EIGHTH EDITION

FRANK H. NETTER, MD

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NETTER ATLAS *of* HUMAN ANATOMY

Classic Regional Approach

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PREFACE

The illustrations comprising the *Netter Atlas of Human Anatomy* were painted by physician-artists, Frank H. Netter, MD, and Carlos Machado, MD. Dr. Netter was a surgeon and Dr. Machado is a cardiologist. Their clinical insights and perspectives have informed their approaches to these works of art. The collective expertise of the anatomists, educators, and clinicians guiding the selection, arrangement, labeling, and creation of the illustrations ensures the accuracy, relevancy, and educational power of this outstanding collection.

You have a copy of the **regionally organized** 8th edition with English language terminology. This is the traditional organization and presentation that has been used since the first edition. Also available is a Latin terminology option that is also regionally organized, as well as an option with English terminology organized by body system. In all cases, the same beautiful and instructive Art Plates and Table information are included.

New to this Edition

New Art

More than 20 new illustrations have been added and over 30 art modifications have been made throughout this edition. Highlights include new views of the temporal and infratemporal fossa, pelvic fascia, nasal cavity and paranasal sinuses, plus multiple new perspectives of the heart, a cross-section of the foot, enhanced surface anatomy plates, and overviews of many body systems. In these pages you will find the most robust illustrated coverage to date for modern clinical anatomy courses.

Terminology and Label Updates

This 8th edition incorporates terms of the *Terminologia Anatomica* (2nd edition), as published by the Federative International Programme on Anatomical Terminology in 2019 (https://fipat.library.dal.ca/ta2) and adopted by the International Federation of Associations of Anatomy in 2020. A fully searchable database of the updated *Terminologia Anatomica* can be accessed at https://ta2viewer.openanatomy.org. Common clinical eponyms and former terminologies are selectively included, parenthetically, for clarity. In addition, a strong effort has been made to reduce label text on the page while maximizing label information through the use of abbreviations (muscle/s = m/mm.; artery/ies = a./aa.; vein/s = v./vv.; and nerve/s = n./nn.) and focusing on the labels most relevant to the subject of each Plate.

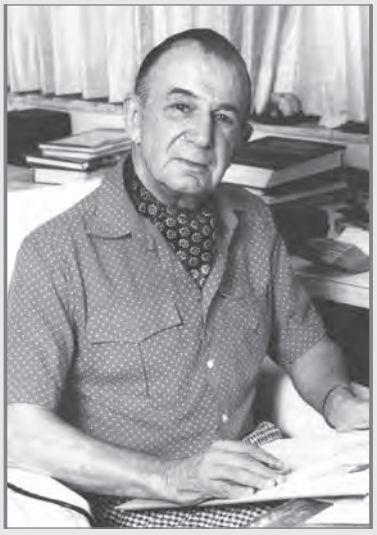
Nerve Tables

The muscle tables and clinical tables of previous editions have been so positively received that new tables have been added to cover four major nerve groups: cranial nerves and the nerves of the cervical, brachial, and lumbosacral plexuses.

Future of the Netter Anatomy Atlas

As the Netter Atlas continues to evolve to meet the needs of students, educators, and clinicians, we welcome suggestions! Please use the following form to provide your feedback:

https://tinyurl.com/NetterAtlas8



To my dear wife, Vera

PREFACE TO THE FIRST EDITION

I have often said that my career as a medical artist for almost 50 years has been a sort of "command performance" in the sense that it has grown in response to the desires and requests of the medical profession. Over these many years, I have produced almost 4,000 illustrations, mostly for *The CIBA* (now *Netter*) *Collection of Medical Illustrations* but also for *Clinical Symposia.* These pictures have been concerned with the varied subdivisions of medical knowledge such as gross anatomy, histology, embryology, physiology, pathology, diagnostic modalities, surgical and therapeutic techniques, and clinical manifestations of a multitude of diseases. As the years went by, however, there were more and more requests from physicians and students for me to produce an atlas purely of gross anatomy. Thus, this atlas has come about, not through any inspiration on my part but rather, like most of my previous works, as a fulfillment of the desires of the medical profession.

It involved going back over all the illustrations I had made over so many years, selecting those pertinent to gross anatomy, classifying them and organizing them by system and region, adapting them to page size and space, and arranging them in logical sequence. Anatomy of course does not change, but our understanding of anatomy and its clinical significance does change, as do anatomical terminology and nomenclature. This therefore required much updating of many of the older pictures and even revision of a number of them in order to make them more pertinent to today's ever-expanding scope of medical and surgical practice. In addition, I found that there were gaps in the portrayal of medical knowledge as pictorialized in the illustrations I had previously done, and this necessitated my making a number of new pictures that are included in this volume.

In creating an atlas such as this, it is important to achieve a happy medium between complexity and simplification. If the pictures are too complex, they may be difficult and confusing to read; if oversimplified, they may not be adequately definitive or may even be misleading. I have therefore striven for a middle course of realism without the clutter of confusing minutiae. I hope that the students and members of the medical and allied professions will find the illustrations readily understandable, yet instructive and useful.

At one point, the publisher and I thought it might be nice to include a foreword by a truly outstanding and renowned anatomist, but there are so many in that category that we could not make a choice. We did think of men like Vesalius, Leonardo da Vinci, William Hunter, and Henry Gray, who of course are unfortunately unavailable, but I do wonder what their comments might have been about this atlas.

Frank H. Netter, MD
(1906–1991)

FRANK H. NETTER, MD

Frank H. Netter was born in New York City in 1906. He studied art at the Art Students League and the National Academy of Design before entering medical school at New York University, where he received his Doctor of Medicine degree in 1931. During his student years, Dr. Netter's notebook sketches attracted the attention of the medical faculty and other physicians, allowing him to augment his income by illustrating articles and textbooks. He continued illustrating as a sideline after establishing a surgical practice in 1933, but he ultimately opted to give up his practice in favor of a full-time commitment to art. After service in the United States Army during World War II, Dr. Netter began his long collaboration with the CIBA Pharmaceutical Company (now Novartis Pharmaceuticals). This 45-year partnership resulted in the production of the extraordinary collection of medical art so familiar to physicians and other medical professionals worldwide.

Icon Learning Systems acquired the Netter Collection in July 2000 and continued to update Dr. Netter's original paintings and to add newly commissioned paintings by artists trained in the style of Dr. Netter. In 2005, Elsevier Inc. purchased the Netter Collection and all publications from Icon Learning Systems. There are now over 50 publications featuring the art of Dr. Netter available through Elsevier Inc.

Dr. Netter's works are among the finest examples of the use of illustration in the teaching of medical concepts. The 13-book *Netter Collection of Medical Illustrations,* which includes the greater part of the more than 20,000 paintings created by Dr. Netter, became and remains one of the most famous medical works ever published. *The Netter Atlas of Human Anatomy,* first published in 1989, presents the anatomic paintings from the Netter Collection. Now translated into 16 languages, it is the anatomy atlas of choice among medical and health professions students the world over.

The Netter illustrations are appreciated not only for their aesthetic qualities, but, more importantly, for their intellectual content. As Dr. Netter wrote in 1949 "clarification of a subject is the aim and goal of illustration. No matter how beautifully painted, how delicately and subtly rendered a subject may be, it is of little value as a *medical illustration* if it does not serve to make clear some medical point." Dr. Netter's planning, conception, point of view, and approach are what inform his paintings and what make them so intellectually valuable.

Frank H. Netter, MD, physician and artist, died in 1991.

ABOUT THE EDITORS

Carlos A.G. Machado, MD was chosen by Novartis to be Dr. Netter's successor. He continues to be the main artist who contributes to the Netter collection of medical illustrations.

Self-taught in medical illustration, cardiologist Carlos Machado has contributed meticulous updates to some of Dr. Netter's original plates and has created many paintings of his own in the style of Netter as an extension of the Netter collection. Dr. Machado's photorealistic expertise and his keen insight into the physician/patient relationship inform his vivid and unforgettable visual style. His dedication to researching each topic and subject he paints places him among the premier medical illustrators at work today.

Learn more about his background and see more of his art at: https://netterimages.com/artist-carlos-a-g-machado.html

Paul E. Neumann, MD was clinically trained in anatomical pathology and neuropathology. Most of his research publications have been in mouse neurogenetics and molecular human genetics. In the past several years, he has concentrated on the anatomical sciences, and has frequently written about anatomical terminology and anatomical ontology in the journal *Clinical Anatomy*. As an officer of the Federative International Programme for Anatomical Terminology (FIPAT), he participated in the production of Terminologia Anatomica (2nd edition), Terminologia Embryologica (2nd edition), and Terminologia Neuroanatomica. In addition to serving as the lead Latin editor of the 8th edition of Netter's Atlas, he was a contributor to the 33rd edition of *Dorland's Illustrated Medical Dictionary*.

R. Shane Tubbs, MS, PA-C, PhD is a native of Birmingham, Alabama and a clinical anatomist. His research interests are centered around clinical/surgical problems that are identified and solved with anatomical studies. This investigative paradigm in anatomy as resulted in over 1,700 peer reviewed publications. Dr. Tubbs' laboratory has made novel discoveries in human anatomy including a new nerve to the skin of the lower eyelid, a new space of the face, a new venous sinus over the spinal cord, new connections between the parts of the sciatic nerve, new ligaments of the neck, a previously undescribed cutaneous branch of the inferior gluteal nerve, and an etiology for postoperative C5 nerve palsies. Moreover, many anatomical feasibility studies from Dr. Tubbs' laboratory have gone on to be used by surgeons from around the world and have thus resulted in new surgical/clinical procedures such as treating hydrocephalus by shunting cerebrospinal fluid into various bones, restoration of upper limb function in paralyzed patients with neurotization procedures using the contralateral spinal accessory nerve, and harvesting of clavicle for anterior cervical discectomy and fusion procedures in patients with cervical instability or degenerative spine disease.

Dr. Tubbs sits on the editorial board of over 15 anatomical journals and has reviewed for over 150 scientific journals. He has been a visiting professor to major institutions in the United States and worldwide. Dr. Tubbs has authored over 40 books and over 75 book chapters. His published books by Elsevier include *Gray's Anatomy Review*, *Gray's Clinical Photographic Dissector of the Human Body*, *Netter's Introduction to Clinical Procedures*, and *Nerves and Nerve Injuries* volumes I and II. He is an editor for the 41st and 42nd editions of the over 150-year-old *Gray's Anatomy*, the 5th through 8th editions of *Netter's Atlas of Anatomy*, and is the editor-in-chief of the journal *Clinical Anatomy*. He is the Chair of the Federative International Programme on Anatomical Terminologies (FIPAT).

Jennifer K. Brueckner-Collins, PhD is a proud Kentucky native. She pursued her undergraduate and graduate training at the University of Kentucky. During her second year of graduate school there, she realized that her professional calling was not basic science research in skeletal muscle biology, but was instead helping medical students master the anatomical sciences. She discovered this during a required teaching assistantship in medical histology, where working with students at the 10-headed microscope changed her career path.

The next semester of graduate school, she assisted in teaching dissection-based gross anatomy, although she had taken anatomy when the lab component was prosection based. After teaching in the first lab, she knew that she needed to learn anatomy more thoroughly through dissection on her own, so she dissected one to two labs ahead of the students that semester; that was when she really learned anatomy and was inspired to teach this discipline as a profession. All of this occurred in the early 1990s, when pursuing a teaching career was frowned upon by many; it was thought that you only pursued this track if you were unsuccessful in research. She taught anatomy part-time during the rest of her graduate training, on her own time, to gain requisite experience to ultimately secure a faculty position.

Dr. Brueckner-Collins spent 10 years at the University of Kentucky as a full-time faculty member teaching dissection-based gross anatomy to medical, dental, and allied health students. Then, after meeting the love of her life, she moved to the University of Louisville and has taught medical and dental students there for more than a decade. Over 20 years of teaching full time at two medical schools in the state, her teaching efforts have been recognized through receipt of the highest teaching honor at each medical school in the state, the Provost's Teaching Award at University of Kentucky, and the Distinguished Teaching Professorship at University of Louisville.

Martha Johnson Gdowski, PhD earned her BS in Biology cum laude from Gannon University in 1990, followed by a PhD in Anatomy from the Pennsylvania State University College of Medicine in 1995. She completed postdoctoral

fellowships at the Cleveland Clinic and Northwestern University School of Medicine prior to accepting a faculty position in the Department of Neuroscience at the University of Rochester School of Medicine and Dentistry in 2001. Previous research interests include the development of an adult model of hydrocephalus, sensorimotor integration in the basal ganglia, and sensorimotor integration in normal and pathological aging.

Her passion throughout her career has been in her service as an educator. Her teaching has encompassed a variety of learning formats, including didactic lecture, laboratory, journal club, and problem-based learning. She has taught for four academic institutions in different capacities (The Pennsylvania State University School of Medicine, Northwestern University School of Medicine, Ithaca College, and The University of Rochester School of Medicine and Dentistry). She has taught in the following curricula: Undergraduate and Graduate Neuroscience, Graduate Neuroanatomy, Graduate Human Anatomy and Physiology for Physical Therapists, Undergraduate Medical Human Anatomy and Histology, and Undergraduate and Graduate Human Anatomy. These experiences have provided an opportunity to instruct students that vary in age, life experience, race, ethnicity, and economic background, revealing how diversity in student populations enriches learning environments in ways that benefit everyone. She has been honored to be the recipient of numerous awards for her teaching and mentoring of students during their undergraduate medical education. Martha enjoys gardening, hiking, and swimming with her husband, Greg Gdowski, PhD, and their dogs, Sophie and Ivy.

Virginia T. Lyons, PhD is an Associate Professor of Medical Education and the Associate Dean for Preclinical Education at the Geisel School of Medicine at Dartmouth. She received her BS in Biology from Rochester Institute of Technology and her PhD in Cell Biology and Anatomy from the University of North Carolina at Chapel Hill. Dr. Lyons has devoted her career to education in the anatomical sciences, teaching gross anatomy, histology, embryology, and neuroanatomy to medical students and other health professions students. She has led courses and curricula in human gross anatomy and embryology for more than 20 years and is a strong advocate for incorporating engaged pedagogies into preclinical medical education. Dr. Lyons has been recognized with numerous awards for teaching and mentoring students and was elected to the Dartmouth chapter of the Alpha Omega Alpha Honor Medical Society. She is the author of *Netter's Essential Systems-Based Anatomy* and co-author of the Human Anatomy Learning Modules website accessed by students worldwide. Dr. Lyons also serves as the Discipline Editor for Anatomy on the Aquifer Sciences Curriculum Editorial Board, working to integrate anatomical concepts into virtual patient cases that are used in multiple settings including clerkships and residency training.

Peter J. Ward, PhD grew up in Casper, Wyoming, graduating from Kelly Walsh High School and then attending Carnegie Mellon University in Pittsburgh, Pennsylvania. He began graduate school at Purdue University, where he first encountered gross anatomy, histology, embryology, and neuroanatomy. Having found a course of study that engrossed him, he helped teach those courses in the veterinary and medical programs at Purdue. Dr. Ward completed a PhD program in anatomy education and, in 2005, he joined the faculty at the West Virginia School of Osteopathic Medicine (WVSOM) in Lewisburg, West Virginia. There he has taught gross anatomy, embryology, neuroscience, histology, and the history of medicine. Dr. Ward has received numerous teaching awards, including the WVSOM Golden Key Award, the Basmajian Award from the American Association of Anatomists, and has been a two-time finalist in the West Virginia Merit Foundation's Professor of the Year selection. Dr. Ward has also been director of the WVSOM plastination facility, coordinator of the anatomy graduate teaching assistants, chair of the curriculum committee, chair of the faculty council, creator and director of a clinical anatomy elective course, and host of many anatomy-centered events between WVSOM and two Japanese Colleges of Osteopathy. Dr. Ward has also served as council member and association secretary for the American Association of Clinical Anatomists. In conjunction with Bone Clones, Inc., Dr. Ward has produced tactile models that mimic the feel of anatomical structures when intact and when ruptured during the physical examination. He created the YouTube channel Clinical Anatomy Explained! and continues to pursue interesting ways to present the anatomical sciences to the public. Dr. Ward was the Senior Associate Editor for the three volumes of *The Netter Collection: The Digestive System*, 2nd Edition, a contributor to *Gray's Anatomy,* 42nd Edition, and is author of *Netter's Integrated Musculoskeletal System: Clinical Anatomy Explained*.

Brion Benninger, MD, MBChB, MSc currently teaches surgical, imaging, and dynamic anatomy to medical students and residents in several countries (United States, New Zealand, China, Japan, Korea, Taiwan, The Caribbean, Mexico). He develops, invents, and assesses ultrasound probes, medical equipment, simulations, and software while identifying dynamic anatomy. He enjoys mixing educational techniques integrating macro imaging and surgical anatomy. Dr. Benninger developed the teaching theory of anatomy deconstruction/reconstruction and was the first to combine ultrasound with Google Glass during physical examination, coining the term "triple feedback examination." An early user of ultrasound, he continues to develop eFAST teaching and training techniques, has developed and shares a patent on a novel ultrasound finger probe, and is currently developing a new revolutionary ultrasound probe for breast screening. He is a reviewer for several ultrasound, clinical anatomy, surgical, and radiology journals and edits and writes medical textbooks. His research interests integrate clinical anatomy with conventional and emerging technologies to improve training techniques in situ and simulation. Dr. Benninger pioneered and coined the term "dynamic anatomy,"

developed a technique to deliver novel contrast medium to humans, and was the first to reveal vessels and nerves not previously seen using CT and MRI imaging. He has mentored more than 200 students on over 350 research projects presented at national and international conferences and has received numerous awards for projects related to emergency procedures, ultrasound, sports medicine, clinical anatomy, medical simulation, reverse translational research, medical education, and technology. He is proud to have received medical teaching awards from several countries and institutions, including being the first recipient in more than 25 years to receive the Commendation Medal Award from the Commission of Osteopathic Accreditation for innovative clinical anatomy teaching that he designed and facilitated in Lebanon, Oregon. Dr. Benninger has received sports medicine accolades from Sir Roger Bannister regarding his medical invention on shoulder proprioception. He is also Executive Director of the Medical Anatomy Center and collaborates with colleagues globally from surgical and nonsurgical specialties. He is also an invited course speaker for surgical anatomy in New Zealand. Dr. Benninger collects medical history books, loves mountains and sports, and is an anonymous restaurant critic. British mentors directly responsible for his training include Prof. Peter Bell (surgery), Prof. Sir Alec Jeffreys (genetic fingerprinting), Profs. David deBono and Tony Gershlick (cardiology), Prof. Roger Greenhalgh (vascular surgery), Profs. Chris Colton, John Webb, and Angus Wallace (orthopaedics), Prof. Harold Ellis CBE (surgery and clinical anatomy), and Prof. Susan Standring (Guys Hospital/Kings College).

Todd M. Hoagland, PhD is Clinical Professor of Biomedical Sciences and Occupational Therapy at Marquette University in the College of Health Sciences. Previously he was Professor of Anatomy at the Medical College of Wisconsin (MCW). Prior to MCW, Dr. Hoagland was at Boston University School of Medicine (BUSM) and he still holds an adjunct faculty position at Boston University Goldman School of Dental Medicine. Dr. Hoagland is a passionate teacher and is dedicated to helping students achieve their goals. He believes in being a strong steward of the anatomical sciences, which involves teaching it to students while contemporaneously developing resources to improve the transfer of knowledge and preparing the next generation to be even better teachers. While at BUSM, Dr. Hoagland was a leader for the Carnegie Initiative on the Doctorate in Neuroscience and helped develop the Vesalius Program (teacher training) for graduate students. The program ensures that graduate students learn about effective teaching, receive authentic experiences in the classroom, and understand how to share what they learn via scholarship.

Dr. Hoagland's dedication to health professions education has been richly rewarded by numerous teaching awards from the University of Notre Dame, BUSM, and MCW. Dr. Hoagland received the Award for Outstanding Ethical Leadership in 2009, was inducted into the Alpha Omega Alpha Honor Medical Society in 2010, received the American Association of Anatomists Basmajian Award in 2012, and was inducted into the Society of Teaching Scholars in 2012 and was their director from 2016–2020.

Dr. Hoagland's scholarly activity centers on (1) evaluating content and instructional/learning methodology in Clinical Human Anatomy and Neuroanatomy courses, especially as relevant to clinical practice, (2) translating basic anatomical science research findings into clinically meaningful information, and (3) evaluating professionalism in students to enhance their self-awareness and improve patient care outcomes. Dr. Hoagland is also consulting editor for *Netter's Atlas of Human Anatomy,* co-author for the digital anatomy textbook *AnatomyOne,* and lead author for *Clinical Human Anatomy Dissection Guide*.

ACKNOWLEDGMENTS

Carlos A. G. Machado, MD

With the completion of this 8th edition, I celebrate 27 years contributing to the Netter brand of educational products, 25 years of which have been dedicated to the update—seven editions—of this highly prestigious, from birth, *Atlas of Human Anatomy*. For these 25 years I have had the privilege and honor of working with some of the most knowledgeable anatomists, educators, and consulting editors—my treasured friends—from whom I have learned considerably.

For the last 16 years it has also been a great privilege to be part of the Elsevier team and be under the skillful coordination and orientation of Marybeth Thiel, Elsevier's Senior Content Development Specialist, and Elyse O'Grady, Executive Content Strategist. I thank both for their friendship, support, sensibility, and very dedicated work.

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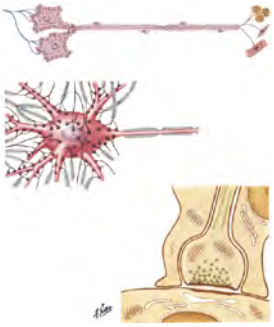


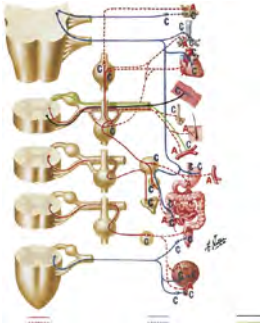
BP 3 Neurons and Synapses

BP 4 Features of a Typical Peripheral Nerve

BP 5 Sites of Visceral Referred Pain

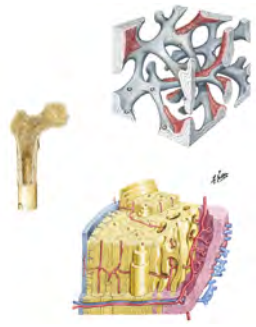
BP 6 Sympathetic Nervous System: General Topography

BP 7 Parasympathetic Nervous System: General Topography

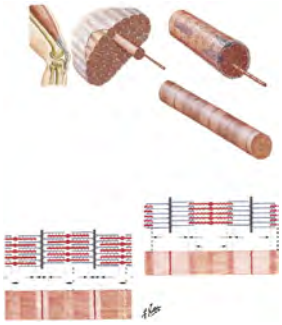


BP 8 Cholinergic and Adrenergic Synapses: Schema

ELECTRONIC BONUS PLATES—*cont'd*

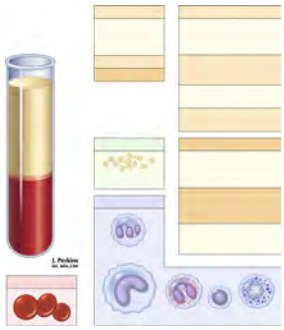


BP 9 Architecture of Bone



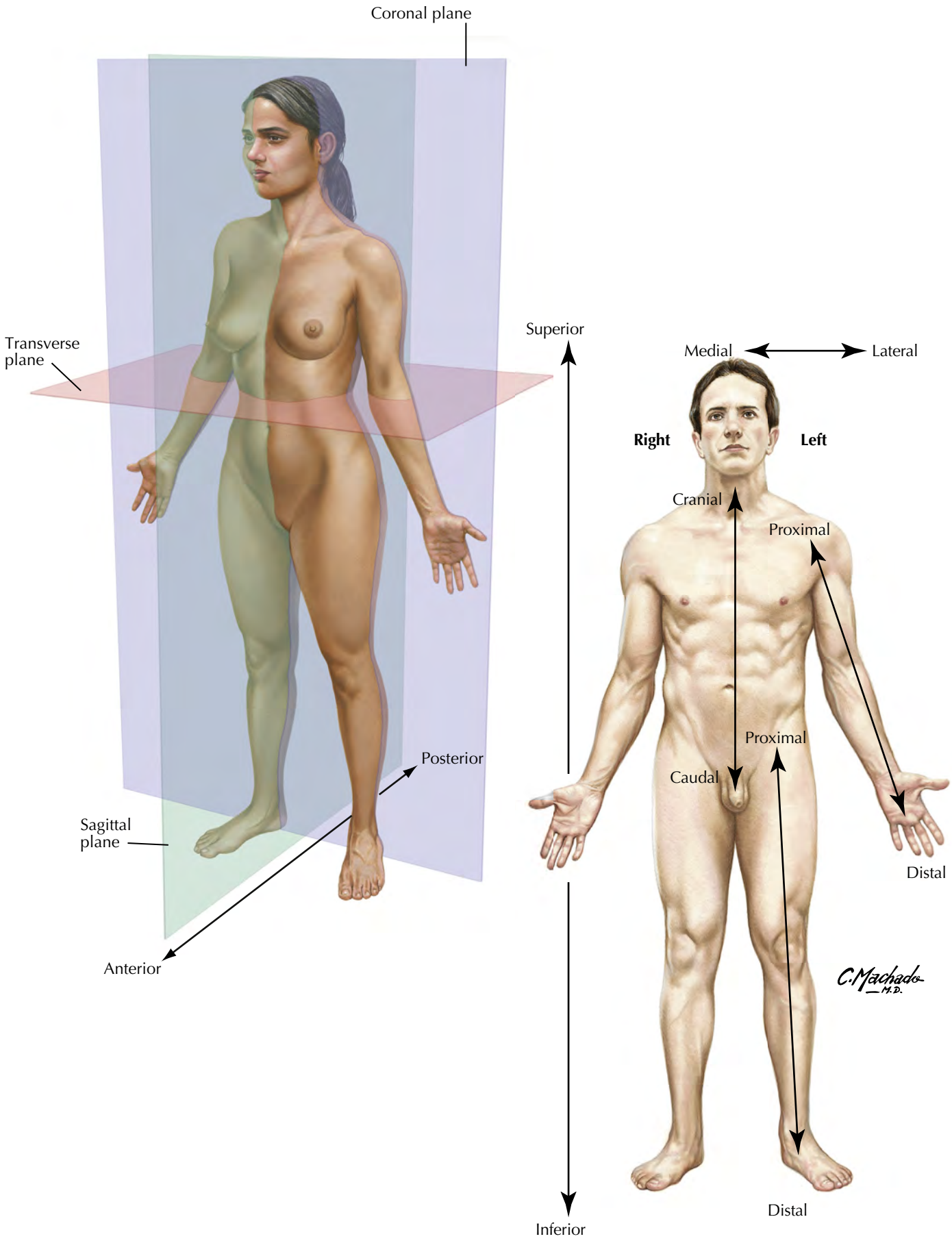
BP 10 Muscle Structure

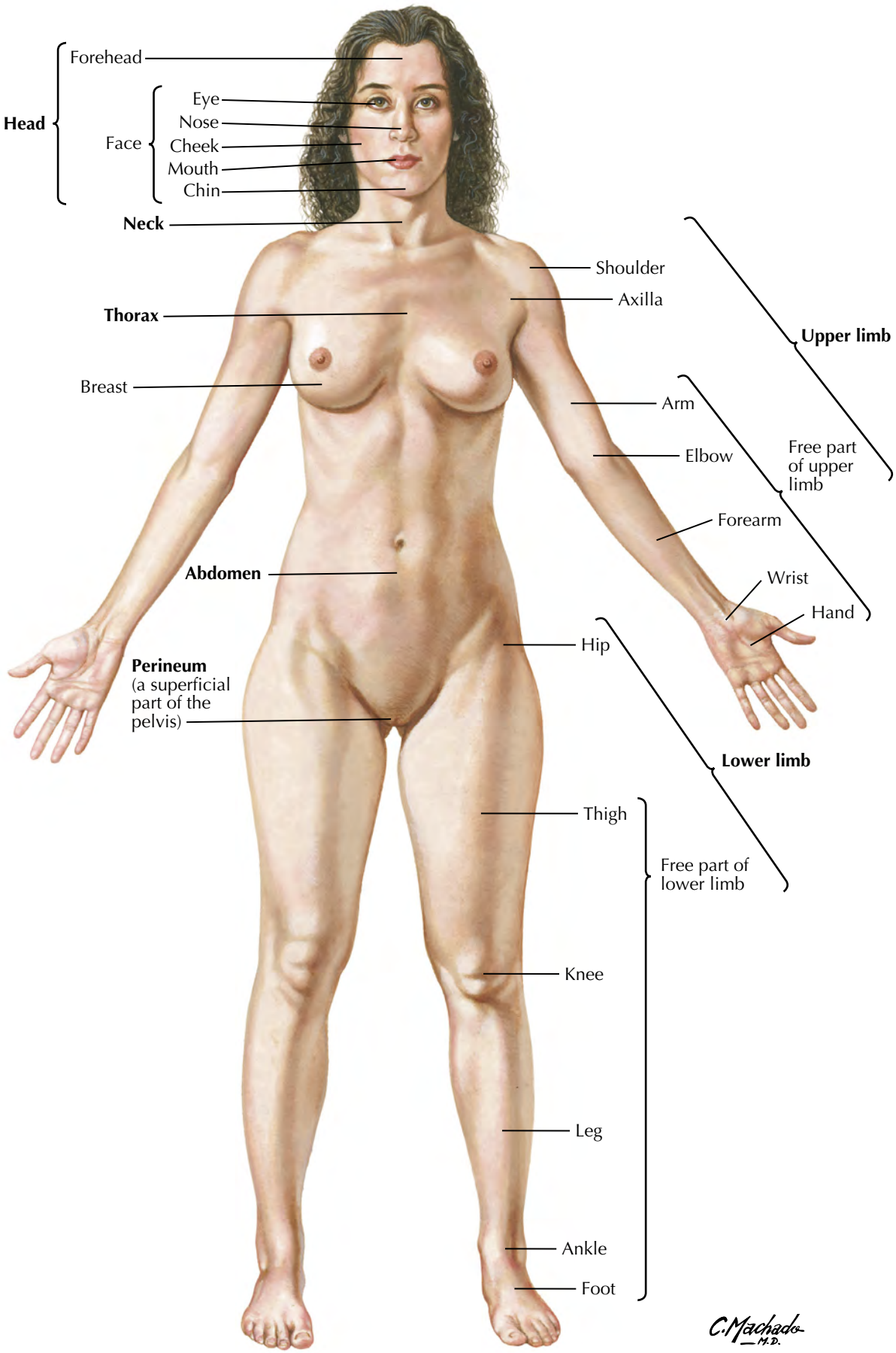
BP 11 Joints: Connective Tissues and Articular Cartilage

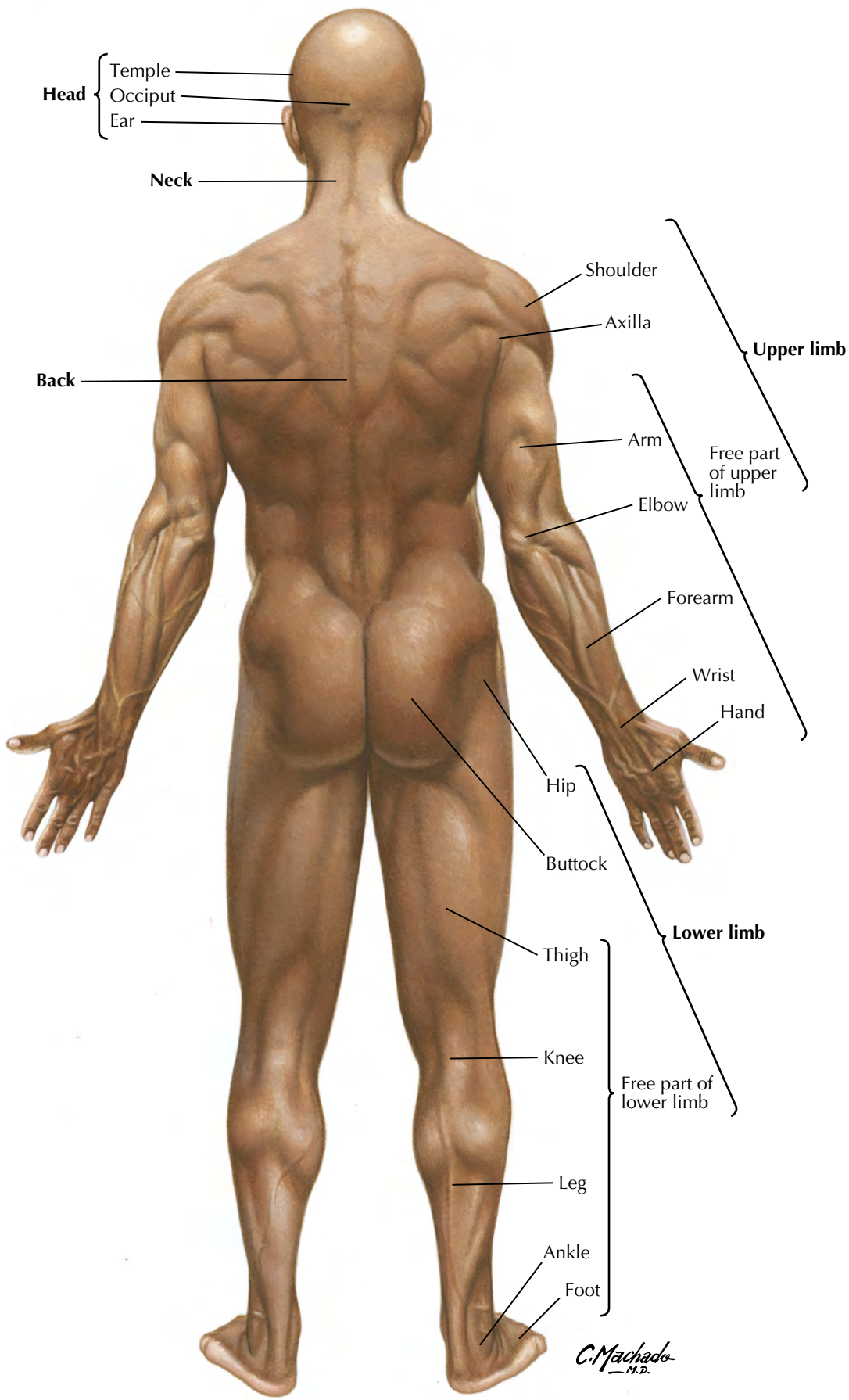


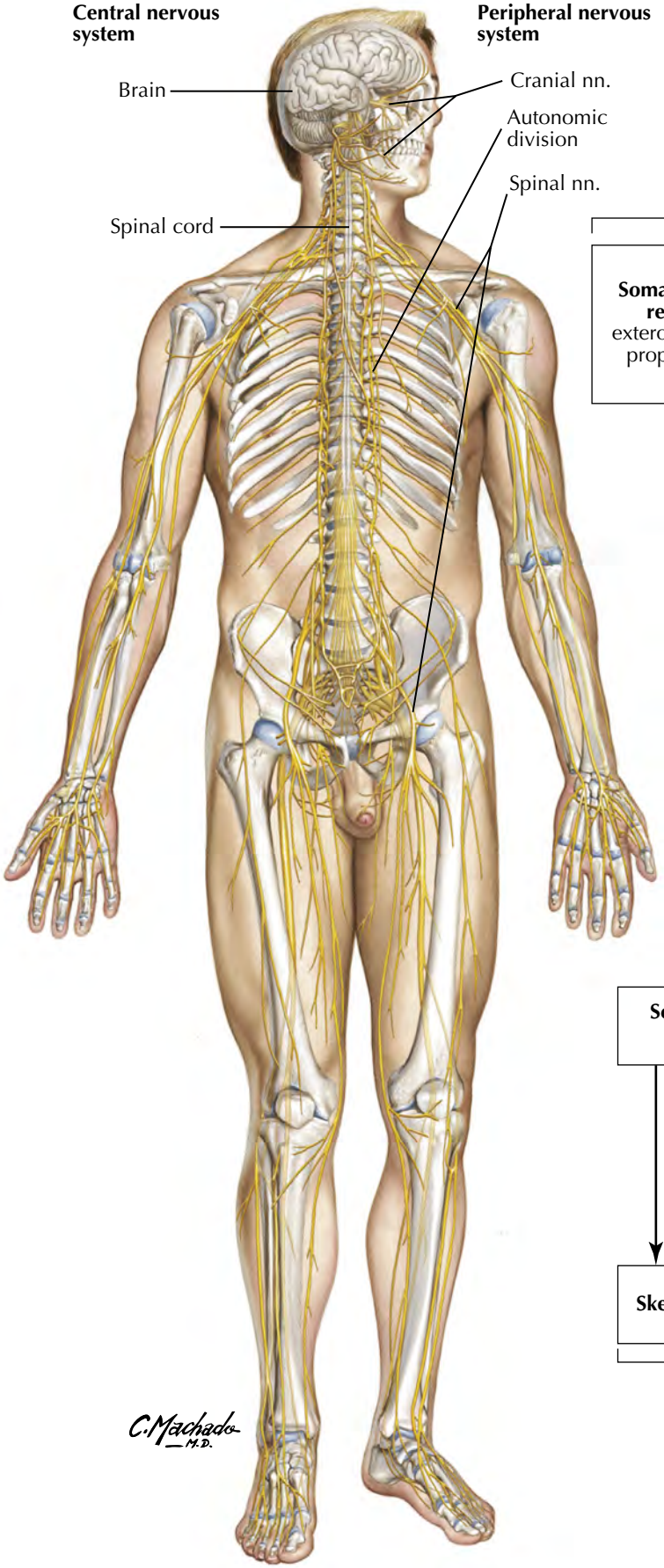
BP 12 Cardiovascular System: Composition of Blood

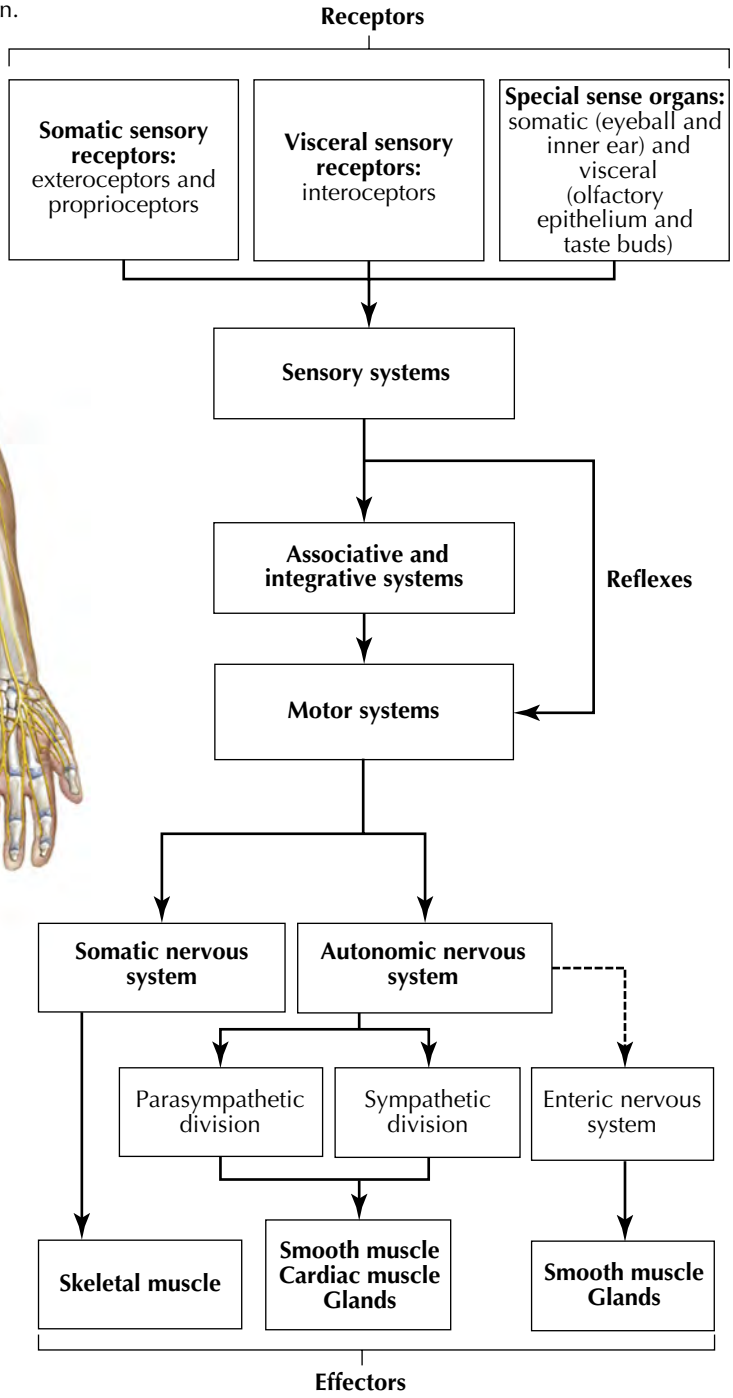
BP 13 Arterial Wall


Coronal plane
Transverse plane
Sagittal plane
Posterior
Anterior
Superior
Inferior
Medial
Lateral
Right
Left
Cranial
Proximal
Proximal
Caudal
Distal
Distal
C.Machado M.D.

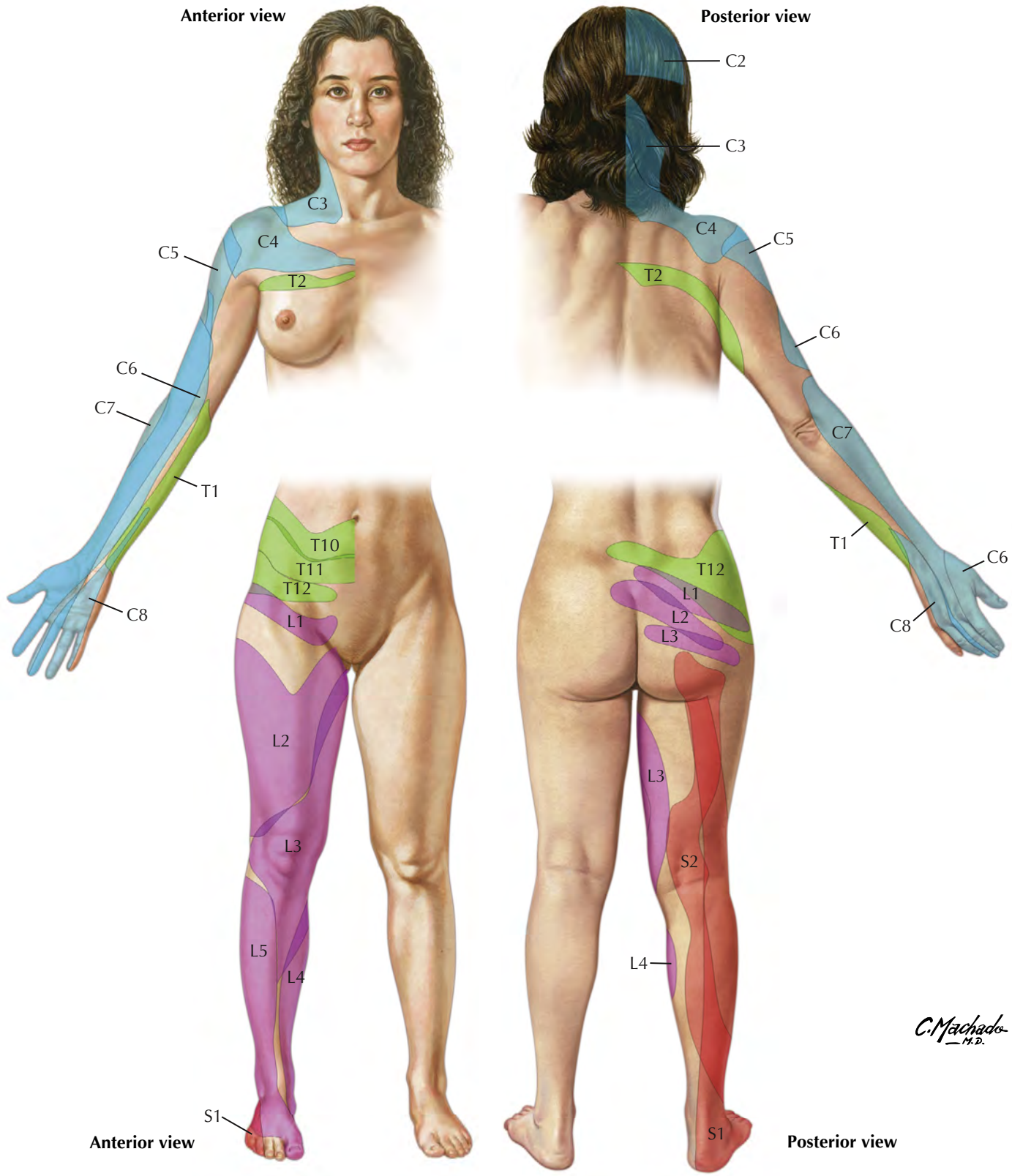

Forehead
Head
Eye
Nose
Face
Cheek
Mouth
Chin
Neck
Shoulder
Axilla
Upper limb
Thorax
Breast
Arm
Elbow
Free part of upper limb
Forearm
Abdomen
Wrist
Hand
Hip
Perineum (a superficial part of the pelvis)
Lower limb
Thigh
Free part of lower limb
Knee
Leg
Ankle
Foot
C. Machado M.D.


Head
Temple
Occiput
Ear
Neck
Back
Shoulder
Axilla
Upper limb
Arm
Free part of upper limb
Elbow
Forearm
Wrist
Hand
Hip
Buttock
Lower limb
Thigh
Knee
Free part of lower limb
Leg
Ankle
Foot
C. Machado M.D.


Central nervous system
Peripheral nervous system
Brain
Cranial nn.
Autonomic division
Spinal nn.
Spinal cord
C. Machado M.D.

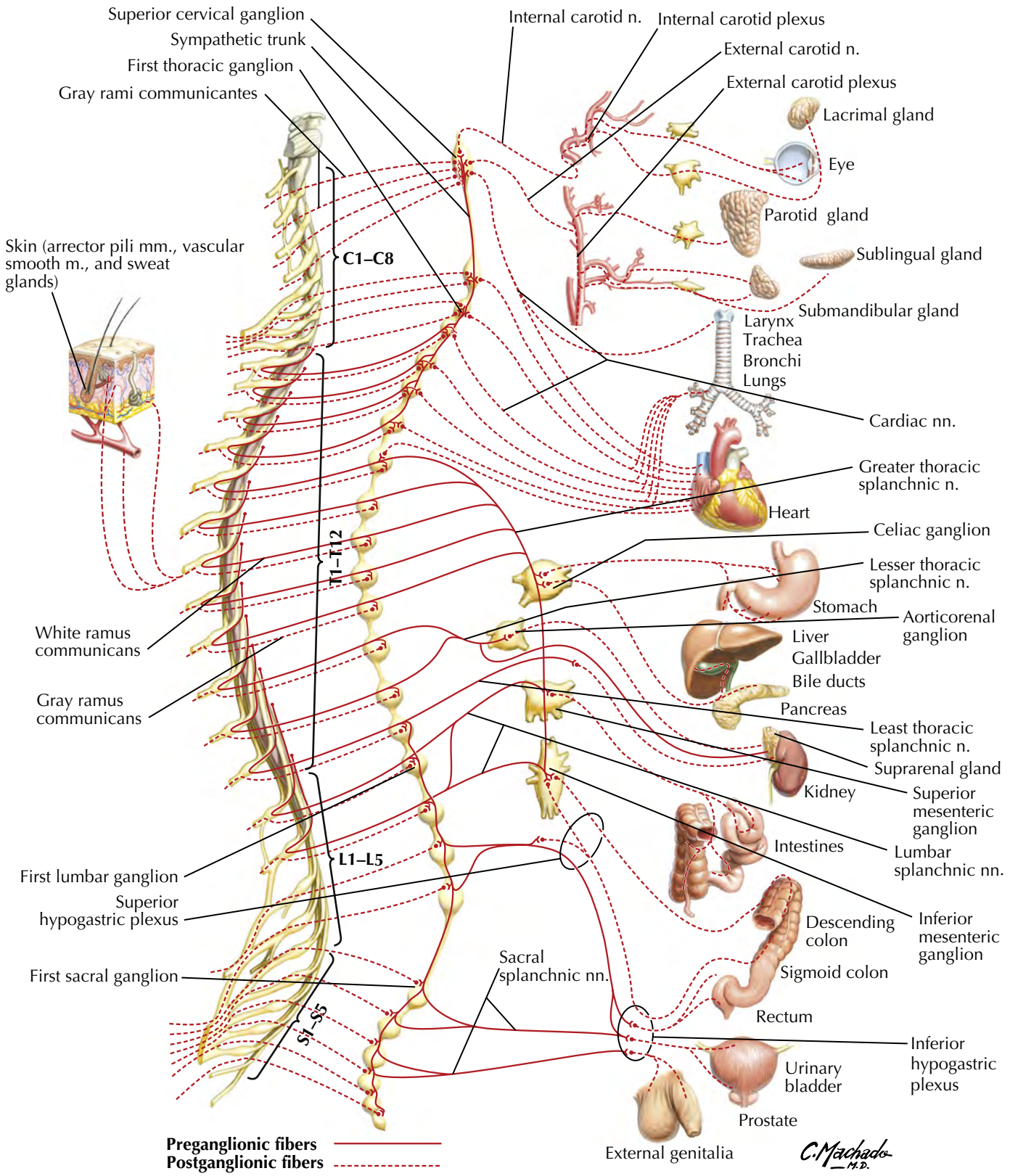

Receptors
Somatic sensory receptors: exteroceptors and proprioceptors
Visceral sensory receptors: interoceptors
Special sense organs: somatic (eyeball and inner ear) and visceral (olfactory epithelium and taste buds)
Sensory systems
Associative and integrative systems
Reflexes
Motor systems
Somatic nervous system
Autonomic nervous system
Parasympathetic division
Sympathetic division
Enteric nervous system
Skeletal muscle
Smooth muscle Cardiac muscle Glands
Smooth muscle Glands
Effectors

See also **Plate 188**

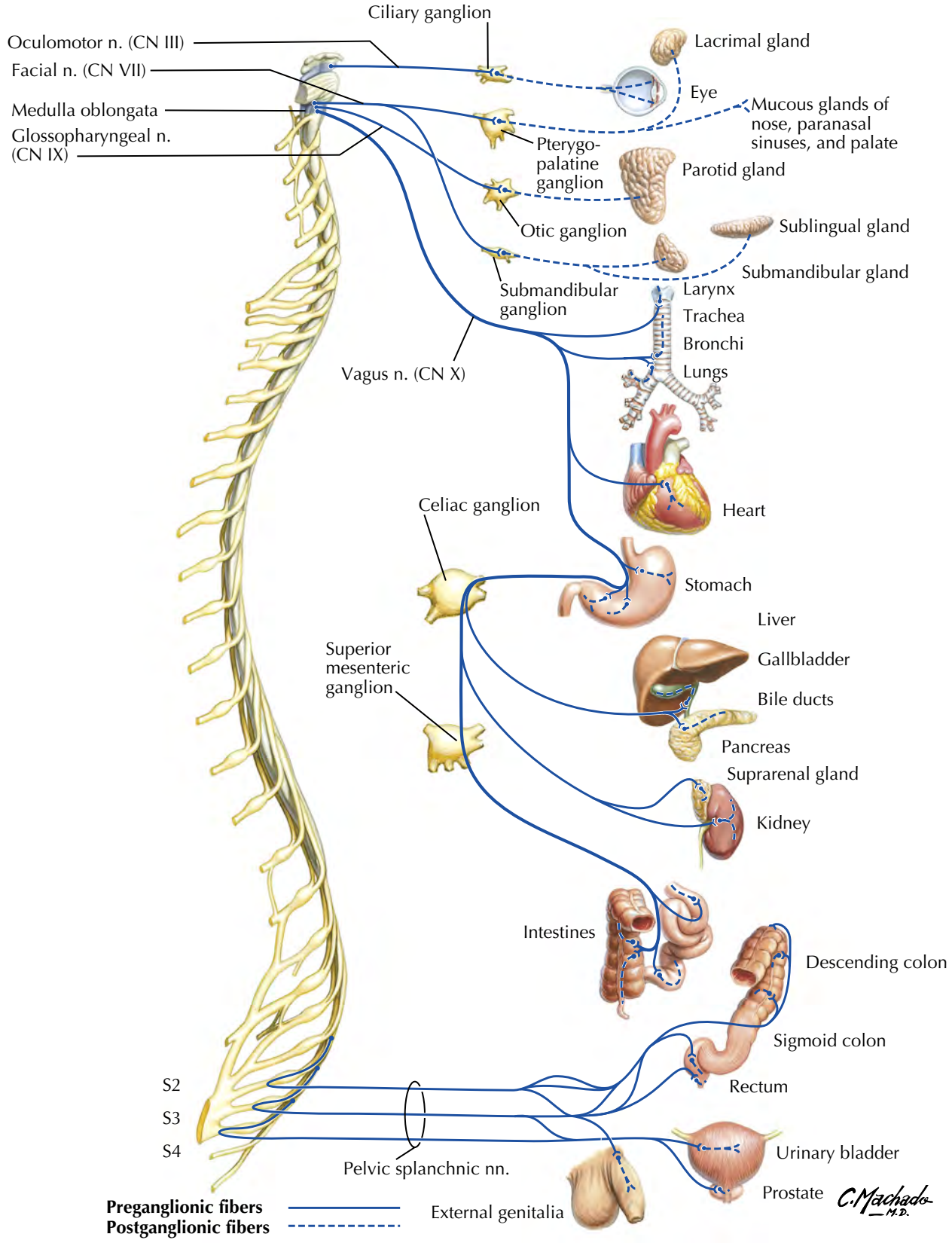


Schematic based on Lee MW, McPhee RW, Stringer MD. An evidence-based approach to human dermatomes. Clin Anat. 2008;21(5):363–373. doi: 10.1002/ca.20636. PMID: 18470936. Please note that these areas are not absolute and vary from person to person. S3, S4, S5, and Co supply the perineum but are not shown for reasons of clarity. Of note, the dermatomes are larger than illustrated as the figure is based on best evidence; gaps represent areas in which the data are inconclusive.

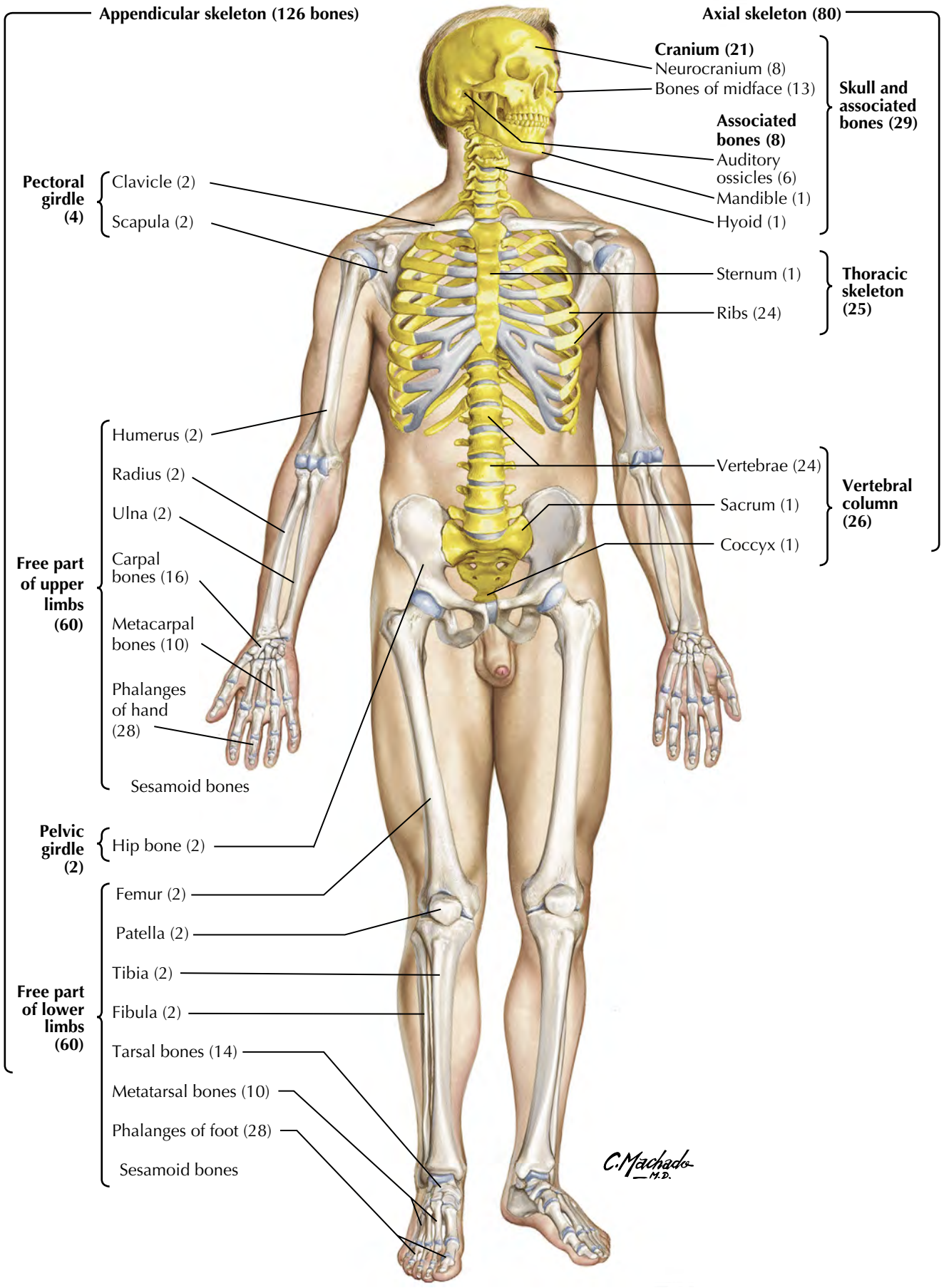
See also **Plates 229, 249, 341, BP 6, BP 8, BP 52**



See also **Plates 324, 414, BP 7, BP 8**

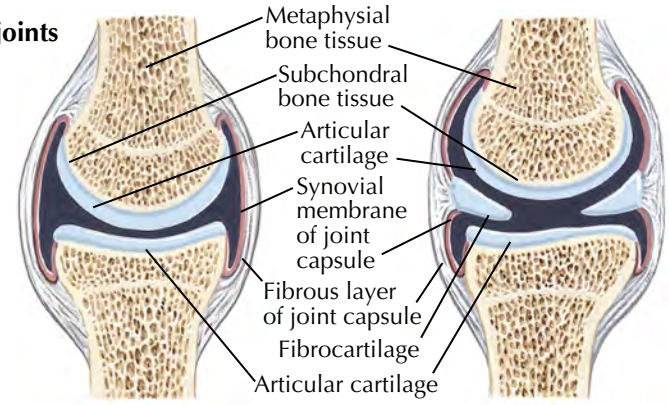


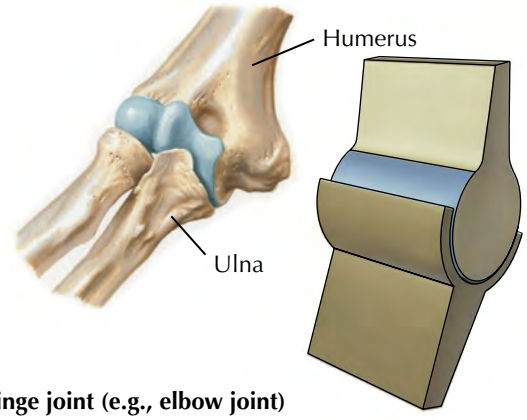
See also **Plate BP 9**



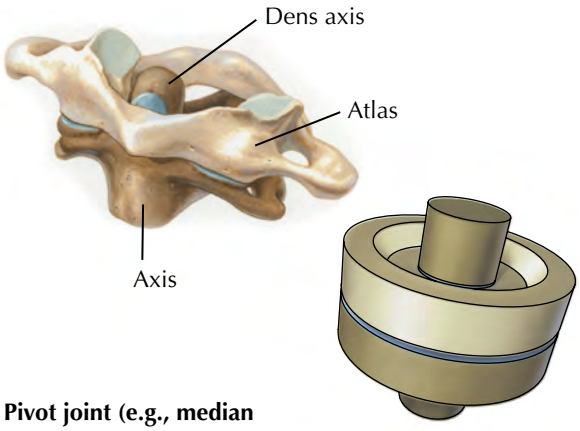
See also **Plate BP 11**

Structure of synovial joints

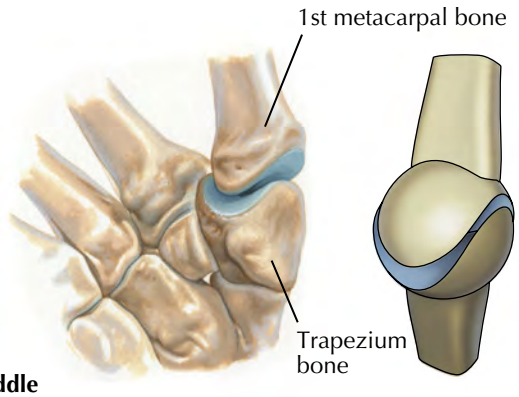




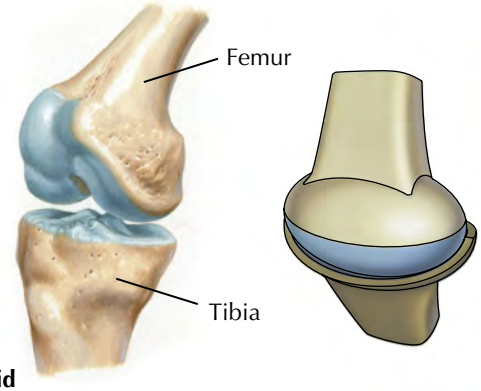
A. Hinge joint (e.g., elbow joint)



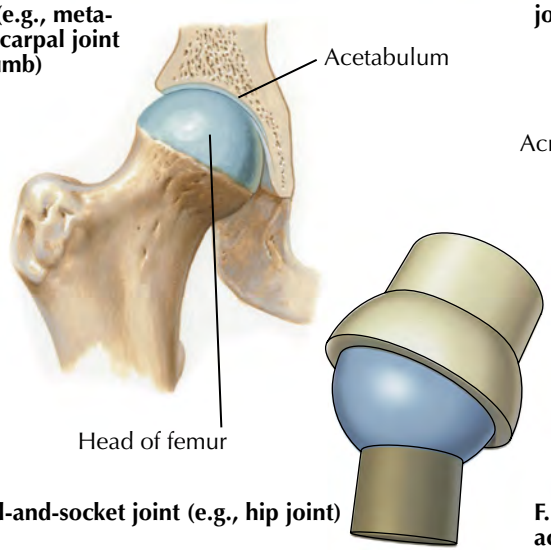
B. Pivot joint (e.g., median atlantoaxial joint)



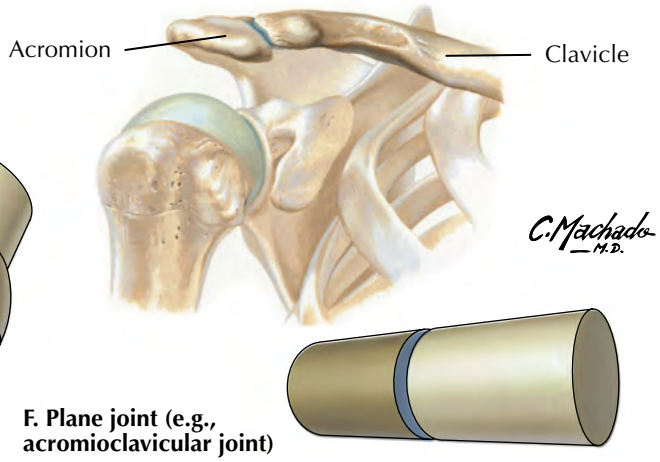
C. Saddle joint (e.g., meta-carpocarpal joint of thumb)



D. Condyloid joint (e.g., knee joint)



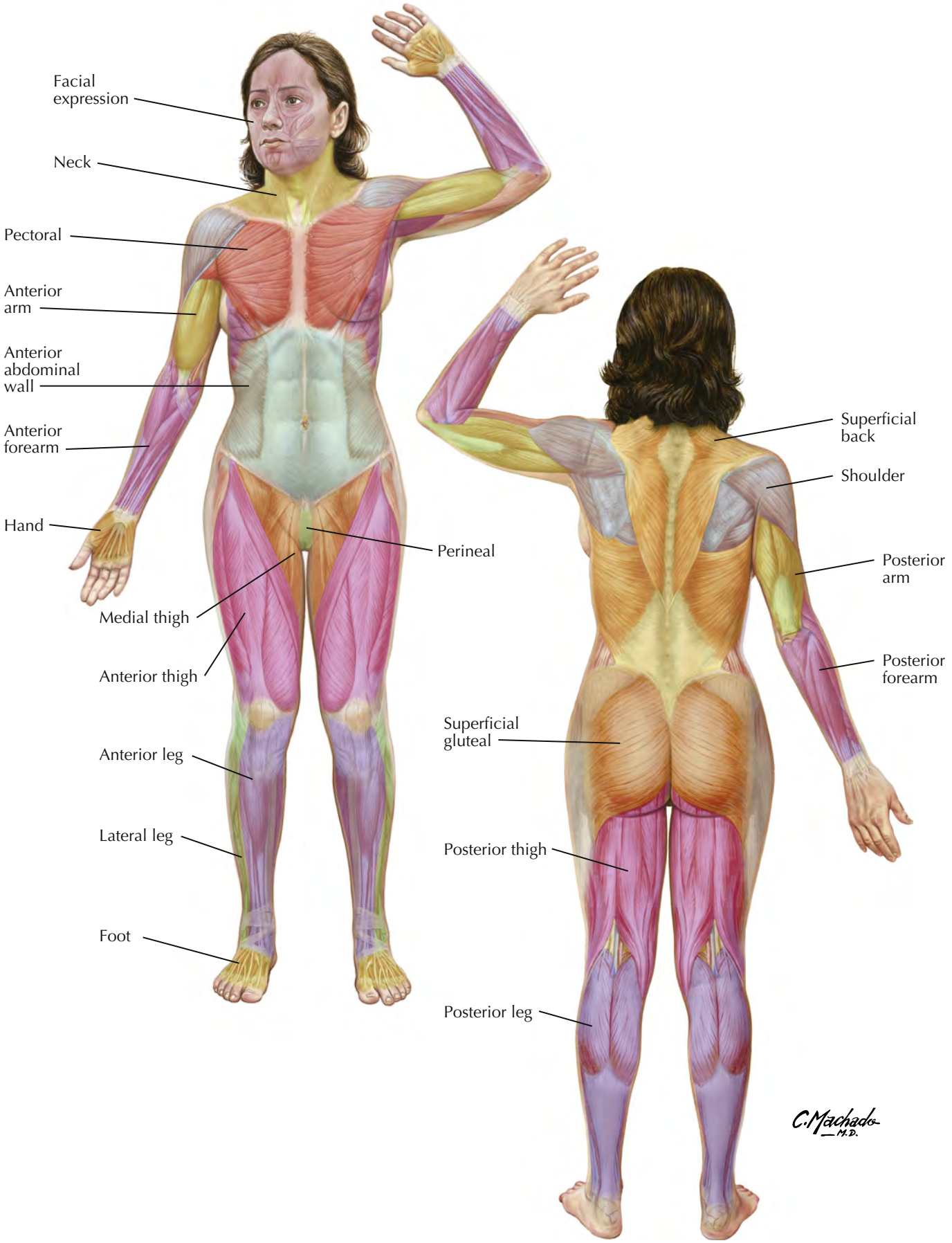
E. Ball-and-socket joint (e.g., hip joint)



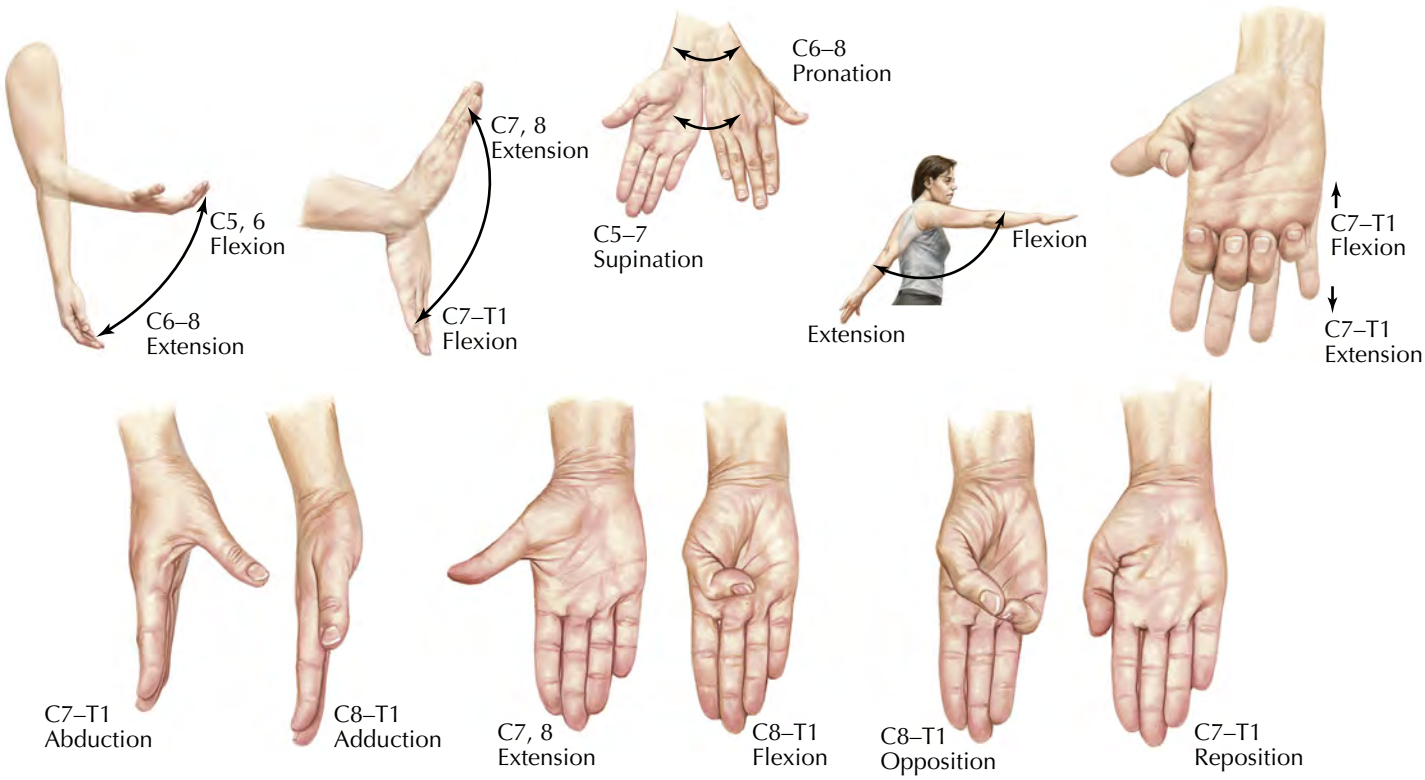
F. Plane joint (e.g., acromioclavicular joint)

Overview of Muscular System

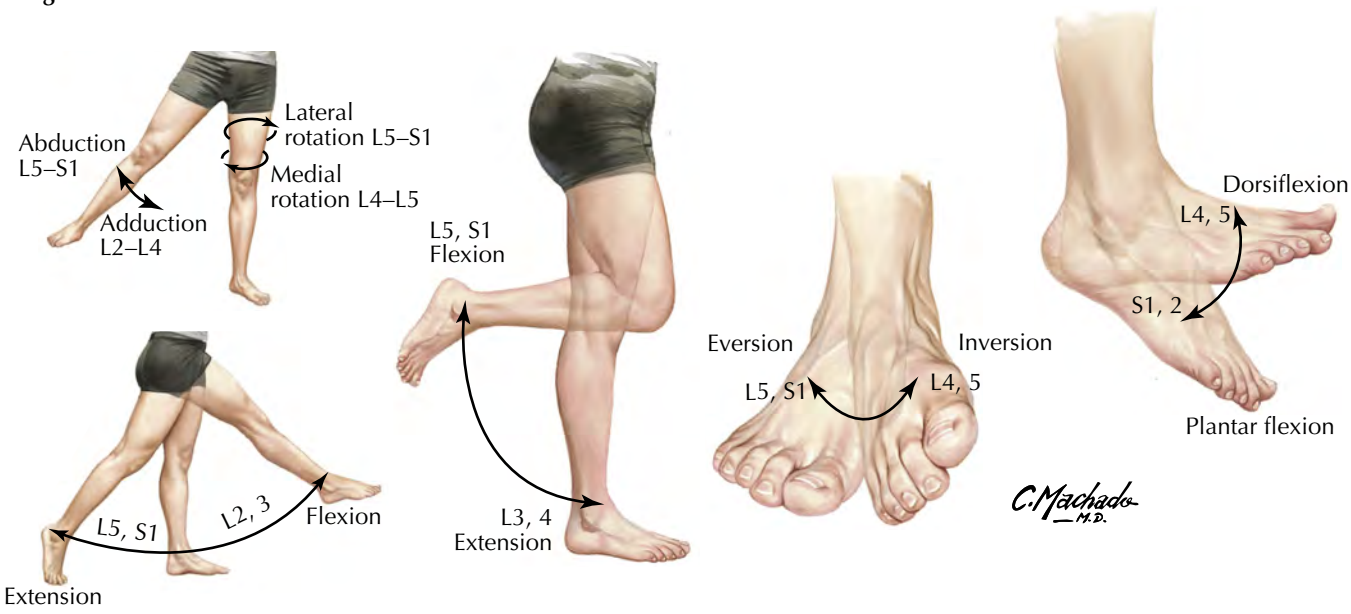
See also **Plate BP 10**



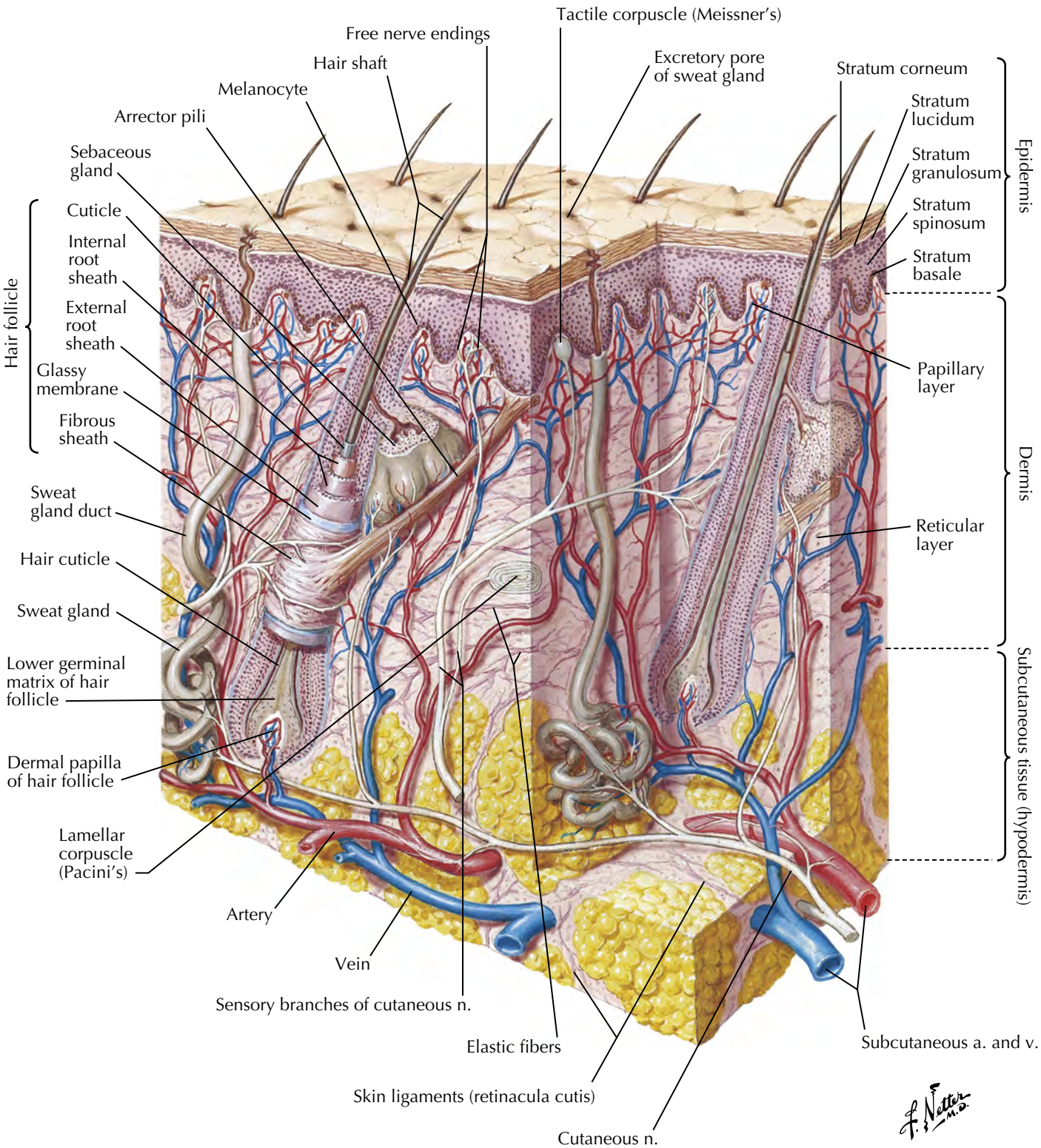
Segmental innervation of upper limb movements

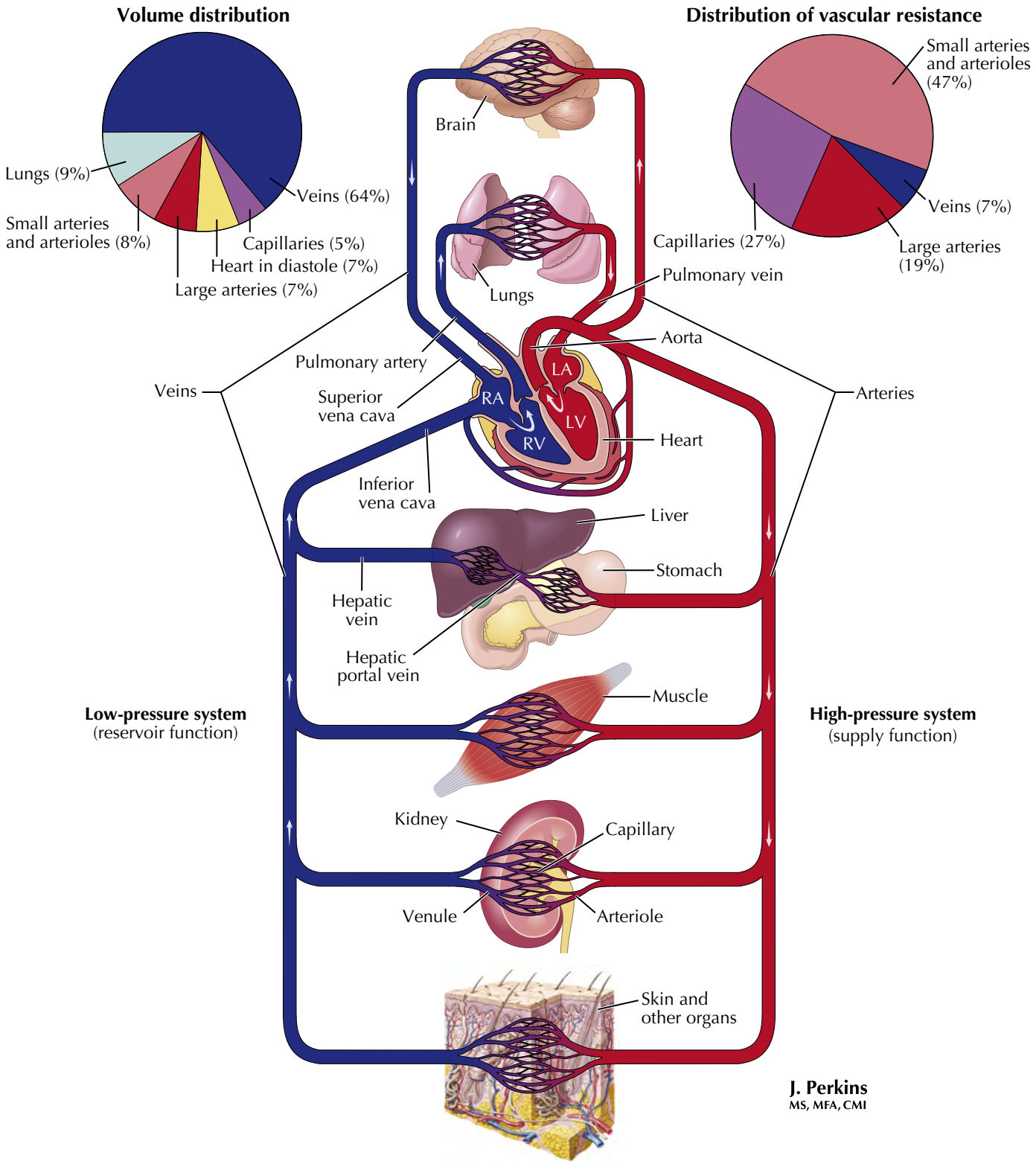


Segmental innervation of lower limb movements

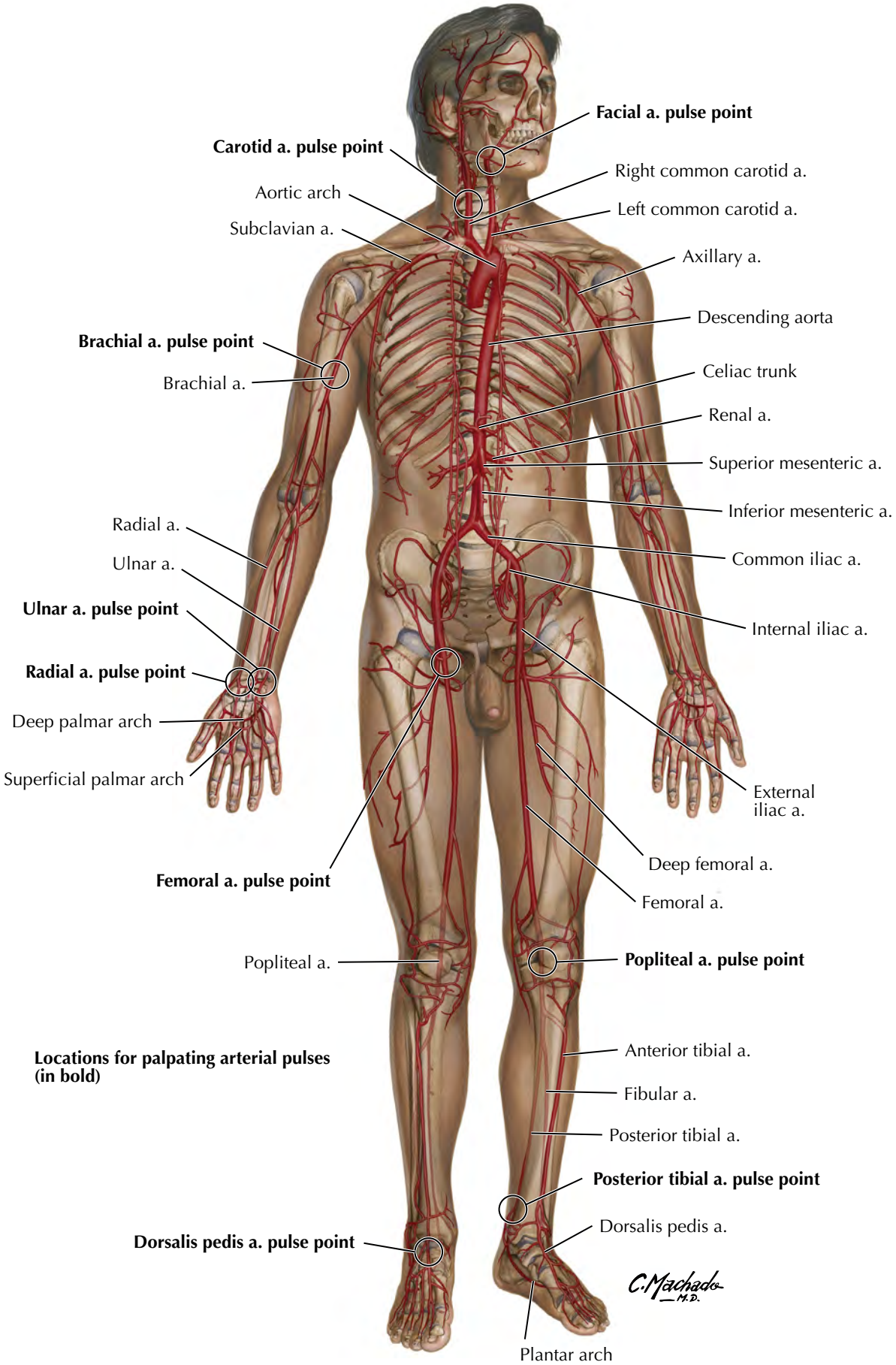


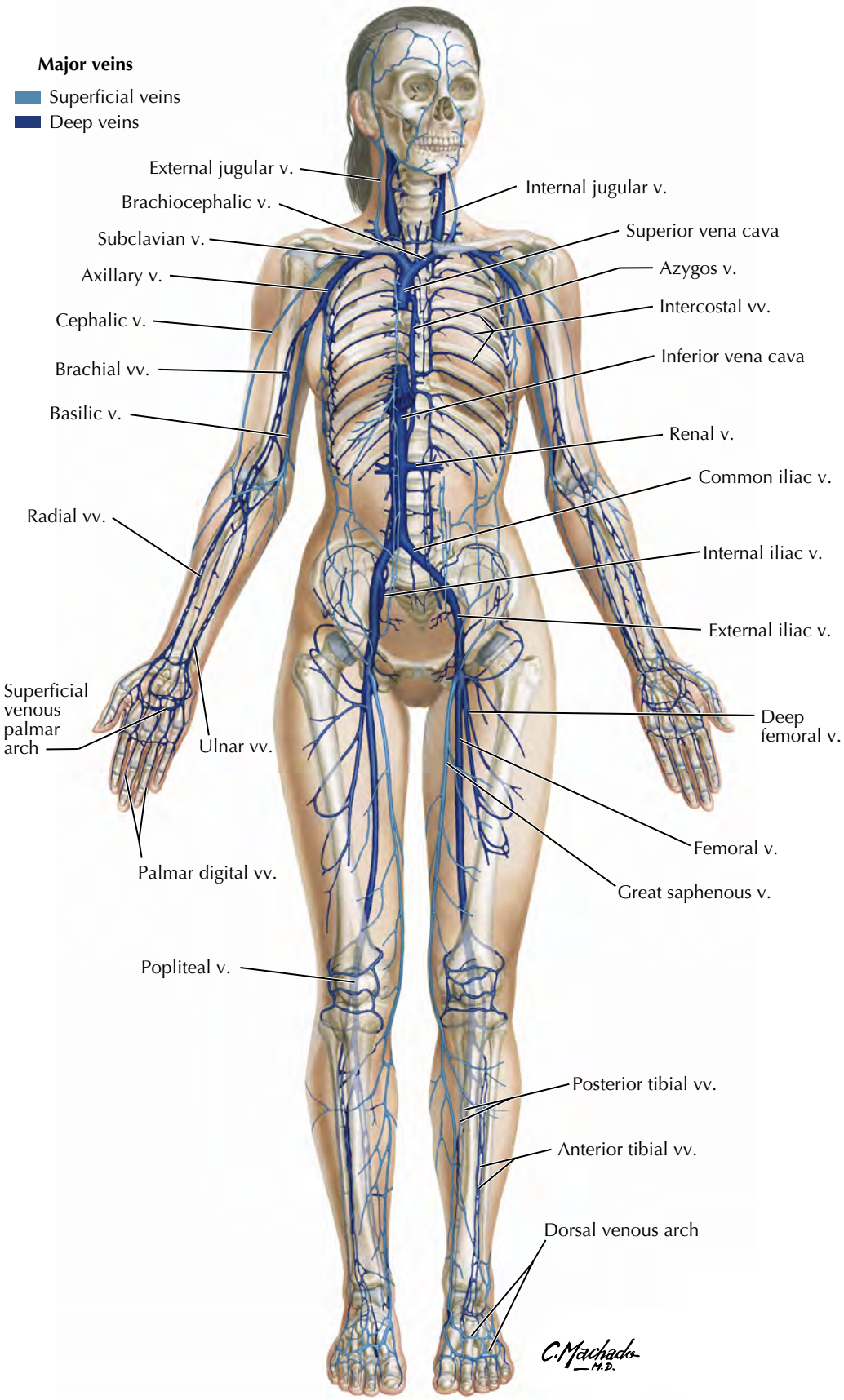
See also **Plate BP 1**

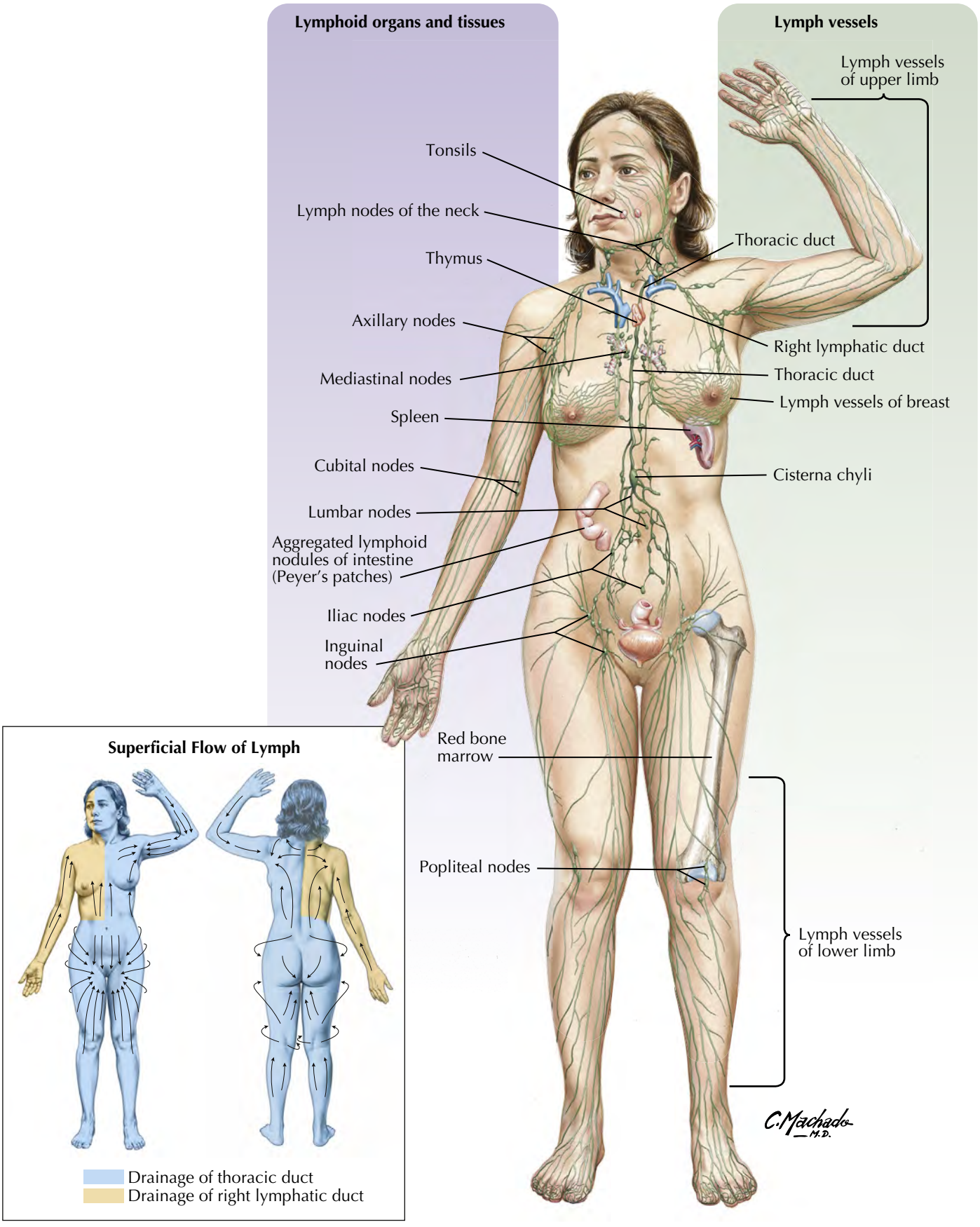


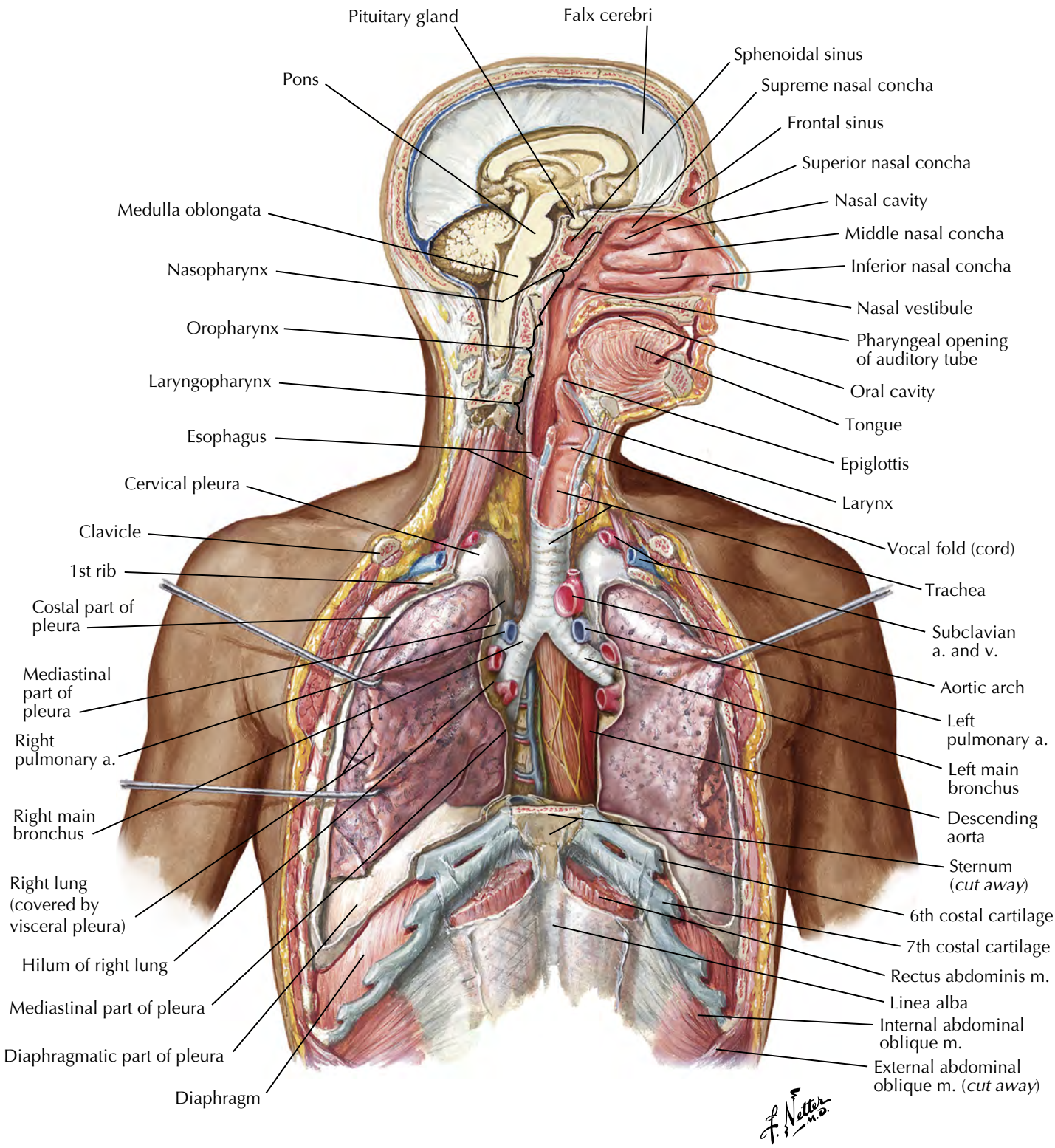

Volume distribution
Lungs (9%)
Veins (64%)
Small arteries and arterioles (8%)
Capillaries (5%)
Heart in diastole (7%)
Large arteries (7%)
Distribution of vascular resistance
Small arteries and arterioles (47%)
Veins (7%)
Capillaries (27%)
Large arteries (19%)
Brain
Lungs
Pulmonary vein
Aorta
Pulmonary artery
Veins
Arteries
Superior vena cava
LA
RA
LV
RV
Heart
Inferior vena cava
Liver
Stomach
Hepatic vein
Hepatic portal vein
Muscle
Low-pressure system
(reservoir function)
High-pressure system
(supply function)
Kidney
Capillary
Venule
Arteriole
Skin and other organs
J. Perkins
MS, MFA, CMI

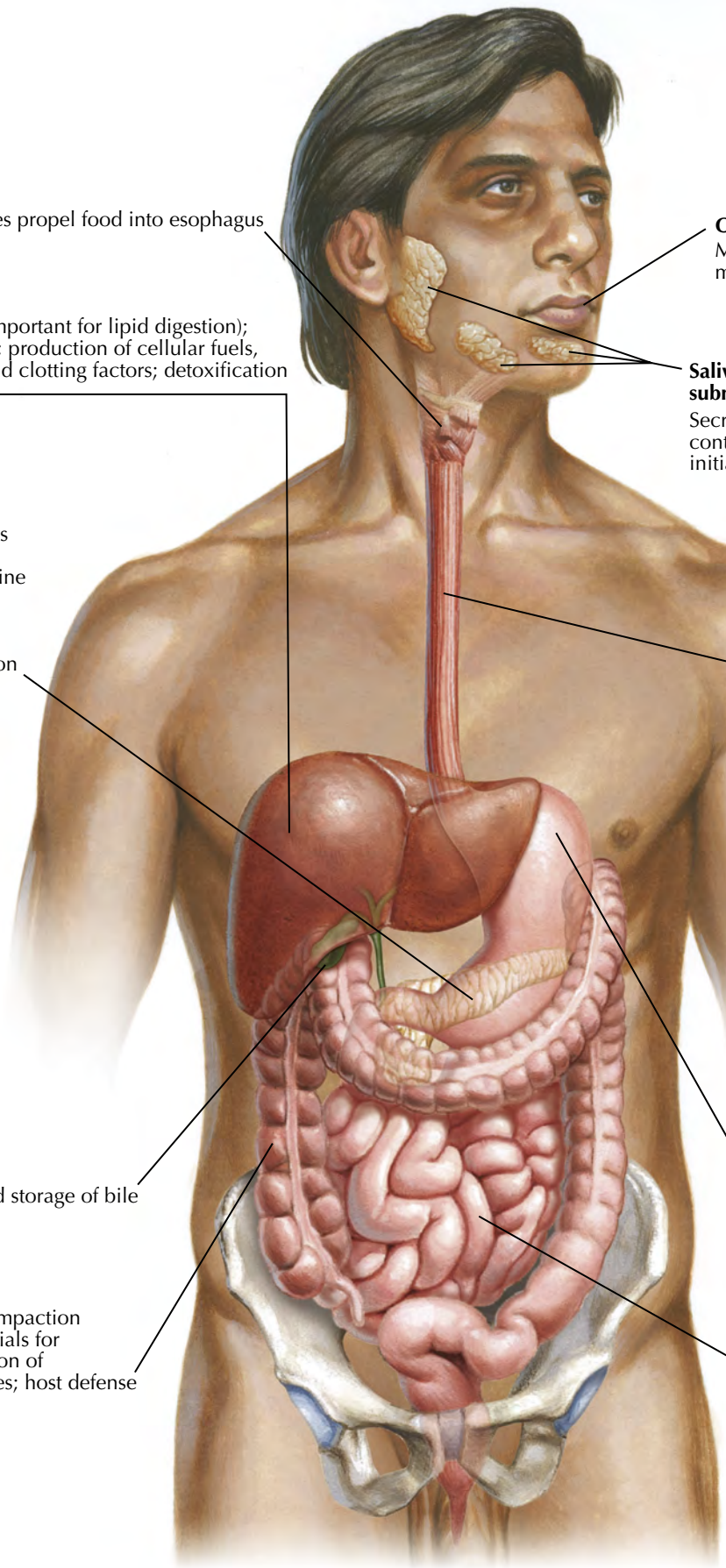
See also **Plate BP 13**




Major veins
Superficial veins
Deep veins
External jugular v.
Internal jugular v.
Brachiocephalic v.
Subclavian v.
Superior vena cava
Axillary v.
Azygos v.
Cephalic v.
Intercostal vv.
Brachial vv.
Inferior vena cava
Basilic v.
Renal v.
Common iliac v.
Radial vv.
Internal iliac v.
External iliac v.
Superficial venous palmar arch
Deep femoral v.
Ulnar vv.
Femoral v.
Palmar digital vv.
Great saphenous v.
Popliteal v.
Posterior tibial vv.
Anterior tibial vv.
Dorsal venous arch
C. Machado M.D.


Lymphoid organs and tissues
Lymph vessels
Lymph vessels of upper limb
Tonsils
Lymph nodes of the neck
Thymus
Thoracic duct
Axillary nodes
Right lymphatic duct
Mediastinal nodes
Thoracic duct
Lymph vessels of breast
Spleen
Cubital nodes
Cisterna chyli
Lumbar nodes
Aggregated lymphoid nodules of intestine (Peyer's patches)
Iliac nodes
Inguinal nodes
Red bone marrow
Popliteal nodes
Lymph vessels of lower limb
C. Machado M.D.
Superficial Flow of Lymph
Drainage of thoracic duct
Drainage of right lymphatic duct


Pituitary gland
Falx cerebri
Sphenoidal sinus
Pons
Supreme nasal concha
Frontal sinus
Superior nasal concha
Medulla oblongata
Nasal cavity
Middle nasal concha
Nasopharynx
Inferior nasal concha
Nasal vestibule
Oropharynx
Pharyngeal opening of auditory tube
Laryngopharynx
Oral cavity
Tongue
Esophagus
Epiglottis
Cervical pleura
Larynx
Clavicle
Vocal fold (cord)
1st rib
Trachea
Costal part of pleura
Subclavian a. and v.
Mediastinal part of pleura
Aortic arch
Right pulmonary a.
Left pulmonary a.
Left main bronchus
Right main bronchus
Descending aorta
Sternum (cut away)
Right lung (covered by visceral pleura)
6th costal cartilage
7th costal cartilage
Hilum of right lung
Rectus abdominis m.
Mediastinal part of pleura
Linea alba
Internal abdominal oblique m.
Diaphragmatic part of pleura
External abdominal oblique m. (cut away)
Diaphragm



Pharynx
Pharyngeal muscles propel food into esophagus

Liver
Secretion of bile (important for lipid digestion); storage of nutrients; production of cellular fuels, plasma proteins, and clotting factors; detoxification and phagocytosis

Pancreas
Secretion of buffers and digestive enzymes by exocrine cells; secretion of hormones by endocrine cells to regulate digestion

Gallbladder
Concentration and storage of bile

Large intestine
Dehydration and compaction of indigestible materials for elimination; resorption of water and electrolytes; host defense

Oral cavity, teeth, tongue
Mechanical breakdown, mixing with saliva

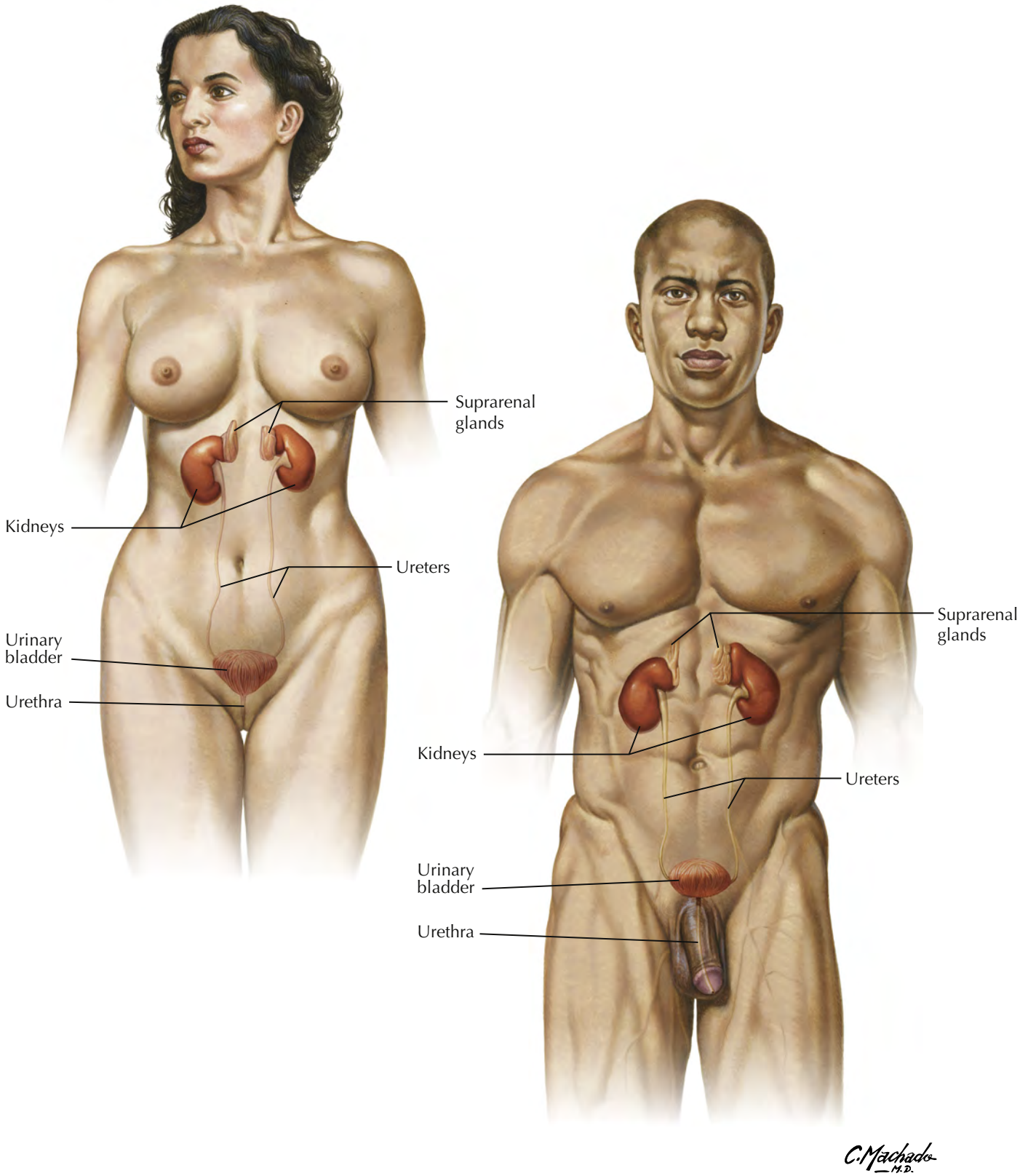
Salivary glands (sublingual, submandibular, parotid)
Secretion of lubricating fluid containing enzymes that initiate digestion

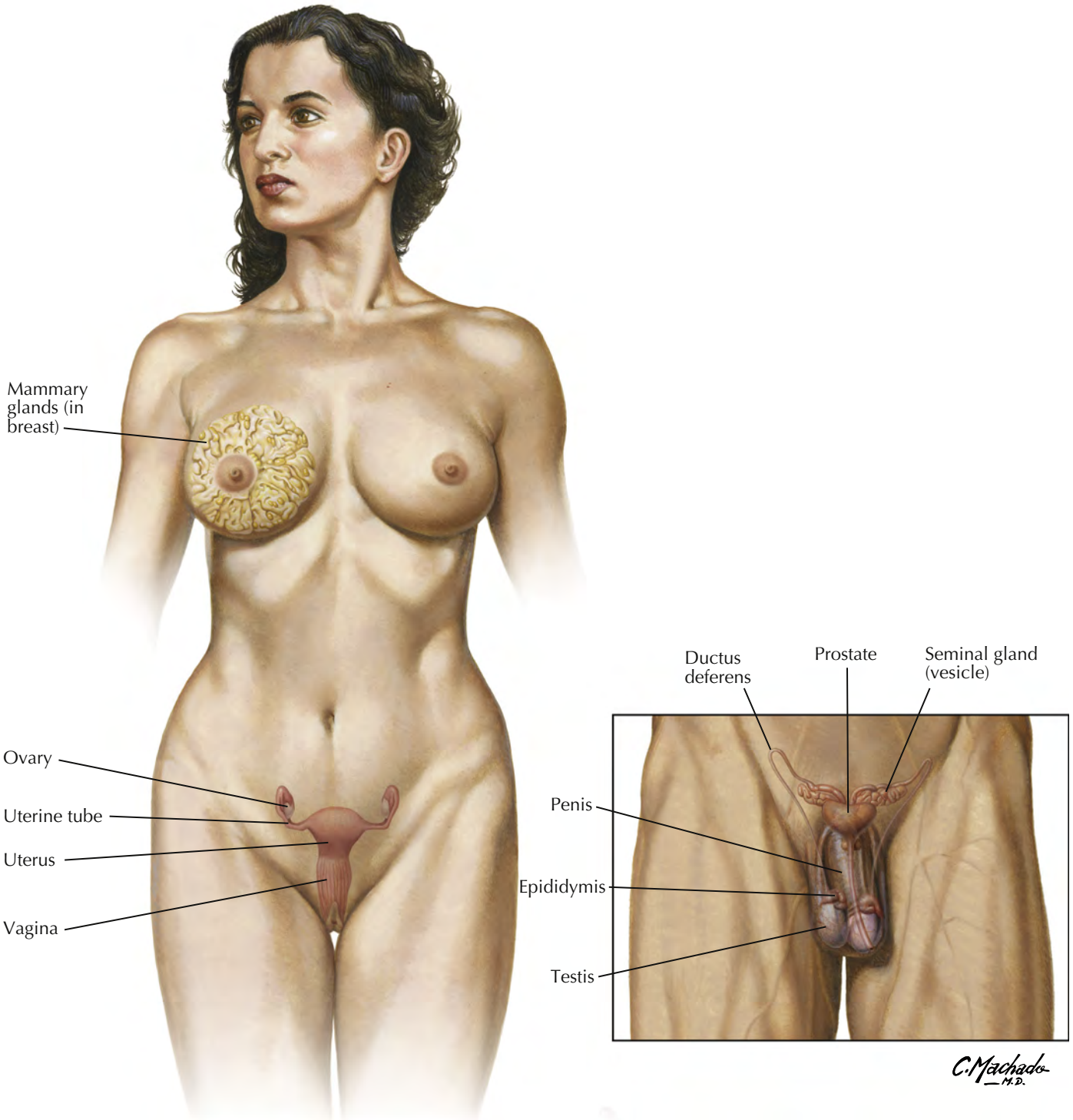
Esophagus
Transport of food into the stomach

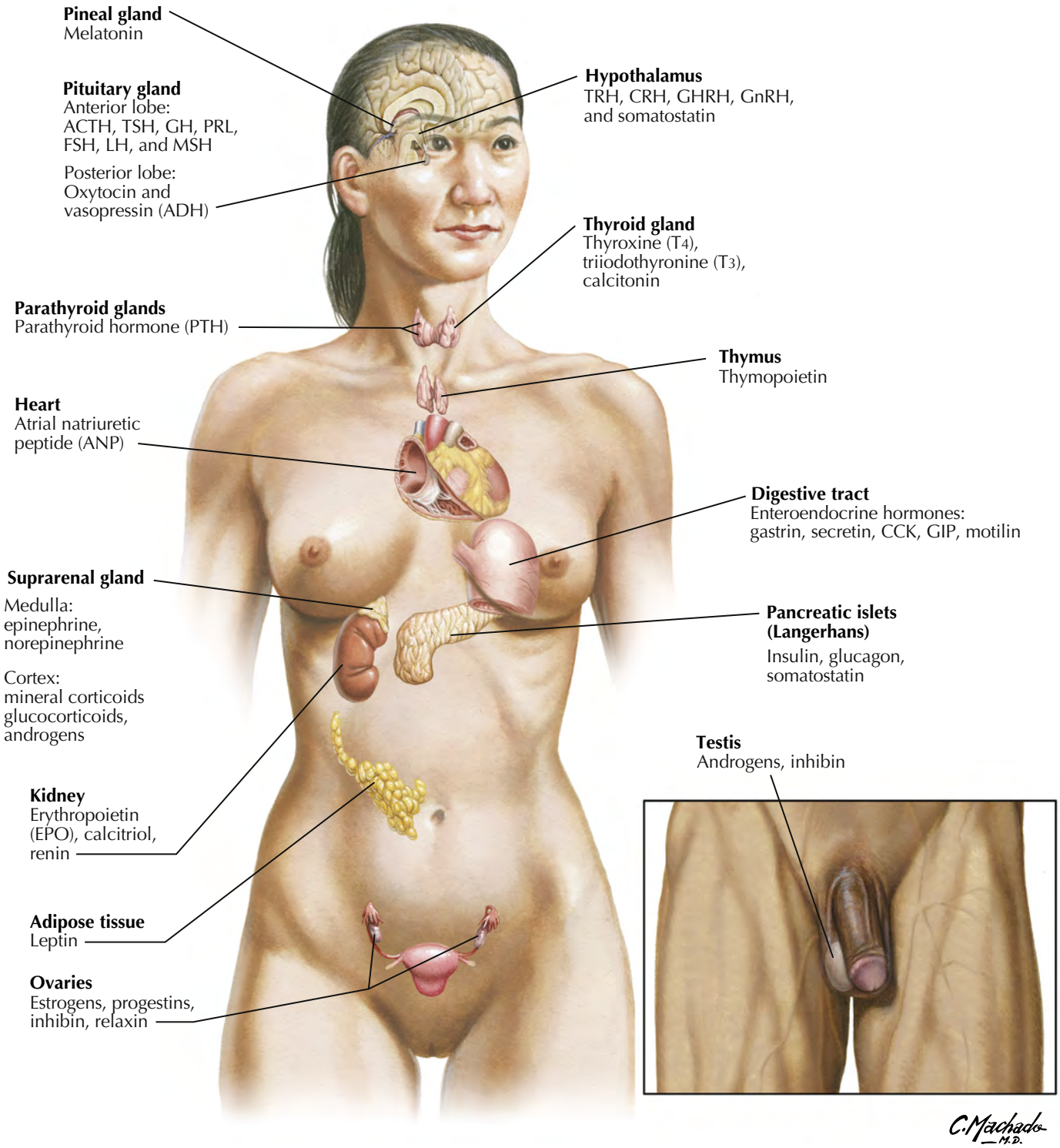
Stomach
Chemical breakdown of food by acid and enzymes; mechanical breakdown via muscular contractions; absorption of water, alcohol, and some minerals

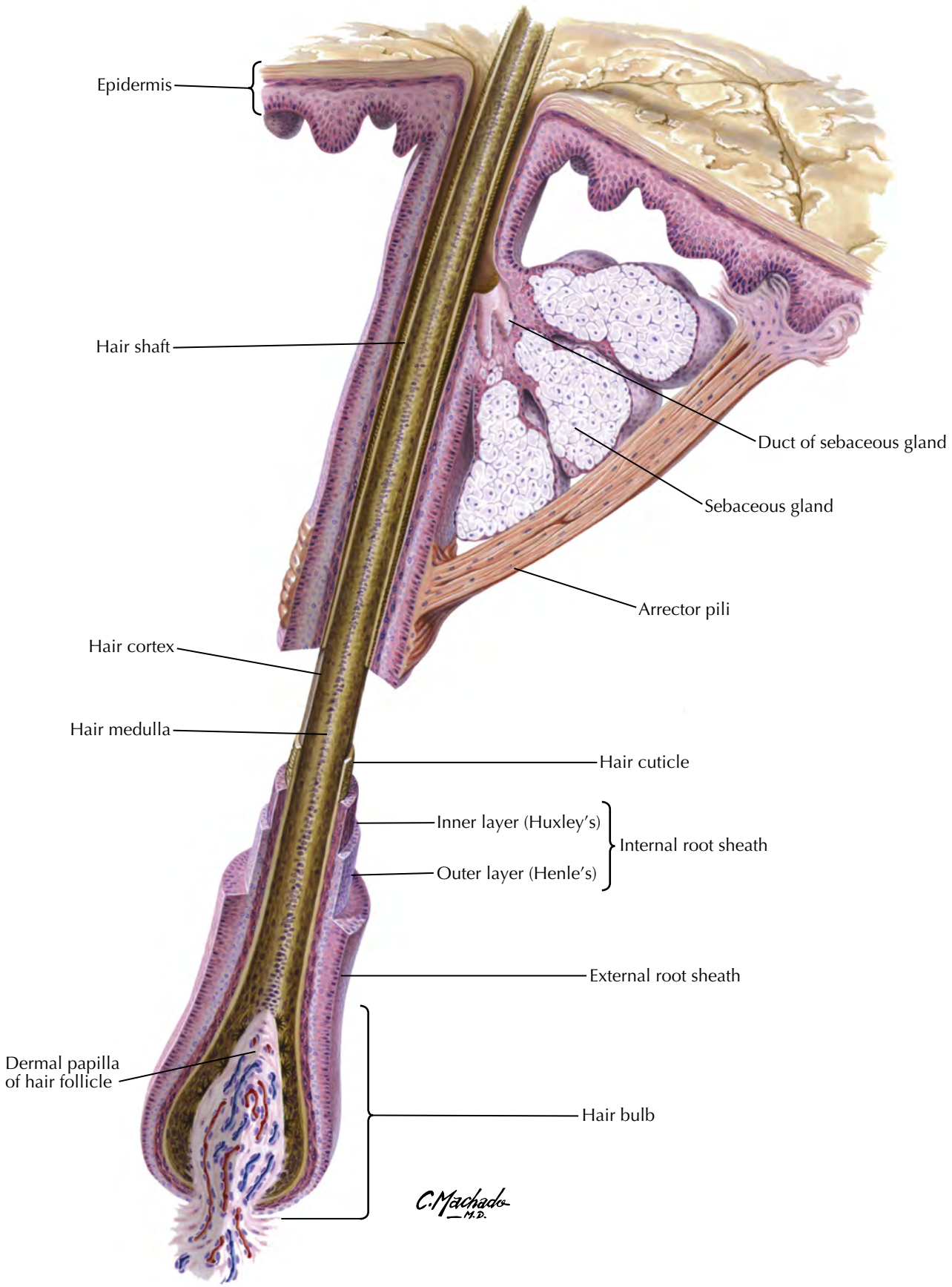
Small intestine
Neutralization of acid from stomach; enzymatic digestion and absorption of water, organic substrates, vitamins, and ions; host defense

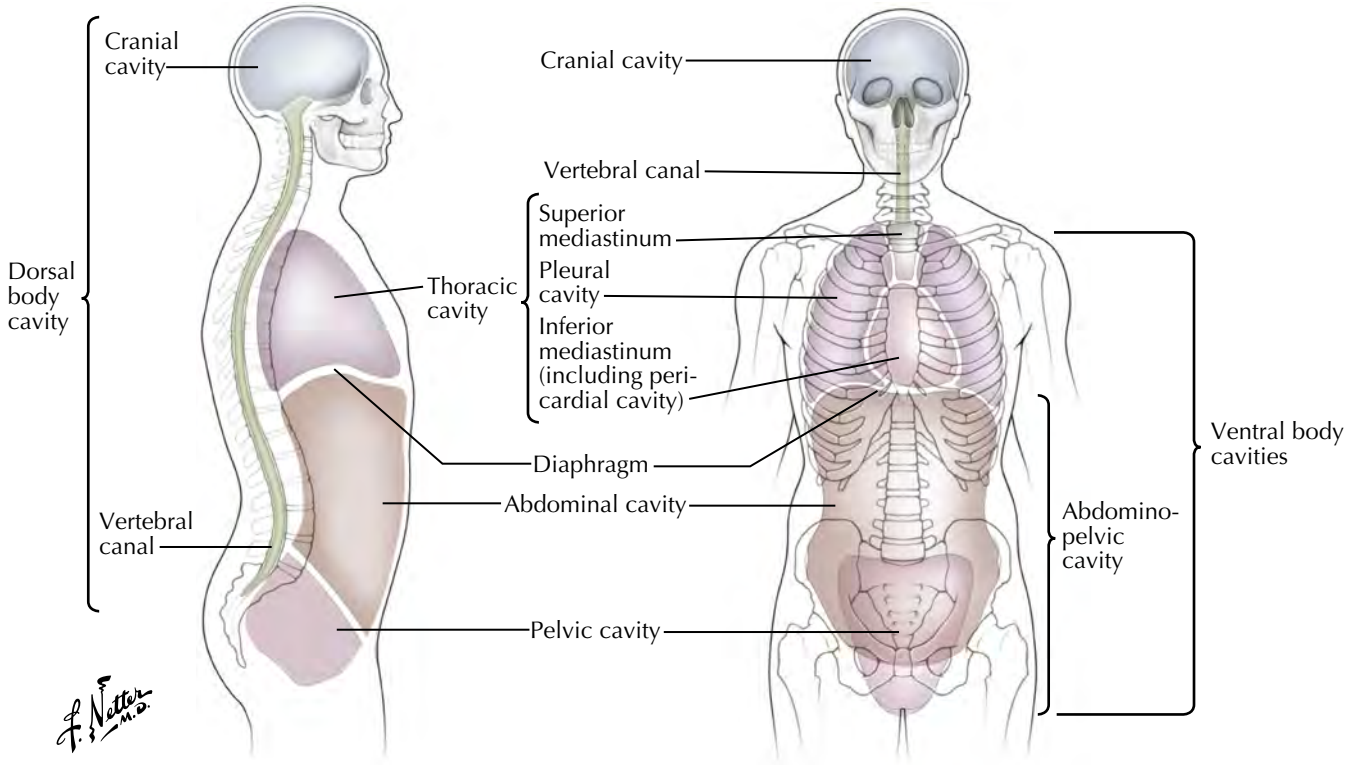
C. Machado, M.D.


Suprarenal glands
Kidneys
Ureters
Urinary bladder
Urethra
Suprarenal glands
Kidneys
Ureters
Urinary bladder
Urethra
C. Machado M.D.

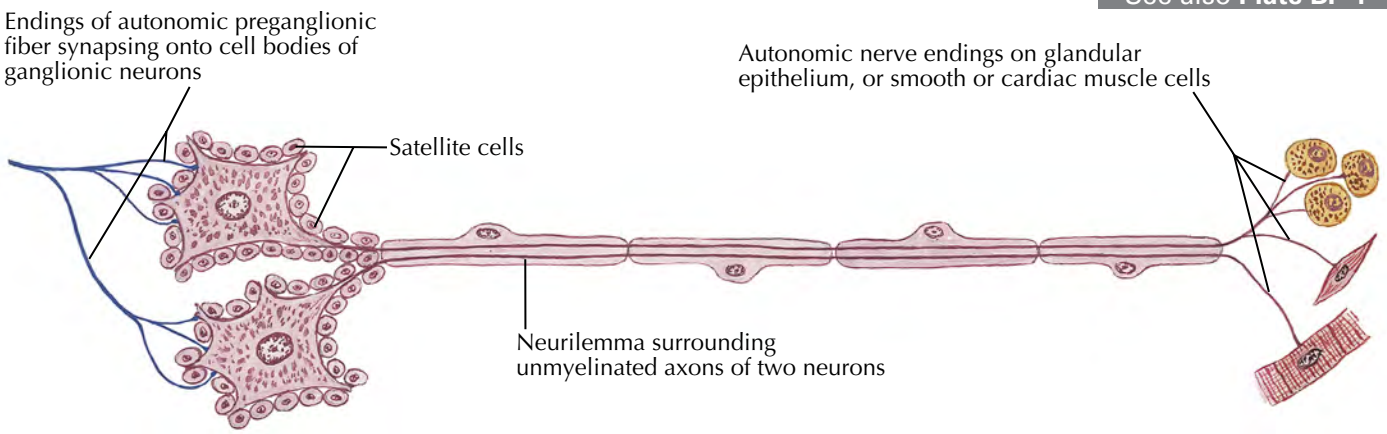

Mammary glands (in breast)
Ovary
Uterine tube
Uterus
Vagina
Ductus deferens
Prostate
Seminal gland (vesicle)
Penis
Epididymis
Testis
C. Machado, M.D.


Pineal gland
Melatonin
Pituitary gland
Anterior lobe:
ACTH, TSH, GH, PRL,
FSH, LH, and MSH
Posterior lobe:
Oxytocin and
vasopressin (ADH)
Hypothalamus
TRH, CRH, GHRH, GnRH,
and somatostatin
Thyroid gland
Thyroxine (T4),
triiodothyronine (T3),
calcitonin
Parathyroid glands
Parathyroid hormone (PTH)
Thymus
Thymopoietin
Heart
Atrial natriuretic
peptide (ANP)
Digestive tract
Enteroendocrine hormones:
gastrin, secretin, CCK, GIP, motilin
Suprarenal gland
Medulla:
epinephrine,
norepinephrine
Cortex:
mineral corticoids
glucocorticoids,
androgens
Pancreatic islets
(Langerhans)
Insulin, glucagon,
somatostatin
Testis
Androgens, inhibin
Kidney
Erythropoietin
(EPO), calcitriol,
renin
Adipose tissue
Leptin
Ovaries
Estrogens, progestins,
inhibin, relaxin
C. Machado M.D.

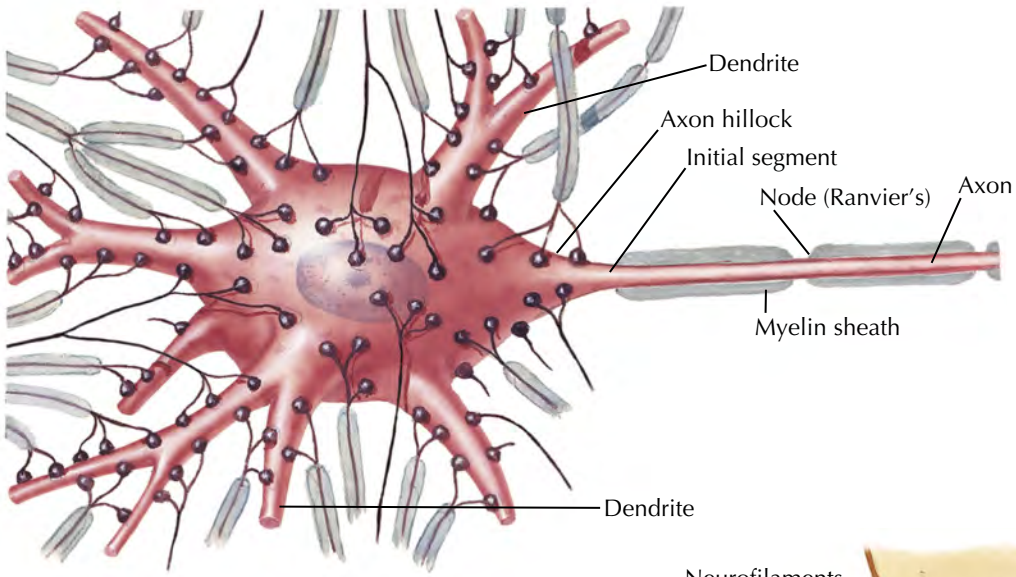

Epidermis
Hair shaft
Duct of sebaceous gland
Sebaceous gland
Arrector pili
Hair cortex
Hair medulla
Hair cuticle
Inner layer (Huxley's)
Outer layer (Henle's)
Internal root sheath
External root sheath
Dermal papilla of hair follicle
Hair bulb
C. Machado M.D.


Cranial cavity
Dorsal body cavity
Thoracic cavity
Vertebral canal
Diaphragm
Abdominal cavity
Pelvic cavity
Cranial cavity
Vertebral canal
Superior mediastinum
Pleural cavity
Inferior mediastinum (including peri-cardial cavity)
Abdomino-pelvic cavity
Ventral body cavities

See also **Plate BP 4**

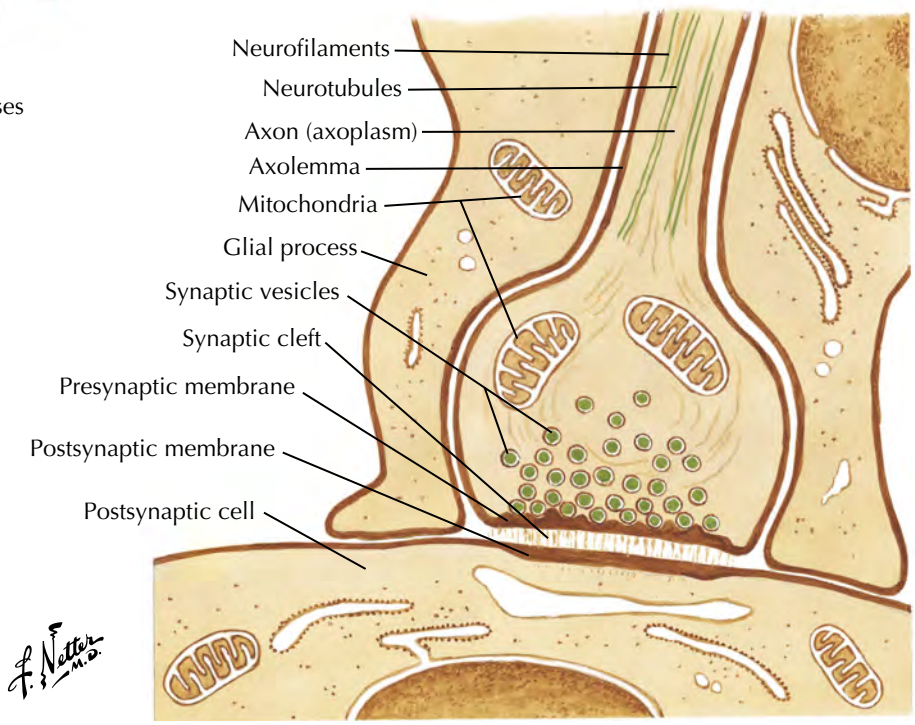


Two postganglionic autonomic neurons of a sympathetic or parasympathetic ganglion



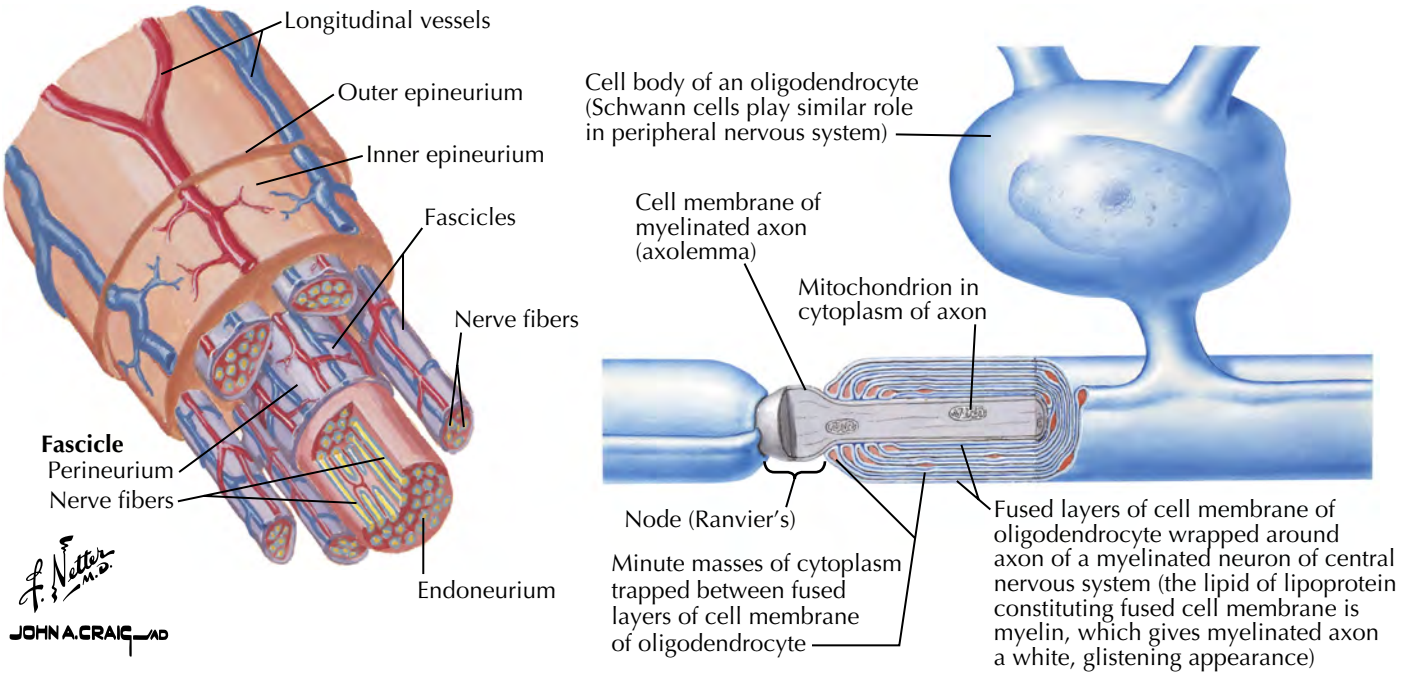
Schematic of synapses on neuron

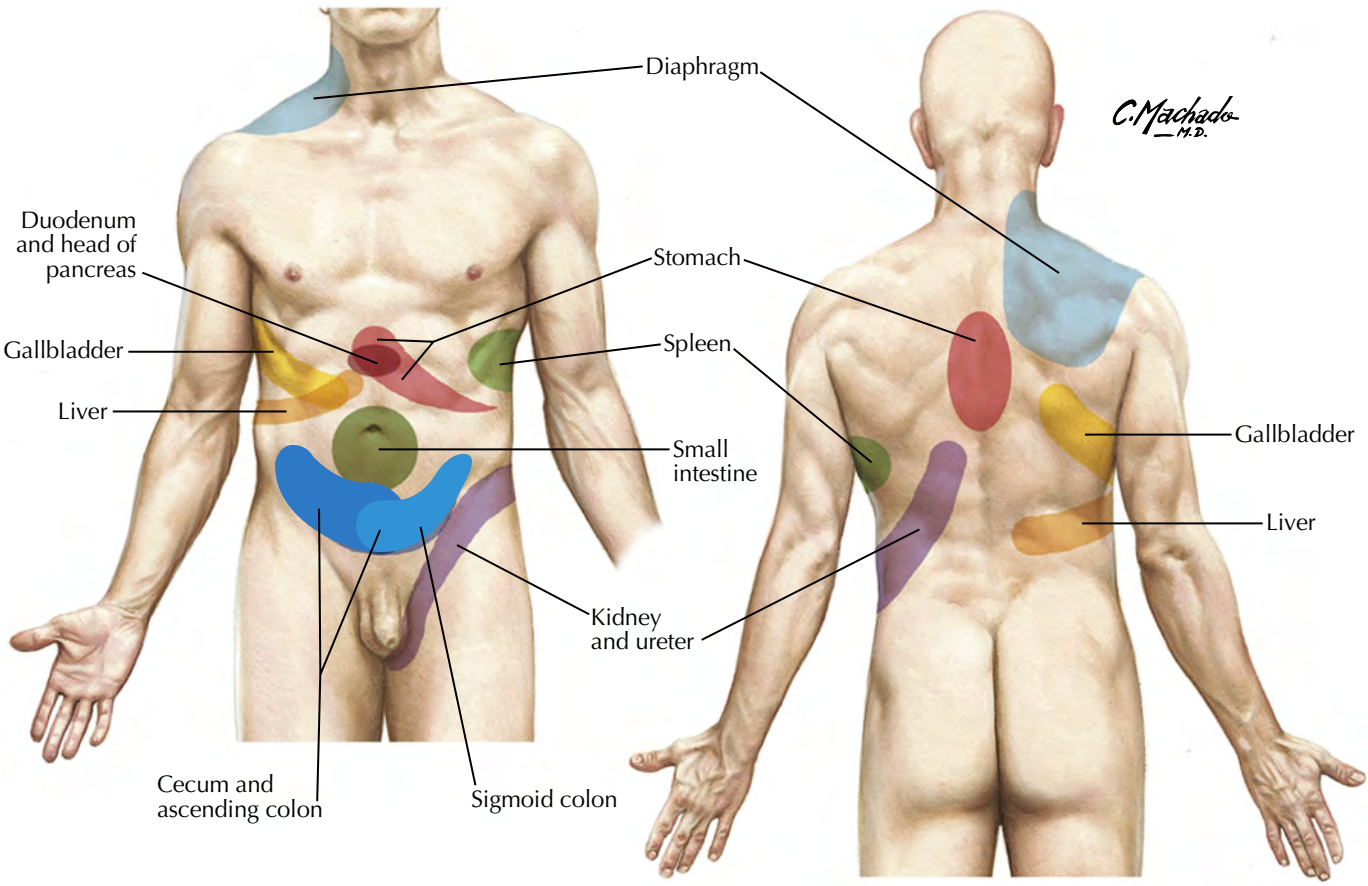
Numerous terminal boutons forming synapses on body and dendrites of a motor neuron

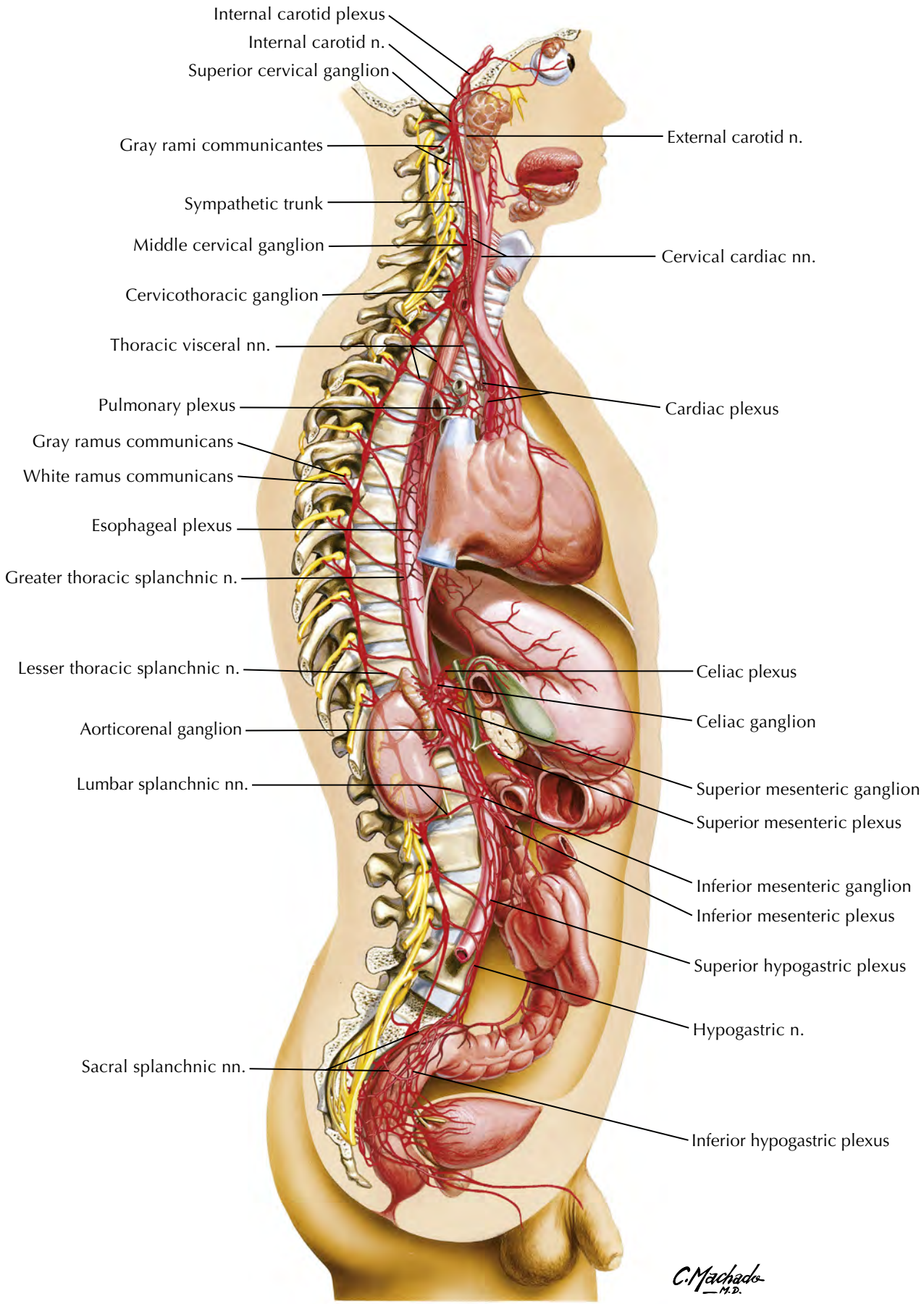


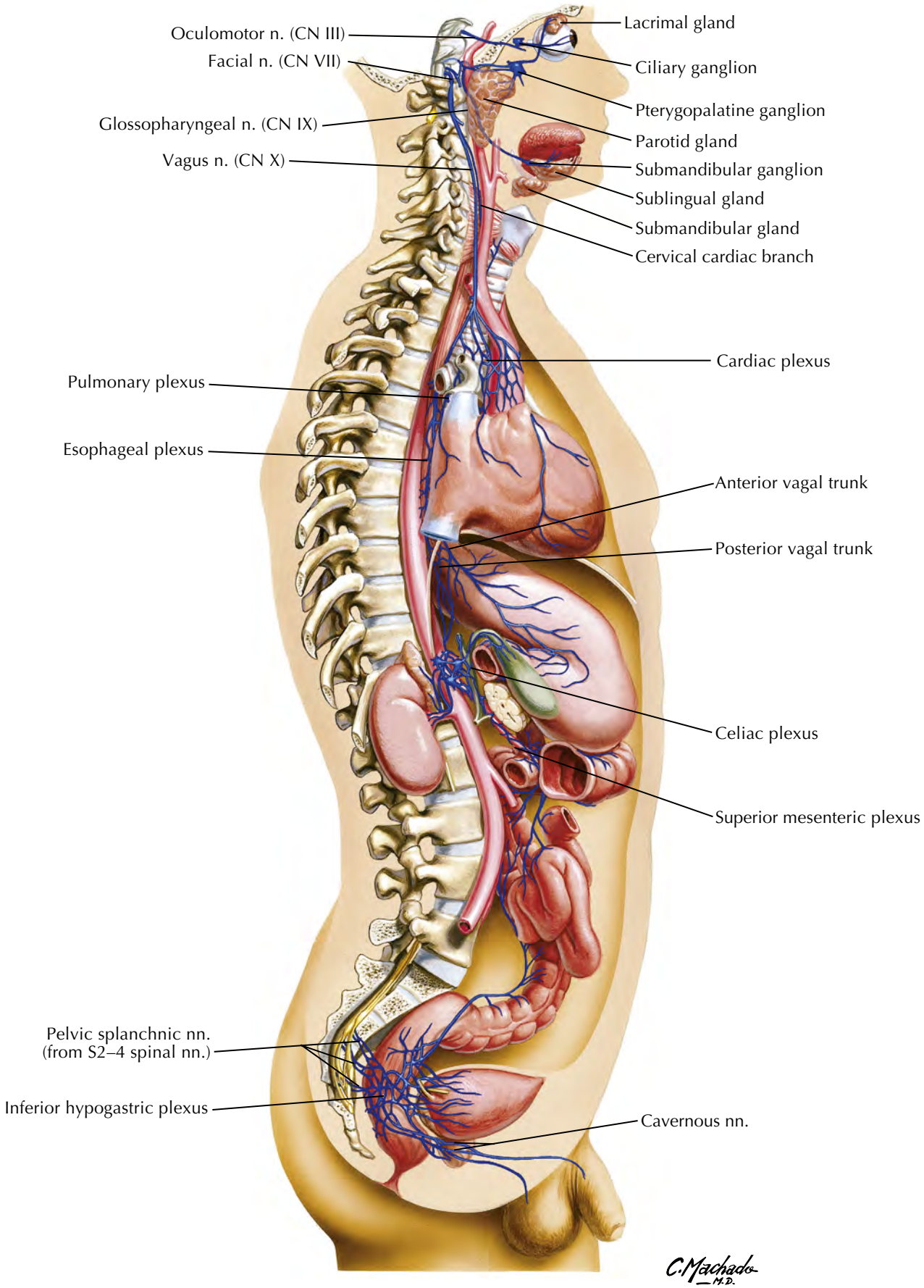
Enlarged section of bouton

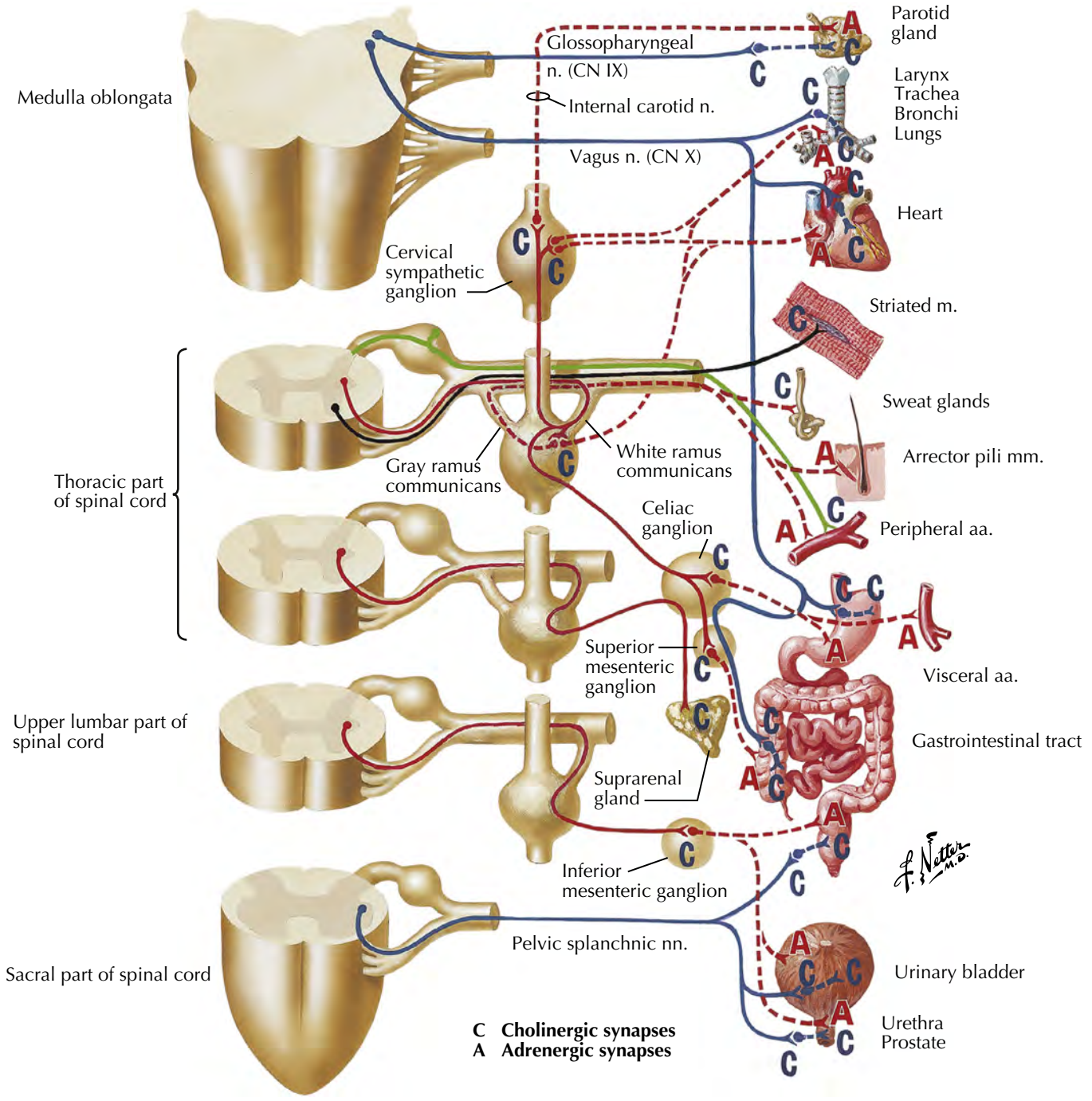
See also **Plate BP 3**

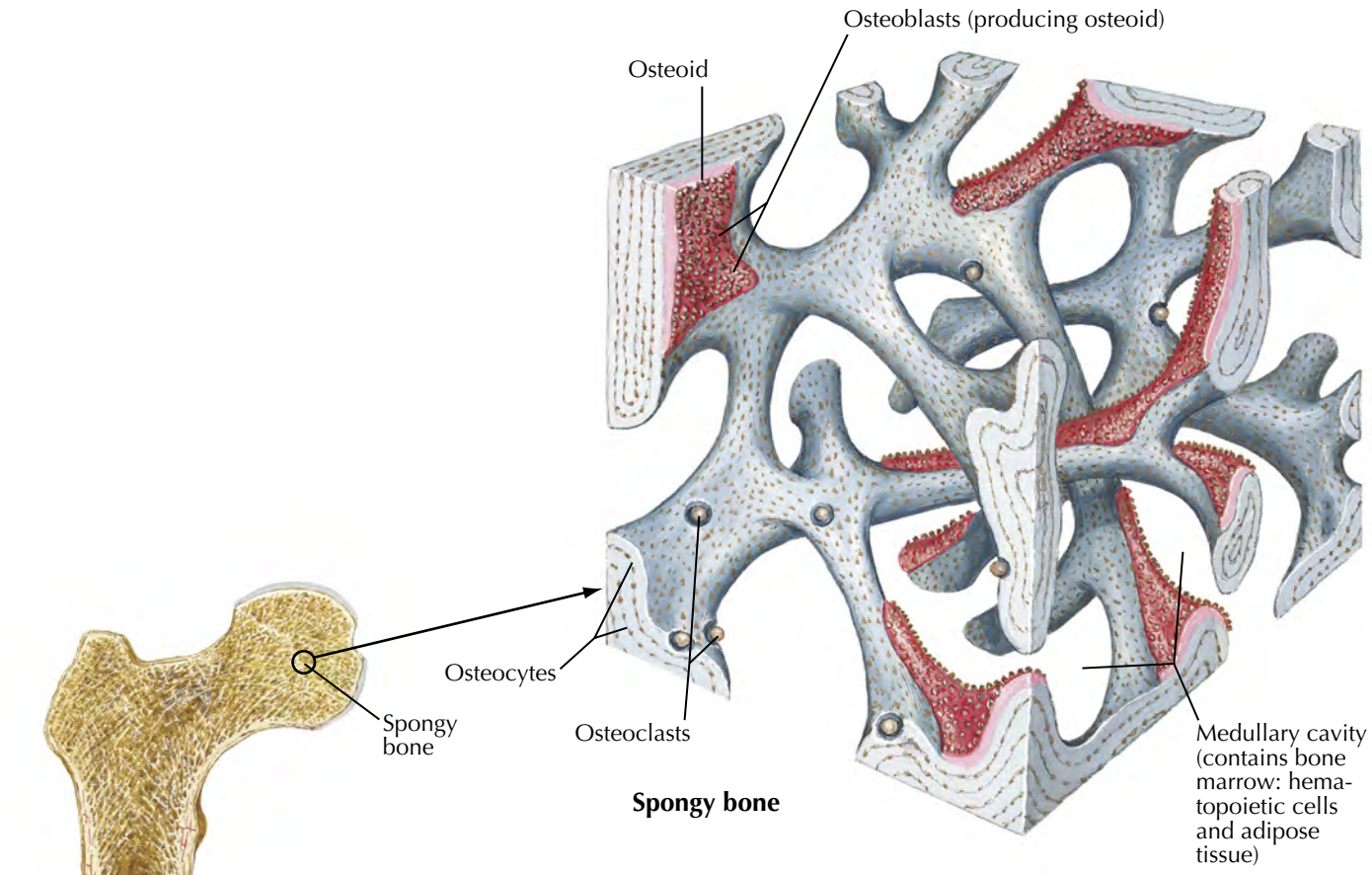



Diaphragm
C. Machado M.D.
Duodenum and head of pancreas
Stomach
Gallbladder
Spleen
Liver
Small intestine
Gallbladder
Liver
Kidney and ureter
Cecum and ascending colon
Sigmoid colon

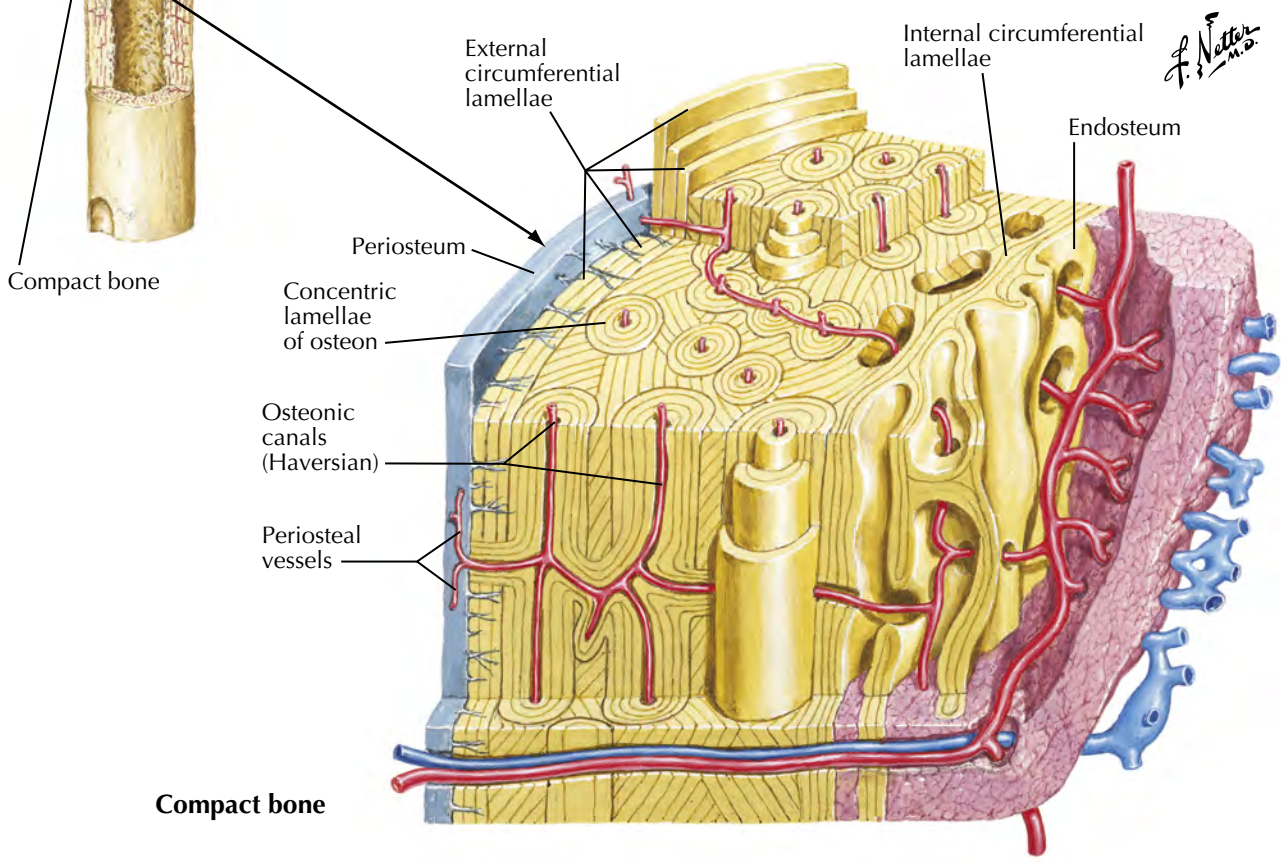

Internal carotid plexus
Internal carotid n.
Superior cervical ganglion
Gray rami communicantes
Sympathetic trunk
Middle cervical ganglion
Cervicothoracic ganglion
Thoracic visceral nn.
Pulmonary plexus
Gray ramus communicans
White ramus communicans
Esophageal plexus
Greater thoracic splanchnic n.
Lesser thoracic splanchnic n.
Aorticorenal ganglion
Lumbar splanchnic nn.
Sacral splanchnic nn.
External carotid n.
Cervical cardiac nn.
Cardiac plexus
Celiac plexus
Celiac ganglion
Superior mesenteric ganglion
Superior mesenteric plexus
Inferior mesenteric ganglion
Inferior mesenteric plexus
Superior hypogastric plexus
Hypogastric n.
Inferior hypogastric plexus
C. Machado M.D.


Oculomotor n. (CN III)
Facial n. (CN VII)
Glossopharyngeal n. (CN IX)
Vagus n. (CN X)
Lacrimal gland
Ciliary ganglion
Pterygopalatine ganglion
Parotid gland
Submandibular ganglion
Sublingual gland
Submandibular gland
Cervical cardiac branch
Cardiac plexus
Pulmonary plexus
Esophageal plexus
Anterior vagal trunk
Posterior vagal trunk
Celiac plexus
Superior mesenteric plexus
Pelvic splanchnic nn.
(from S2–4 spinal nn.)
Inferior hypogastric plexus
Cavernous nn.
C. Machado M.D.

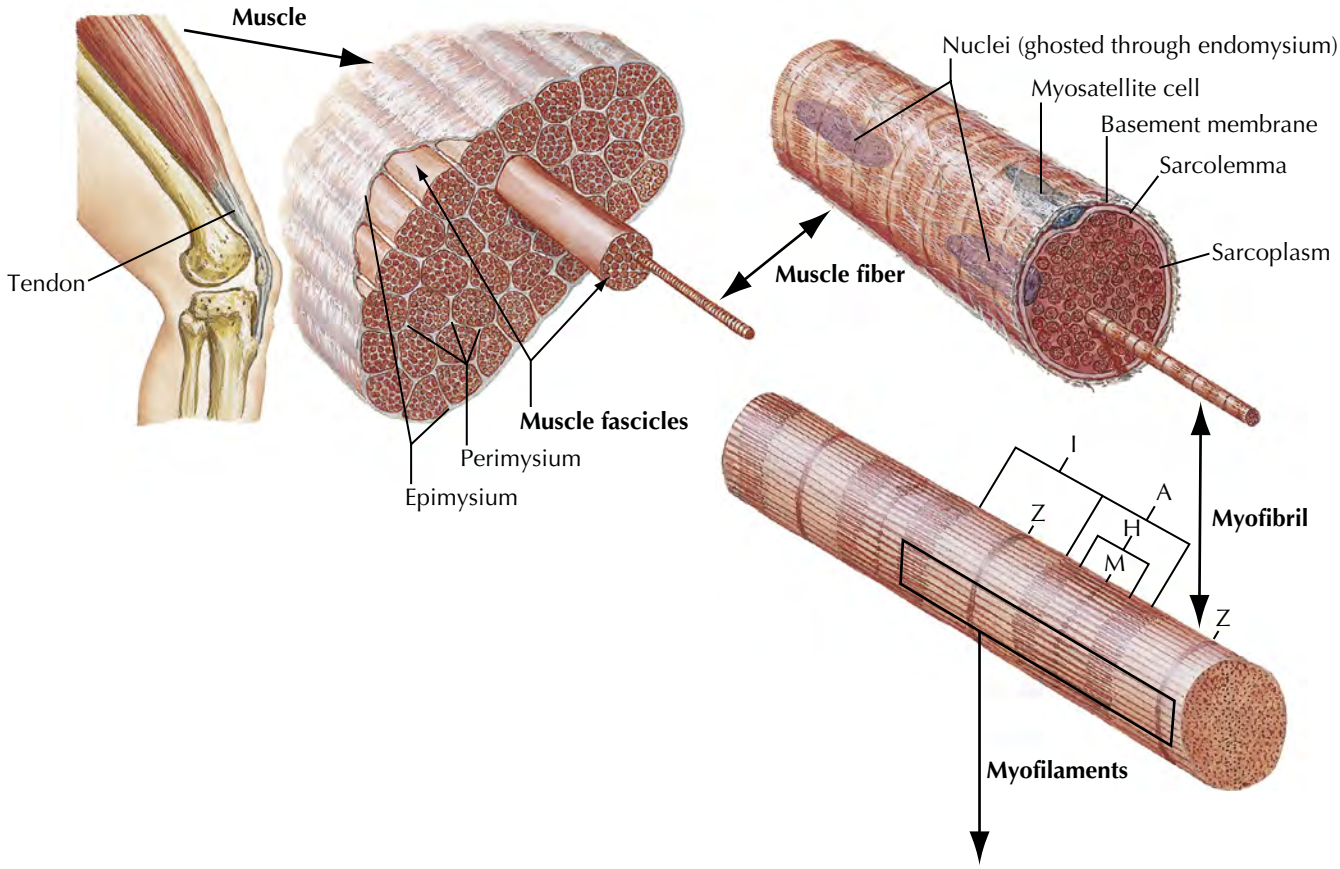

Medulla oblongata
Glossopharyngeal n. (CN IX)
Internal carotid n.
Vagus n. (CN X)
Parotid gland
Larynx
Trachea
Bronchi
Lungs
Heart
Cervical sympathetic ganglion
Striated m.
Sweat glands
Arrector pili mm.
Peripheral aa.
Thoracic part of spinal cord
Gray ramus communicans
White ramus communicans
Celiac ganglion
Superior mesenteric ganglion
Visceral aa.
Gastrointestinal tract
Upper lumbar part of spinal cord
Suprarenal gland
Inferior mesenteric ganglion
Pelvic splanchnic nn.
Sacral part of spinal cord
Urinary bladder
Urethra
Prostate
C Cholinergic synapses
A Adrenergic synapses
Sympathetic fibers
Presynaptic
Postsynaptic
Parasympathetic fibers
Presynaptic
Postsynaptic
Somatic fibers
Antidromic conduction

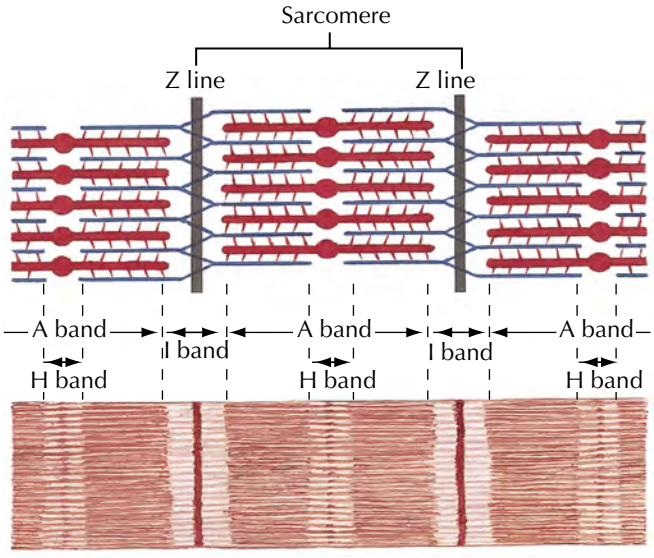


Spongy bone

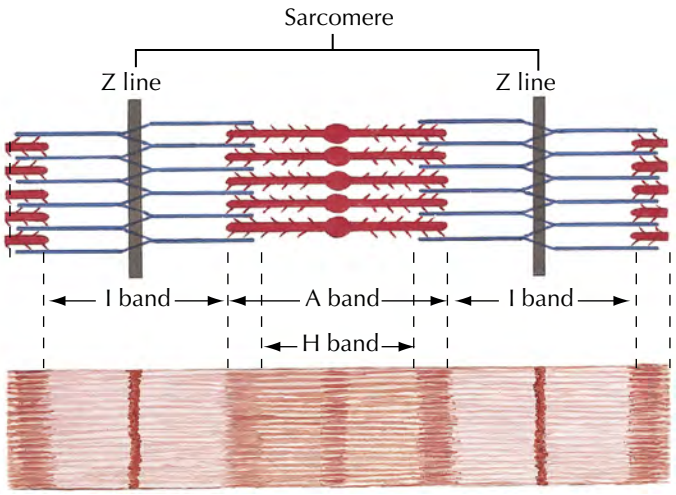


Compact bone

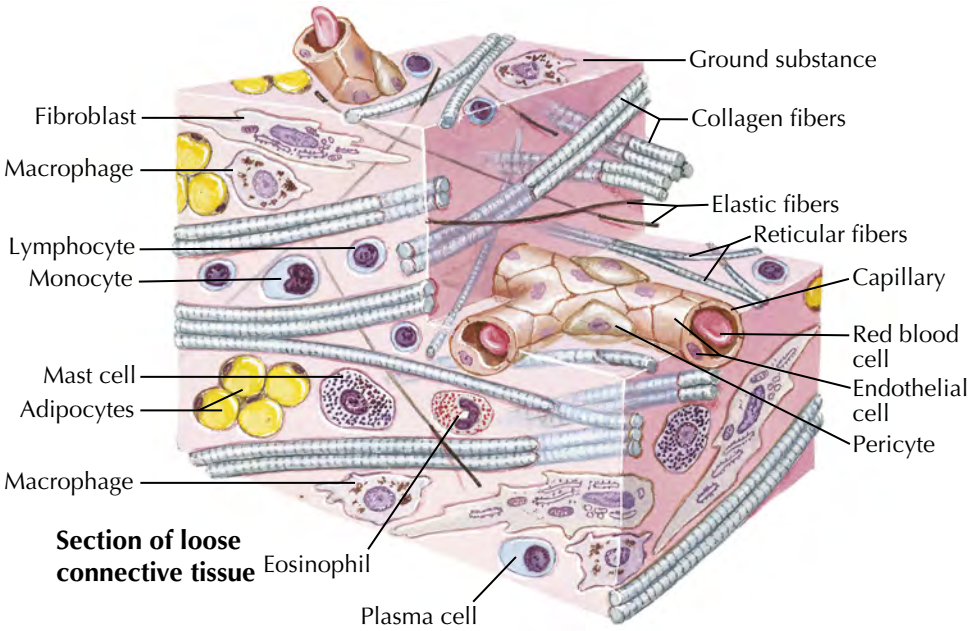




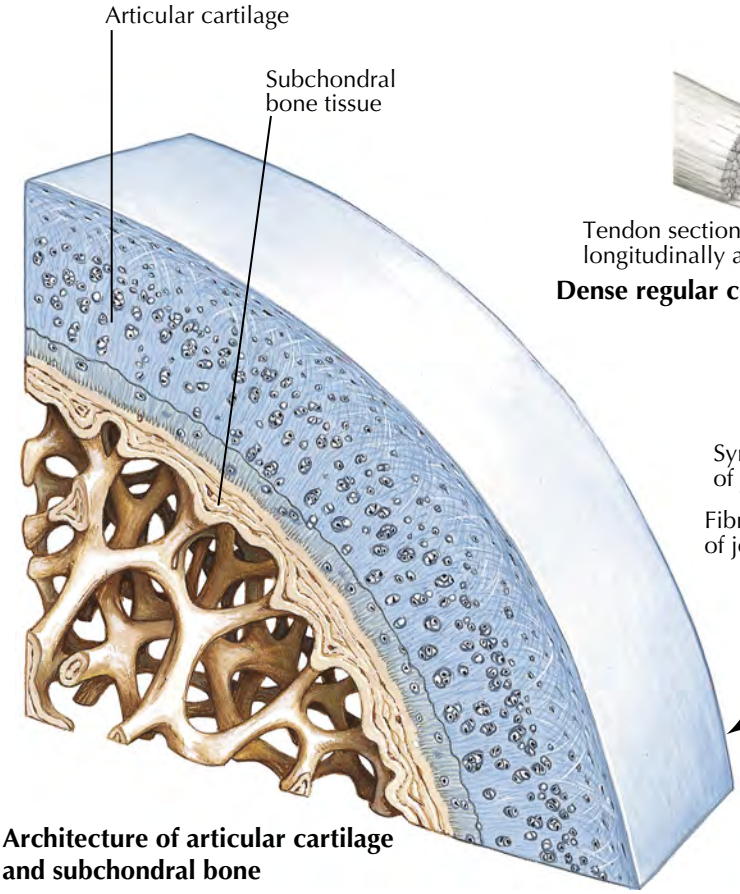
Muscle contracted



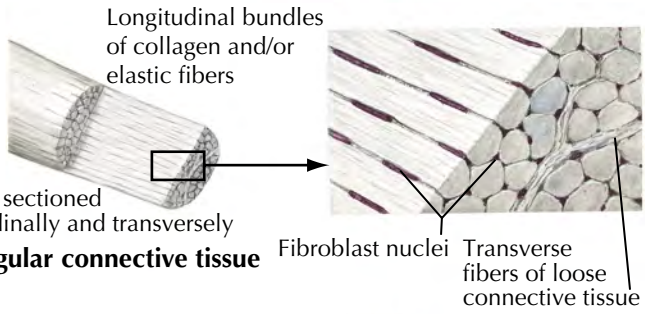
Muscle relaxed



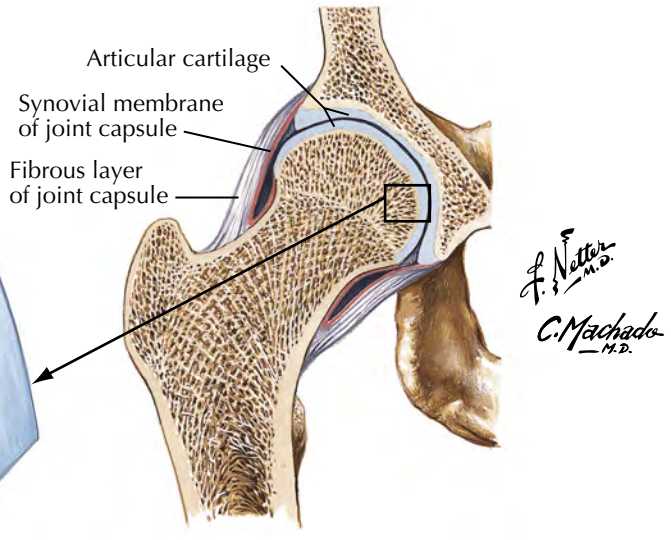
Section of loose connective tissue



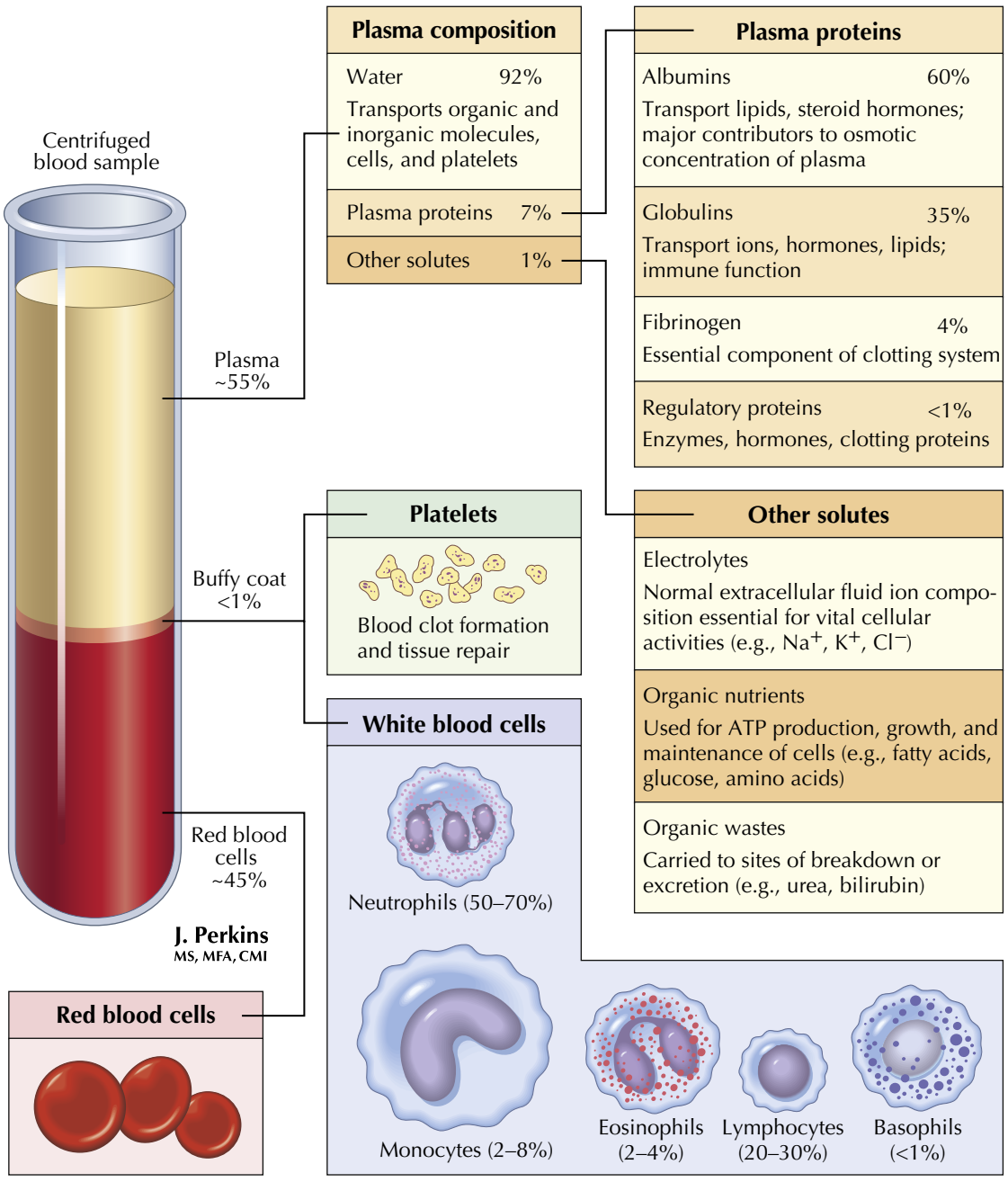
Architecture of articular cartilage and subchondral bone

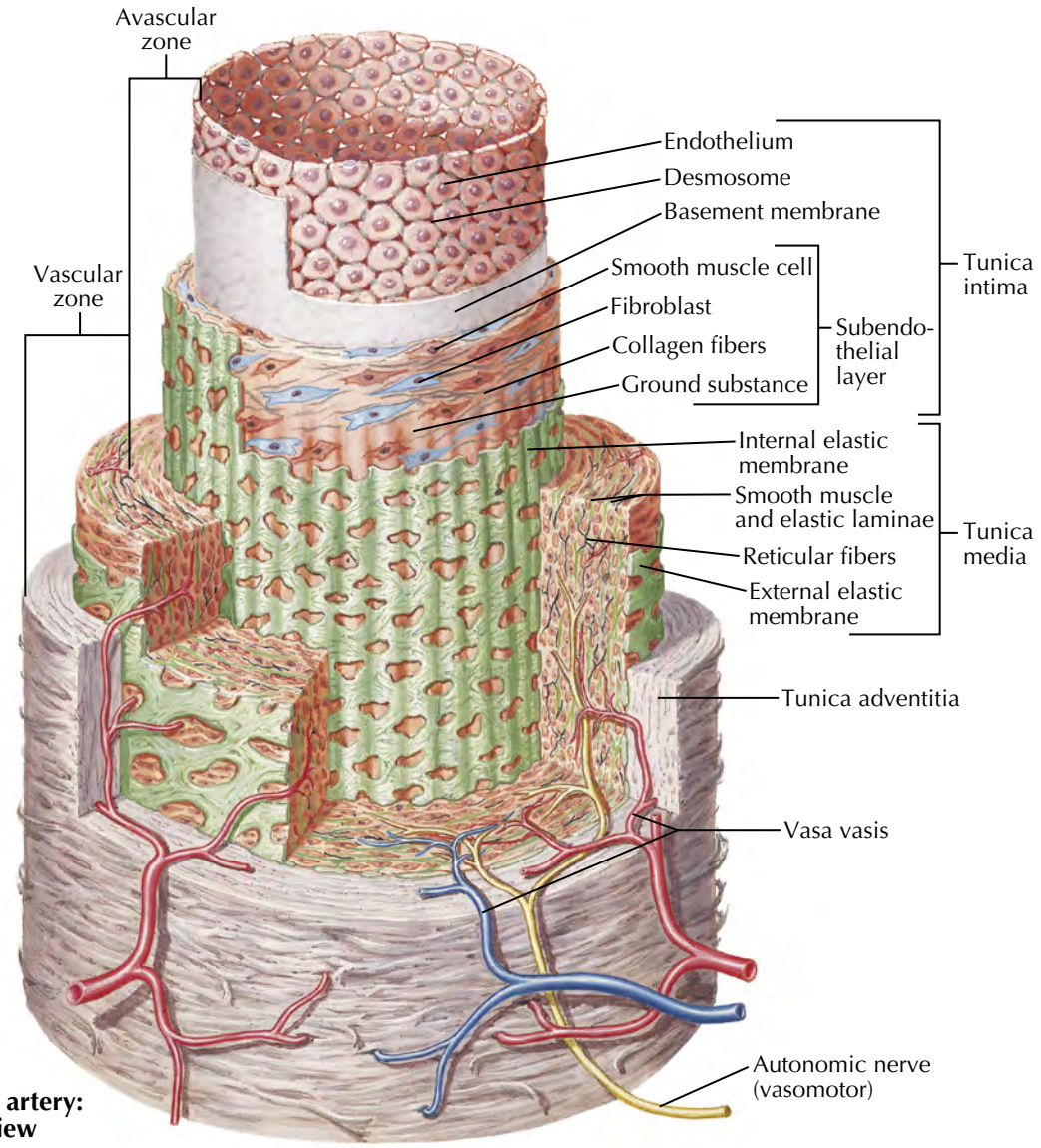


Dense regular connective tissue

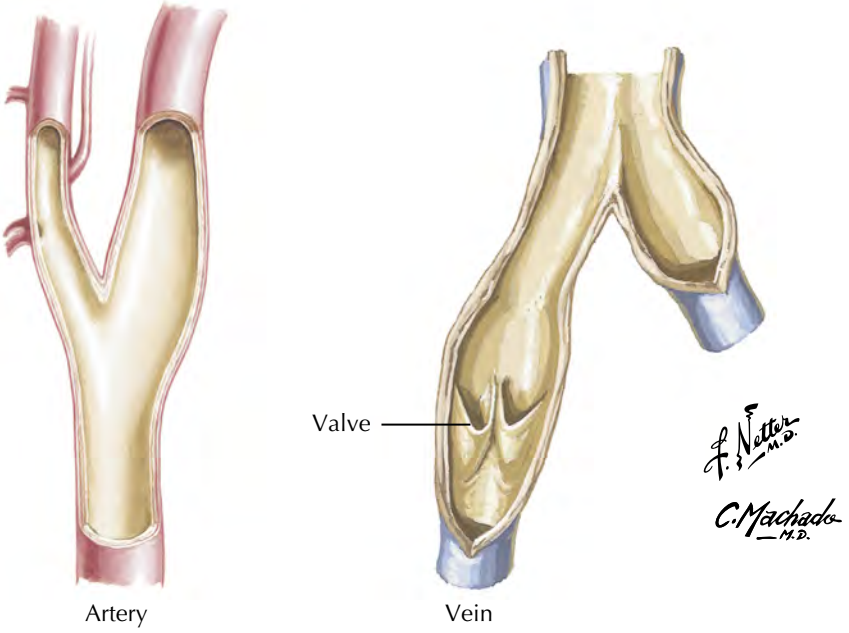


Joint with cartilage-covered articular surfaces


Centrifuged blood sample
Plasma ~55%
Buffy coat <1%
Red blood cells ~45%
J. Perkins
MS, MFA, CMI
Plasma composition
Water 92%
Transports organic and inorganic molecules, cells, and platelets
Plasma proteins 7%
Other solutes 1%
Plasma proteins
Albumins 60%
Transport lipids, steroid hormones; major contributors to osmotic concentration of plasma
Globulins 35%
Transport ions, hormones, lipids; immune function
Fibrinogen 4%
Essential component of clotting system
Regulatory proteins <1%
Enzymes, hormones, clotting proteins
Platelets
Blood clot formation and tissue repair
Other solutes
Electrolytes
Normal extracellular fluid ion composition essential for vital cellular activities (e.g., Na^+, K^+, Cl^-)
Organic nutrients
Used for ATP production, growth, and maintenance of cells (e.g., fatty acids, glucose, amino acids)
Organic wastes
Carried to sites of breakdown or excretion (e.g., urea, bilirubin)
White blood cells
Neutrophils (50–70%)
Monocytes (2–8%)
Eosinophils (2–4%)
Lymphocytes (20–30%)
Basophils (<1%)
Red blood cells



Wall of an artery: cutaway view



Artery

Vein

HEAD AND NECK 2

Surface Anatomy	22–24	**Cranial and Cervical Nerves**	143–162
Bones and Joints	25–47	**Cerebral Vasculature**	163–175
Neck	48–58	**Regional Imaging**	176–177
Nose	59–82	**Structures with High Clinical Significance**	Tables 2.1–2.4
Mouth	83–90	**Cranial Nerves**	Tables 2.5–2.8
Pharynx	91–102	**Branches of Cervical Plexus**	Table 2.9
Larynx and Endocrine Glands	103–109	**Muscles**	Tables 2.10–2.14
Eye	110–120	**Electronic Bonus Plates**	BP 14–BP 32
Ear	121–126		
Brain and Meninges	127–142		

ELECTRONIC BONUS PLATES

BP 14 Somatosensory System: Trunk and Limbs

BP 15 Pyramidal System

BP 16 3D Skull Reconstruction CTs

BP 17 Degenerative Changes in Cervical Vertebrae

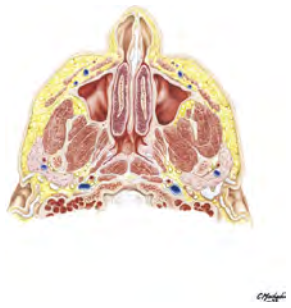
BP 18 Atlantooccipital Junction

BP 19 Muscles of Facial Expression: Anterior View

BP 20 Musculature of Face

BP 21 Arteries of Nasal Cavity: Bony Nasal Septum Turned Up

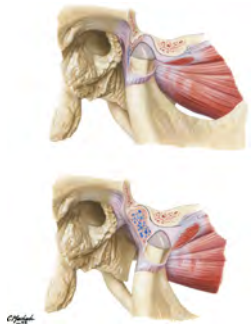
ELECTRONIC BONUS PLATES—*cont'd*



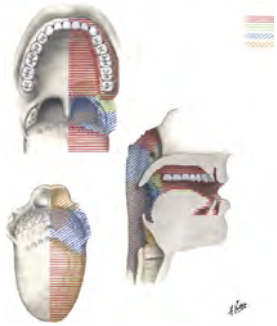
BP 22 Nose and Maxillary Sinus: Transverse Section

BP 23 Paranasal Sinuses

BP 24 Subclavian Artery

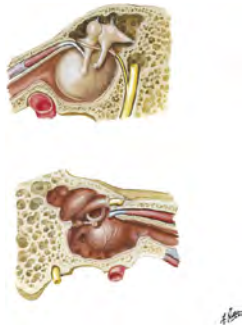


BP 25 Opening of the Mandible



BP 26 Afferent Innervation of Oral Cavity and Pharynx

BP 27 Fasciae of Orbit and Eyeball



BP 28 Tympanic Cavity: Medial and Lateral Views

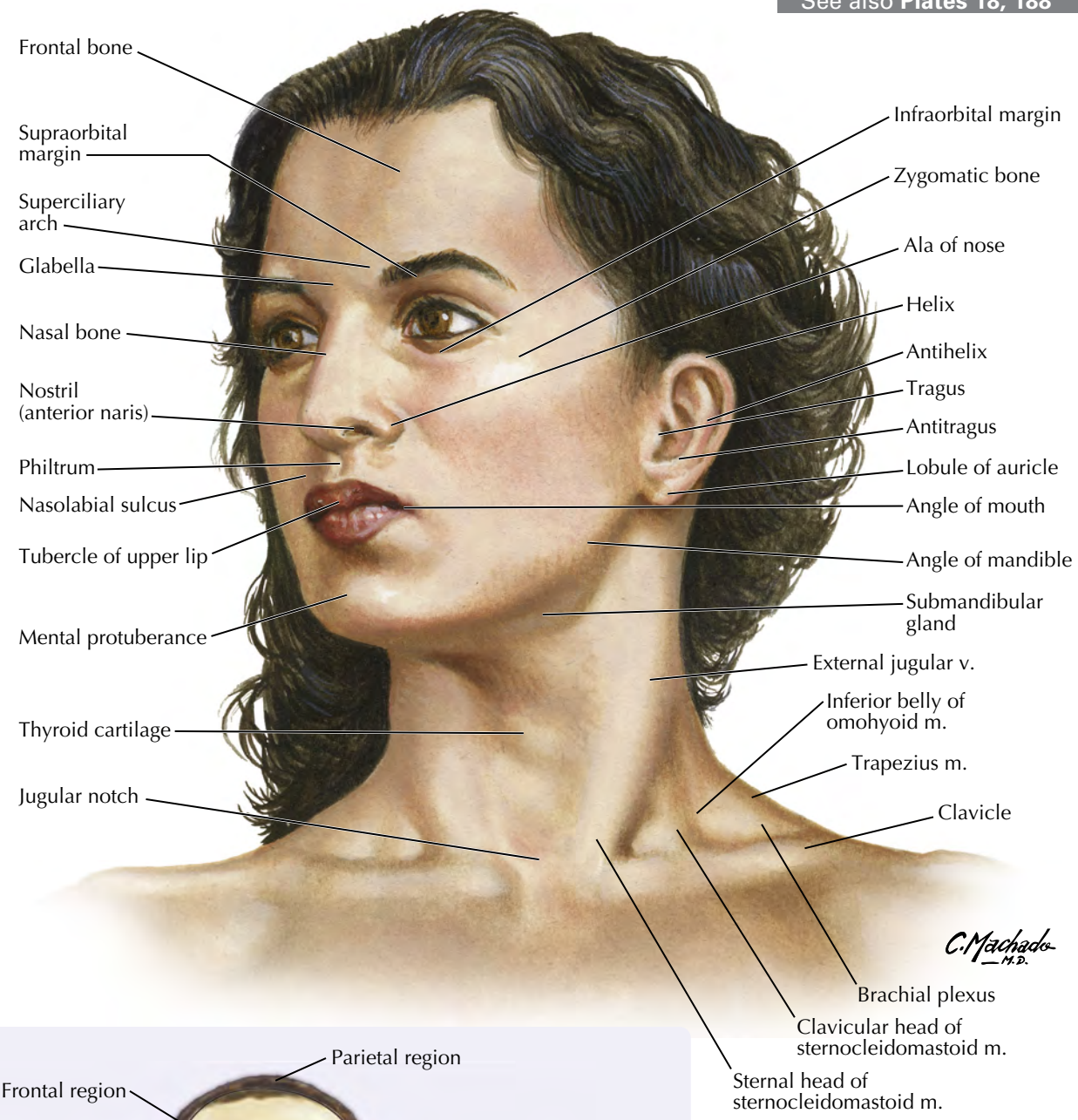
BP 29 Anatomy of the Pediatric Ear

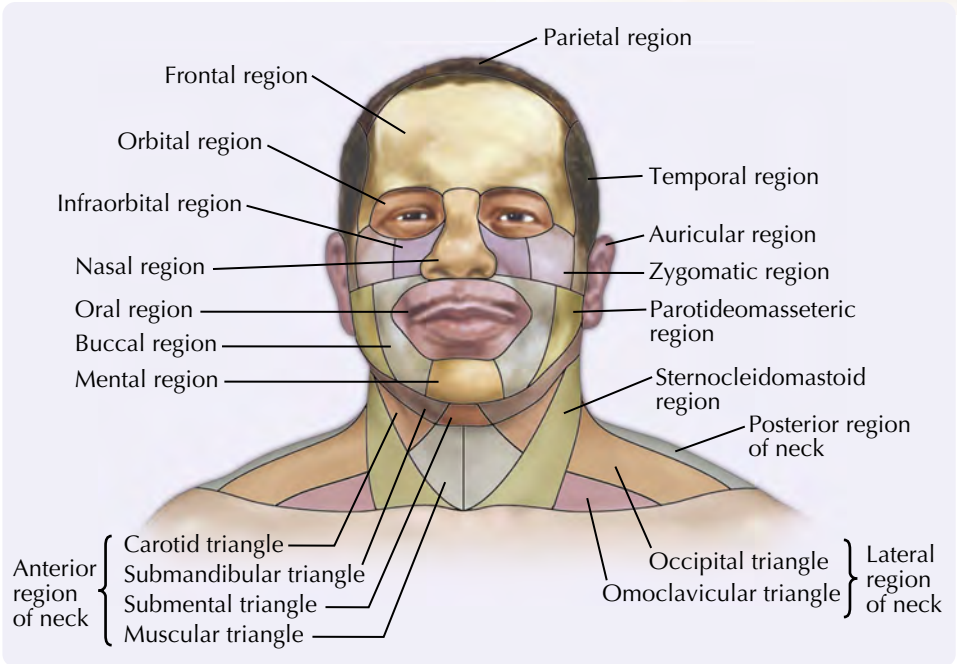
BP 30 Auditory Tube (Eustachian)

BP 31 Cranial Imaging (MRV and MRA)

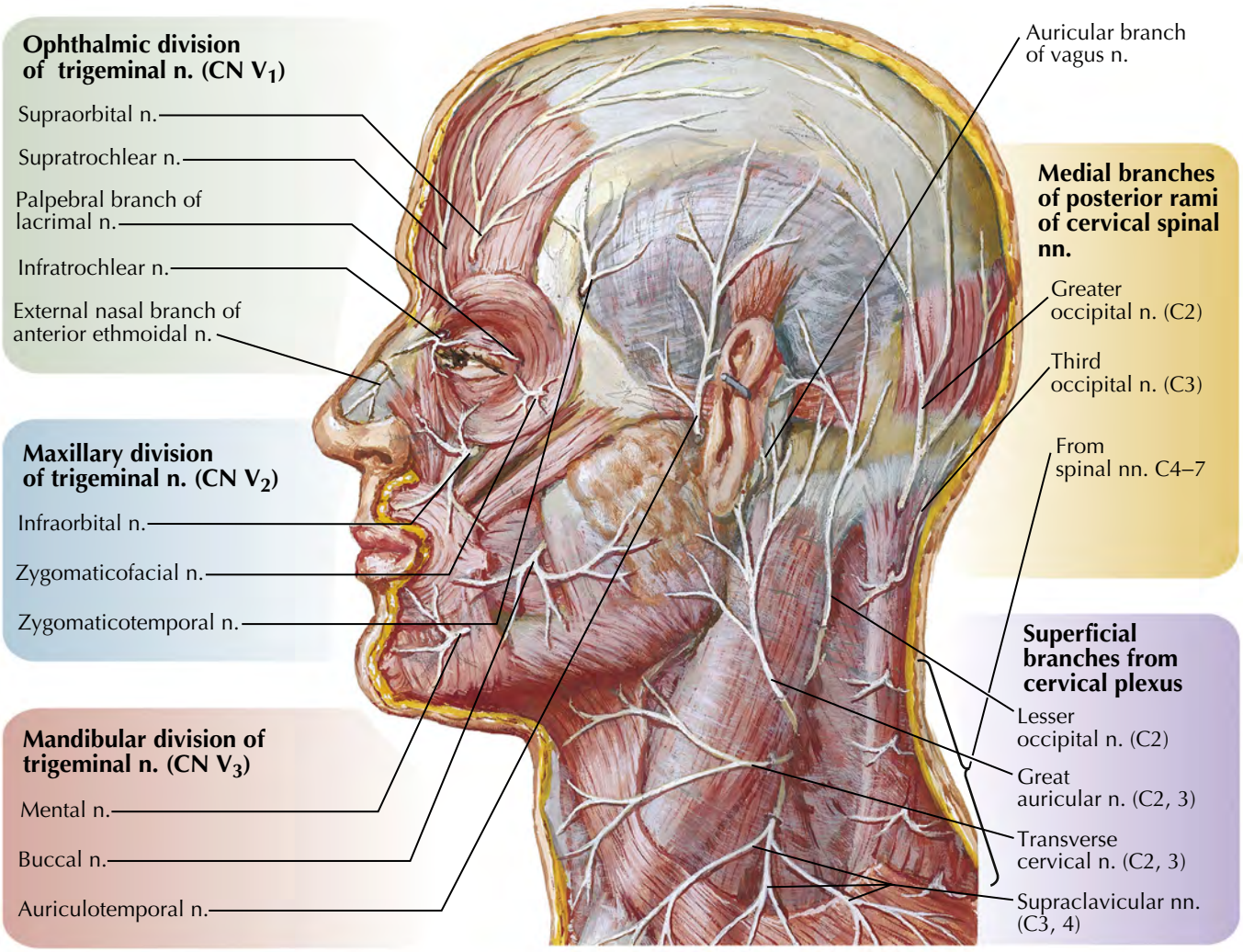
BP 32 Axial and Coronal MRIs of Brain

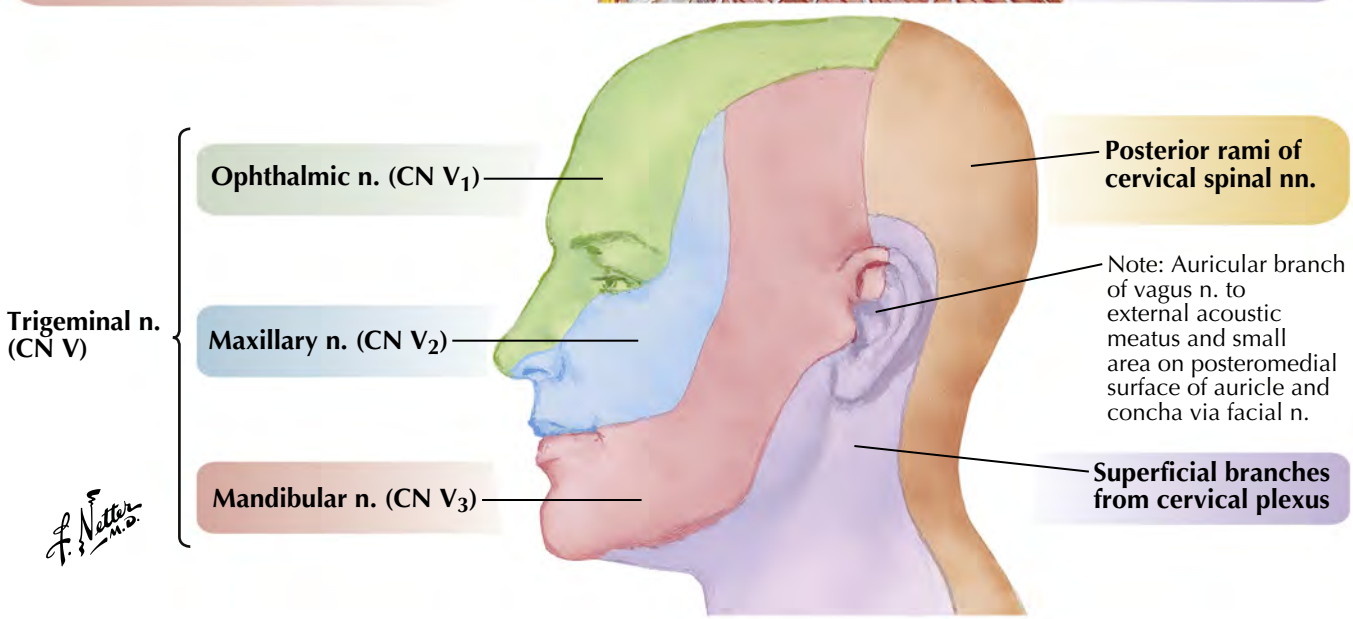
See also **Plates 18, 188**



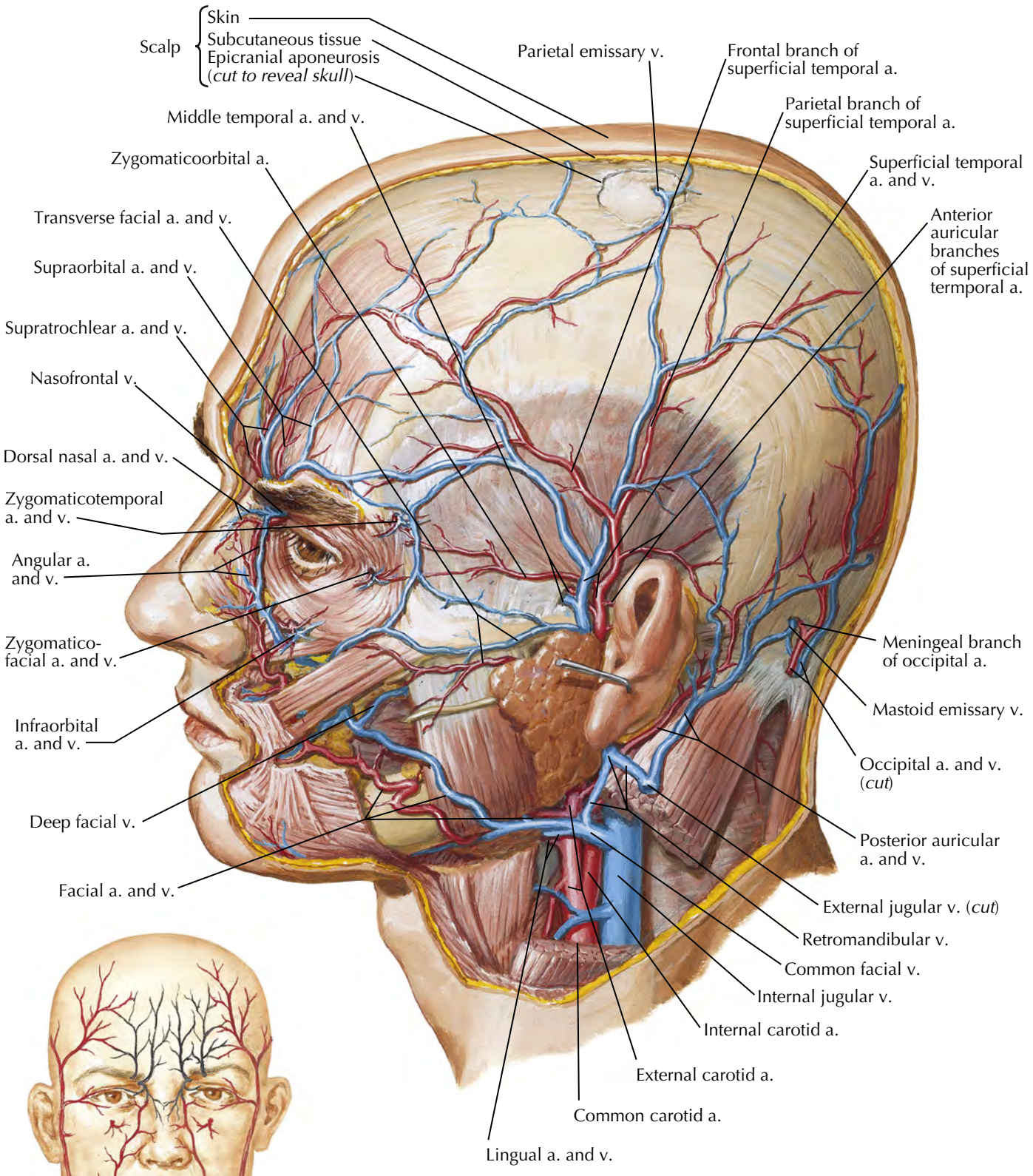


See also **Plates 6, 59, 60, 79**





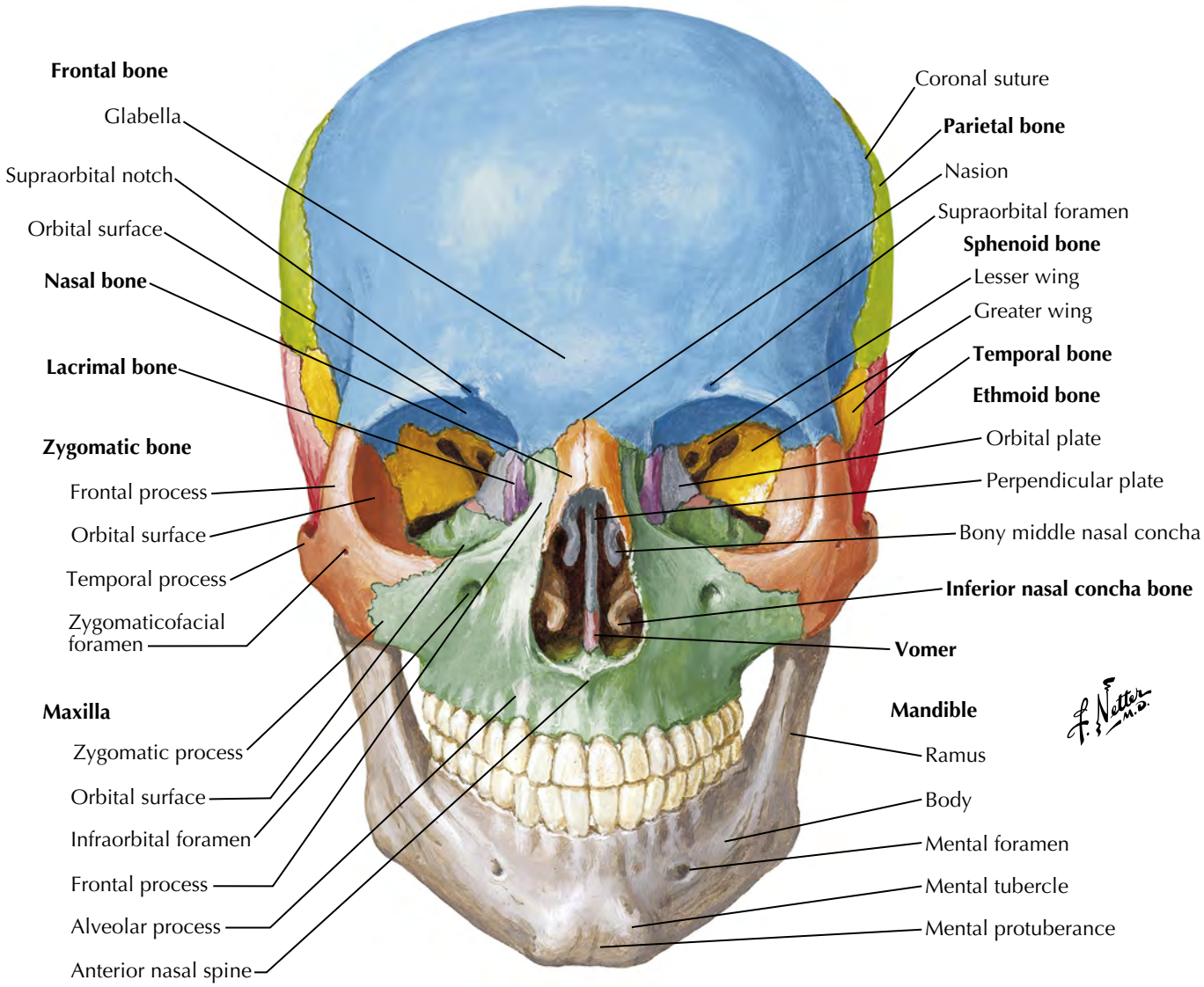
See also **Plates 74, 99, 100**



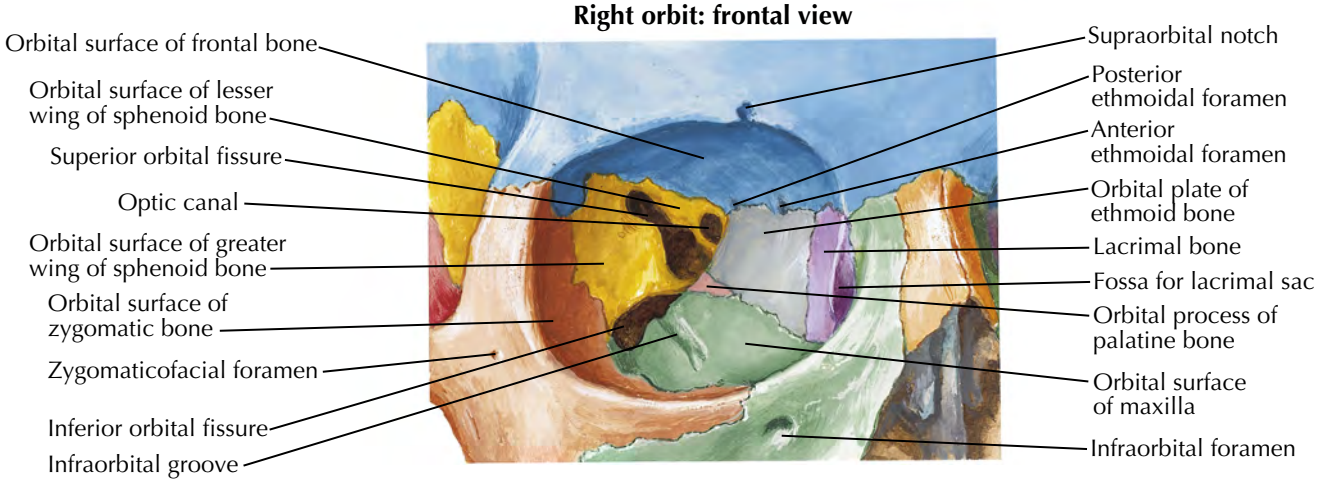
Sources of arterial supply of face

Black: from internal carotid artery (via ophthalmic artery)
Red: from external carotid artery

See also **Plate 27**

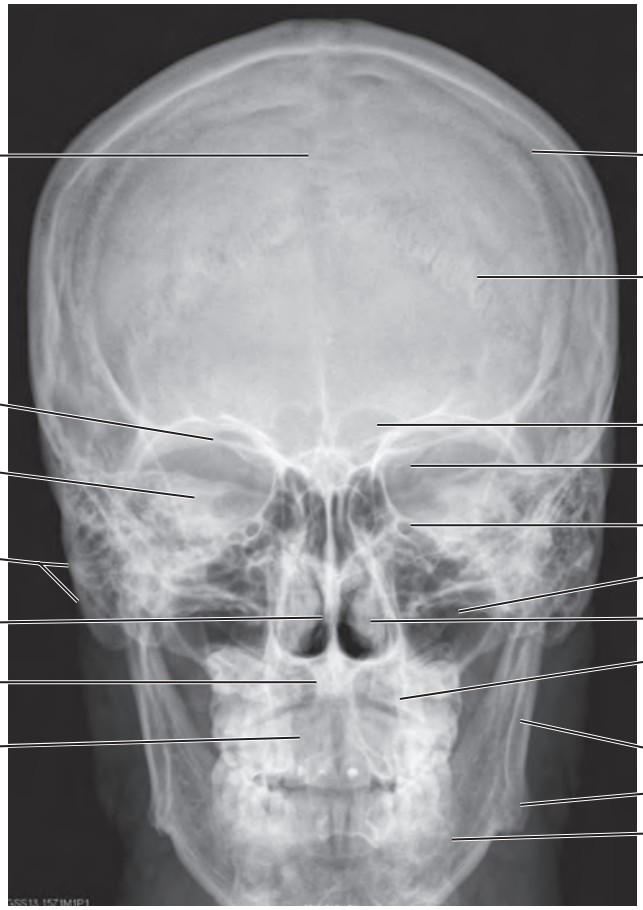


Right orbit: frontal view



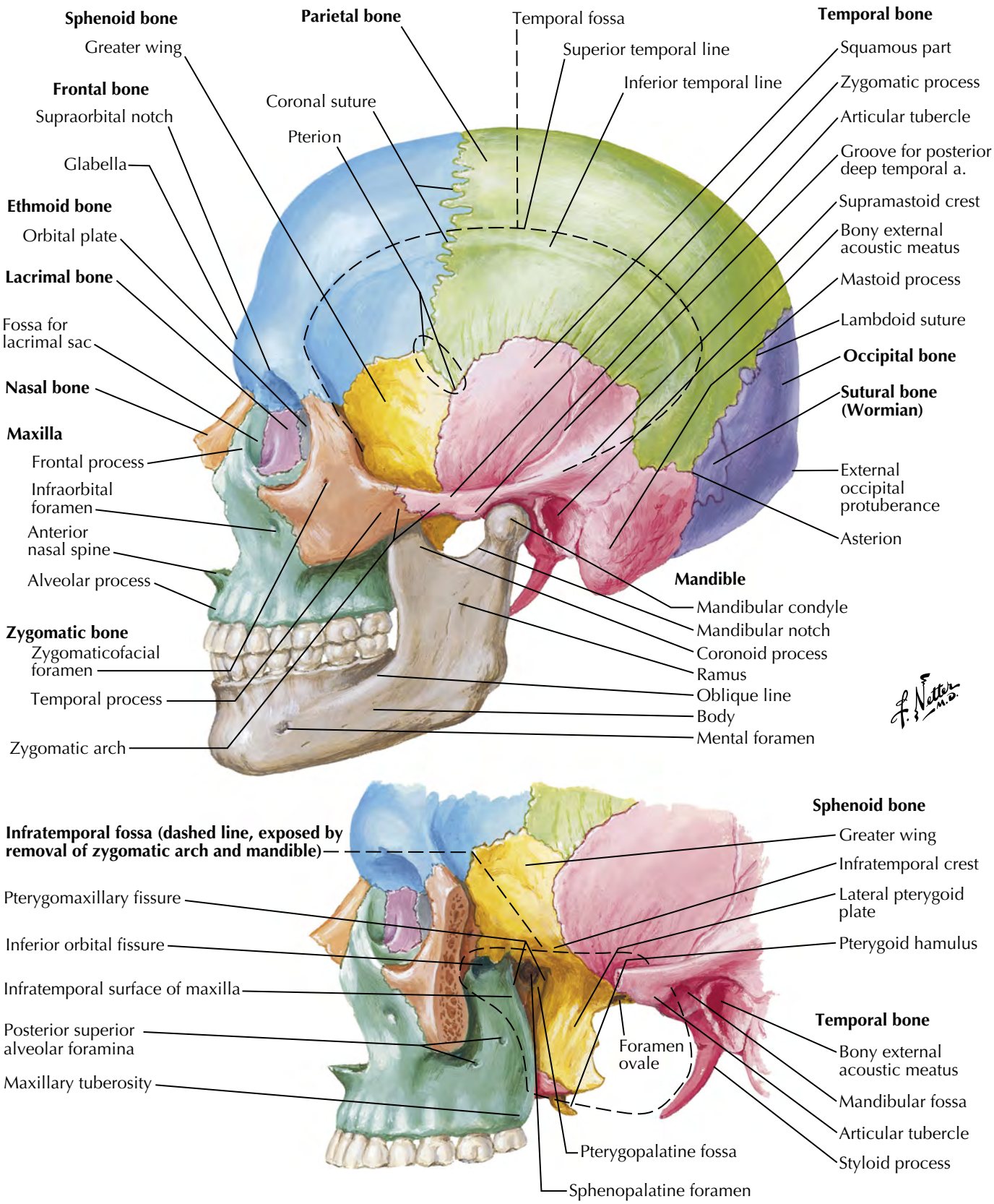
See also **Plate 25**

Posterior anterior view

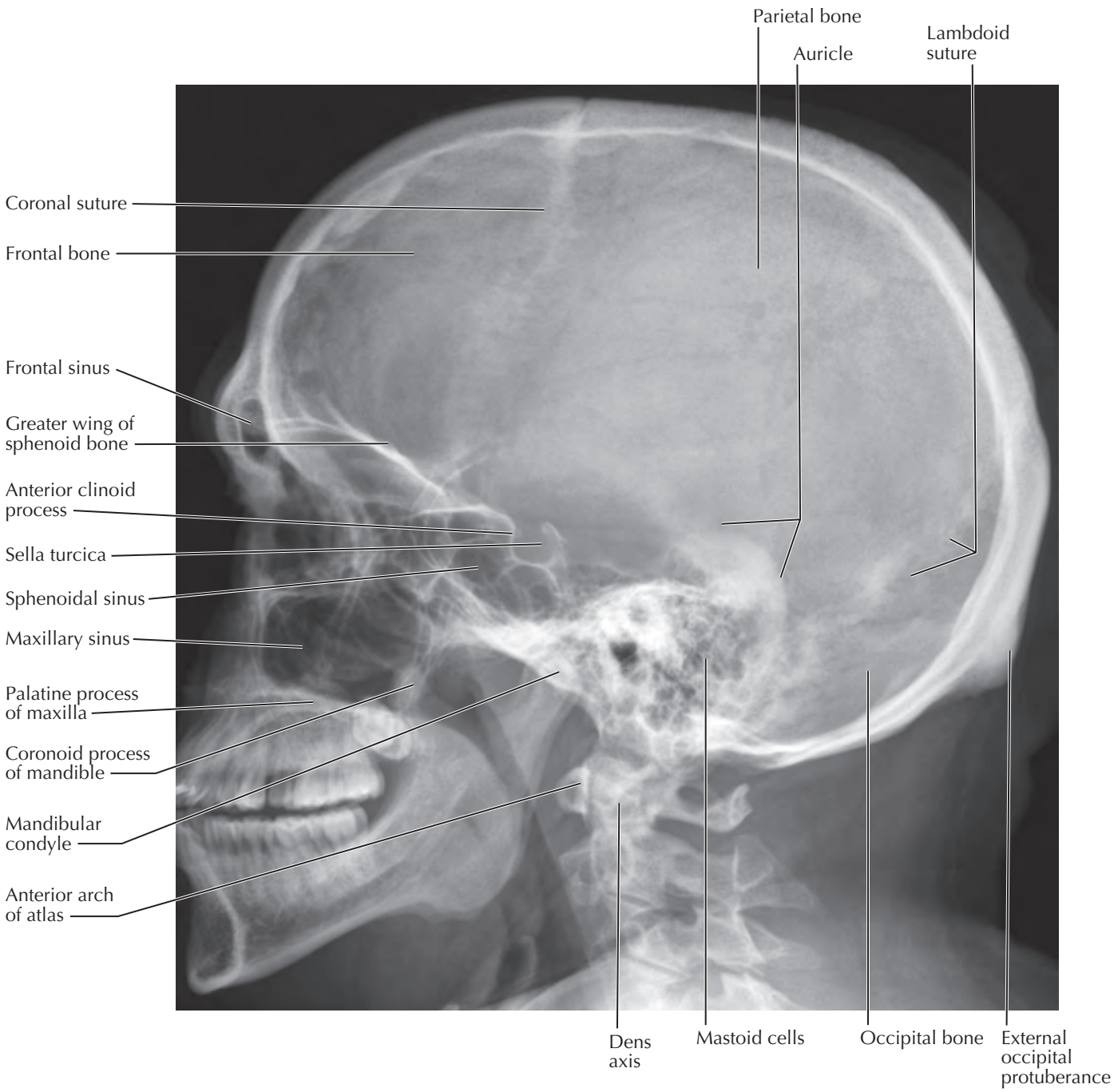


Waters' view

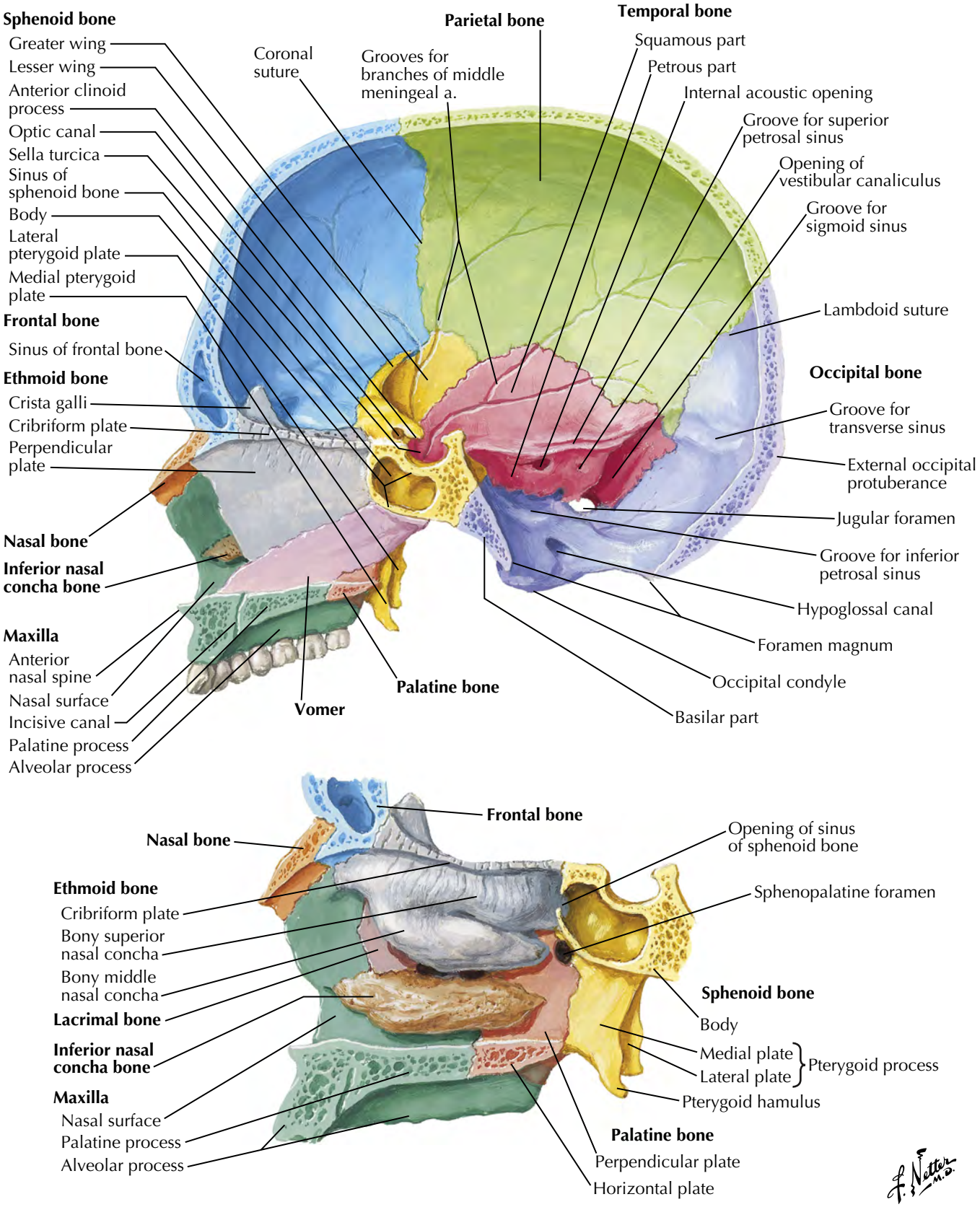
See also **Plates 28, 29, 36**



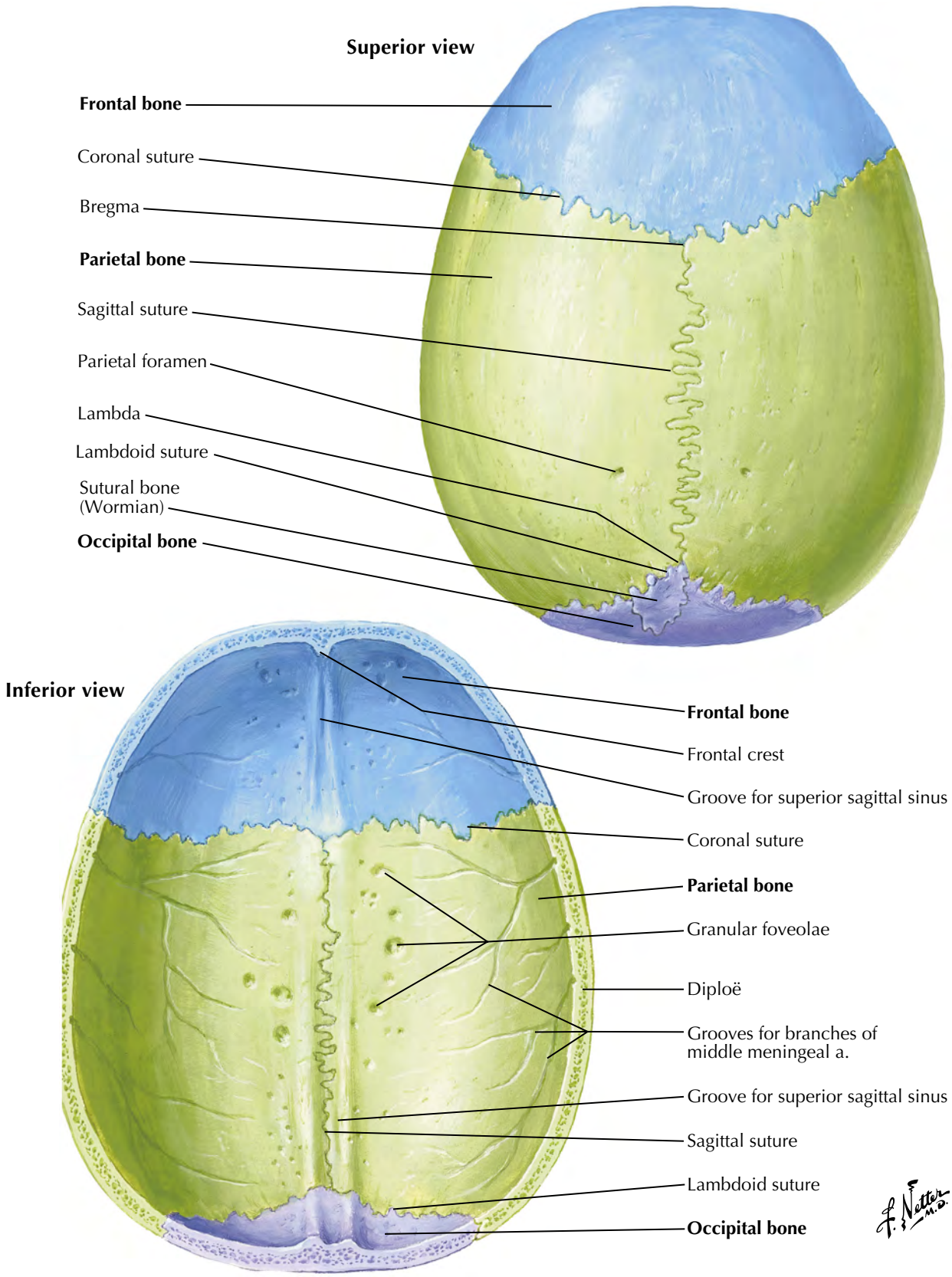
See also **Plates 29, BP 35**



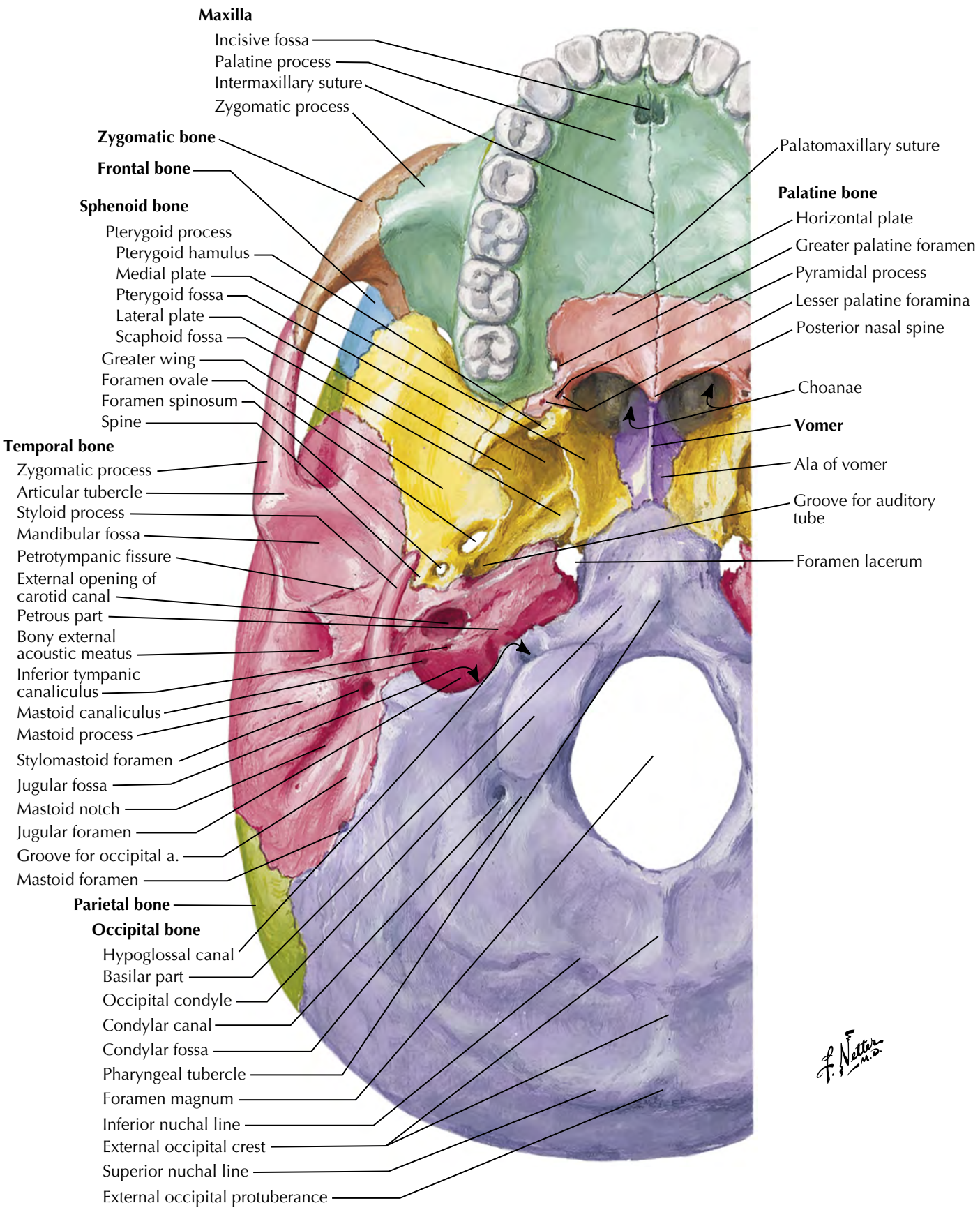
See also **Plates 17, 64**

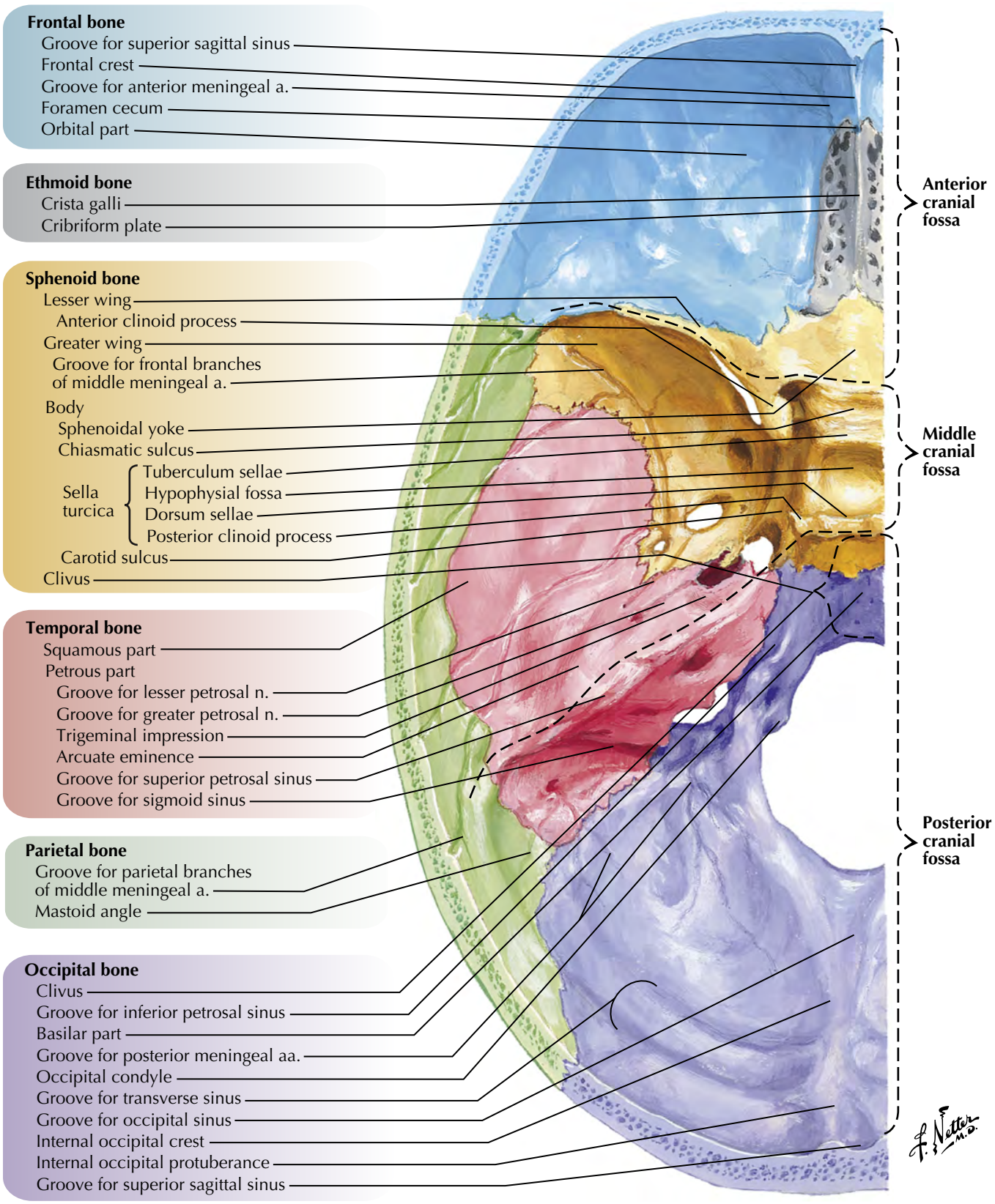


View of lateral nasal wall with nasal septum removed

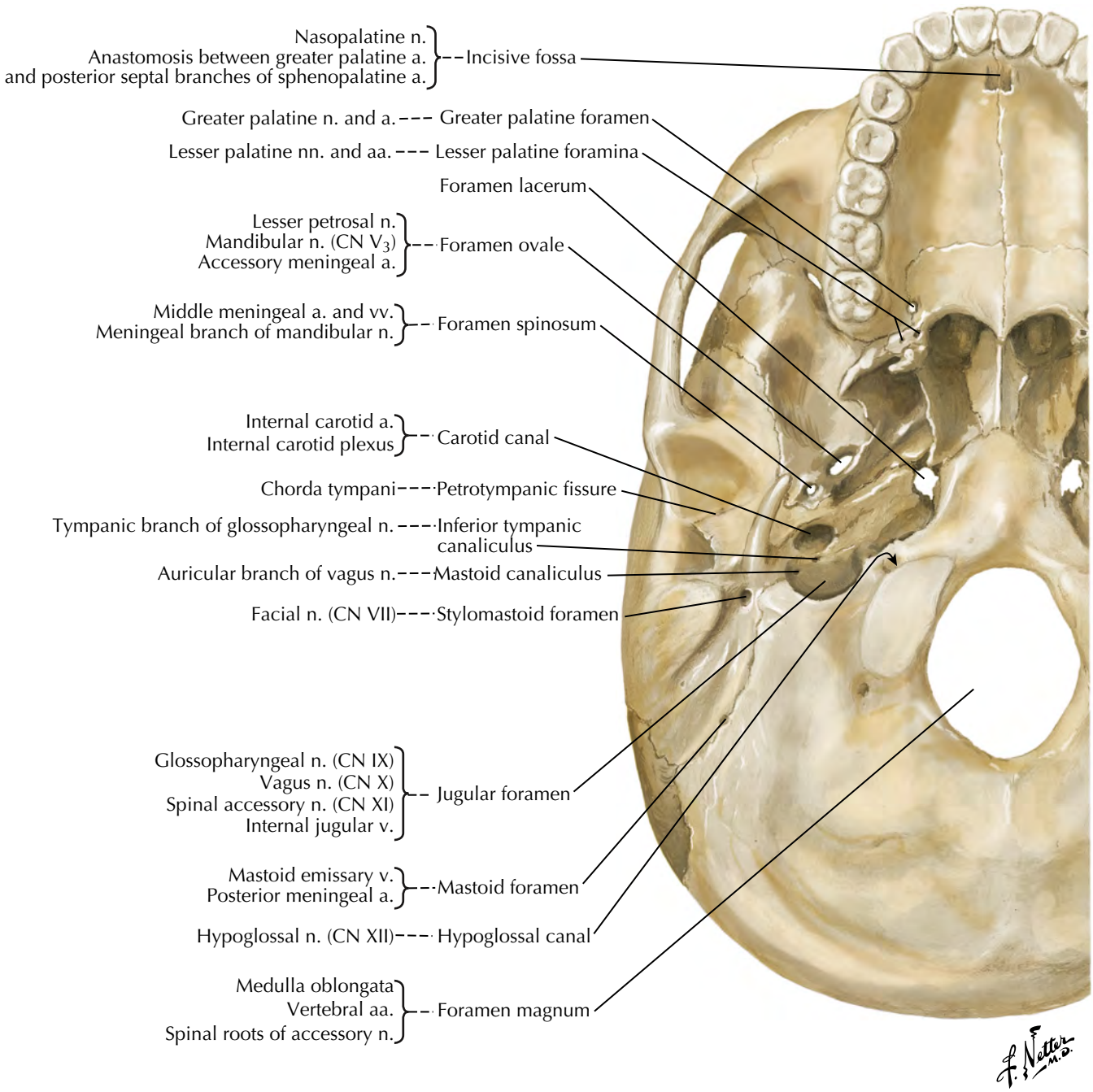

Superior view
Frontal bone
Coronal suture
Bregma
Parietal bone
Sagittal suture
Parietal foramen
Lambda
Lambdoid suture
Sutural bone (Wormian)
Occipital bone
Inferior view
Frontal bone
Frontal crest
Groove for superior sagittal sinus
Coronal suture
Parietal bone
Granular foveolae
Diploë
Grooves for branches of middle meningeal a.
Groove for superior sagittal sinus
Sagittal suture
Lambdoid suture
Occipital bone
F. Netter M.D.

See also **Plate 33**

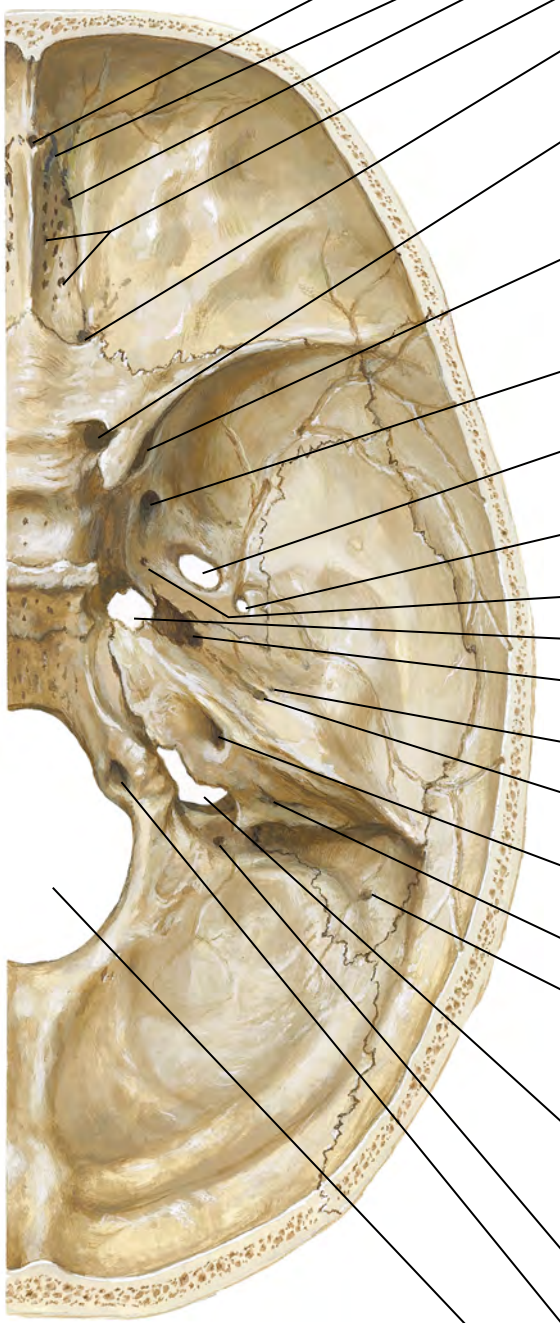



Frontal bone
Groove for superior sagittal sinus
Frontal crest
Groove for anterior meningeal a.
Foramen cecum
Orbital part
Ethmoid bone
Crista galli
Cribriform plate
Sphenoid bone
Lesser wing
Anterior clinoid process
Greater wing
Groove for frontal branches of middle meningeal a.
Body
Sphenoidal yoke
Chiasmatic sulcus
Sella turcica
Tuberculum sellae
Hypophysial fossa
Dorsum sellae
Posterior clinoid process
Carotid sulcus
Clivus
Temporal bone
Squamous part
Petrous part
Groove for lesser petrosal n.
Groove for greater petrosal n.
Trigeminal impression
Arcuate eminence
Groove for superior petrosal sinus
Groove for sigmoid sinus
Parietal bone
Groove for parietal branches of middle meningeal a.
Mastoid angle
Occipital bone
Clivus
Groove for inferior petrosal sinus
Basilar part
Groove for posterior meningeal aa.
Occipital condyle
Groove for transverse sinus
Groove for occipital sinus
Internal occipital crest
Internal occipital protuberance
Groove for superior sagittal sinus
Anterior cranial fossa
Middle cranial fossa
Posterior cranial fossa
F. Netter M.D.

See also **Plate 31**

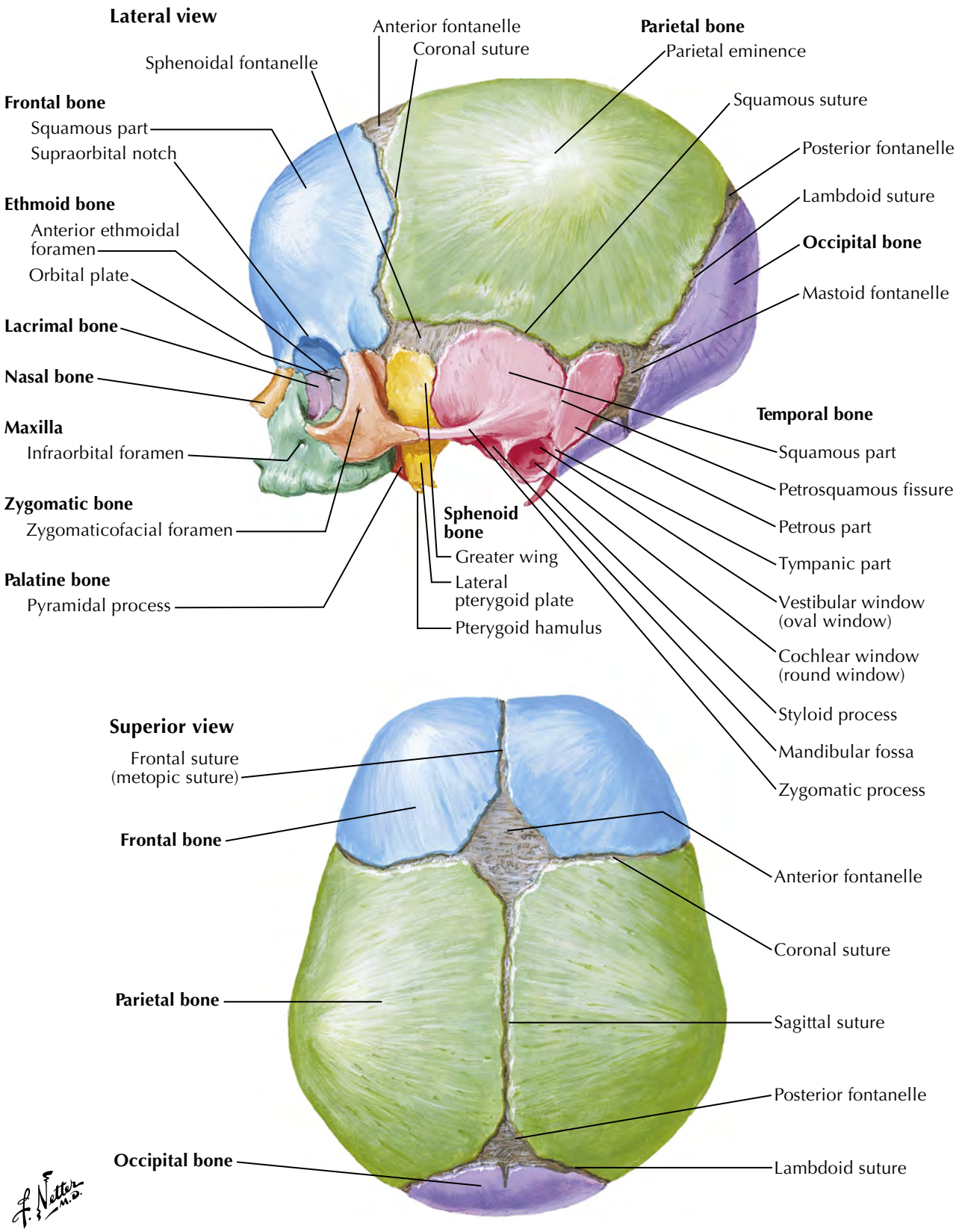


See also **Plates 32, 131**

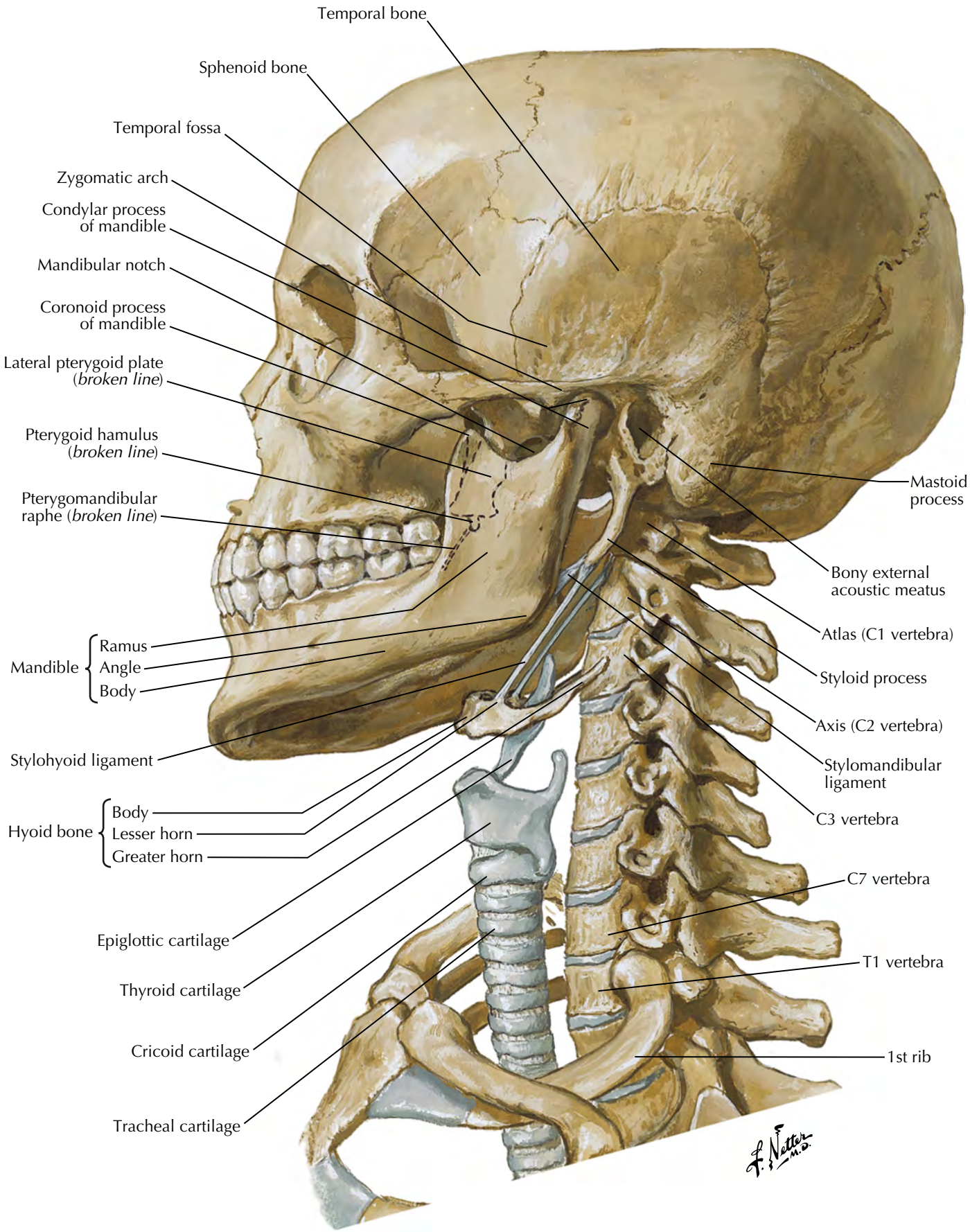


- Foramen cecum — Emissary v. to superior sagittal sinus
- Nasal fissure / Anterior ethmoidal foramen — Anterior ethmoidal a. and v.; Anterior ethmoidal n.
- Cribriform foramina — Olfactory n. (CN I)
- Posterior ethmoidal foramen — Posterior ethmoidal a. and v.; Posterior ethmoidal n.
- Optic canal — Optic n. (CN II); Ophthalmic a.
- Superior orbital fissure — Oculomotor n. (CN III); Trochlear n. (CN IV); Ophthalmic n. (CN V_1); Abducens n. (CN VI); Superior ophthalmic v.
- Foramen rotundum — Maxillary n. (CN V_2)
- Foramen ovale — Mandibular n. (CN V_3); Accessory meningeal a.; Lesser petrosal n.
- Foramen spinosum — Middle meningeal a. and vv.; Meningeal branch of mandibular n.
- Sphenoidal emissary foramen (of Vesalius) (inconstant) — Emissary v.
- Foramen lacerum
- Carotid canal — Internal carotid a.; Internal carotid plexus
- Hiatus for — Lesser petrosal n.
- Hiatus for — Greater petrosal n.
- Internal acoustic meatus — Facial n. (CN VII); Vestibulocochlear n. (CN VIII); Labyrinthine a.
- Vestibular canaliculus — Endolymphatic duct
- Mastoid foramen — Mastoid emissary v.
- Jugular foramen — Inferior petrosal sinus; Glossopharyngeal n. (CN IX); Vagus n. (CN X); Spinal accessory n. (CN XI); Sigmoid sinus; Posterior meningeal a.
- Condylar canal — Condylar emissary v.; Meningeal branch of ascending pharyngeal a.
- Hypoglossal canal — Hypoglossal n. (CN XII)
- Foramen magnum — Medulla oblongata; Vertebral aa.; Meningeal branches of vertebral aa.; Spinal roots of accessory n.

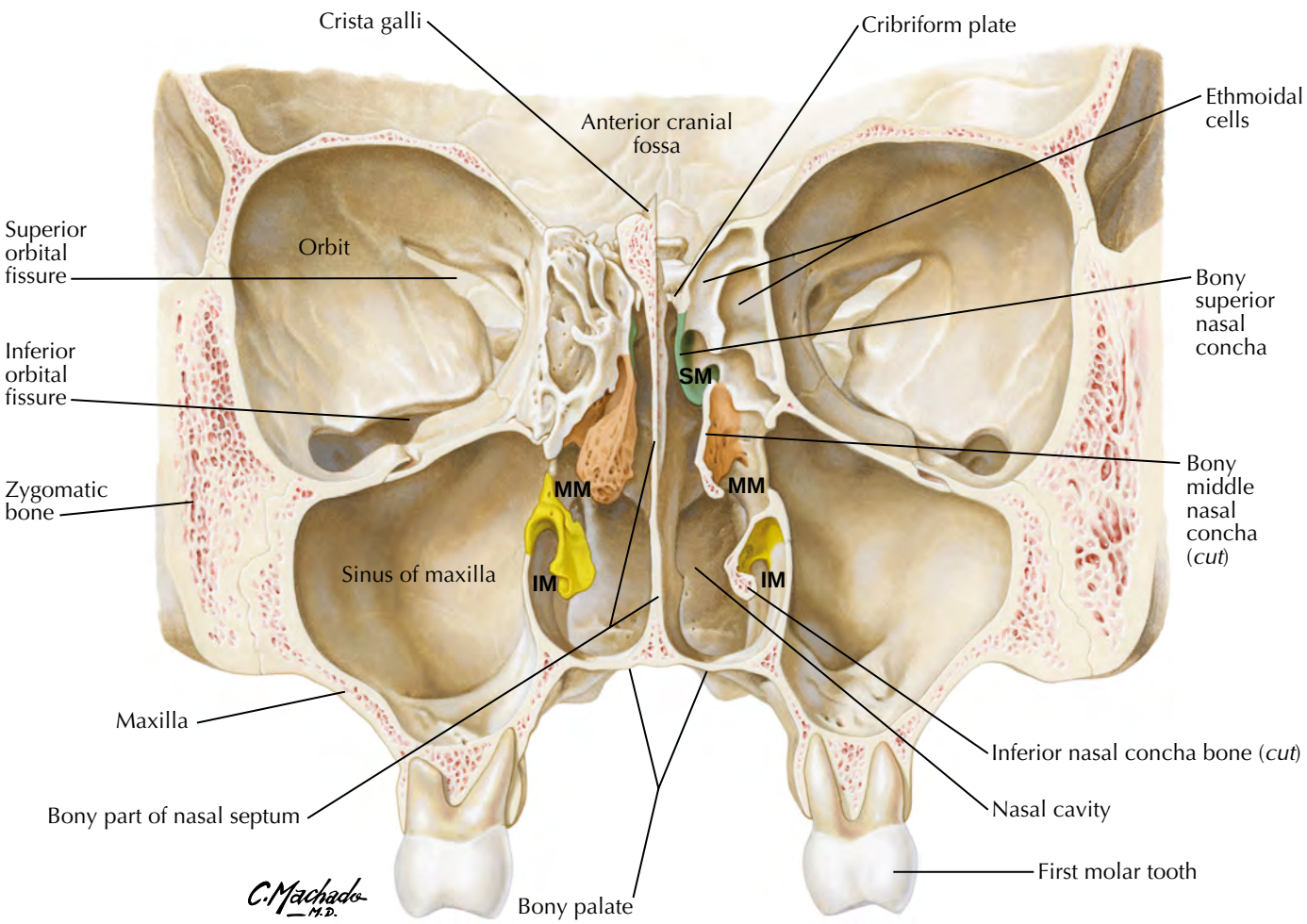
See also **Plates 27, 30, BP 16**



See also **Plates 27, 43, BP 18, BP 35**



See also **Plates 62, 69, BP 22**



Bony superior nasal concha

Bony middle nasal concha

Inferior nasal concha bone

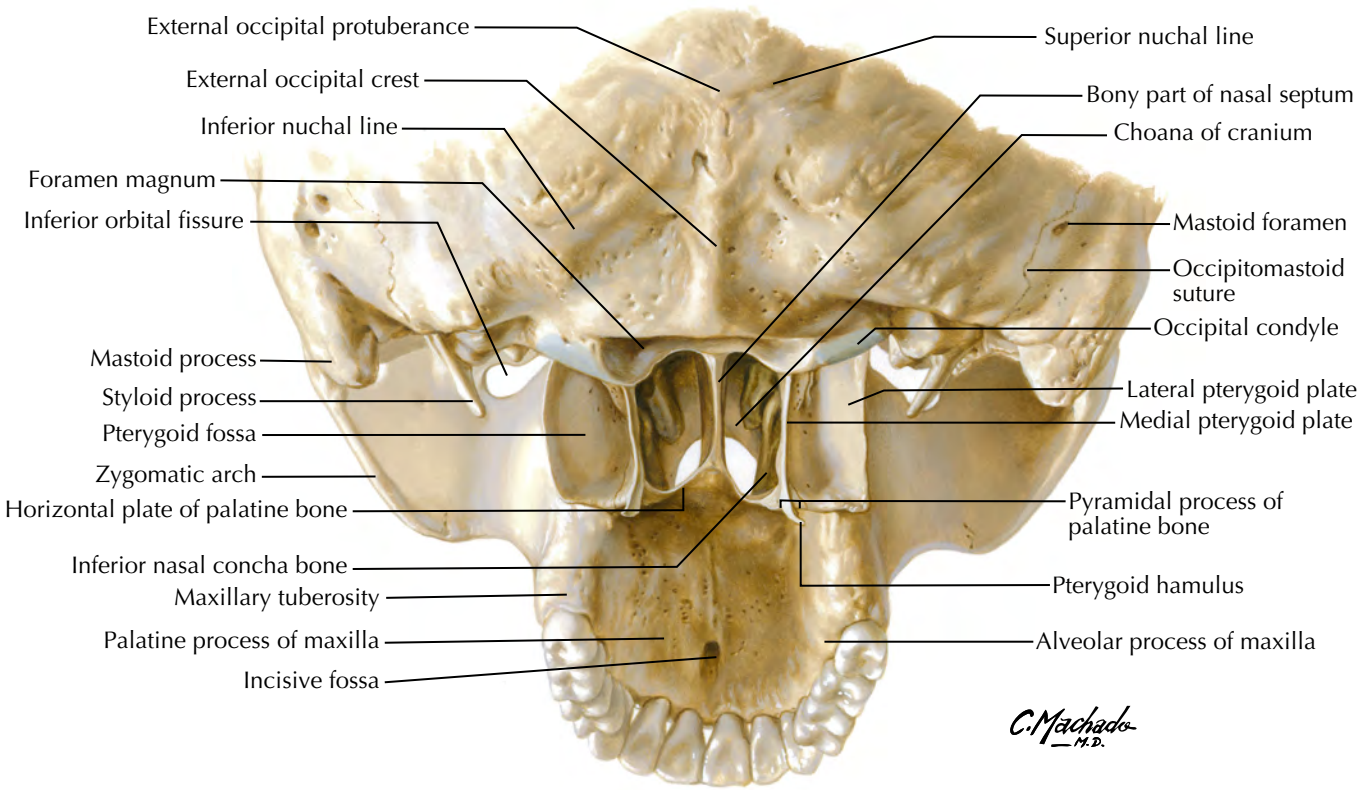
SM Superior nasal meatus

MM Middle nasal meatus

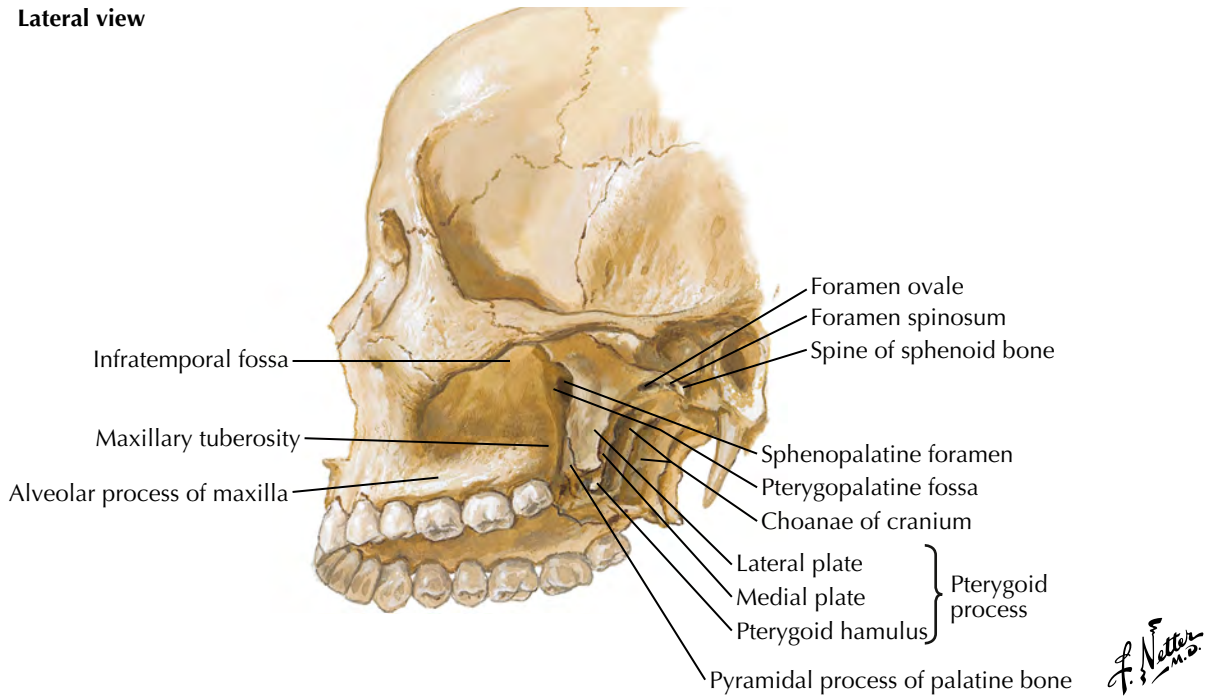
IM Inferior nasal meatus

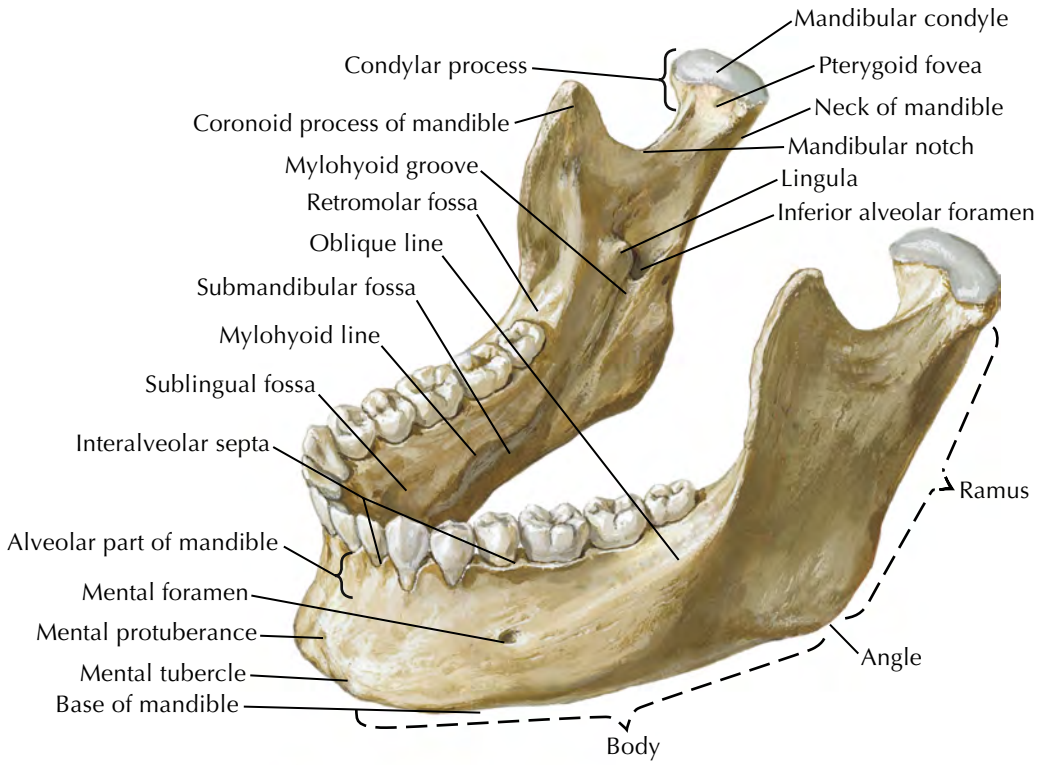
See also **Plates 64, 66, BP 21**

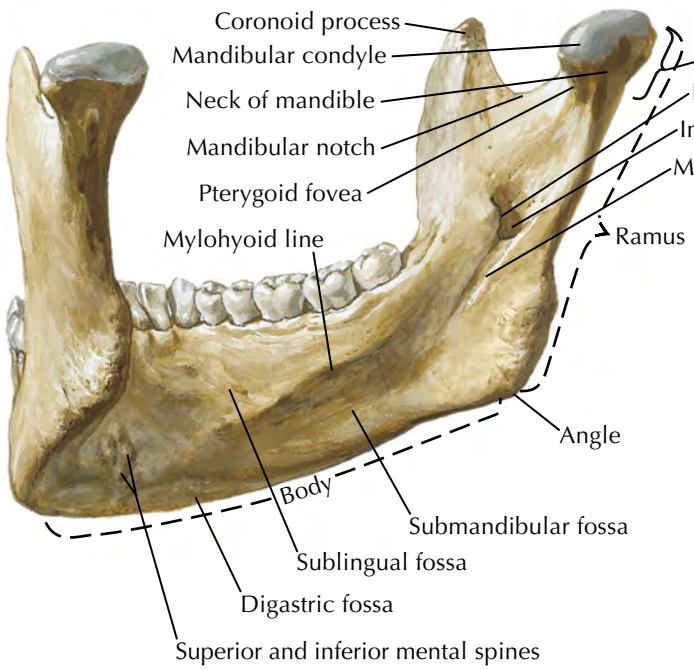
Posterior view



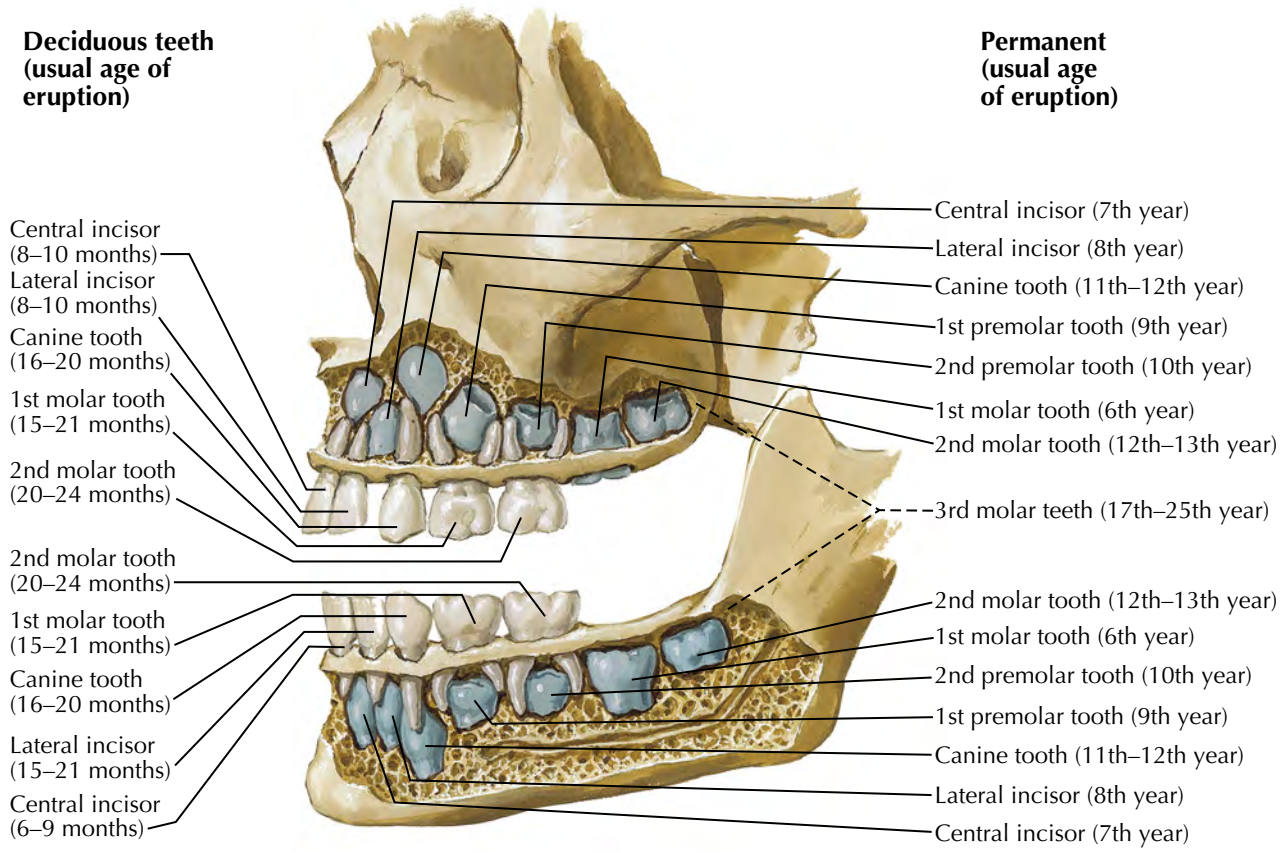
Lateral view

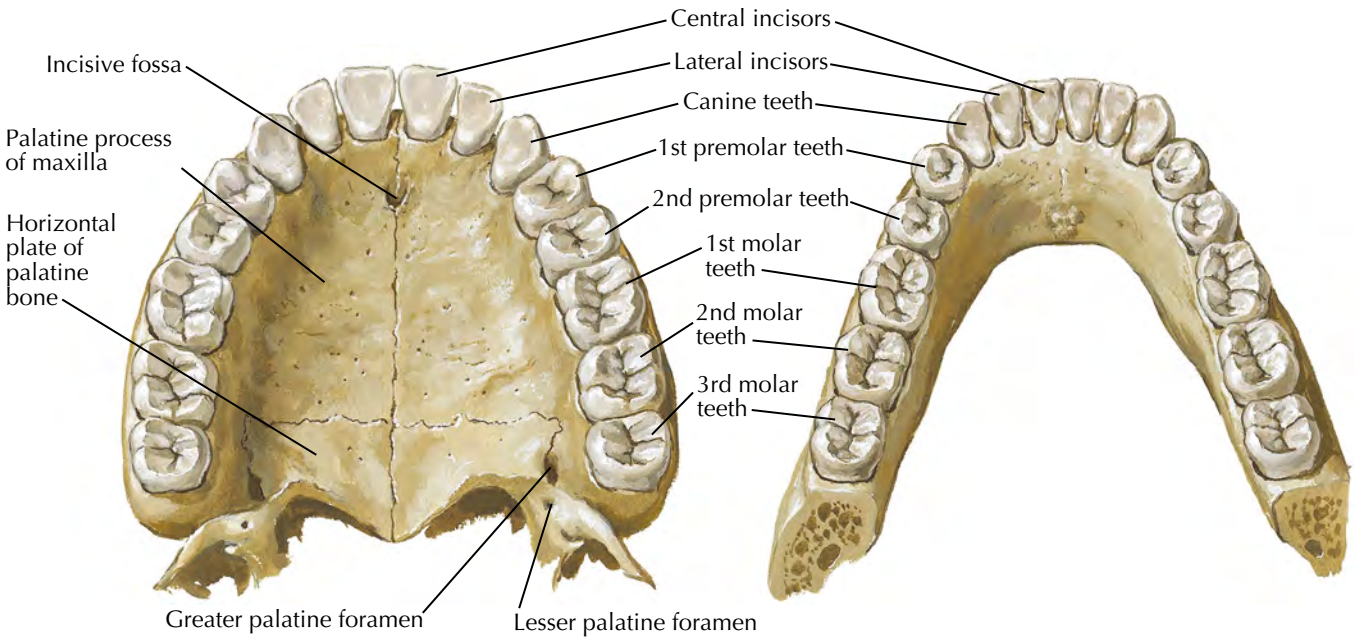






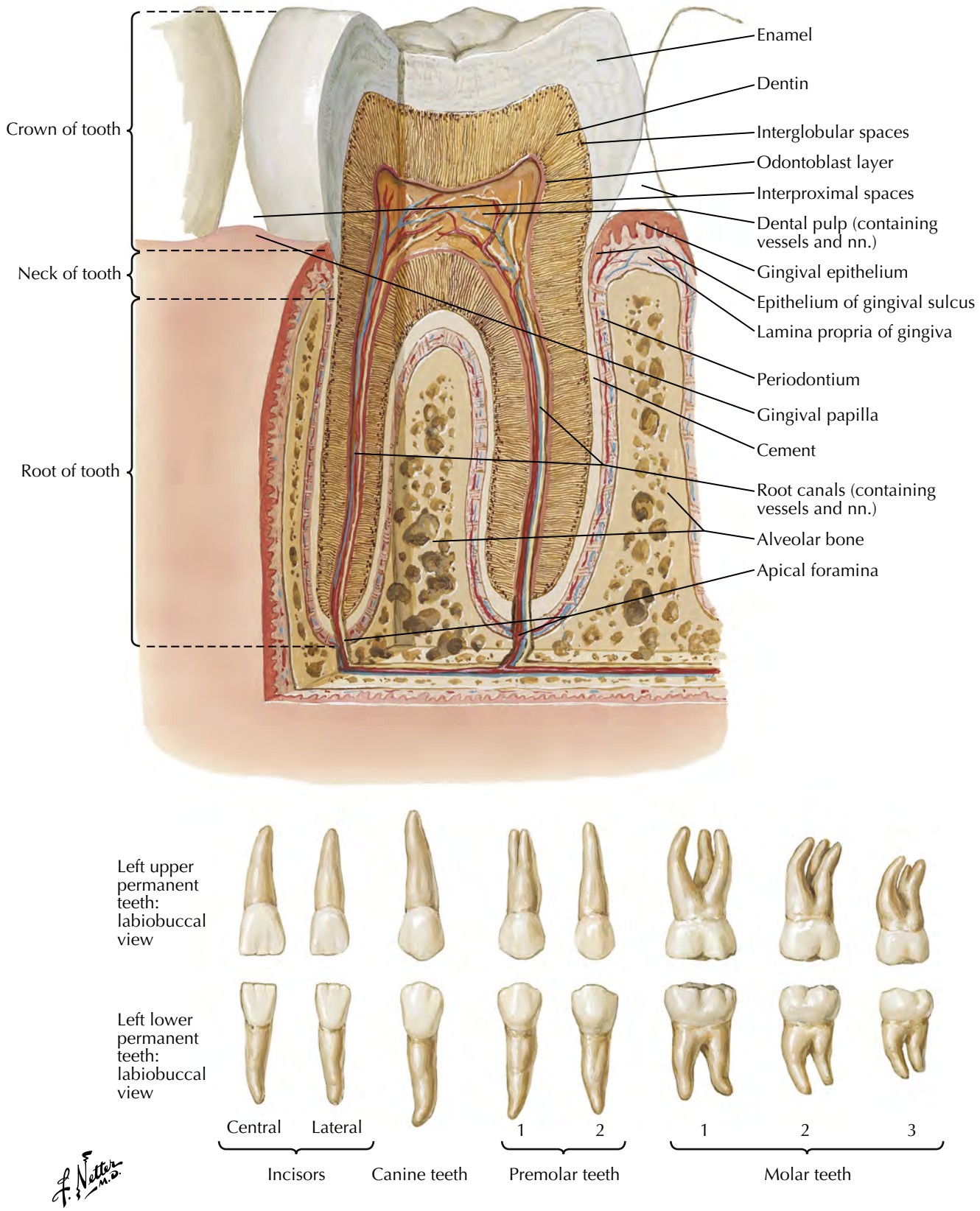
Mandible of aged, edentulous person



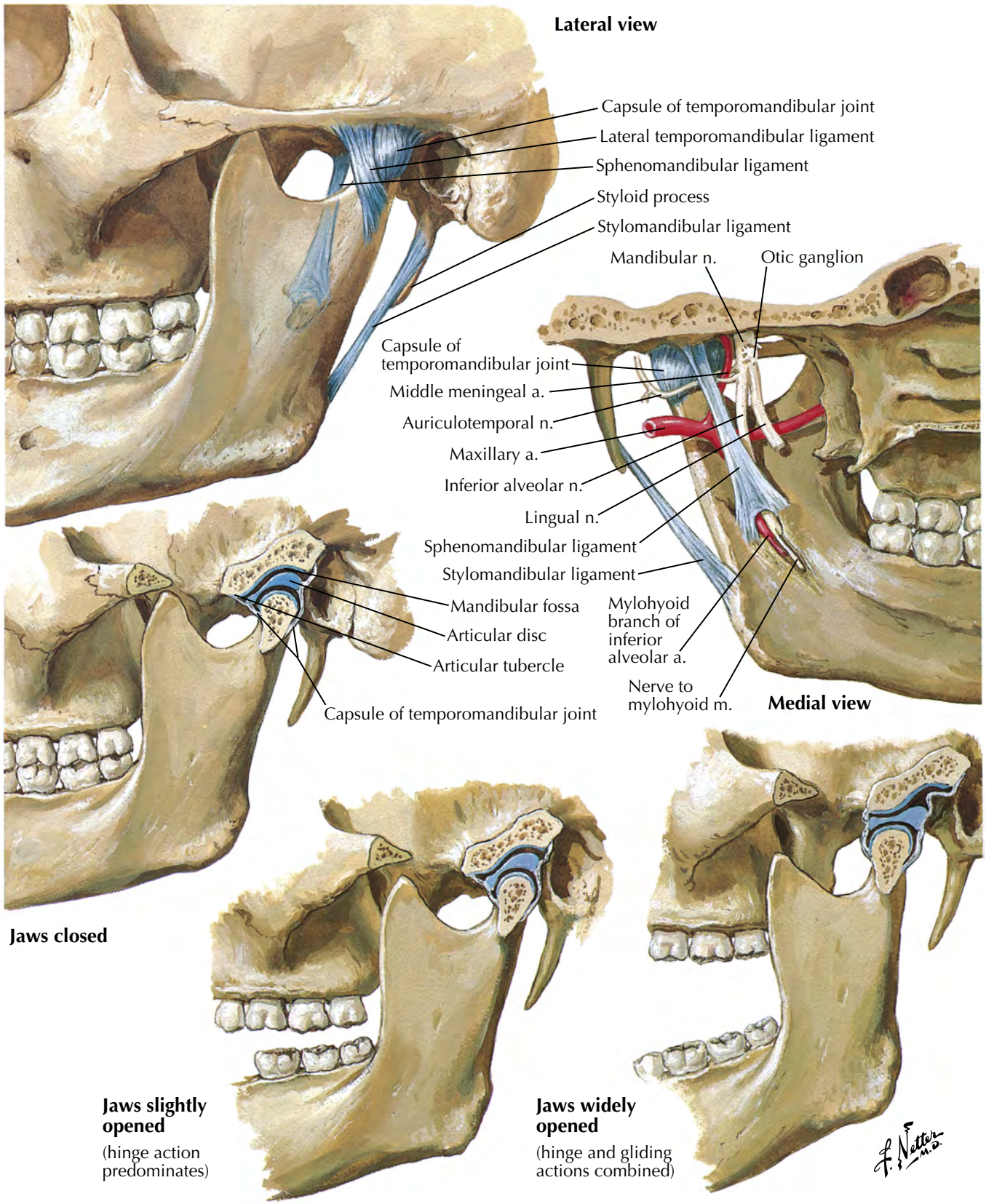


Upper permanent teeth

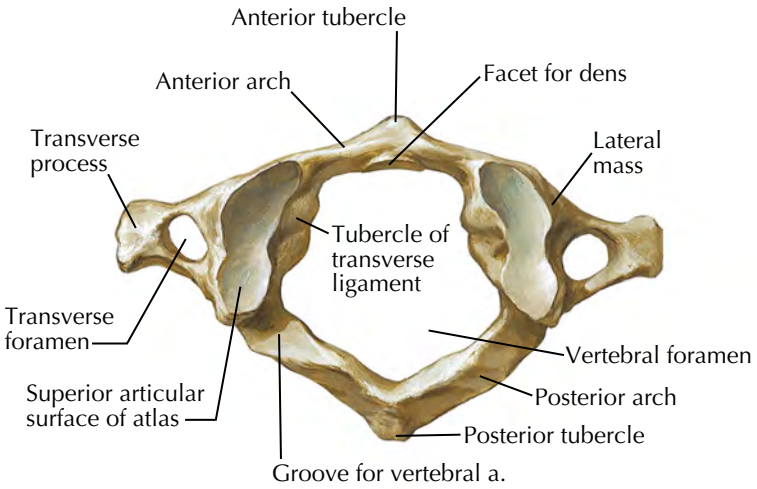
Lower permanent teeth


Crown of tooth
Neck of tooth
Root of tooth
Enamel
Dentin
Interglobular spaces
Odontoblast layer
Interproximal spaces
Dental pulp (containing vessels and nn.)
Gingival epithelium
Epithelium of gingival sulcus
Lamina propria of gingiva
Periodontium
Gingival papilla
Cement
Root canals (containing vessels and nn.)
Alveolar bone
Apical foramina
Left upper permanent teeth: labiobuccal view
Left lower permanent teeth: labiobuccal view
Central
Lateral
1
2
1
2
3
Incisors
Canine teeth
Premolar teeth
Molar teeth

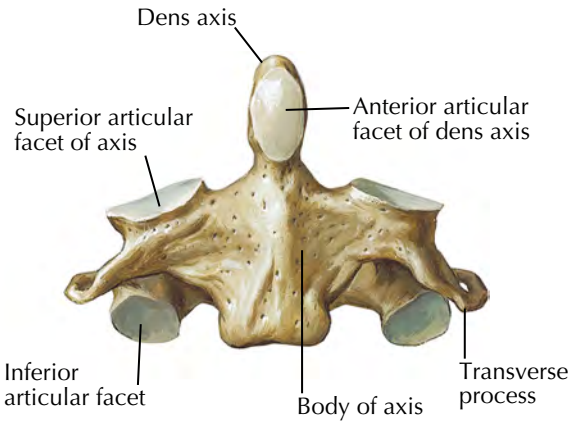
See also **Plates 73, 76**



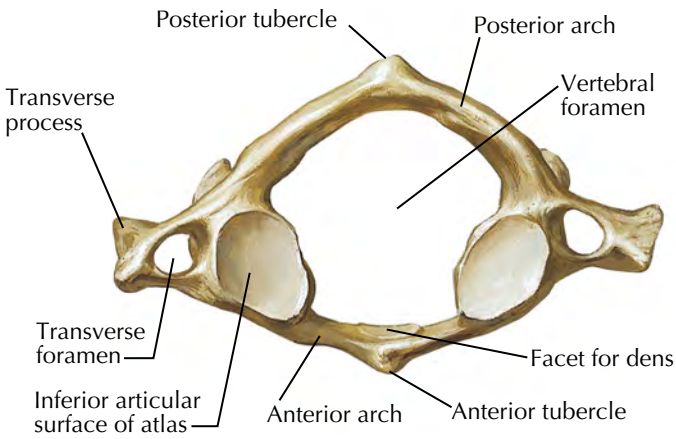
See also **Plates 45, 47, BP 18**



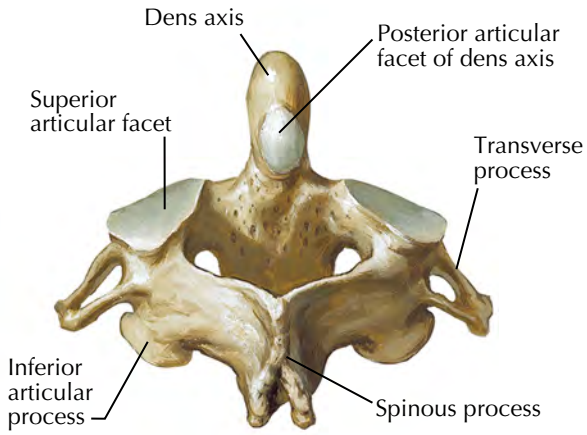
Atlas: superior view



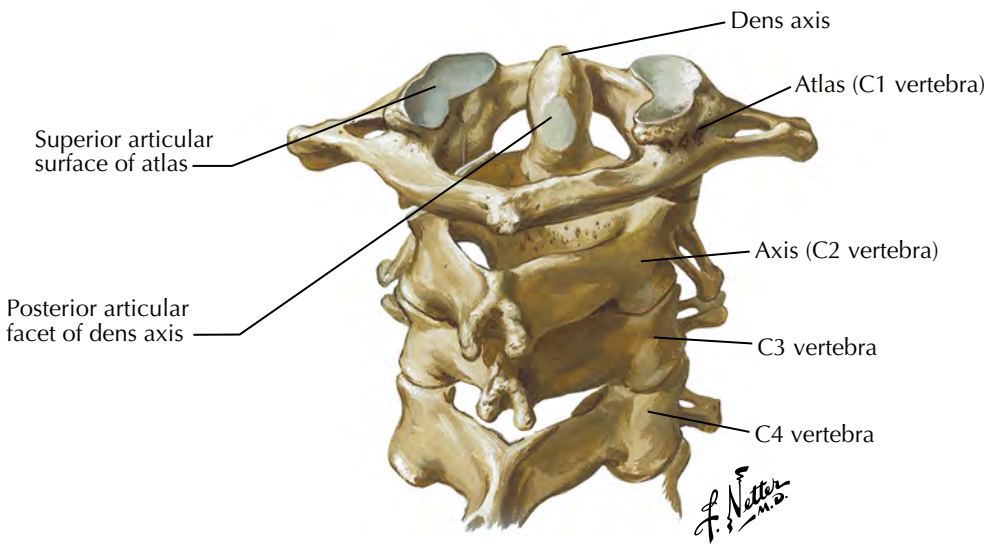
Axis: anterior view



Atlas: inferior view

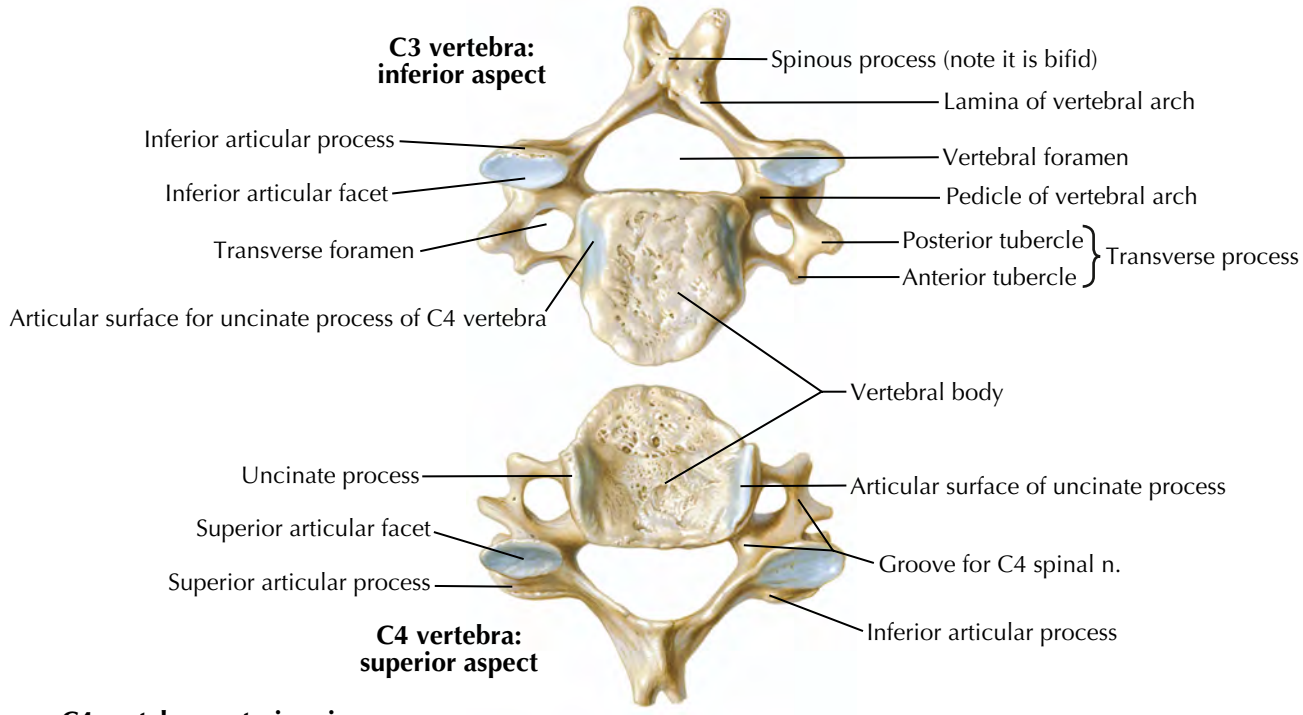


Axis: posterosuperior view

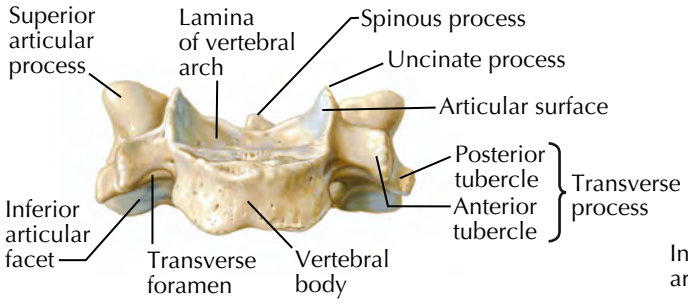


Upper cervical vertebrae: posterosuperior view

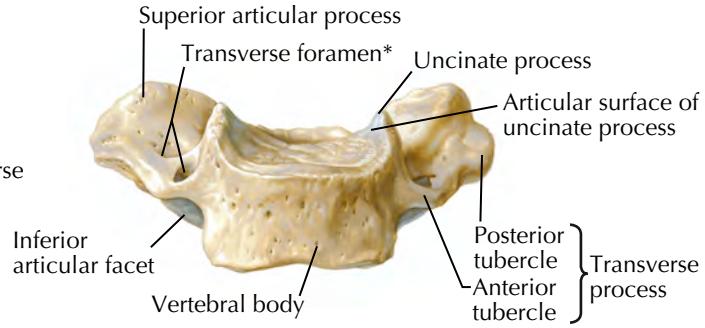
Inferior aspect of C3 vertebra and superior aspect of C4 vertebra showing the sites of the articular surfaces of the uncovertebral joints



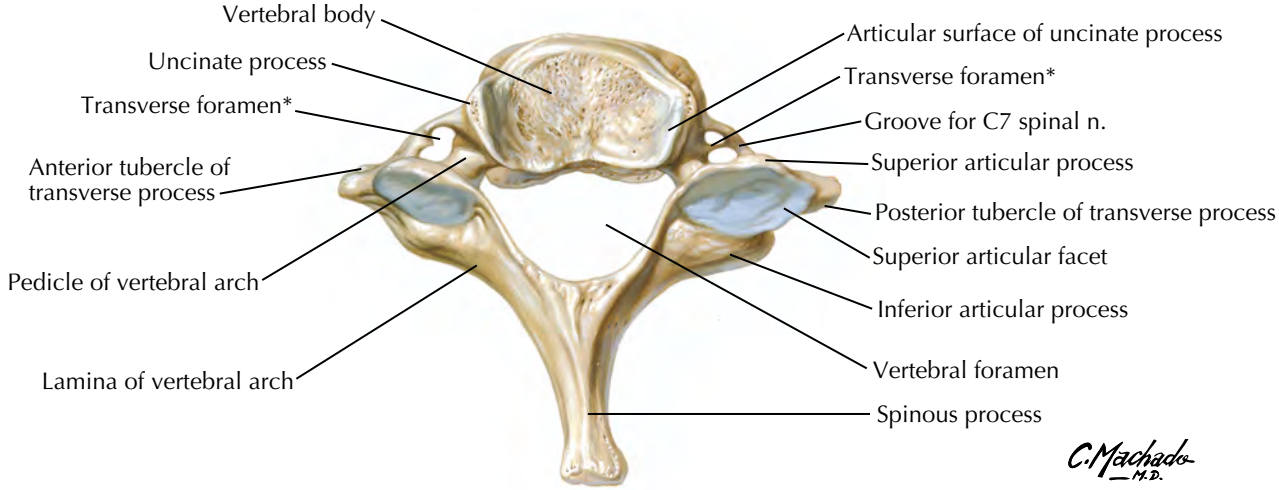
C4 vertebra: anterior view



C7 vertebra: anterior view



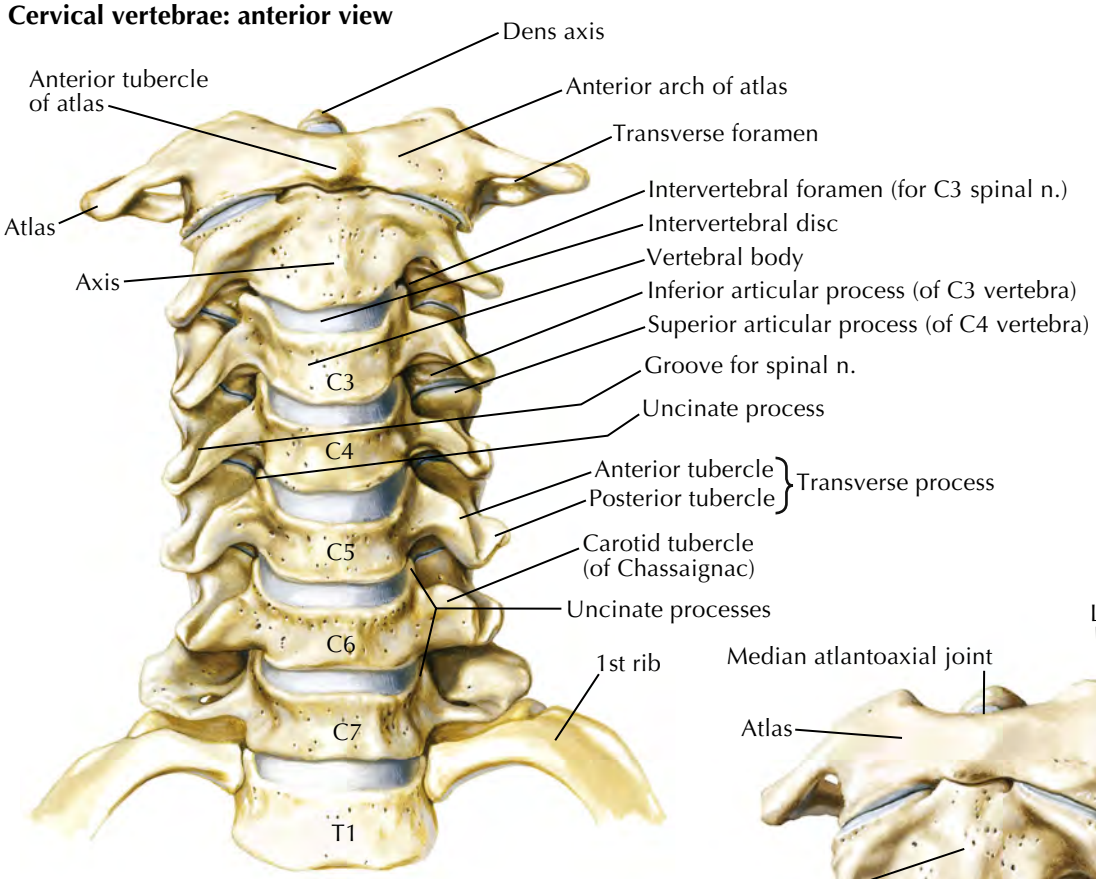
C7 vertebra (vertebra prominens): superior view

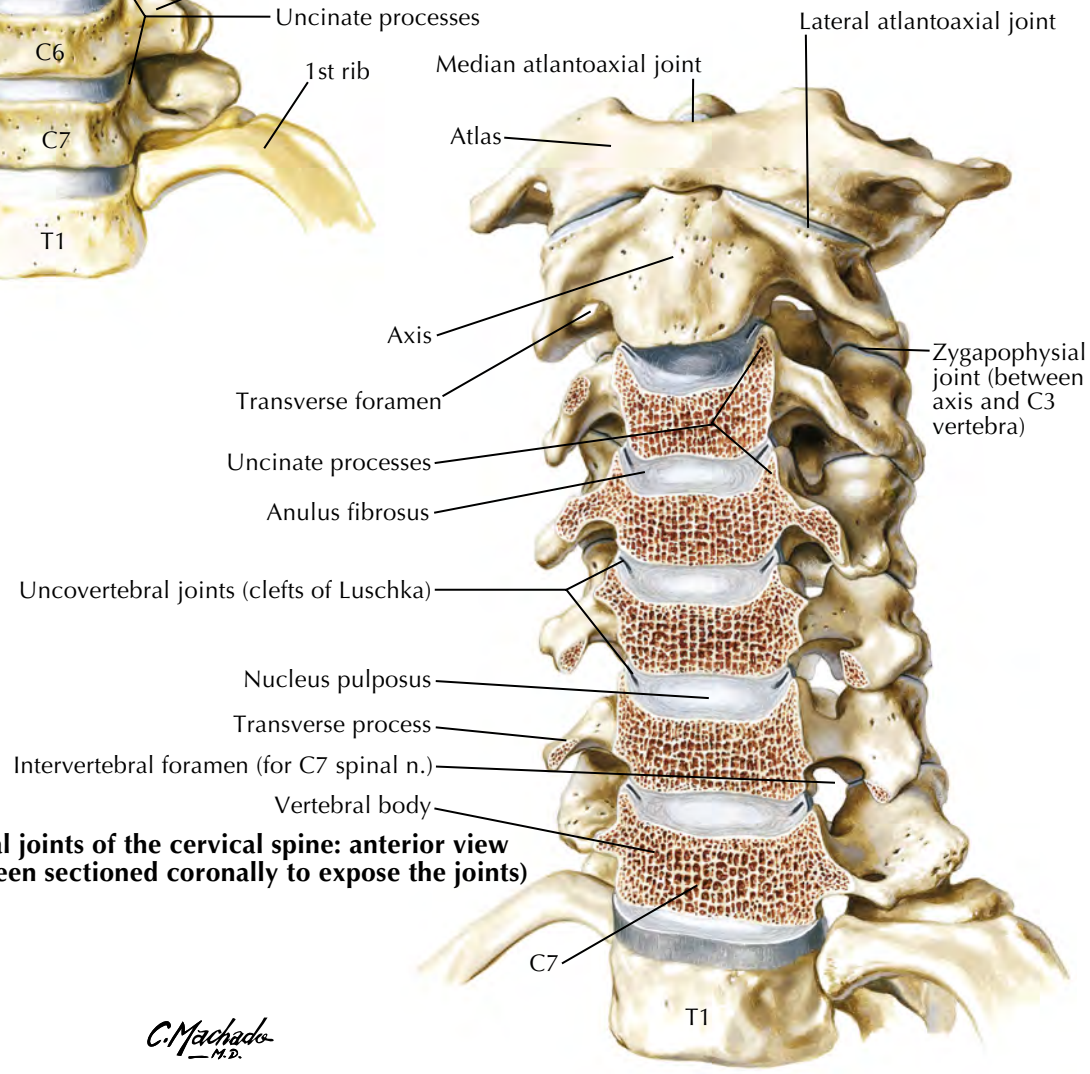


**The transverse foramina of C7 transmit vertebral veins, but usually not the vertebral artery, and are asymmetrical in these drawings. Note the right transverse foramen is septated.*

See also **Plates 46, BP 17, BP 18**

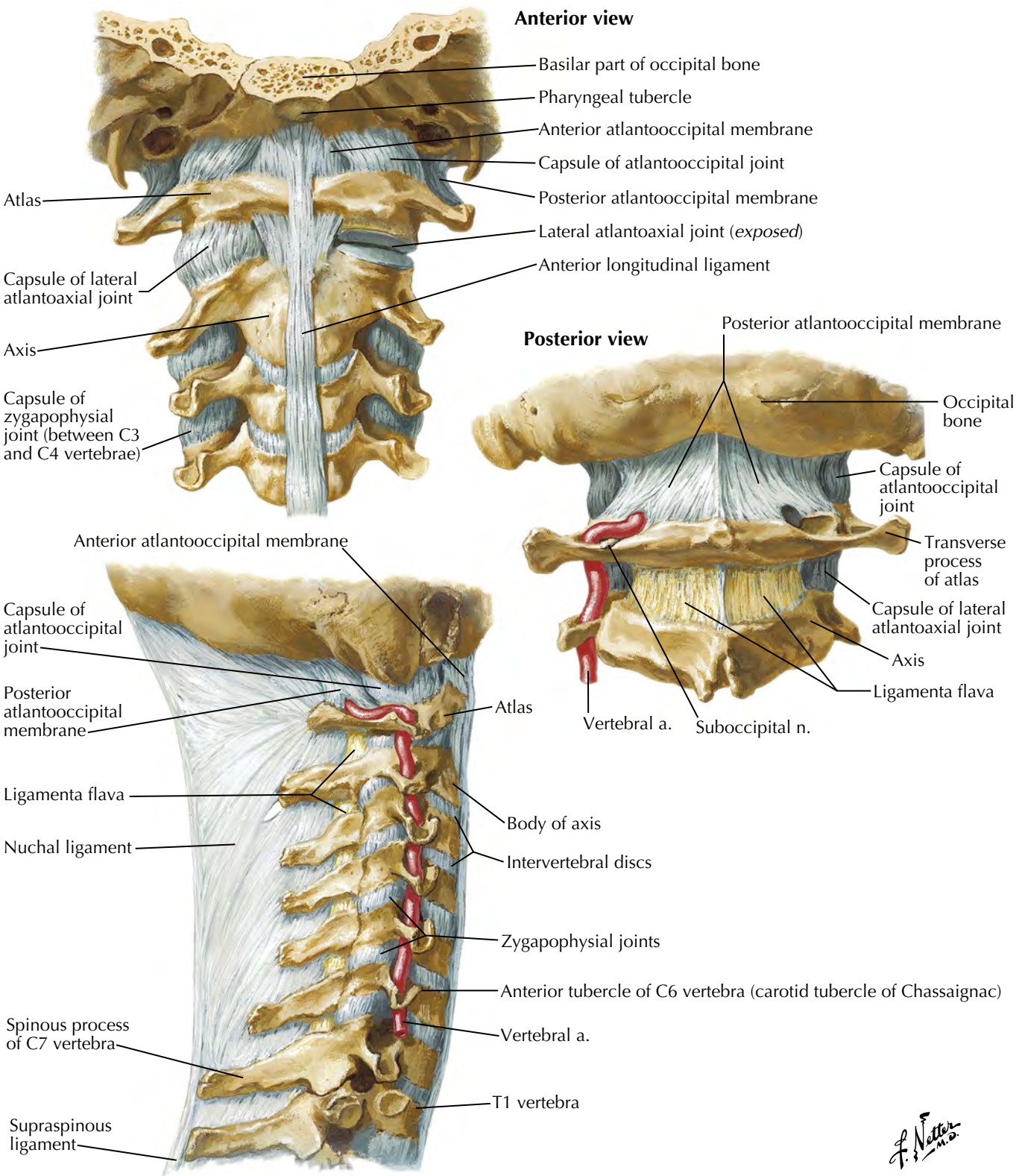
Cervical vertebrae: anterior view



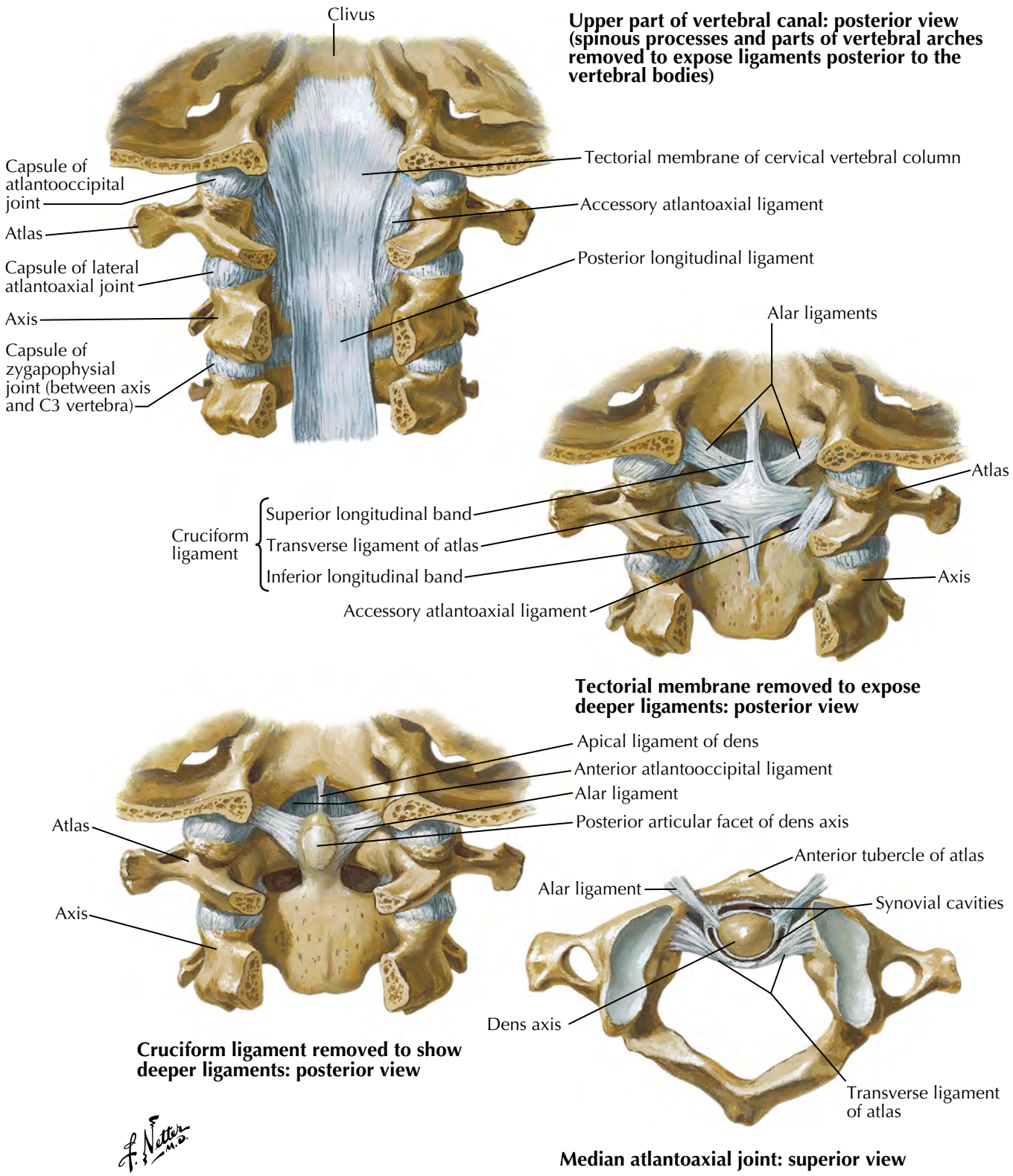


The uncovertebral joints of the cervical spine: anterior view (C3 to C7 have been sectioned coronally to expose the joints)

C. Machado, M.D.


Anterior view
Basilar part of occipital bone
Pharyngeal tubercle
Anterior atlantooccipital membrane
Capsule of atlantooccipital joint
Posterior atlantooccipital membrane
Lateral atlantoaxial joint (exposed)
Anterior longitudinal ligament
Atlas
Capsule of lateral atlantoaxial joint
Axis
Capsule of zygapophysial joint (between C3 and C4 vertebrae)
Posterior view
Posterior atlantooccipital membrane
Occipital bone
Capsule of atlantooccipital joint
Transverse process of atlas
Capsule of lateral atlantoaxial joint
Axis
Ligamenta flava
Vertebral a.
Suboccipital n.
Anterior atlantooccipital membrane
Capsule of atlantooccipital joint
Posterior atlantooccipital membrane
Atlas
Ligamenta flava
Nuchal ligament
Body of axis
Intervertebral discs
Zygapophysial joints
Anterior tubercle of C6 vertebra (carotid tubercle of Chassaignac)
Vertebral a.
Spinous process of C7 vertebra
T1 vertebra
Supraspinous ligament
Right lateral view

See also **Plates 43, BP 18, BP 35**



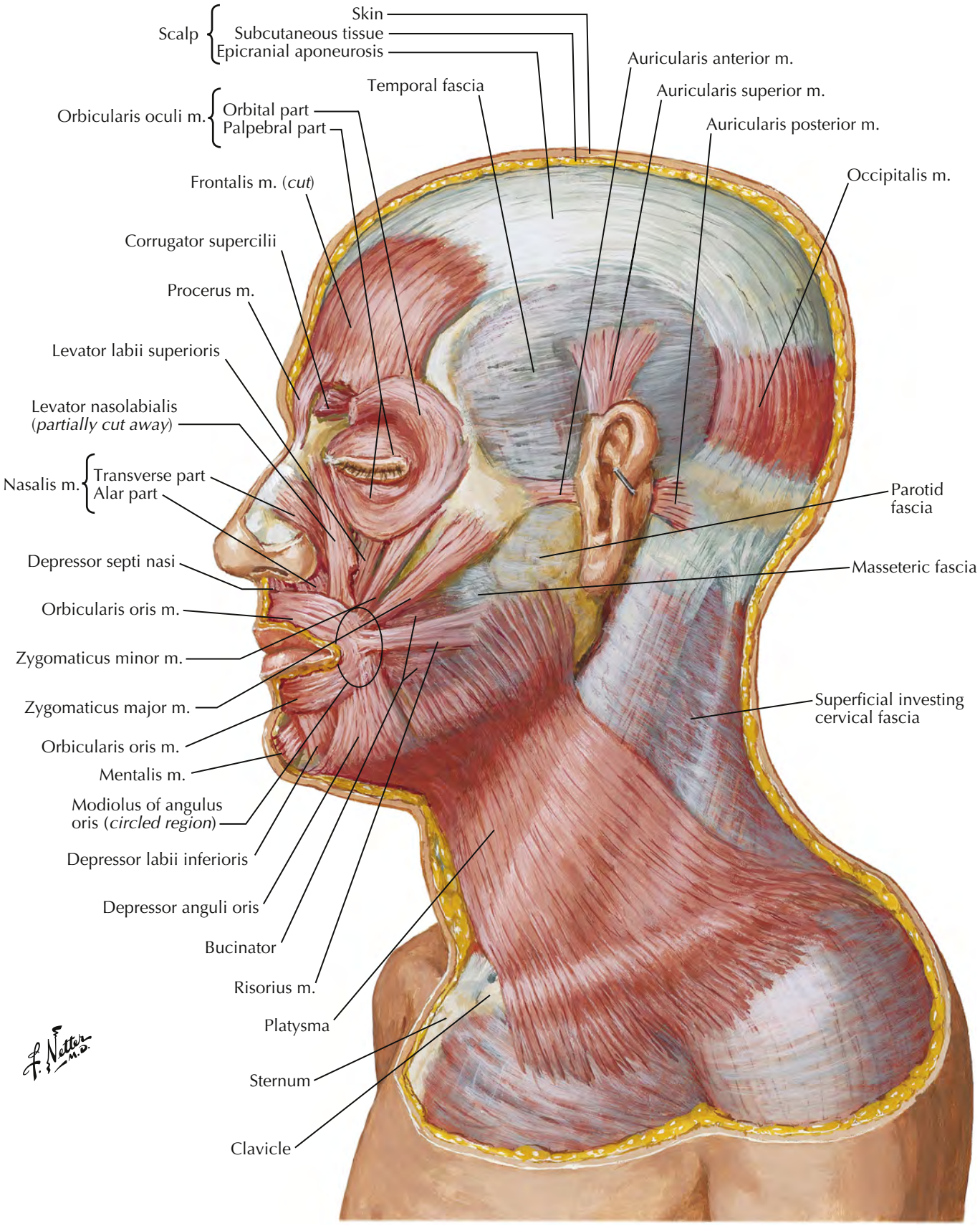
Upper part of vertebral canal: posterior view (spinous processes and parts of vertebral arches removed to expose ligaments posterior to the vertebral bodies)

Tectorial membrane removed to expose deeper ligaments: posterior view

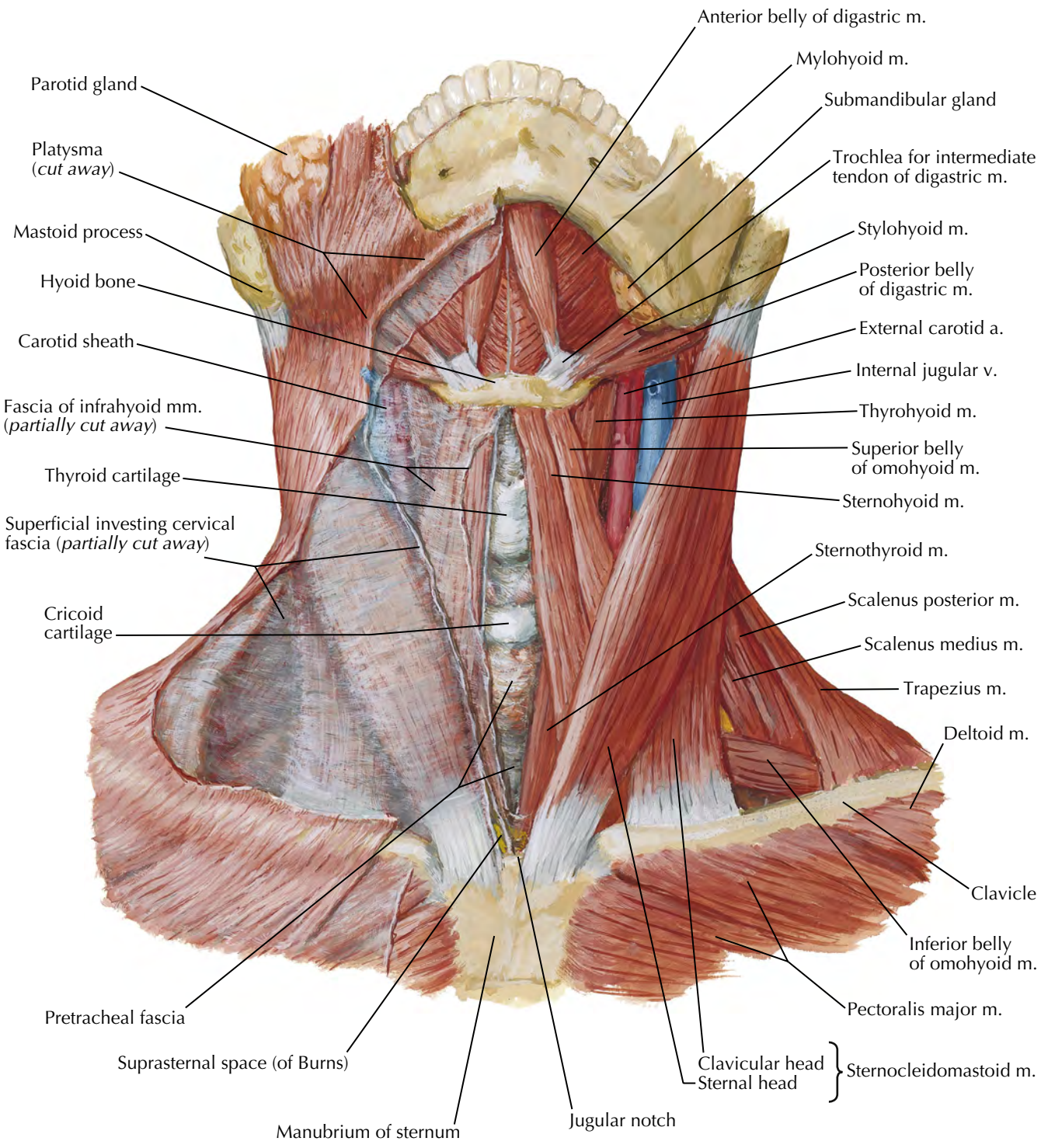
Cruciform ligament removed to show deeper ligaments: posterior view

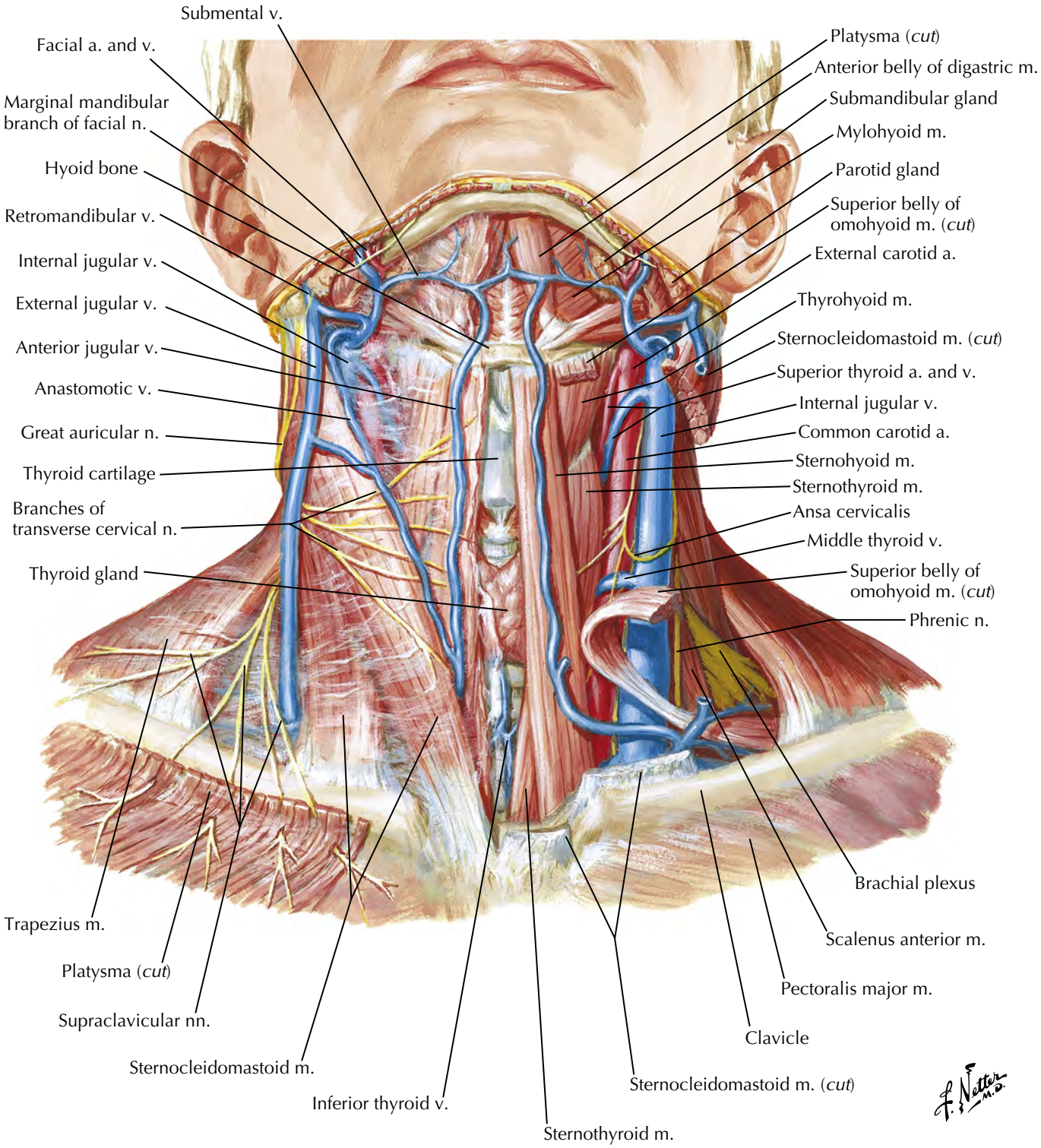
Median atlantoaxial joint: superior view

See also **Plates 52, 72, 73, BP 19, BP 20**



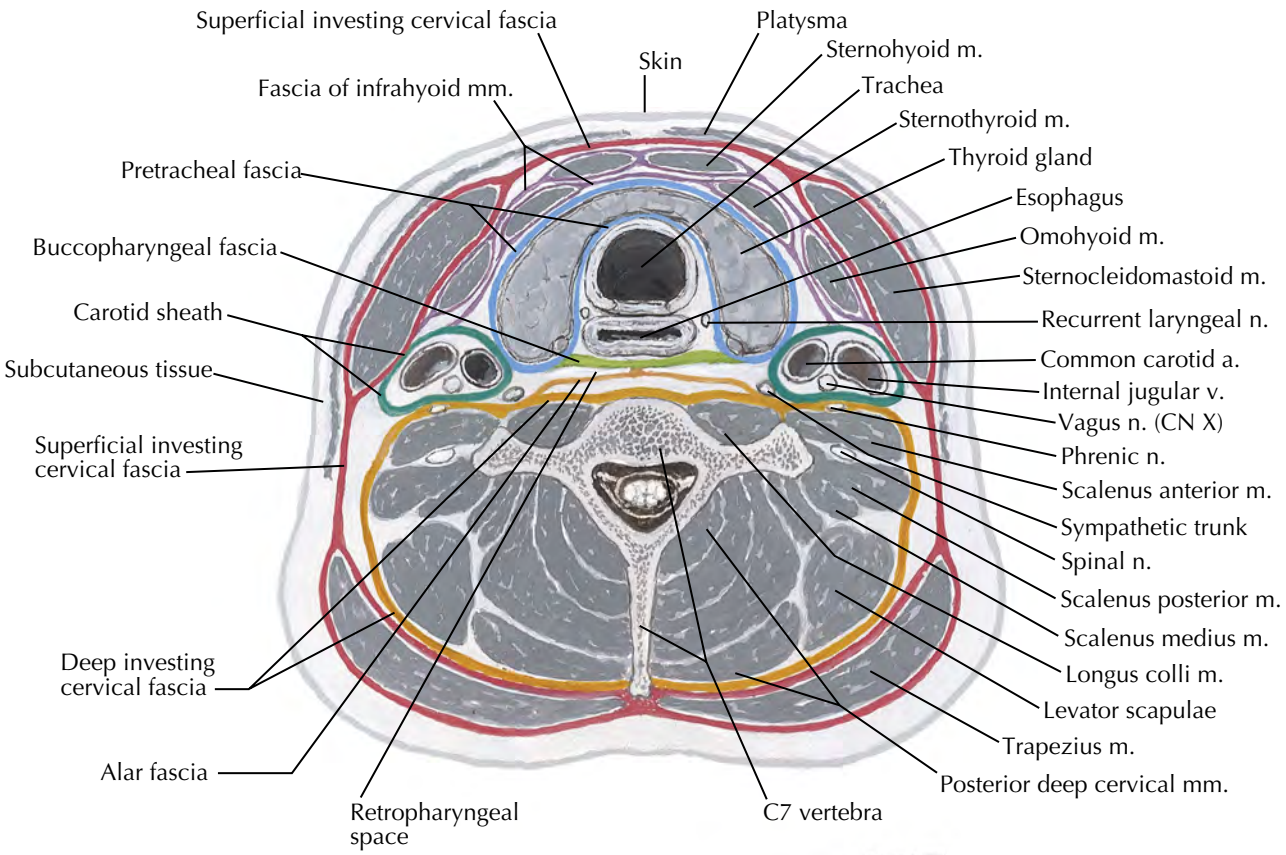
See also **Plates 37, 50, 51, 53**



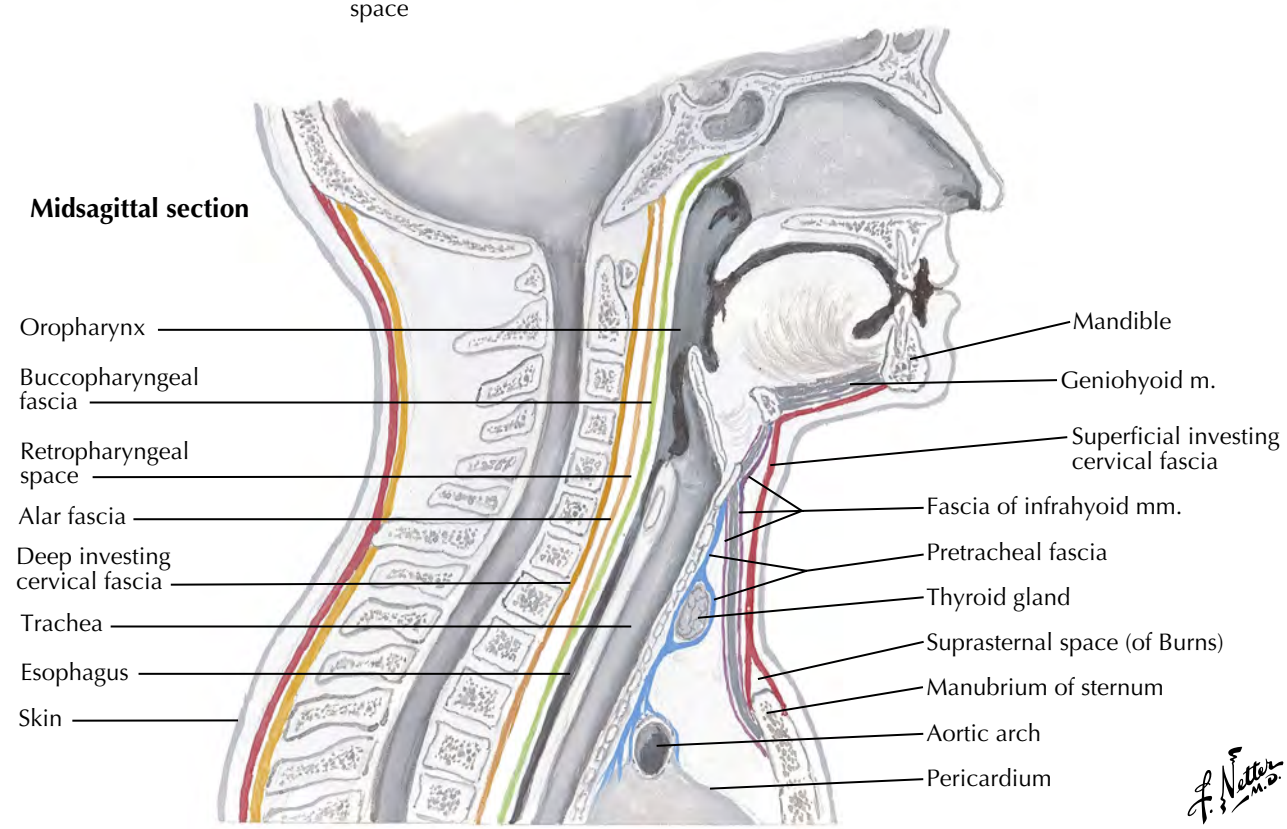

Submental v.
Facial a. and v.
Marginal mandibular branch of facial n.
Hyoid bone
Retromandibular v.
Internal jugular v.
External jugular v.
Anterior jugular v.
Anastomotic v.
Great auricular n.
Thyroid cartilage
Branches of transverse cervical n.
Thyroid gland
Platysma (*cut*)
Anterior belly of digastric m.
Submandibular gland
Mylohyoid m.
Parotid gland
Superior belly of omohyoid m. (*cut*)
External carotid a.
Thyrohyoid m.
Sternocleidomastoid m. (*cut*)
Superior thyroid a. and v.
Internal jugular v.
Common carotid a.
Sternohyoid m.
Sternothyroid m.
Ansa cervicalis
Middle thyroid v.
Superior belly of omohyoid m. (*cut*)
Phrenic n.
Brachial plexus
Scalenus anterior m.
Pectoralis major m.
Clavicle
Sternocleidomastoid m. (*cut*)
Sternothyroid m.
Inferior thyroid v.
Sternocleidomastoid m.
Supraclavicular nn.
Platysma (*cut*)
Trapezius m.

See also **Plate 49**

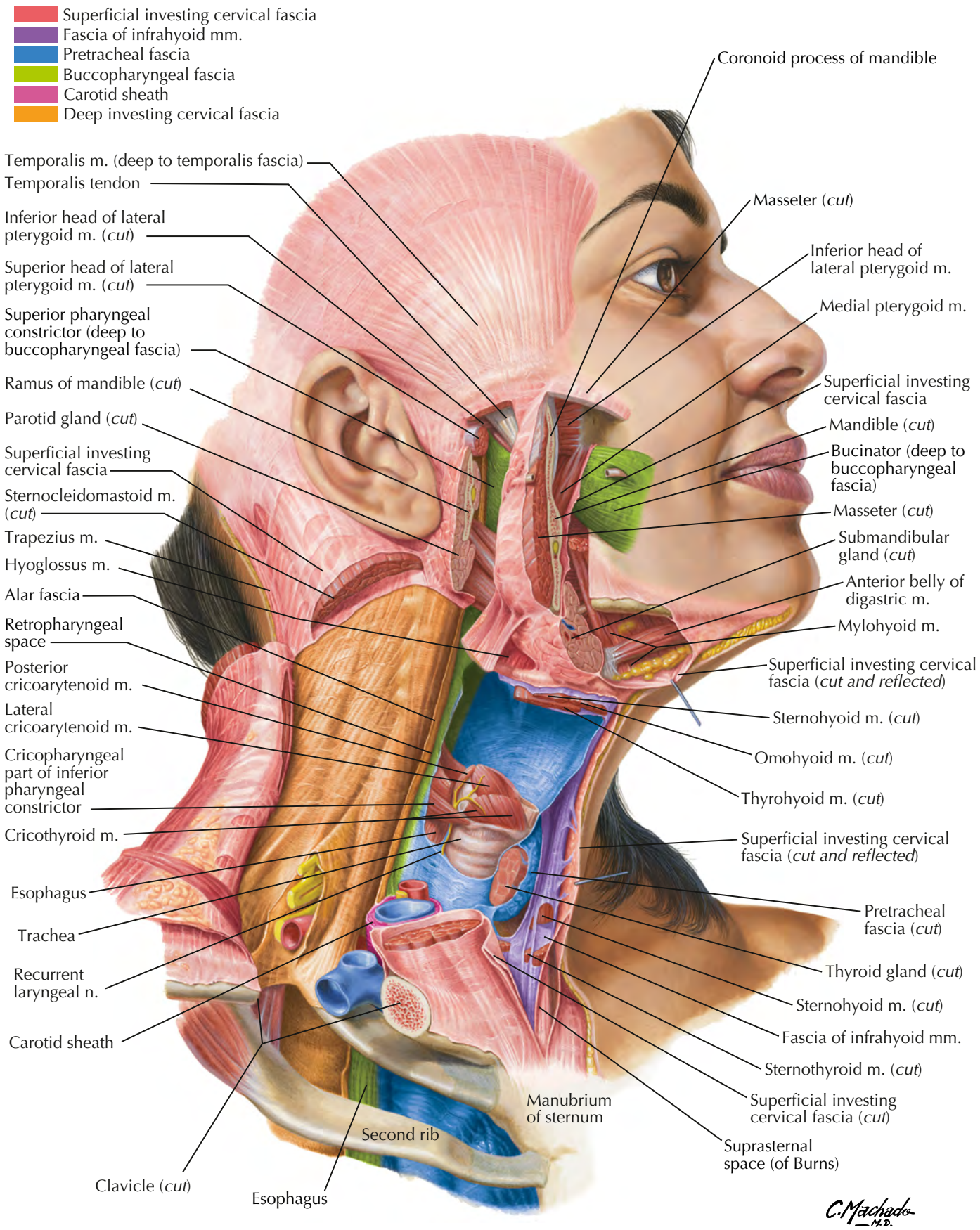
Cross section



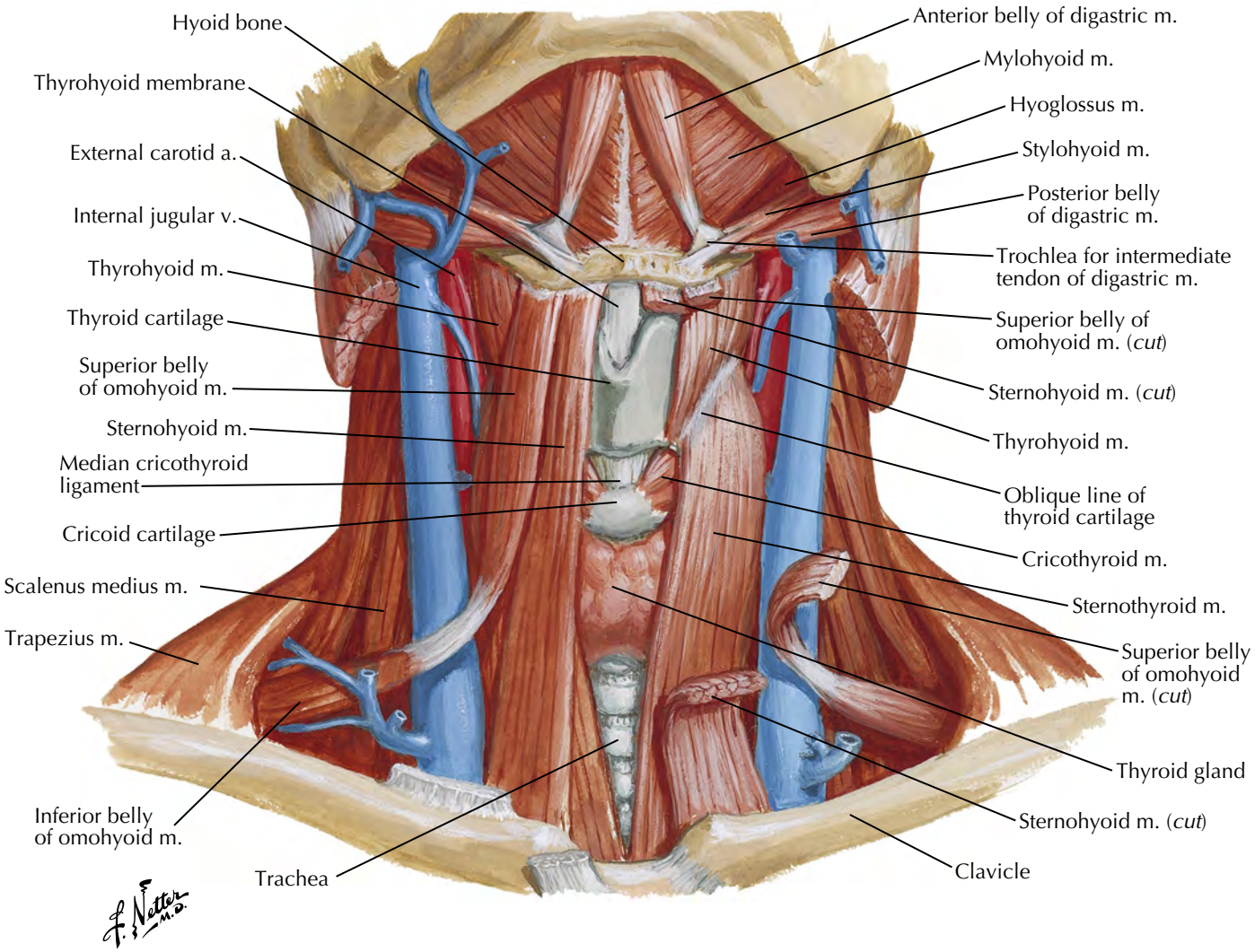
Midsagittal section



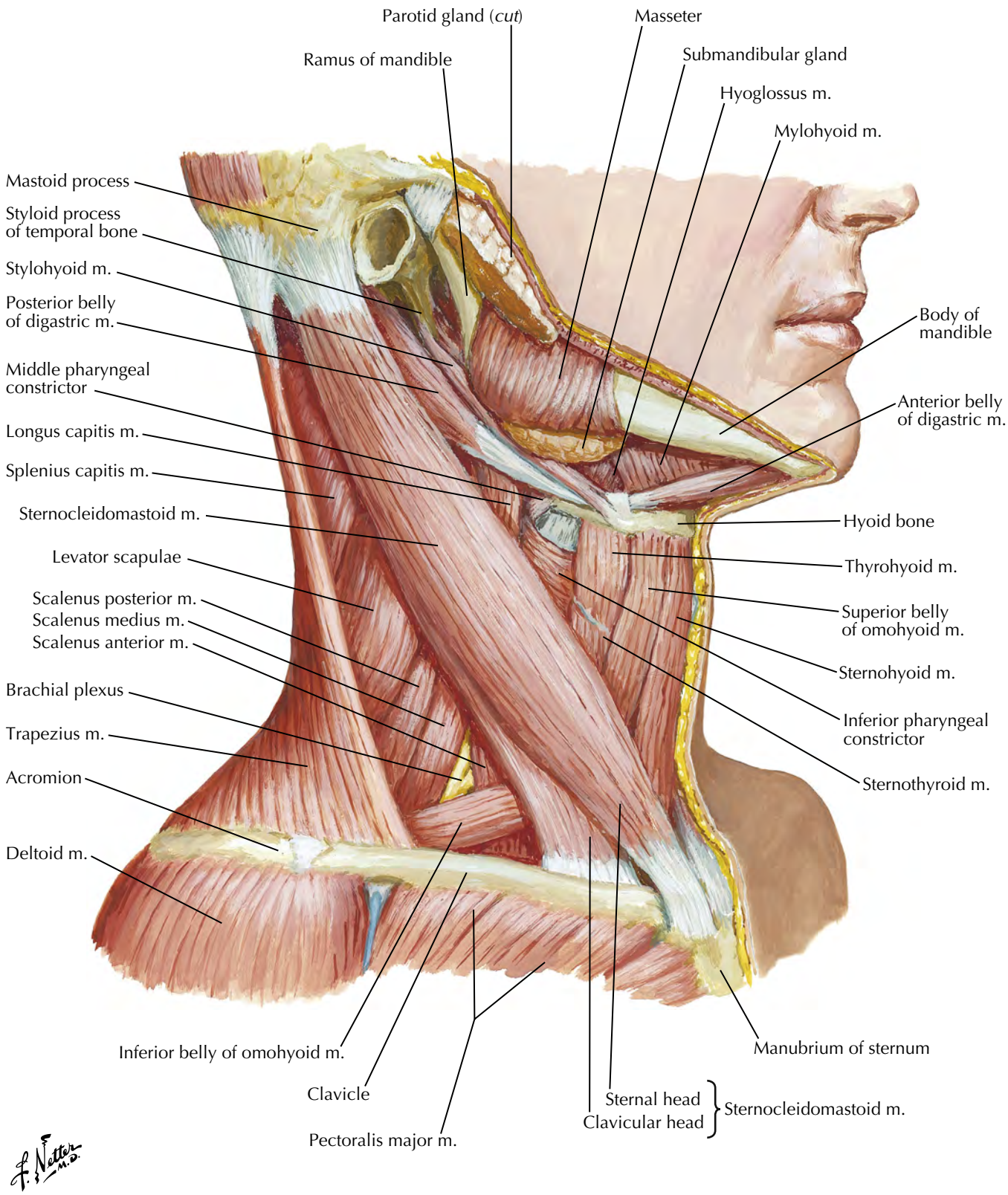
See also **Plates 49, 50, 51**

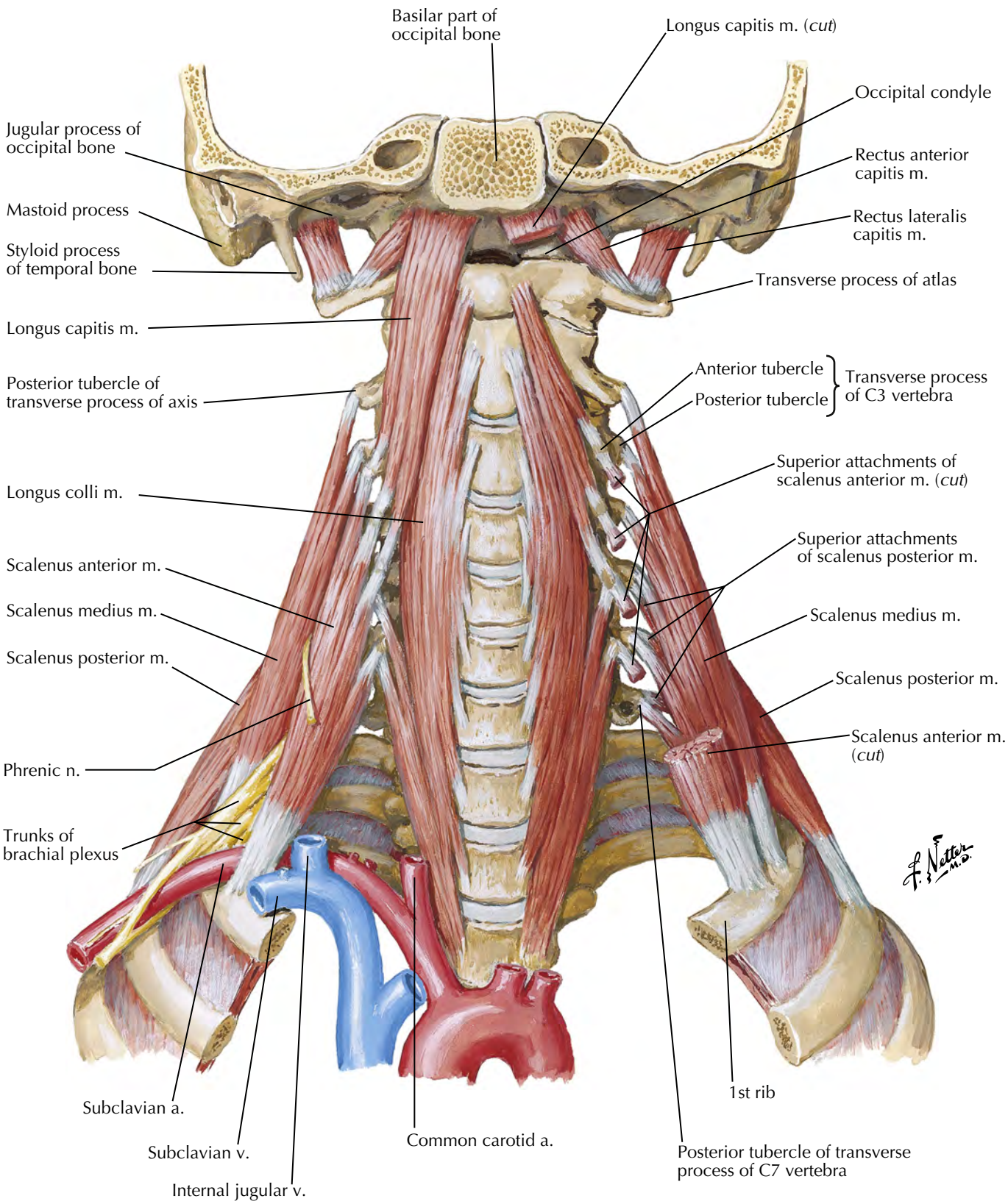


See also **Plates 49, 54, 87**

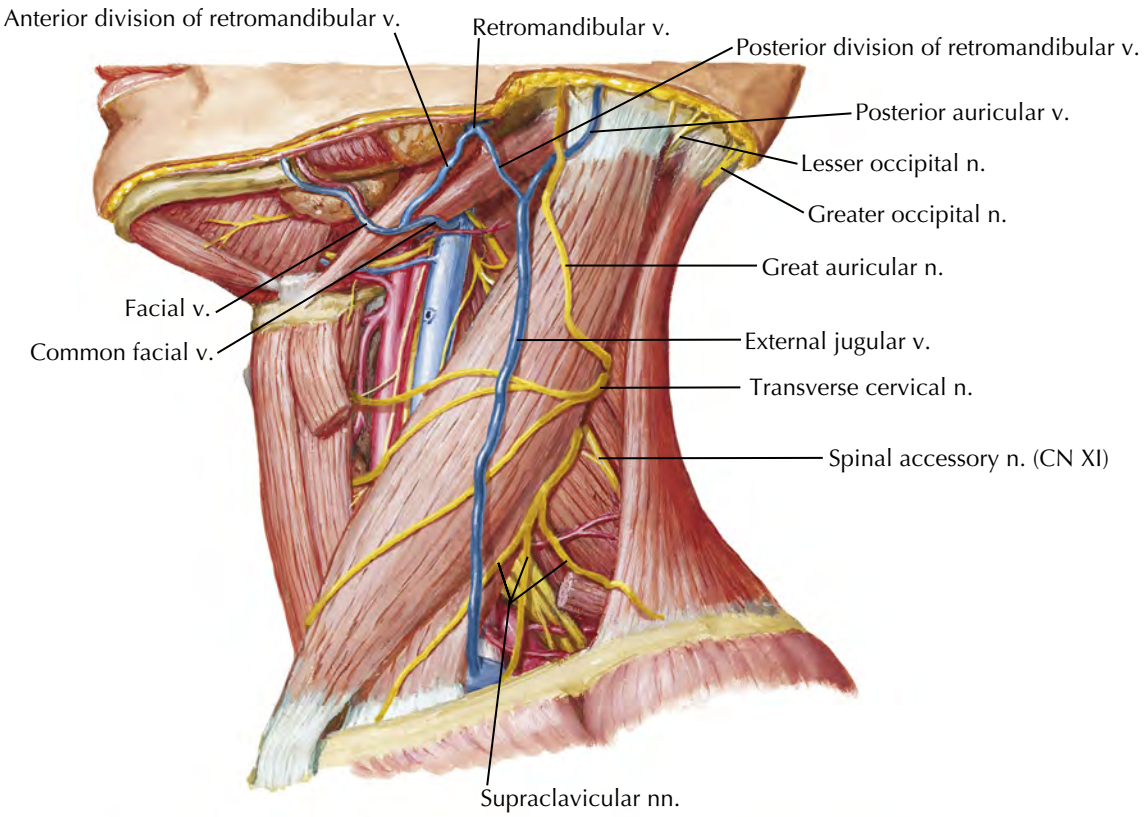


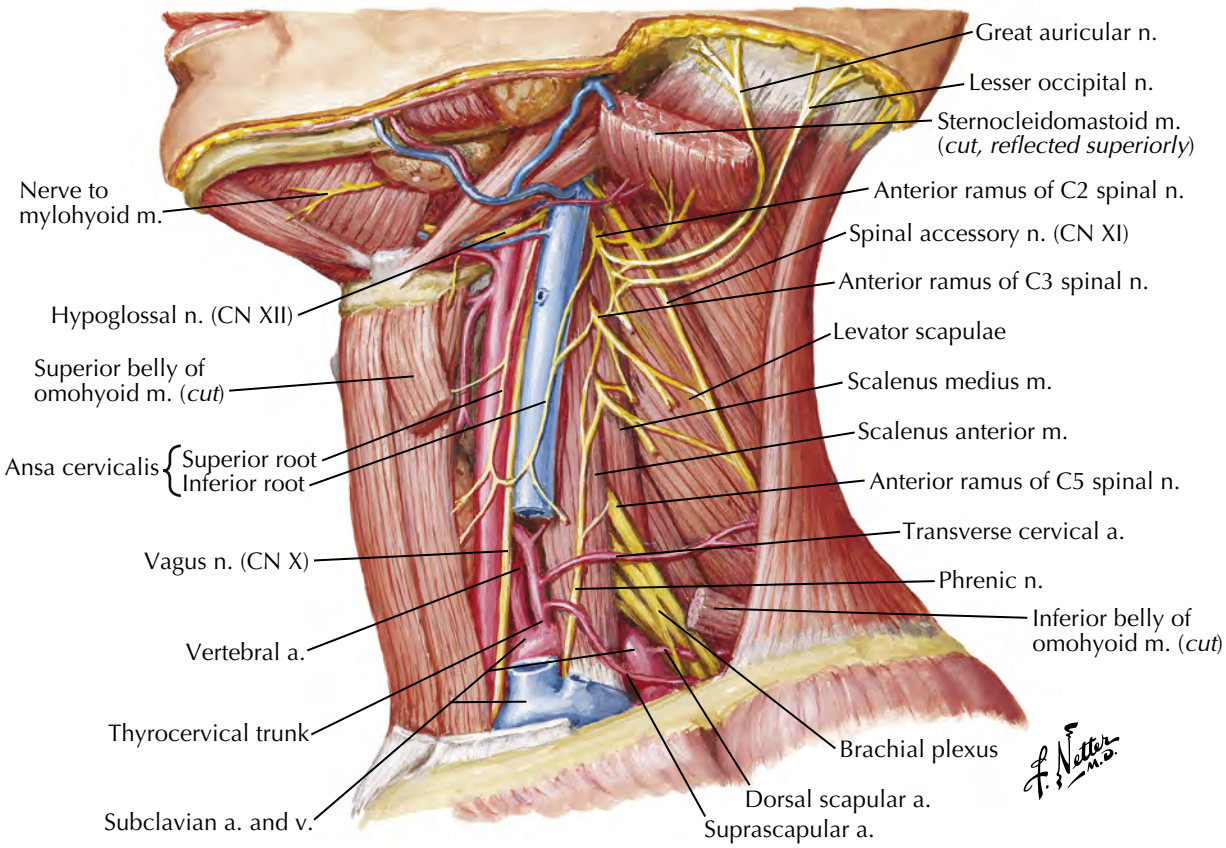
See also **Plates 49, 50, 53**




Basilar part of occipital bone
Longus capitis m. (*cut*)
Occipital condyle
Jugular process of occipital bone
Rectus anterior capitis m.
Mastoid process
Rectus lateralis capitis m.
Styloid process of temporal bone
Transverse process of atlas
Longus capitis m.
Anterior tubercle
Posterior tubercle
Transverse process of C3 vertebra
Posterior tubercle of transverse process of axis
Superior attachments of scalenus anterior m. (*cut*)
Longus colli m.
Superior attachments of scalenus posterior m.
Scalenus anterior m.
Scalenus medius m.
Scalenus medius m.
Scalenus posterior m.
Scalenus posterior m.
Scalenus anterior m. (*cut*)
Phrenic n.
Trunks of brachial plexus
1st rib
Subclavian a.
Subclavian v.
Common carotid a.
Internal jugular v.
Posterior tubercle of transverse process of C7 vertebra

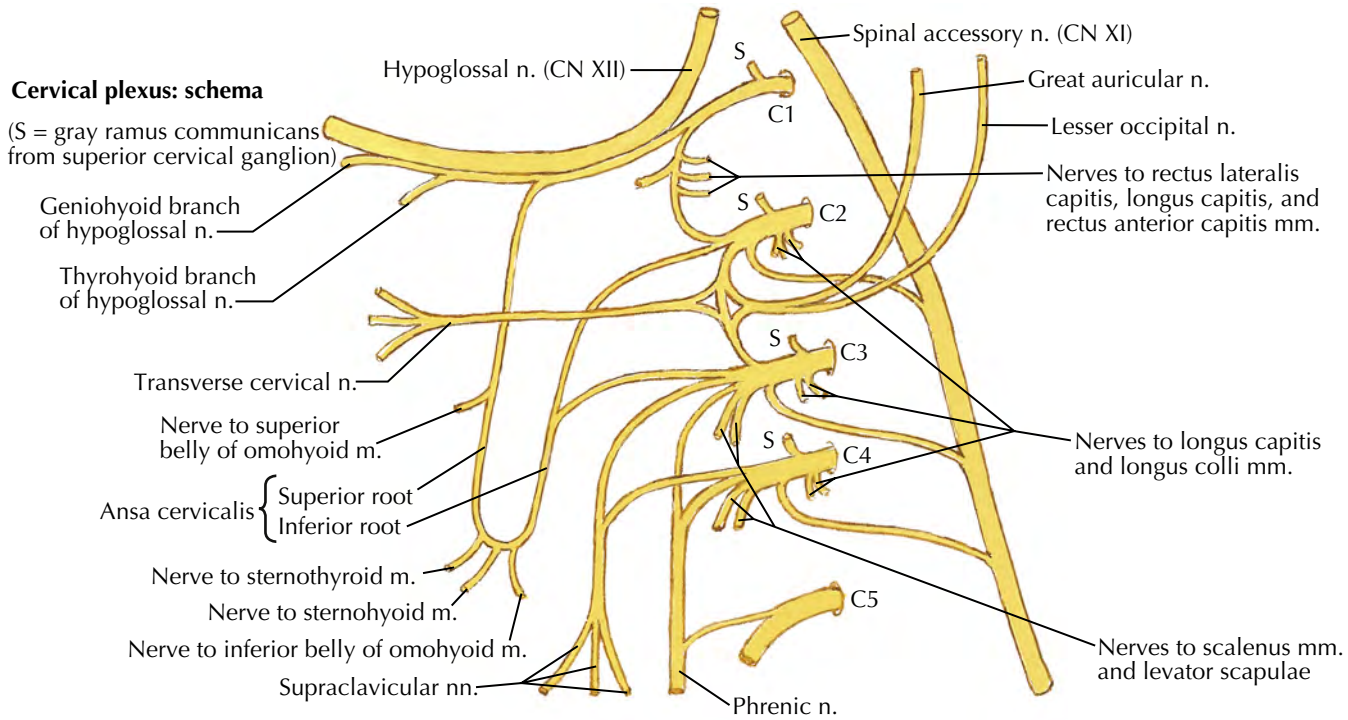
See also **Plates 154, 155, 156**



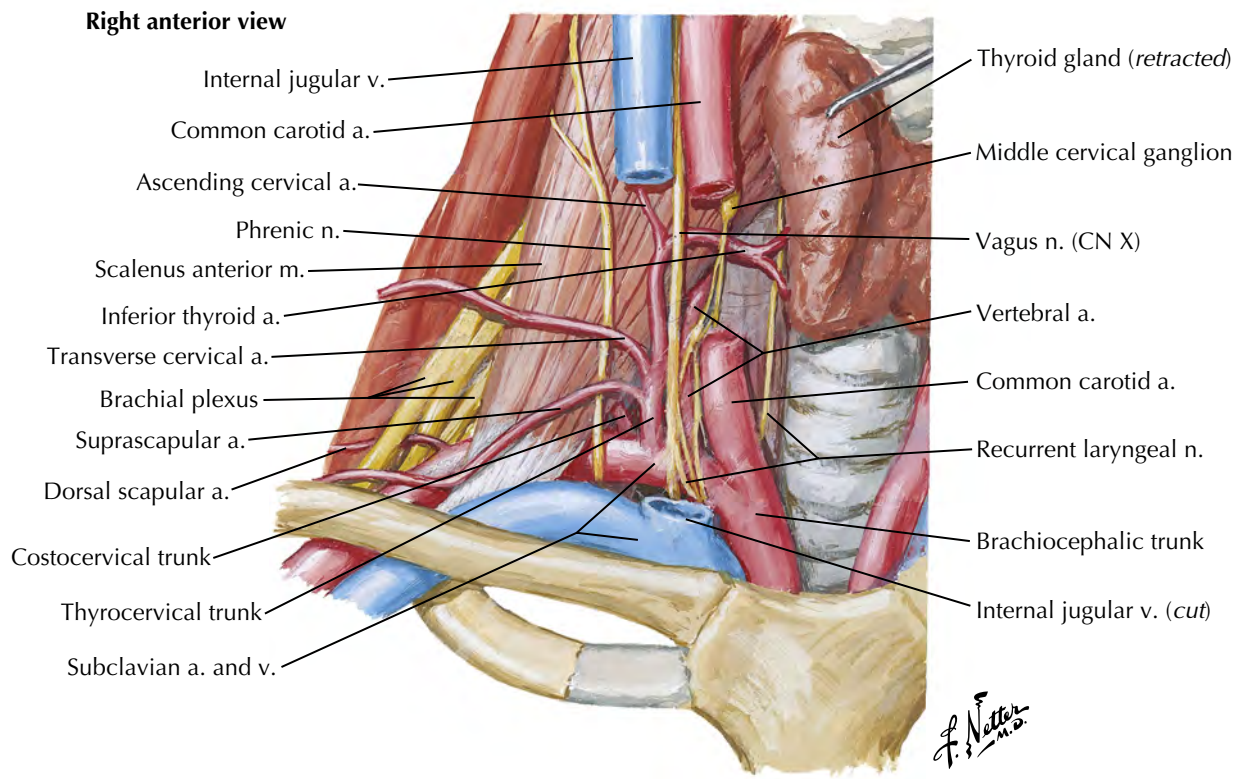


See also **Plate 156**

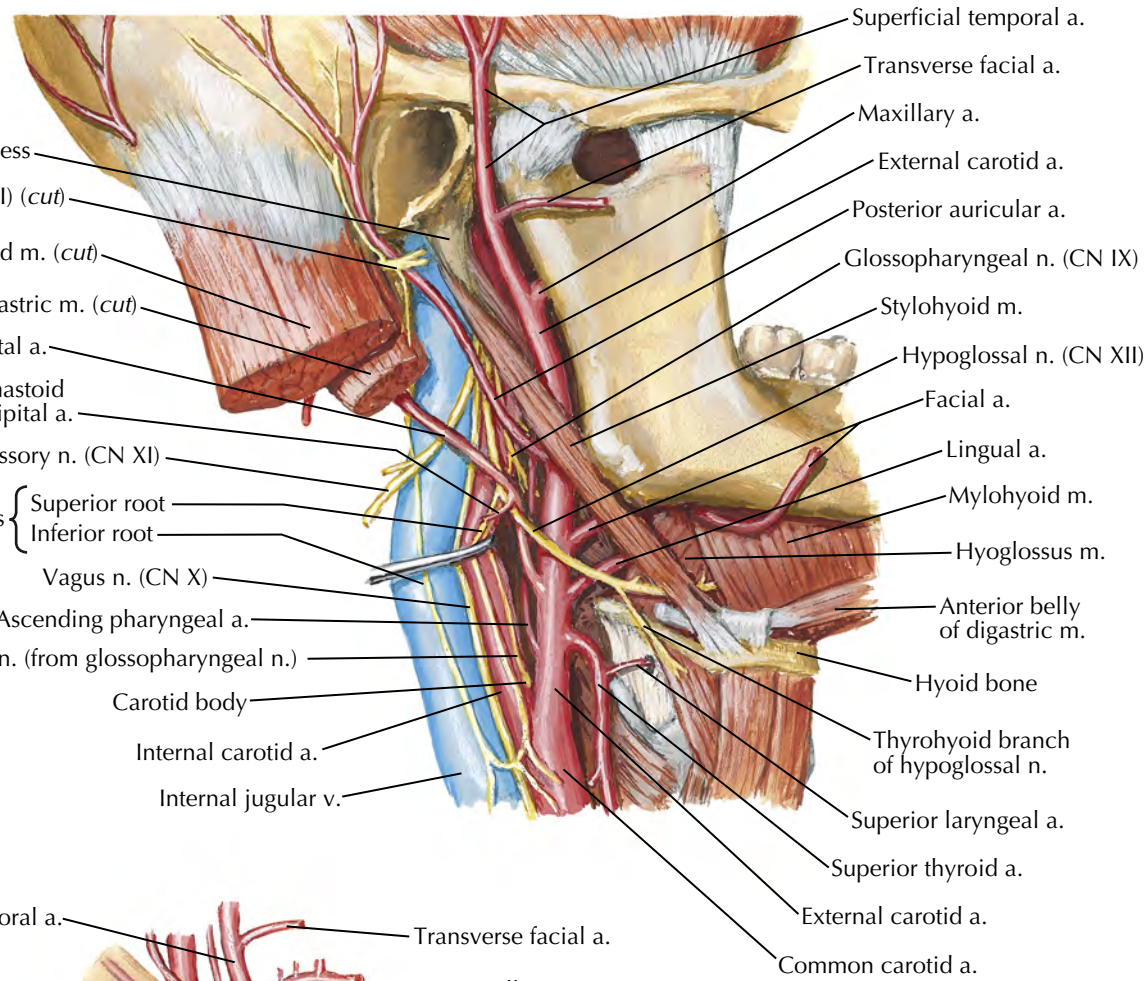
Cervical plexus: schema

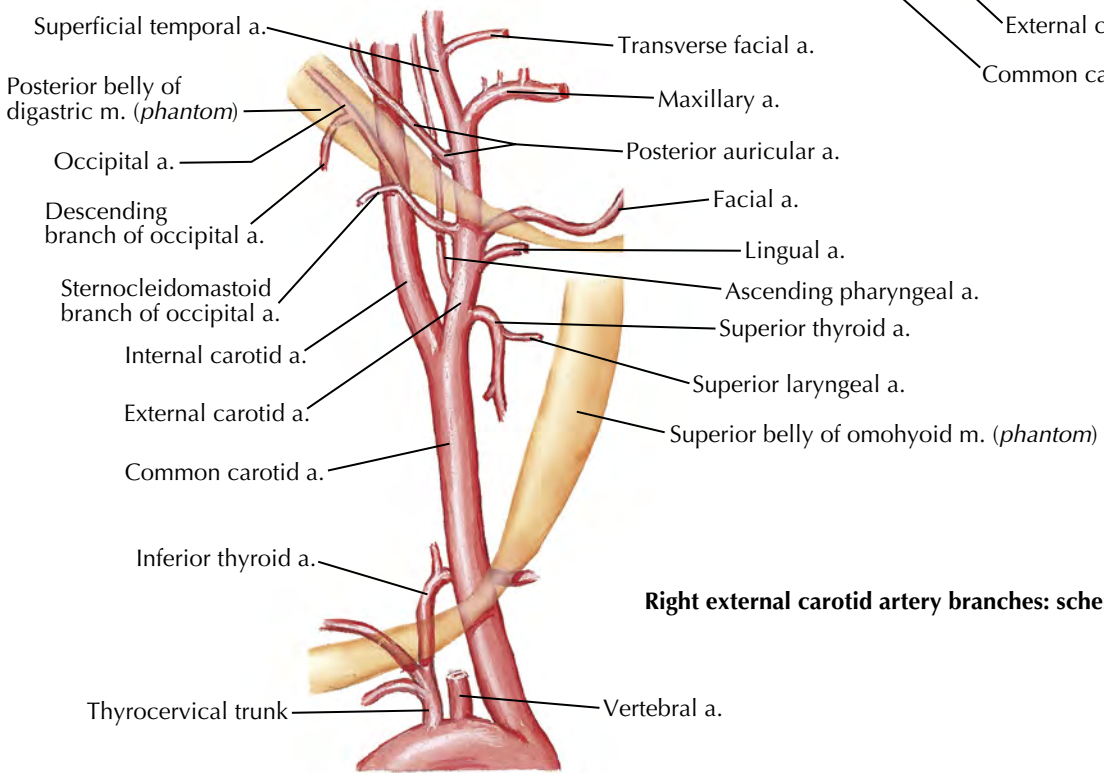


Right anterior view



Retromandibular space: right lateral view

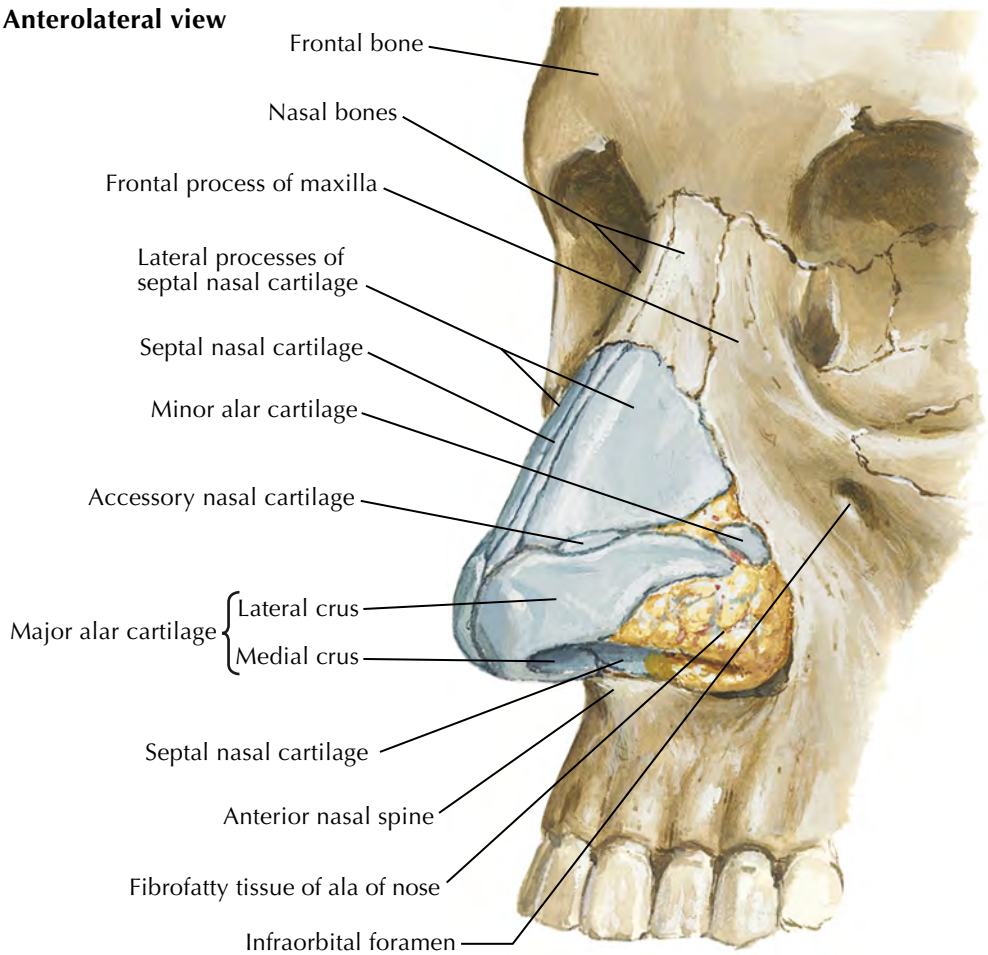




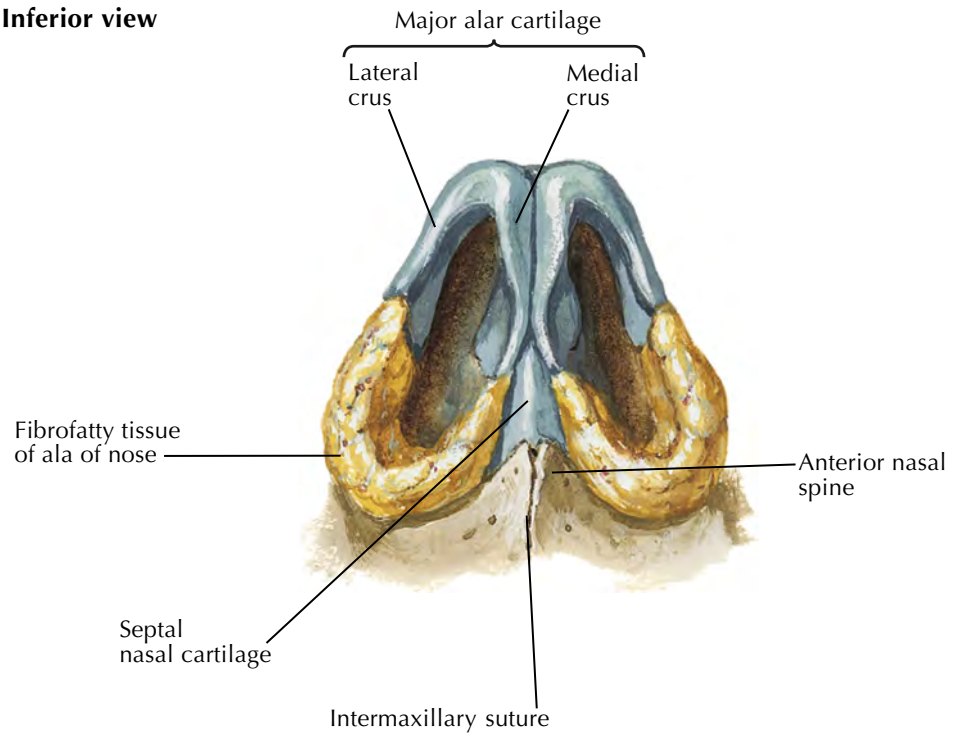
Right external carotid artery branches: schema

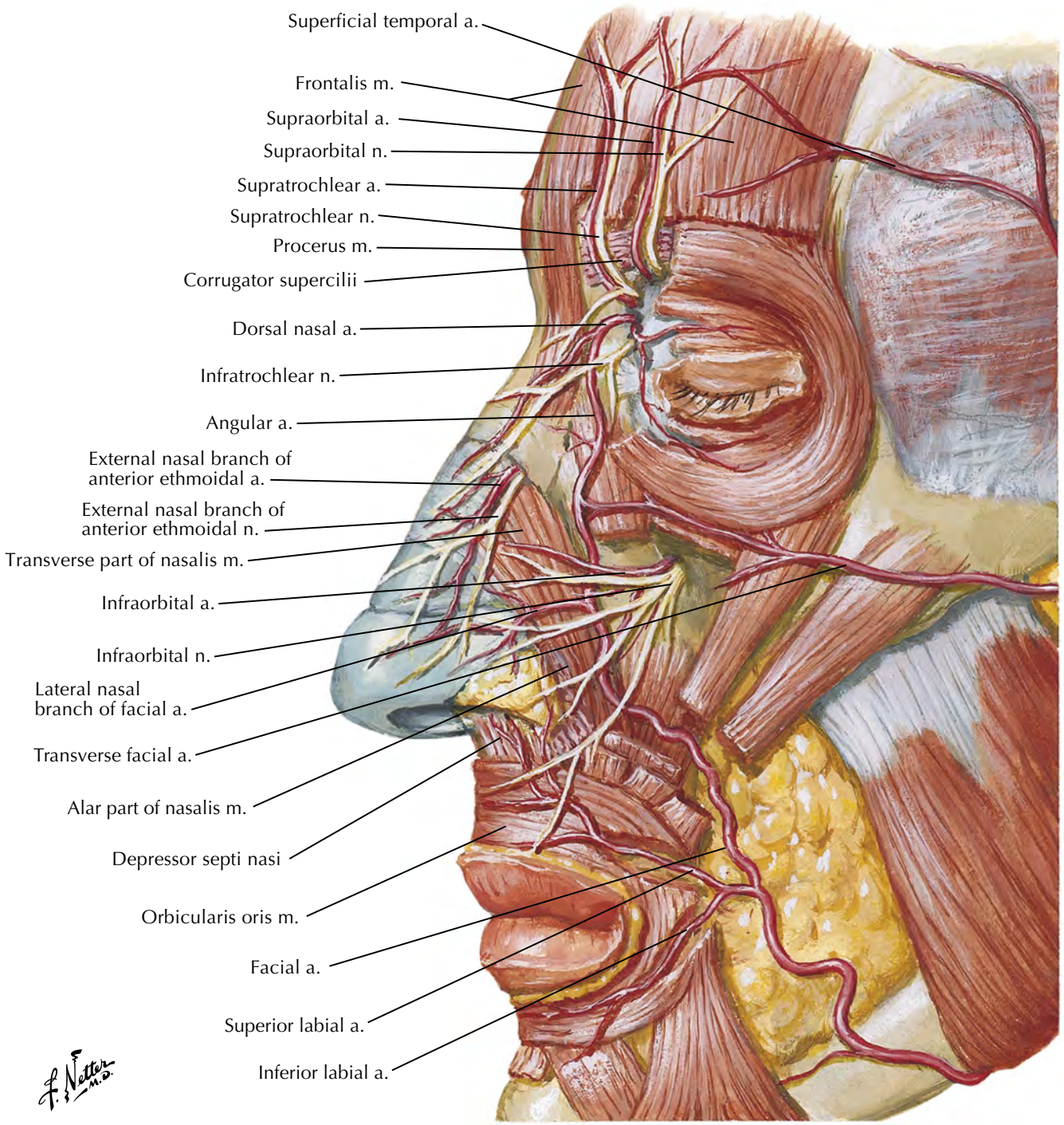
See also **Plate 63**

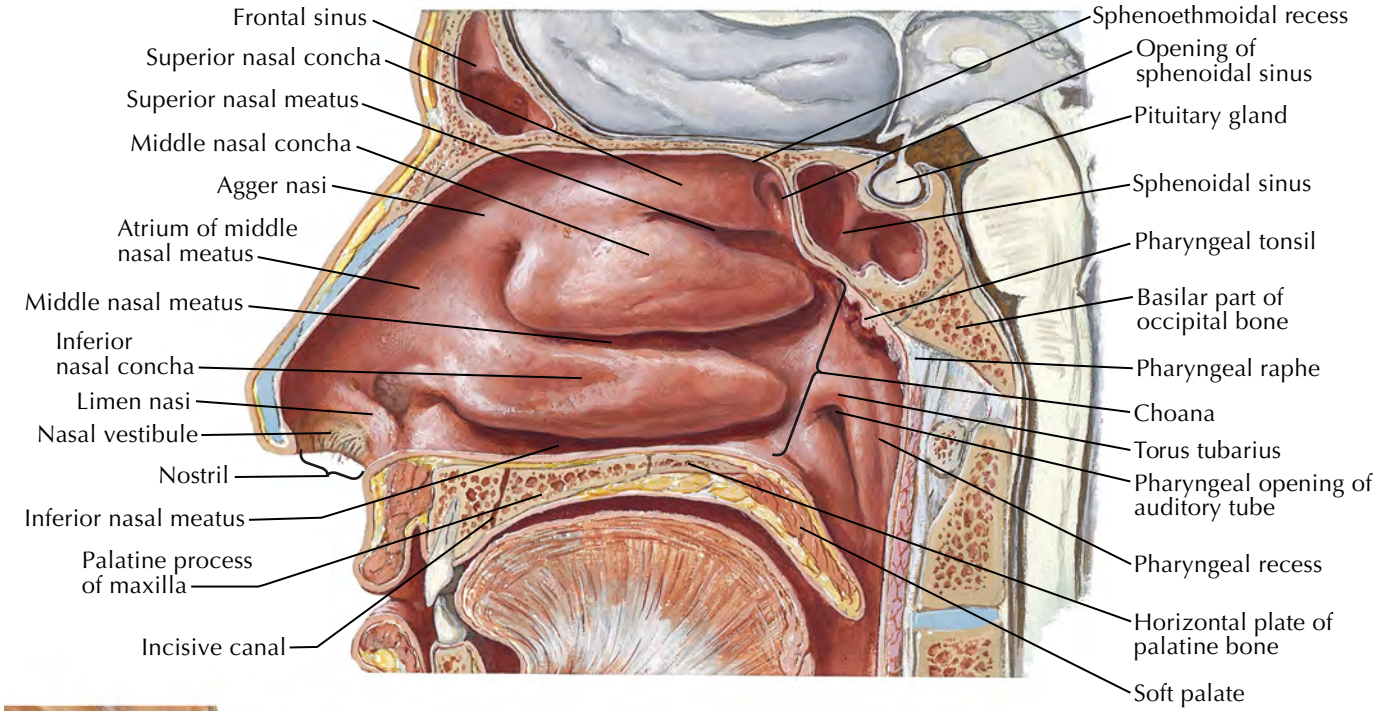
Anterolateral view

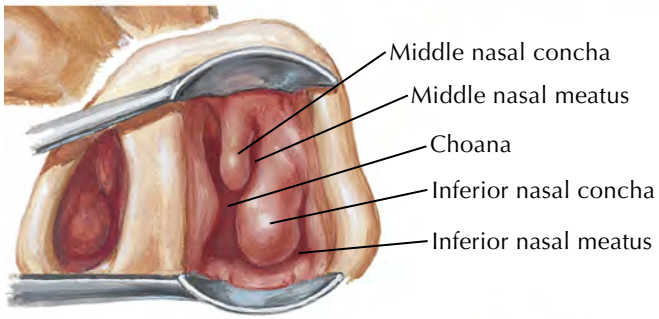


Inferior view

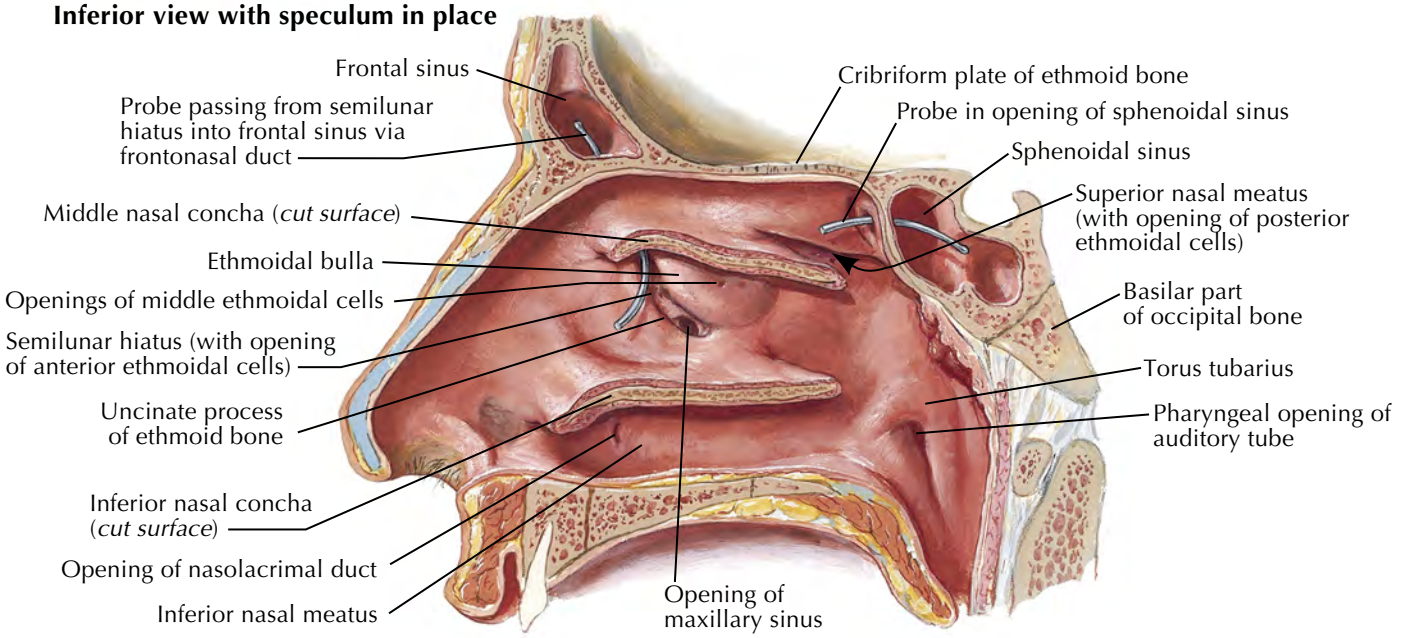


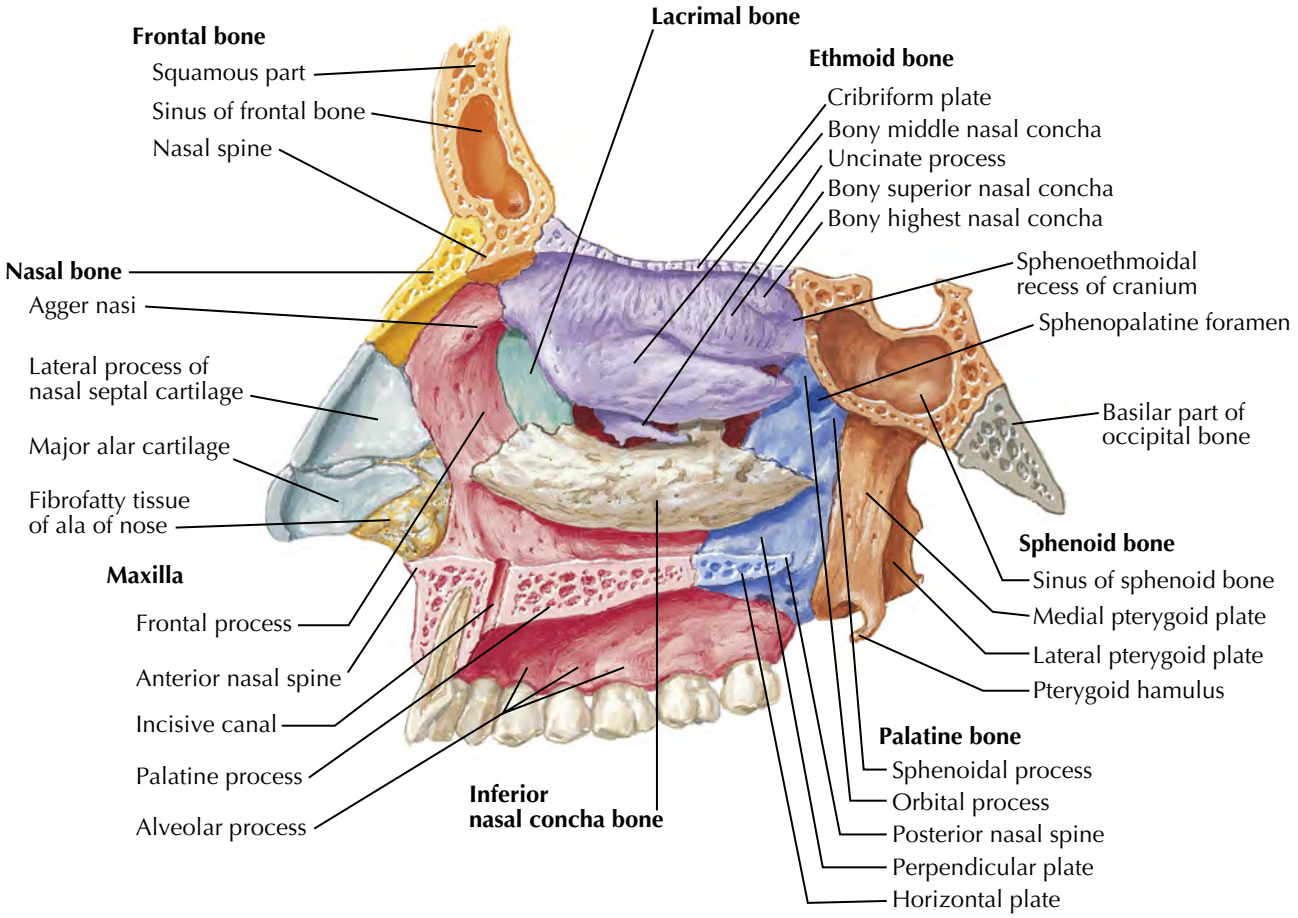

Superficial temporal a.
Frontalis m.
Supraorbital a.
Supraorbital n.
Supratrochlear a.
Supratrochlear n.
Procerus m.
Corrugator supercilii
Dorsal nasal a.
Infratrochlear n.
Angular a.
External nasal branch of anterior ethmoidal a.
External nasal branch of anterior ethmoidal n.
Transverse part of nasalis m.
Infraorbital a.
Infraorbital n.
Lateral nasal branch of facial a.
Transverse facial a.
Alar part of nasalis m.
Depressor septi nasi
Orbicularis oris m.
Facial a.
Superior labial a.
Inferior labial a.

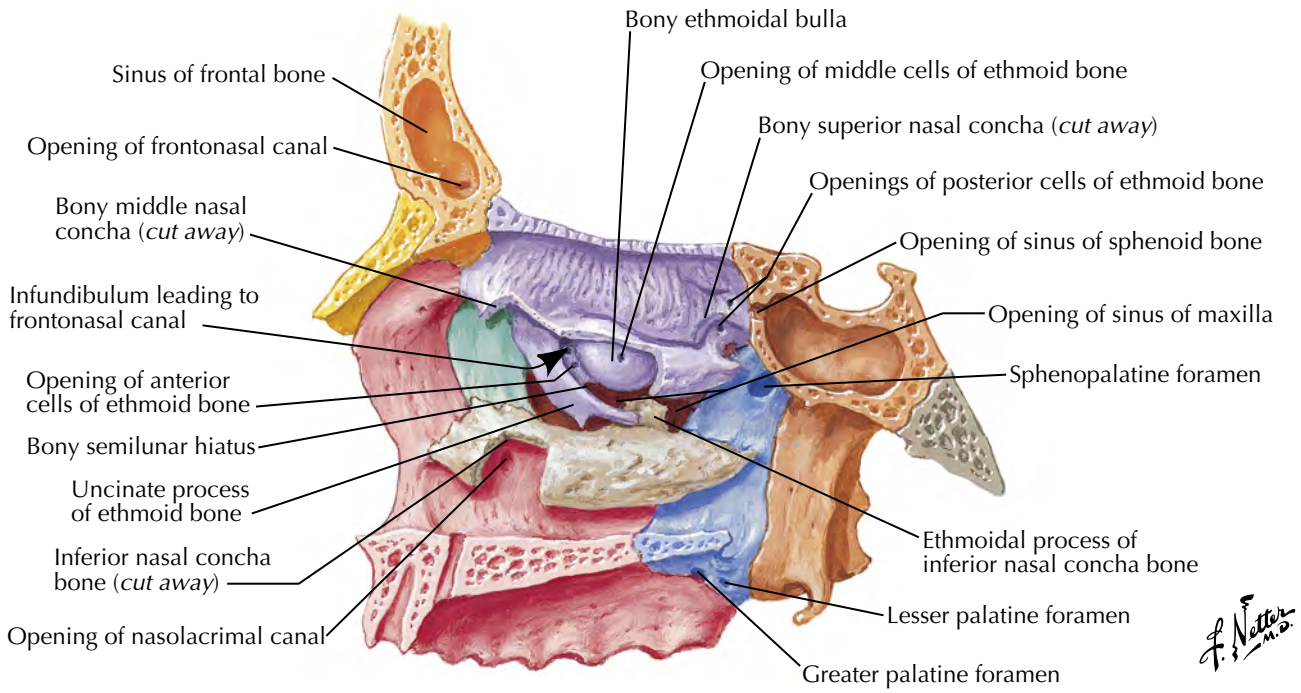




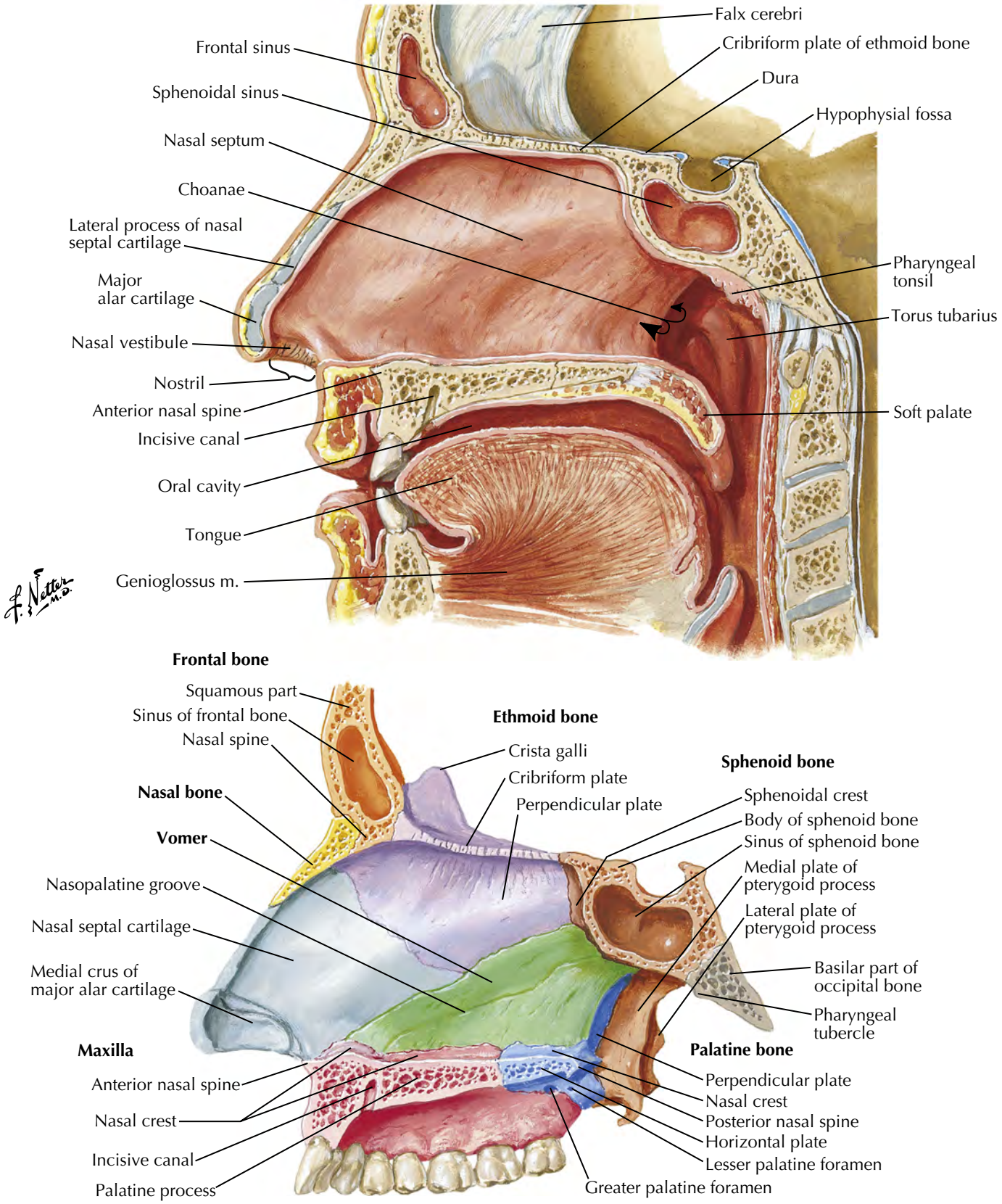
Inferior view with speculum in place




Frontal bone
Squamous part
Sinus of frontal bone
Nasal spine
Nasal bone
Agger nasi
Lateral process of nasal septal cartilage
Major alar cartilage
Fibrofatty tissue of ala of nose
Maxilla
Frontal process
Anterior nasal spine
Incisive canal
Palatine process
Alveolar process
Lacrimal bone
Ethmoid bone
Cribriform plate
Bony middle nasal concha
Uncinate process
Bony superior nasal concha
Bony highest nasal concha
Sphenoethmoidal recess of cranium
Sphenopalatine foramen
Basilar part of occipital bone
Sphenoid bone
Sinus of sphenoid bone
Medial pterygoid plate
Lateral pterygoid plate
Pterygoid hamulus
Palatine bone
Sphenoidal process
Orbital process
Posterior nasal spine
Perpendicular plate
Horizontal plate
Inferior nasal concha bone

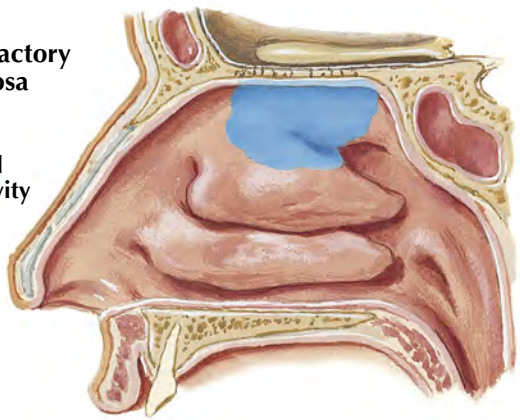

Bony ethmoidal bulla
Sinus of frontal bone
Opening of middle cells of ethmoid bone
Opening of frontonasal canal
Bony superior nasal concha (*cut away*)
Bony middle nasal concha (*cut away*)
Openings of posterior cells of ethmoid bone
Opening of sinus of sphenoid bone
Infundibulum leading to frontonasal canal
Opening of sinus of maxilla
Opening of anterior cells of ethmoid bone
Sphenopalatine foramen
Bony semilunar hiatus
Uncinate process of ethmoid bone
Ethmoidal process of inferior nasal concha bone
Inferior nasal concha bone (*cut away*)
Lesser palatine foramen
Opening of nasolacrimal canal
Greater palatine foramen

See also **Plate 29**

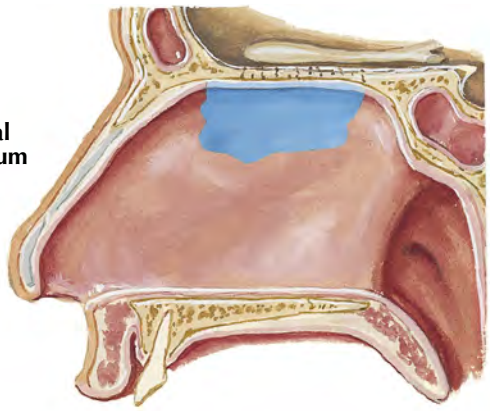


Distribution of olfactory part of nasal mucosa (*shaded blue*)

Lateral wall of nasal cavity

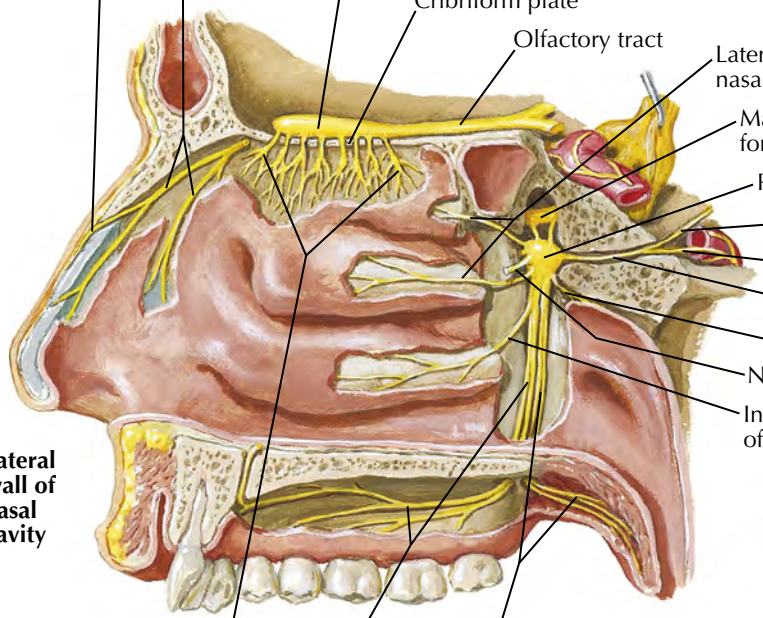


Nasal septum



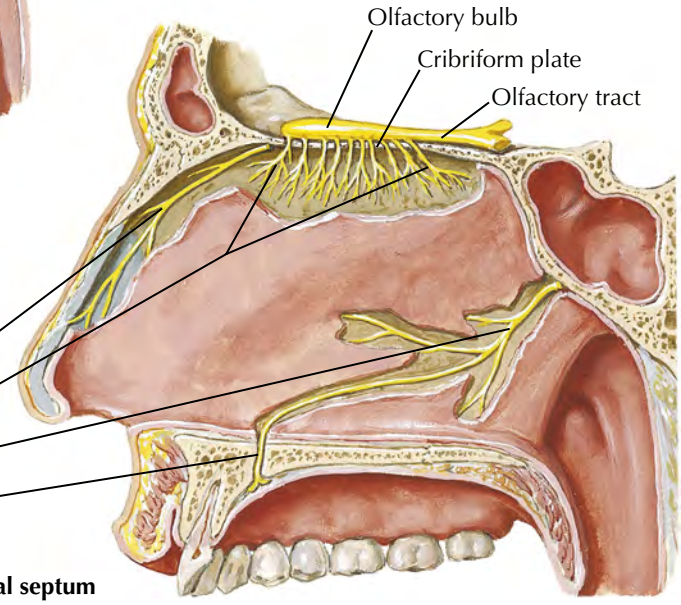
External nasal branch of anterior ethmoidal n.
Lateral nasal branches of anterior ethmoidal n.
Olfactory bulb
Cribriform plate
Olfactory tract
Lateral superior posterior nasal branches of maxillary n.
Maxillary n. (CN V_2) (sphenopalatine foramen dissected away)
Pterygopalatine ganglion
Greater petrosal n.
Deep petrosal n.
Nerve of pterygoid canal (Vidian n.)
Pharyngeal n.
Nasopalatine n. (*cut*)
Inferior posterior nasal branch of greater palatine n.

Lateral wall of nasal cavity



Olfactory n. (CN I)
Greater palatine n.
Lesser palatine nn.

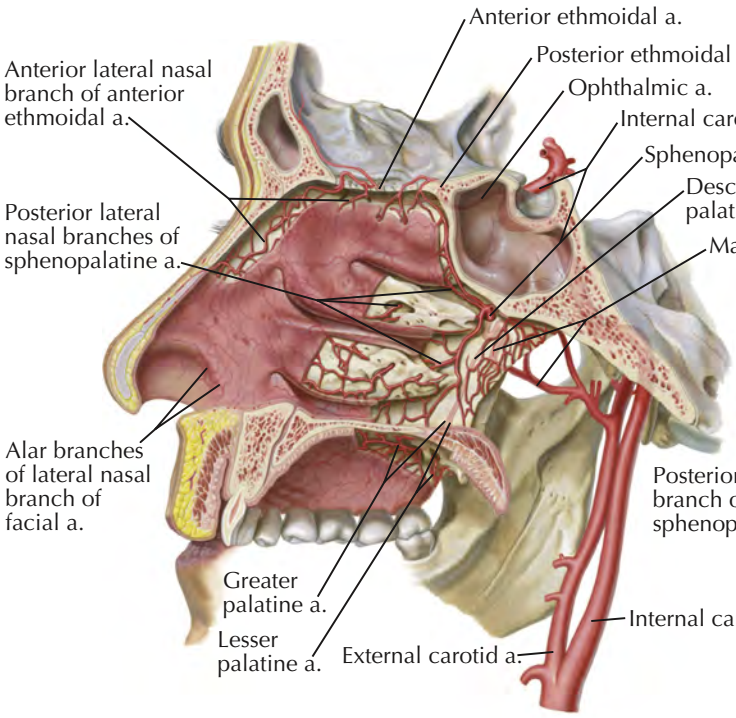
Olfactory bulb
Cribriform plate
Olfactory tract



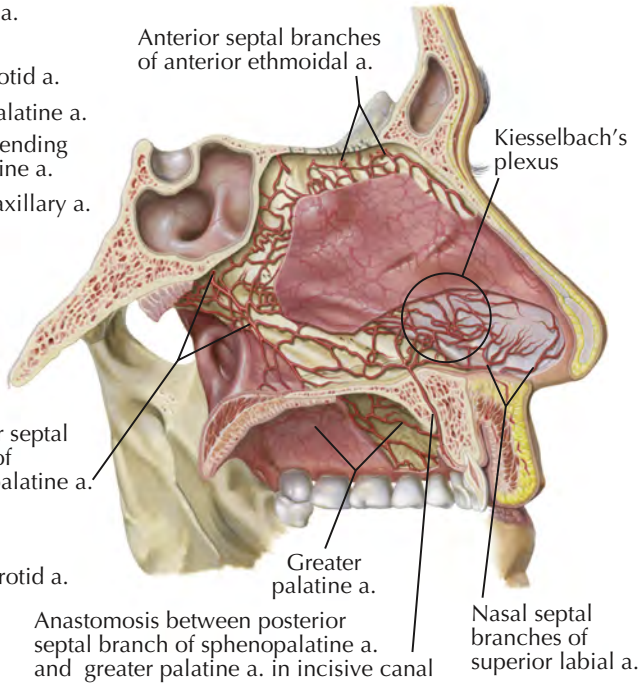
Medial nasal branch of anterior ethmoidal n.
Olfactory n. (CN I)
Nasopalatine n.
Incisive canal

Nasal septum

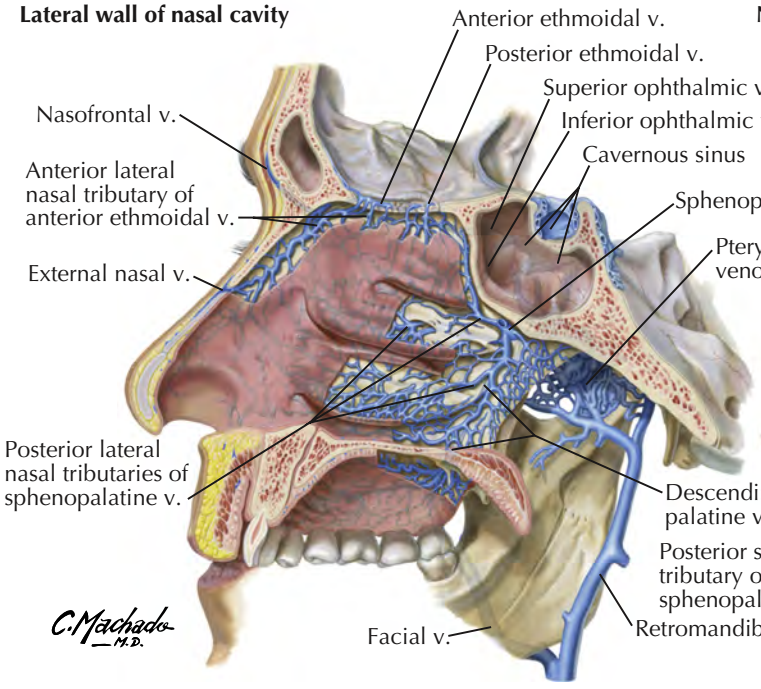
Lateral wall of nasal cavity



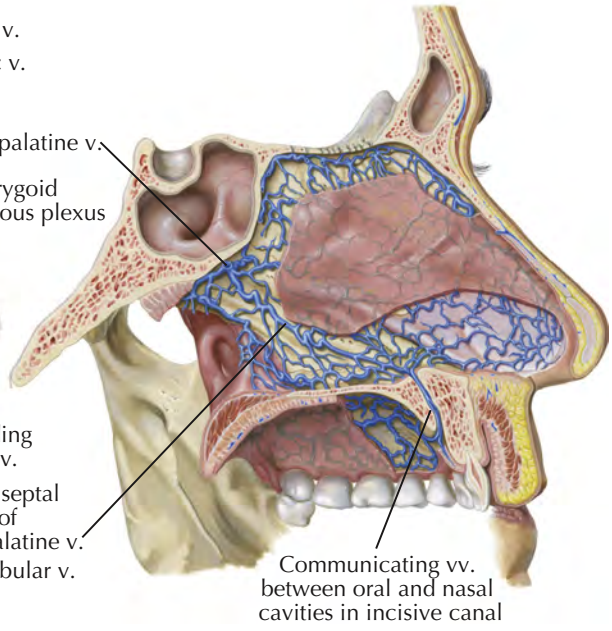
Nasal septum

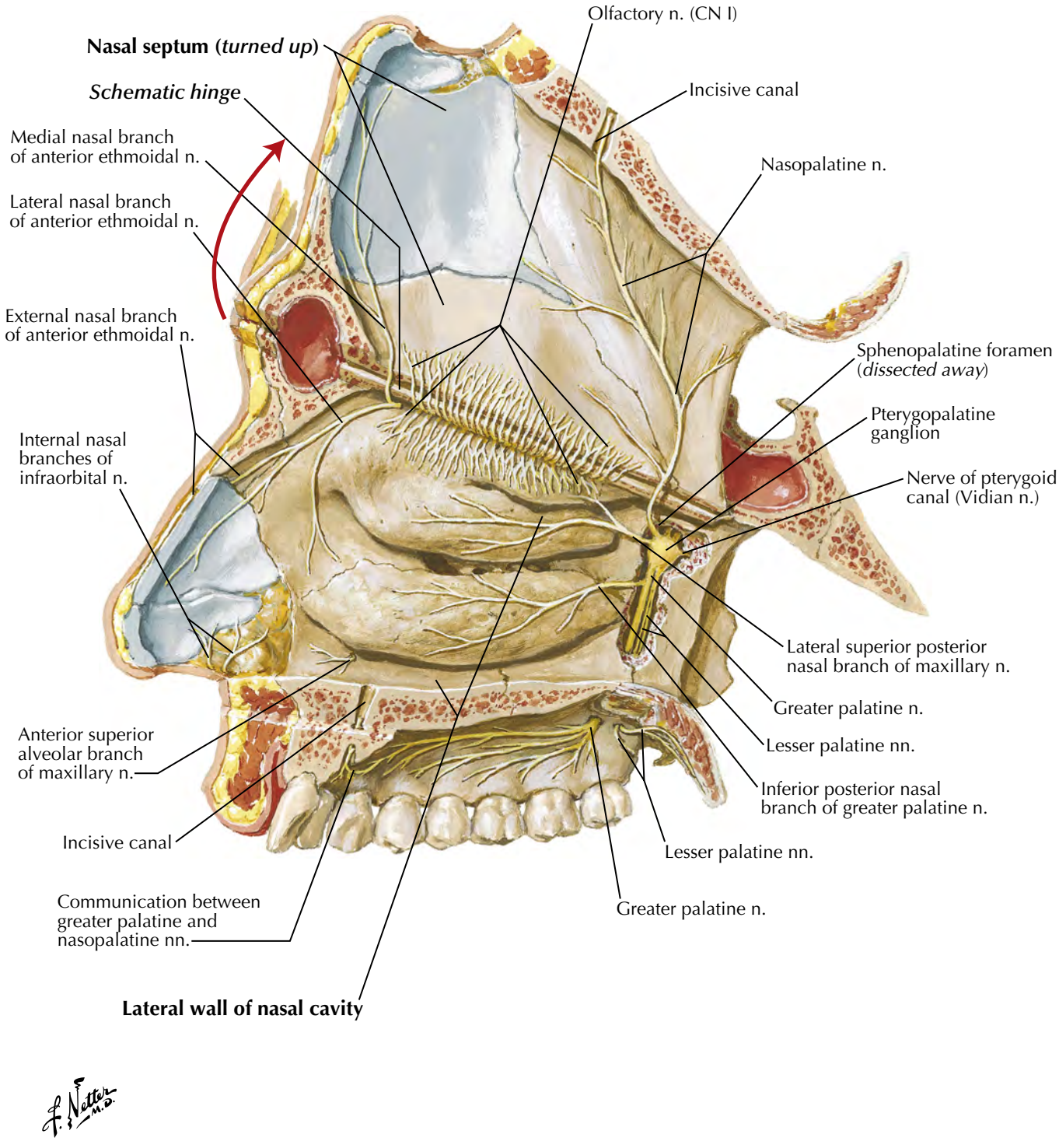


Lateral wall of nasal cavity

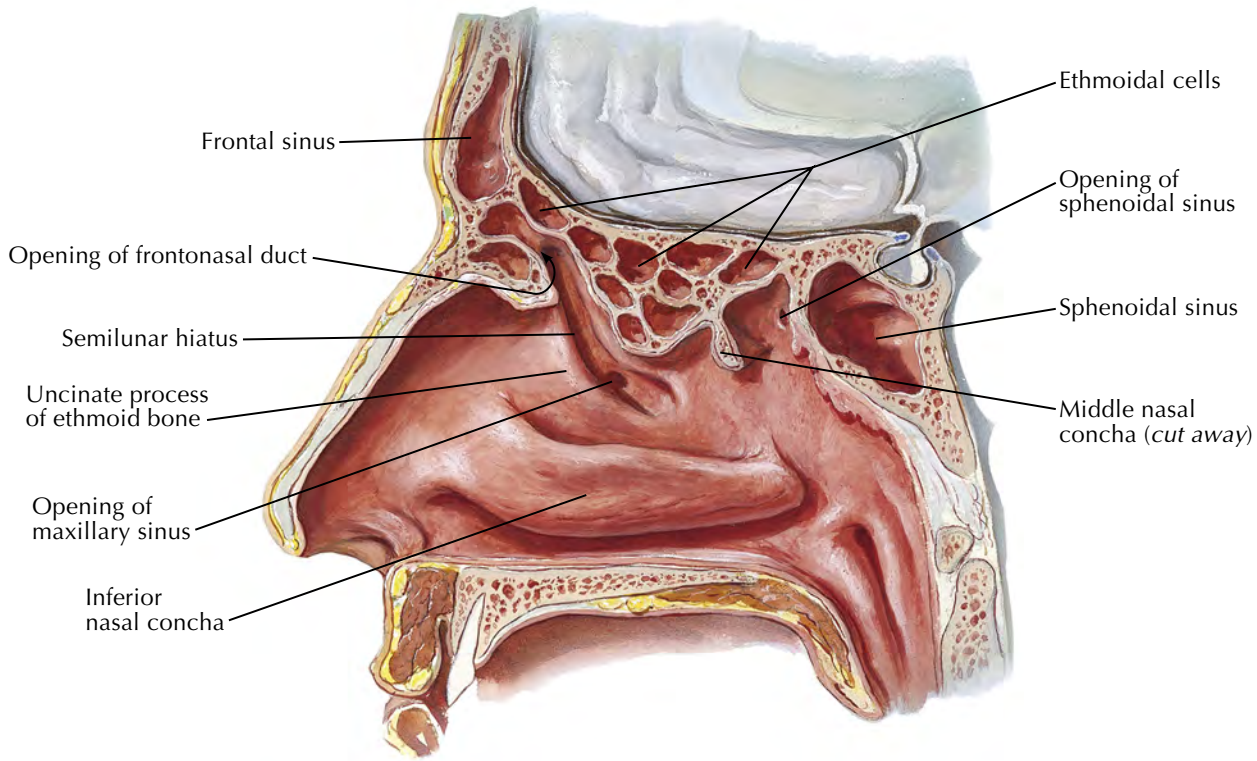


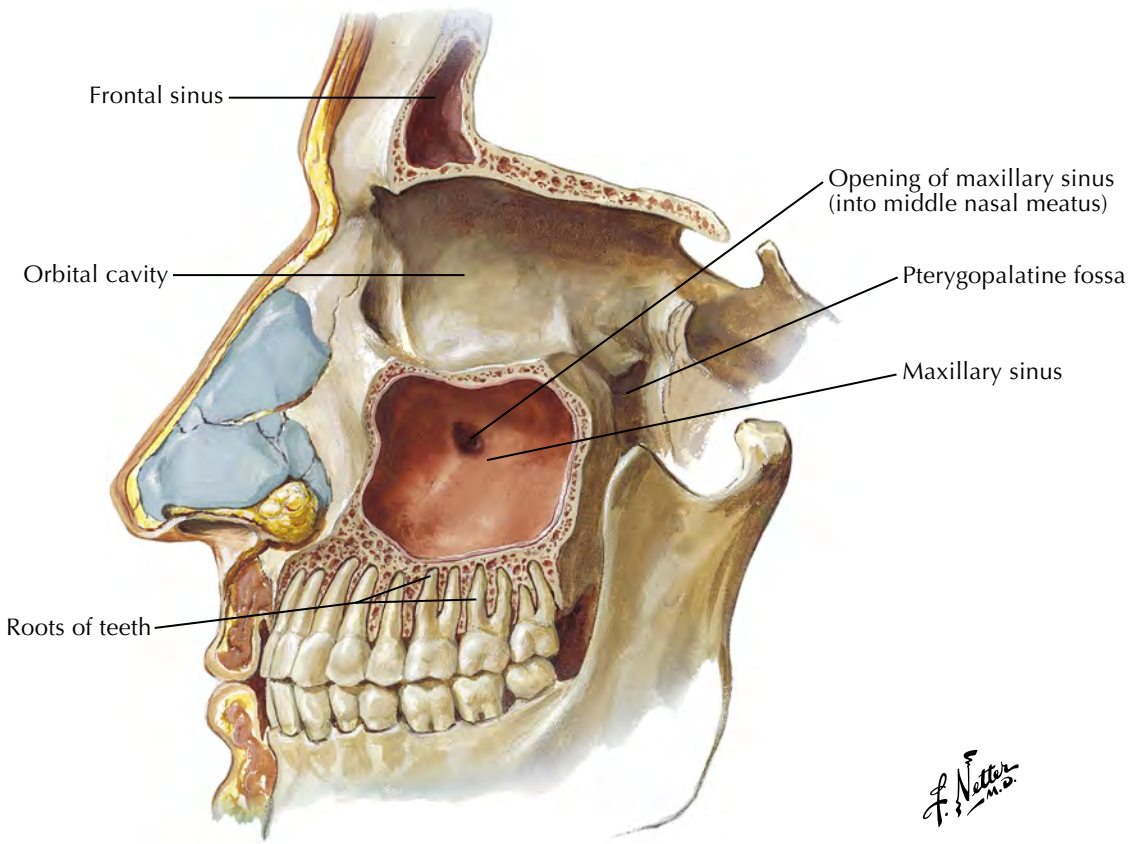
Nasal septum



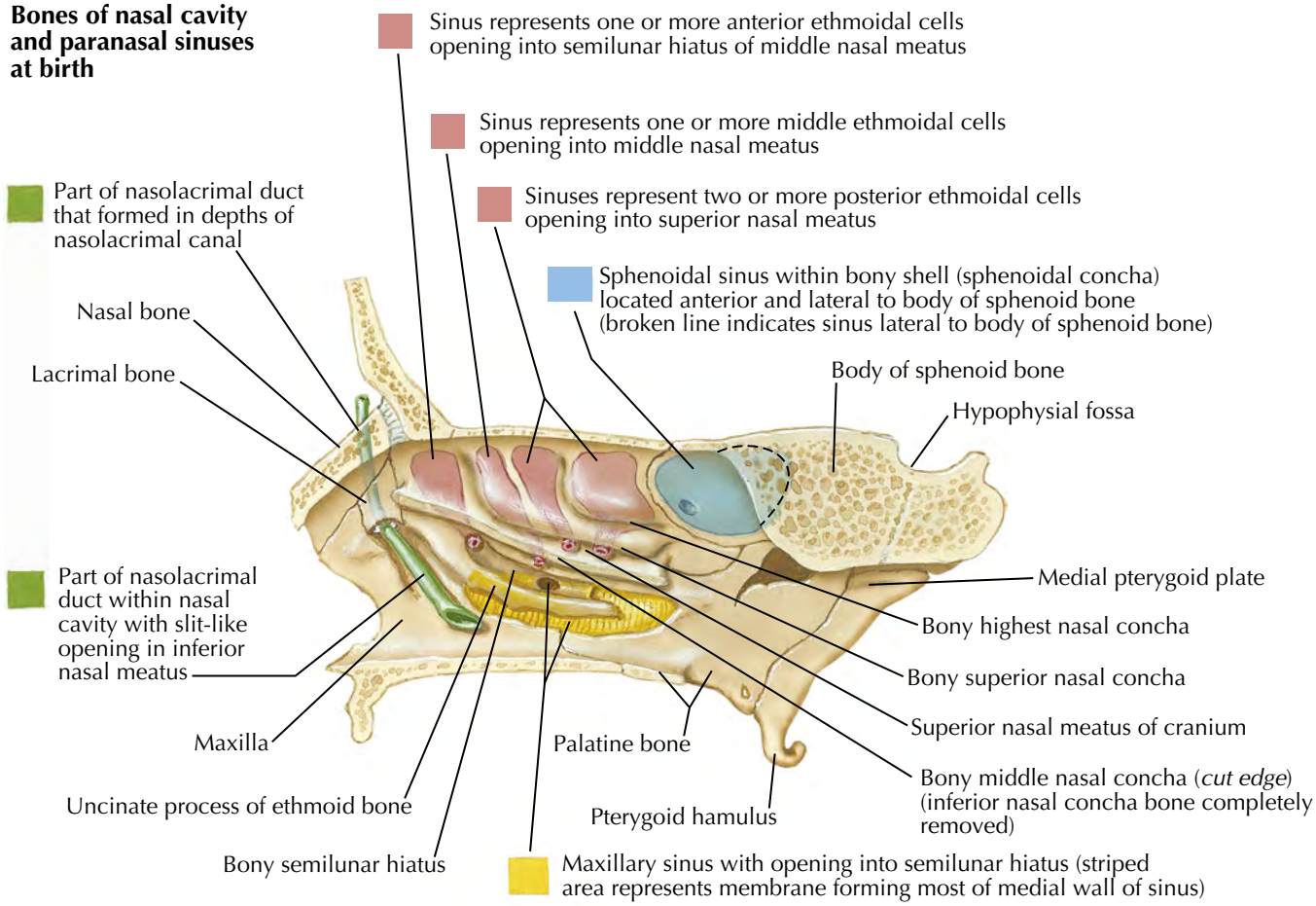

Olfactory n. (CN I)
Nasal septum (*turned up*)
Schematic hinge
Incisive canal
Medial nasal branch of anterior ethmoidal n.
Nasopalatine n.
Lateral nasal branch of anterior ethmoidal n.
External nasal branch of anterior ethmoidal n.
Sphenopalatine foramen (*dissected away*)
Pterygopalatine ganglion
Internal nasal branches of infraorbital n.
Nerve of pterygoid canal (Vidian n.)
Lateral superior posterior nasal branch of maxillary n.
Greater palatine n.
Lesser palatine nn.
Anterior superior alveolar branch of maxillary n.
Inferior posterior nasal branch of greater palatine n.
Incisive canal
Lesser palatine nn.
Communication between greater palatine and nasopalatine nn.
Greater palatine n.
Lateral wall of nasal cavity

See also **Plate 61**

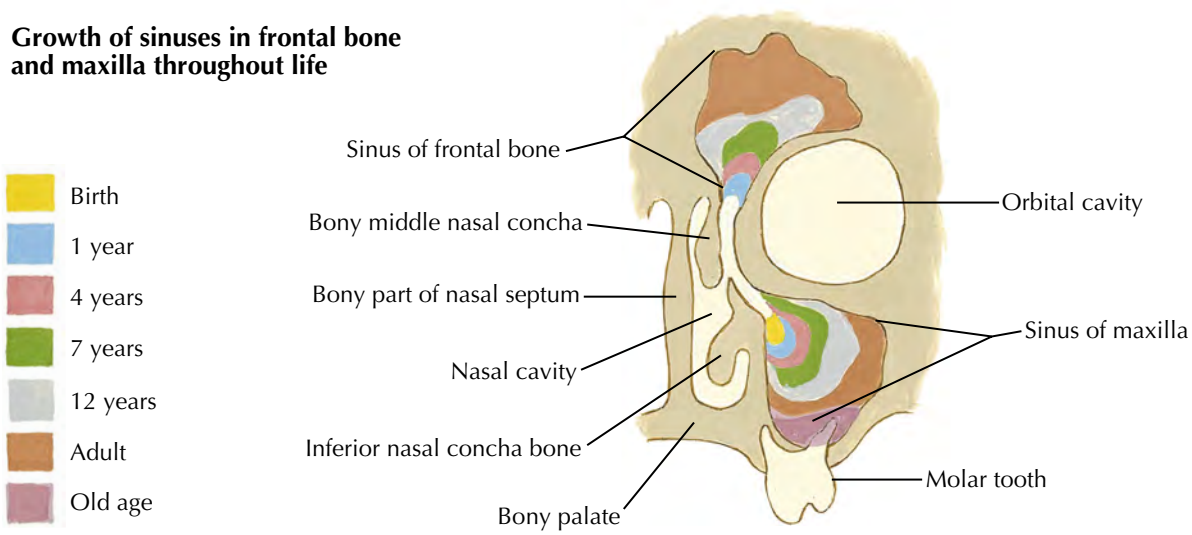




Bones of nasal cavity and paranasal sinuses at birth

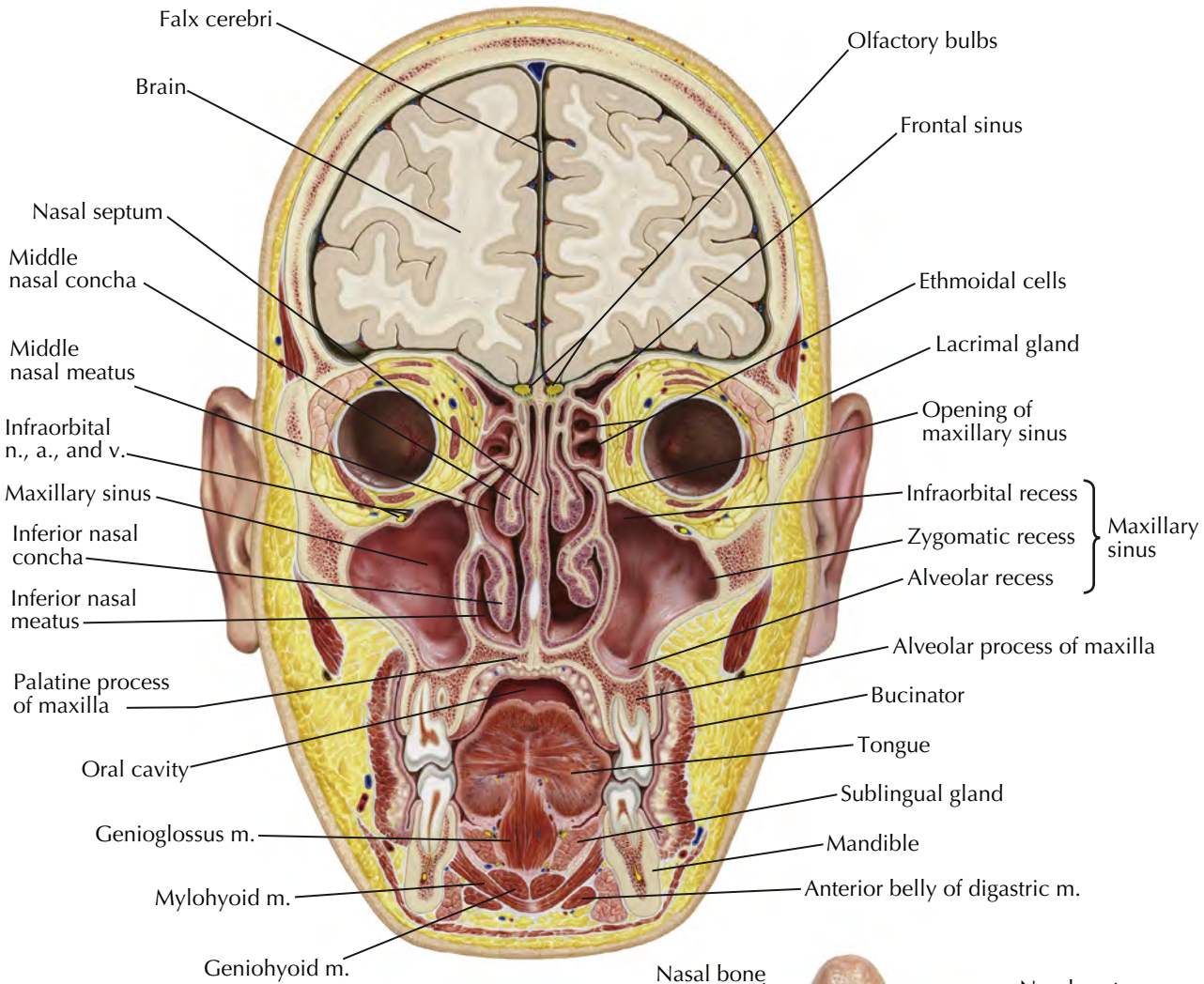


Growth of sinuses in frontal bone and maxilla throughout life

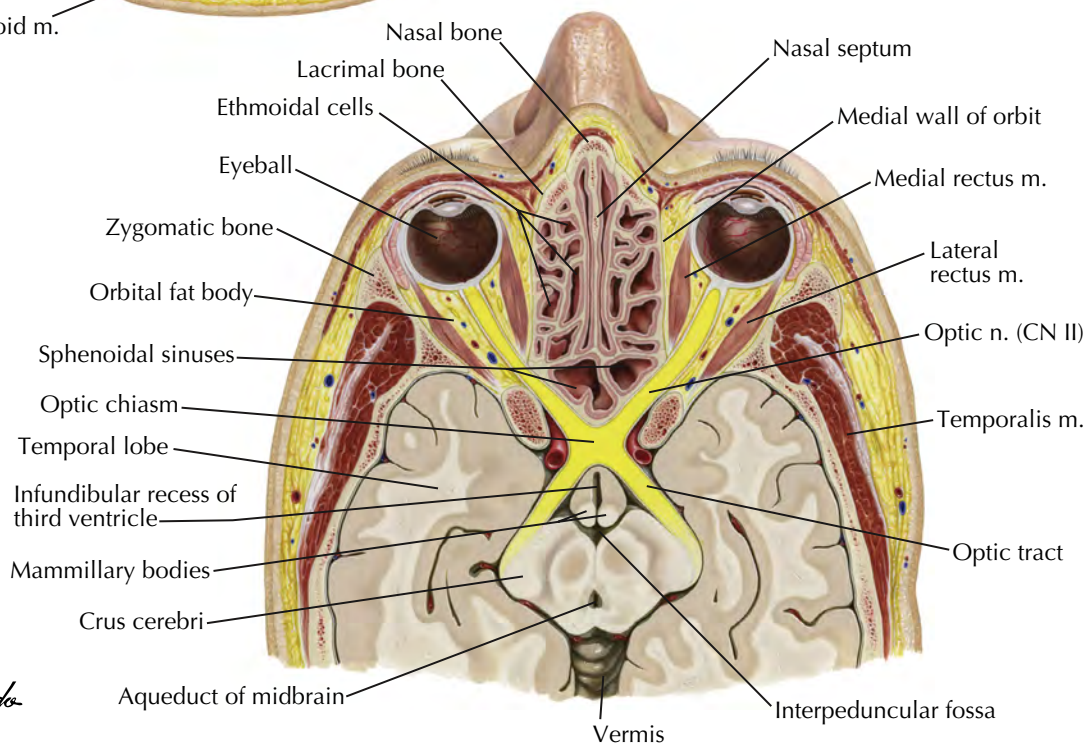


See also **Plates BP 22, BP 23**

Coronal section

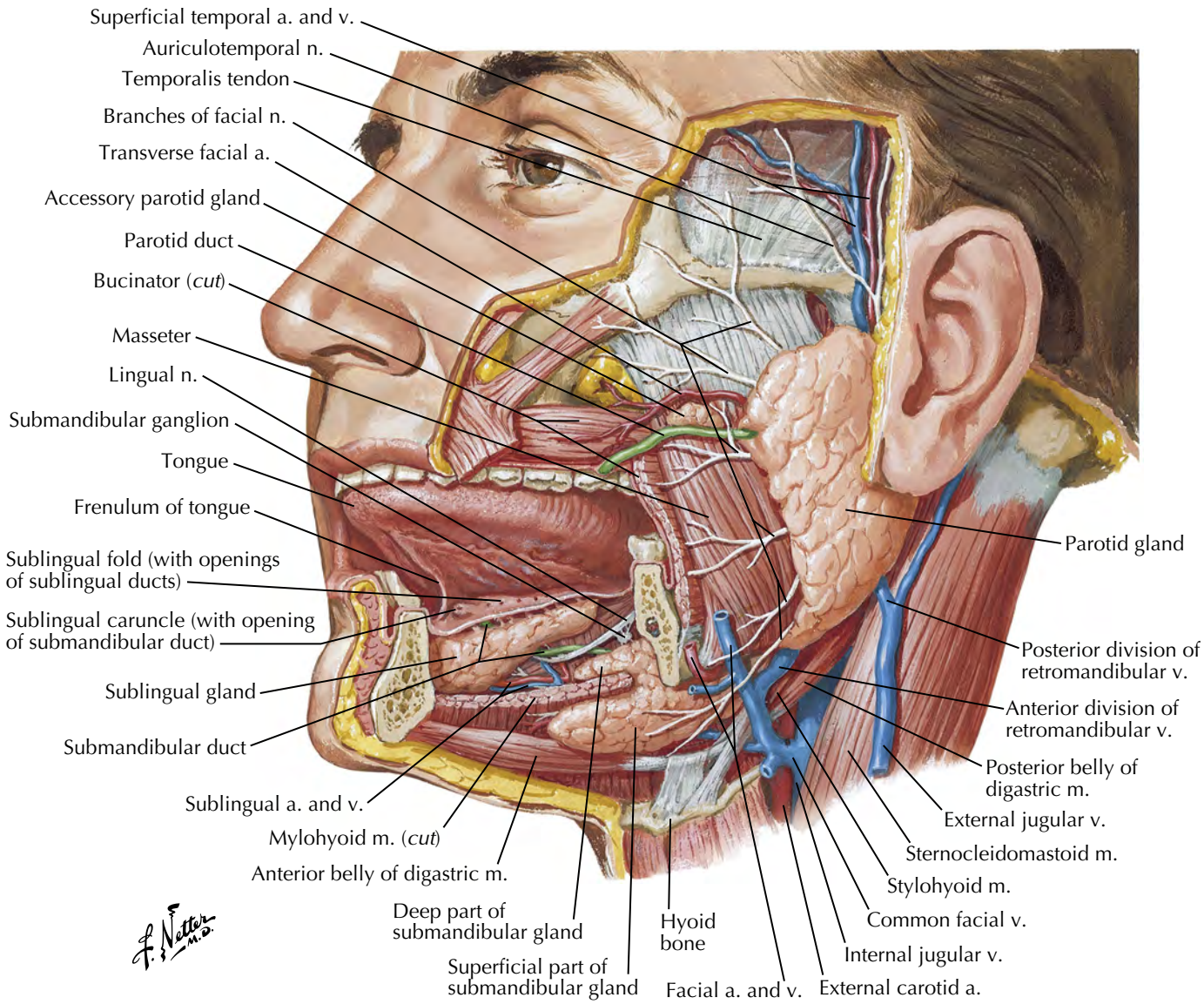


Transverse section



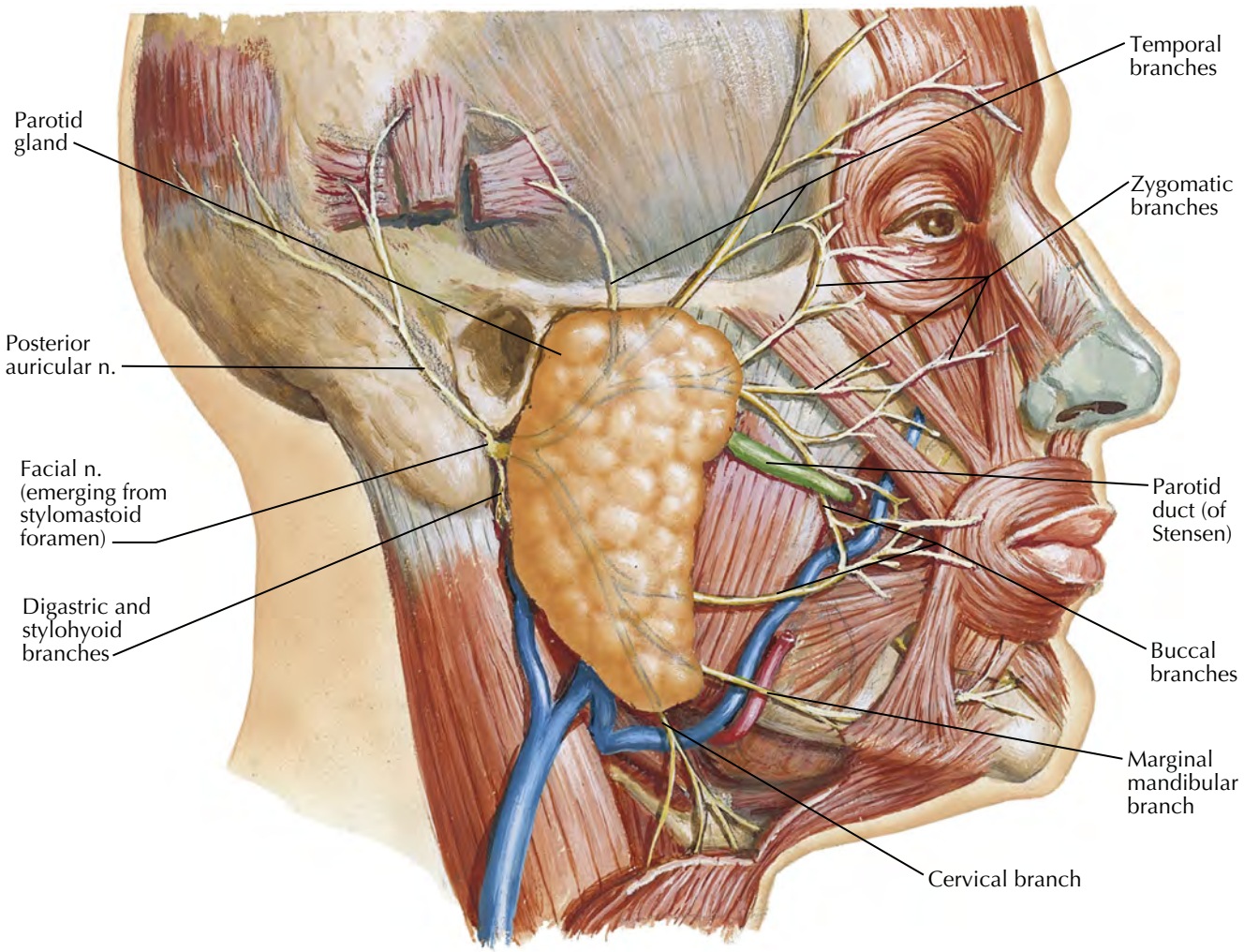
C. Machado, M.D.

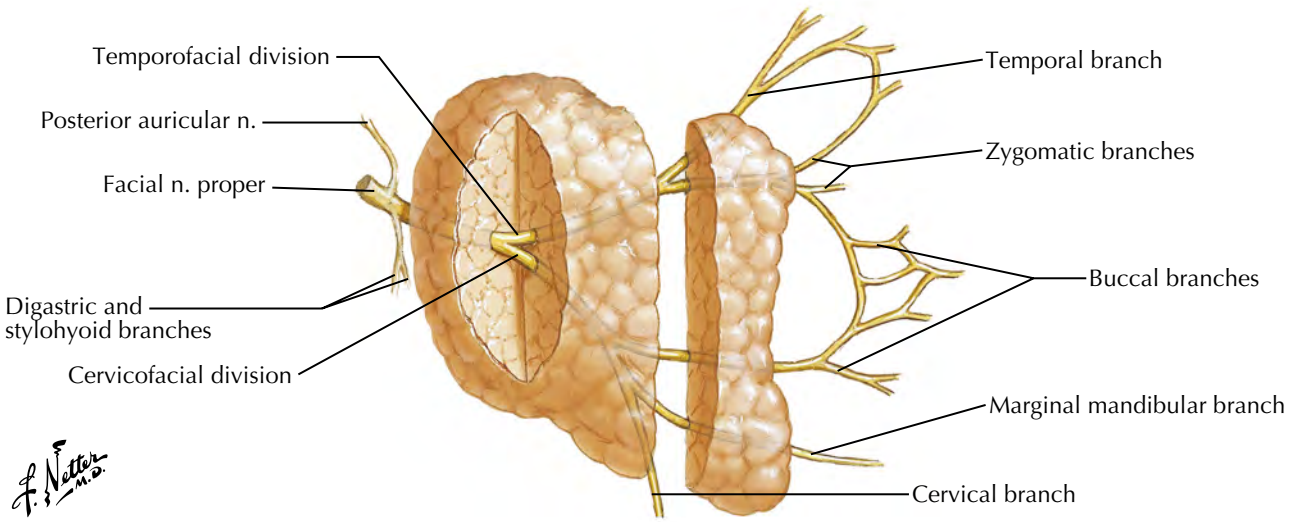
See also **Plates 71, 160, 161**



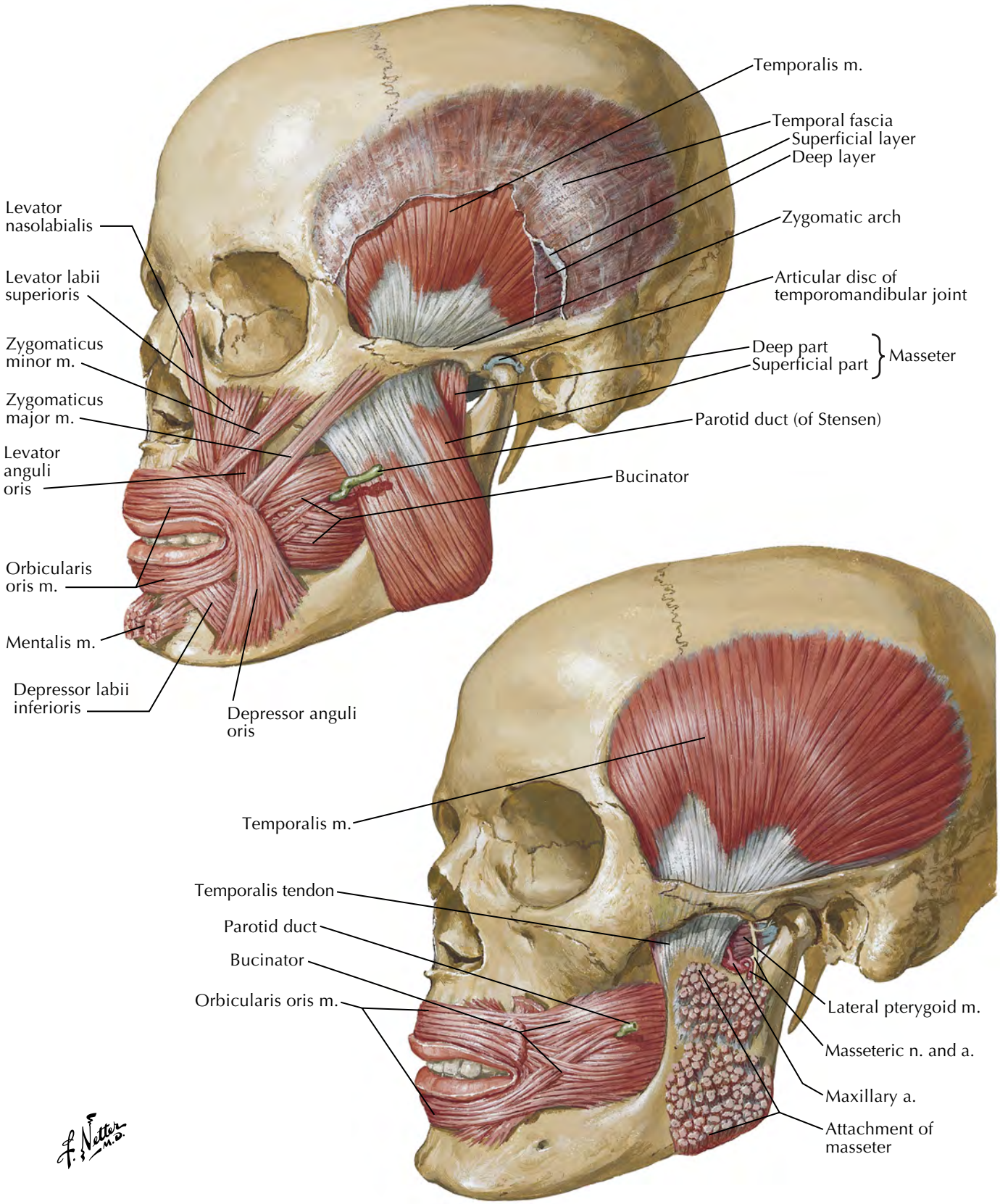
Facial Nerve Branches and Parotid Gland

See also **Plates 70, 150**



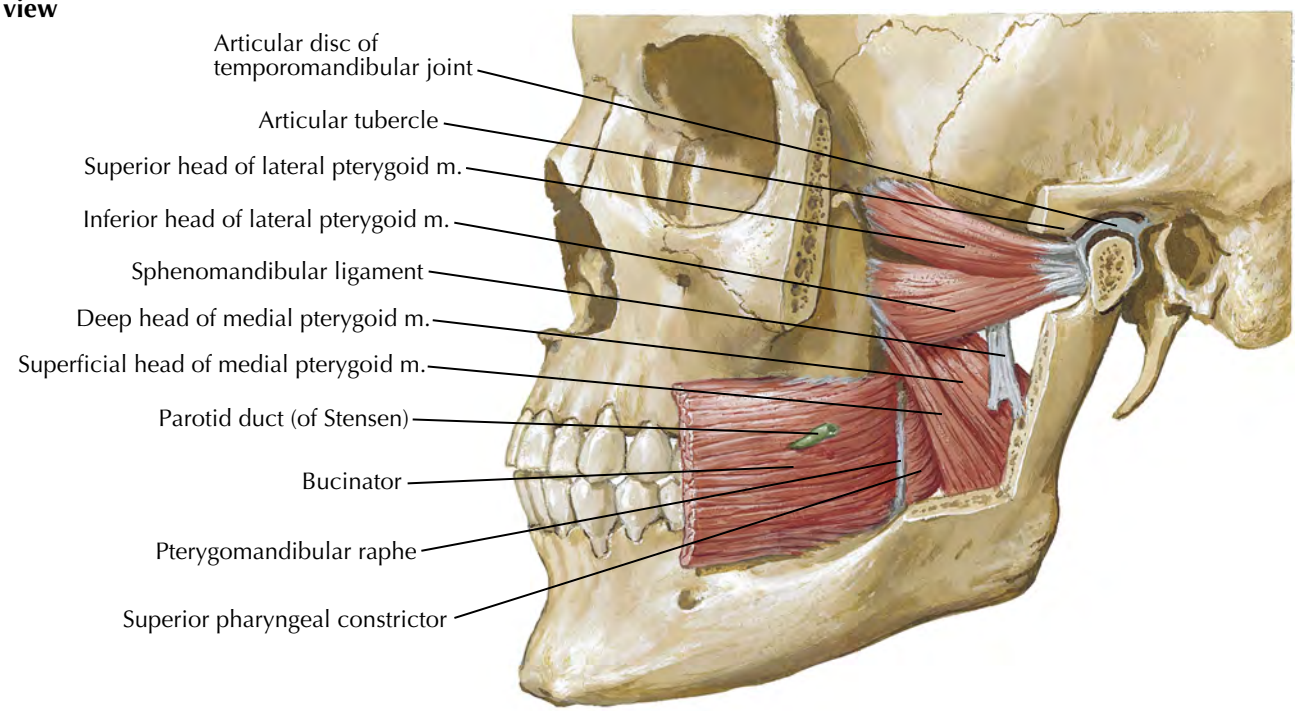


For facial muscles see **Plates 48, BP 25**

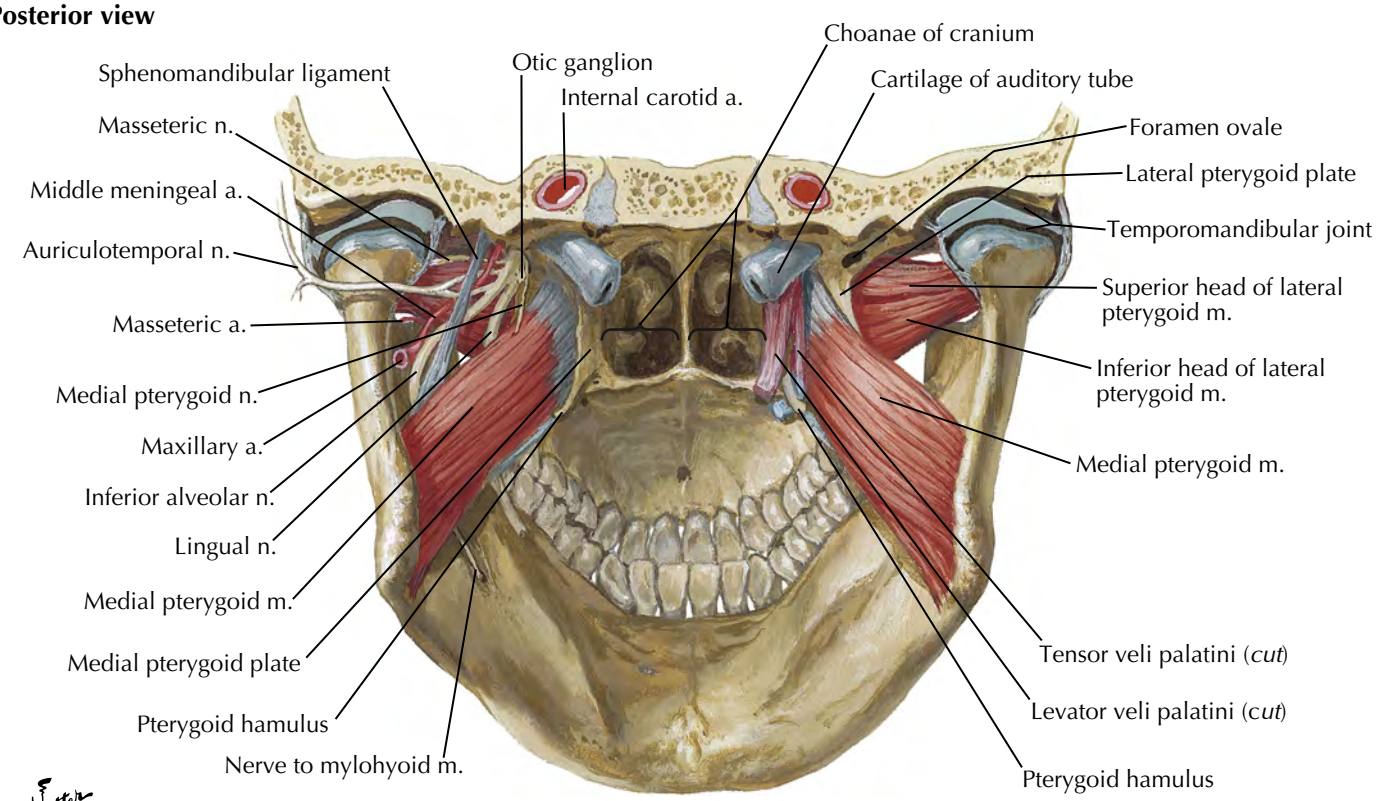


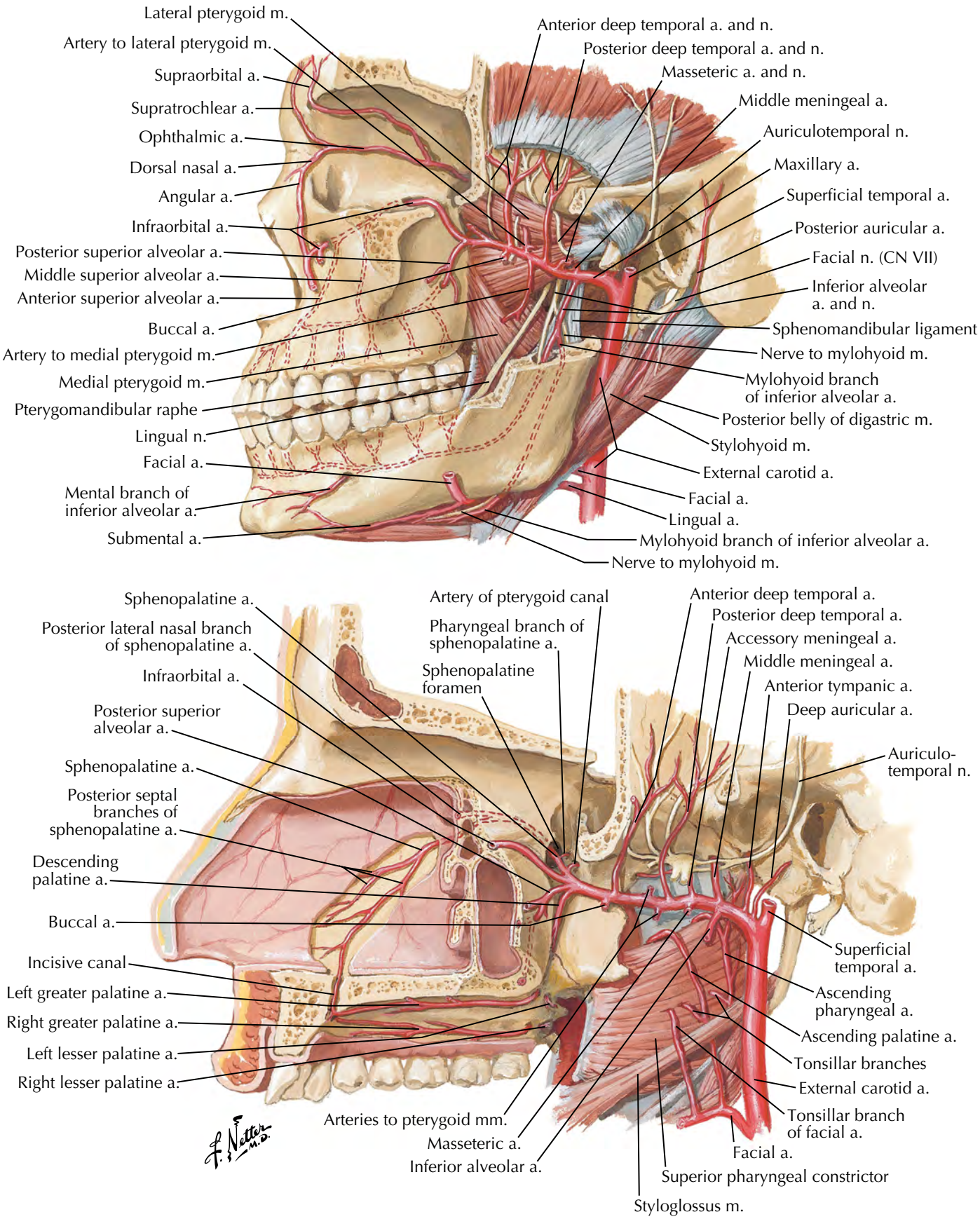
See also **Plates 72, 77, BP 25**

Lateral view

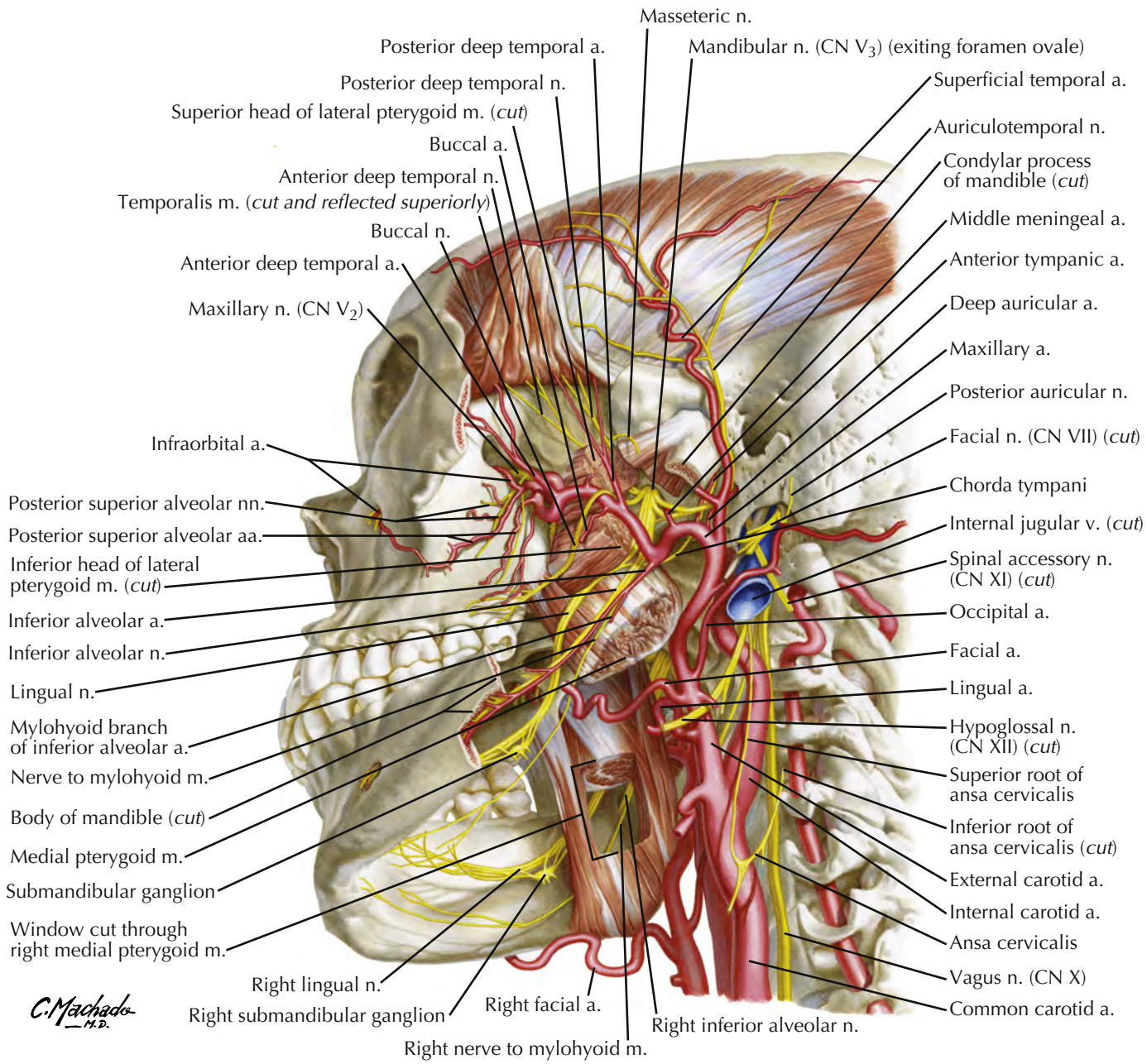


Posterior view



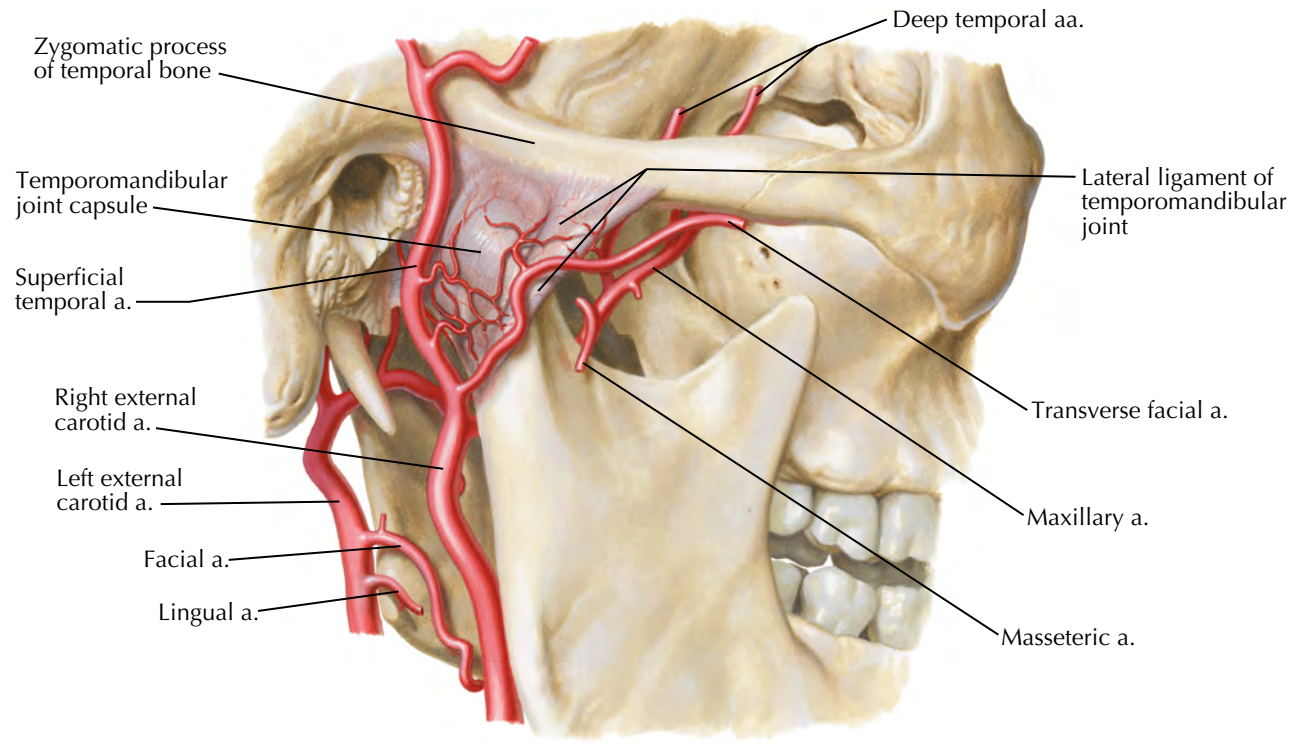

Lateral pterygoid m.
Artery to lateral pterygoid m.
Supraorbital a.
Supratrochlear a.
Ophthalmic a.
Dorsal nasal a.
Angular a.
Infraorbital a.
Posterior superior alveolar a.
Middle superior alveolar a.
Anterior superior alveolar a.
Buccal a.
Artery to medial pterygoid m.
Medial pterygoid m.
Pterygomandibular raphe
Lingual n.
Facial a.
Mental branch of inferior alveolar a.
Submental a.
Anterior deep temporal a. and n.
Posterior deep temporal a. and n.
Masseteric a. and n.
Middle meningeal a.
Auriculotemporal n.
Maxillary a.
Superficial temporal a.
Posterior auricular a.
Facial n. (CN VII)
Inferior alveolar a. and n.
Sphenomandibular ligament
Nerve to mylohyoid m.
Mylohyoid branch of inferior alveolar a.
Posterior belly of digastric m.
Stylohyoid m.
External carotid a.
Facial a.
Lingual a.
Mylohyoid branch of inferior alveolar a.
Nerve to mylohyoid m.
Sphenopalatine a.
Posterior lateral nasal branch of sphenopalatine a.
Infraorbital a.
Posterior superior alveolar a.
Sphenopalatine a.
Posterior septal branches of sphenopalatine a.
Descending palatine a.
Buccal a.
Incisive canal
Left greater palatine a.
Right greater palatine a.
Left lesser palatine a.
Right lesser palatine a.
Artery of pterygoid canal
Pharyngeal branch of sphenopalatine a.
Sphenopalatine foramen
Arteries to pterygoid mm.
Masseteric a.
Inferior alveolar a.
Anterior deep temporal a.
Posterior deep temporal a.
Accessory meningeal a.
Middle meningeal a.
Anterior tympanic a.
Deep auricular a.
Auriculo-temporal n.
Superficial temporal a.
Ascending pharyngeal a.
Ascending palatine a.
Tonsillar branches
External carotid a.
Tonsillar branch of facial a.
Facial a.
Superior pharyngeal constrictor
Styloglossus m.

See also **Plates 74, 76, 77**

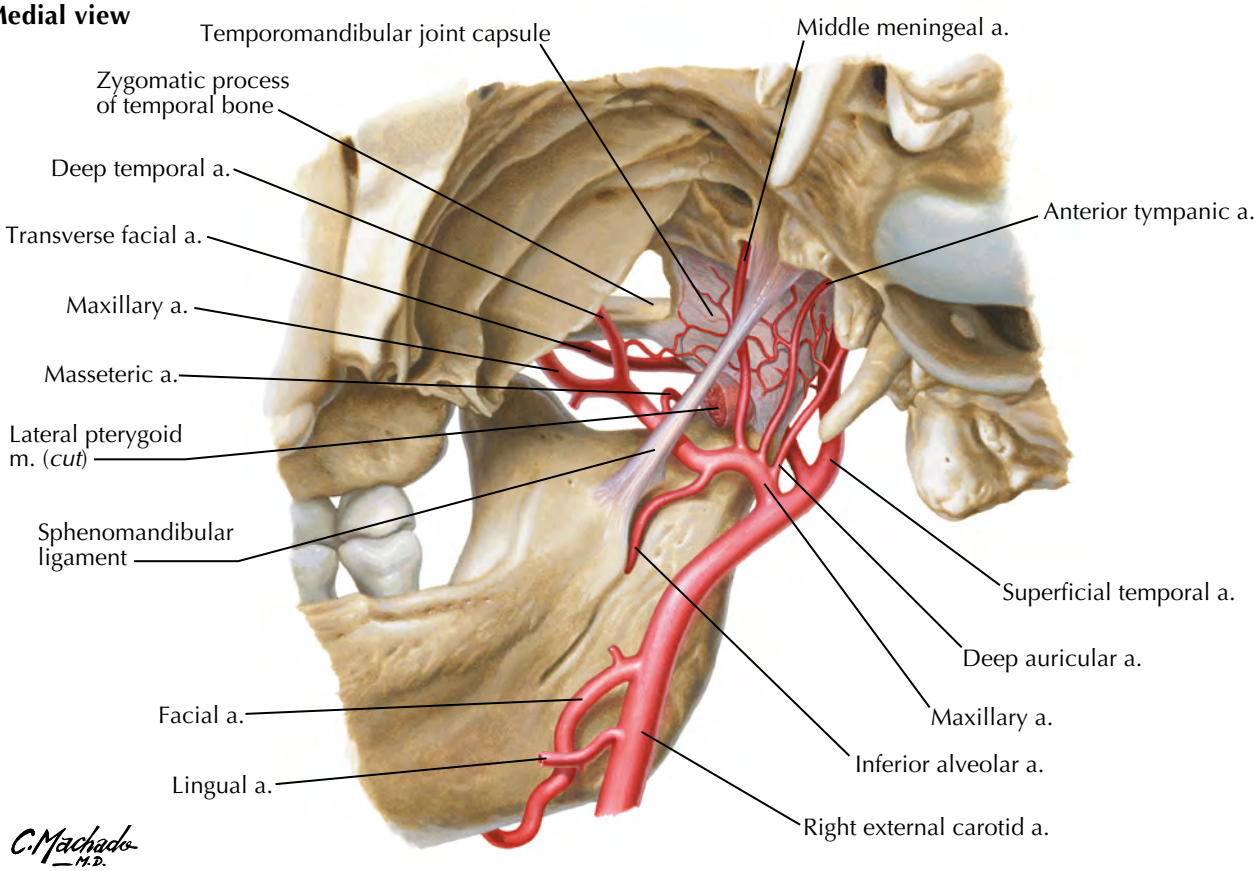


See also **Plates 74, 77, 81**

Lateral view



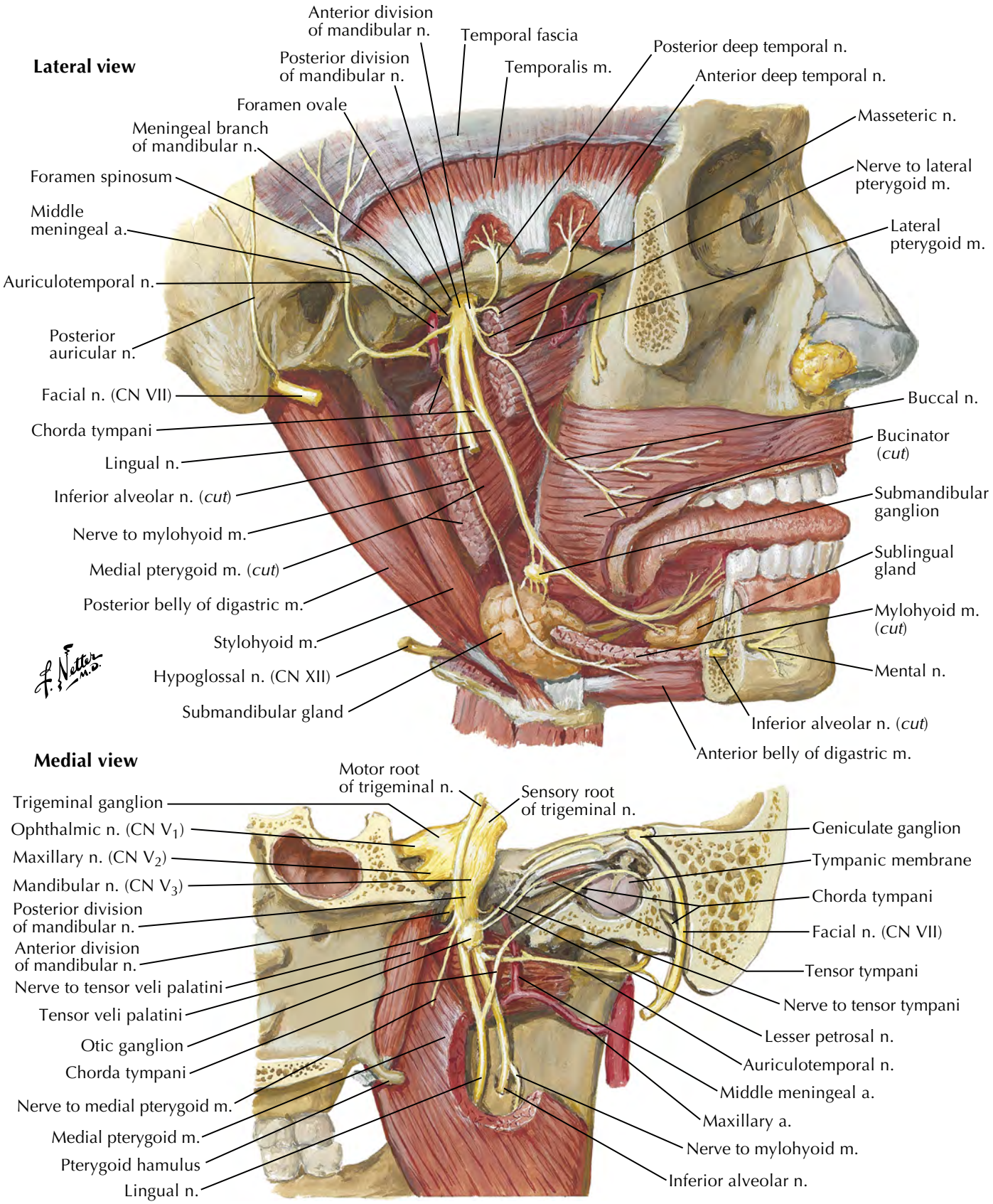
Medial view



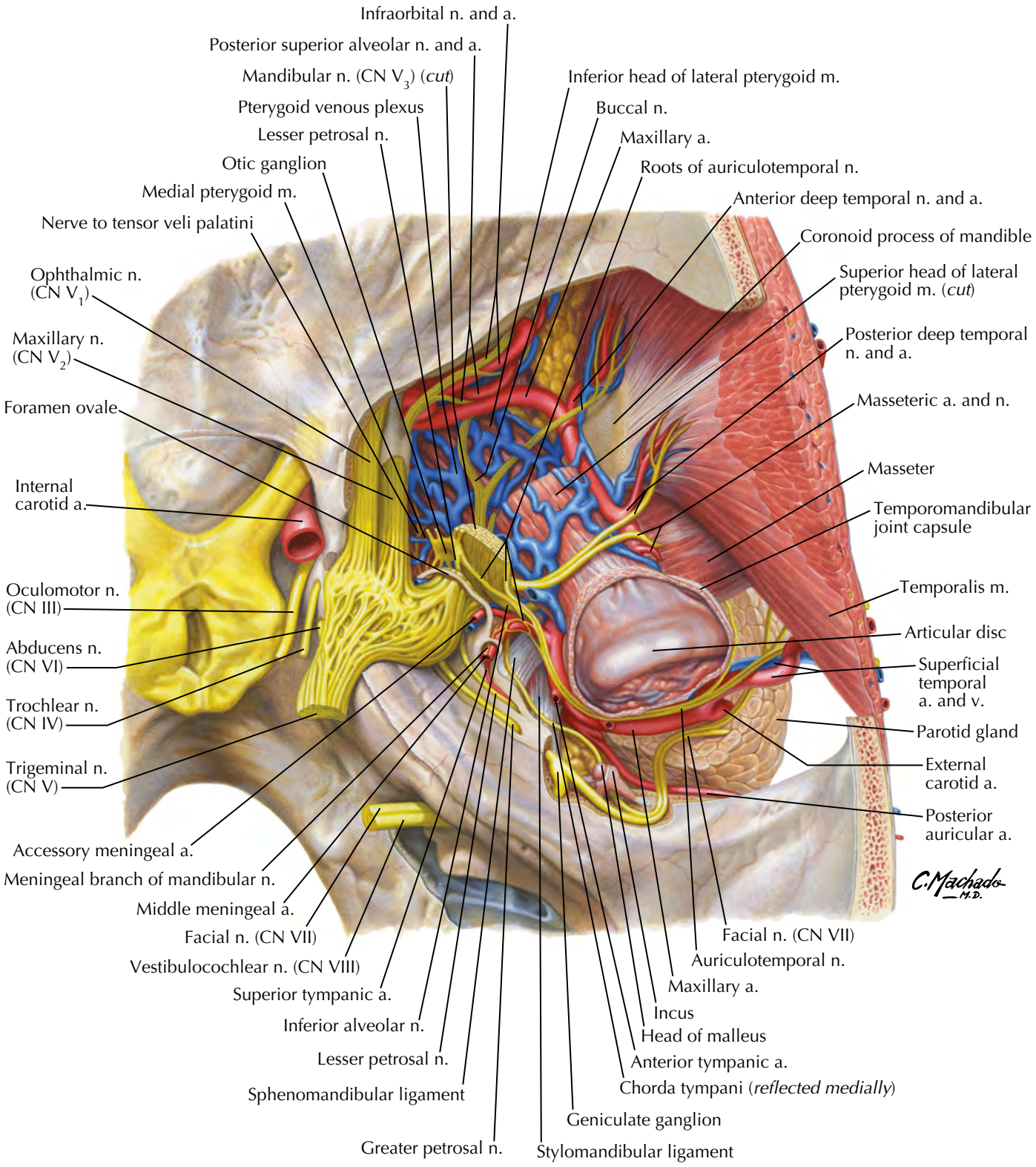
C. Machado M.D.

Mandibular Nerve (CN V_3)

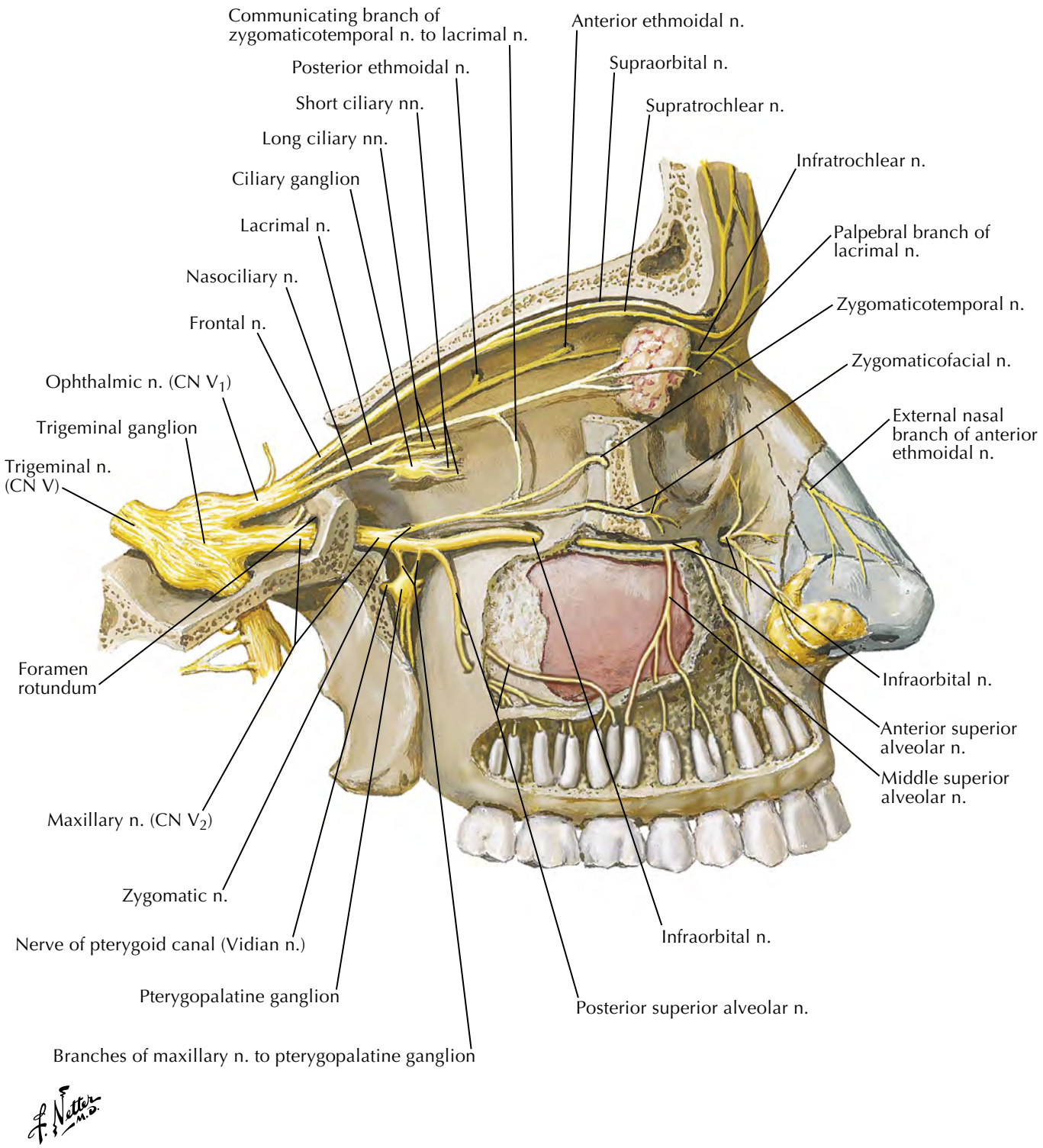
See also **Plates 98, 149**



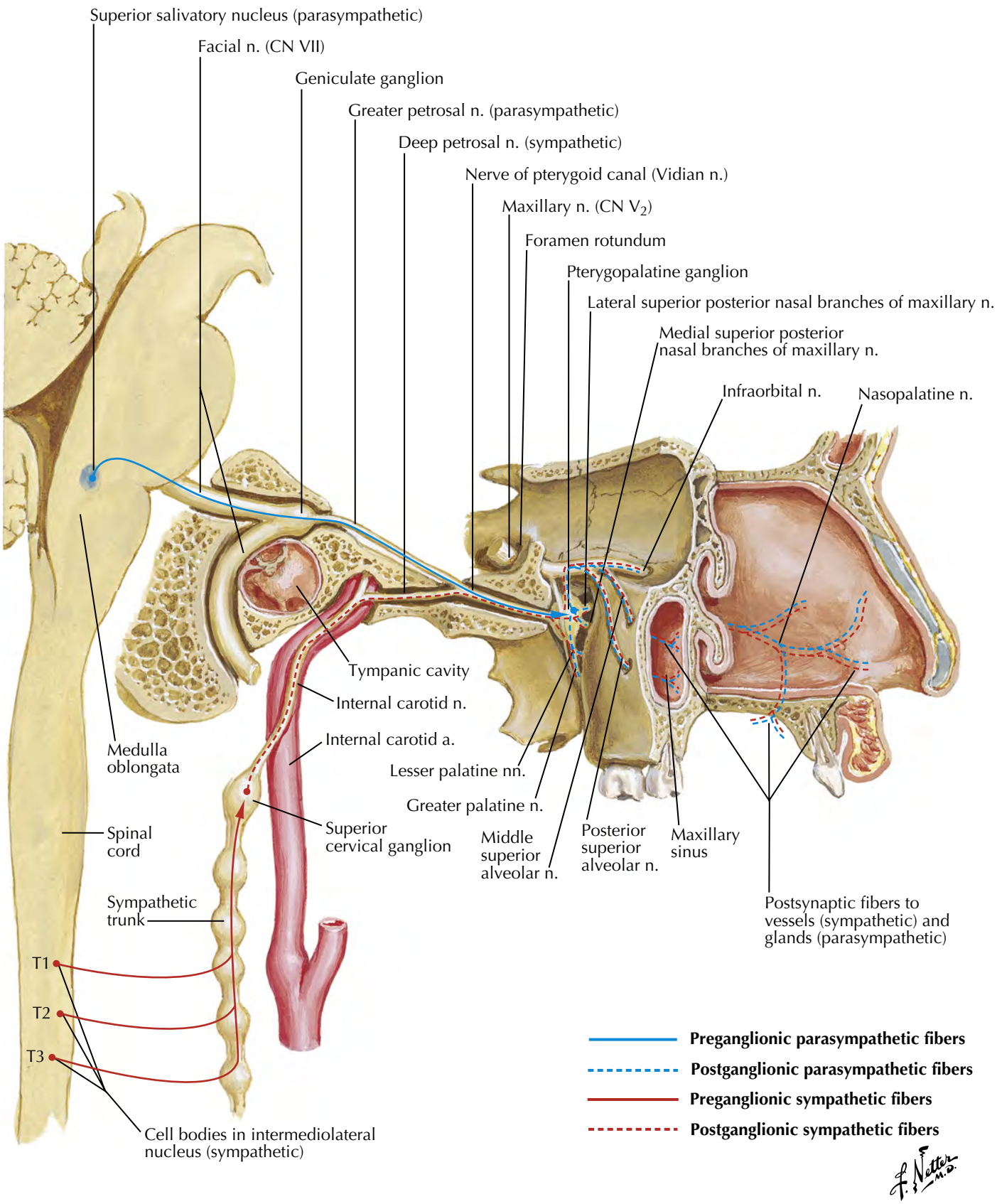
See also **Plates 74, 76, 77, 81, 82, 131**



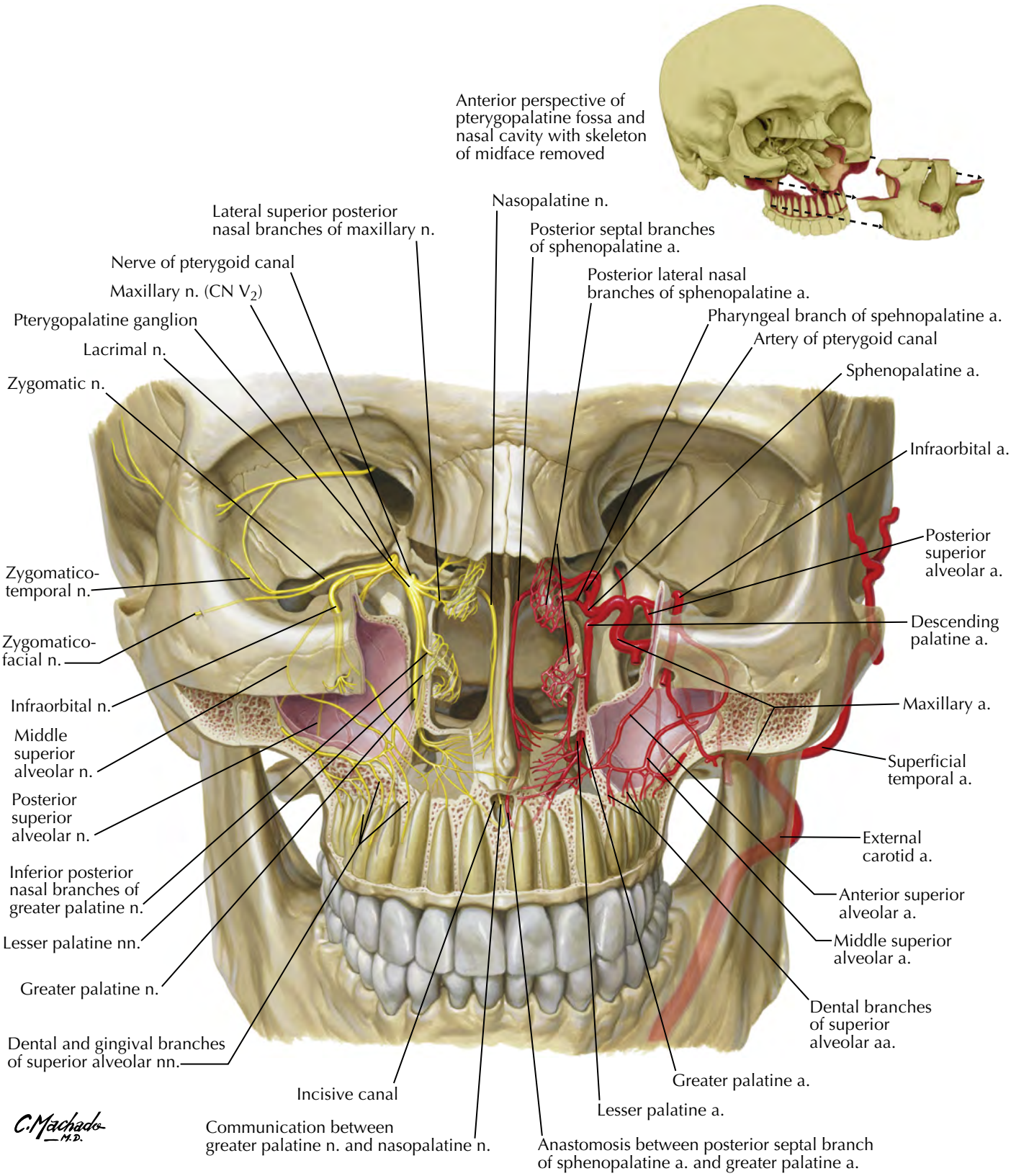
See also **Plates 81, 84**



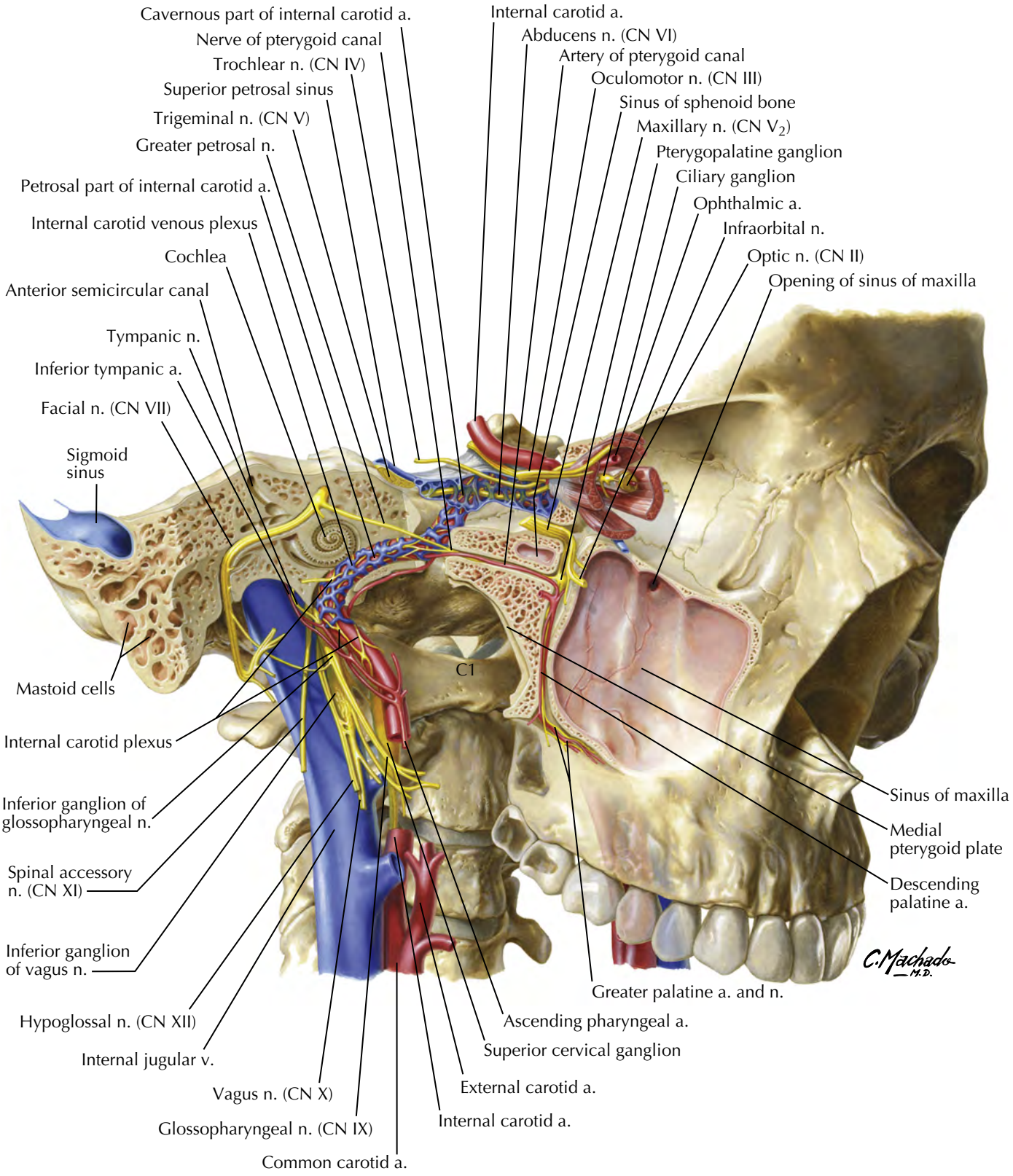
See also **Plates 149, 158, 160**

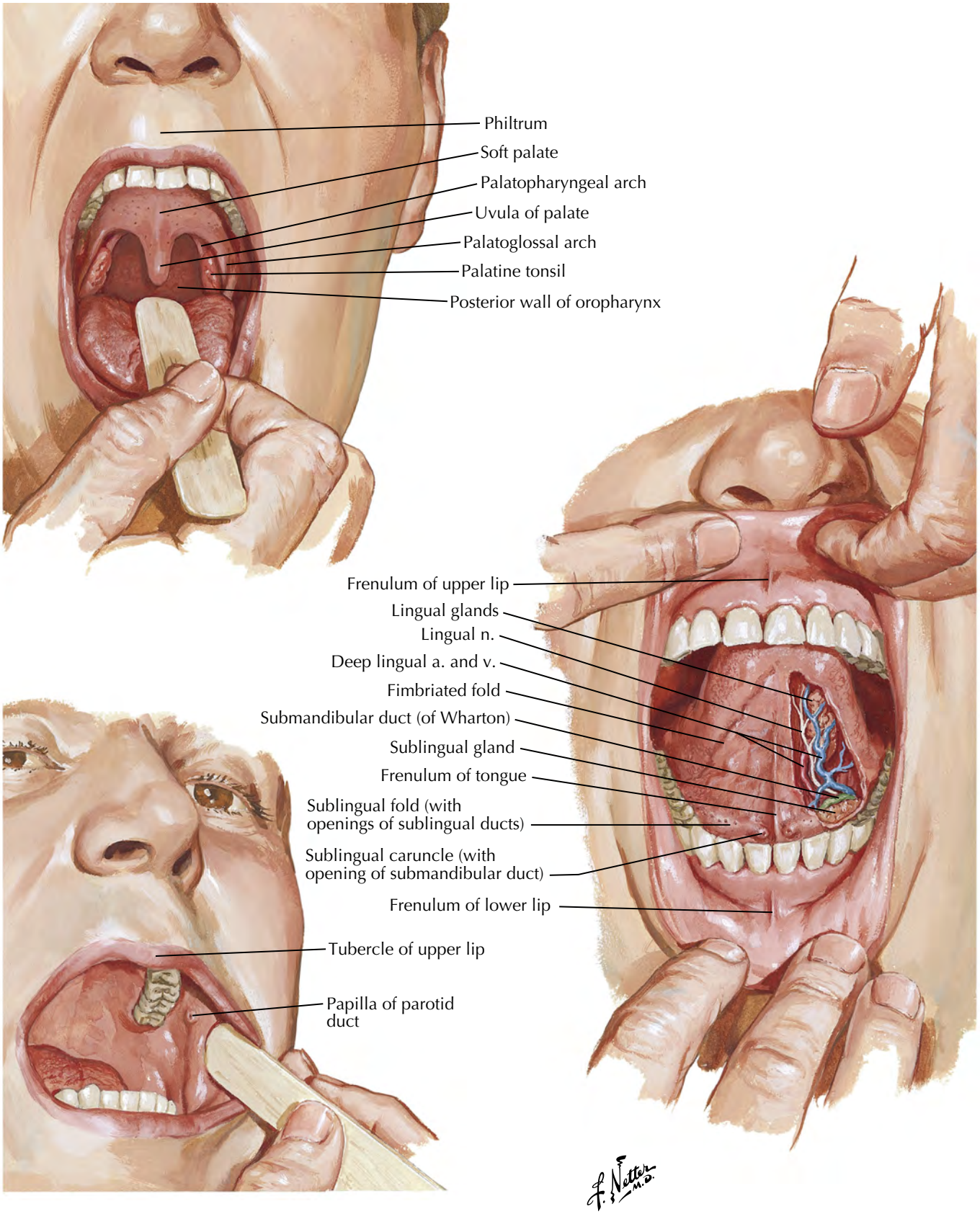


See also **Plates 64, 66, 79**

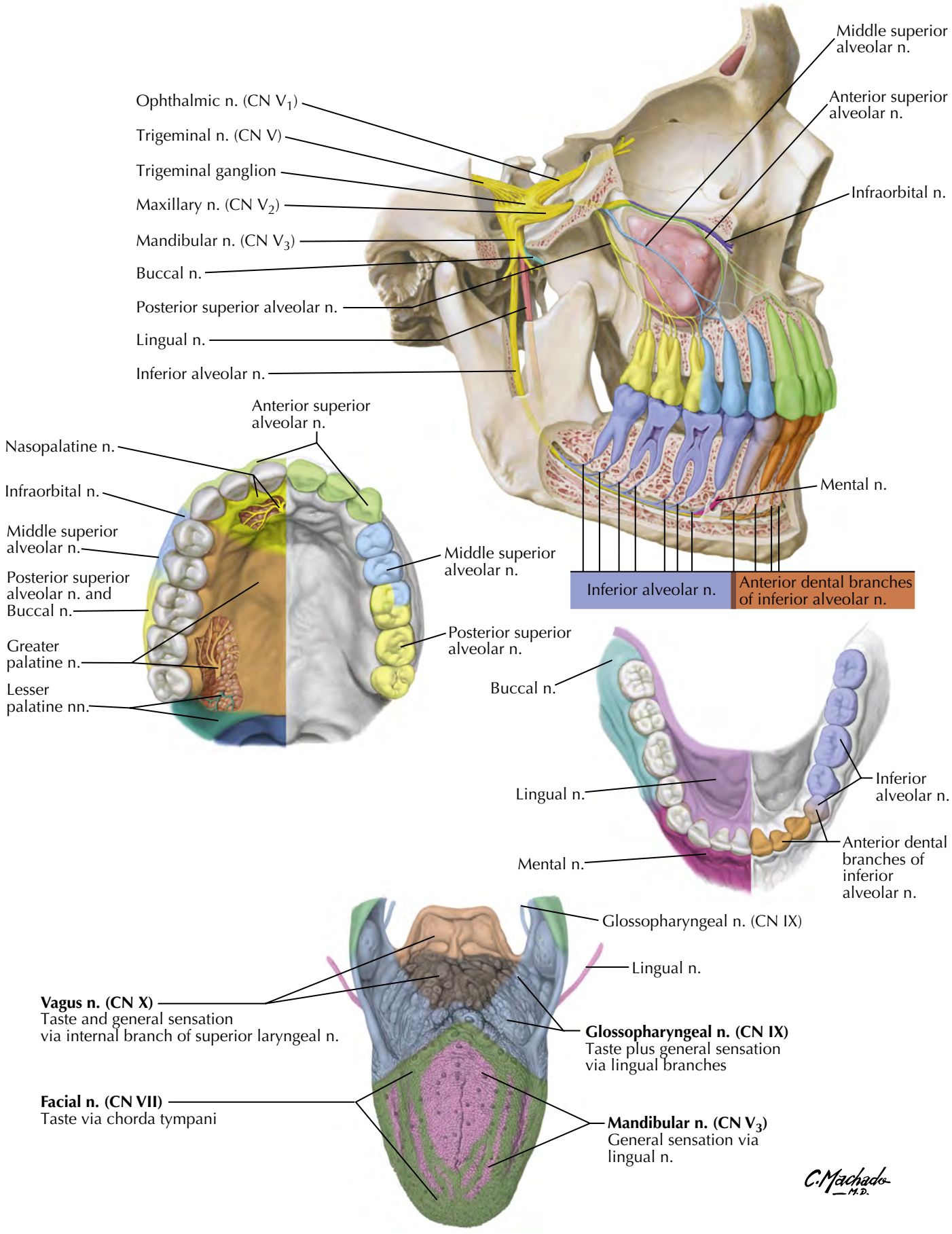


See also **Plates 91, 131, 158, 163**

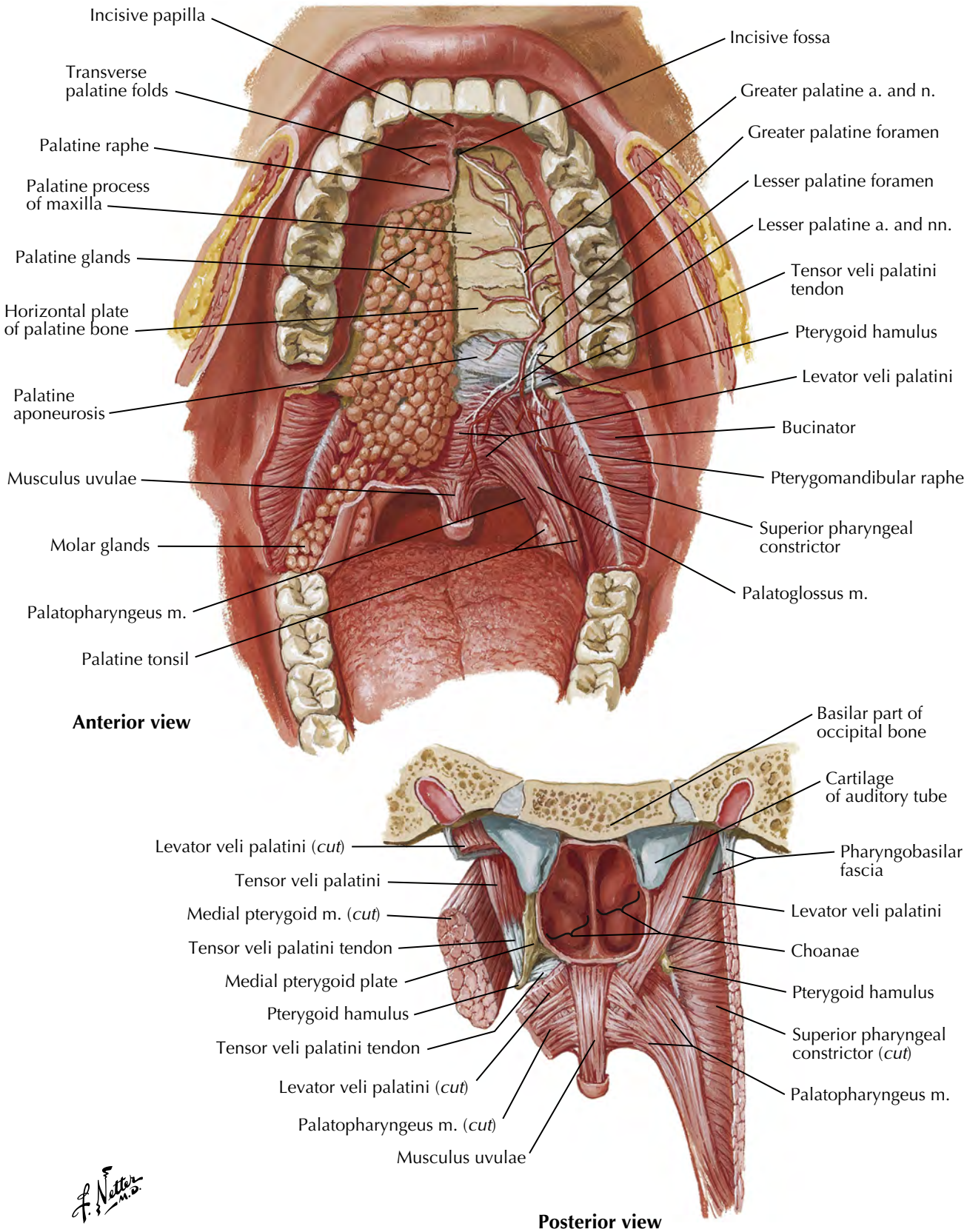



Philtrum
Soft palate
Palatopharyngeal arch
Uvula of palate
Palatoglossal arch
Palatine tonsil
Posterior wall of oropharynx
Frenulum of upper lip
Lingual glands
Lingual n.
Deep lingual a. and v.
Fimbriated fold
Submandibular duct (of Wharton)
Sublingual gland
Frenulum of tongue
Sublingual fold (with openings of sublingual ducts)
Sublingual caruncle (with opening of submandibular duct)
Frenulum of lower lip
Tubercle of upper lip
Papilla of parotid duct

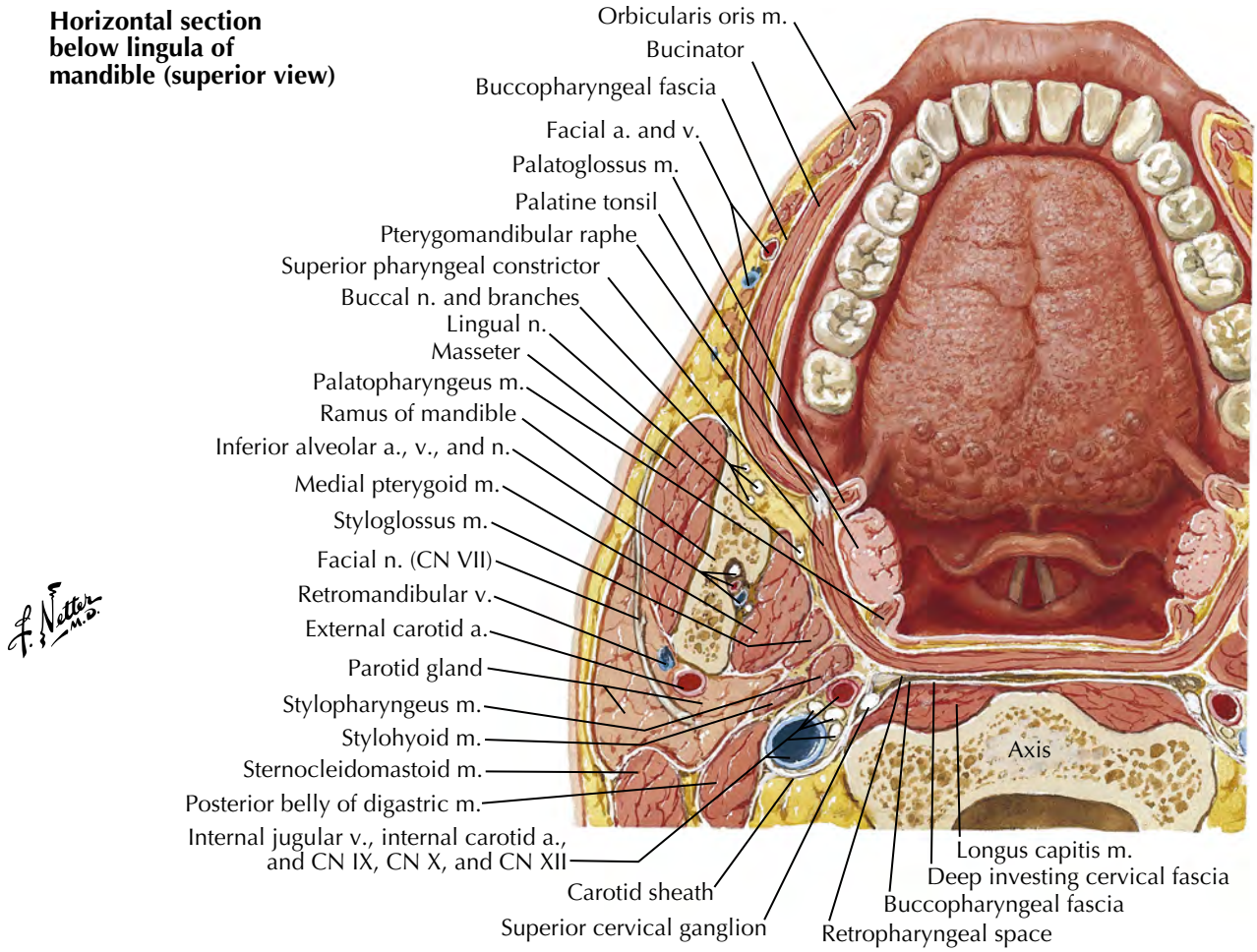
See also **Plates 77, 79, 160, 162, BP 26**

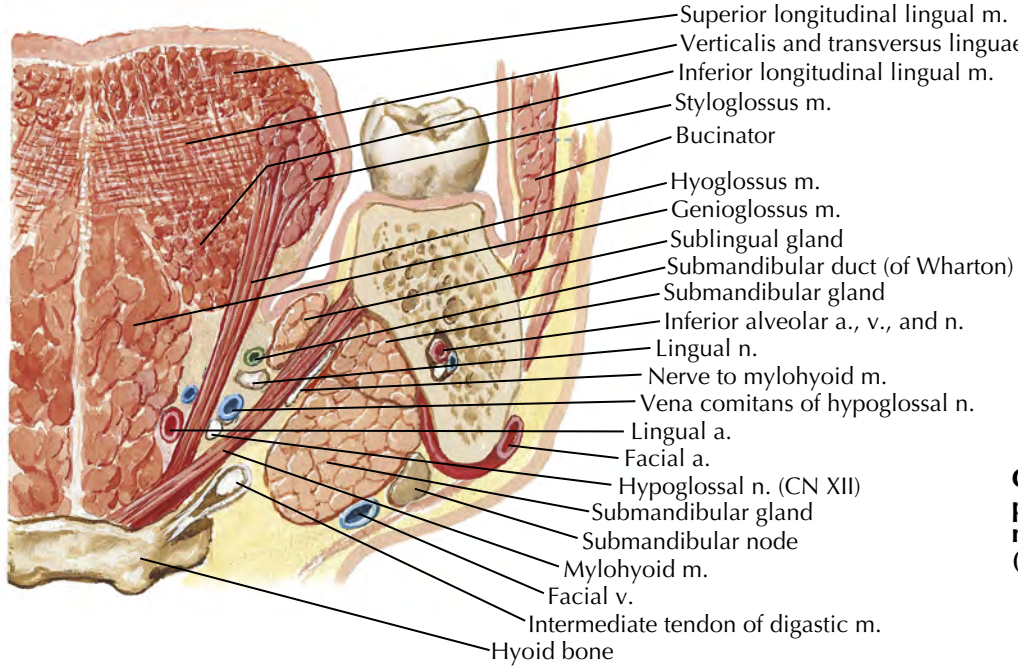


See also **Plates 66, 79, BP 26**



Horizontal section below lingula of mandible (superior view)

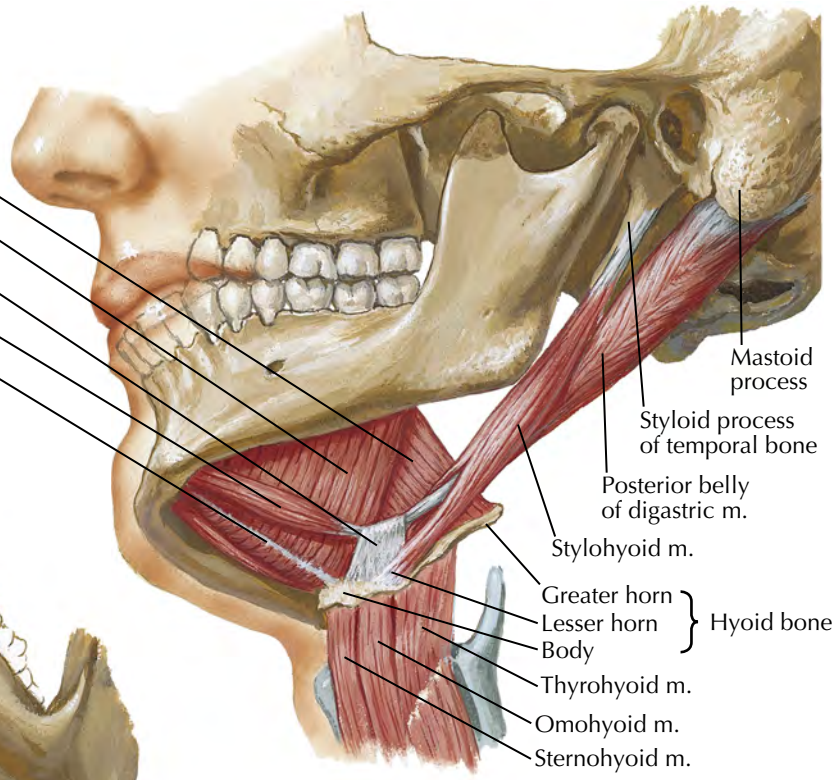




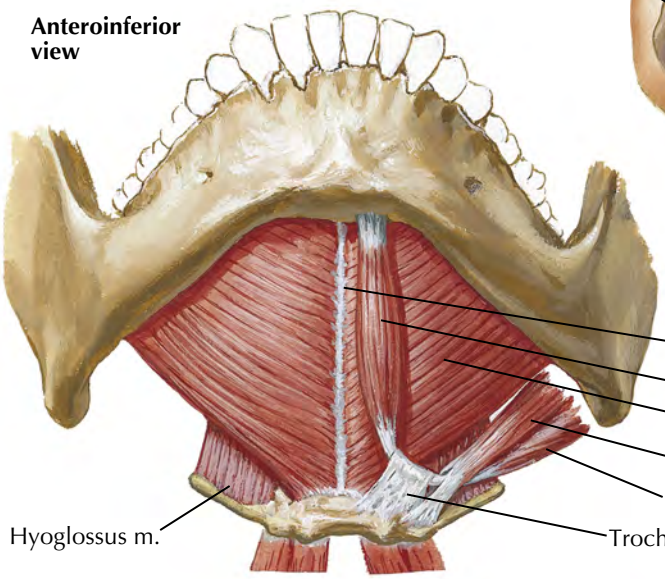
Coronal section posterior to 1st molar tooth (anterior view)

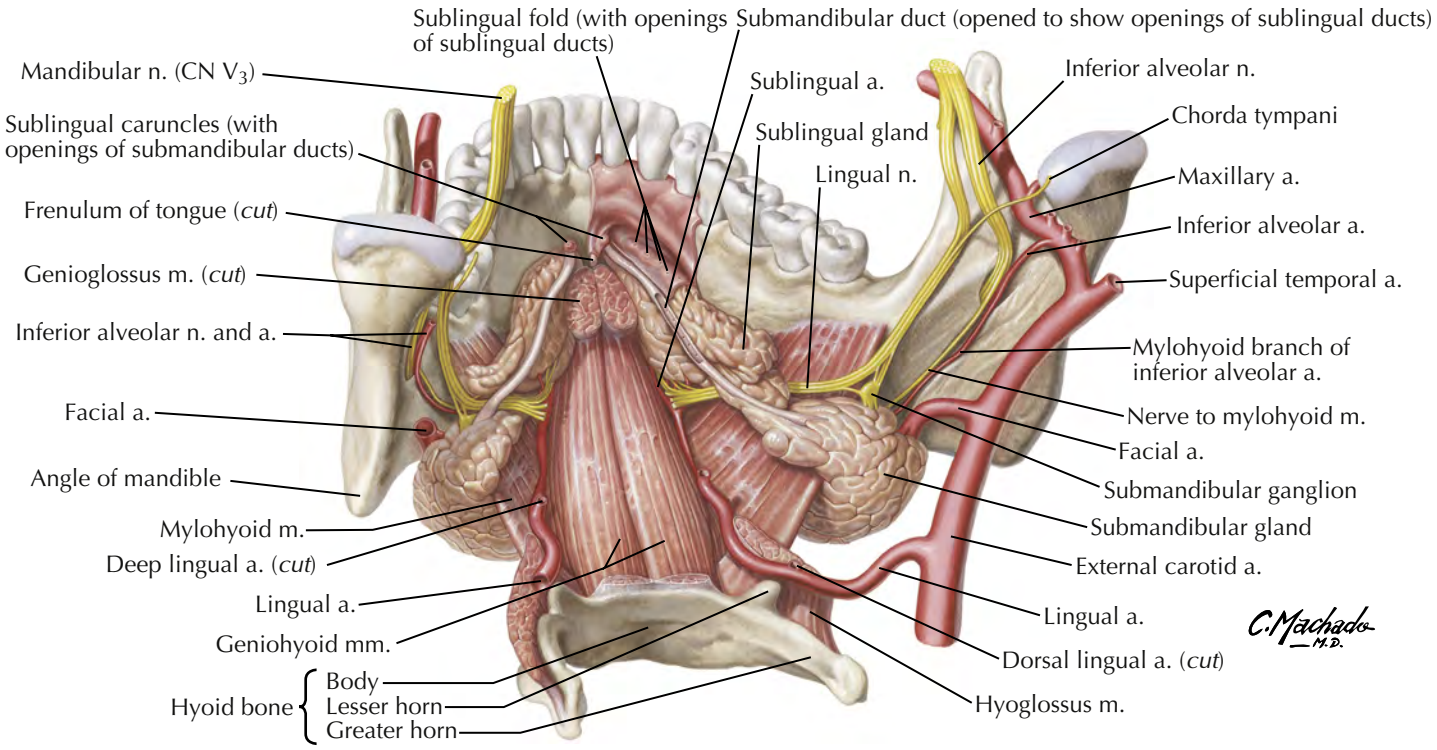
See also **Plates 53, 77**

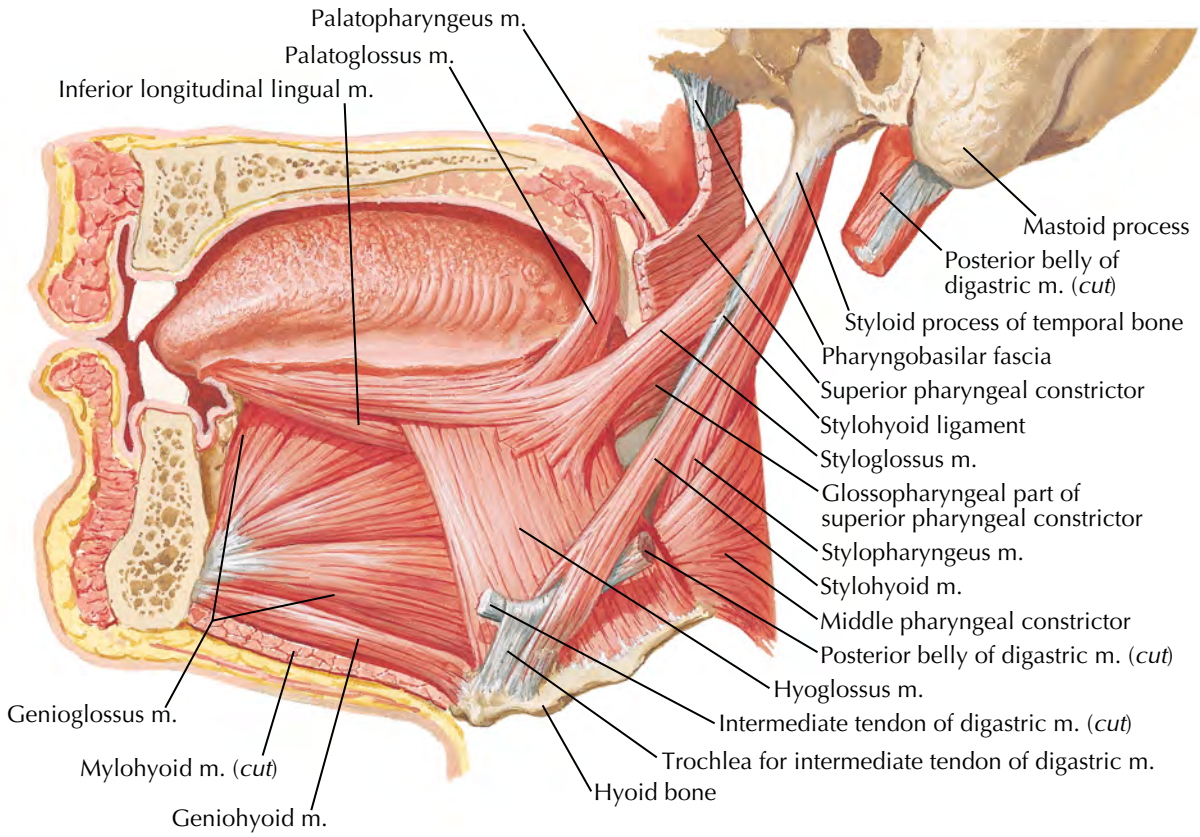
Lateral, slightly inferior view



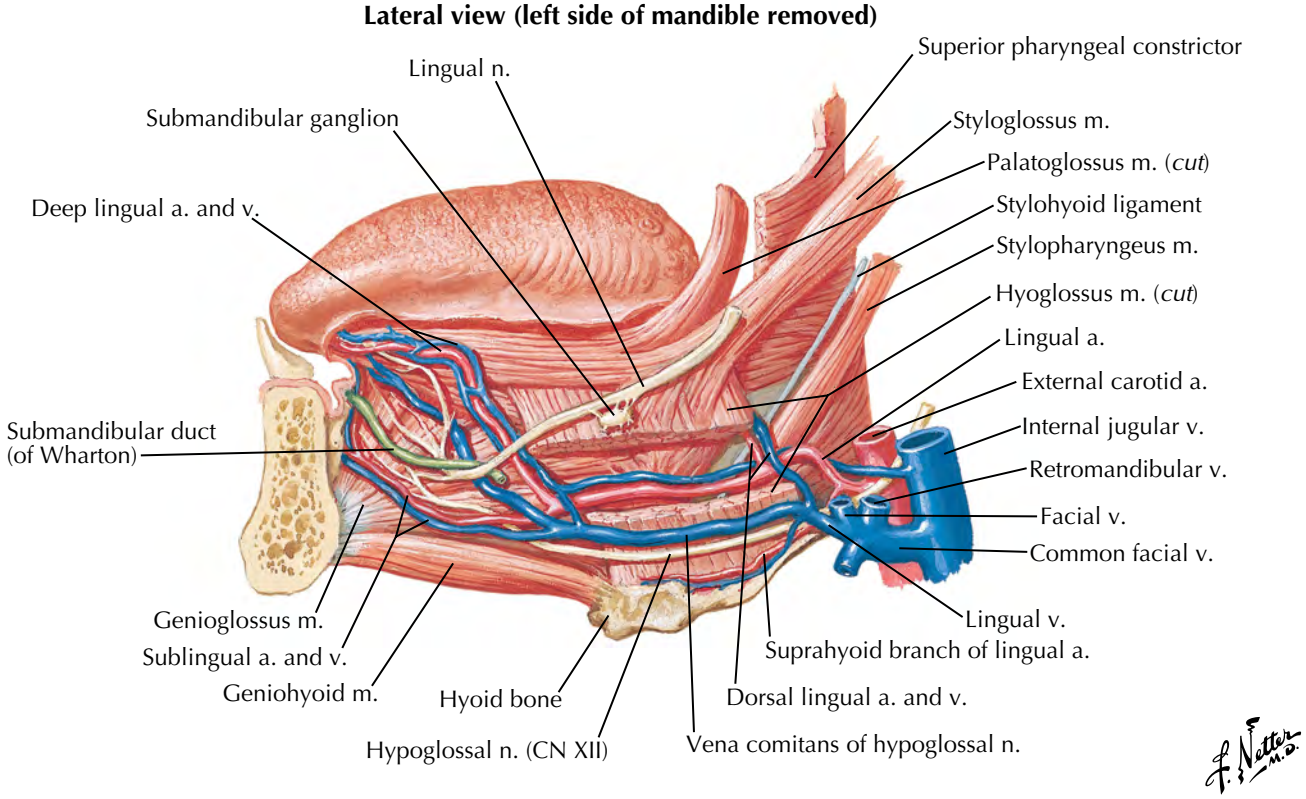
Anteroinferior view

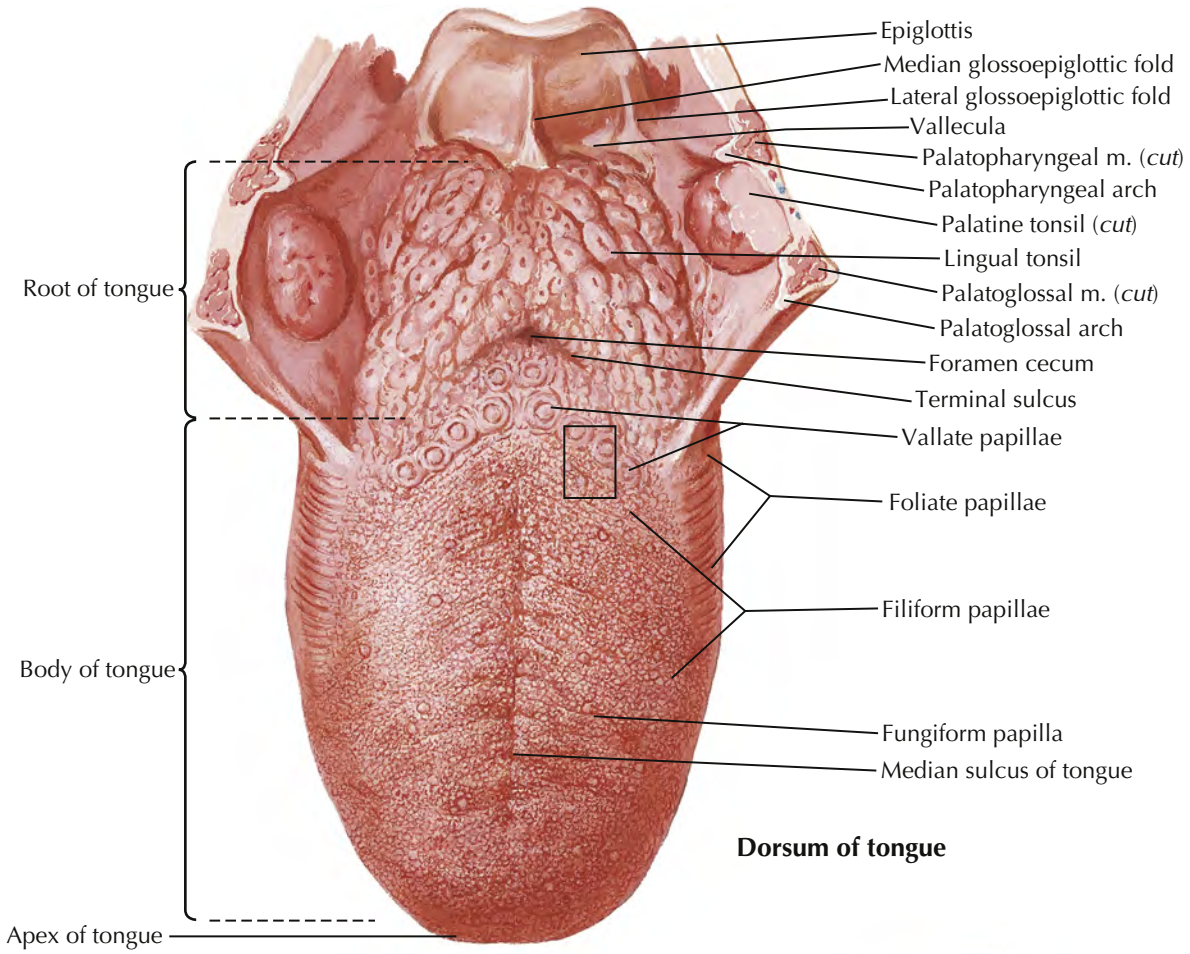




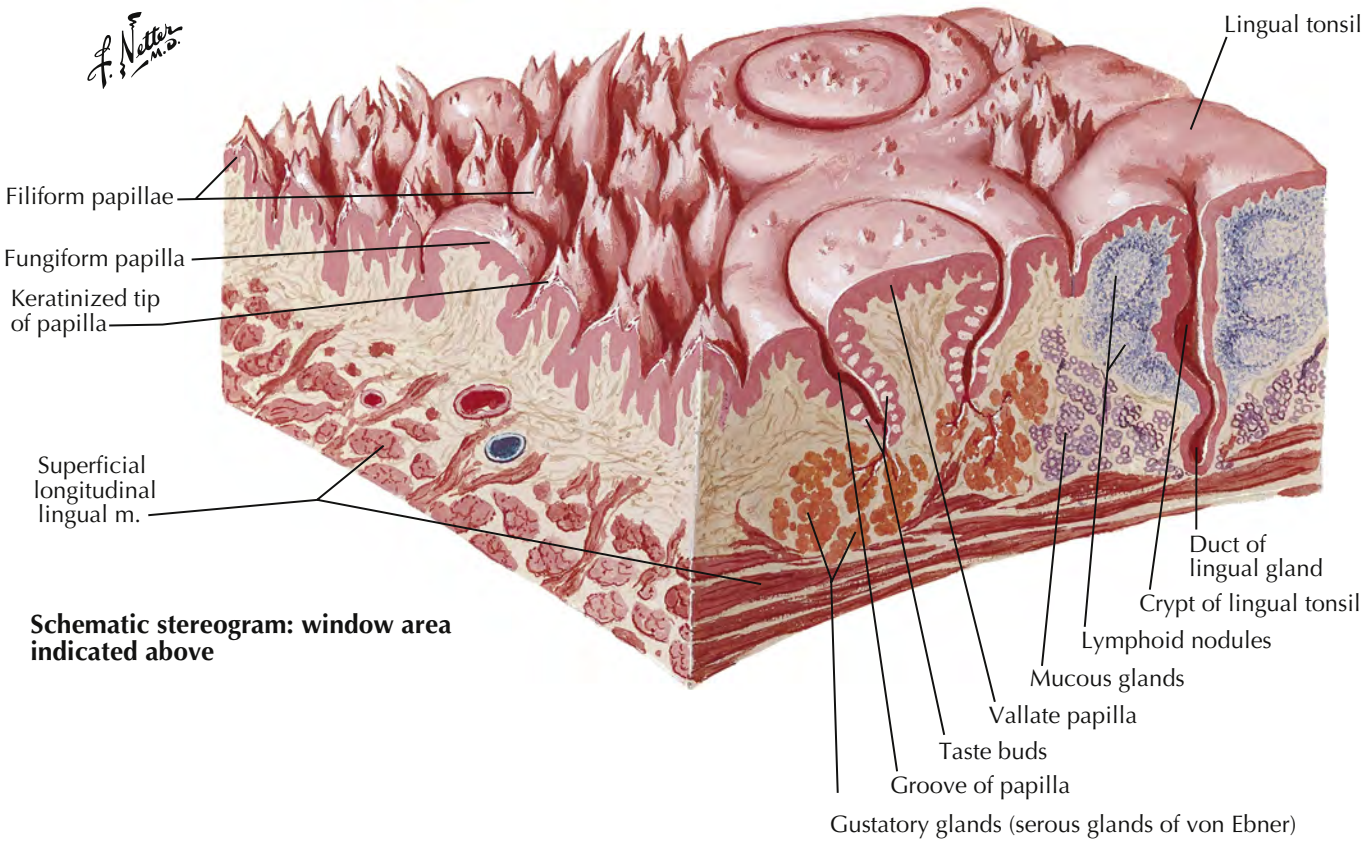


Lateral view (left side of mandible removed)



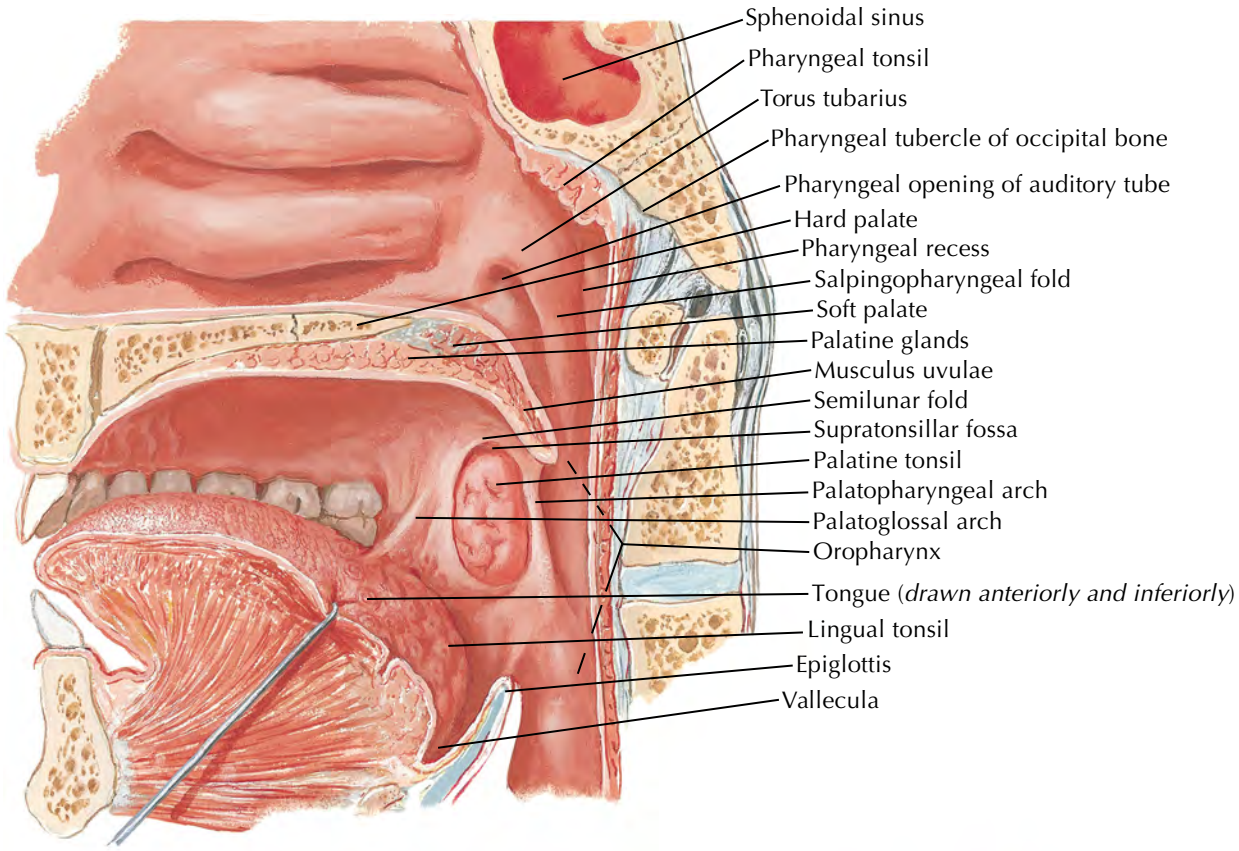


Dorsum of tongue

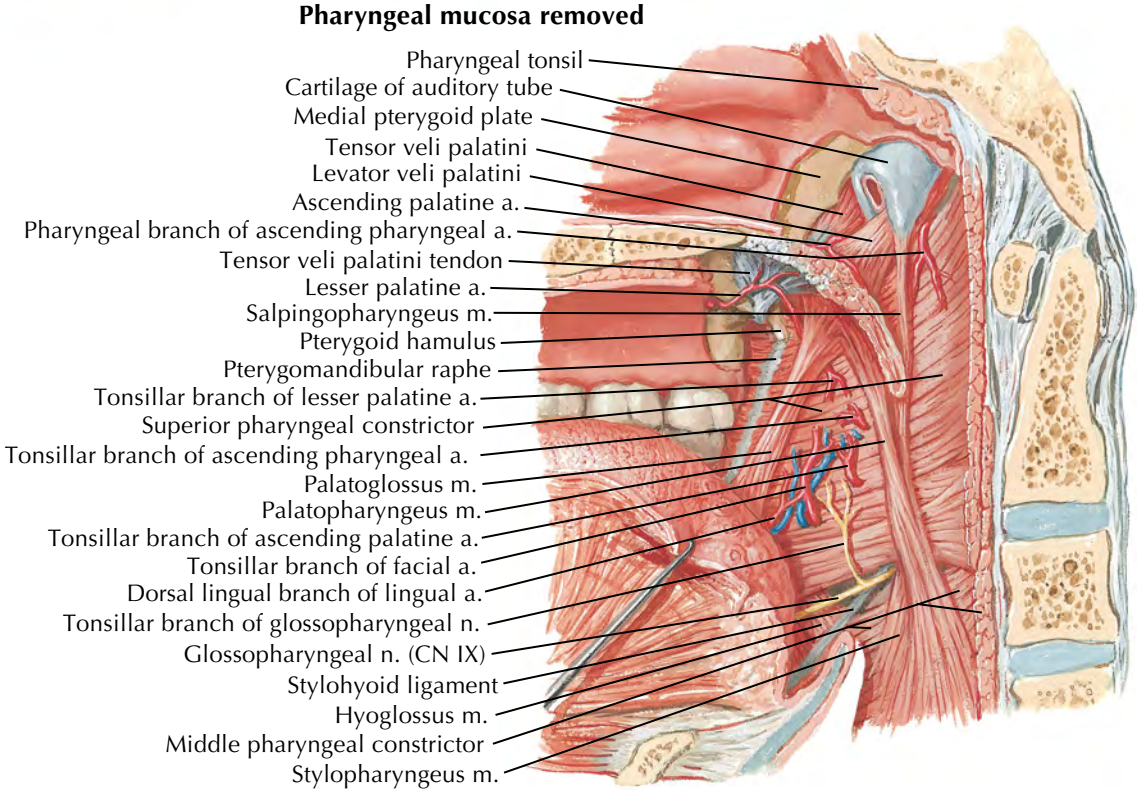


Schematic stereogram: window area indicated above

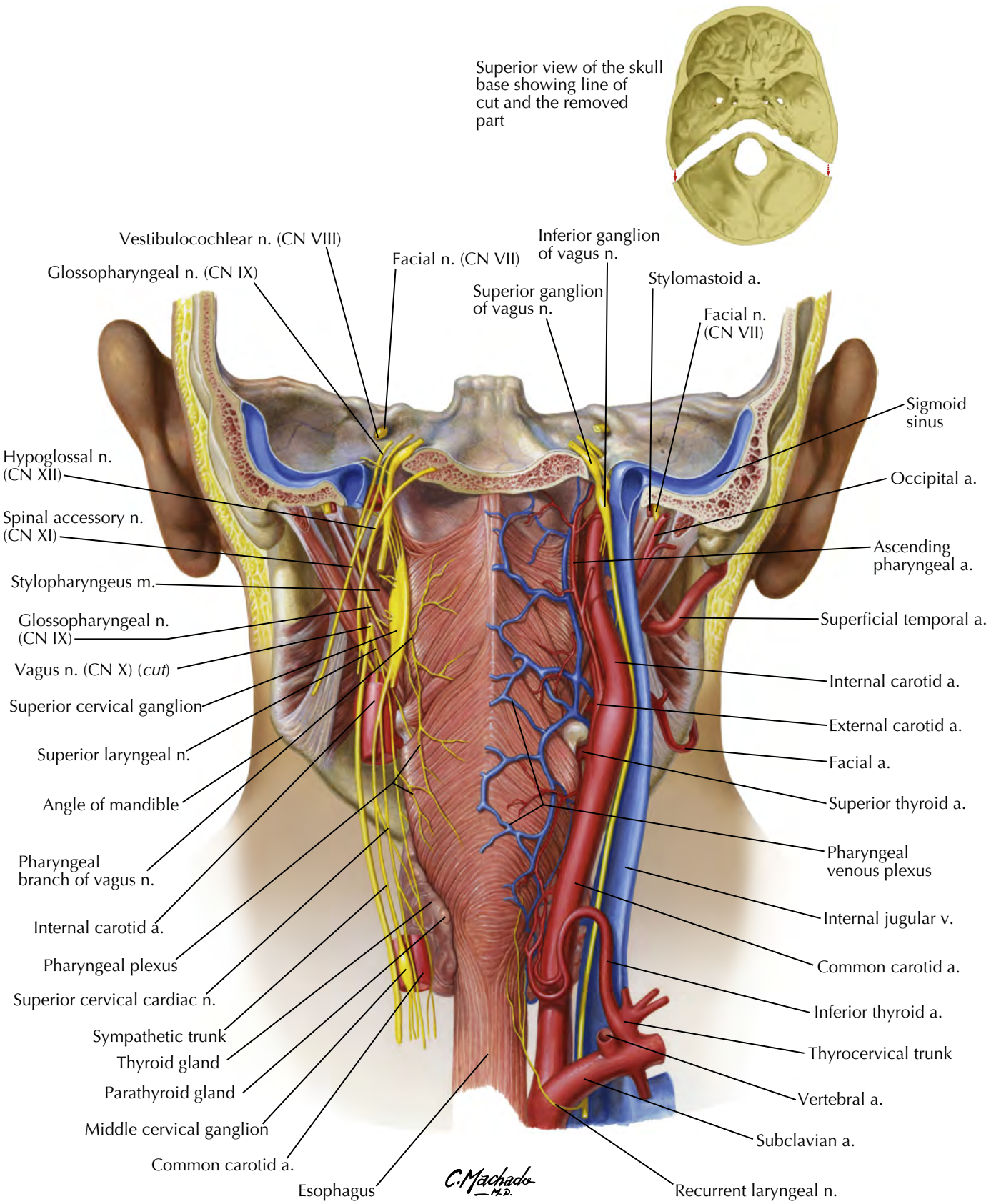
Medial view
sagittal section



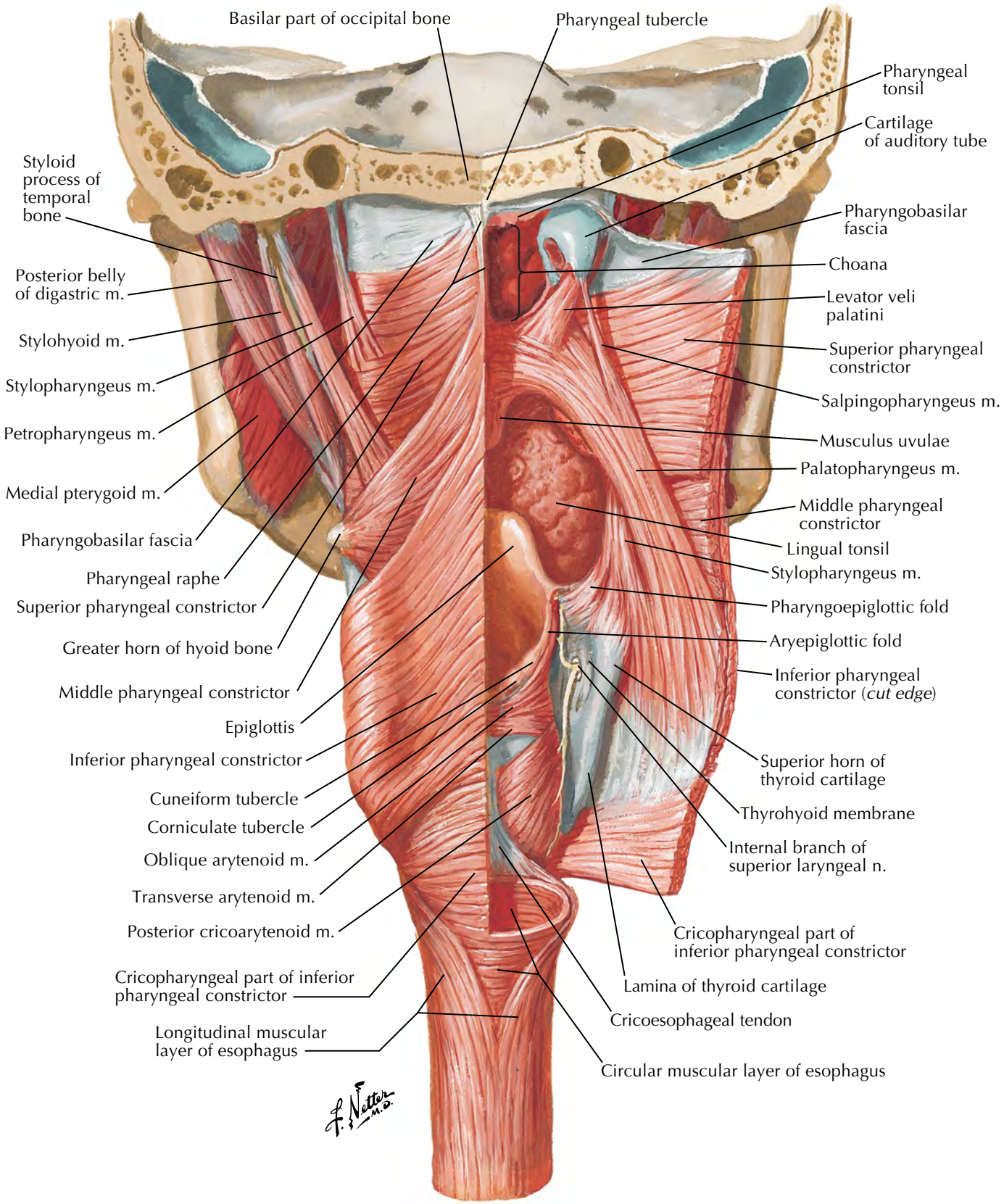
Pharyngeal mucosa removed

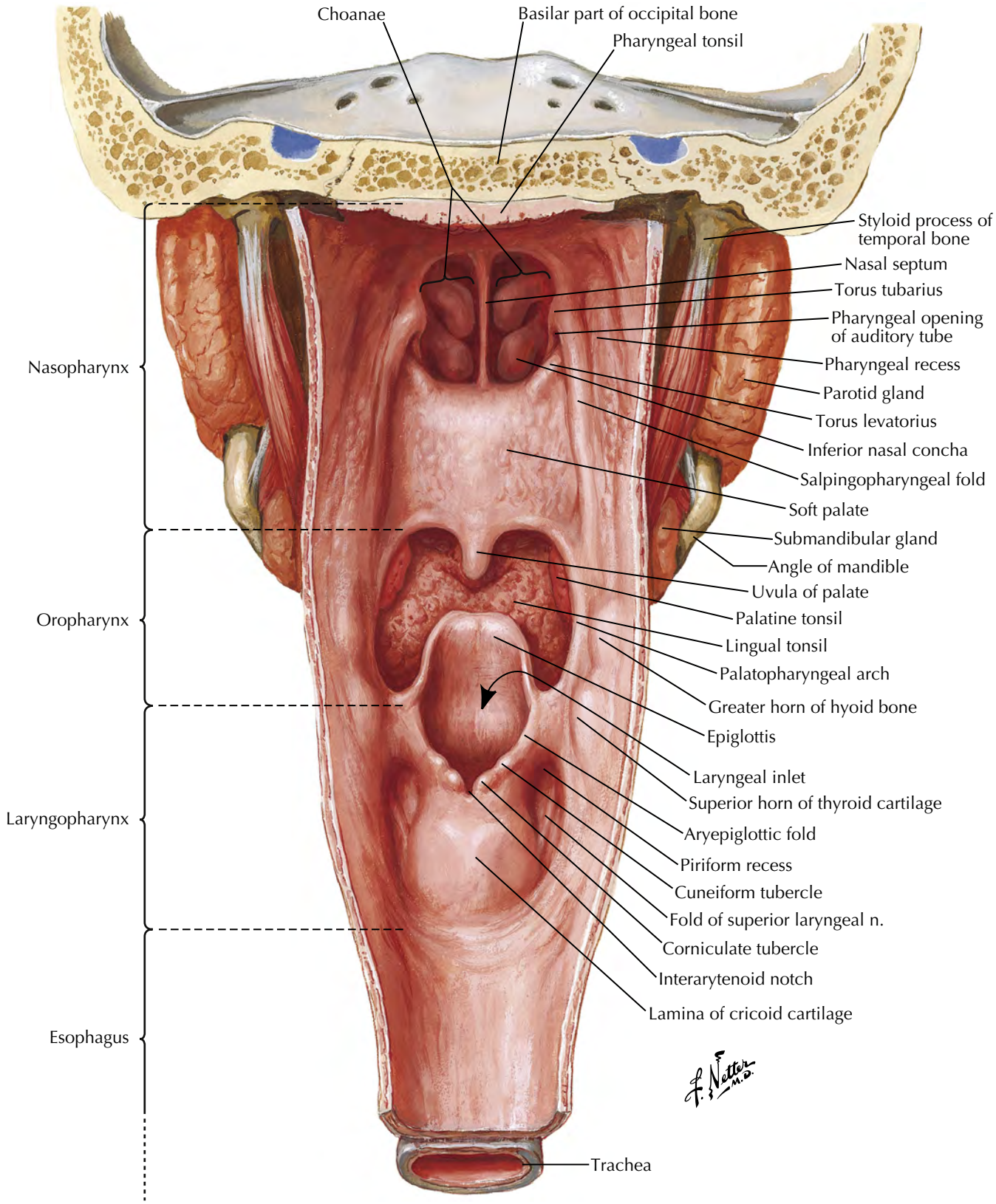


Posterior View of Pharynx: Nerves and Vessels

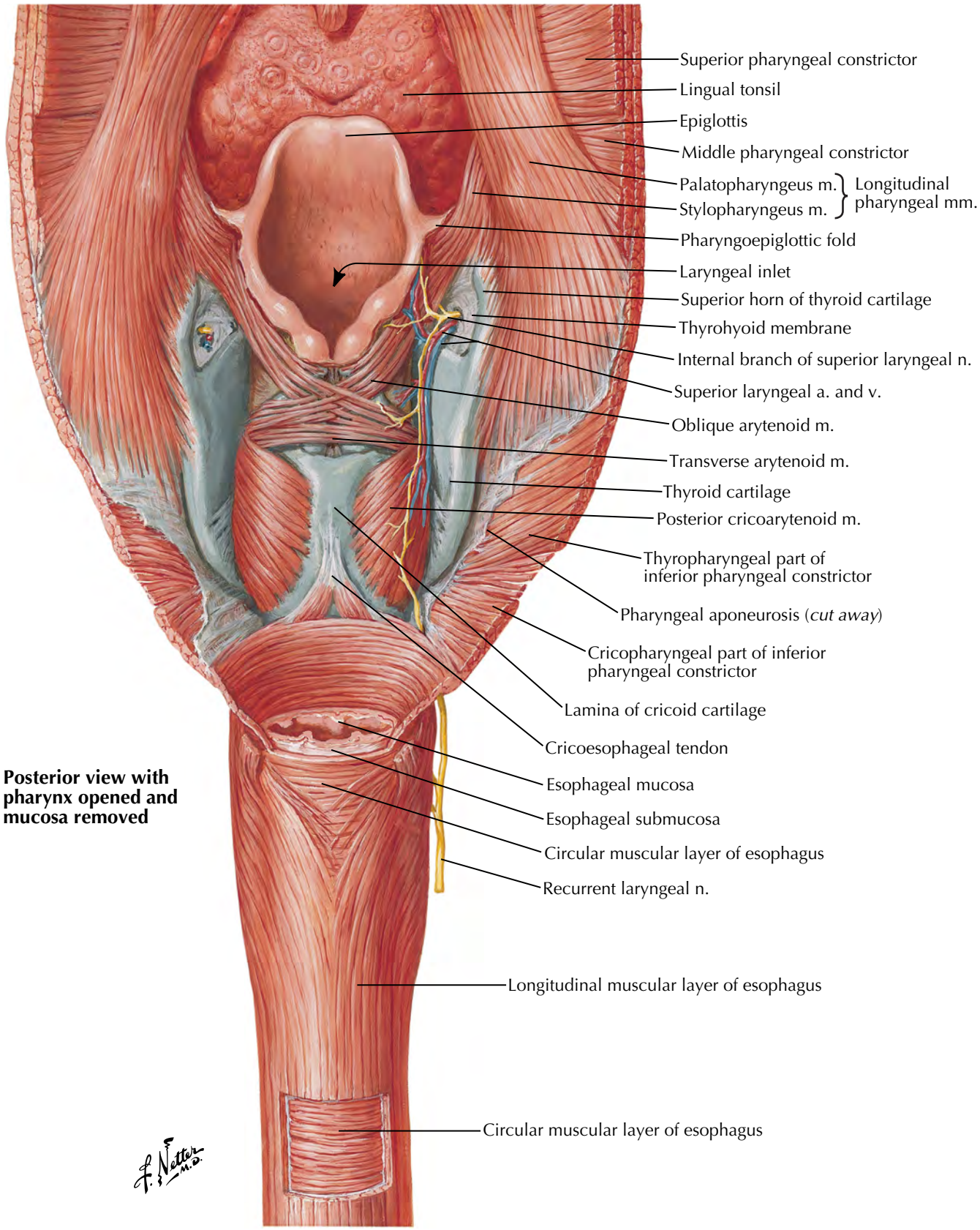


See also **Plates 91, 97**



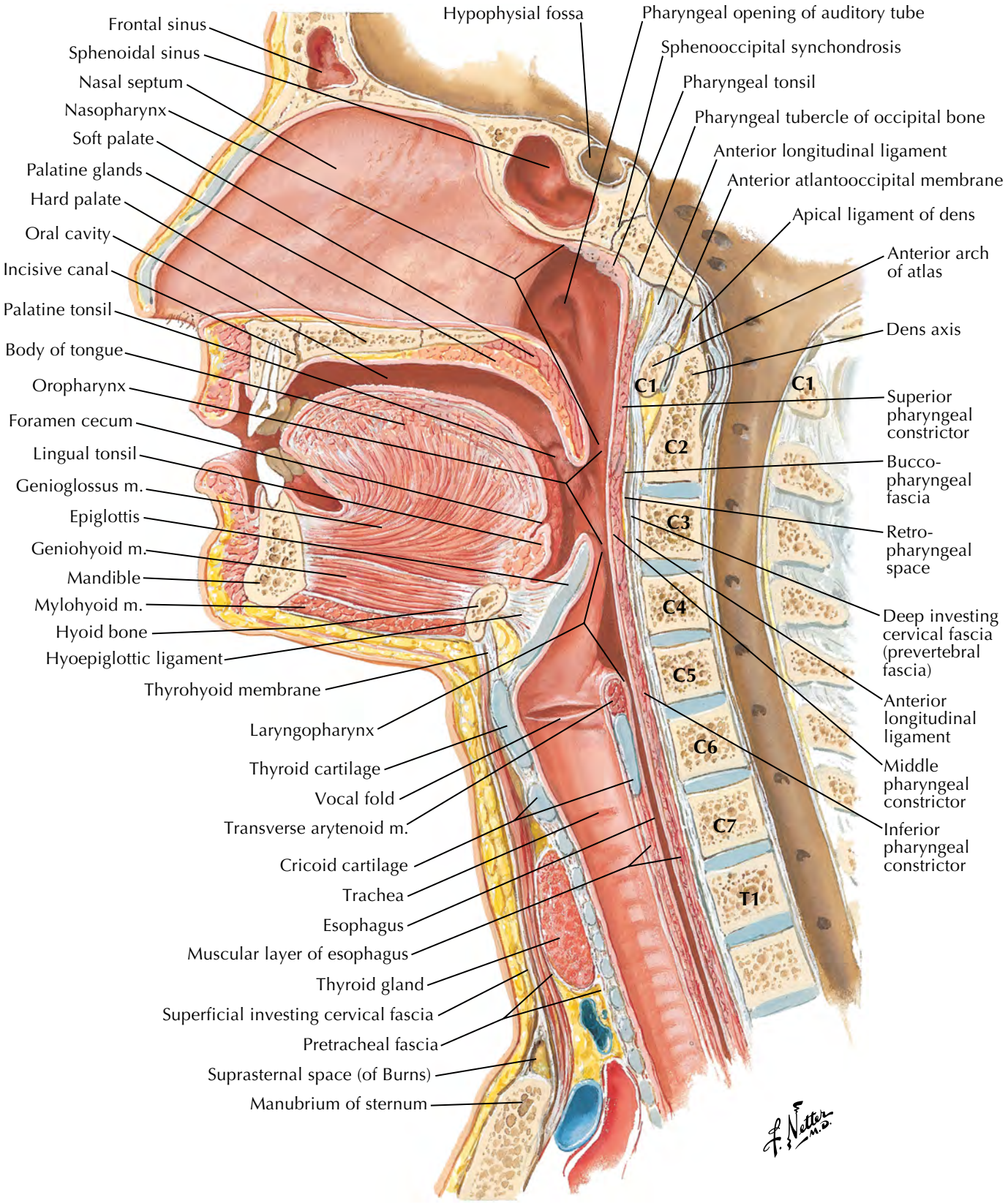

Choanae
Basilar part of occipital bone
Pharyngeal tonsil
Styloid process of temporal bone
Nasal septum
Torus tubarius
Pharyngeal opening of auditory tube
Pharyngeal recess
Parotid gland
Torus levatorius
Inferior nasal concha
Salpingopharyngeal fold
Soft palate
Submandibular gland
Angle of mandible
Uvula of palate
Palatine tonsil
Lingual tonsil
Palatopharyngeal arch
Greater horn of hyoid bone
Epiglottis
Laryngeal inlet
Superior horn of thyroid cartilage
Aryepiglottic fold
Piriform recess
Cuneiform tubercle
Fold of superior laryngeal n.
Corniculate tubercle
Interarytenoid notch
Lamina of cricoid cartilage
Nasopharynx
Oropharynx
Laryngopharynx
Esophagus
Trachea

See also **Plates 106, 107, 108**

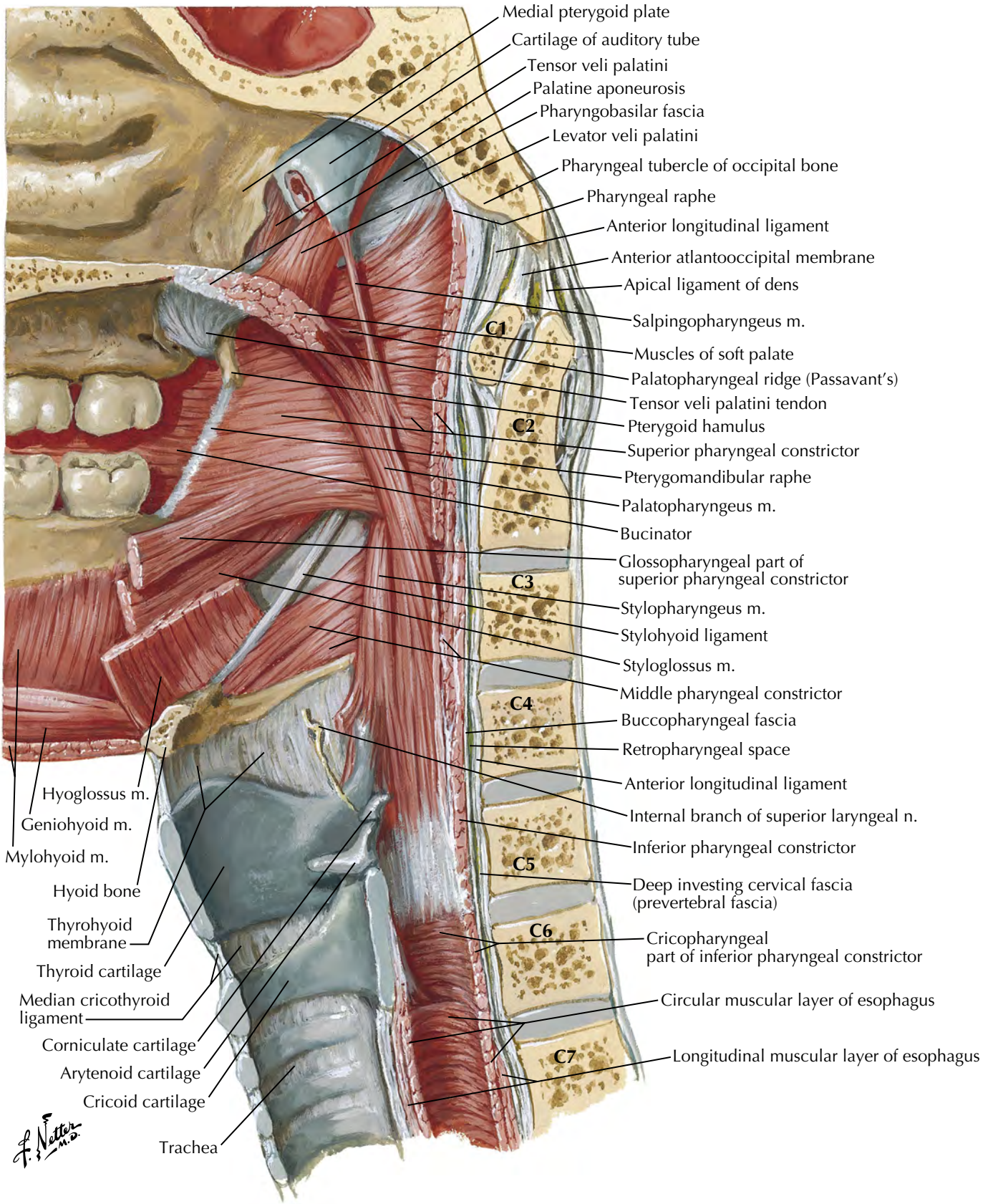


Posterior view with pharynx opened and mucosa removed

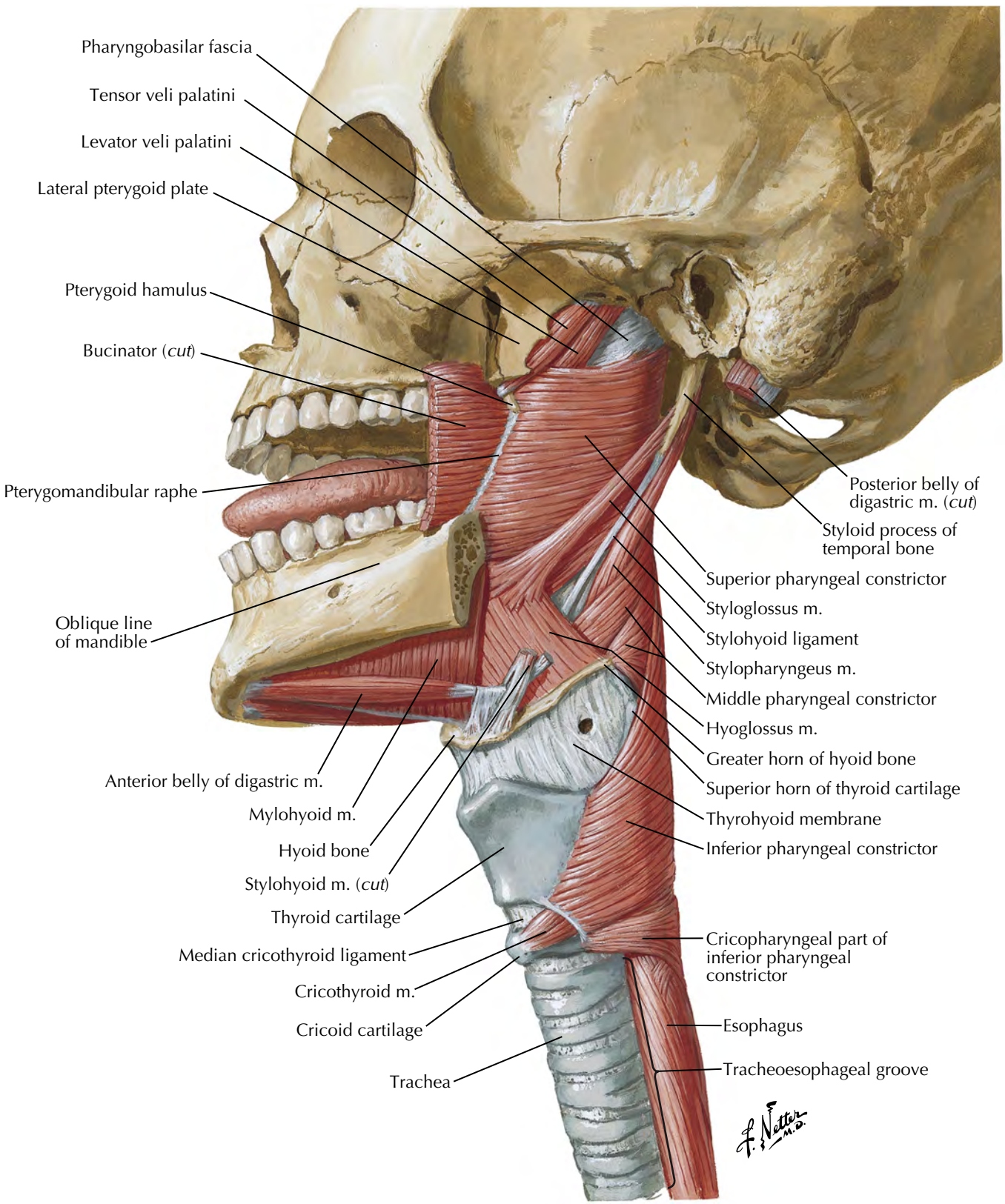
See also **Plate BP 26**



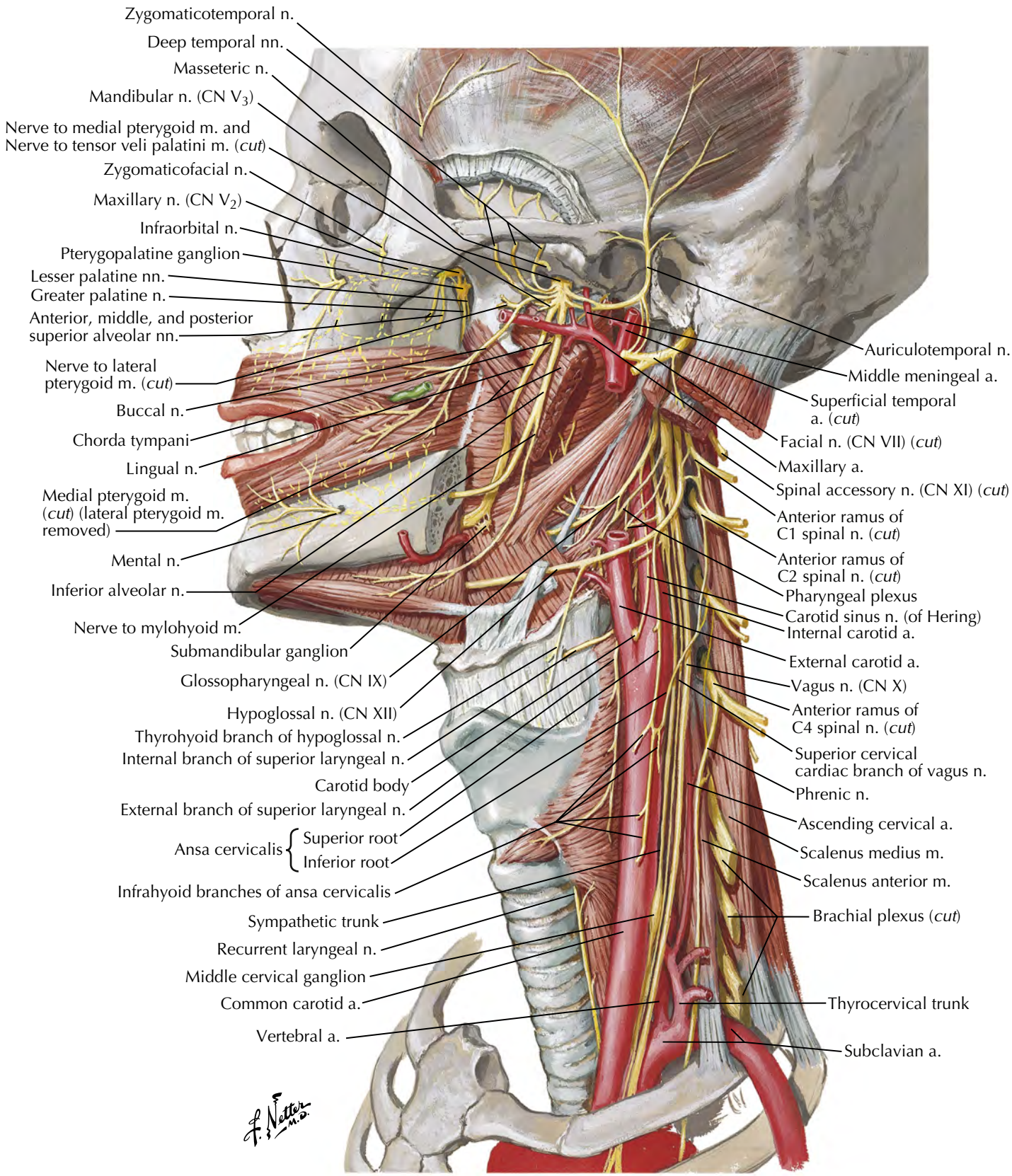
See also **Plate 77**



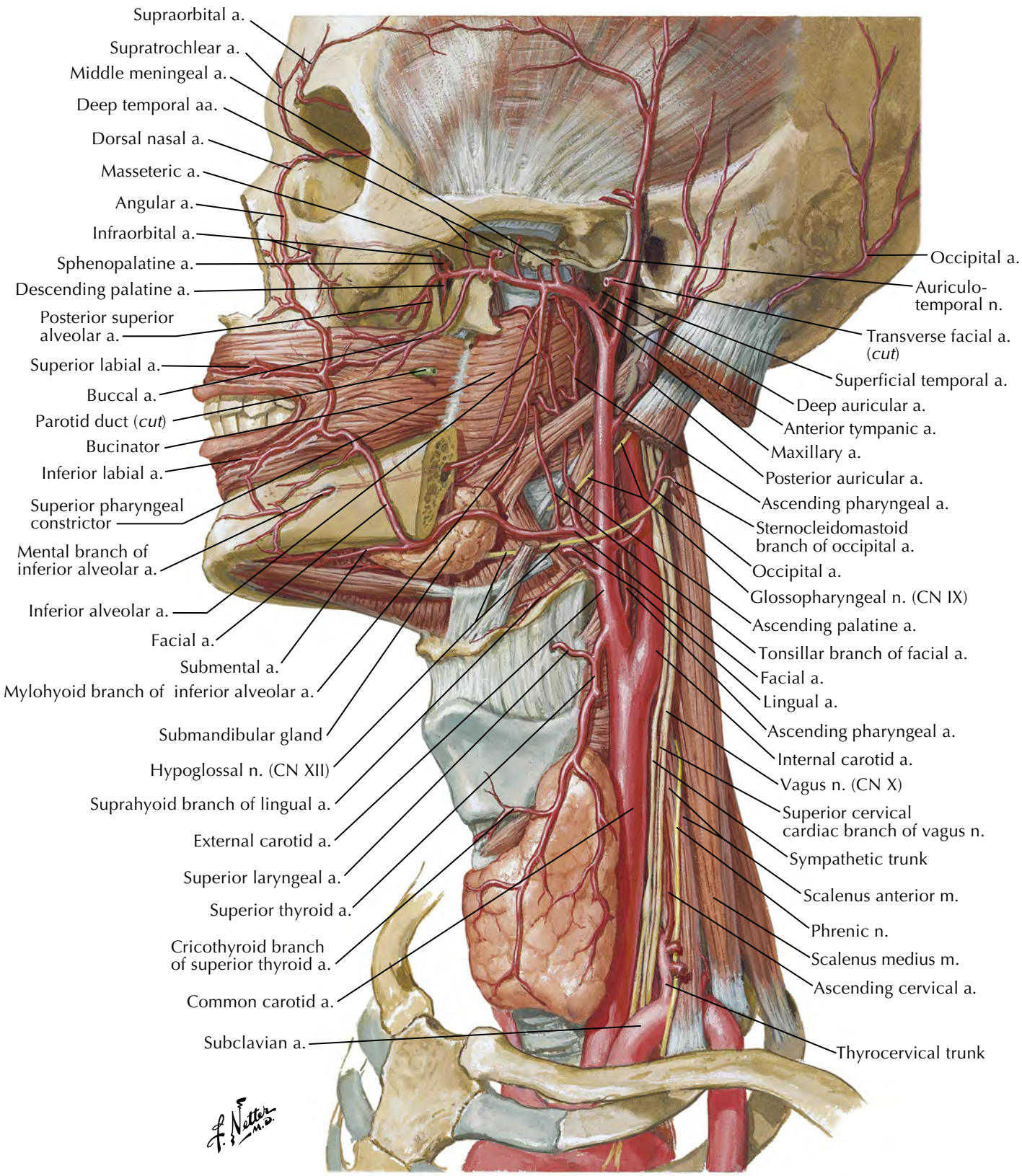
See also **Plate 92**



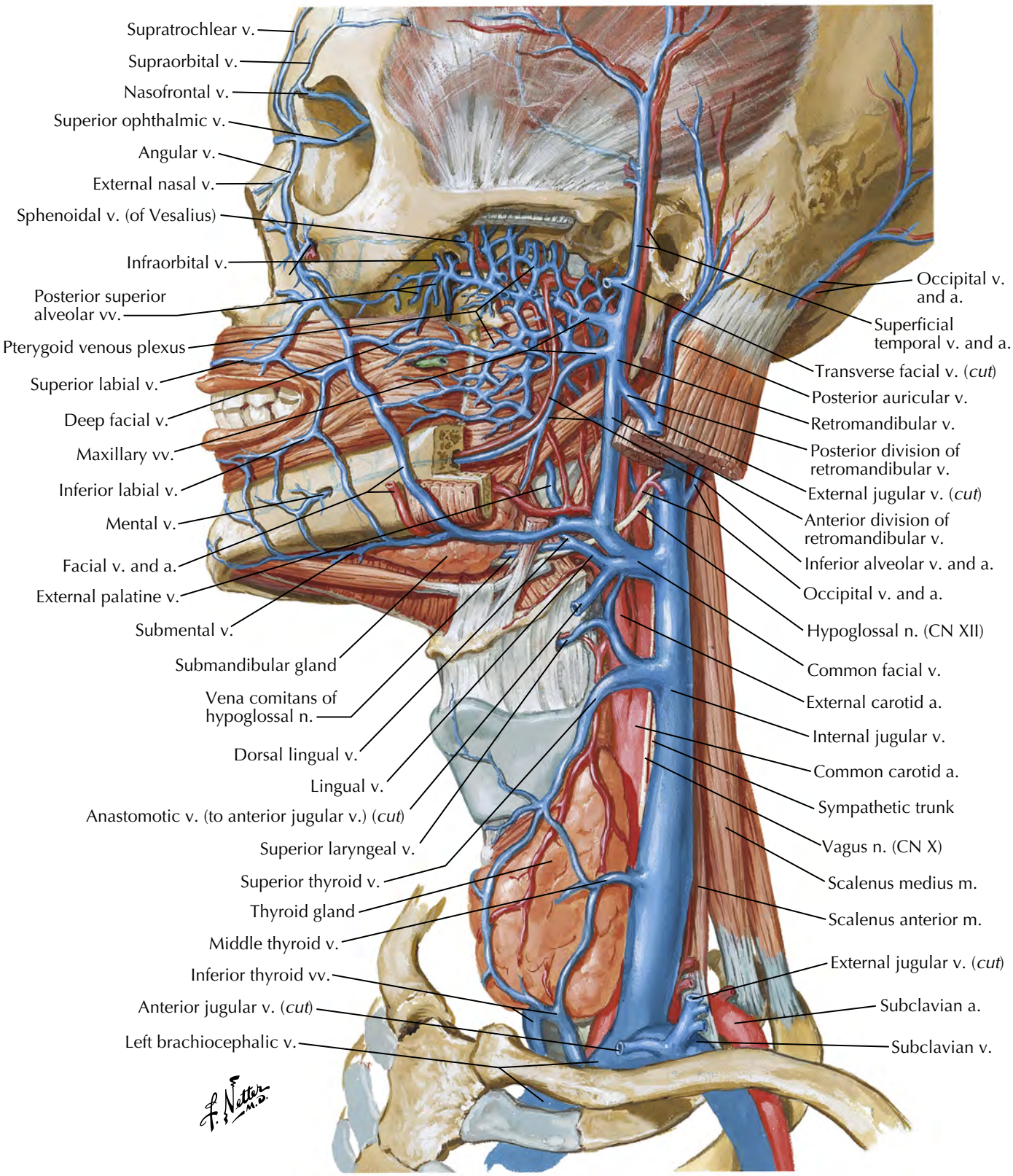
See also **Plates 77, 149, 152**



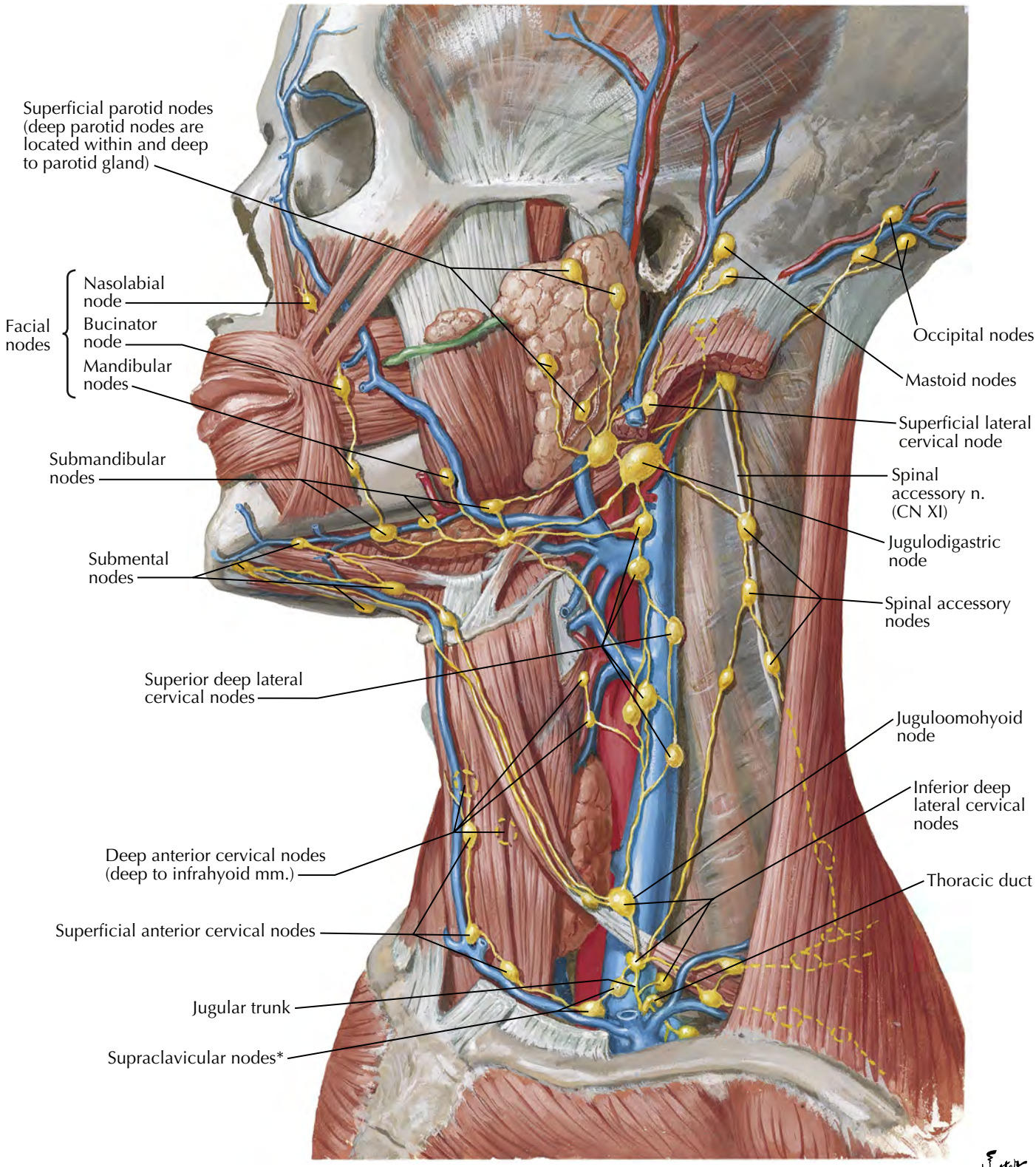
See also **Plates 58, 74**



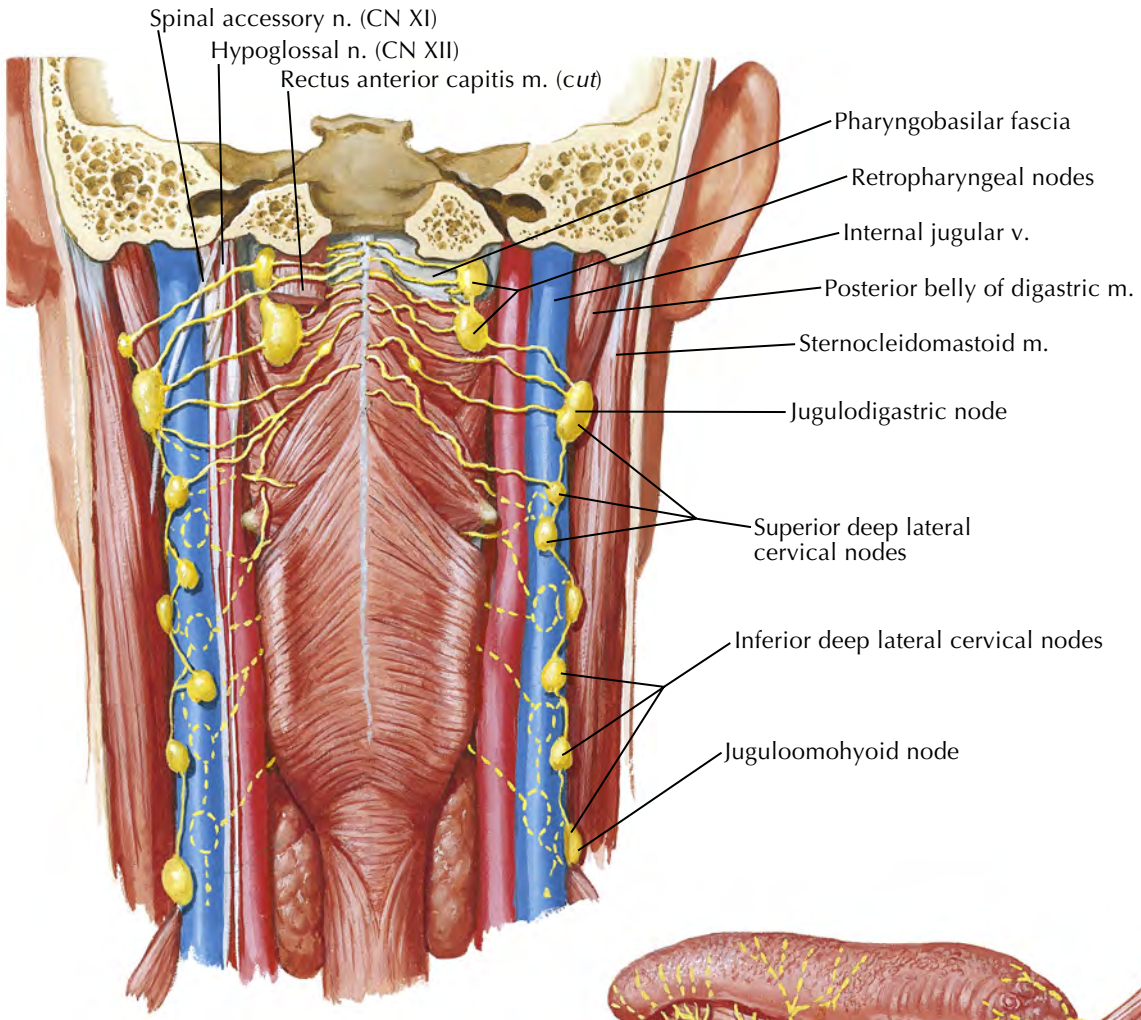
See also **Plate 101**



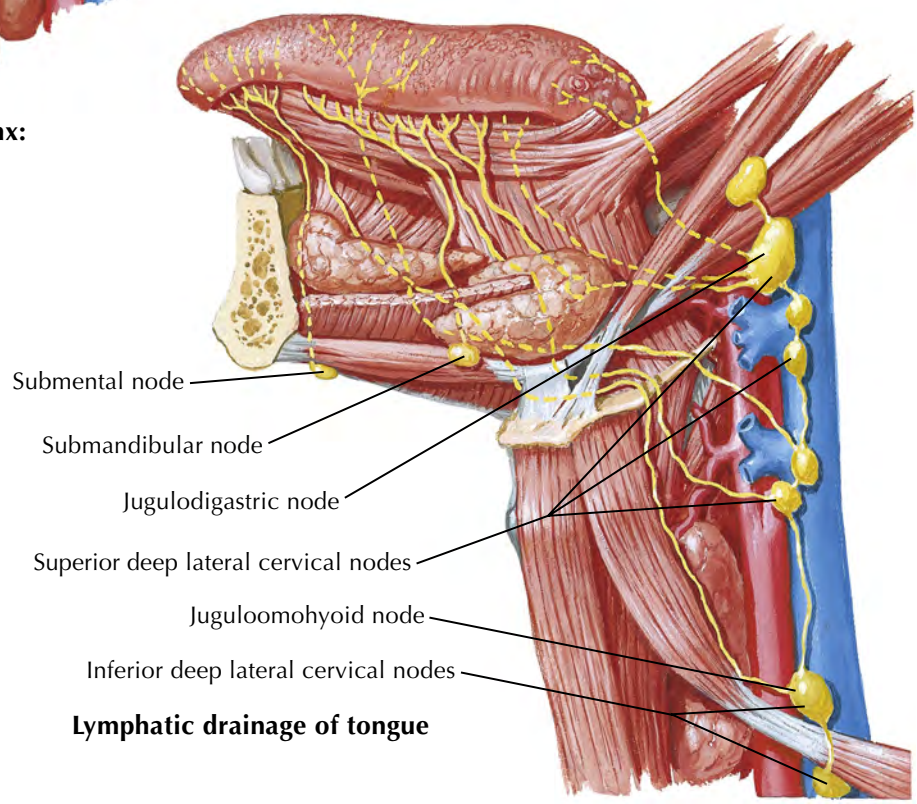
See also **Plate 260**



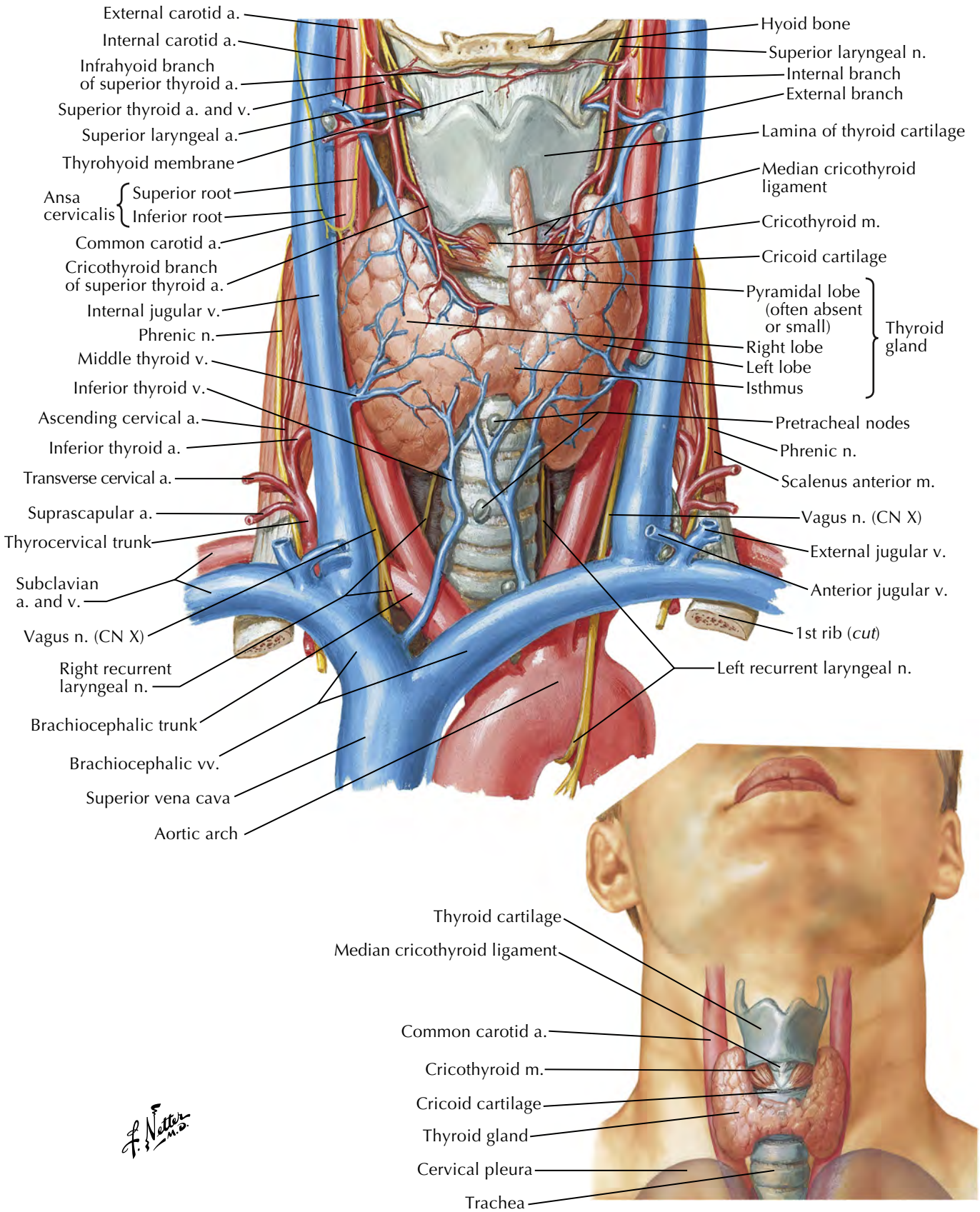
**The supraclavicular group of nodes, especially on the left, are also sometimes referred to as the signal or sentinel lymph nodes of Virchow or Troisier, especially when sufficiently enlarged and palpable. These nodes (or a single node) are so termed because they may be the first recognized presumptive evidence of malignant disease in the viscera.*



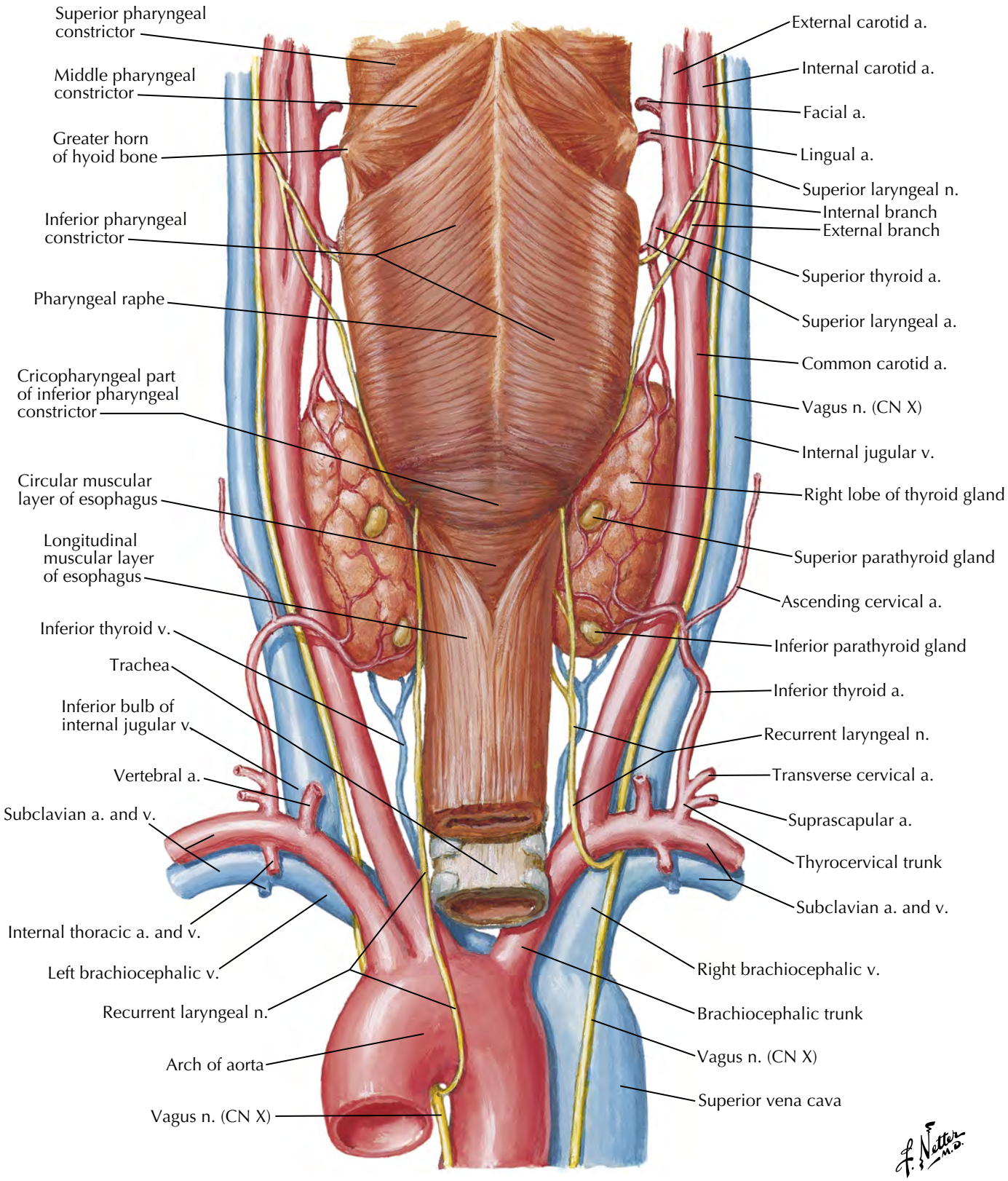
Lymphatic drainage of pharynx: posterior view



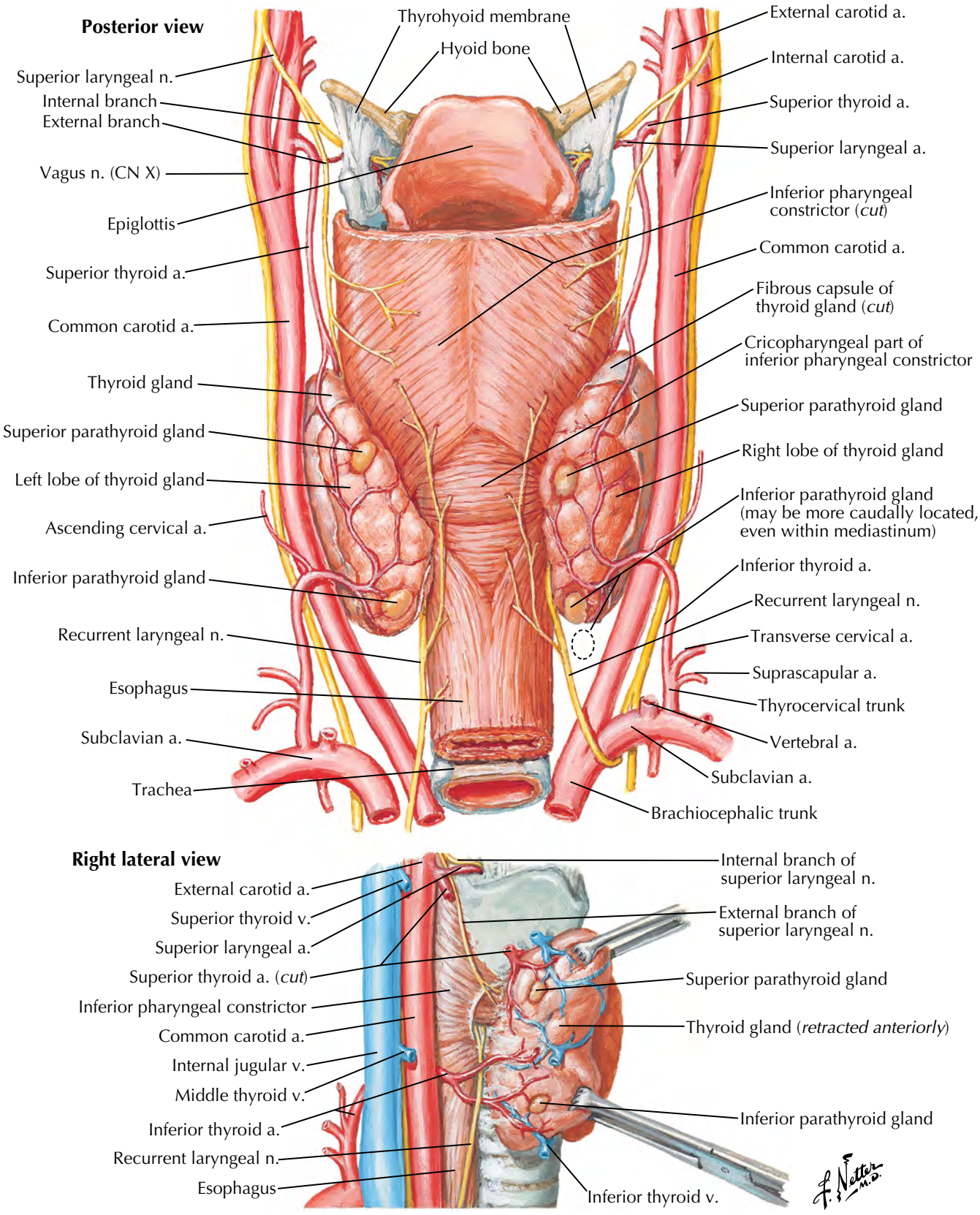
Lymphatic drainage of tongue

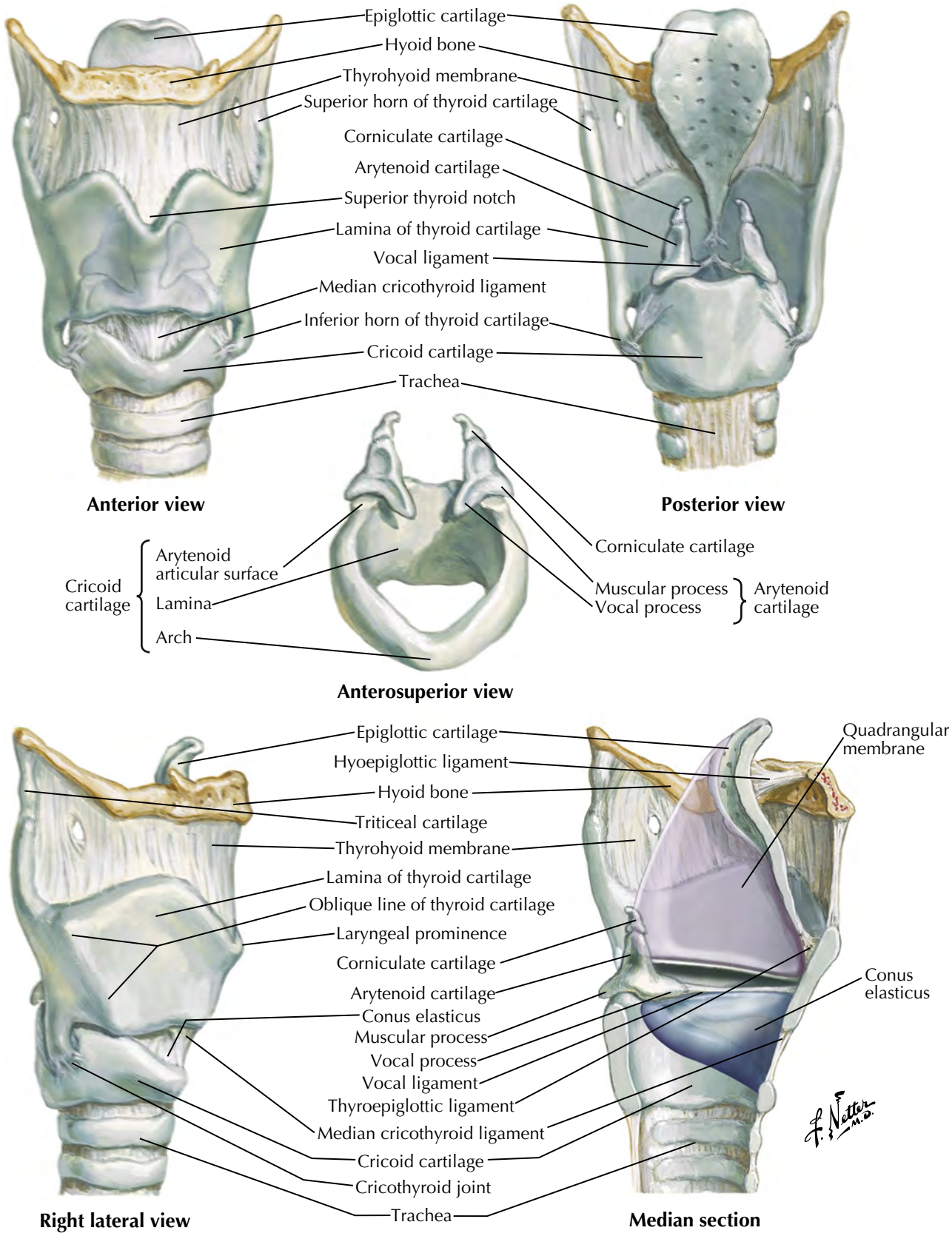

External carotid a.
Internal carotid a.
Infrahyoid branch of superior thyroid a.
Superior thyroid a. and v.
Superior laryngeal a.
Thyrohyoid membrane
Ansa cervicalis
Superior root
Inferior root
Common carotid a.
Cricothyroid branch of superior thyroid a.
Internal jugular v.
Phrenic n.
Middle thyroid v.
Inferior thyroid v.
Ascending cervical a.
Inferior thyroid a.
Transverse cervical a.
Suprascapular a.
Thyrocervical trunk
Subclavian a. and v.
Vagus n. (CN X)
Right recurrent laryngeal n.
Brachiocephalic trunk
Brachiocephalic vv.
Superior vena cava
Aortic arch
Hyoid bone
Superior laryngeal n.
Internal branch
External branch
Lamina of thyroid cartilage
Median cricothyroid ligament
Cricothyroid m.
Cricoid cartilage
Pyramidal lobe (often absent or small)
Right lobe
Left lobe
Isthmus
Thyroid gland
Pretracheal nodes
Phrenic n.
Scalenus anterior m.
Vagus n. (CN X)
External jugular v.
Anterior jugular v.
1st rib (cut)
Left recurrent laryngeal n.
Thyroid cartilage
Median cricothyroid ligament
Common carotid a.
Cricothyroid m.
Cricoid cartilage
Thyroid gland
Cervical pleura
Trachea

See also **Plate 105**

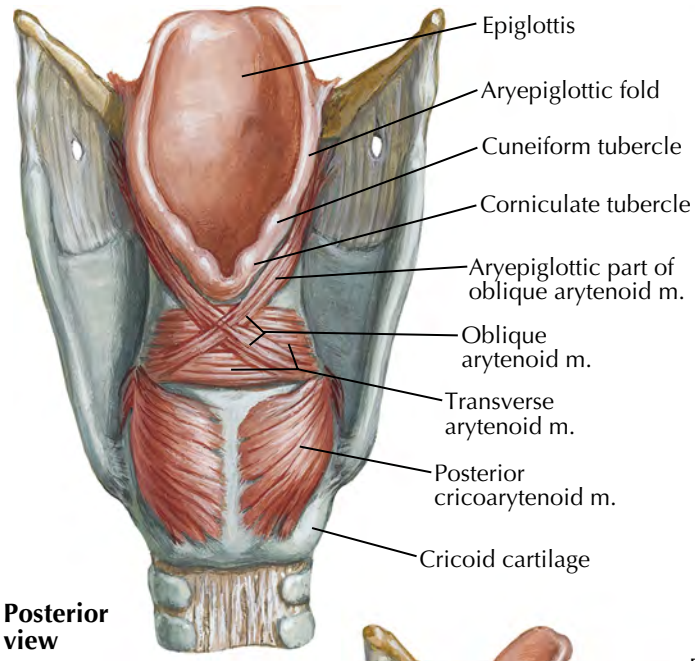


See also **Plates 94, 104, 108**

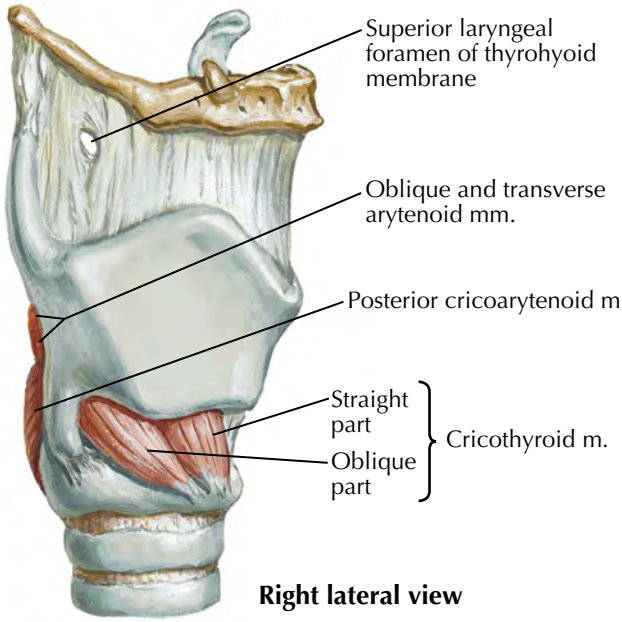



Epiglottic cartilage
Hyoid bone
Thyrohyoid membrane
Superior horn of thyroid cartilage
Corniculate cartilage
Arytenoid cartilage
Superior thyroid notch
Lamina of thyroid cartilage
Vocal ligament
Median cricothyroid ligament
Inferior horn of thyroid cartilage
Cricoid cartilage
Trachea
Anterior view
Posterior view
Cricoid cartilage
Arytenoid articular surface
Lamina
Arch
Corniculate cartilage
Muscular process
Vocal process
Arytenoid cartilage
Anterosuperior view
Epiglottic cartilage
Hyoepiglottic ligament
Hyoid bone
Triticeal cartilage
Thyrohyoid membrane
Lamina of thyroid cartilage
Oblique line of thyroid cartilage
Laryngeal prominence
Corniculate cartilage
Arytenoid cartilage
Conus elasticus
Muscular process
Vocal process
Vocal ligament
Thyroepiglottic ligament
Median cricothyroid ligament
Cricoid cartilage
Cricothyroid joint
Trachea
Quadrangular membrane
Conus elasticus
Right lateral view
Median section

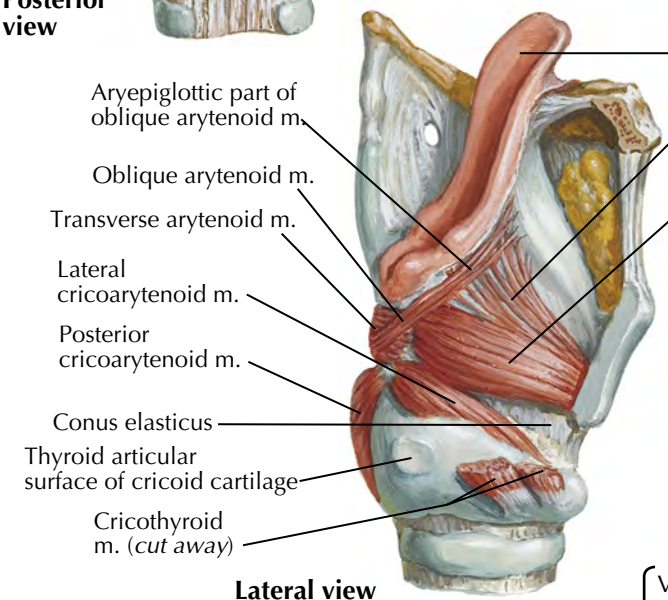
See also **Plates 94, 106, 108, 109**



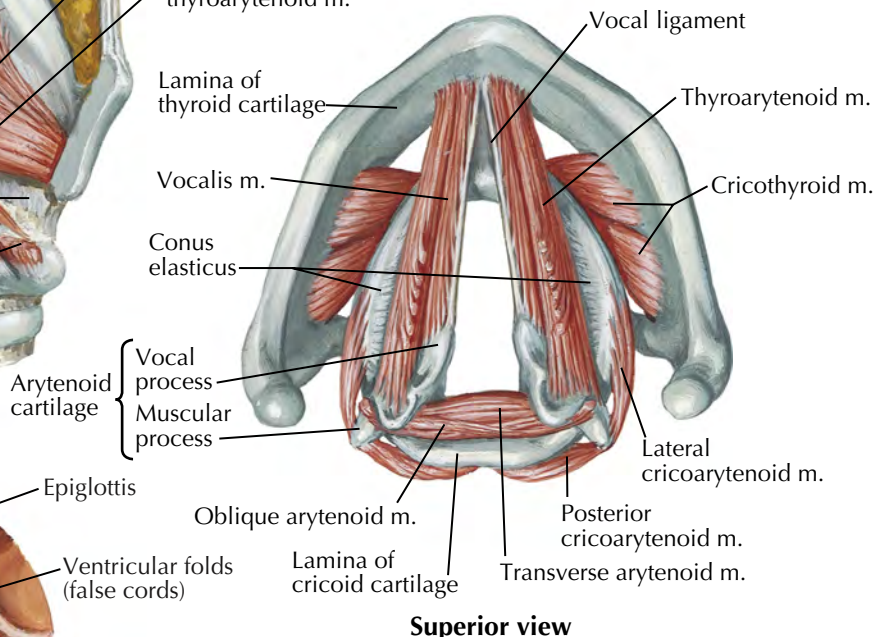
Posterior view



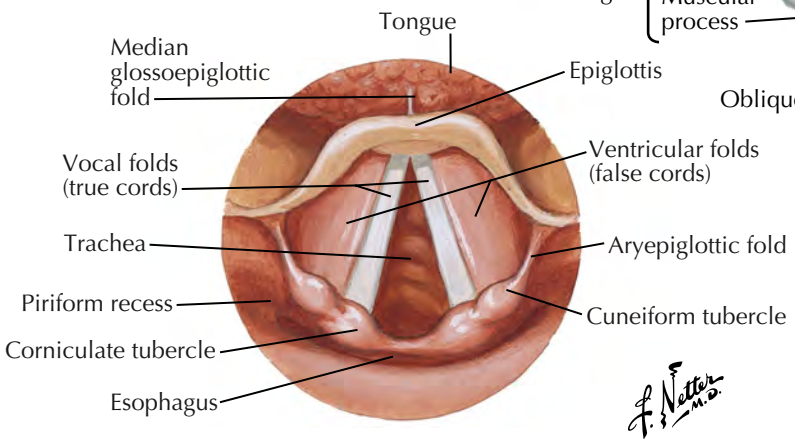
Right lateral view



Lateral view

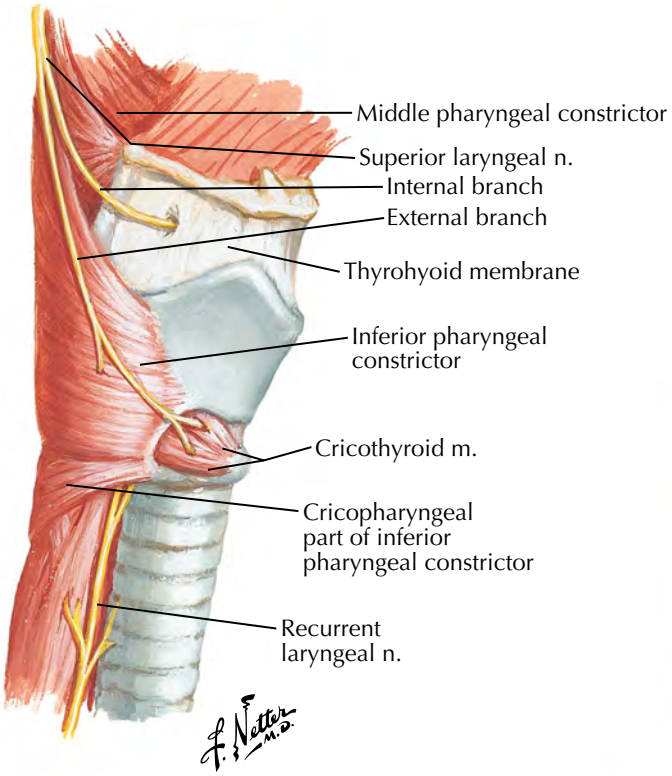


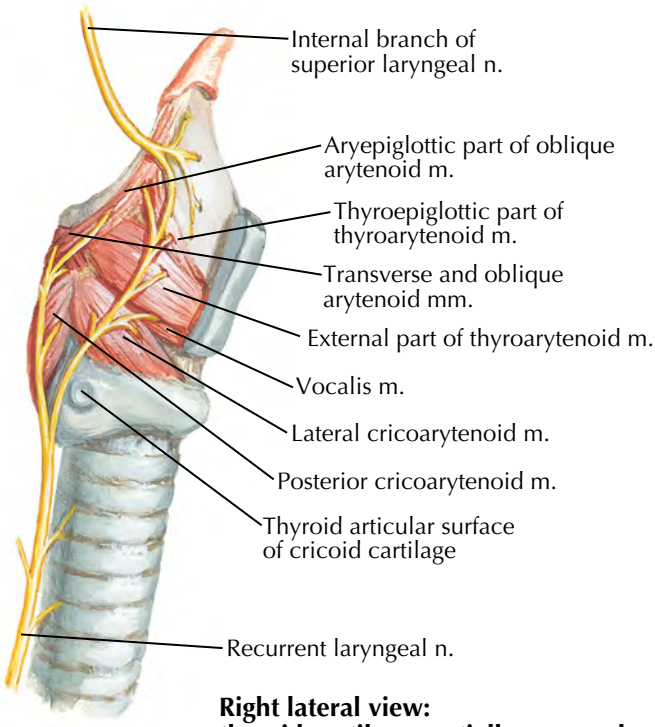
Superior view



Laryngoscopic view: inspiration

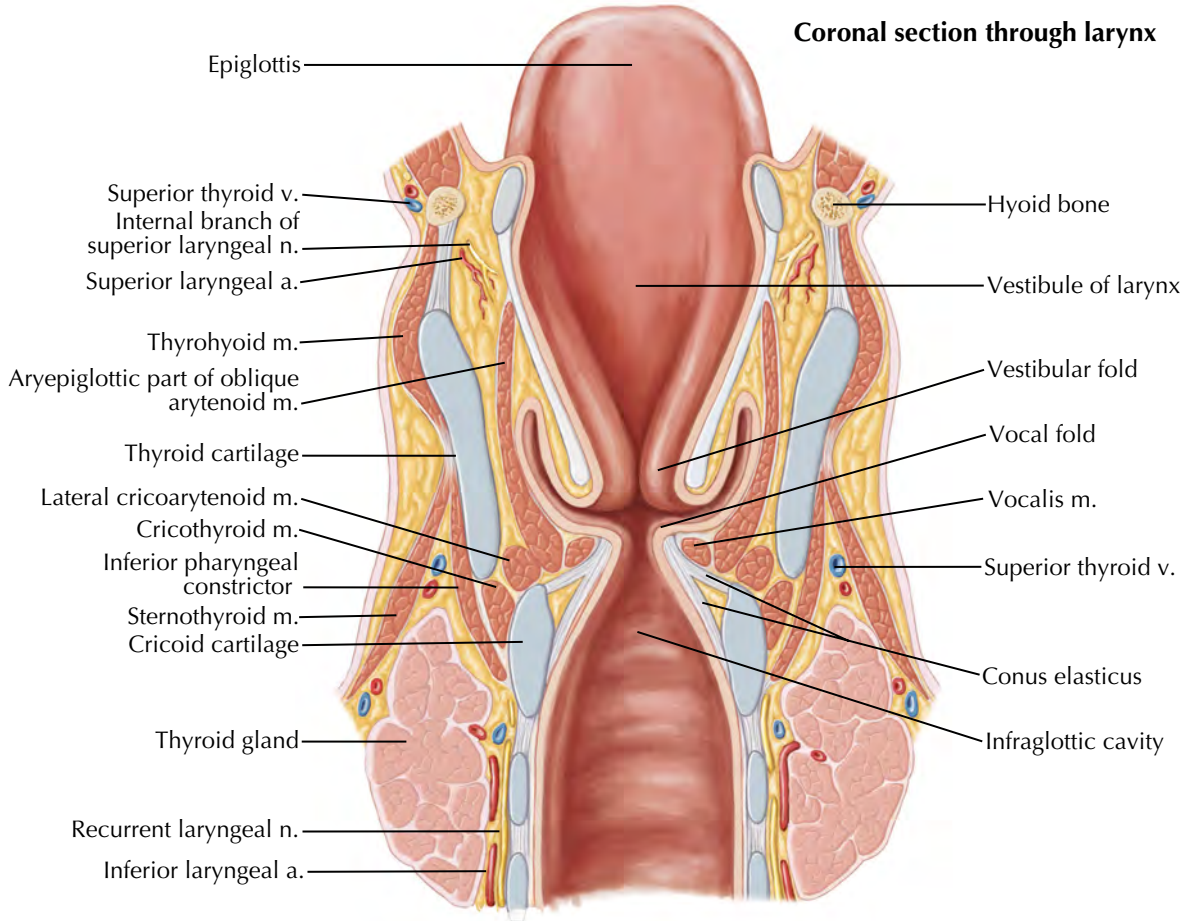
See also **Plates 103, 106, 107, 109**





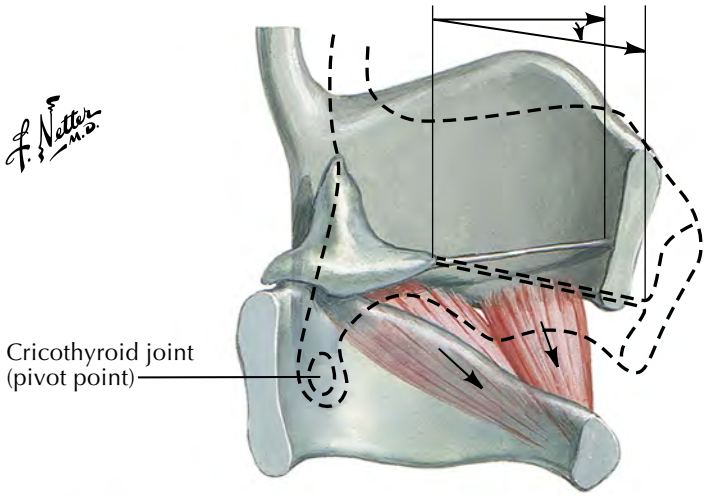
Right lateral view: thyroid cartilage partially removed

Coronal section through larynx

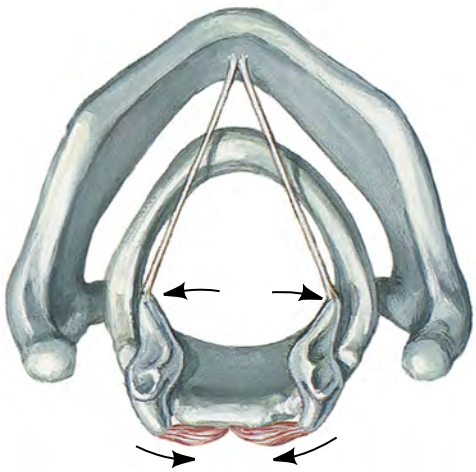


Action of Intrinsic Muscles of Larynx

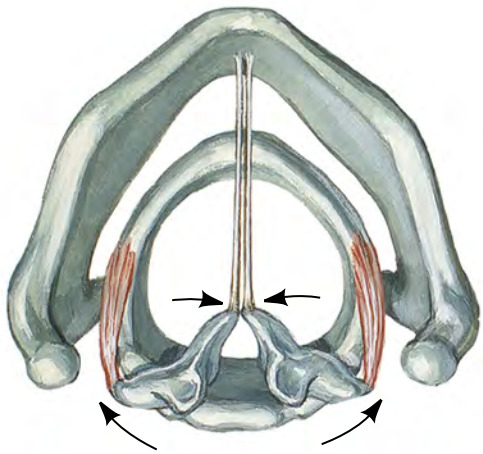
See also **Plates 106, 107, 108**



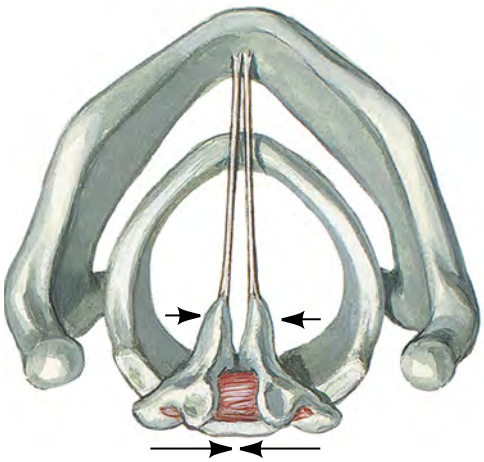
Action of cricothyroid muscles
Stretching of vocal ligaments



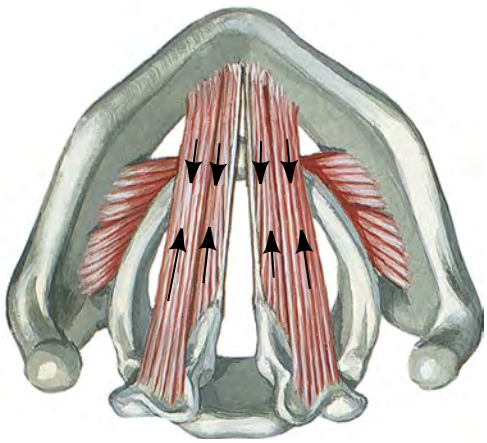
Action of posterior cricoarytenoid muscles
Abduction of vocal ligaments



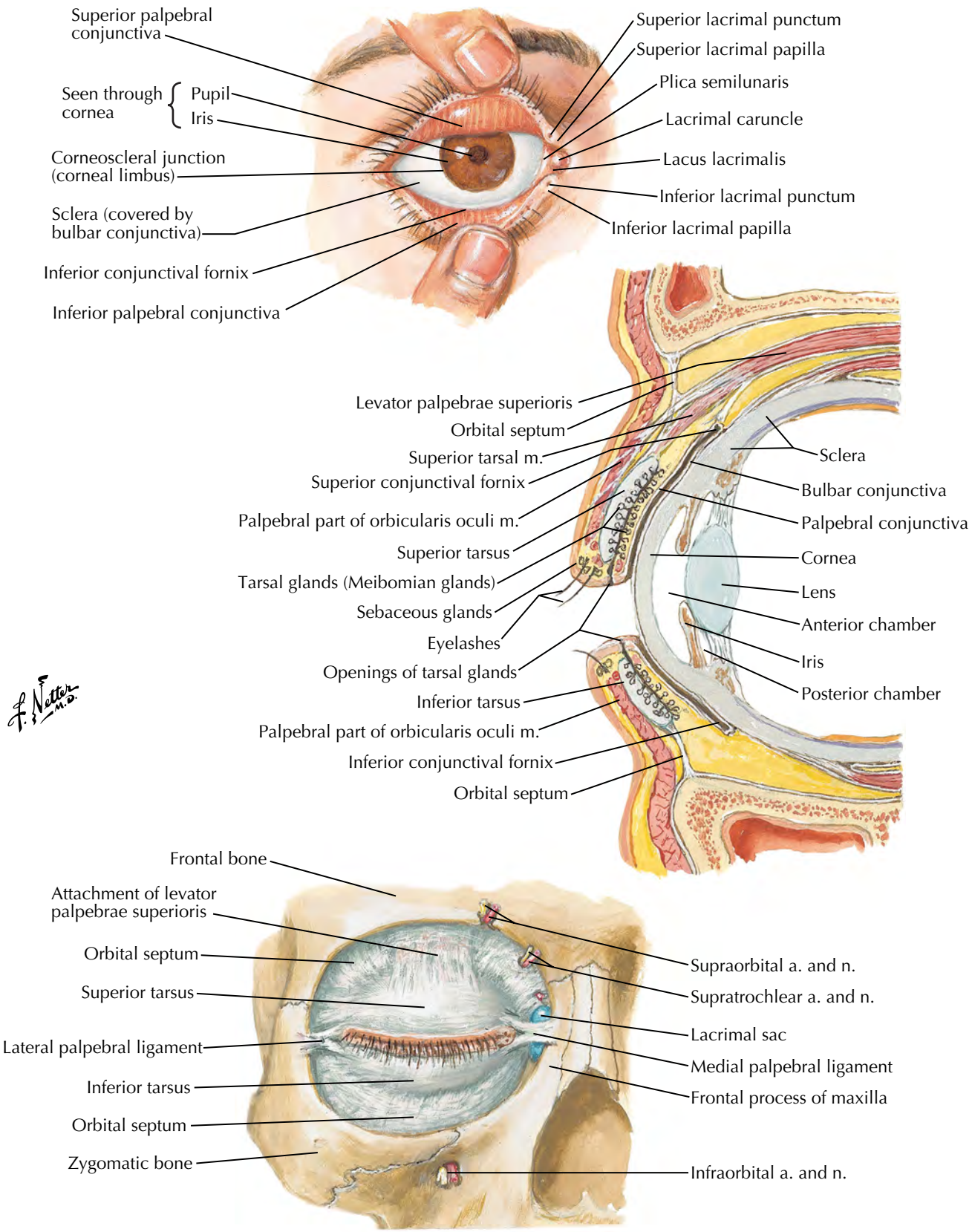
Action of lateral cricoarytenoid muscles
Adduction of vocal ligaments



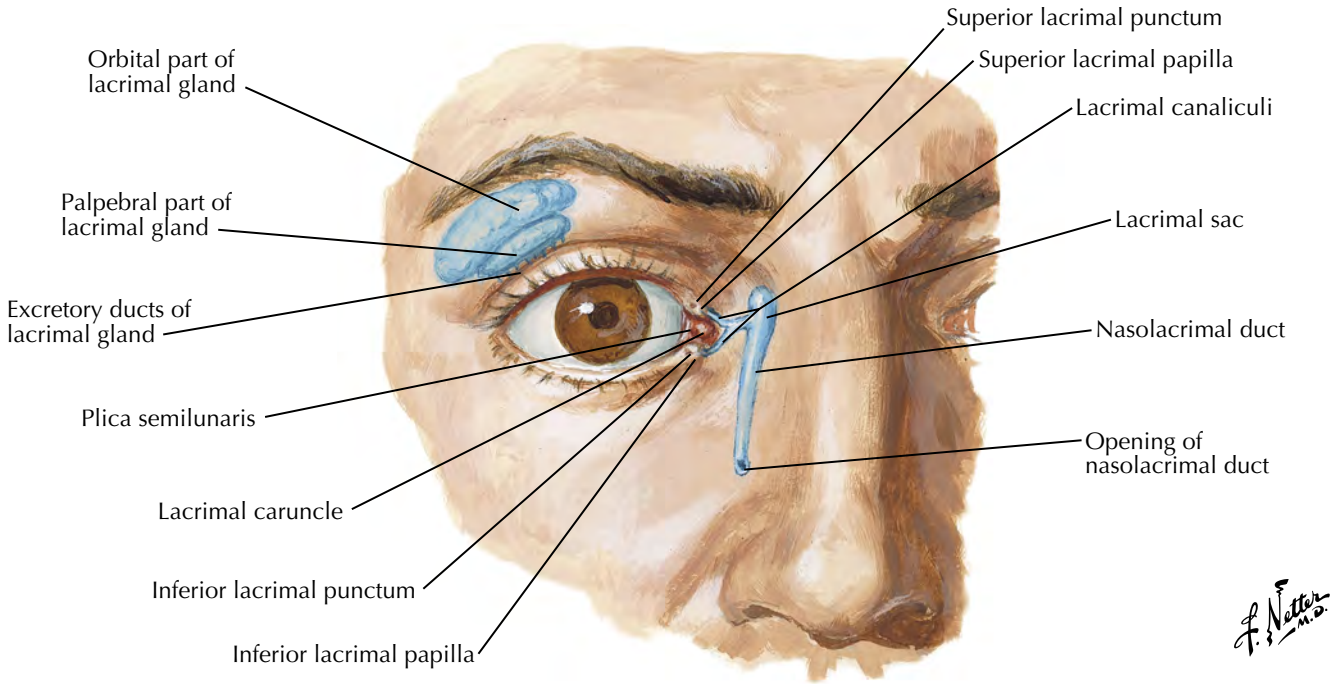
Action of transverse and oblique arytenoid muscles
Adduction of vocal ligaments

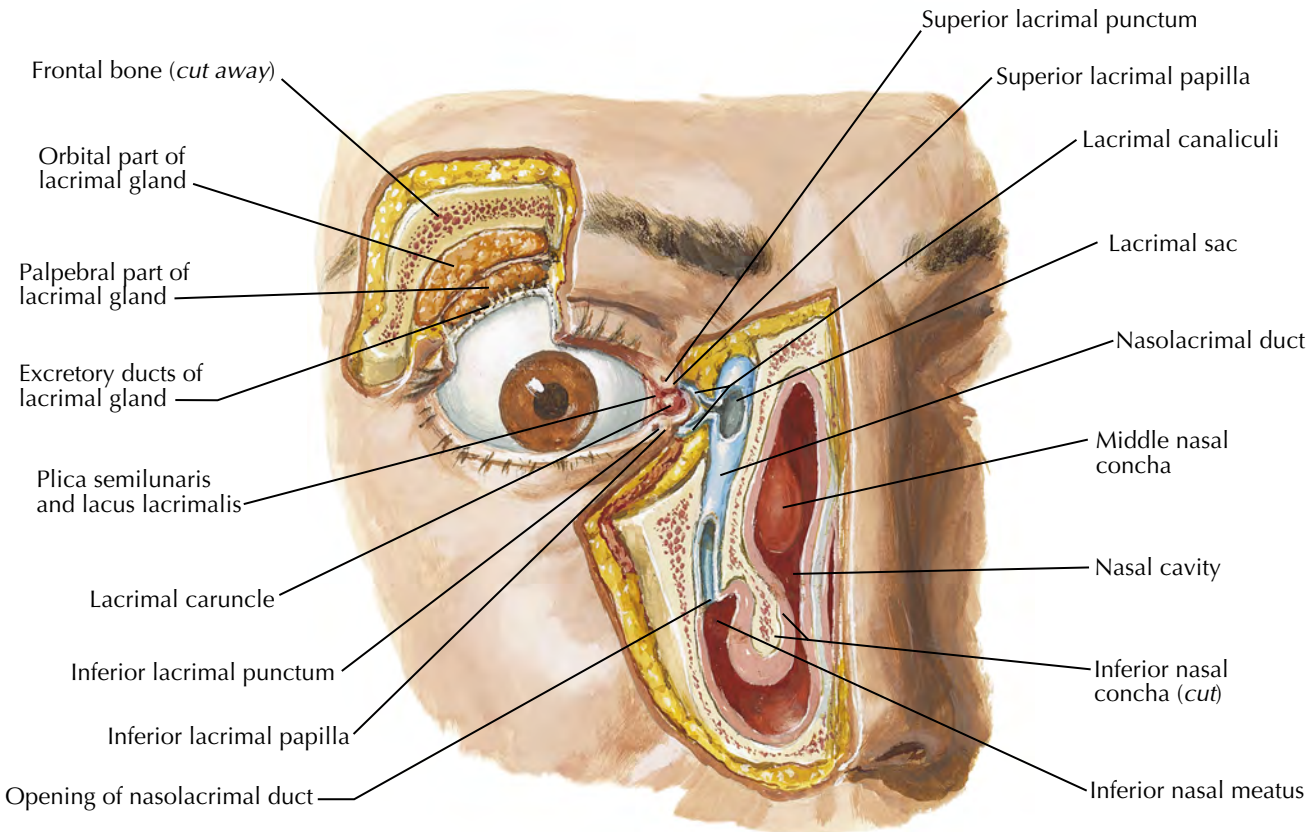


Action of vocalis and thyroarytenoid muscles
Shortening (relaxation) of vocal ligaments

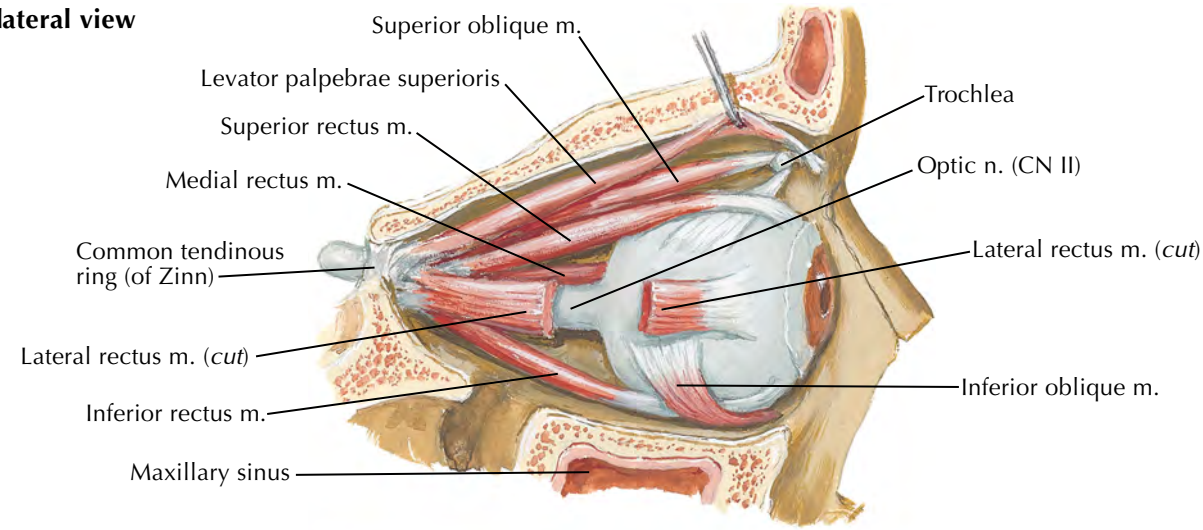

Superior palpebral conjunctiva
Seen through cornea
Pupil
Iris
Corneoscleral junction (corneal limbus)
Sclera (covered by bulbar conjunctiva)
Inferior conjunctival fornix
Inferior palpebral conjunctiva
Superior lacrimal punctum
Superior lacrimal papilla
Plica semilunaris
Lacrimal caruncle
Lacus lacrimalis
Inferior lacrimal punctum
Inferior lacrimal papilla
Levator palpebrae superioris
Orbital septum
Superior tarsal m.
Superior conjunctival fornix
Palpebral part of orbicularis oculi m.
Superior tarsus
Tarsal glands (Meibomian glands)
Sebaceous glands
Eyelashes
Openings of tarsal glands
Inferior tarsus
Palpebral part of orbicularis oculi m.
Inferior conjunctival fornix
Orbital septum
Sclera
Bulbar conjunctiva
Palpebral conjunctiva
Cornea
Lens
Anterior chamber
Iris
Posterior chamber
Frontal bone
Attachment of levator palpebrae superioris
Orbital septum
Superior tarsus
Lateral palpebral ligament
Inferior tarsus
Orbital septum
Zygomatic bone
Supraorbital a. and n.
Supratrochlear a. and n.
Lacrimal sac
Medial palpebral ligament
Frontal process of maxilla
Infraorbital a. and n.

See also **Plates 61, 160**

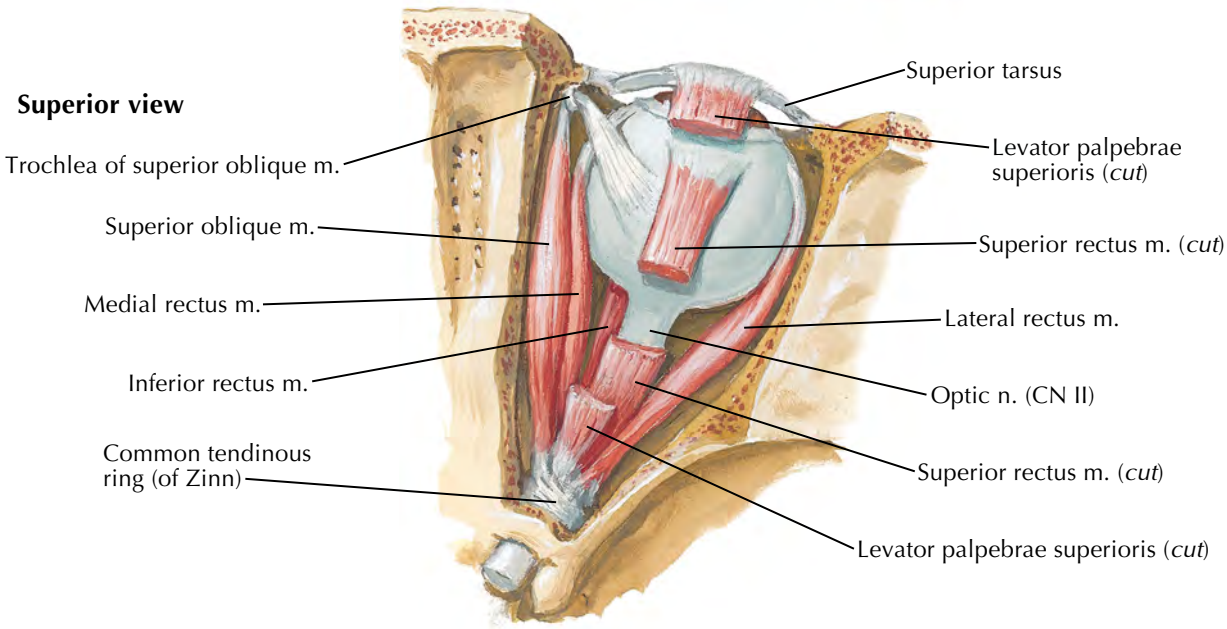




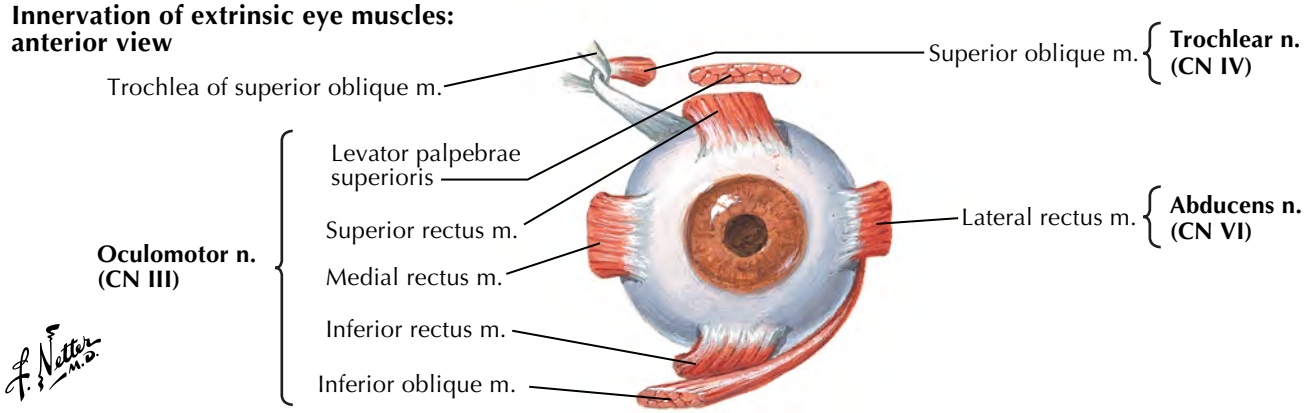
Right lateral view



Superior view

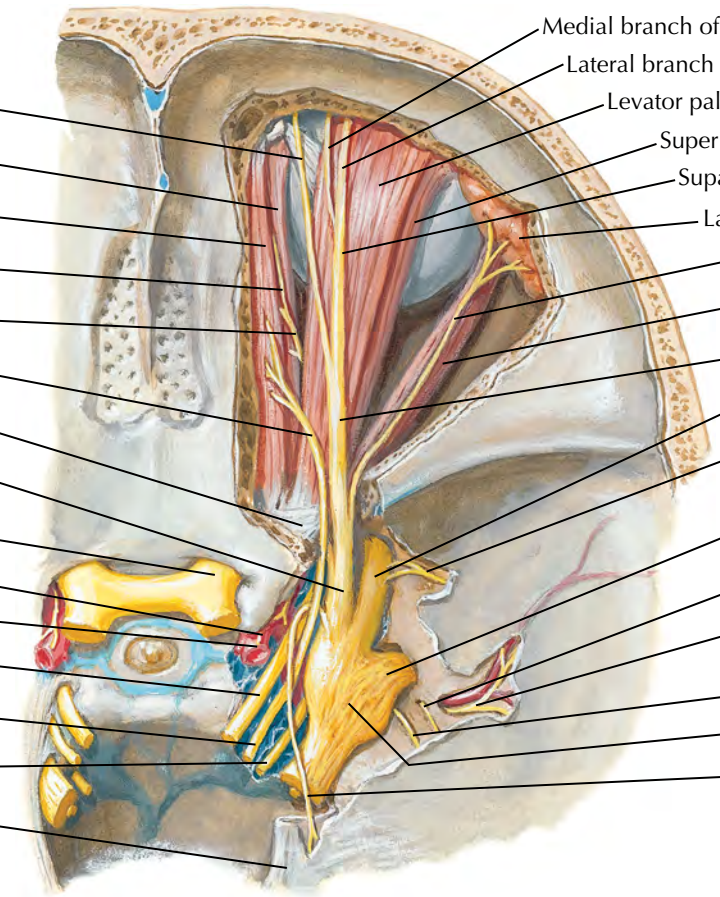


Innervation of extrinsic eye muscles: anterior view

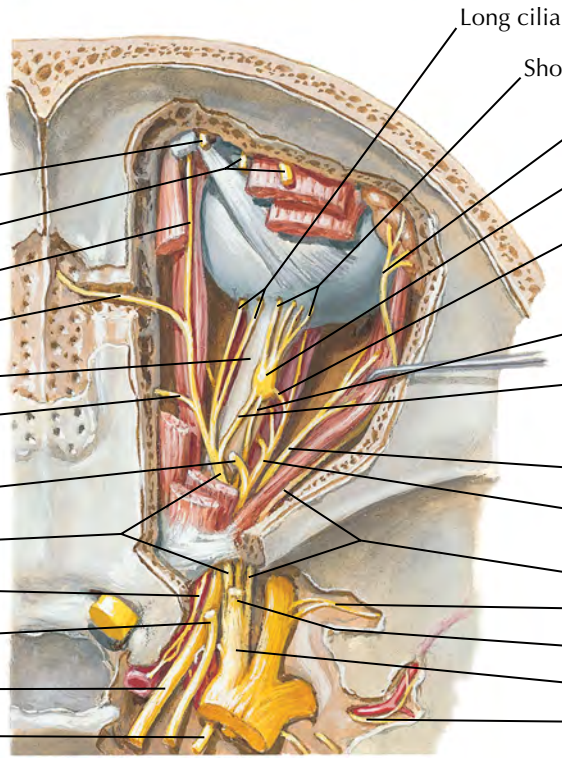


See also **Plates 79, 148, 149, BP 27**

Superior view

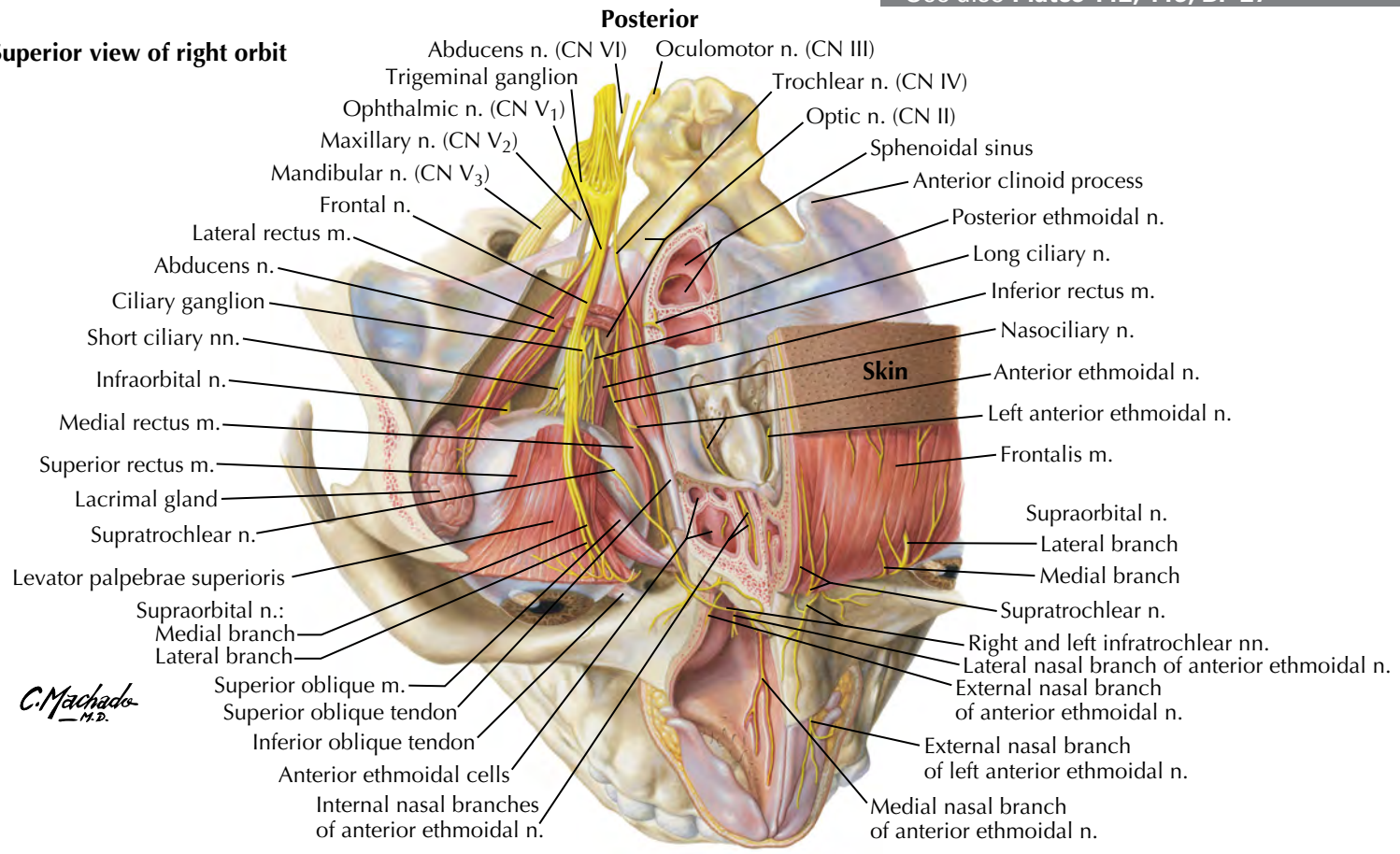


Superior view:
levator palpebrae superioris, superior rectus, and superior oblique muscles partially cut away

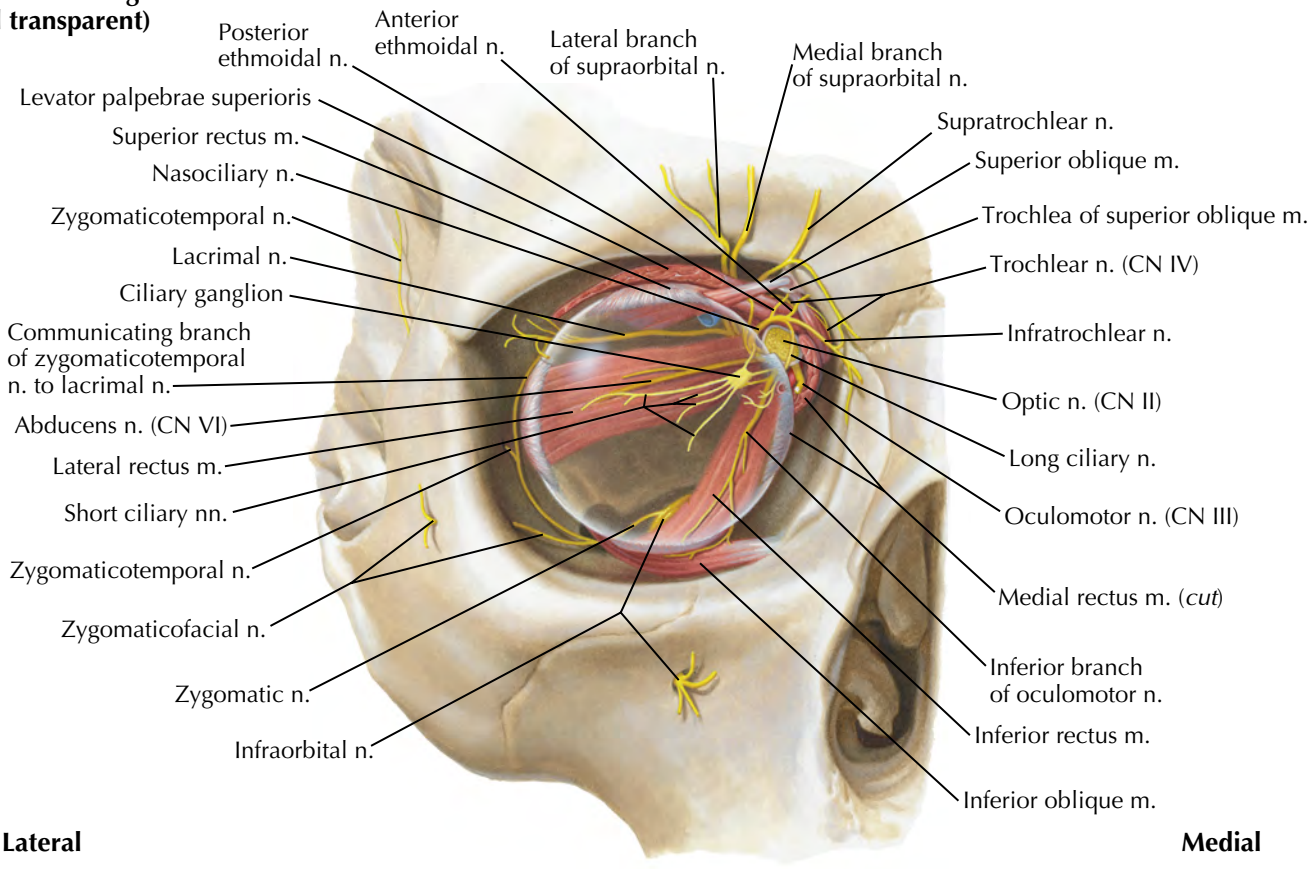


See also **Plates 112, 113, BP 27**

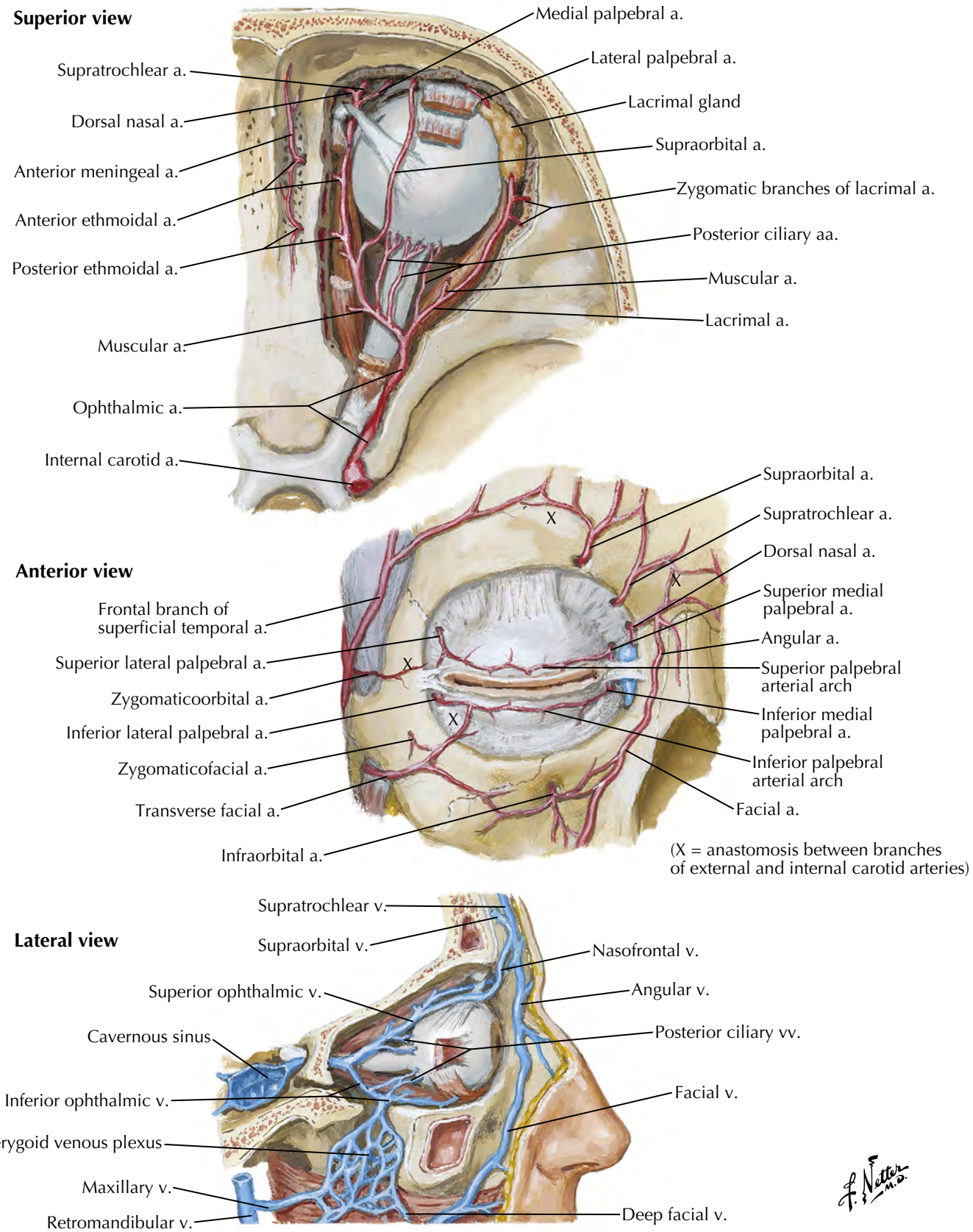
Superior view of right orbit



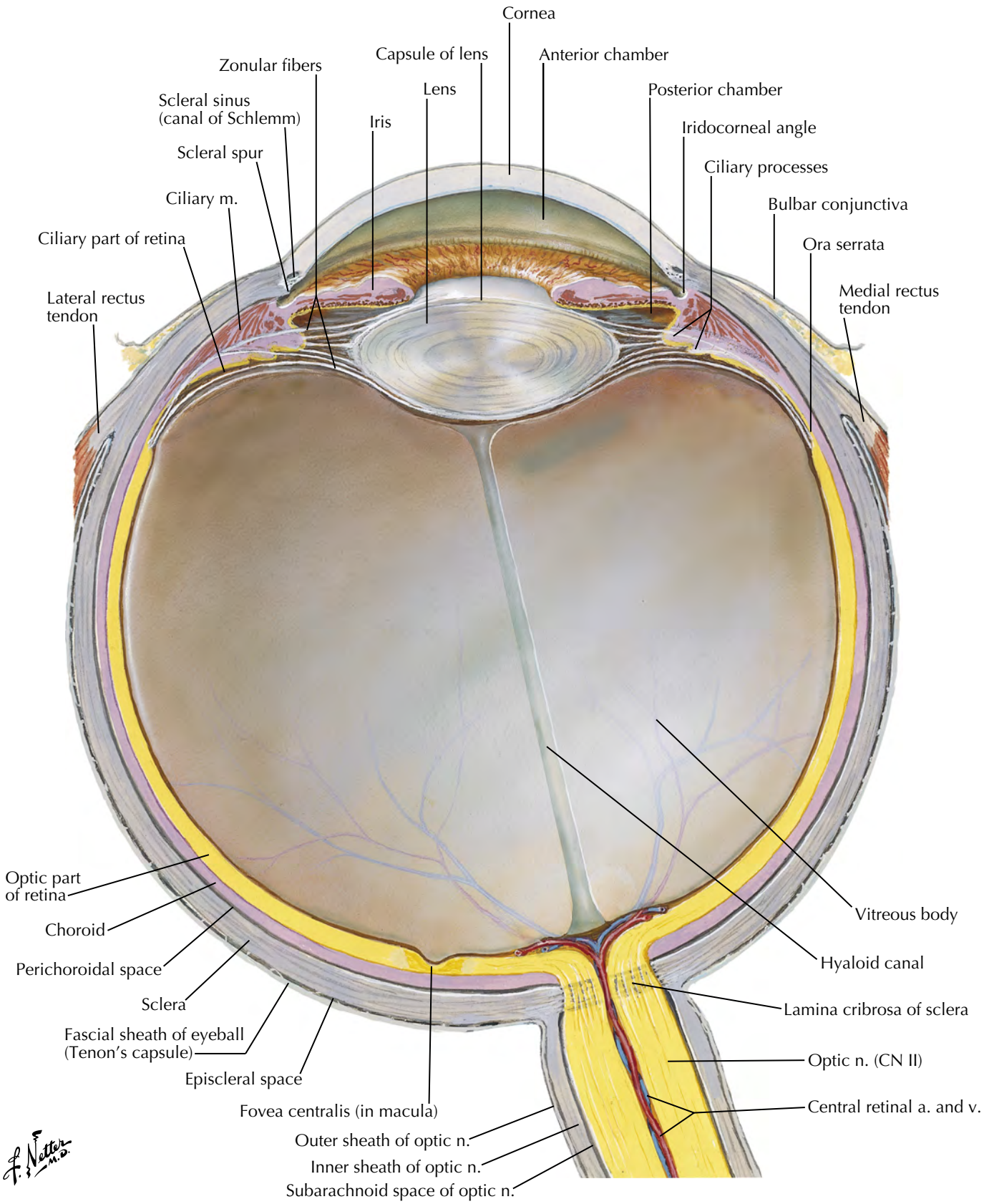
Anterior view of right orbit (eyeball transparent)

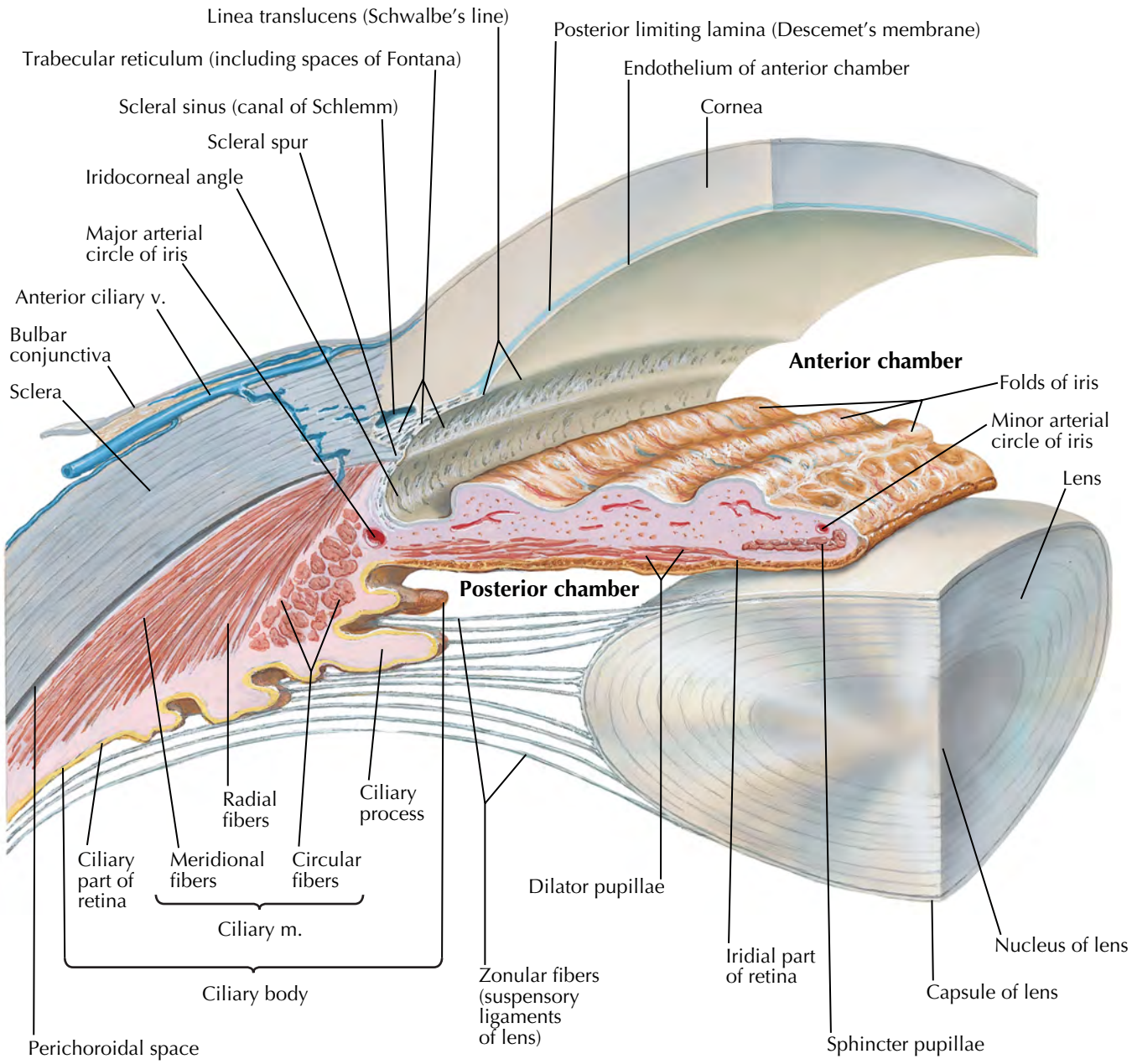


See also **Plates 24, 100, 110**

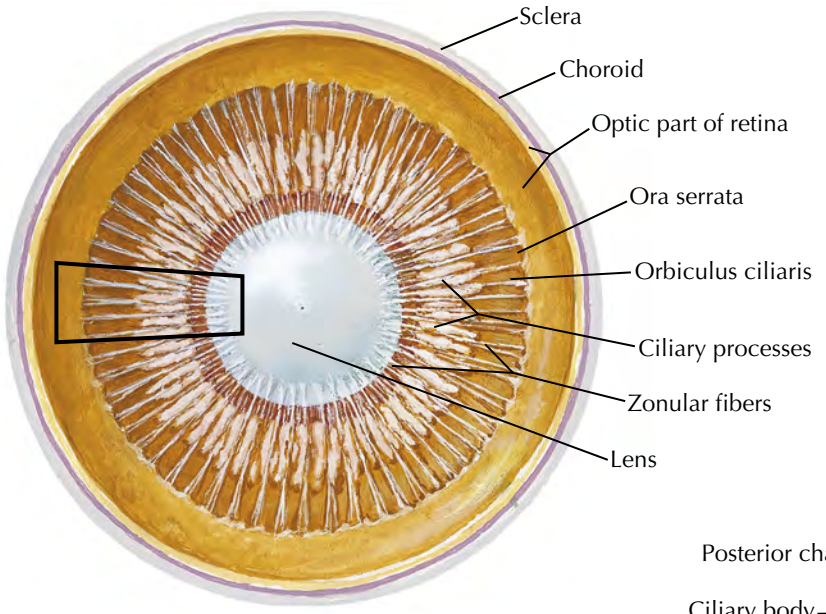


See also **Plates 117, 118**

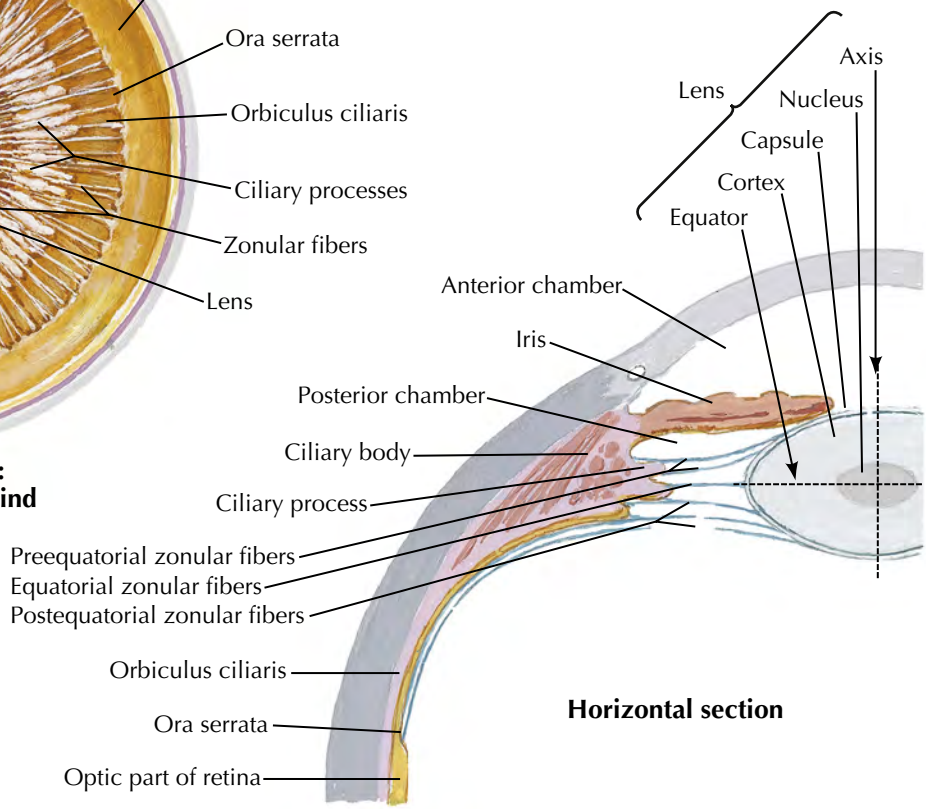




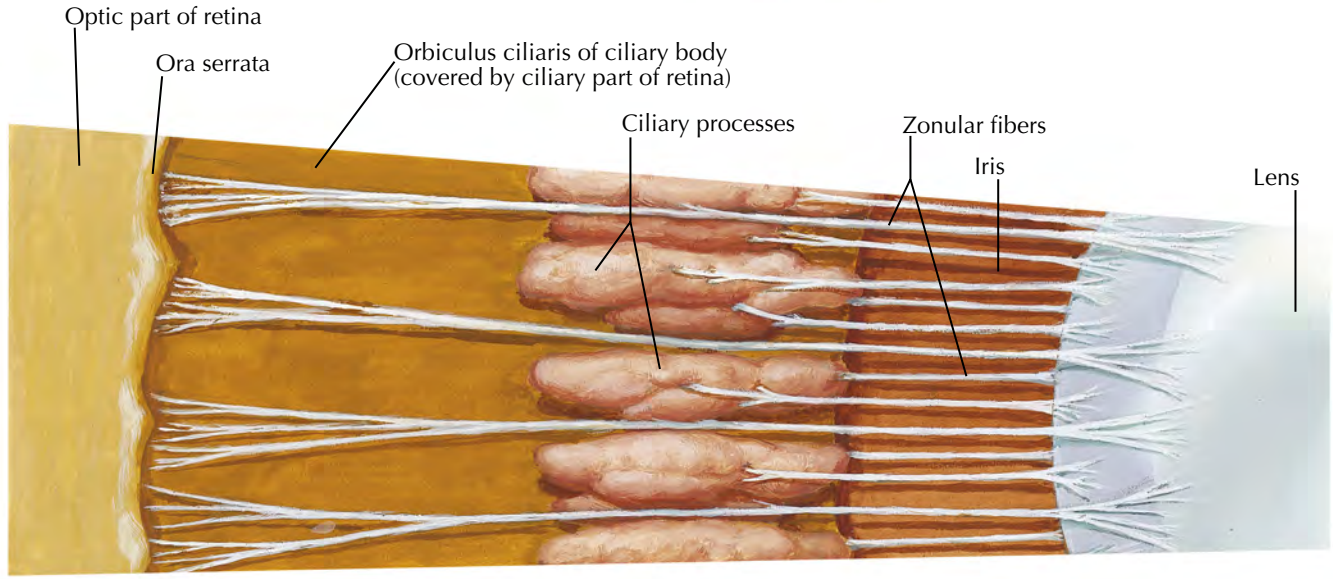
Note: For clarity, only single plane of zonular fibers shown; actually, fibers surround entire circumference of lens.



Eyeball sectioned in coronal plane: anterior segment viewed from behind

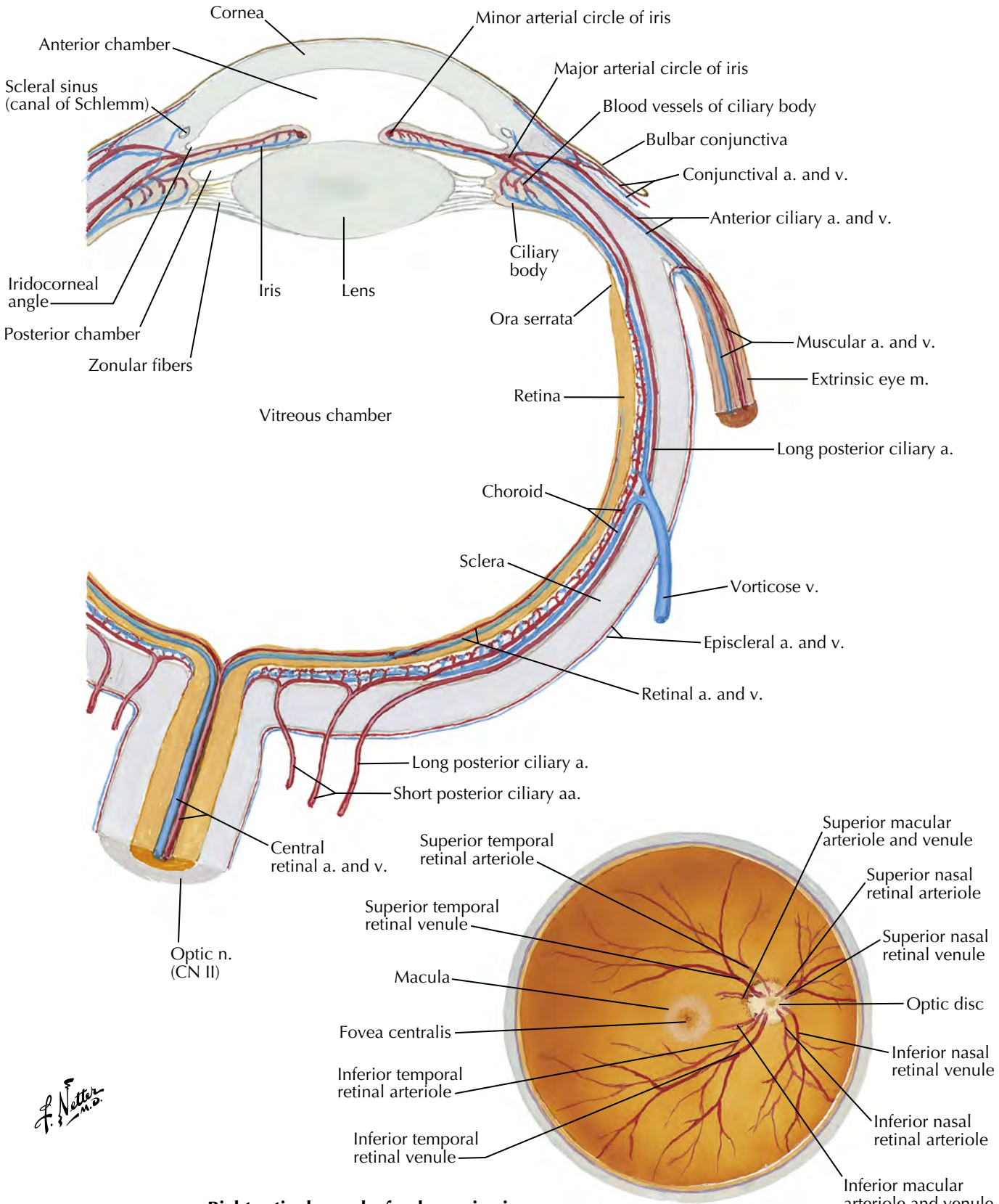


Horizontal section



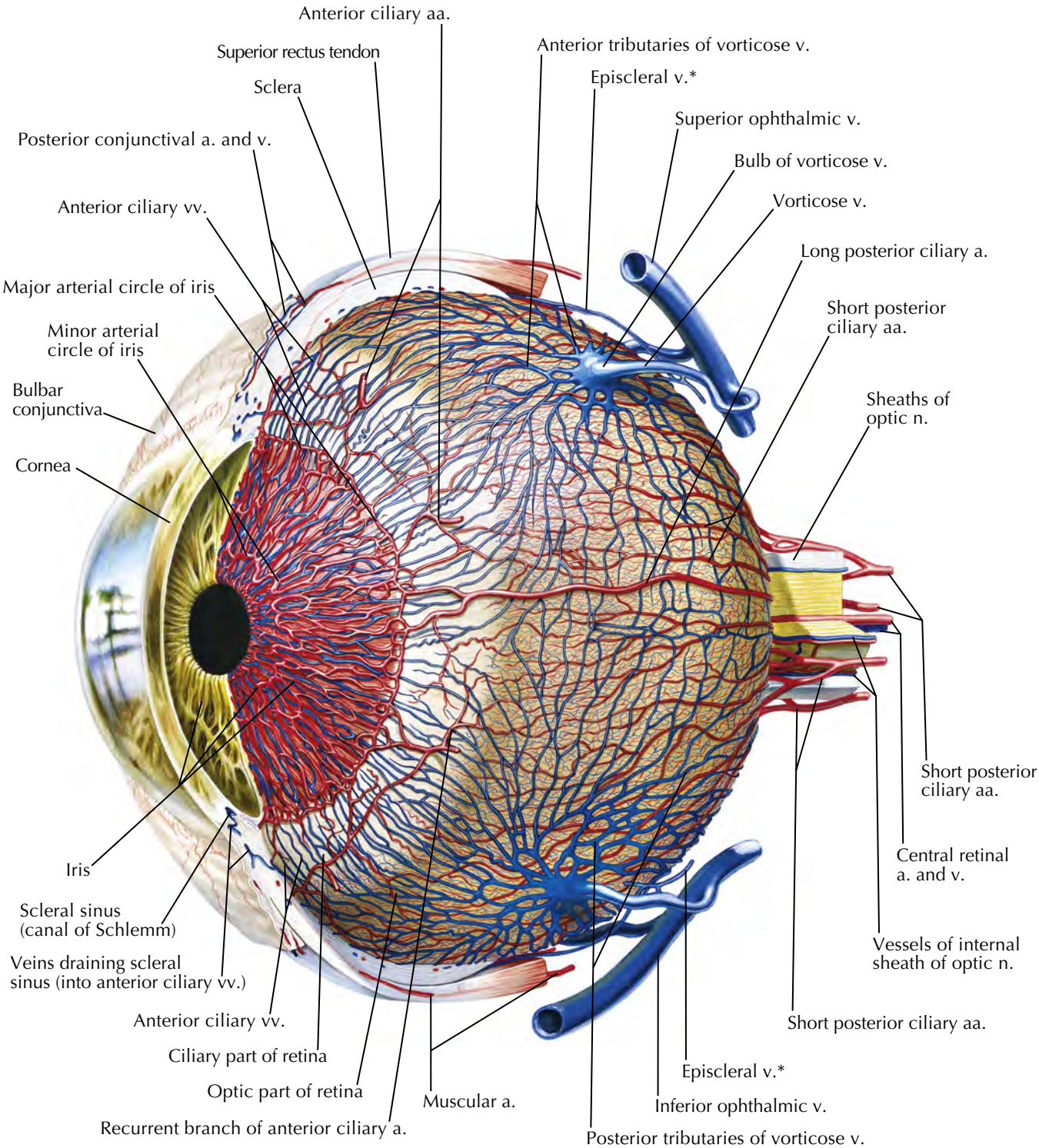
Enlargement of segment outlined in top illustration (semischematic)

See also **Plate 120**



Right retinal vessels: funduscopic view

Vascular arrangements within the vascular layer of eyeball



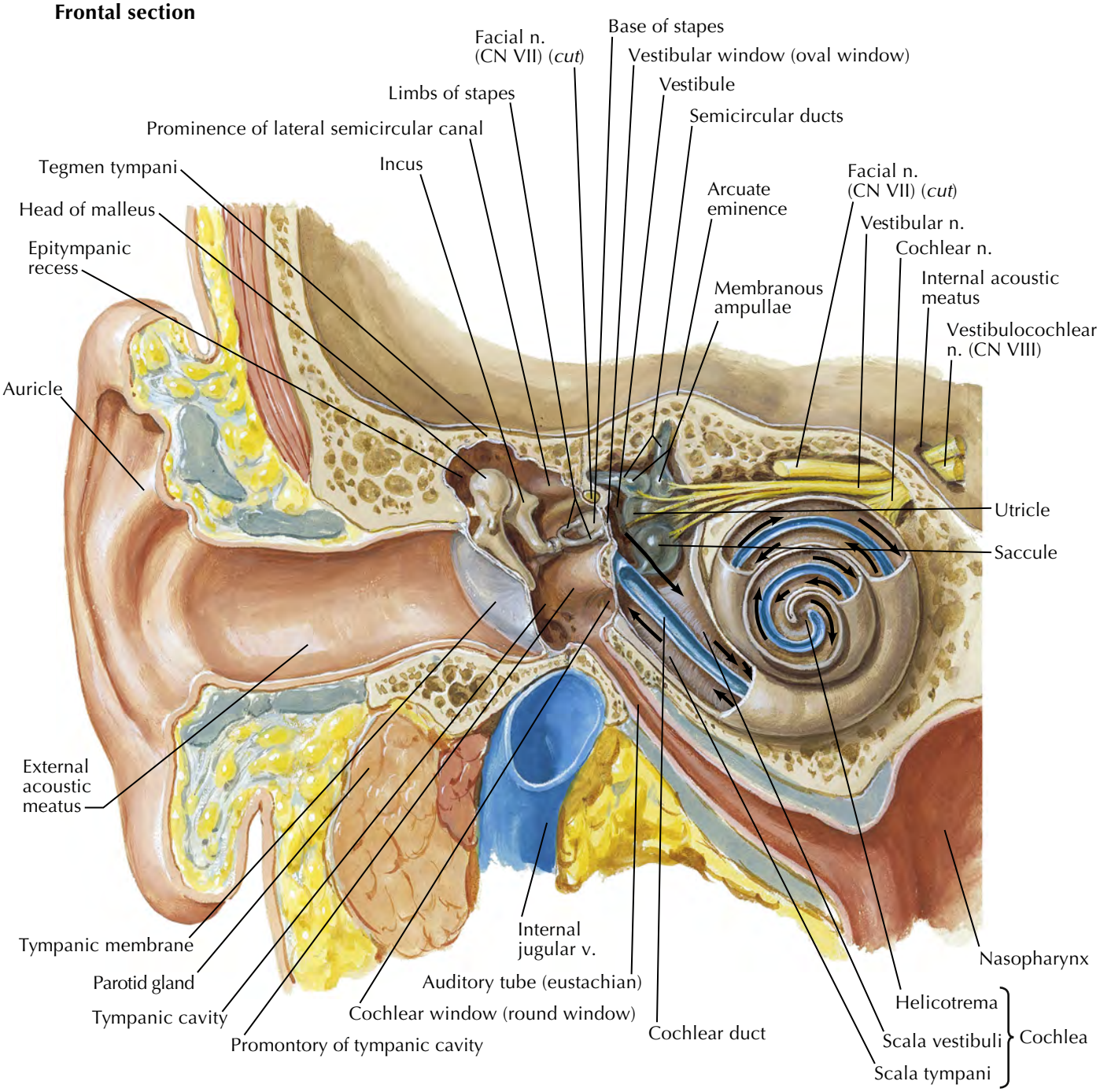
**The episcleral veins are shown here anastomosing with the vorticose veins, which they do; however, they also drain into the anterior ciliary veins.*

C. Machado M.D.

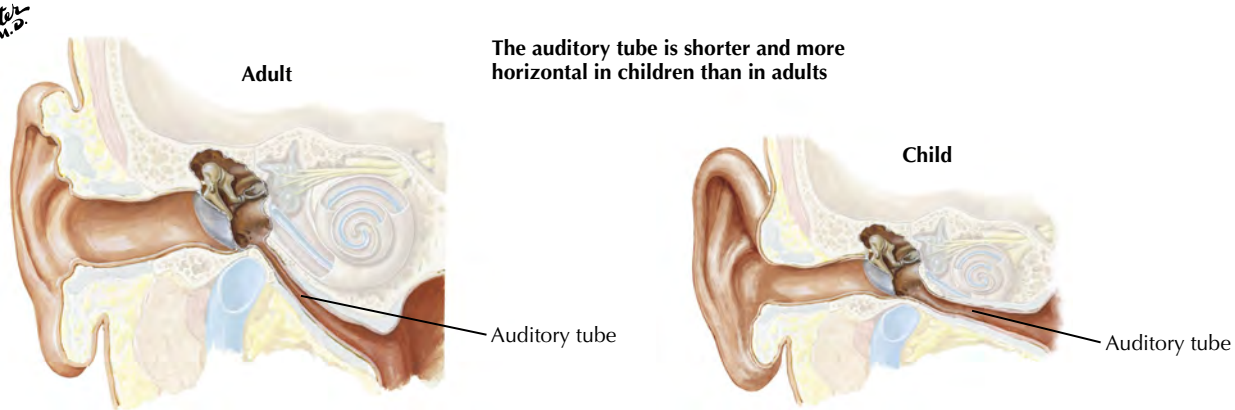
Ear and Course of Sound in Cochlea

See also **Plates BP 28, BP 29, BP 30**

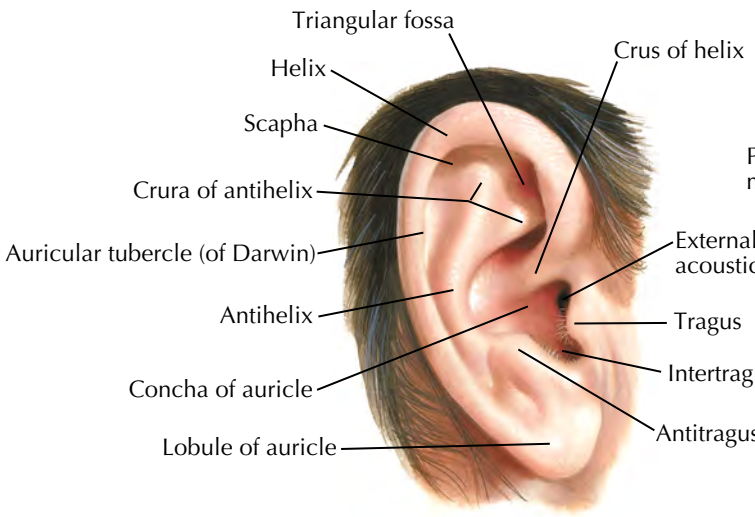
Frontal section



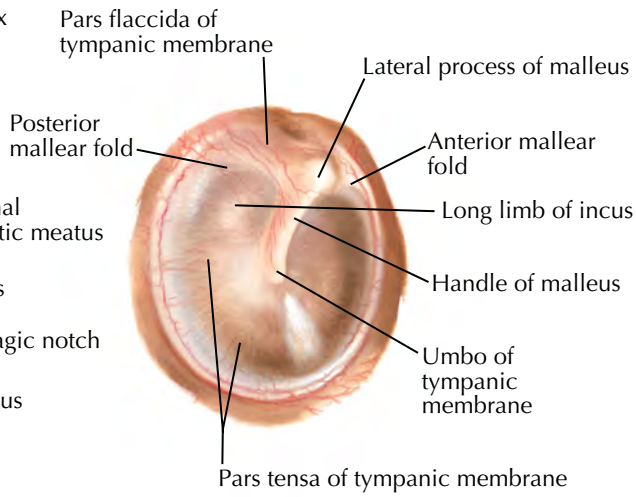
The auditory tube is shorter and more horizontal in children than in adults



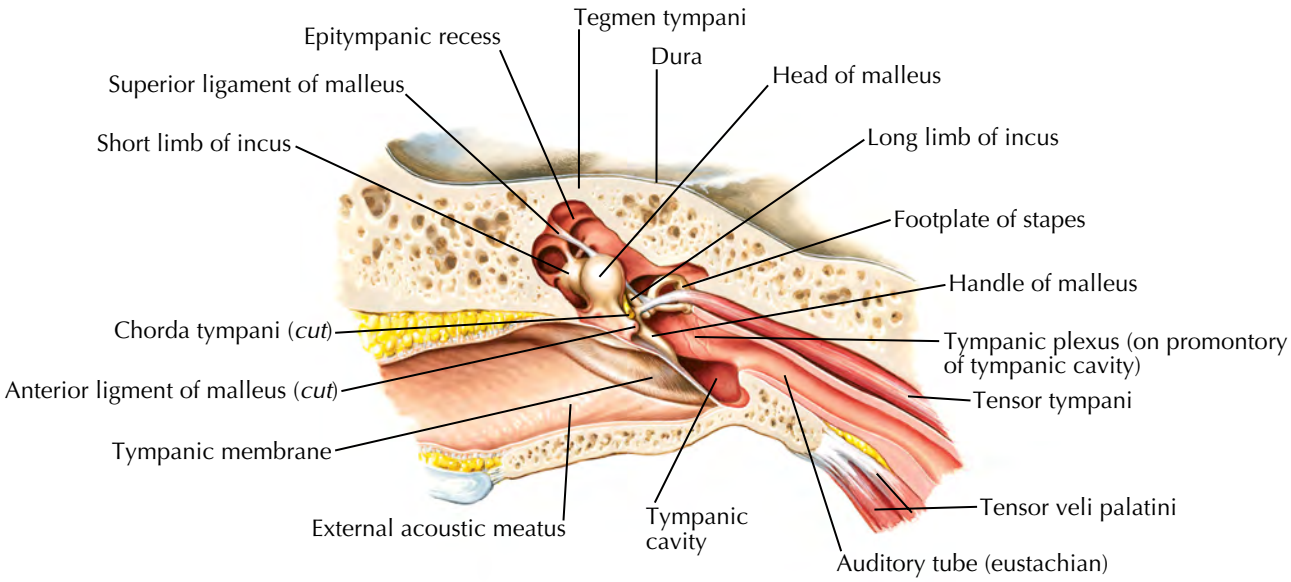
Right auricle



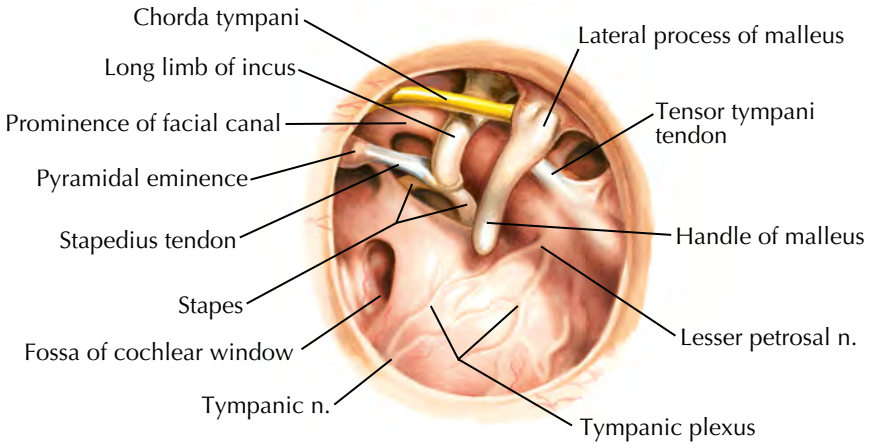
Otoscopic view of right tympanic membrane



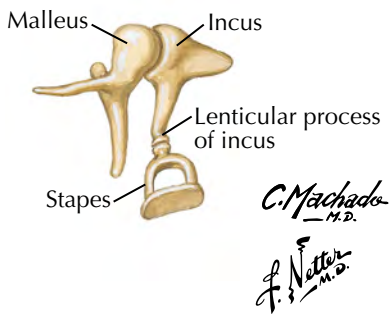
Coronal oblique section of external acoustic meatus and middle ear



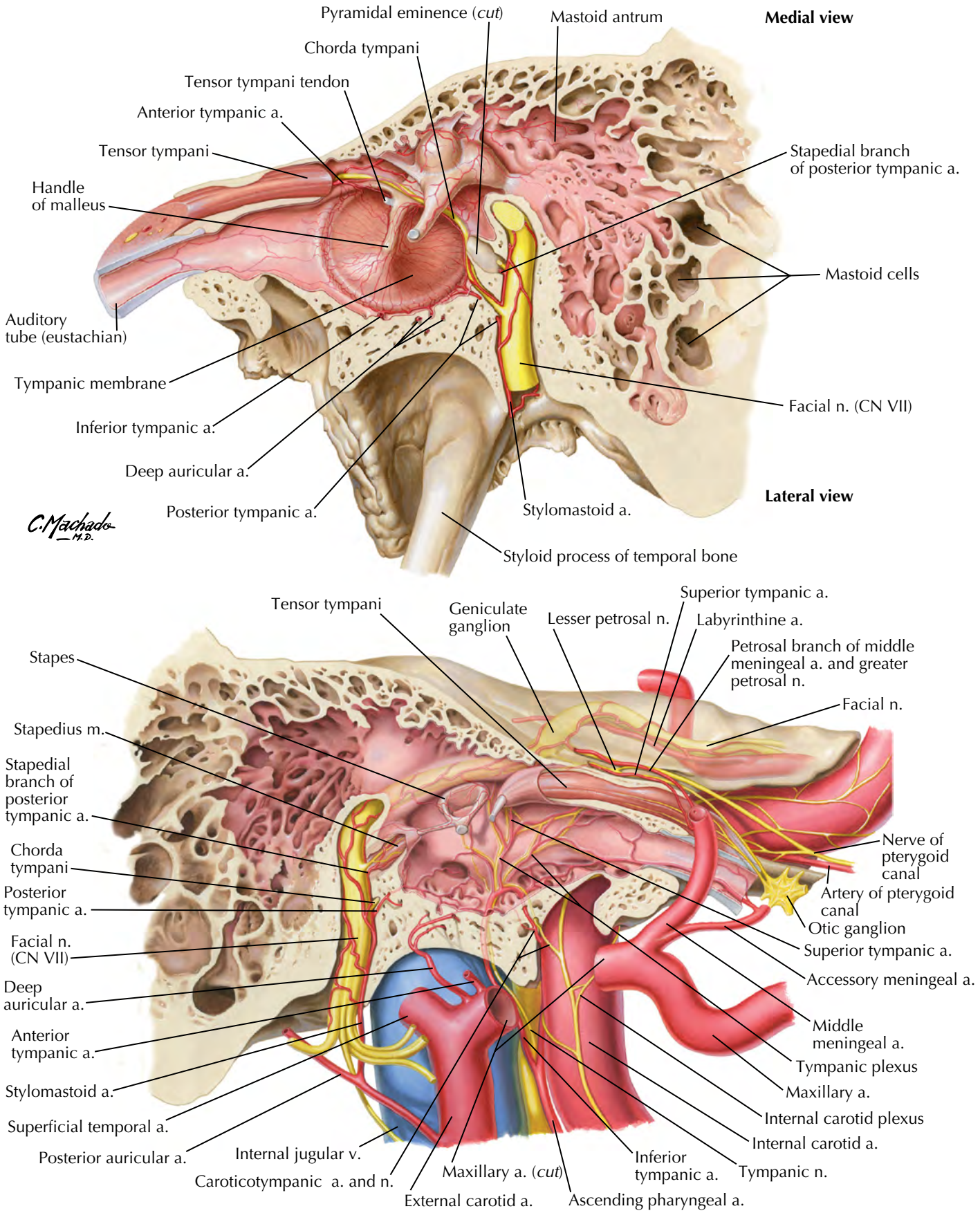
Right tympanic cavity after removal of tympanic membrane (lateral view)



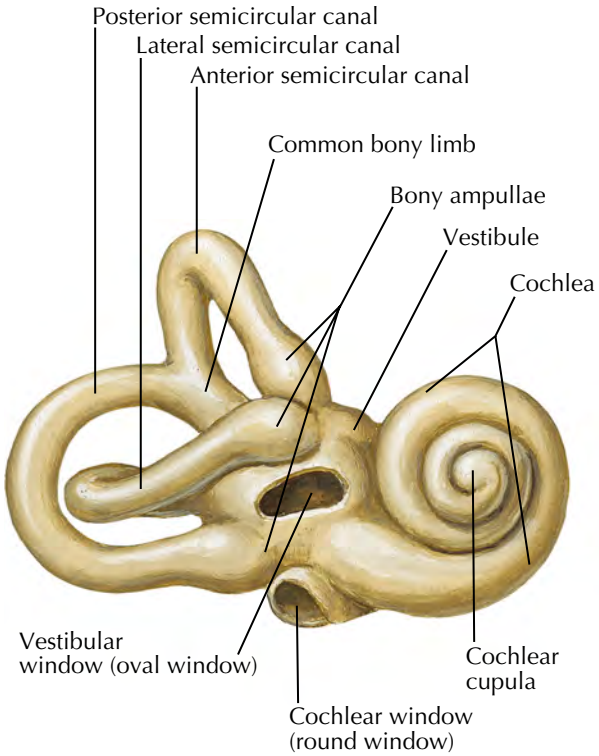
Auditory ossicles: medial view



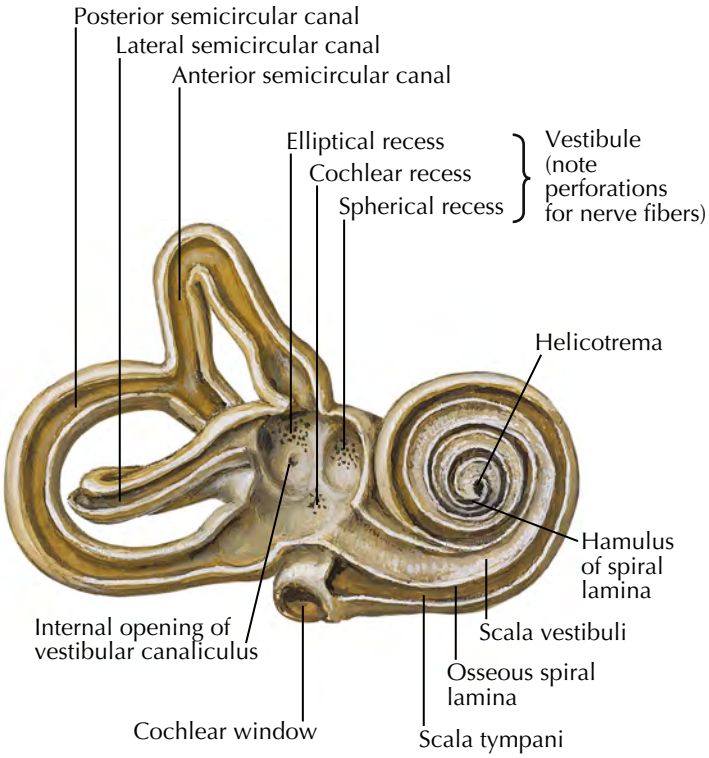
See also **Plates 77, 162, BP 28**



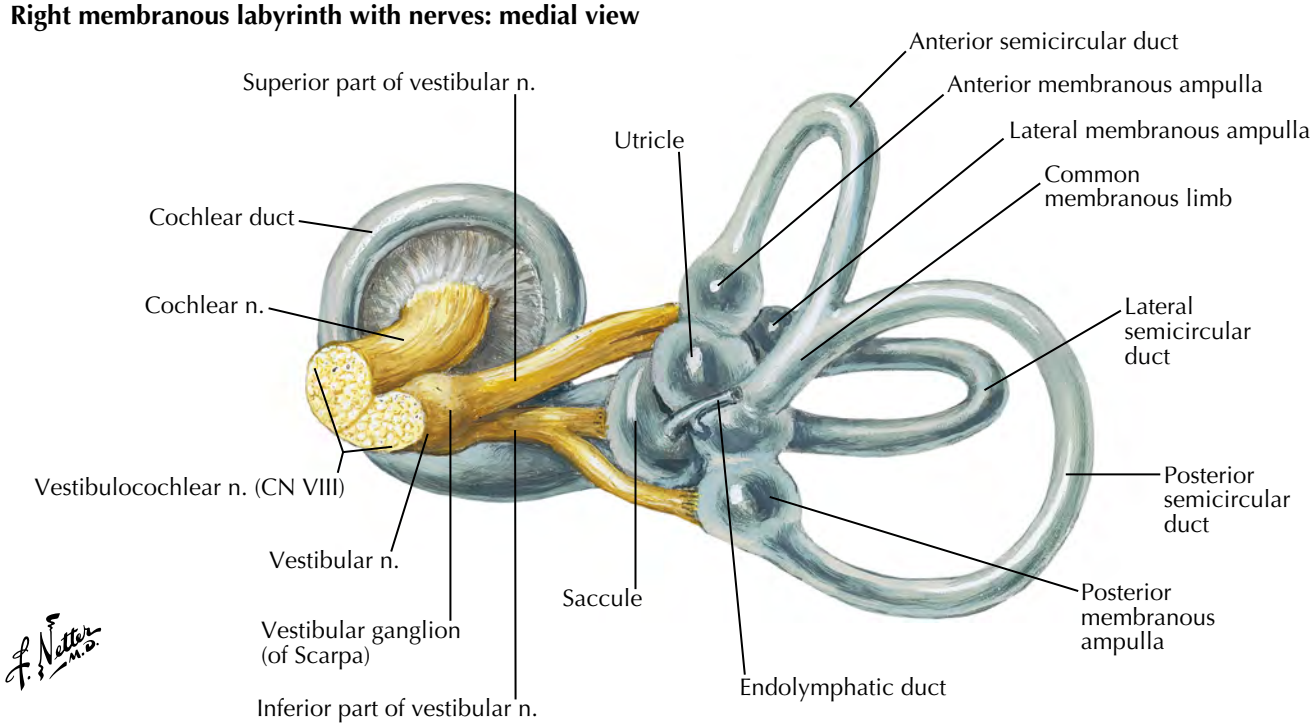
Right bony labyrinth (otic capsule), anterolateral view: surrounding cancellous bone removed



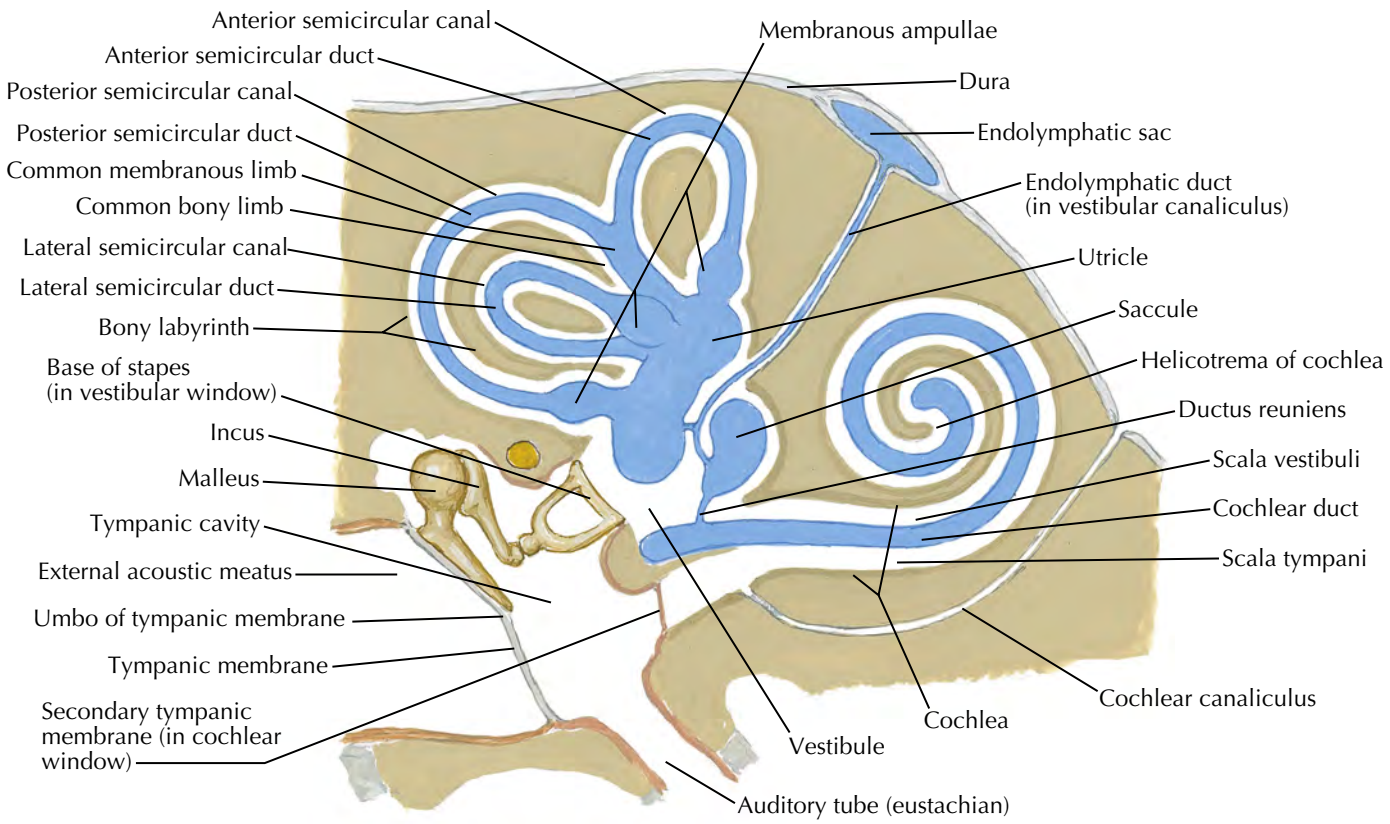
Dissected right bony labyrinth (otic capsule): membranous labyrinth removed



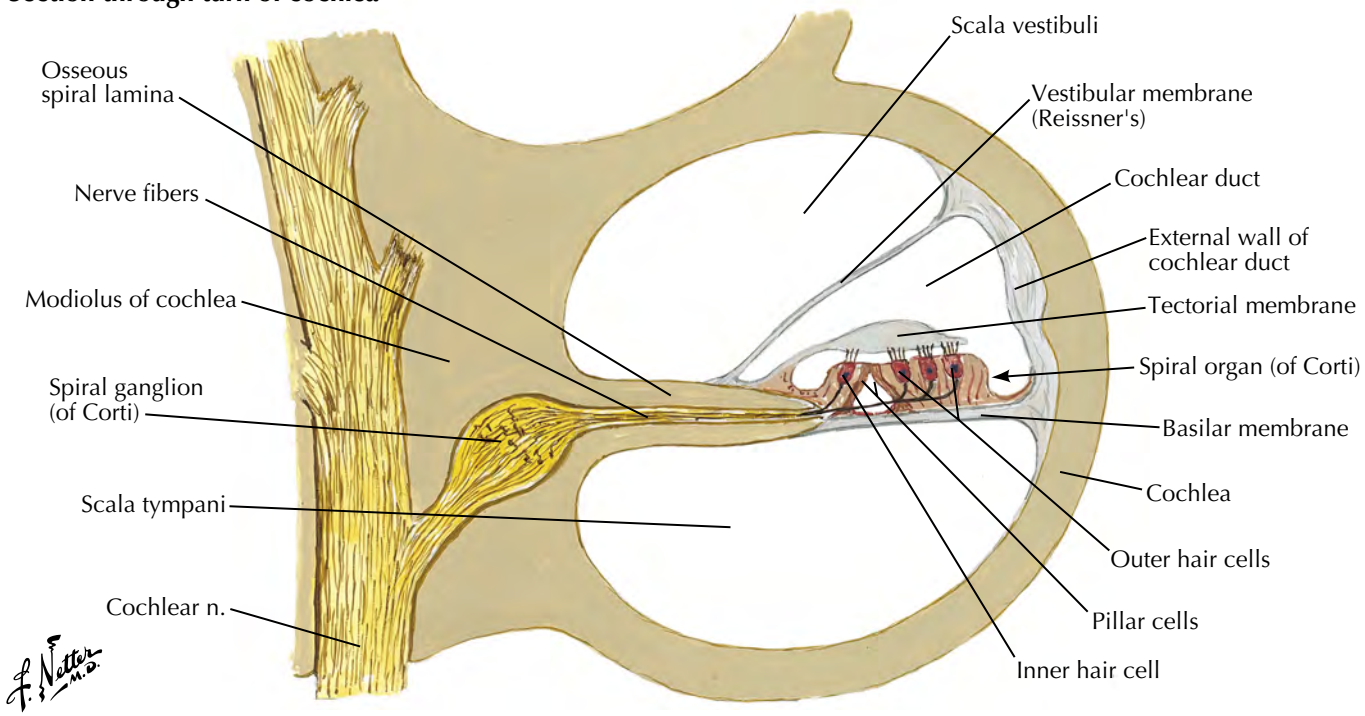
Right membranous labyrinth with nerves: medial view



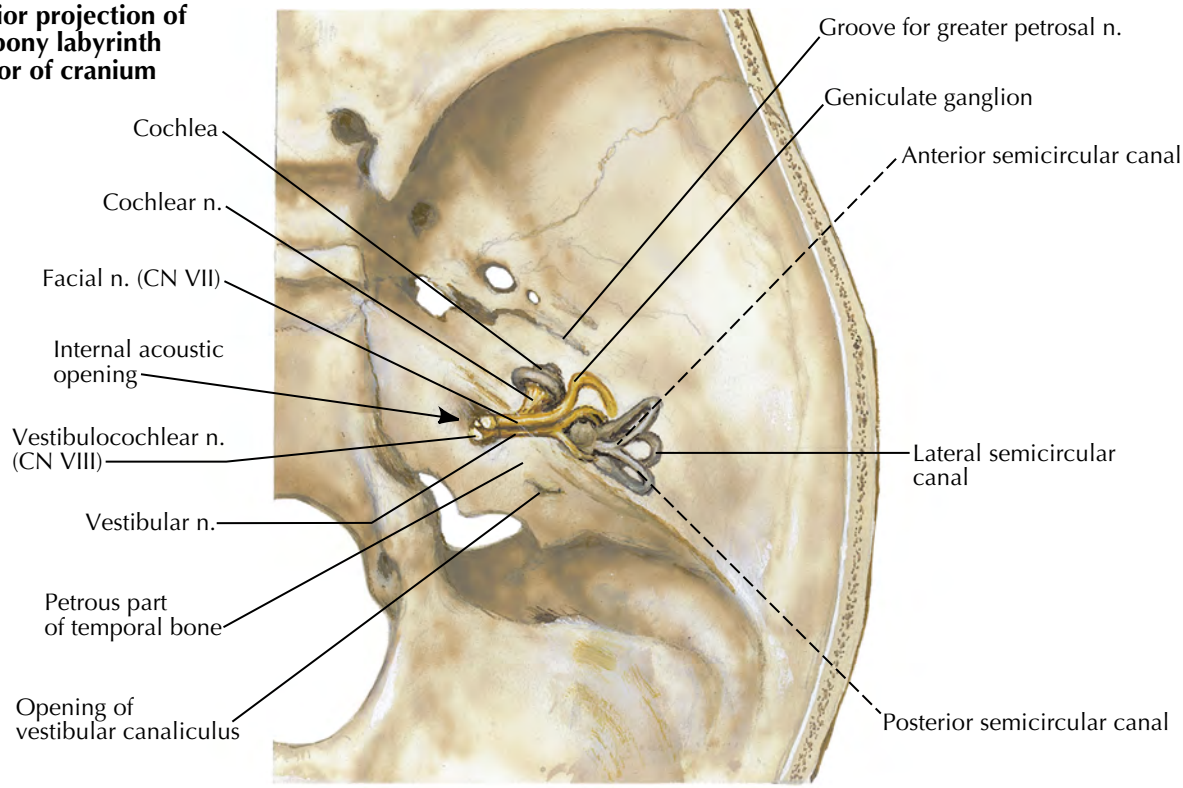
Bony and membranous labyrinths: schema



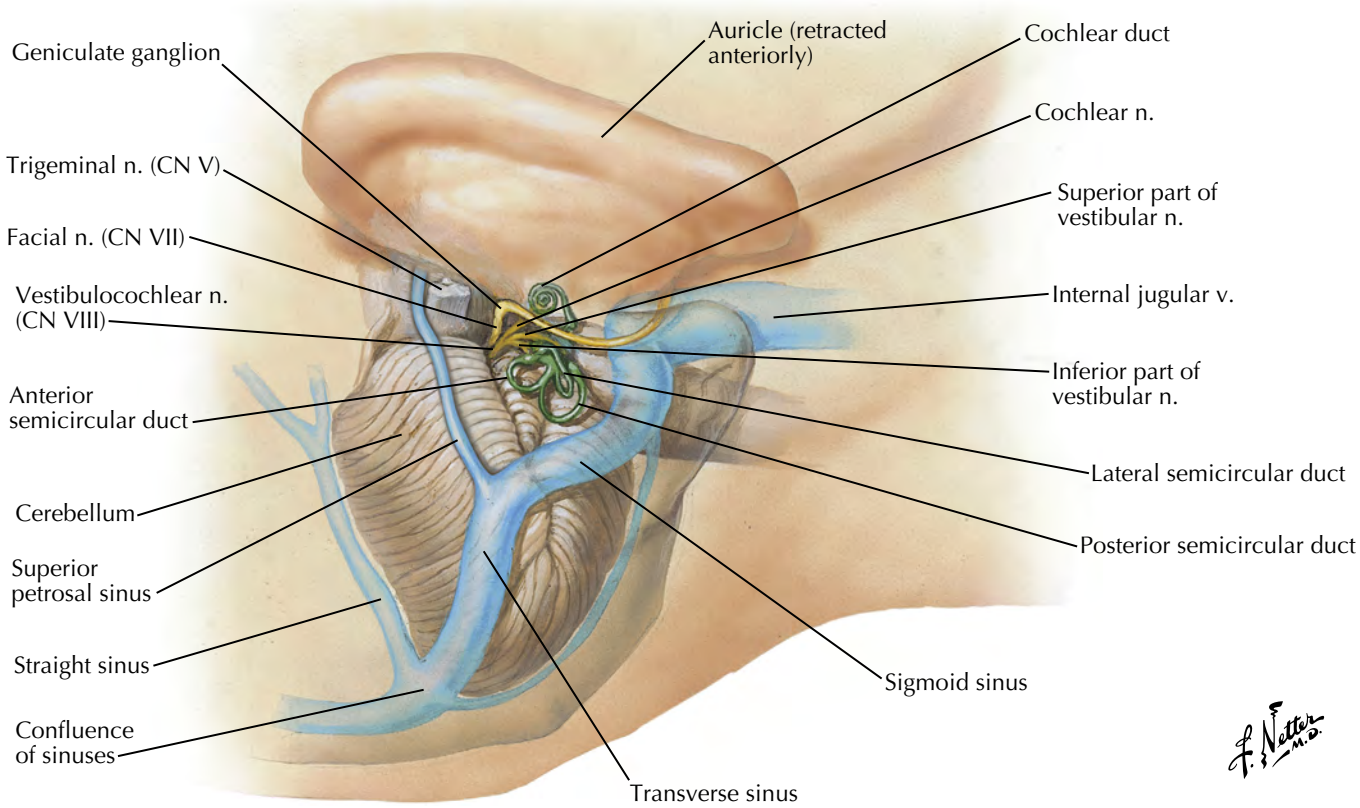
Section through turn of cochlea



Superior projection of right bony labyrinth on floor of cranium

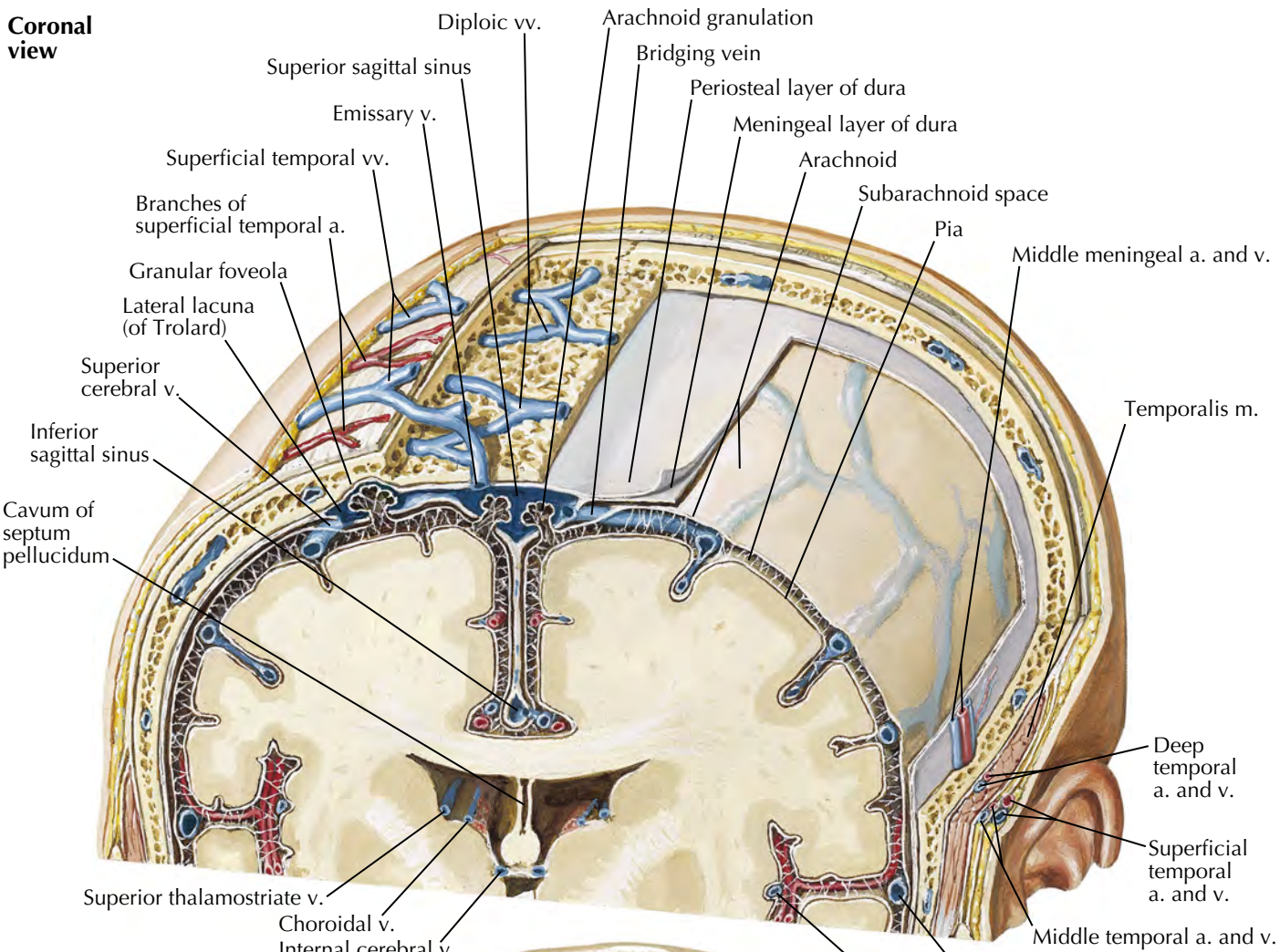


Lateral projection of right membranous labyrinth

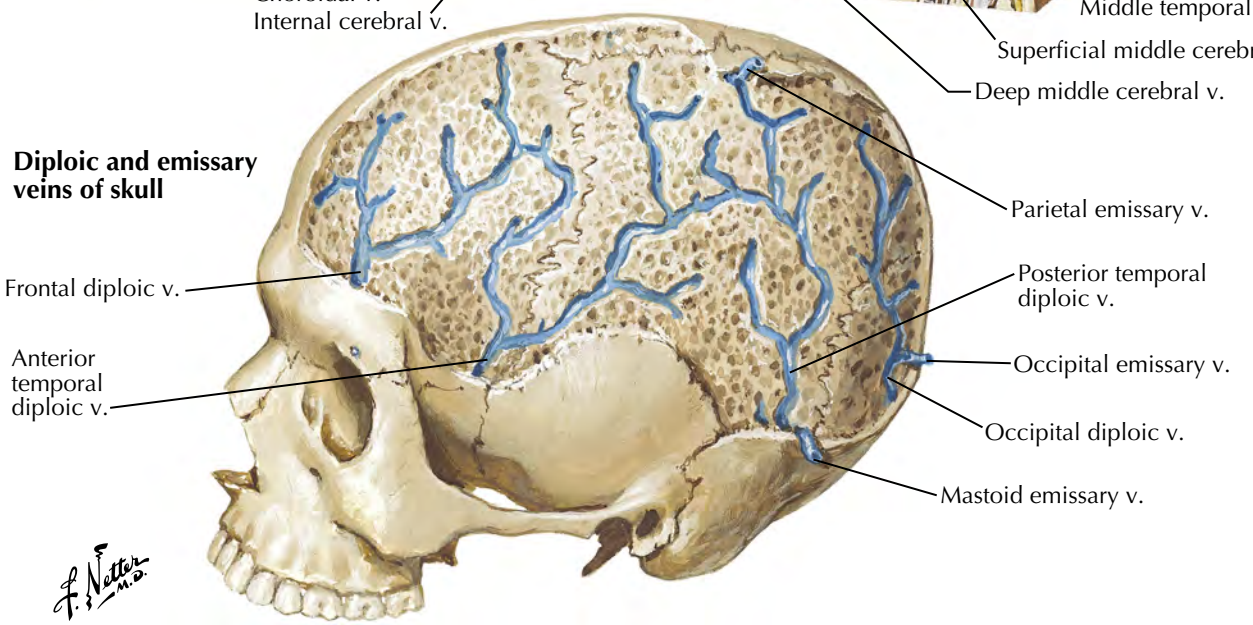


See also **Plate 24**

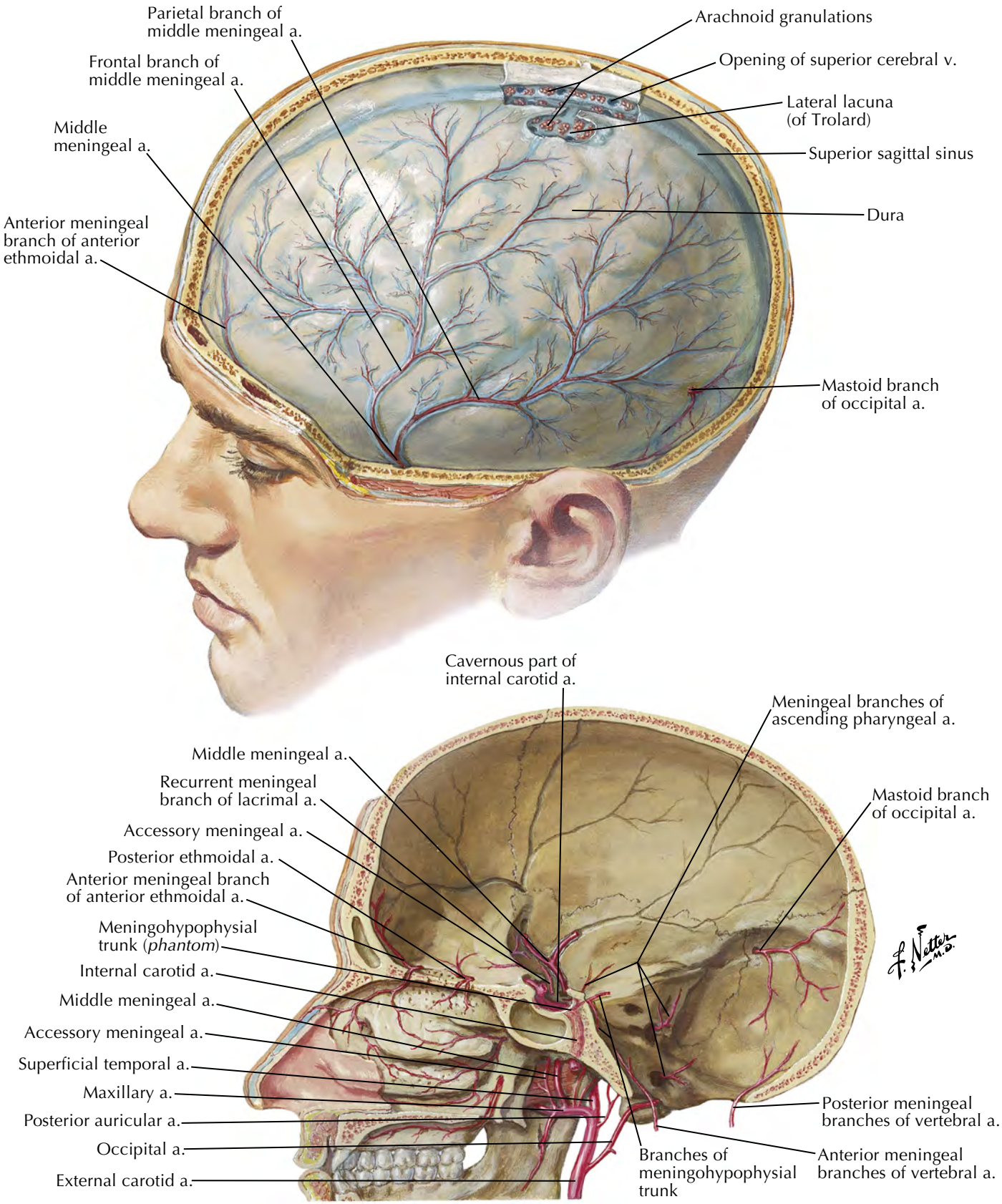
Coronal view



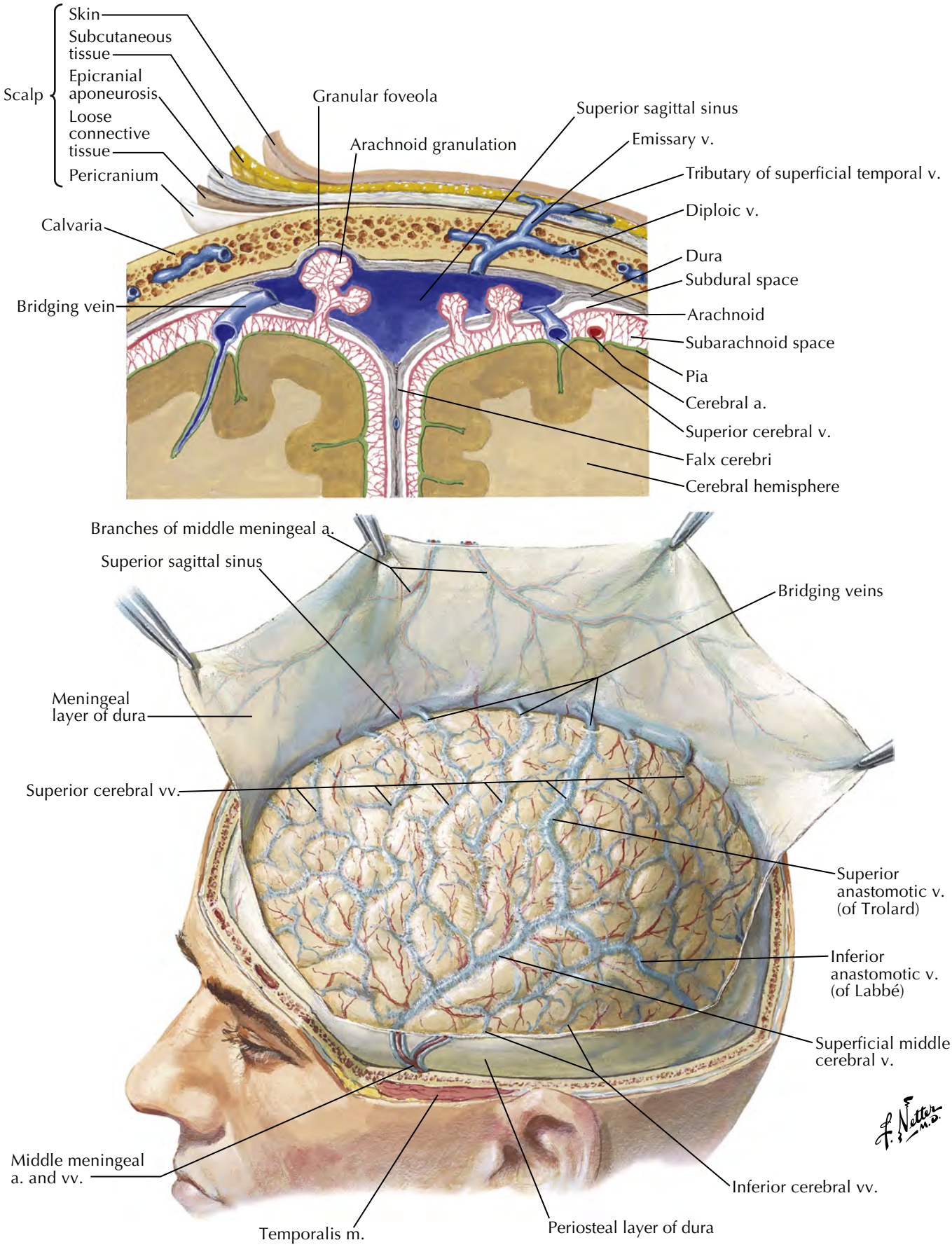
Diploic and emissary veins of skull



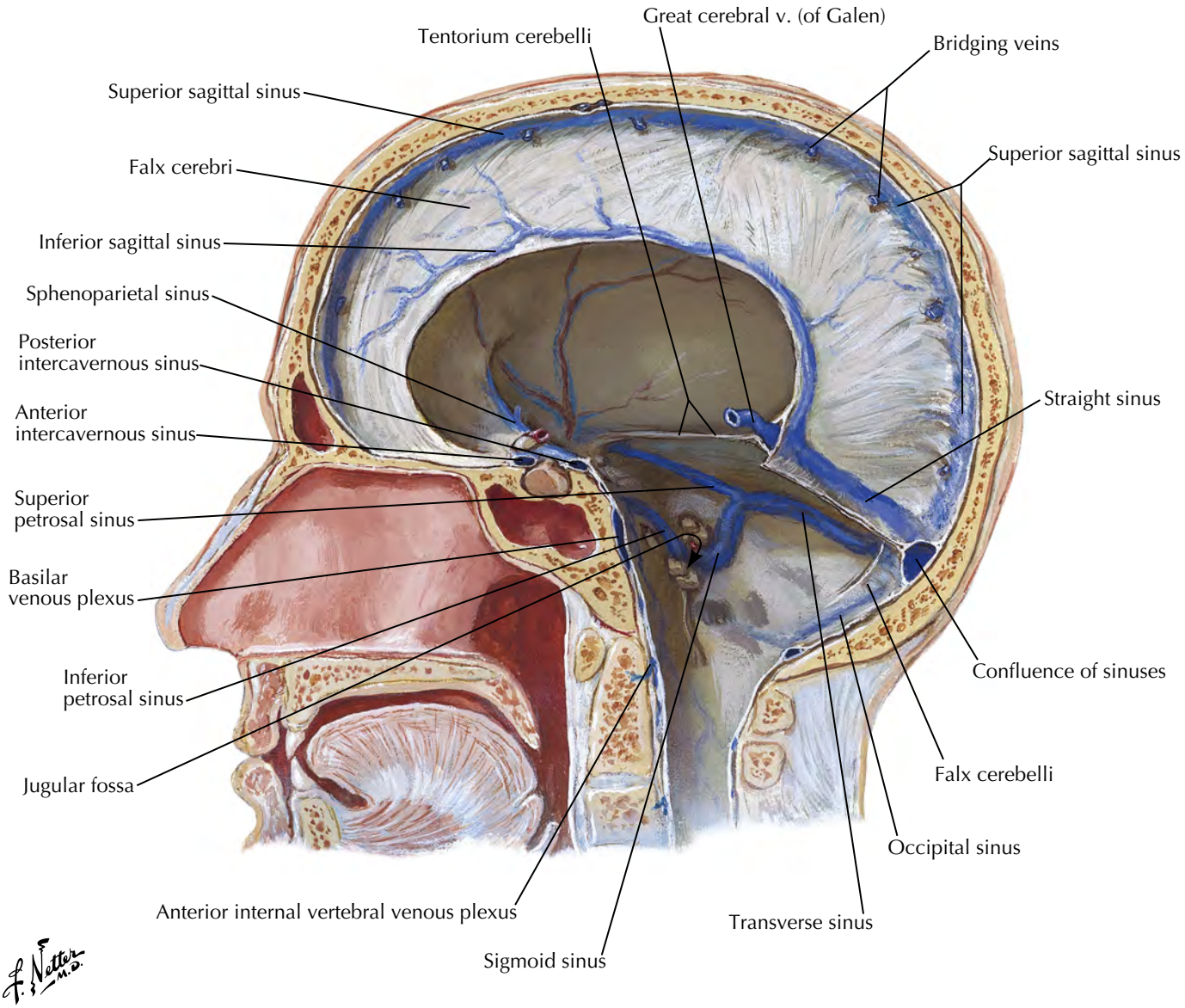
See also **Plate 163**



For deep veins of brain see **Plate 172**

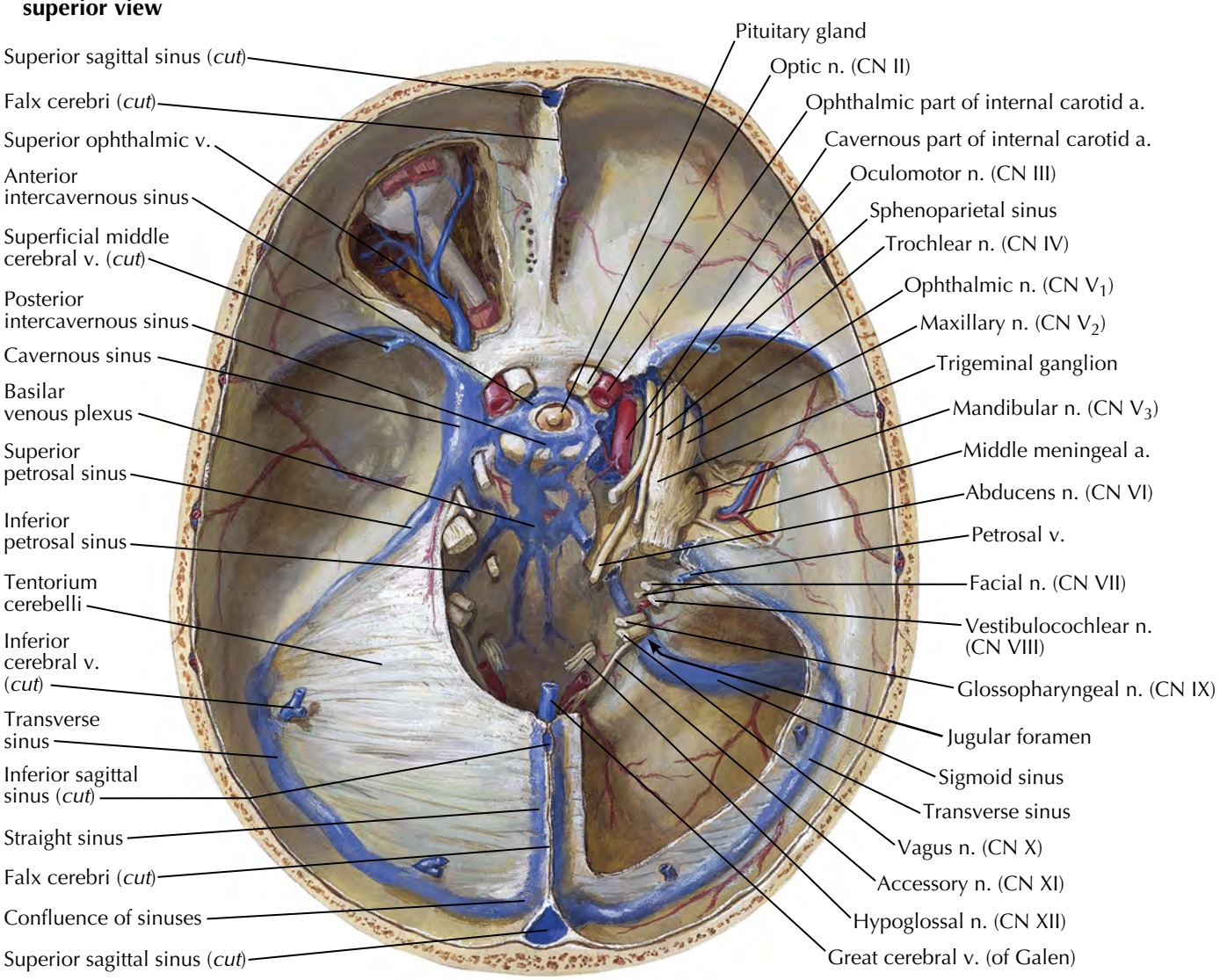


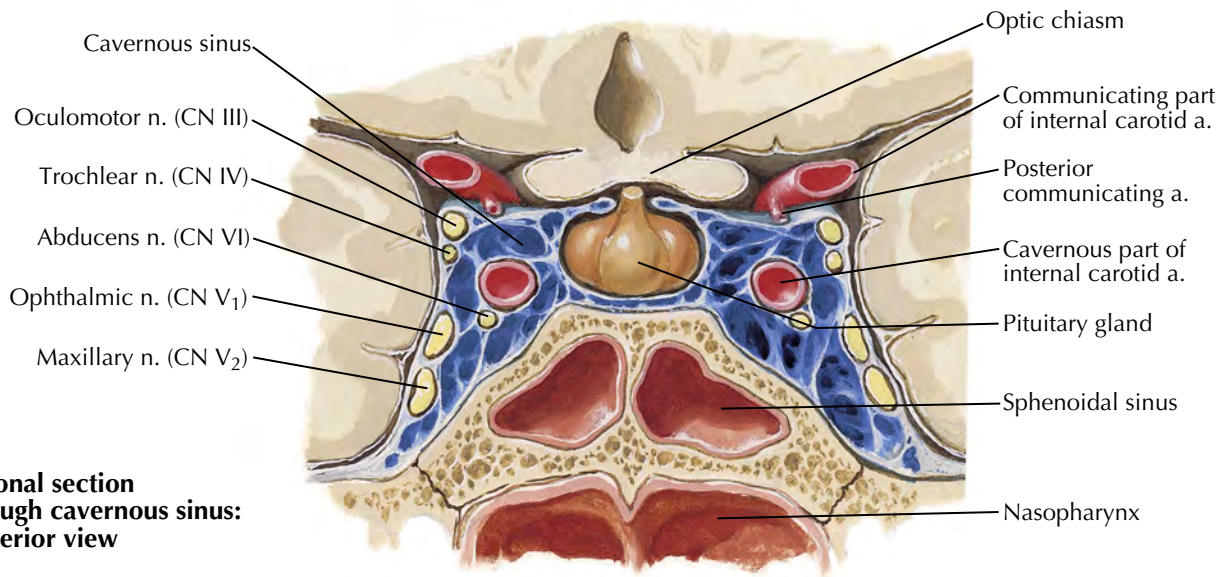
See also **Plates 127, 133**



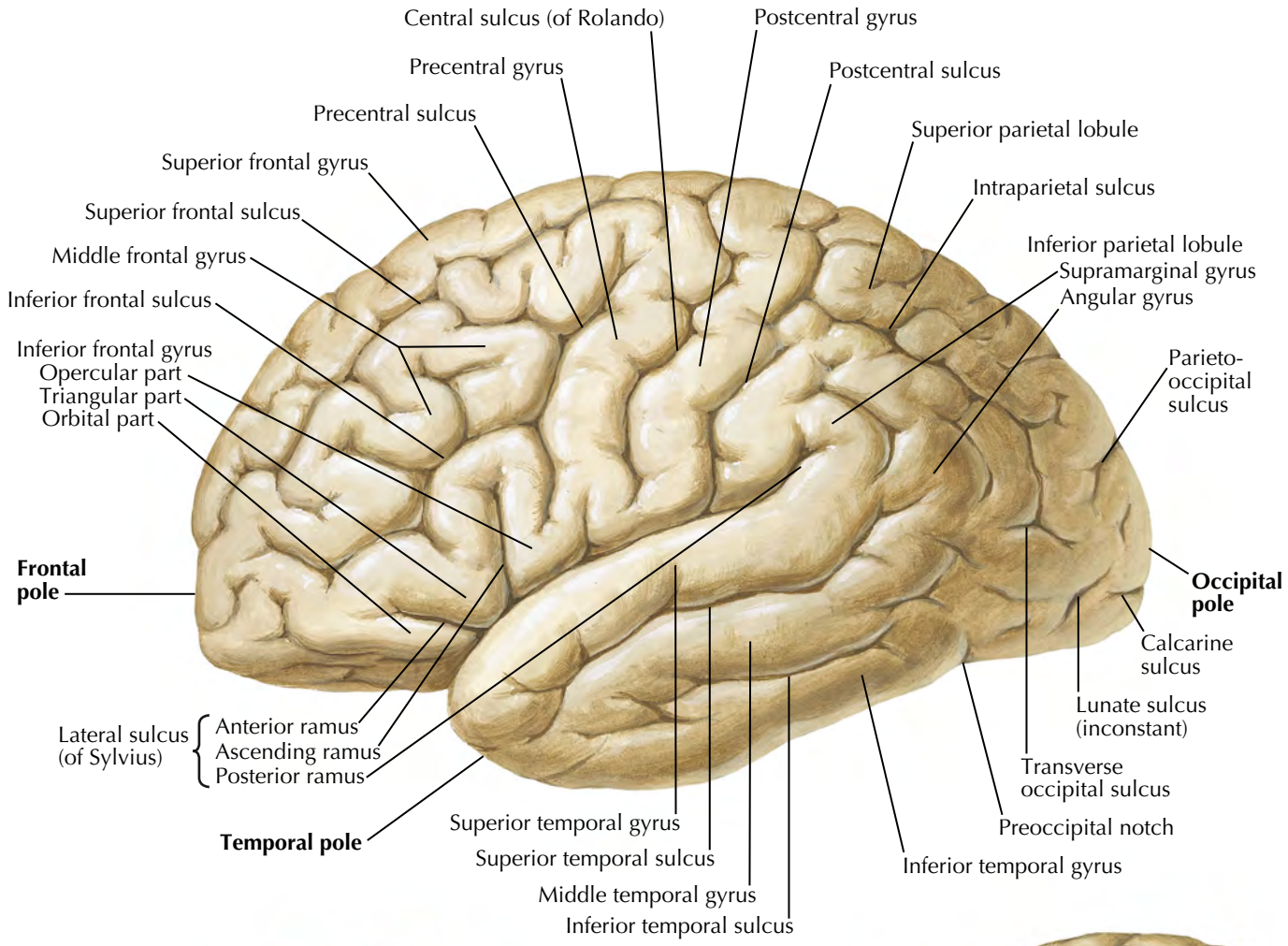
See also **Plates 82, 113**

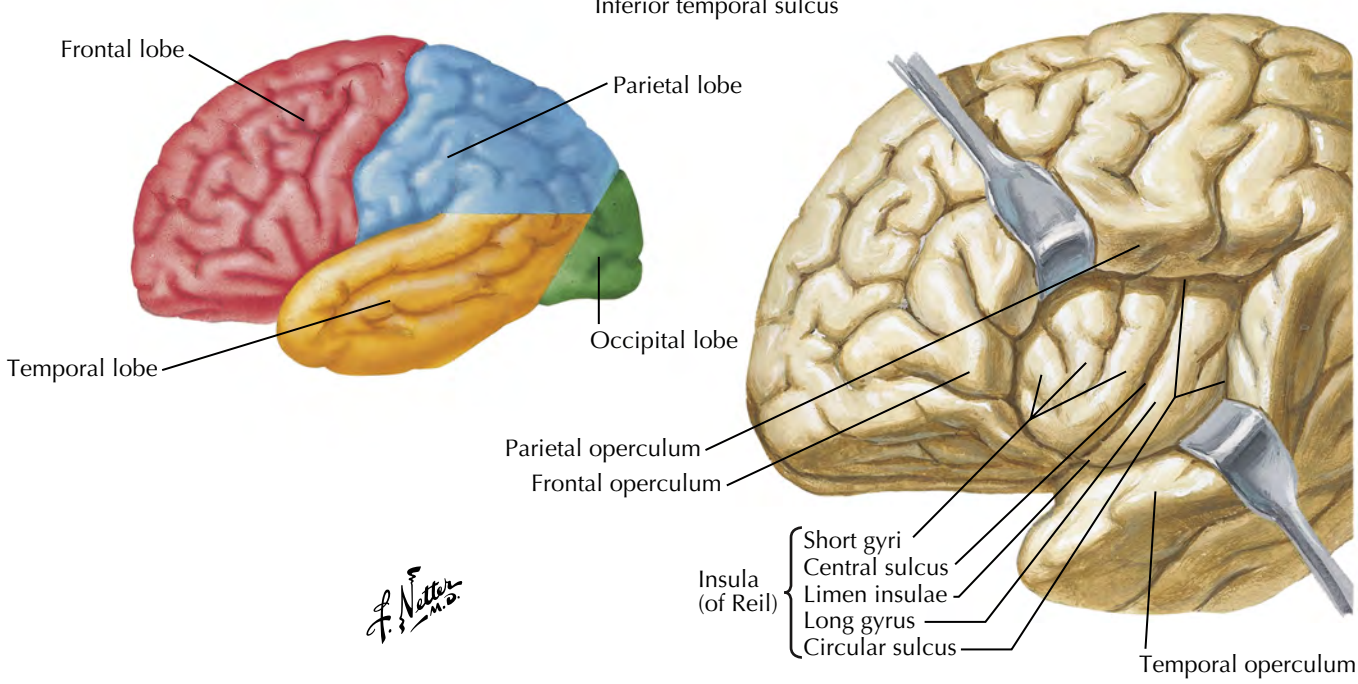
Skull sectioned horizontally: superior view





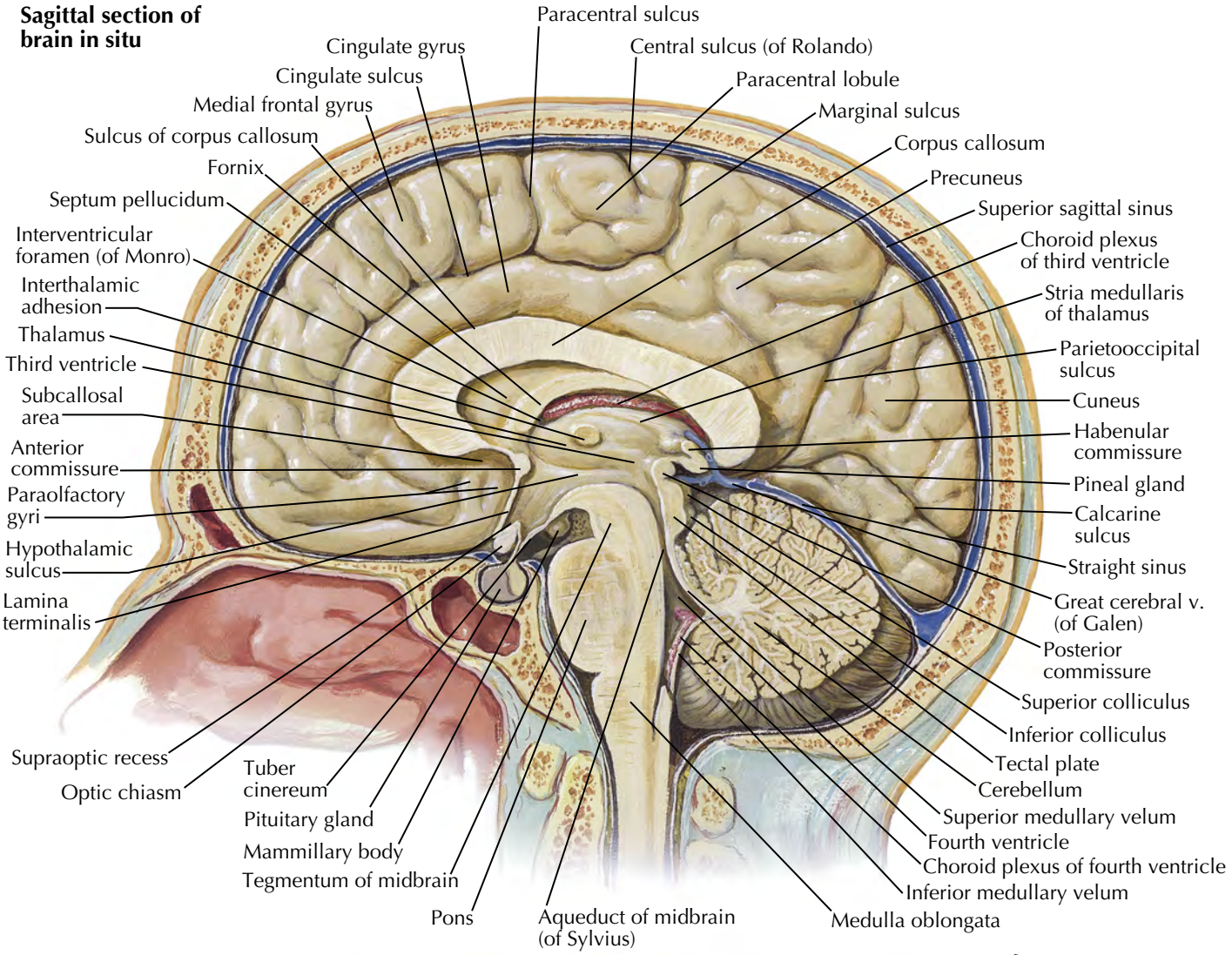
Coronal section through cavernous sinus: posterior view


Central sulcus (of Rolando)
Postcentral gyrus
Precentral gyrus
Postcentral sulcus
Precentral sulcus
Superior parietal lobule
Superior frontal gyrus
Intraparietal sulcus
Superior frontal sulcus
Inferior parietal lobule
Middle frontal gyrus
Supramarginal gyrus
Inferior frontal sulcus
Angular gyrus
Inferior frontal gyrus
Opercular part
Triangular part
Orbital part
Parieto-occipital sulcus
Frontal pole
Occipital pole
Calcarine sulcus
Lateral sulcus (of Sylvius)
Anterior ramus
Ascending ramus
Posterior ramus
Lunate sulcus (inconstant)
Transverse occipital sulcus
Temporal pole
Preoccipital notch
Superior temporal gyrus
Superior temporal sulcus
Inferior temporal gyrus
Middle temporal gyrus
Inferior temporal sulcus

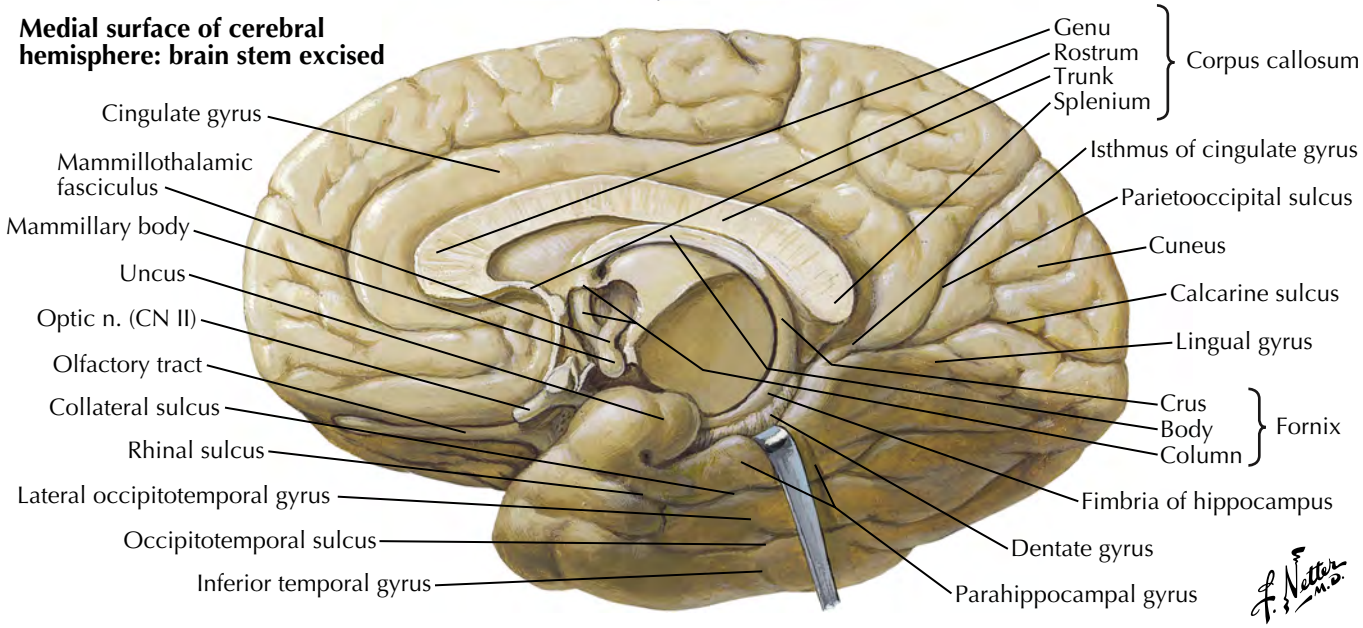

Frontal lobe
Parietal lobe
Occipital lobe
Temporal lobe
Parietal operculum
Frontal operculum
Insula (of Reil)
Short gyri
Central sulcus
Limen insulae
Long gyrus
Circular sulcus
Temporal operculum

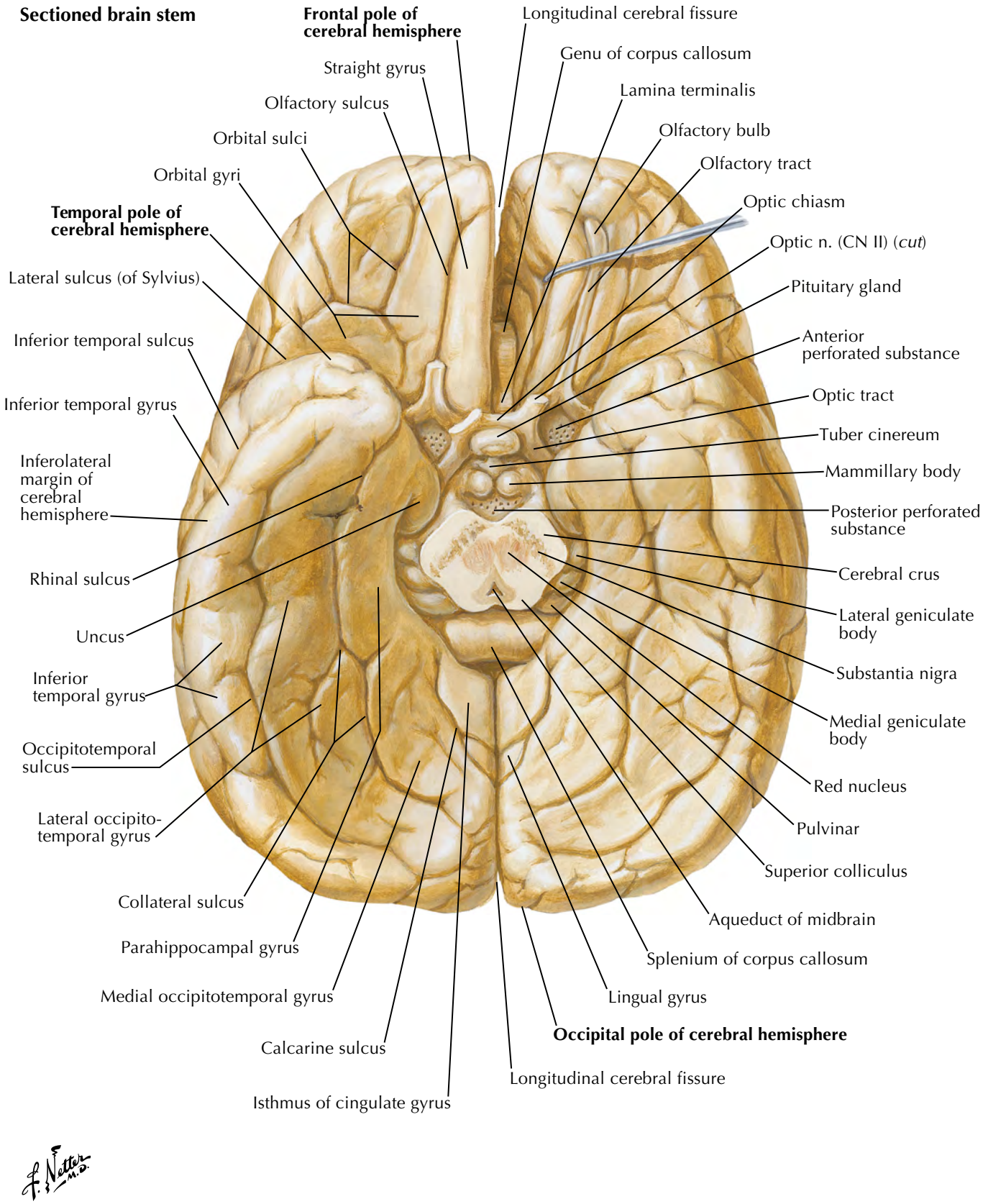
See also **Plate 174**

Sagittal section of brain in situ

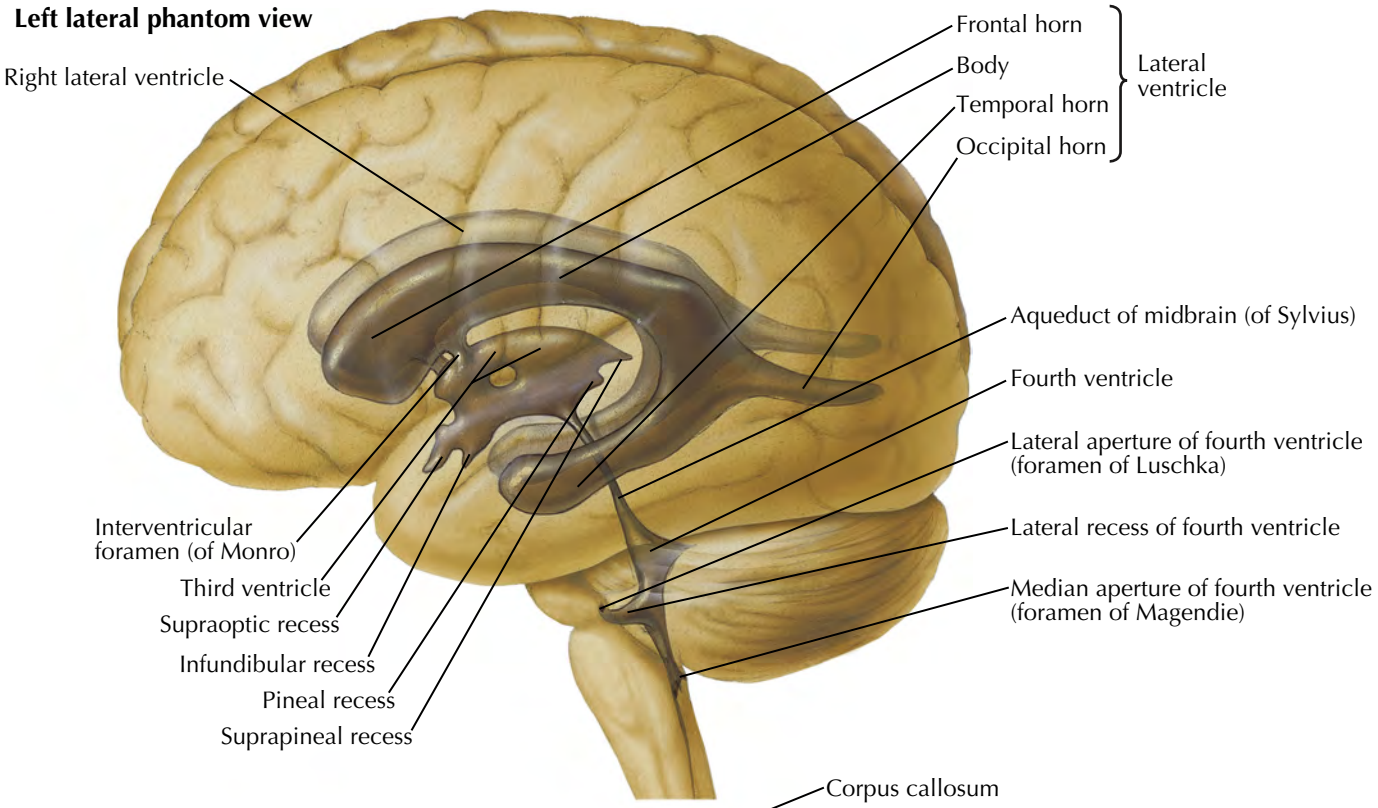


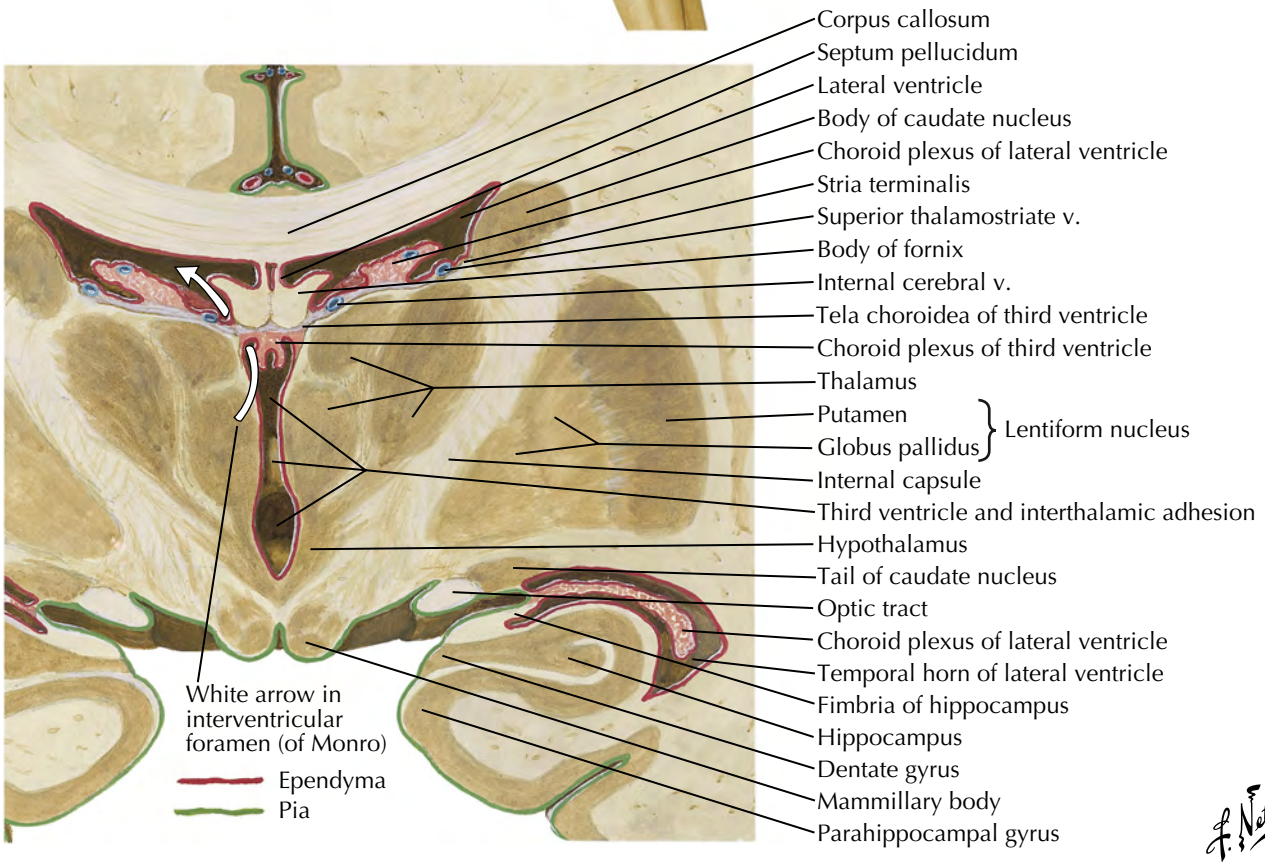
Medial surface of cerebral hemisphere: brain stem excised




Sectioned brain stem
Frontal pole of cerebral hemisphere
Longitudinal cerebral fissure
Genu of corpus callosum
Straight gyrus
Lamina terminalis
Olfactory sulcus
Olfactory bulb
Orbital sulci
Olfactory tract
Orbital gyri
Optic chiasm
Temporal pole of cerebral hemisphere
Optic n. (CN II) (*cut*)
Lateral sulcus (of Sylvius)
Pituitary gland
Inferior temporal sulcus
Anterior perforated substance
Inferior temporal gyrus
Optic tract
Tuber cinereum
Inferolateral margin of cerebral hemisphere
Mammillary body
Posterior perforated substance
Rhinal sulcus
Cerebral crus
Uncus
Lateral geniculate body
Inferior temporal gyrus
Substantia nigra
Medial geniculate body
Occipitotemporal sulcus
Red nucleus
Lateral occipito-temporal gyrus
Pulvinar
Superior colliculus
Collateral sulcus
Aqueduct of midbrain
Parahippocampal gyrus
Splenium of corpus callosum
Medial occipitotemporal gyrus
Lingual gyrus
Occipital pole of cerebral hemisphere
Calcarine sulcus
Longitudinal cerebral fissure
Isthmus of cingulate gyrus

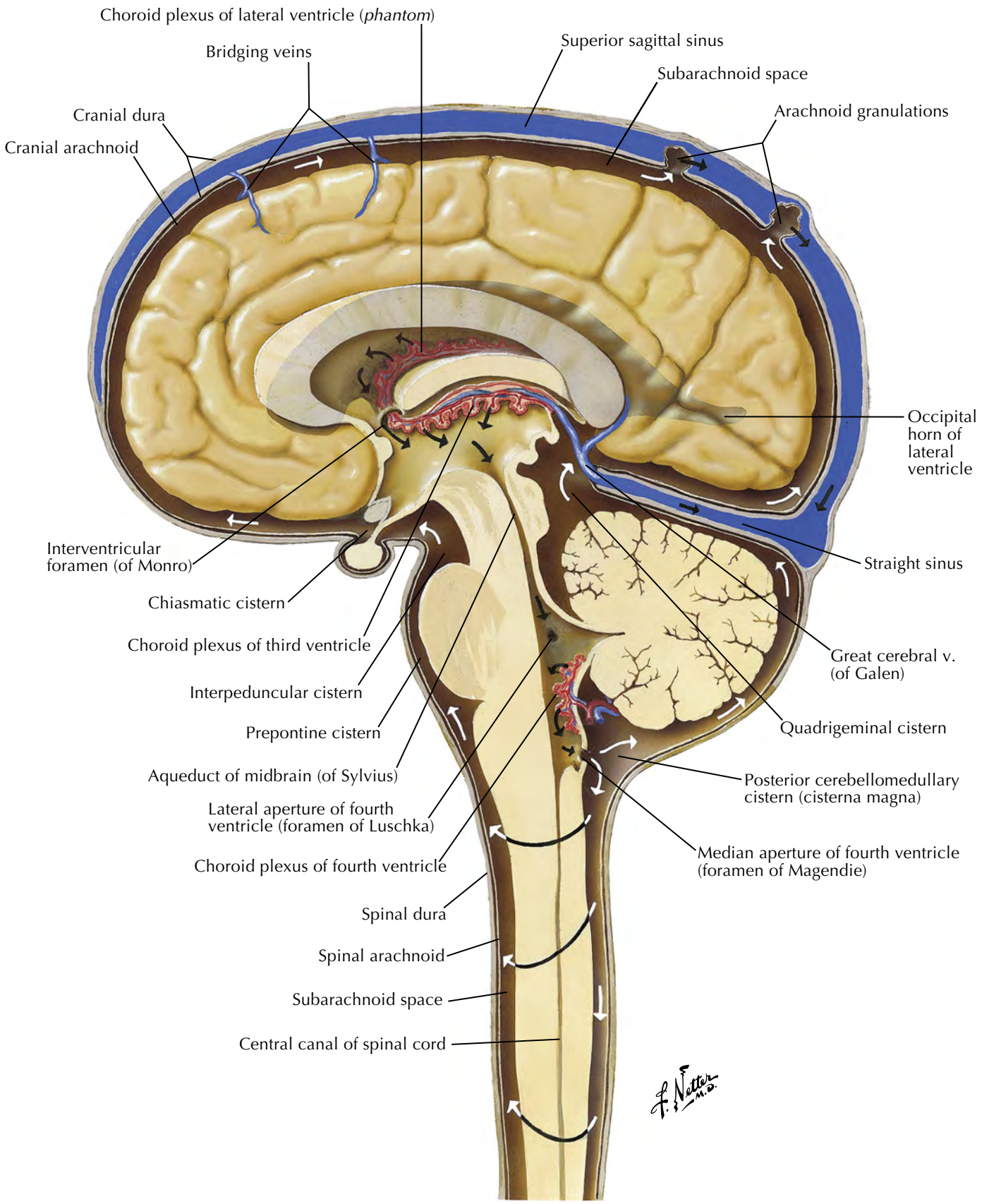
Left lateral phantom view



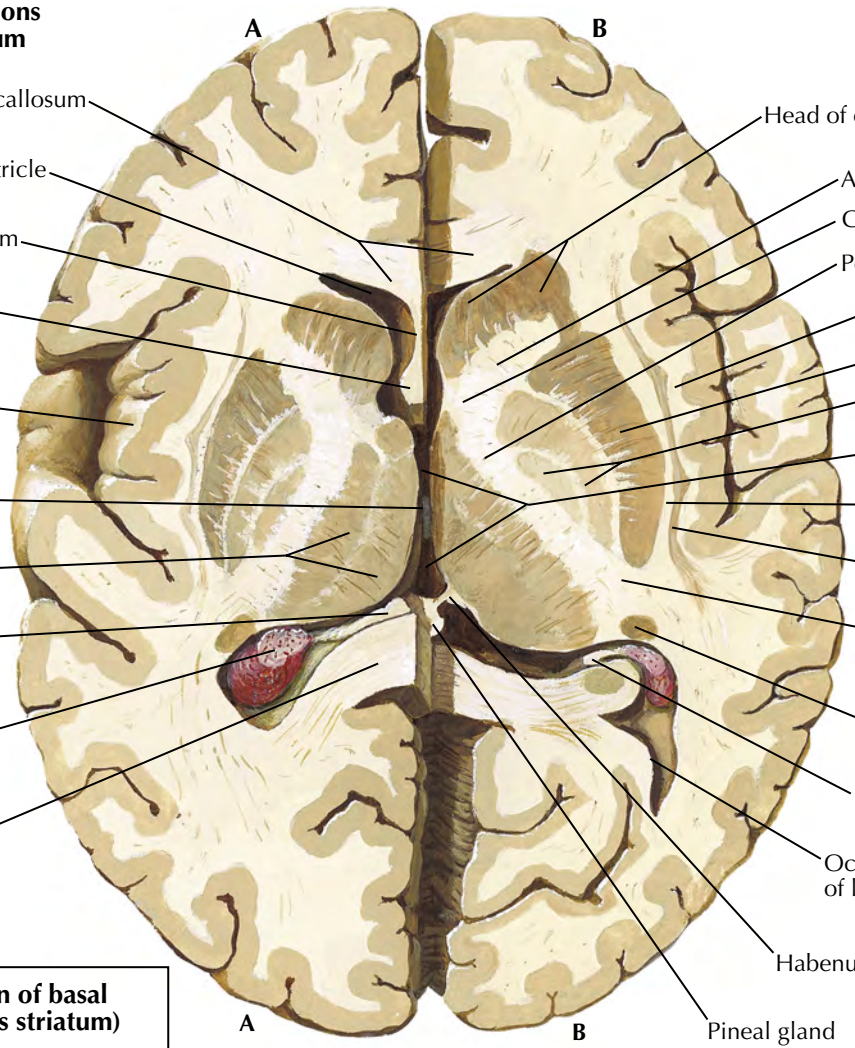


Coronal section of brain: posterior view

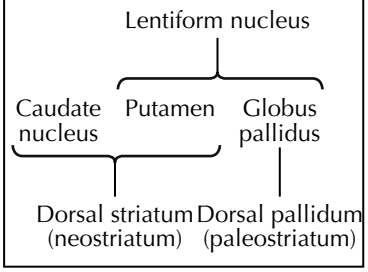
See also **Plates 135, 172, 173**

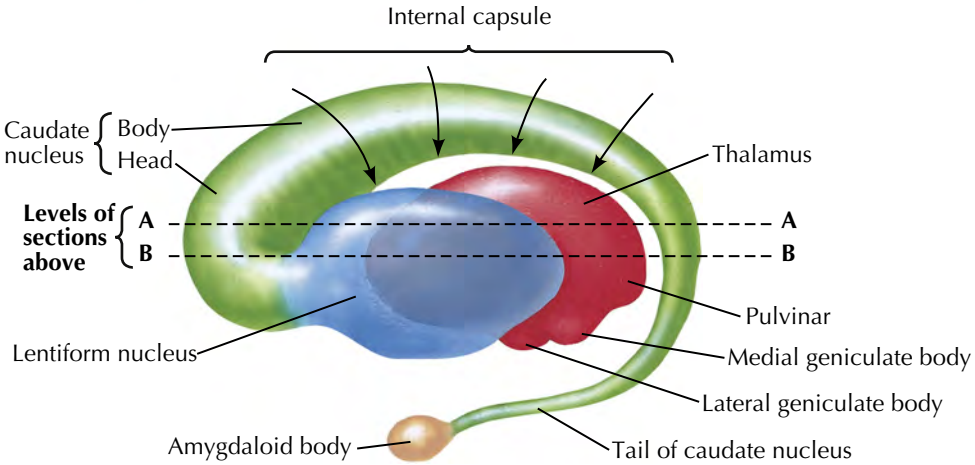


Horizontal sections through cerebrum

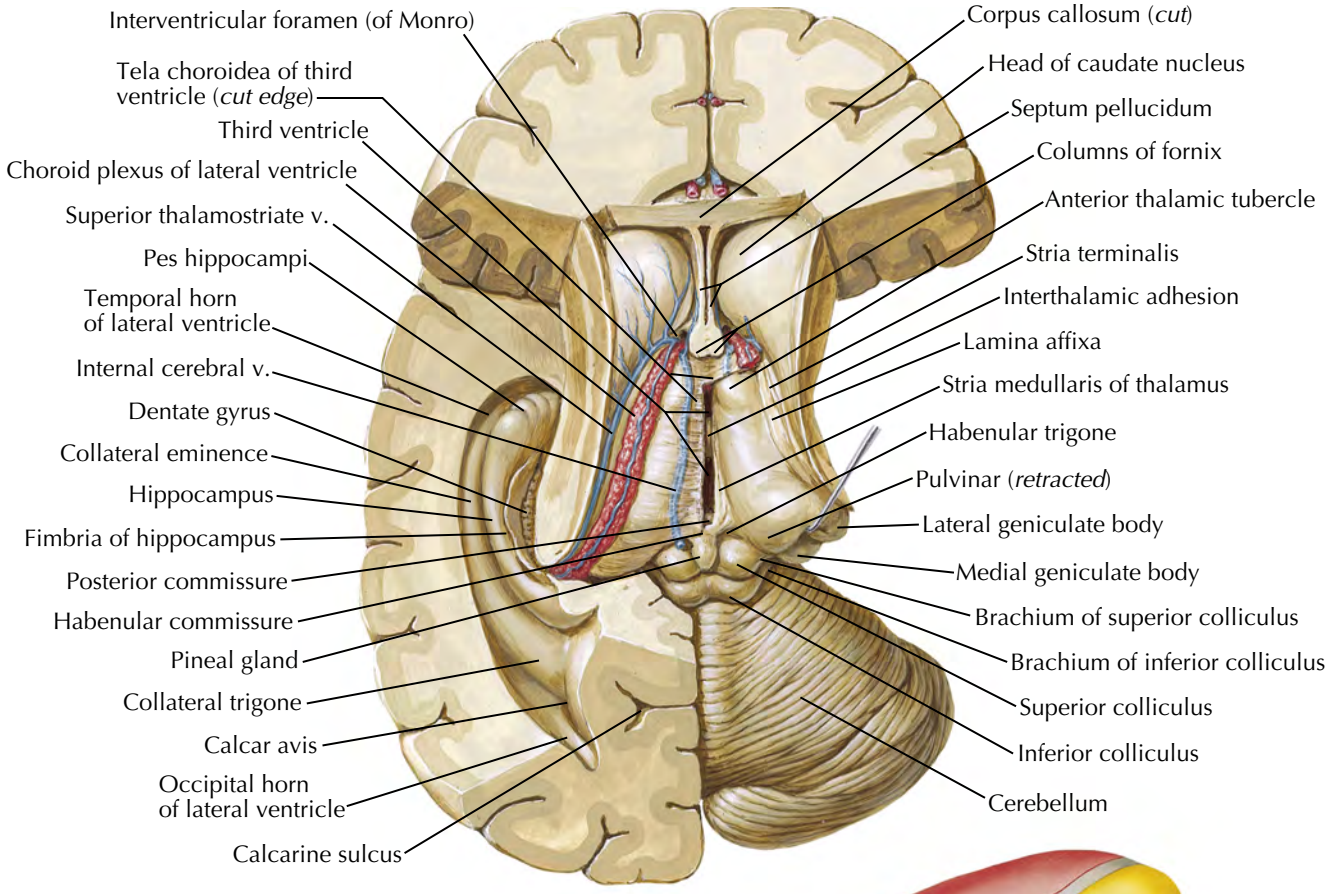


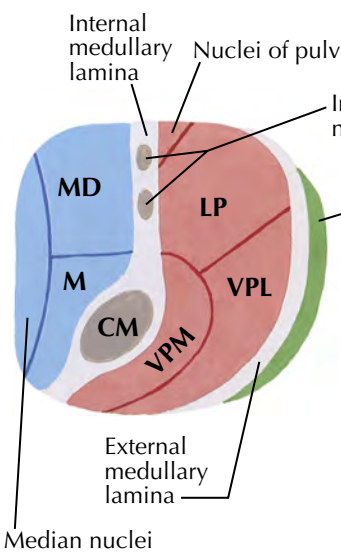
Organization of basal nuclei (corpus striatum)





Interrelationship of thalamus, lentiform nucleus, caudate nucleus, and amygdaloid body (schema): left lateral view



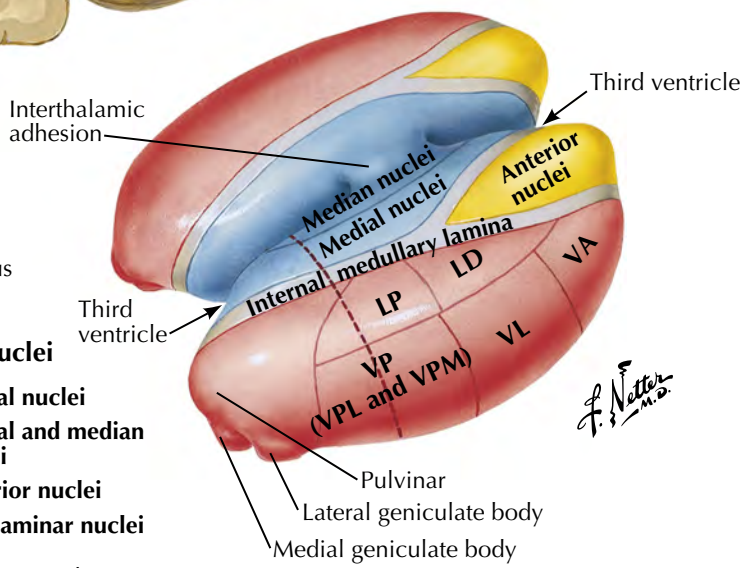


Schematic section through thalamus
(at level of broken line shown in figure at right)

Thalamic nuclei

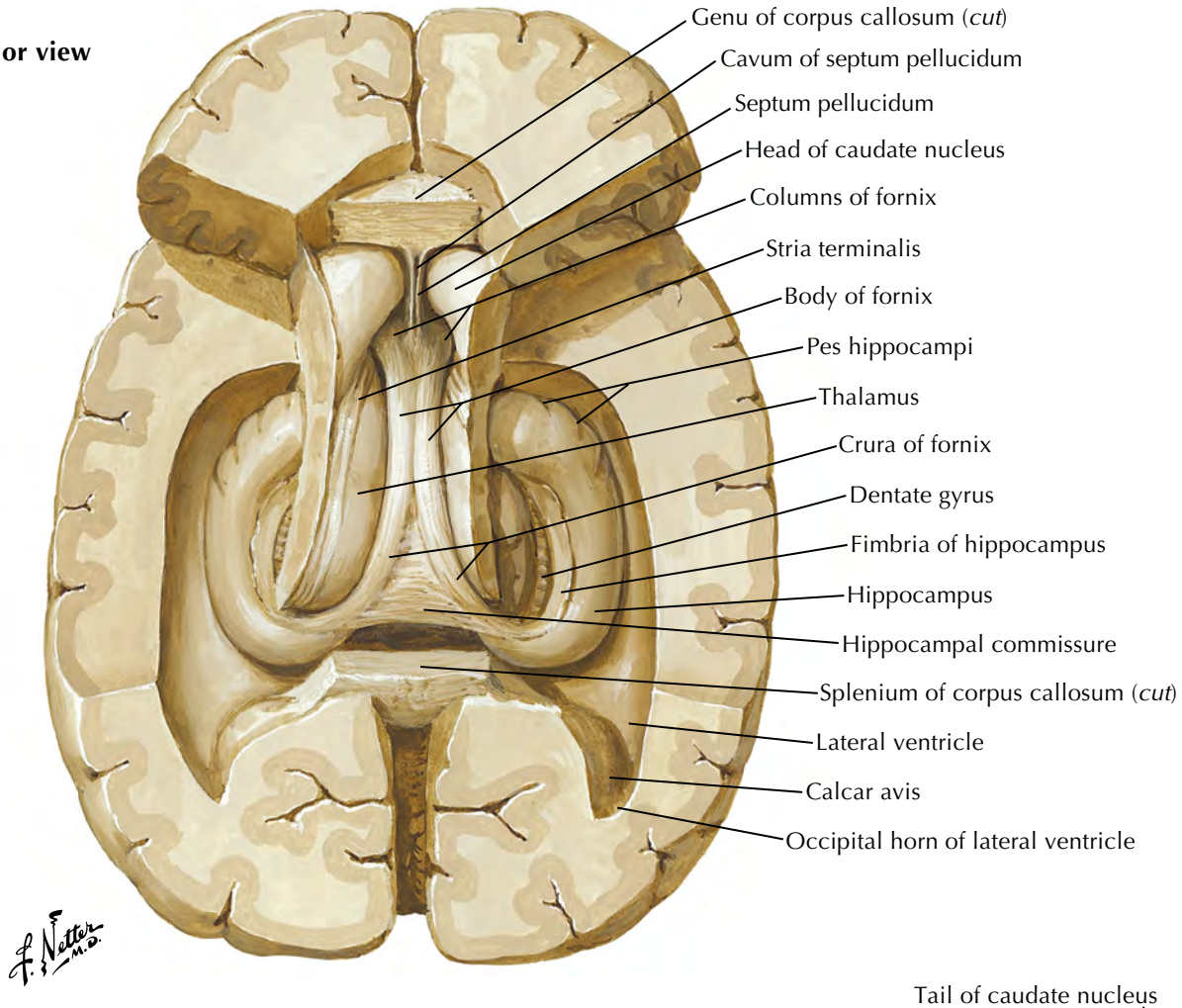
- **Lateral nuclei**
- **Medial and median nuclei**
- **Anterior nuclei**
- **Intralaminar nuclei**

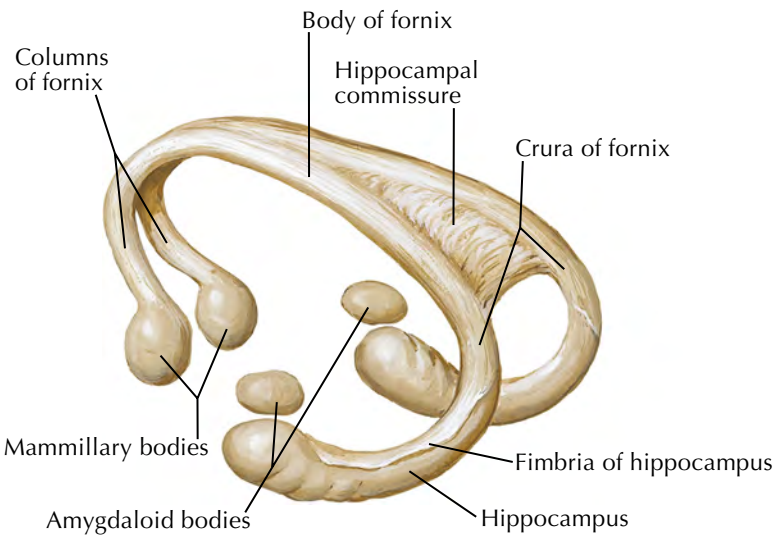
CM	Centromedian nucleus
LD	Lateral dorsal nucleus
LP	Lateral posterior nucleus
M	Medial nuclei
MD	Medial dorsal nucleus
VA	Ventral anterior nucleus
VL	Ventral lateral nuclei
VP	Ventral posterior nuclei
VPL	Ventral posterolateral nucleus
VPM	Ventral posteromedial nucleus



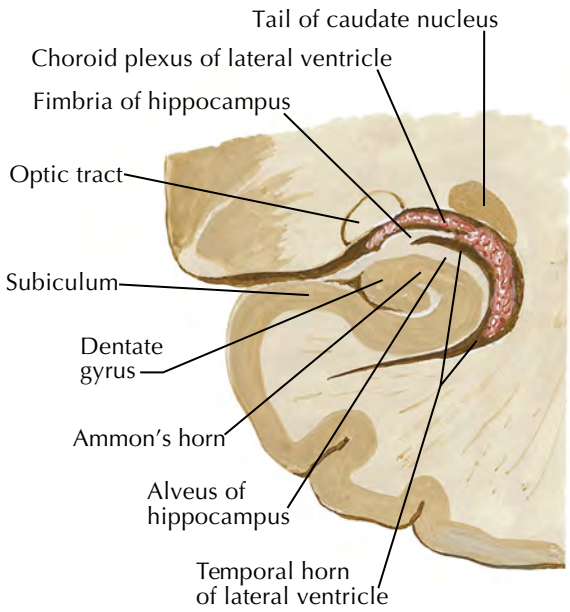
Schematic representation of thalamus
(external medullary lamina and reticular nucleus removed)

Superior view

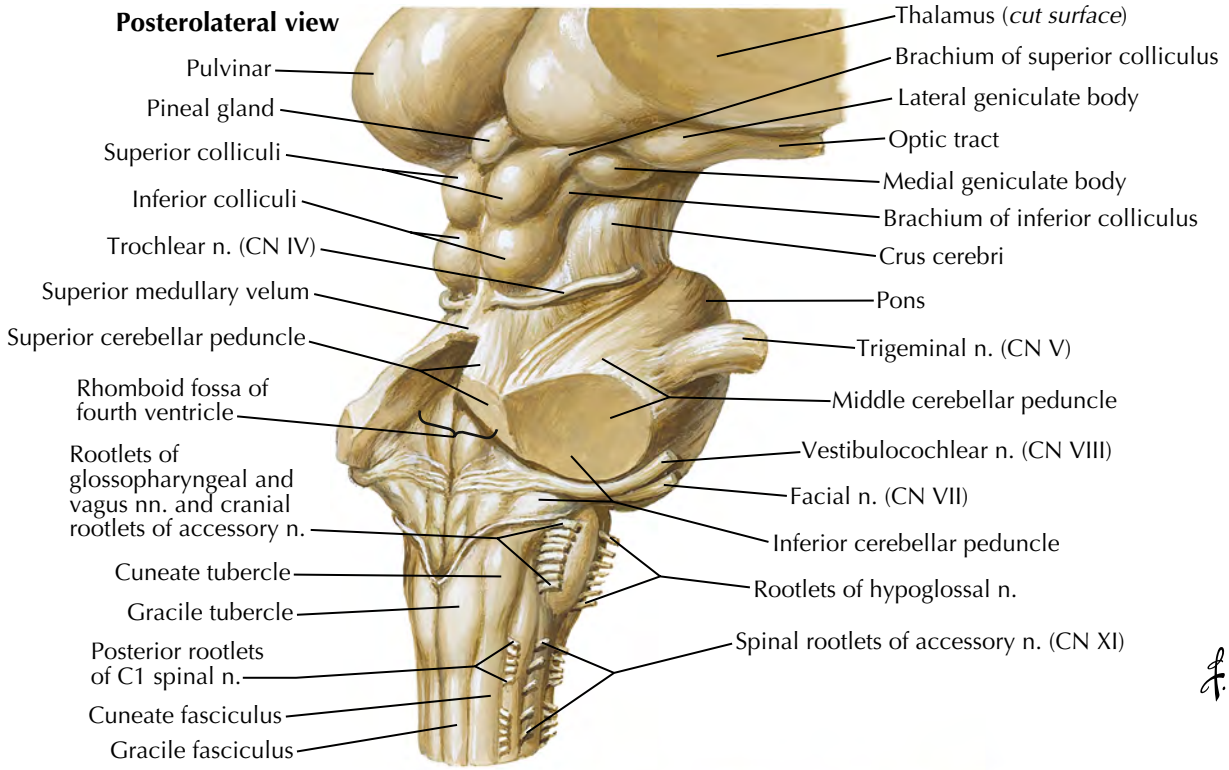


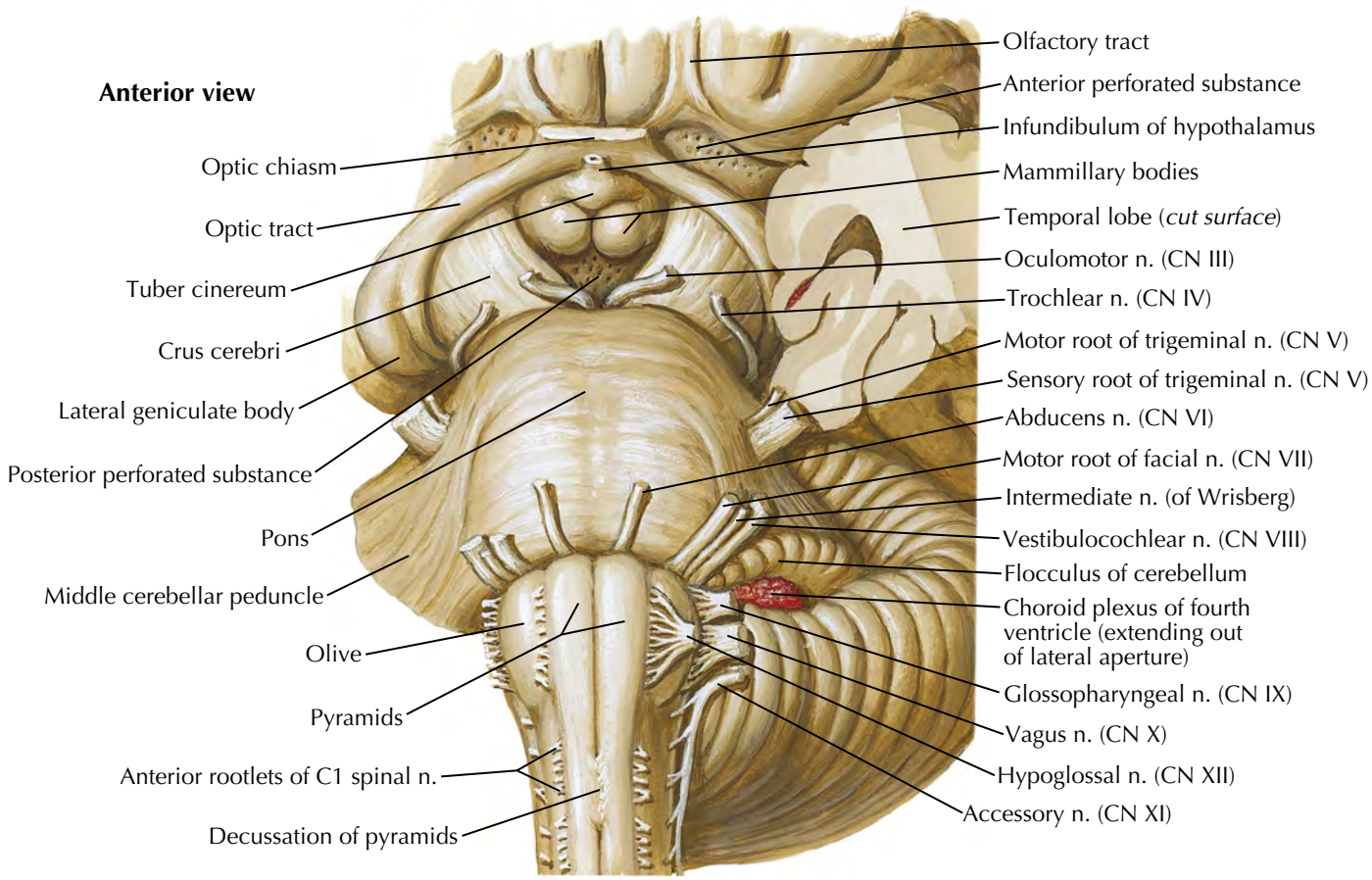


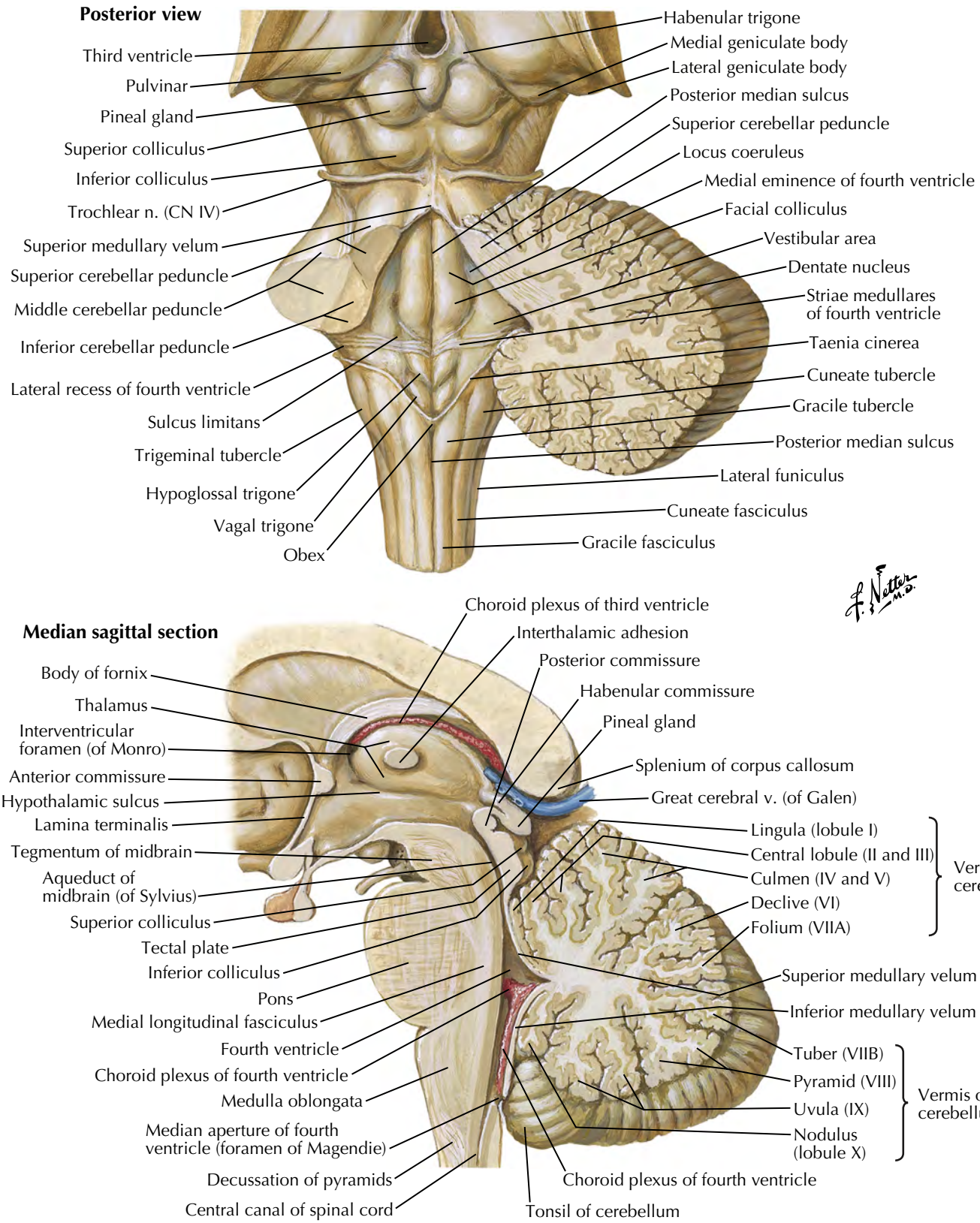
Fornix: schema

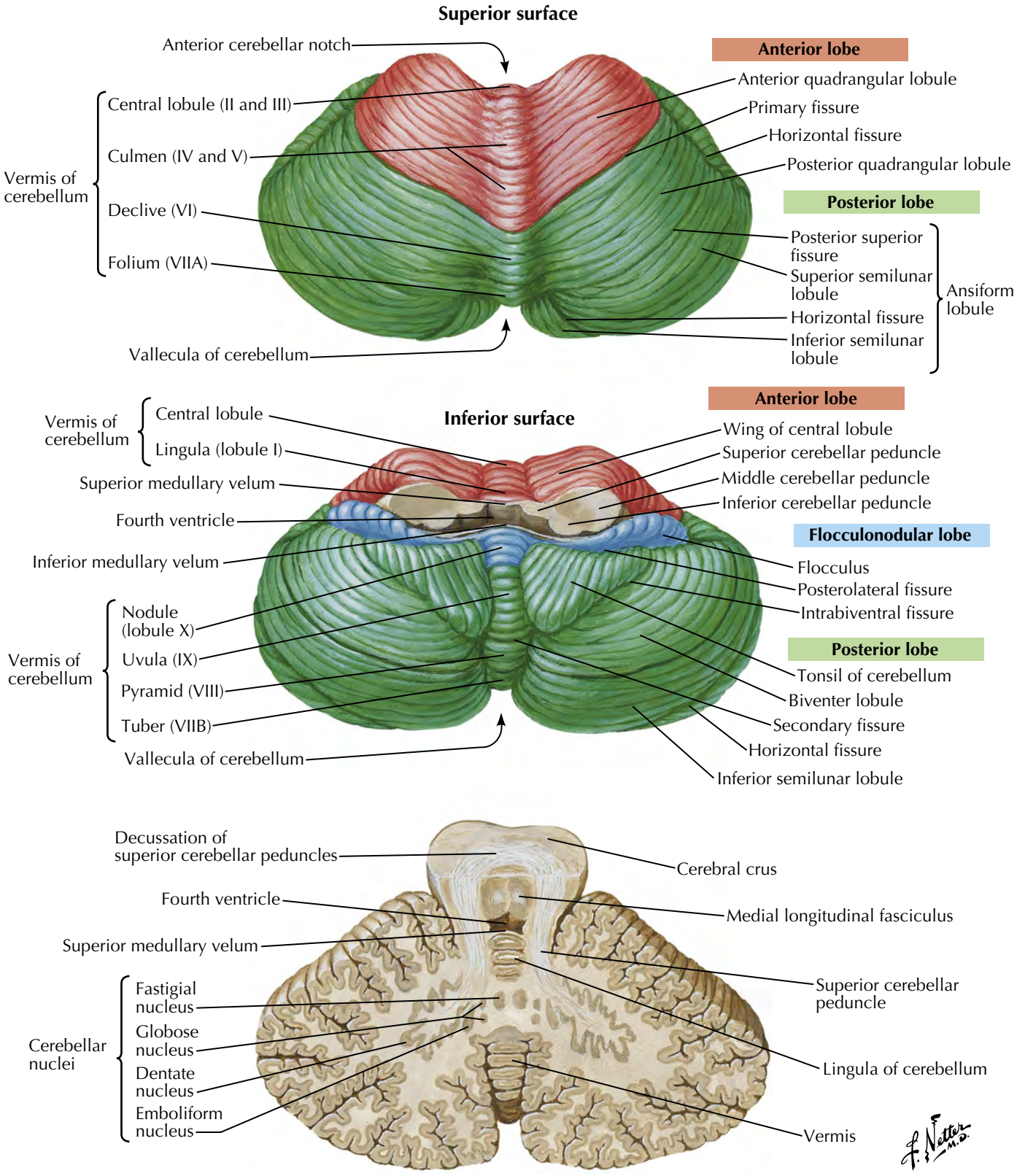


Coronal section: posterior view

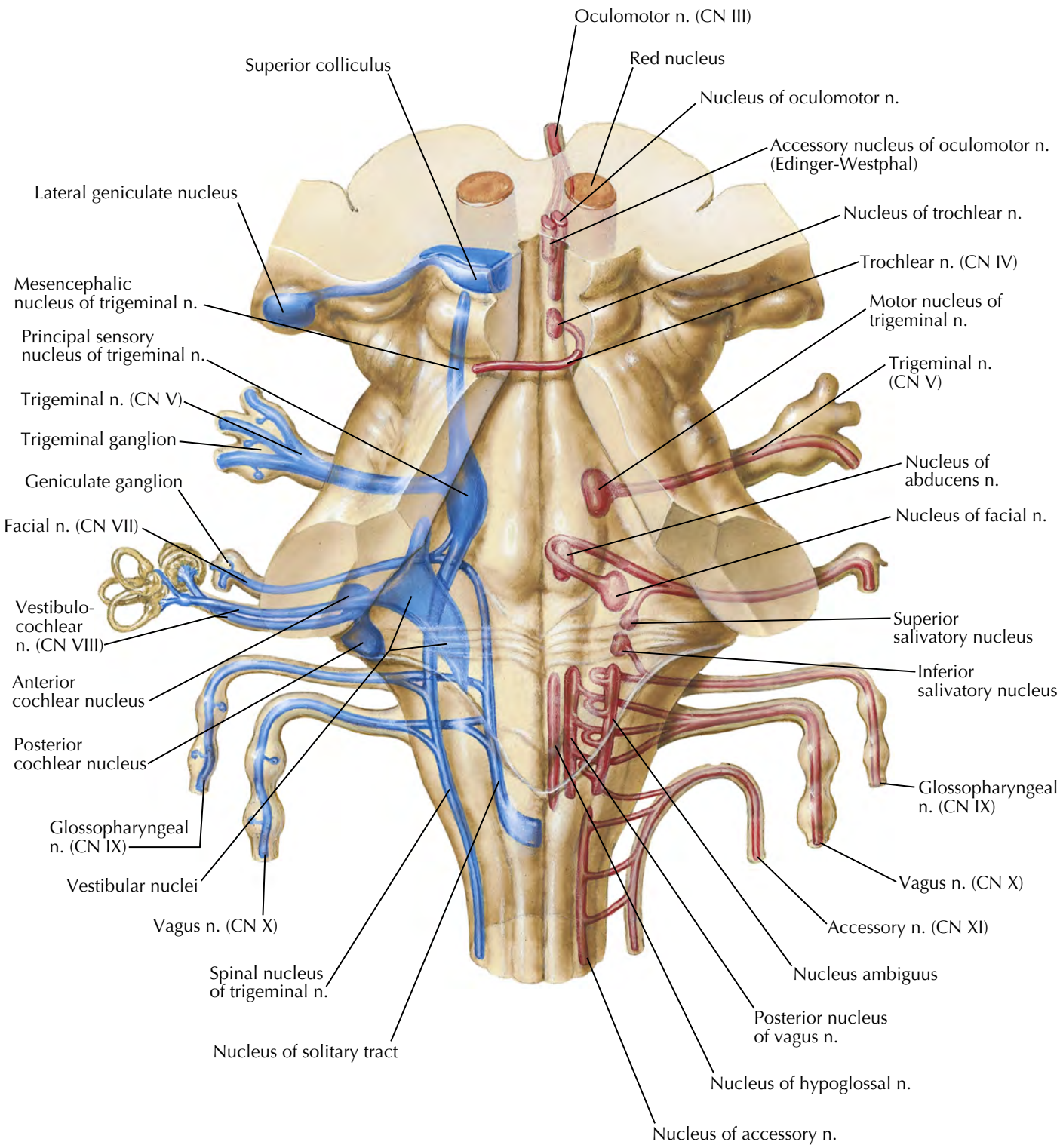

Posterolateral view
Pulvinar
Pineal gland
Superior colliculi
Inferior colliculi
Trochlear n. (CN IV)
Superior medullary velum
Superior cerebellar peduncle
Rhomboid fossa of fourth ventricle
Rootlets of glossopharyngeal and vagus nn. and cranial rootlets of accessory n.
Cuneate tubercle
Gracile tubercle
Posterior rootlets of C1 spinal n.
Cuneate fasciculus
Gracile fasciculus
Thalamus (cut surface)
Brachium of superior colliculus
Lateral geniculate body
Optic tract
Medial geniculate body
Brachium of inferior colliculus
Crus cerebri
Pons
Trigeminal n. (CN V)
Middle cerebellar peduncle
Vestibulocochlear n. (CN VIII)
Facial n. (CN VII)
Inferior cerebellar peduncle
Rootlets of hypoglossal n.
Spinal rootlets of accessory n. (CN XI)


Anterior view
Optic chiasm
Optic tract
Tuber cinereum
Crus cerebri
Lateral geniculate body
Posterior perforated substance
Pons
Middle cerebellar peduncle
Olive
Pyramids
Anterior rootlets of C1 spinal n.
Decussation of pyramids
Olfactory tract
Anterior perforated substance
Infundibulum of hypothalamus
Mammillary bodies
Temporal lobe (cut surface)
Oculomotor n. (CN III)
Trochlear n. (CN IV)
Motor root of trigeminal n. (CN V)
Sensory root of trigeminal n. (CN V)
Abducens n. (CN VI)
Motor root of facial n. (CN VII)
Intermediate n. (of Wrisberg)
Vestibulocochlear n. (CN VIII)
Flocculus of cerebellum
Choroid plexus of fourth ventricle (extending out of lateral aperture)
Glossopharyngeal n. (CN IX)
Vagus n. (CN X)
Hypoglossal n. (CN XII)
Accessory n. (CN XI)


Posterior view
Third ventricle
Pulvinar
Pineal gland
Superior colliculus
Inferior colliculus
Trochlear n. (CN IV)
Superior medullary velum
Superior cerebellar peduncle
Middle cerebellar peduncle
Inferior cerebellar peduncle
Lateral recess of fourth ventricle
Sulcus limitans
Trigeminal tubercle
Hypoglossal trigone
Vagal trigone
Obex
Habenular trigone
Medial geniculate body
Lateral geniculate body
Posterior median sulcus
Superior cerebellar peduncle
Locus coeruleus
Medial eminence of fourth ventricle
Facial colliculus
Vestibular area
Dentate nucleus
Striae medullares of fourth ventricle
Taenia cinerea
Cuneate tubercle
Gracile tubercle
Posterior median sulcus
Lateral funiculus
Cuneate fasciculus
Gracile fasciculus
Median sagittal section
Body of fornix
Thalamus
Interventricular foramen (of Monro)
Anterior commissure
Hypothalamic sulcus
Lamina terminalis
Tegmentum of midbrain
Aqueduct of midbrain (of Sylvius)
Superior colliculus
Tectal plate
Inferior colliculus
Pons
Medial longitudinal fasciculus
Fourth ventricle
Choroid plexus of fourth ventricle
Medulla oblongata
Median aperture of fourth ventricle (foramen of Magendie)
Decussation of pyramids
Central canal of spinal cord
Choroid plexus of third ventricle
Interthalamic adhesion
Posterior commissure
Habenular commissure
Pineal gland
Splenium of corpus callosum
Great cerebral v. (of Galen)
Lingula (lobule I)
Central lobule (II and III)
Culmen (IV and V)
Declive (VI)
Folium (VIIA)
Vermis of cerebellum
Superior medullary velum
Inferior medullary velum
Tuber (VIIB)
Pyramid (VIII)
Uvula (IX)
Nodulus (lobule X)
Vermis of cerebellum
Choroid plexus of fourth ventricle
Tonsil of cerebellum

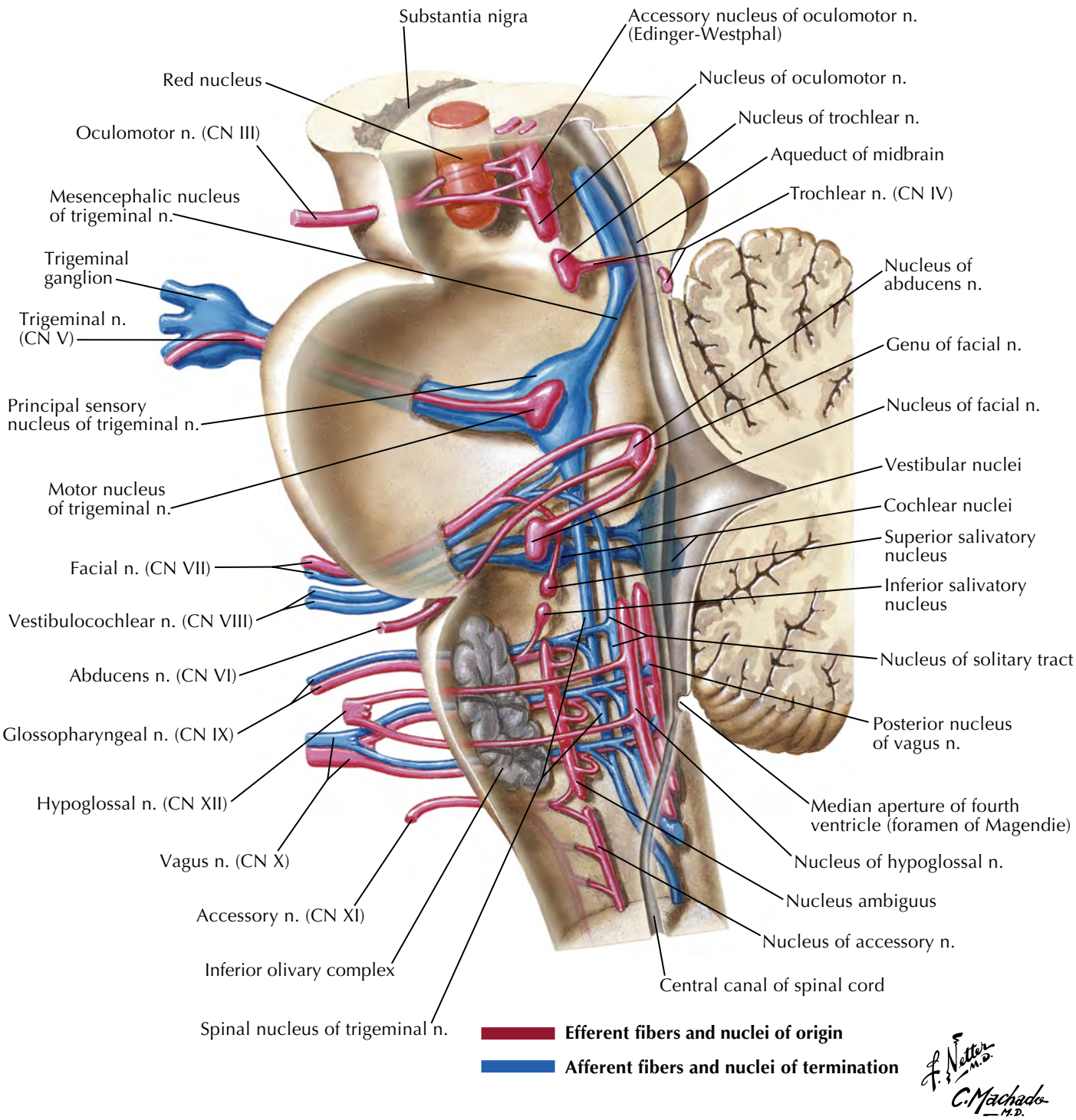


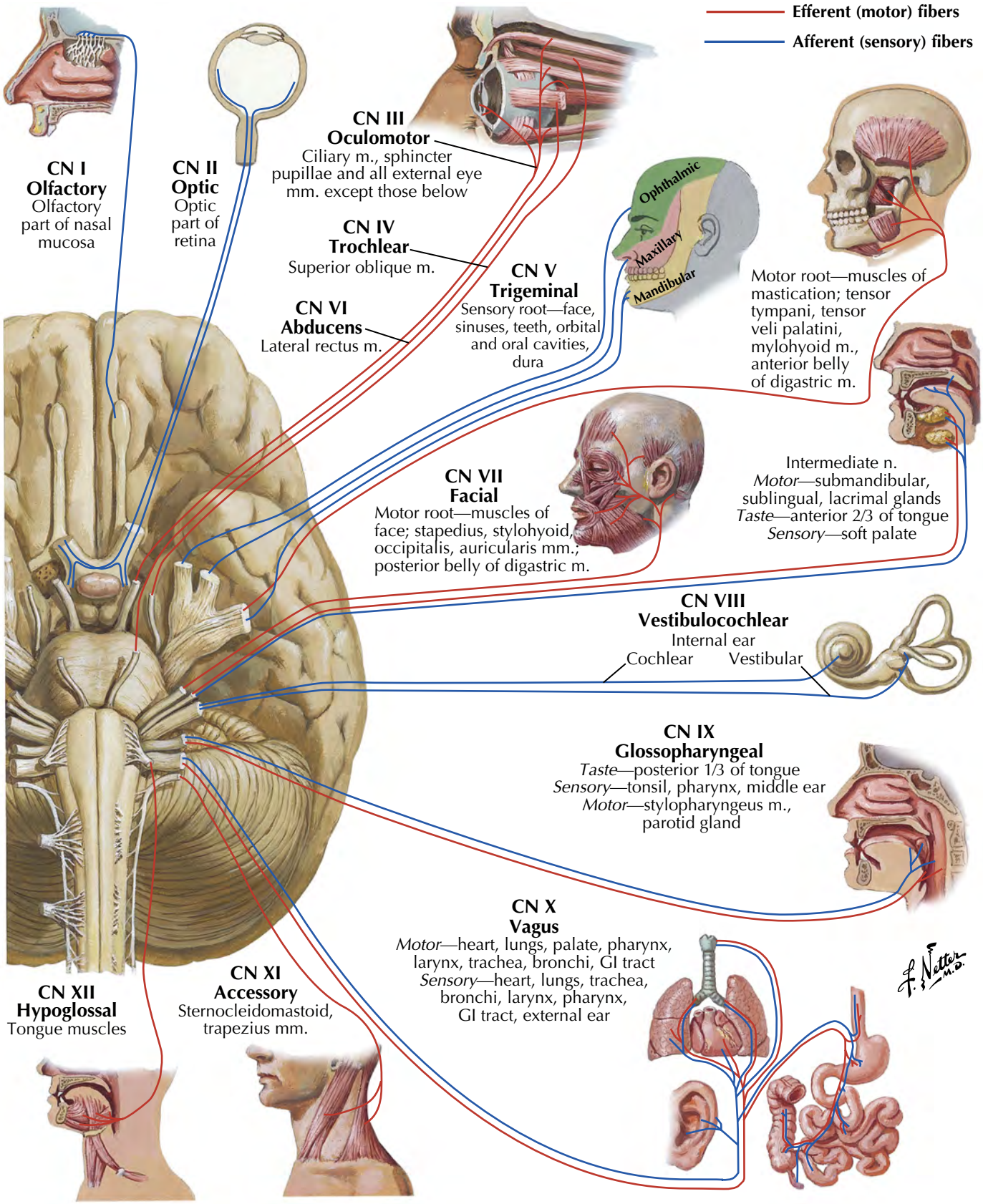
Section in plane of superior cerebellar peduncle



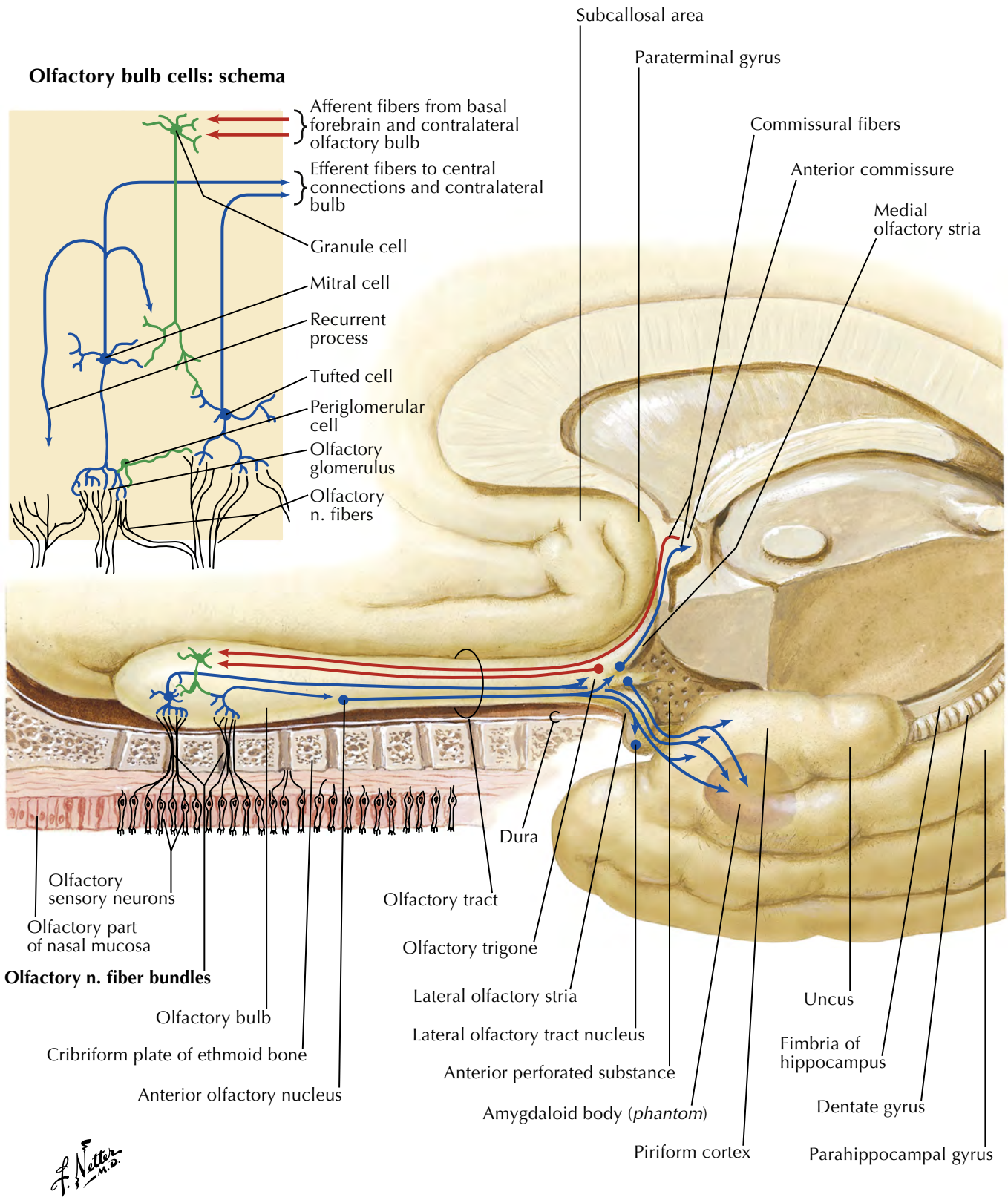
Efferent fibers and the nuclei of origin

Afferent fibers and the nuclei of termination


Substantia nigra
Accessory nucleus of oculomotor n. (Edinger-Westphal)
Red nucleus
Nucleus of oculomotor n.
Oculomotor n. (CN III)
Nucleus of trochlear n.
Aqueduct of midbrain
Mesencephalic nucleus of trigeminal n.
Trochlear n. (CN IV)
Trigeminal ganglion
Nucleus of abducens n.
Trigeminal n. (CN V)
Genu of facial n.
Principal sensory nucleus of trigeminal n.
Nucleus of facial n.
Vestibular nuclei
Motor nucleus of trigeminal n.
Cochlear nuclei
Superior salivatory nucleus
Facial n. (CN VII)
Inferior salivatory nucleus
Vestibulocochlear n. (CN VIII)
Nucleus of solitary tract
Abducens n. (CN VI)
Posterior nucleus of vagus n.
Glossopharyngeal n. (CN IX)
Median aperture of fourth ventricle (foramen of Magendie)
Hypoglossal n. (CN XII)
Nucleus of hypoglossal n.
Vagus n. (CN X)
Nucleus ambiguus
Accessory n. (CN XI)
Nucleus of accessory n.
Inferior olivary complex
Central canal of spinal cord
Spinal nucleus of trigeminal n.
Efferent fibers and nuclei of origin
Afferent fibers and nuclei of termination
F. Netter M.D.
C. Machado M.D.

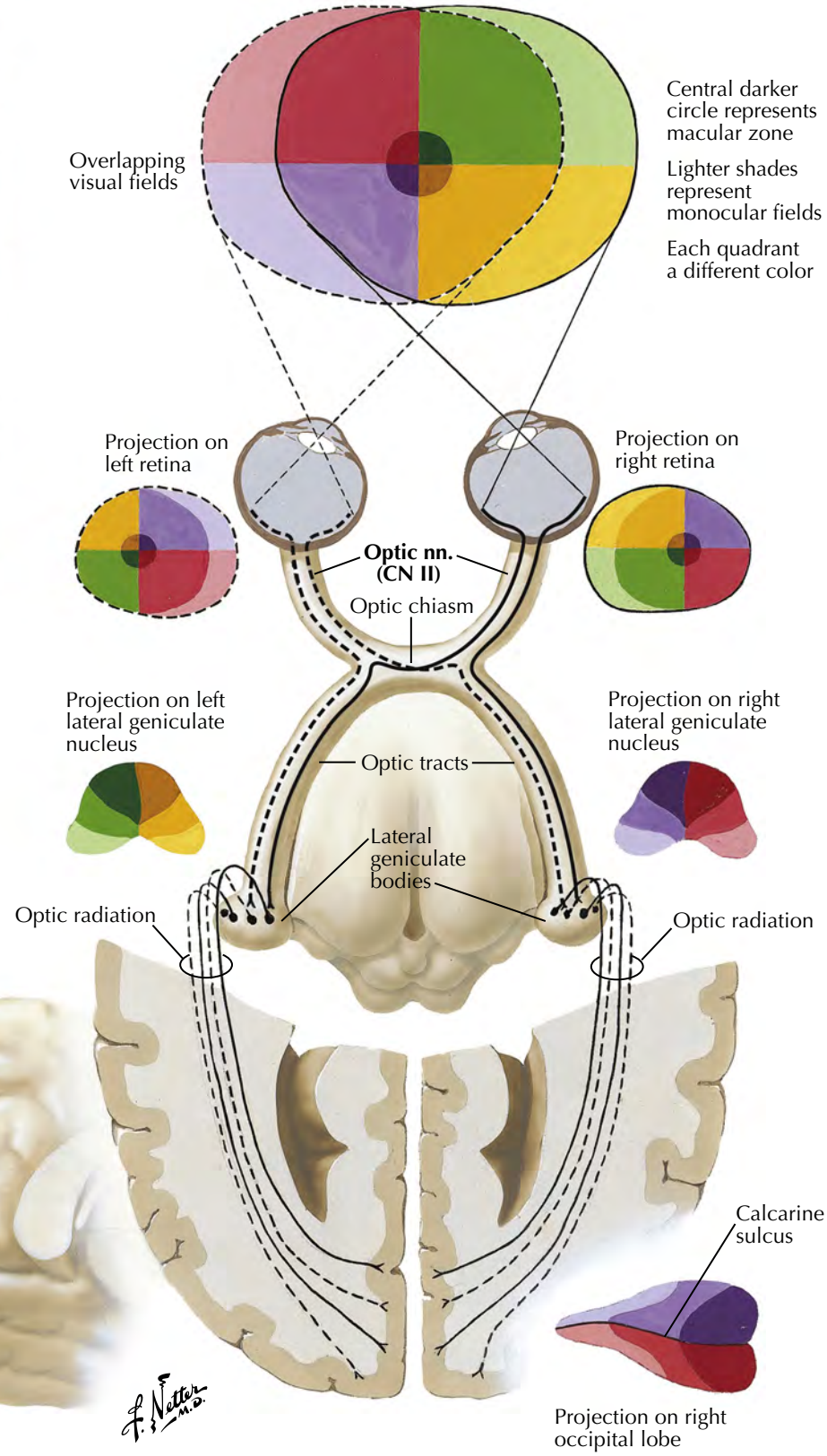

Efferent (motor) fibers
Afferent (sensory) fibers
CN I
Olfactory
Olfactory part of nasal mucosa
CN II
Optic
Optic part of retina
CN III
Oculomotor
Ciliary m., sphincter pupillae and all external eye mm. except those below
CN IV
Trochlear
Superior oblique m.
CN V
Trigeminal
Sensory root—face, sinuses, teeth, orbital and oral cavities, dura
Ophthalmic
Maxillary
Mandibular
Motor root—muscles of mastication; tensor tympani, tensor veli palatini, mylohyoid m., anterior belly of digastric m.
CN VI
Abducens
Lateral rectus m.
CN VII
Facial
Motor root—muscles of face; stapedius, stylohyoid, occipitalis, auricularis mm.; posterior belly of digastric m.
Intermediate n.
Motor—submandibular, sublingual, lacrimal glands
Taste—anterior 2/3 of tongue
Sensory—soft palate
CN VIII
Vestibulocochlear
Internal ear
Cochlear
Vestibular
CN IX
Glossopharyngeal
Taste—posterior 1/3 of tongue
Sensory—tonsil, pharynx, middle ear
Motor—stylopharyngeus m., parotid gland
CN X
Vagus
Motor—heart, lungs, palate, pharynx, larynx, trachea, bronchi, GI tract
Sensory—heart, lungs, trachea, bronchi, larynx, pharynx, GI tract, external ear
CN XI
Accessory
Sternocleidomastoid, trapezius mm.
CN XII
Hypoglossal
Tongue muscles

See also **Plate 64**

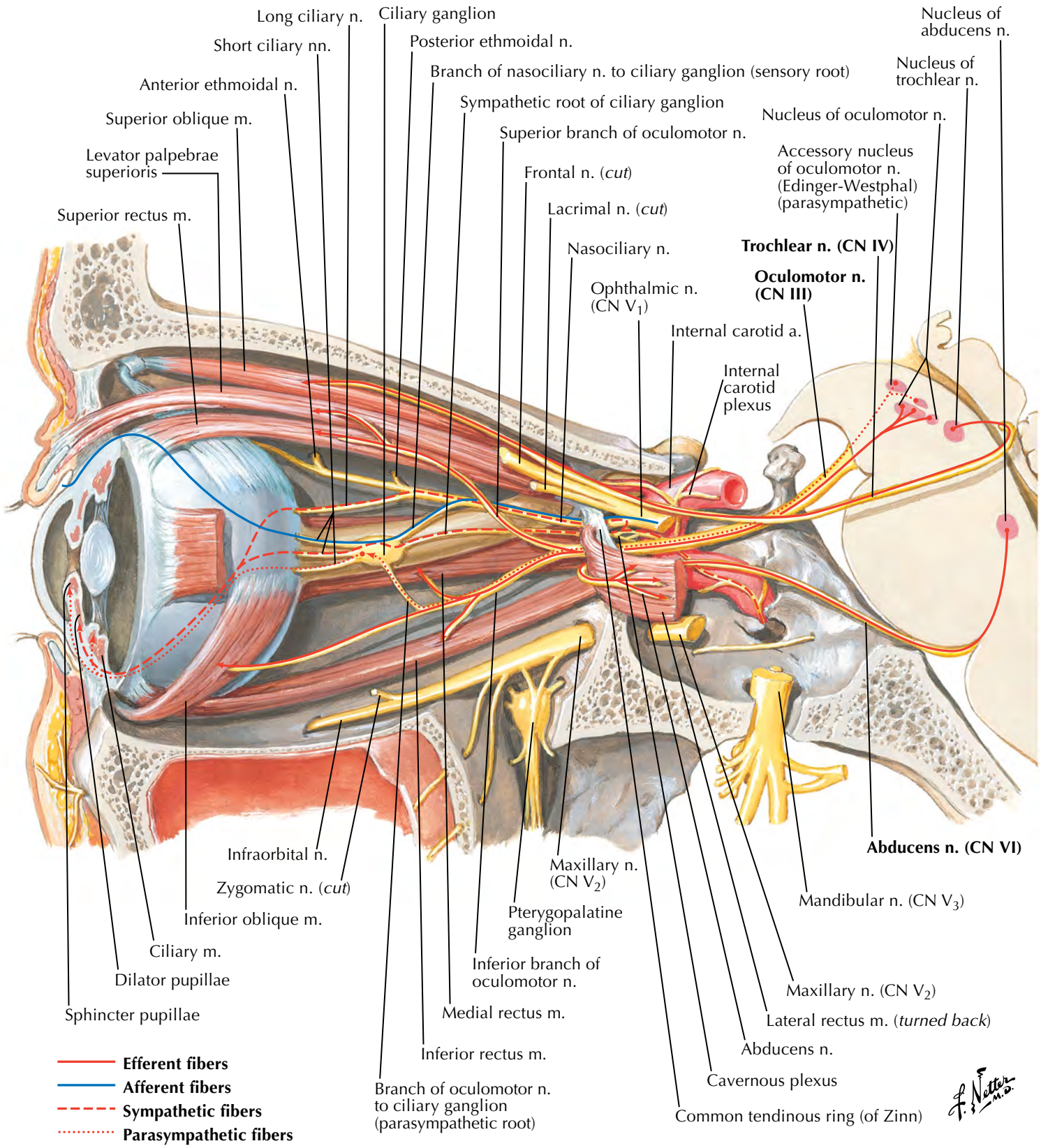


Structure of retina: schema

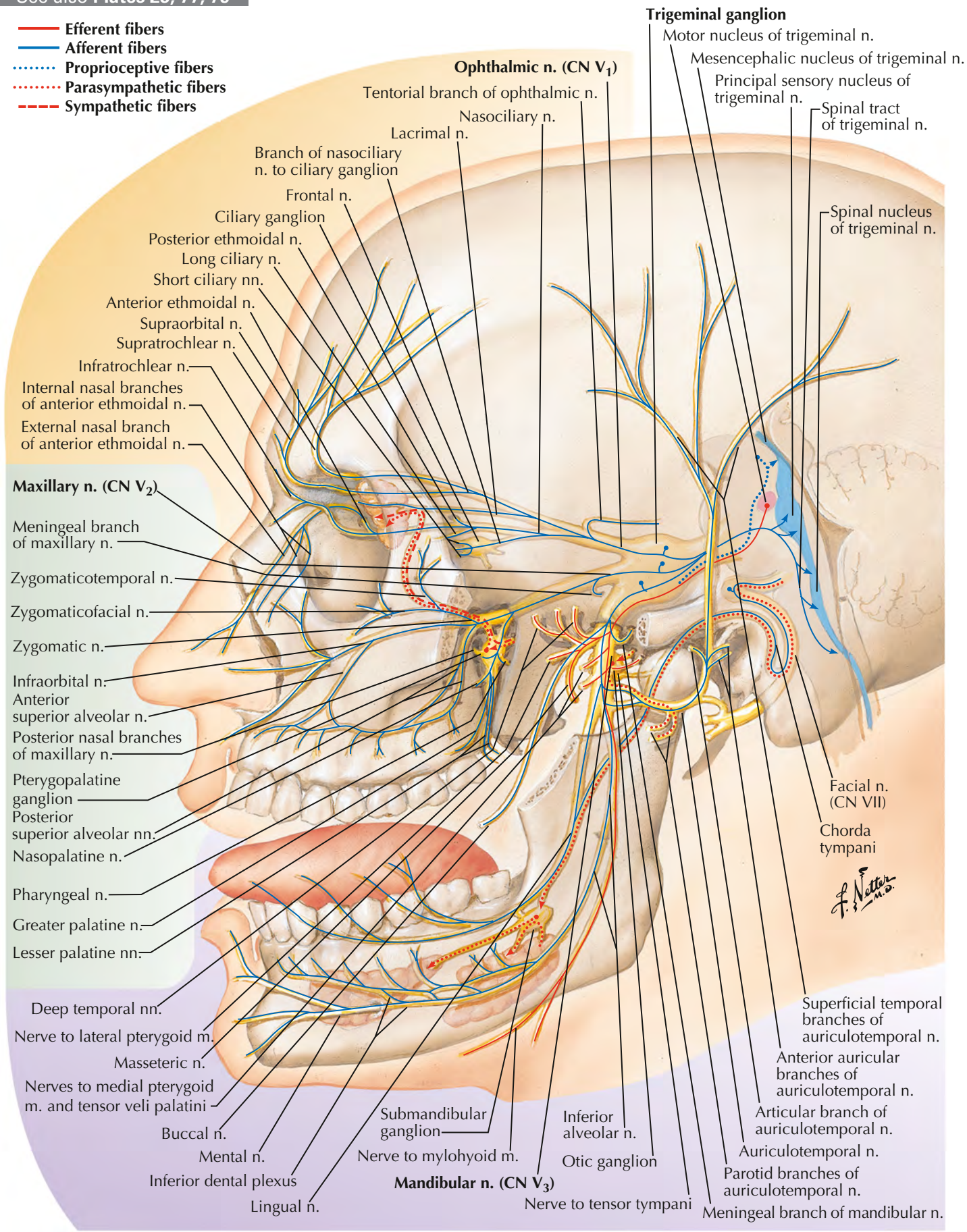
- **A** Amacrine cells
- **B** Bipolar cells
- **C** Cone cells
- **G** Retinal ganglion cells
- **H** Horizontal cells
- **P** Retinal pigment cells
- **R** Rod cells



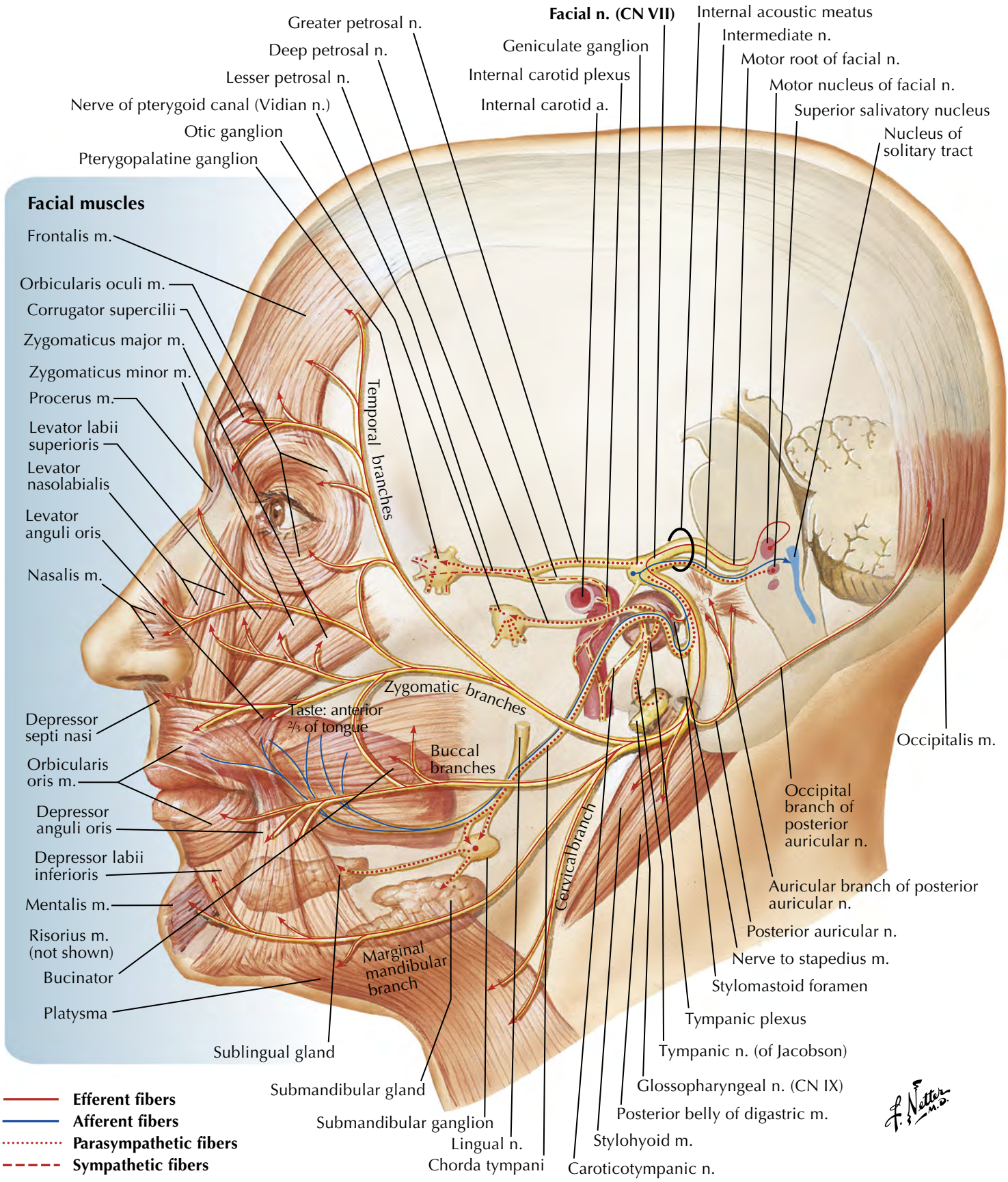
See also **Plates 113, 159**

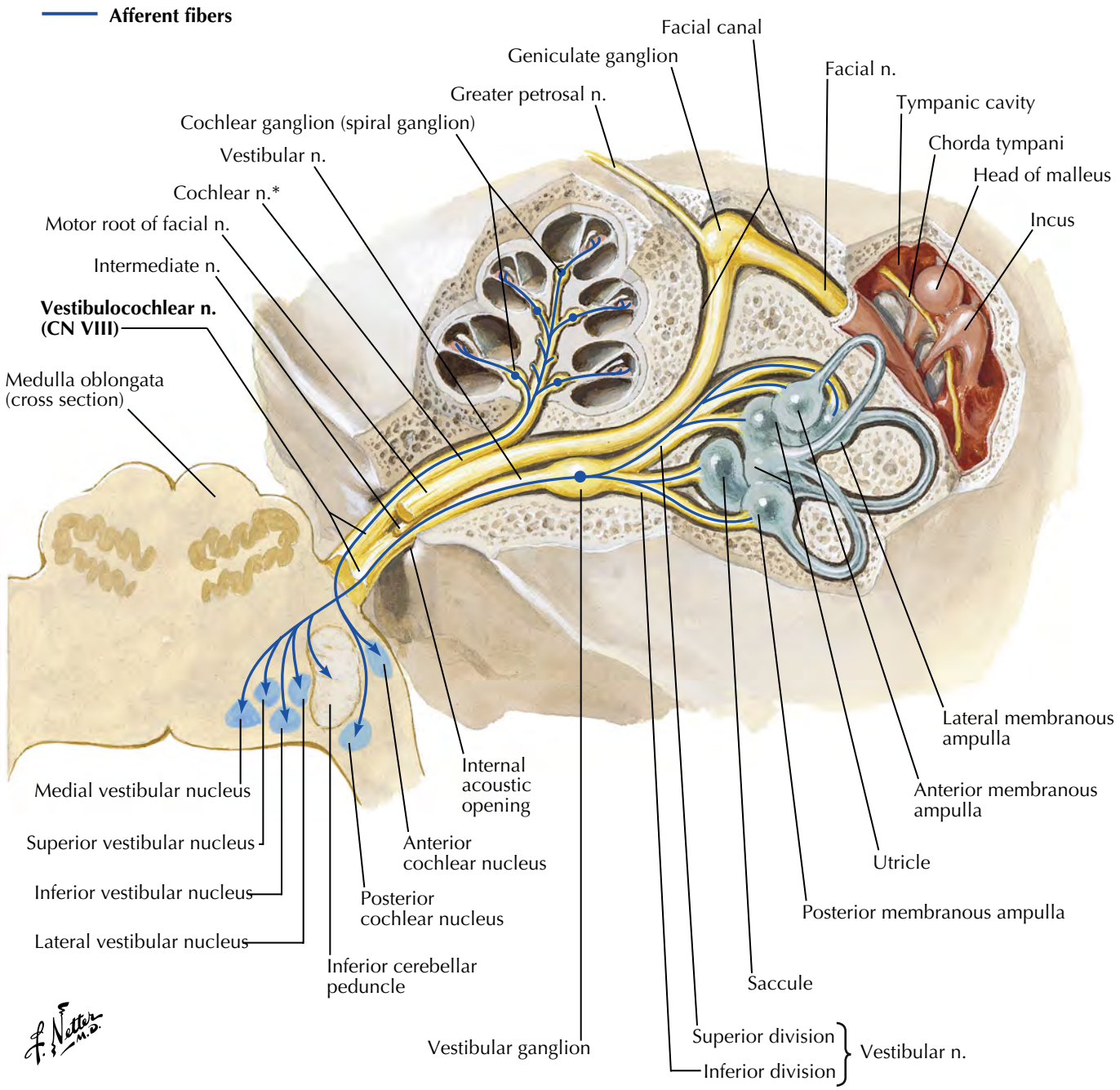


See also **Plates 23, 77, 79**

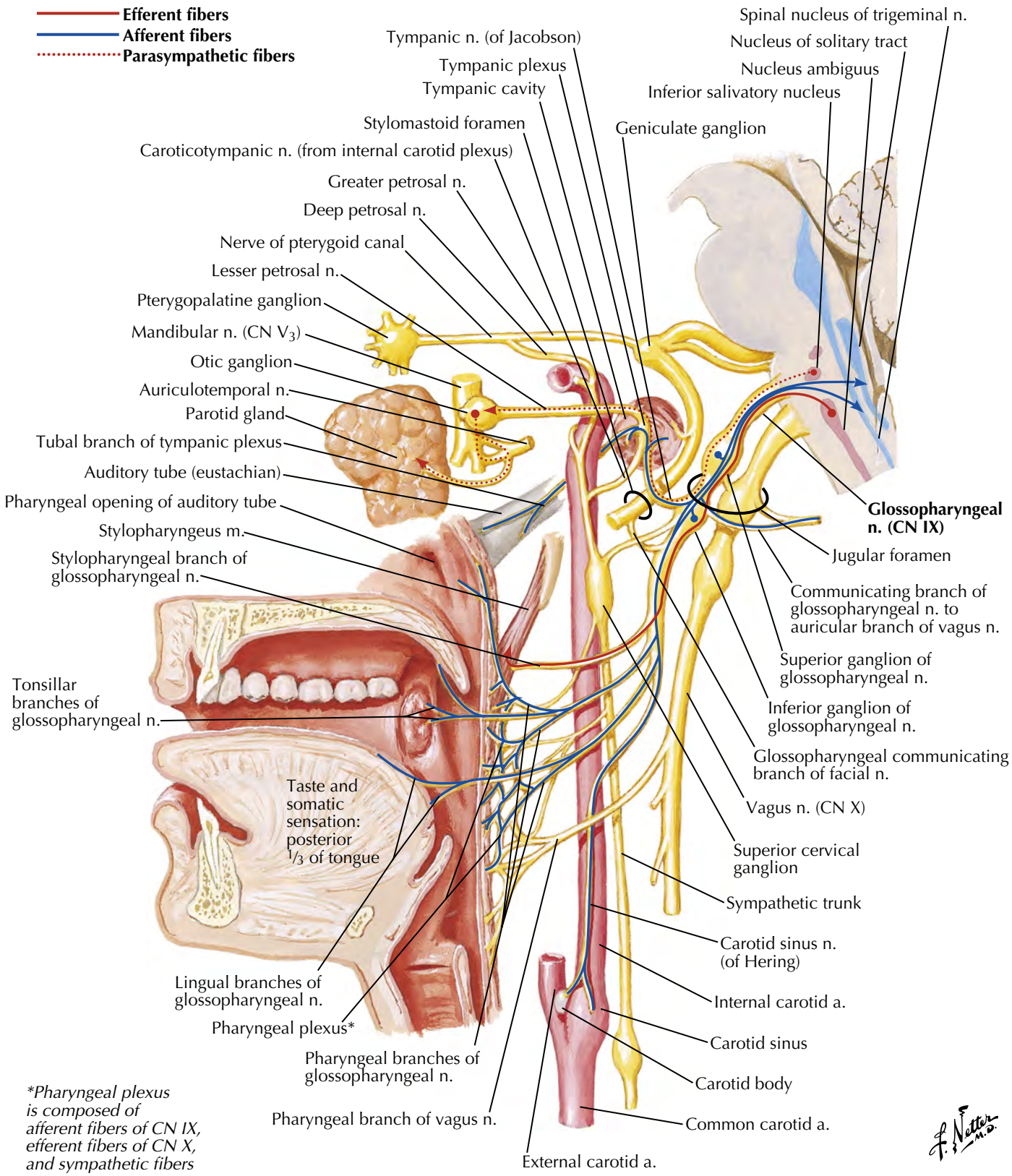


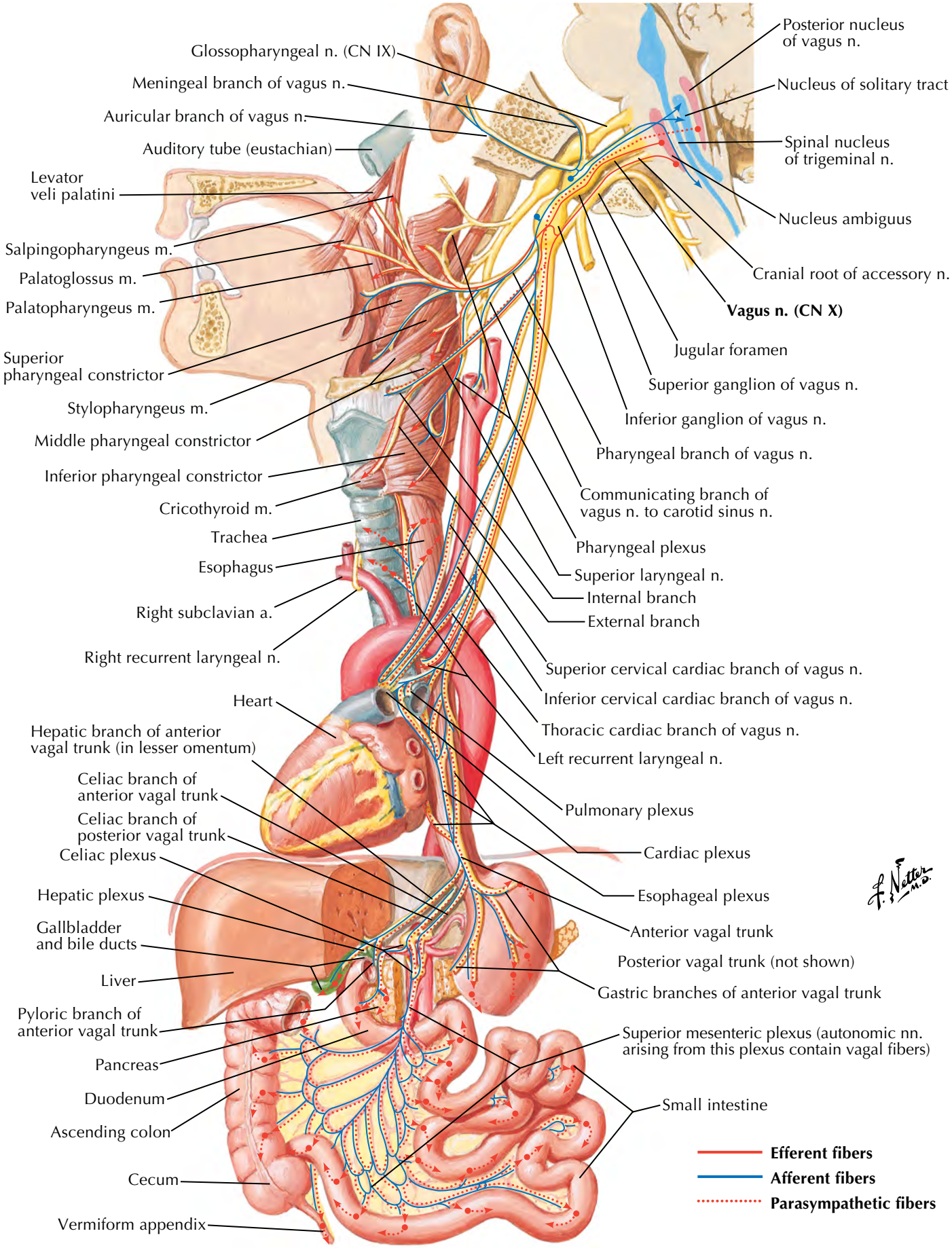
See also **Plate 71**

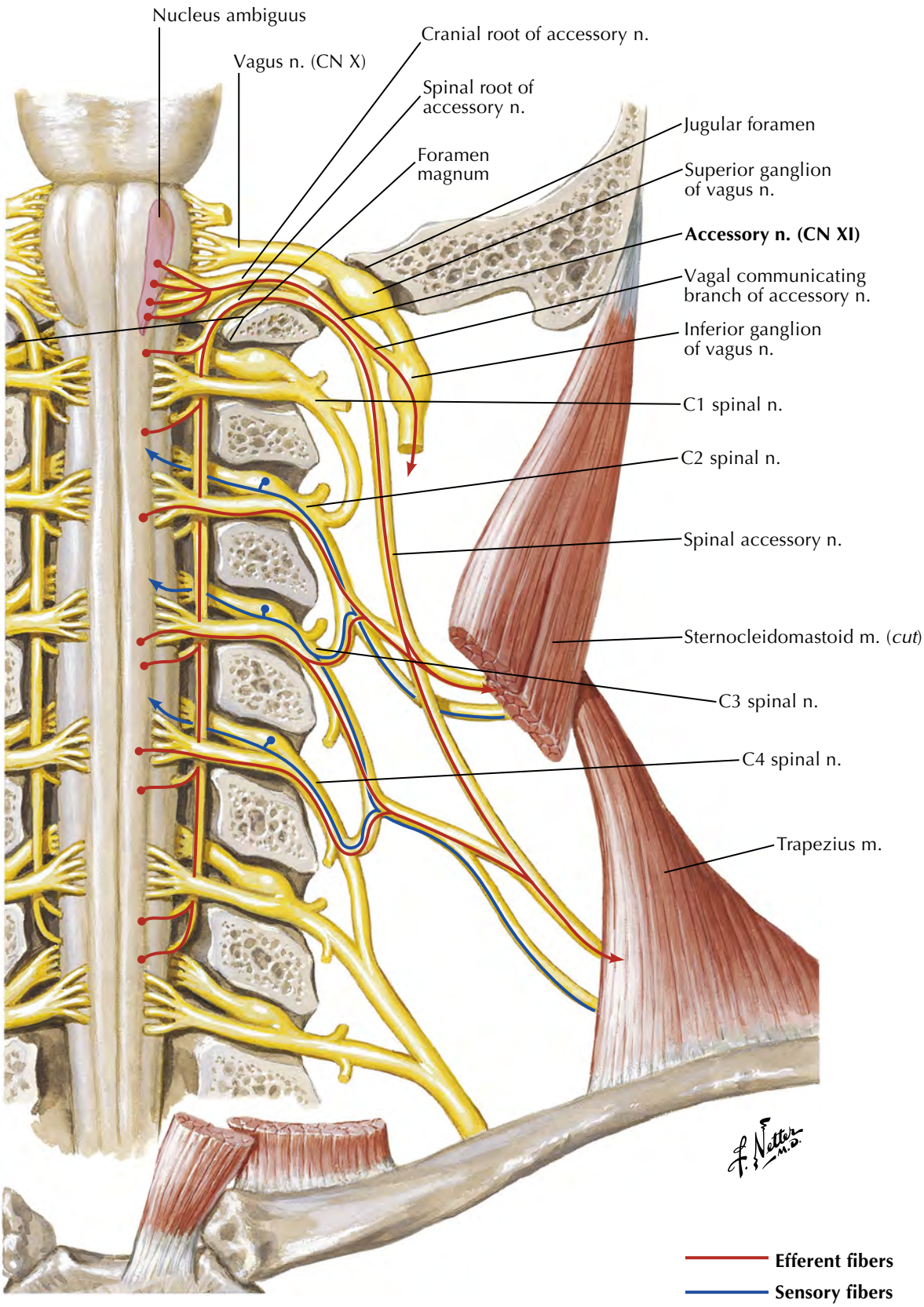




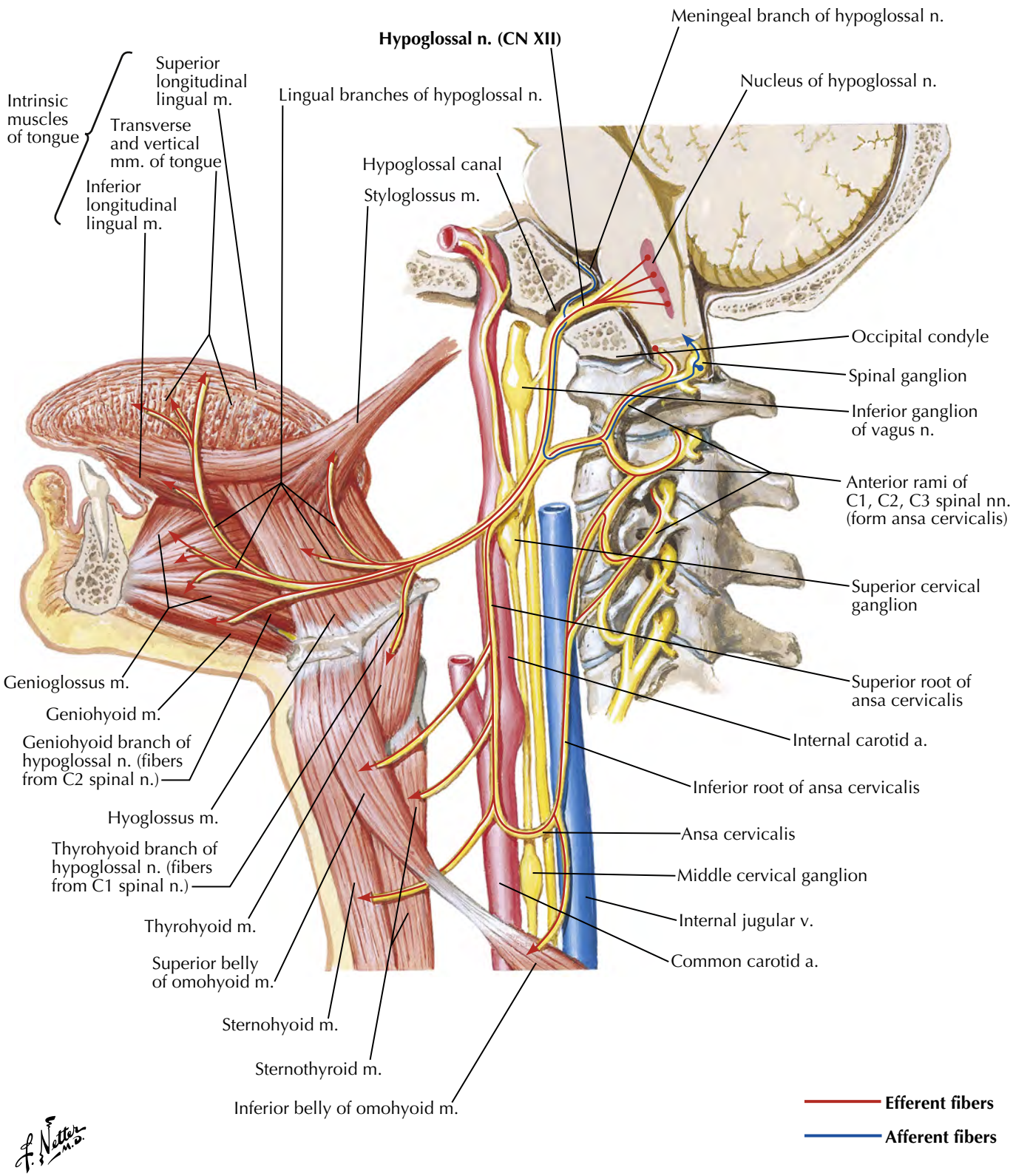
*Note: The cochlear nerve also contains efferent fibers to the sensory epithelium. These fibers are derived from the vestibular nerve while in the internal acoustic meatus.


Efferent fibers
Afferent fibers
Parasympathetic fibers
Spinal nucleus of trigeminal n.
Tympanic n. (of Jacobson)
Nucleus of solitary tract
Tympanic plexus
Nucleus ambiguus
Tympanic cavity
Inferior salivatory nucleus
Stylomastoid foramen
Geniculate ganglion
Caroticotympanic n. (from internal carotid plexus)
Greater petrosal n.
Deep petrosal n.
Nerve of pterygoid canal
Lesser petrosal n.
Pterygopalatine ganglion
Mandibular n. (CN V3)
Otic ganglion
Auriculotemporal n.
Parotid gland
Tubal branch of tympanic plexus
Auditory tube (eustachian)
Pharyngeal opening of auditory tube
Stylopharyngeus m.
Stylopharyngeal branch of glossopharyngeal n.
Glossopharyngeal n. (CN IX)
Jugular foramen
Communicating branch of glossopharyngeal n. to auricular branch of vagus n.
Superior ganglion of glossopharyngeal n.
Inferior ganglion of glossopharyngeal n.
Glossopharyngeal communicating branch of facial n.
Vagus n. (CN X)
Superior cervical ganglion
Sympathetic trunk
Carotid sinus n. (of Hering)
Internal carotid a.
Carotid sinus
Carotid body
Common carotid a.
External carotid a.
Tonsillar branches of glossopharyngeal n.
Taste and somatic sensation: posterior 1/3 of tongue
Lingual branches of glossopharyngeal n.
Pharyngeal plexus*
Pharyngeal branches of glossopharyngeal n.
Pharyngeal branch of vagus n.
*Pharyngeal plexus is composed of afferent fibers of CN IX, efferent fibers of CN X, and sympathetic fibers

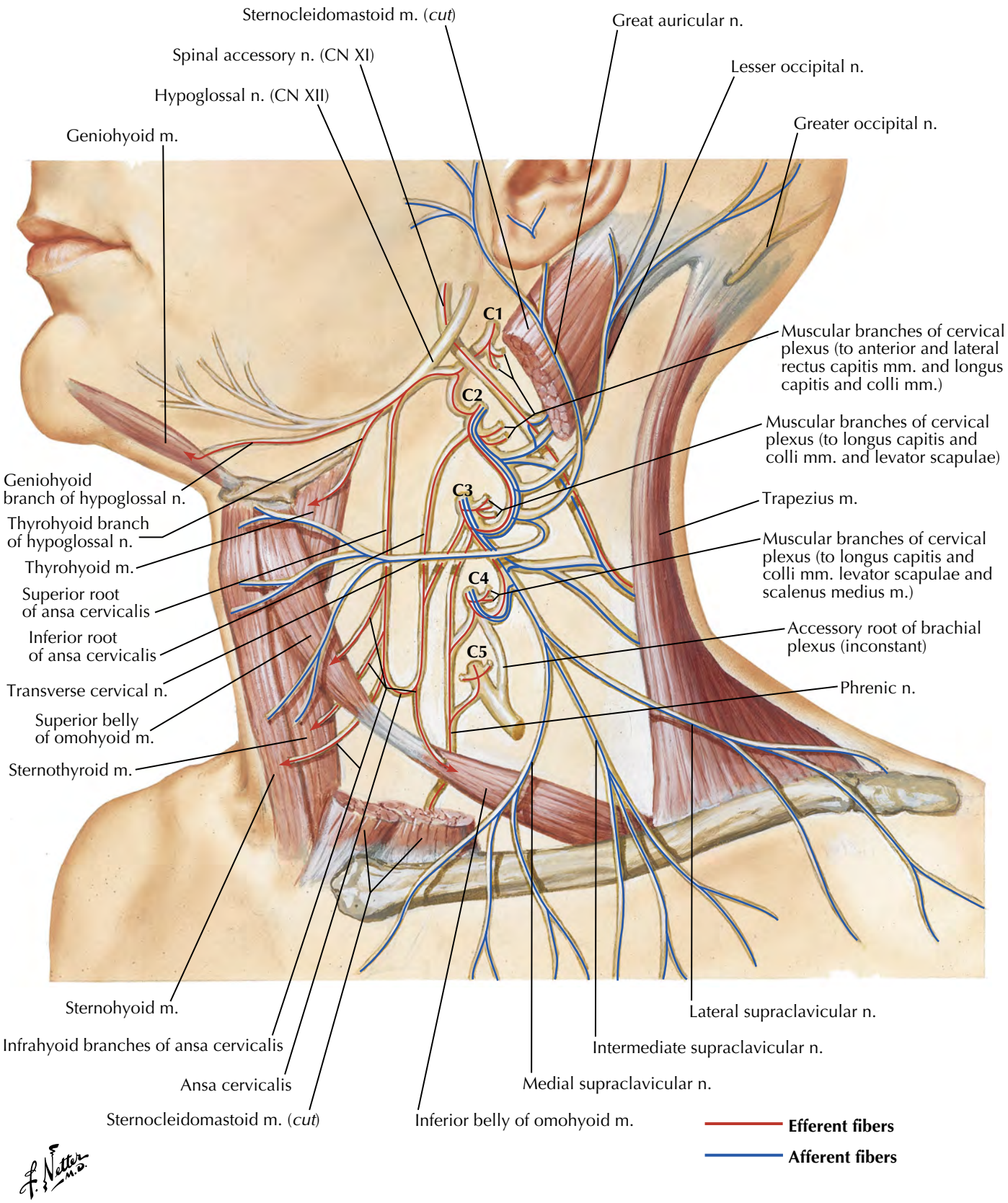

Glossopharyngeal n. (CN IX)
Meningeal branch of vagus n.
Auricular branch of vagus n.
Auditory tube (eustachian)
Levator veli palatini
Salpingopharyngeus m.
Palatoglossus m.
Palatopharyngeus m.
Superior pharyngeal constrictor
Stylopharyngeus m.
Middle pharyngeal constrictor
Inferior pharyngeal constrictor
Cricothyroid m.
Trachea
Esophagus
Right subclavian a.
Right recurrent laryngeal n.
Heart
Hepatic branch of anterior vagal trunk (in lesser omentum)
Celiac branch of anterior vagal trunk
Celiac branch of posterior vagal trunk
Celiac plexus
Hepatic plexus
Gallbladder and bile ducts
Liver
Pyloric branch of anterior vagal trunk
Pancreas
Duodenum
Ascending colon
Cecum
Vermiform appendix
Posterior nucleus of vagus n.
Nucleus of solitary tract
Spinal nucleus of trigeminal n.
Nucleus ambiguus
Cranial root of accessory n.
Vagus n. (CN X)
Jugular foramen
Superior ganglion of vagus n.
Inferior ganglion of vagus n.
Pharyngeal branch of vagus n.
Communicating branch of vagus n. to carotid sinus n.
Pharyngeal plexus
Superior laryngeal n.
Internal branch
External branch
Superior cervical cardiac branch of vagus n.
Inferior cervical cardiac branch of vagus n.
Thoracic cardiac branch of vagus n.
Left recurrent laryngeal n.
Pulmonary plexus
Cardiac plexus
Esophageal plexus
Anterior vagal trunk
Posterior vagal trunk (not shown)
Gastric branches of anterior vagal trunk
Superior mesenteric plexus (autonomic nn. arising from this plexus contain vagal fibers)
Small intestine
Efferent fibers
Afferent fibers
Parasympathetic fibers


Nucleus ambiguus
Vagus n. (CN X)
Cranial root of accessory n.
Spinal root of accessory n.
Foramen magnum
Jugular foramen
Superior ganglion of vagus n.
Accessory n. (CN XI)
Vagal communicating branch of accessory n.
Inferior ganglion of vagus n.
C1 spinal n.
C2 spinal n.
Spinal accessory n.
Sternocleidomastoid m. (*cut*)
C3 spinal n.
C4 spinal n.
Trapezius m.
F. Netter M.D.
Efferent fibers
Sensory fibers

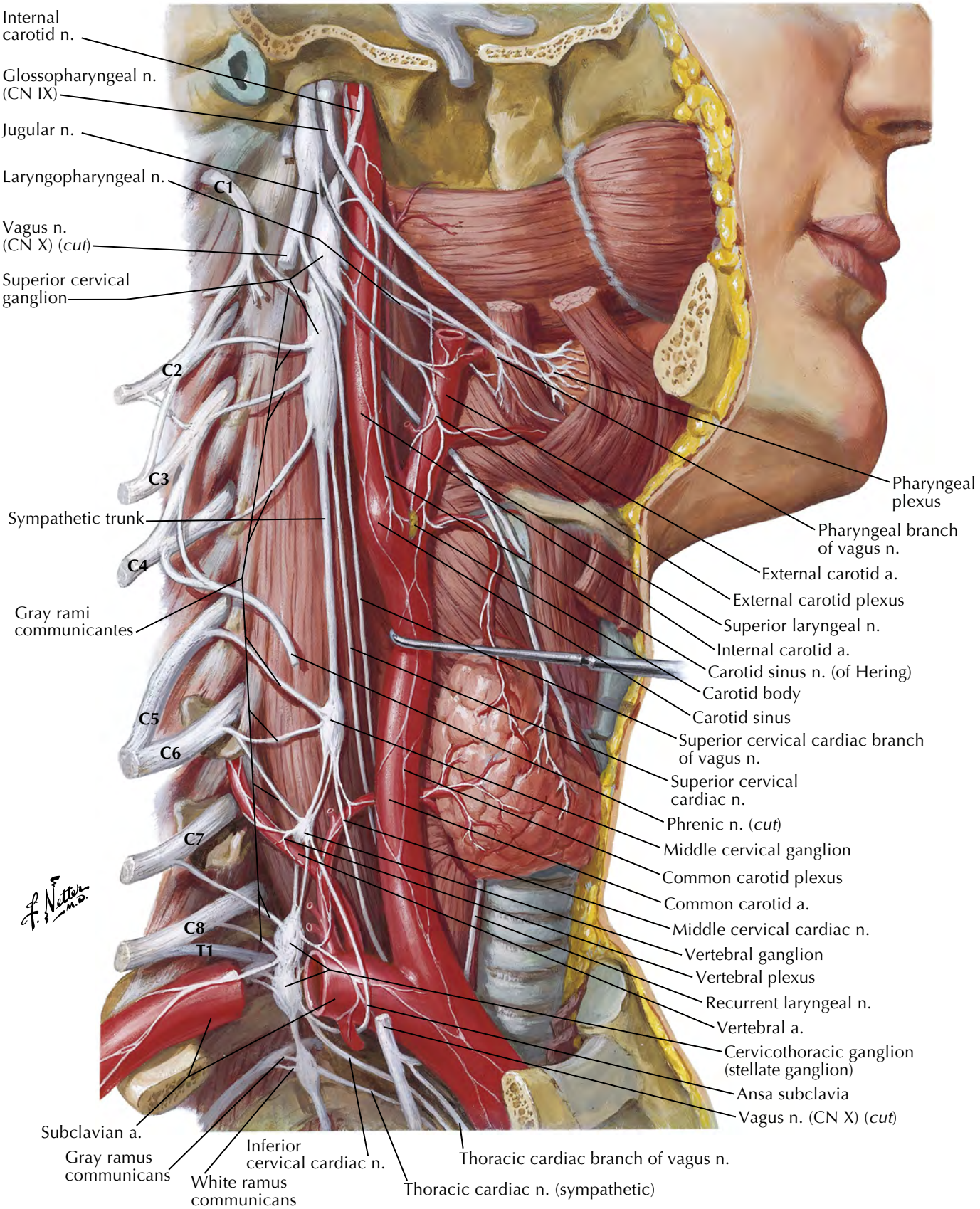
See also **Plate 56**



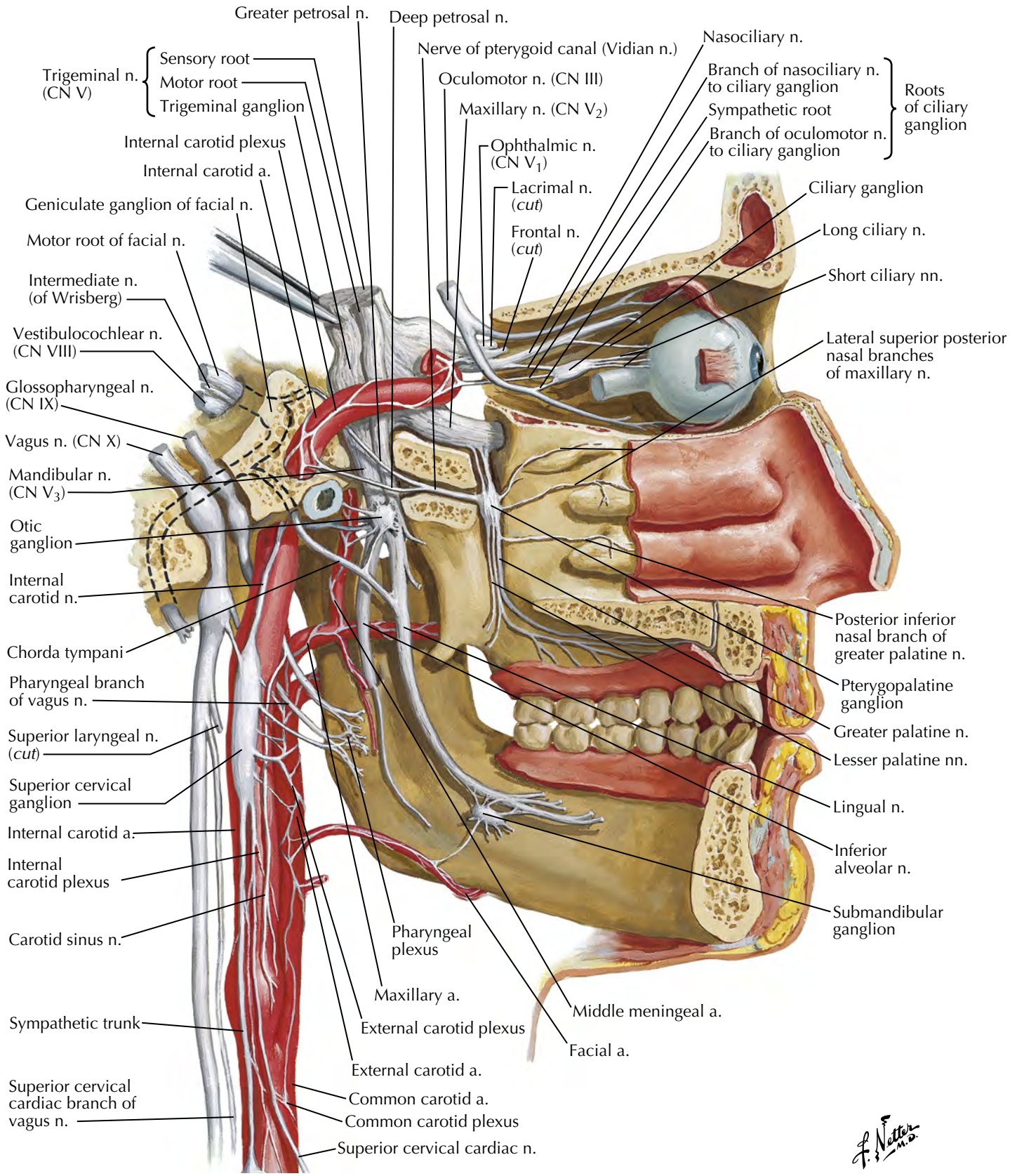
See also **Plates 56, 57**



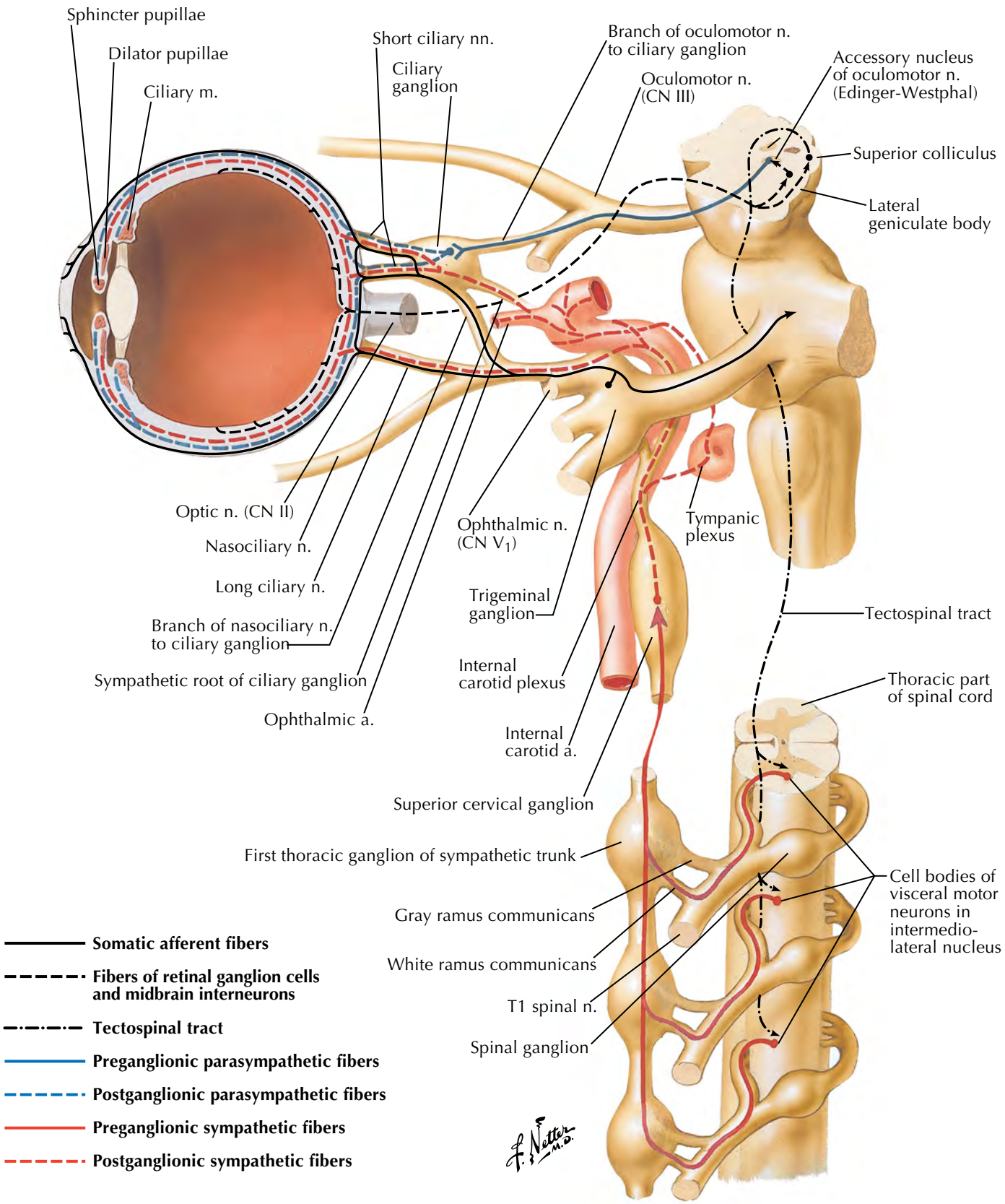
See also **Plate 152**



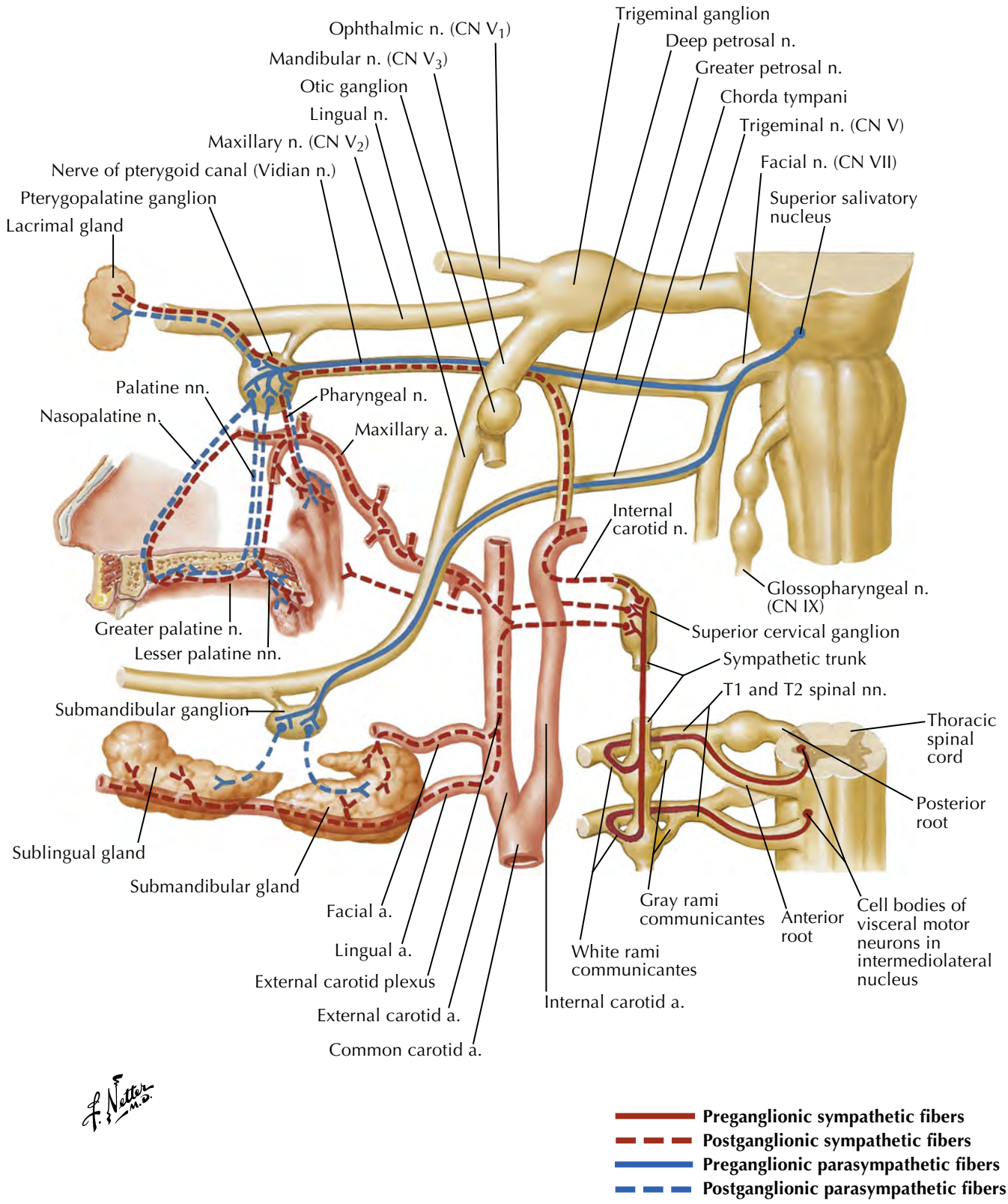
See also **Plates 80, 149, 160**



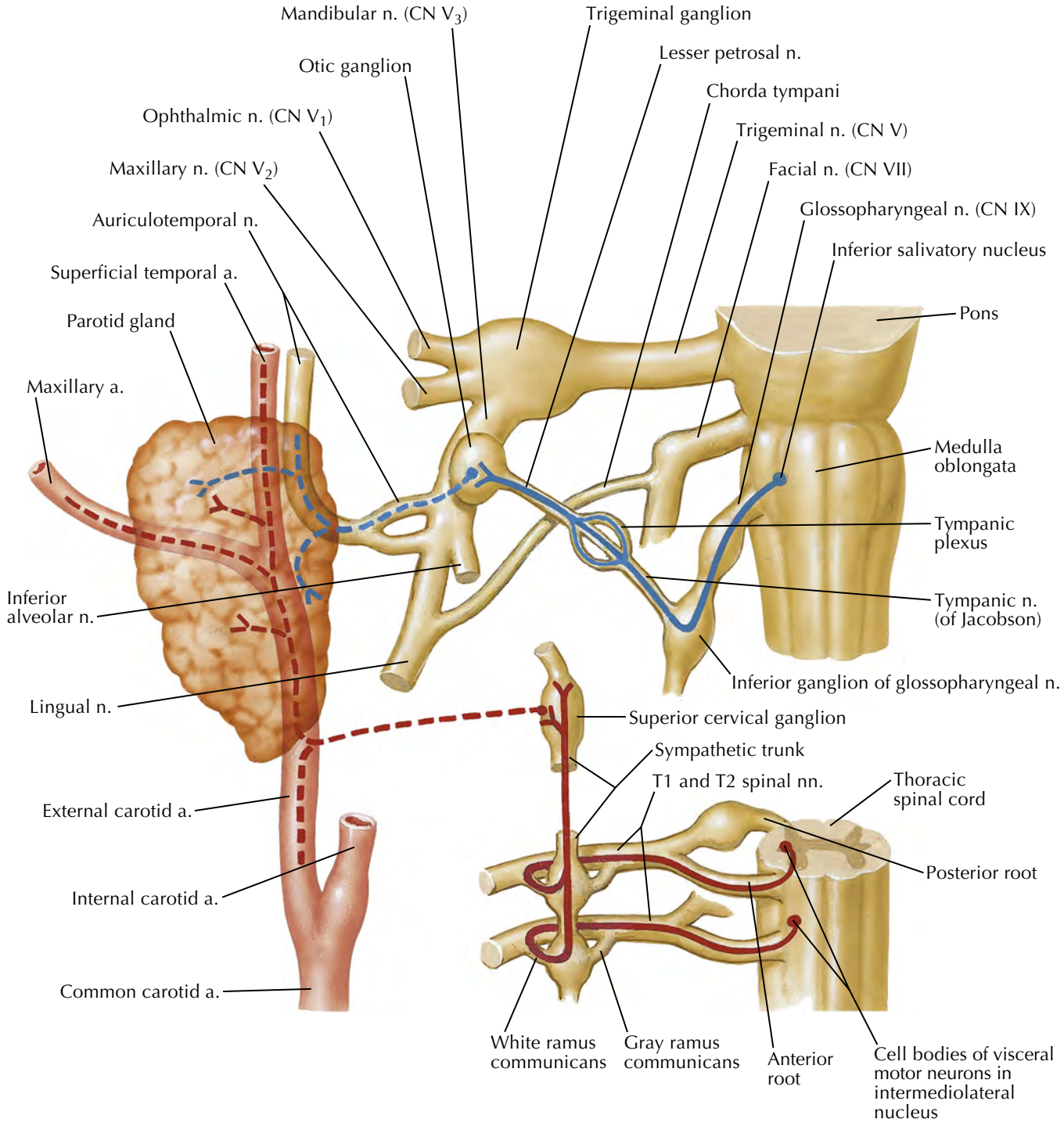
See also **Plates 80, 149, 160**



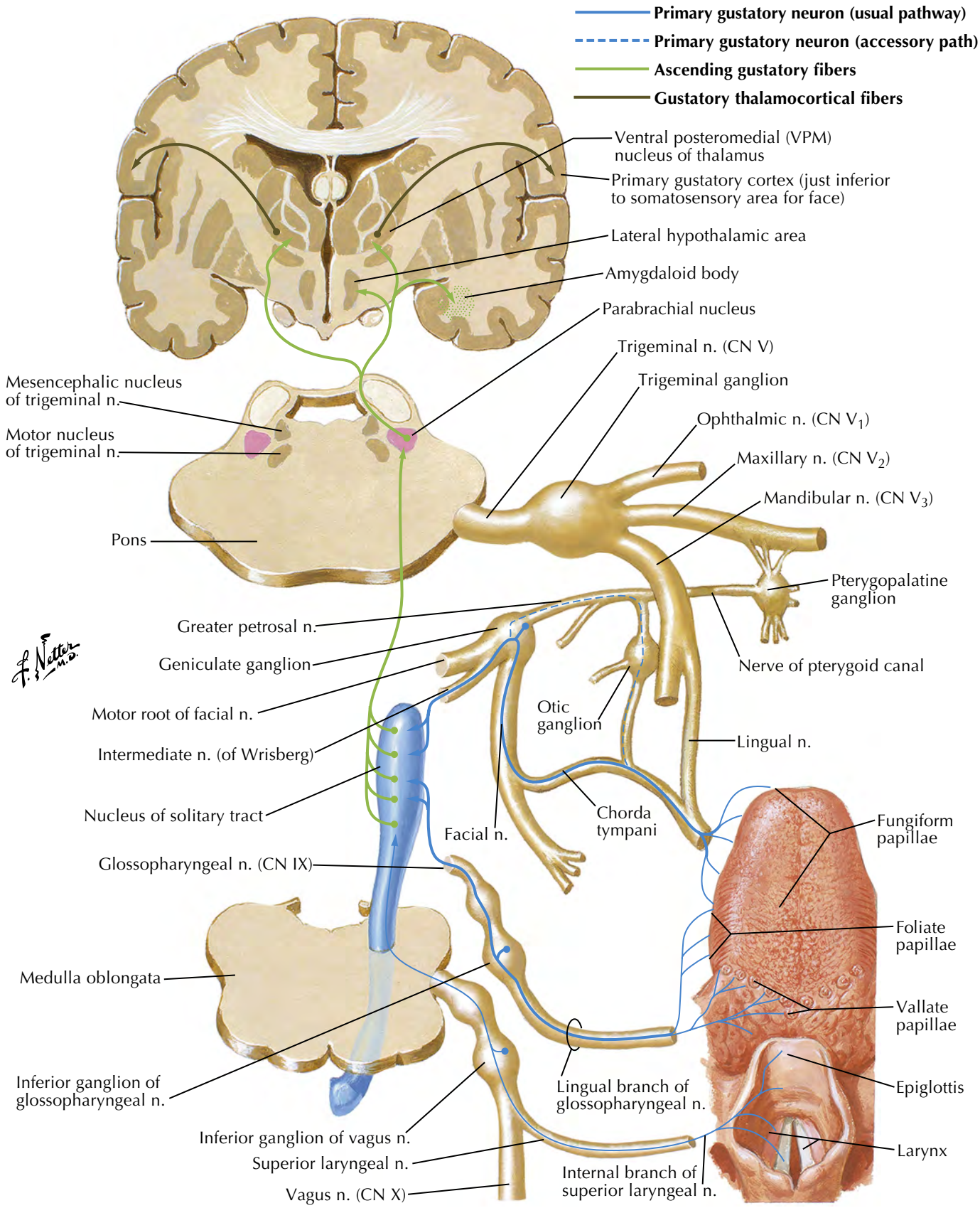
See also **Plates 77, 87, 111**



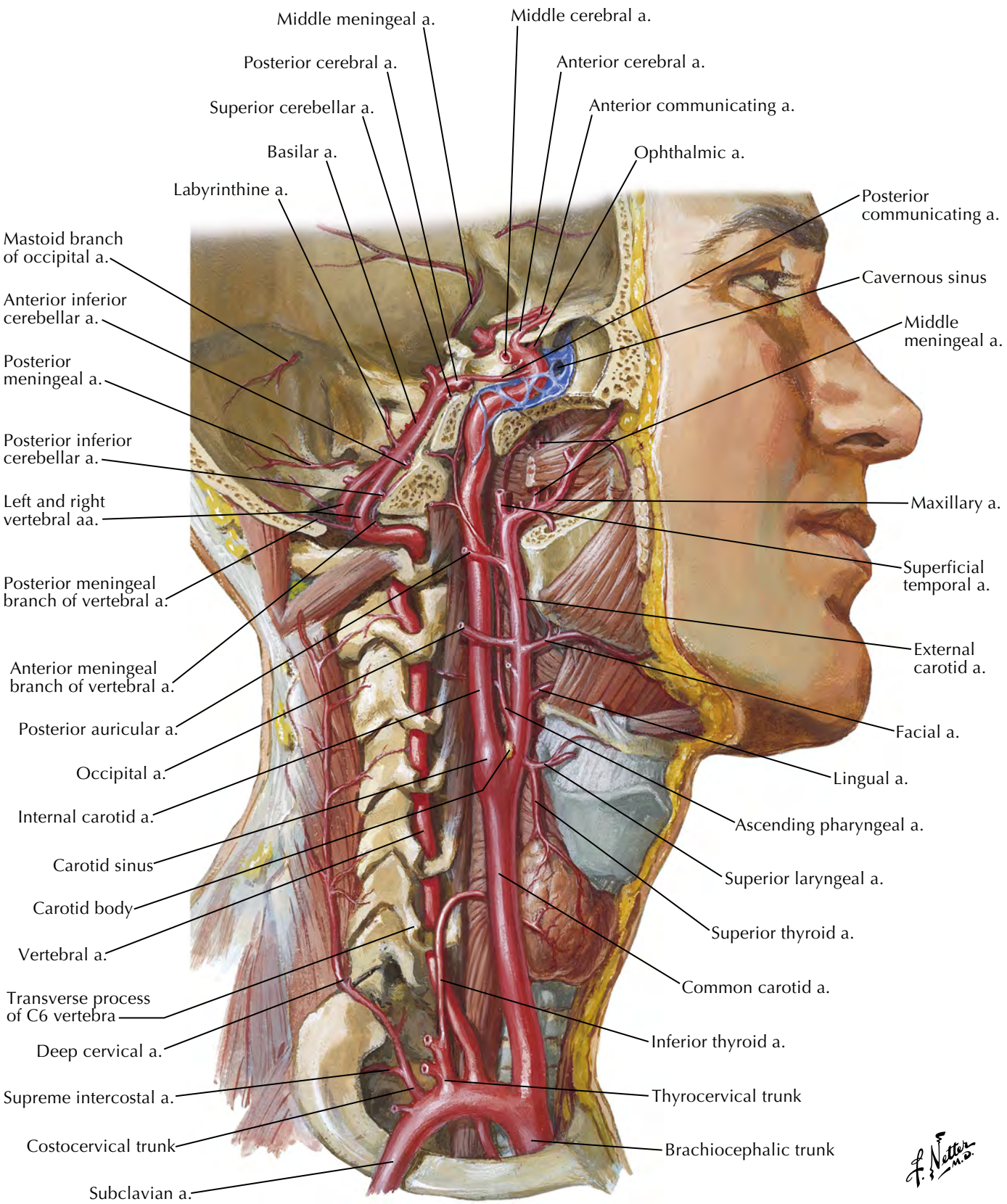
See also **Plate 77**



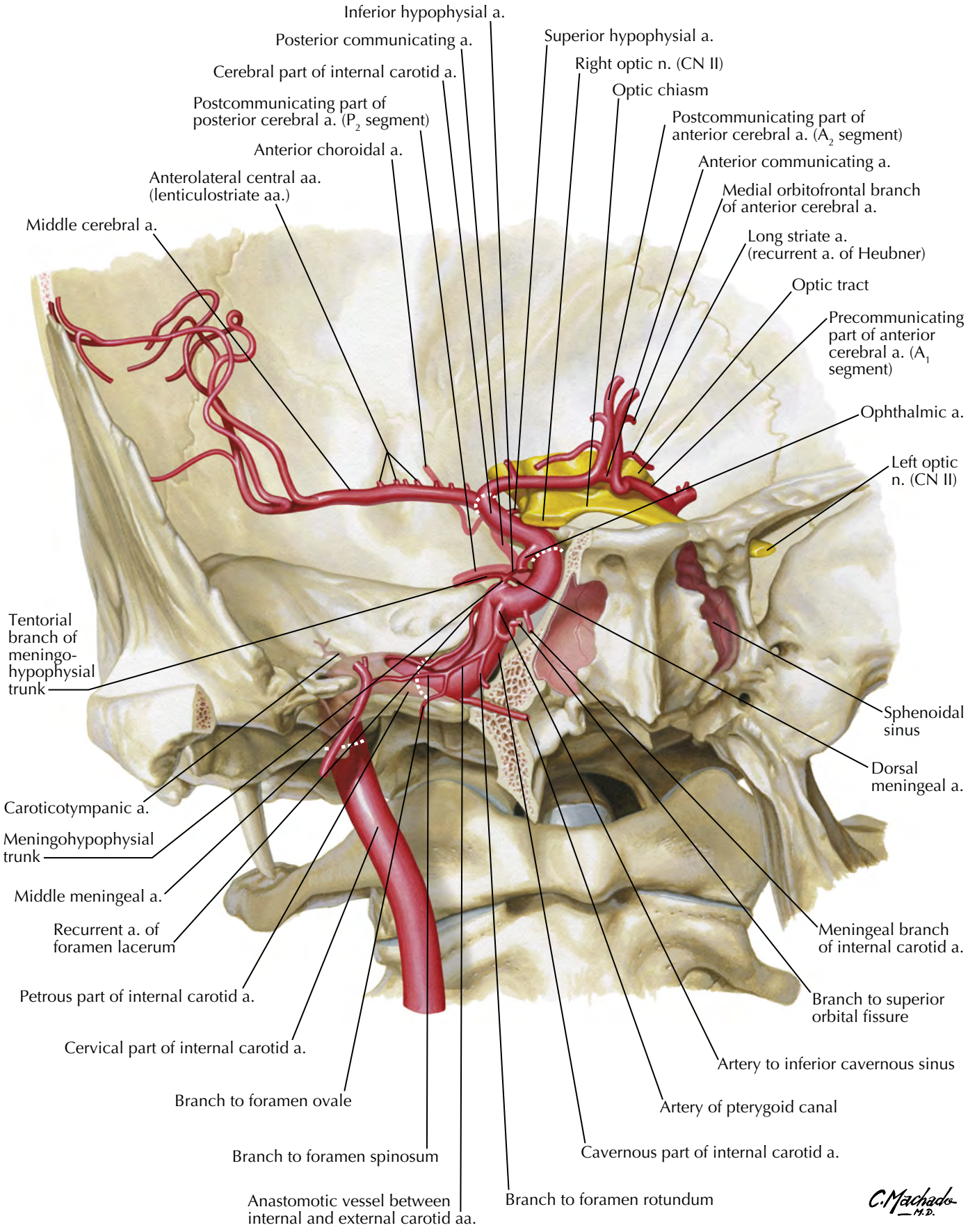
Preganglionic sympathetic fibers
Postganglionic sympathetic fibers
Preganglionic parasympathetic fibers
Postganglionic parasympathetic fibers

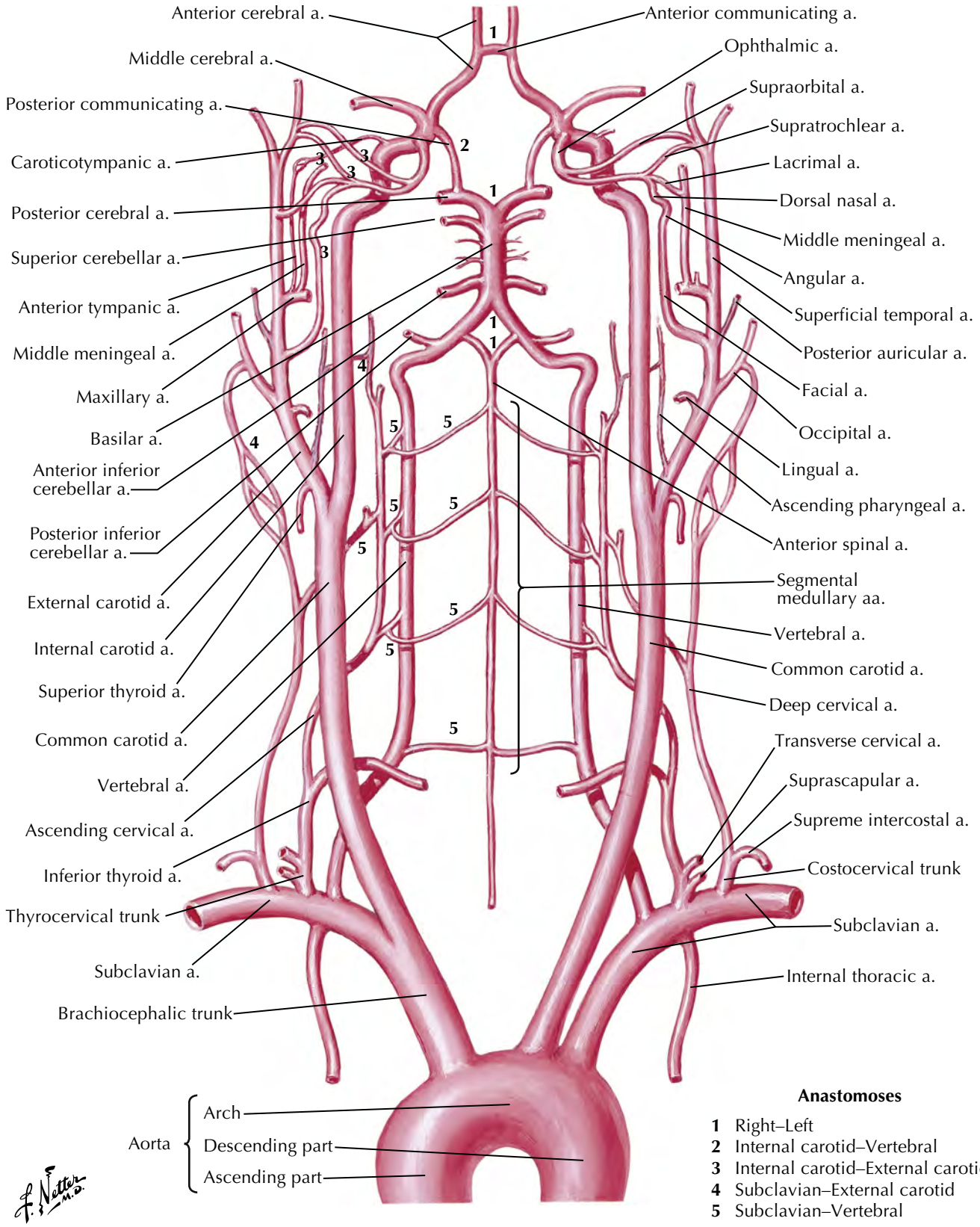

Primary gustatory neuron (usual pathway)
Primary gustatory neuron (accessory path)
Ascending gustatory fibers
Gustatory thalamocortical fibers
Ventral posteromedial (VPM) nucleus of thalamus
Primary gustatory cortex (just inferior to somatosensory area for face)
Lateral hypothalamic area
Amygdaloid body
Parabrachial nucleus
Trigeminal n. (CN V)
Trigeminal ganglion
Ophthalmic n. (CN V1)
Maxillary n. (CN V2)
Mandibular n. (CN V3)
Mesencephalic nucleus of trigeminal n.
Motor nucleus of trigeminal n.
Pons
Pterygopalatine ganglion
Greater petrosal n.
Geniculate ganglion
Motor root of facial n.
Intermediate n. (of Wrisberg)
Nucleus of solitary tract
Glossopharyngeal n. (CN IX)
Nerve of pterygoid canal
Otic ganglion
Lingual n.
Chorda tympani
Facial n.
Fungiform papillae
Foliate papillae
Vallate papillae
Epiglottis
Larynx
Medulla oblongata
Inferior ganglion of glossopharyngeal n.
Lingual branch of glossopharyngeal n.
Inferior ganglion of vagus n.
Superior laryngeal n.
Vagus n. (CN X)
Internal branch of superior laryngeal n.

See also **Plates 58, 82, 164**



See also **Plates 163, 166**

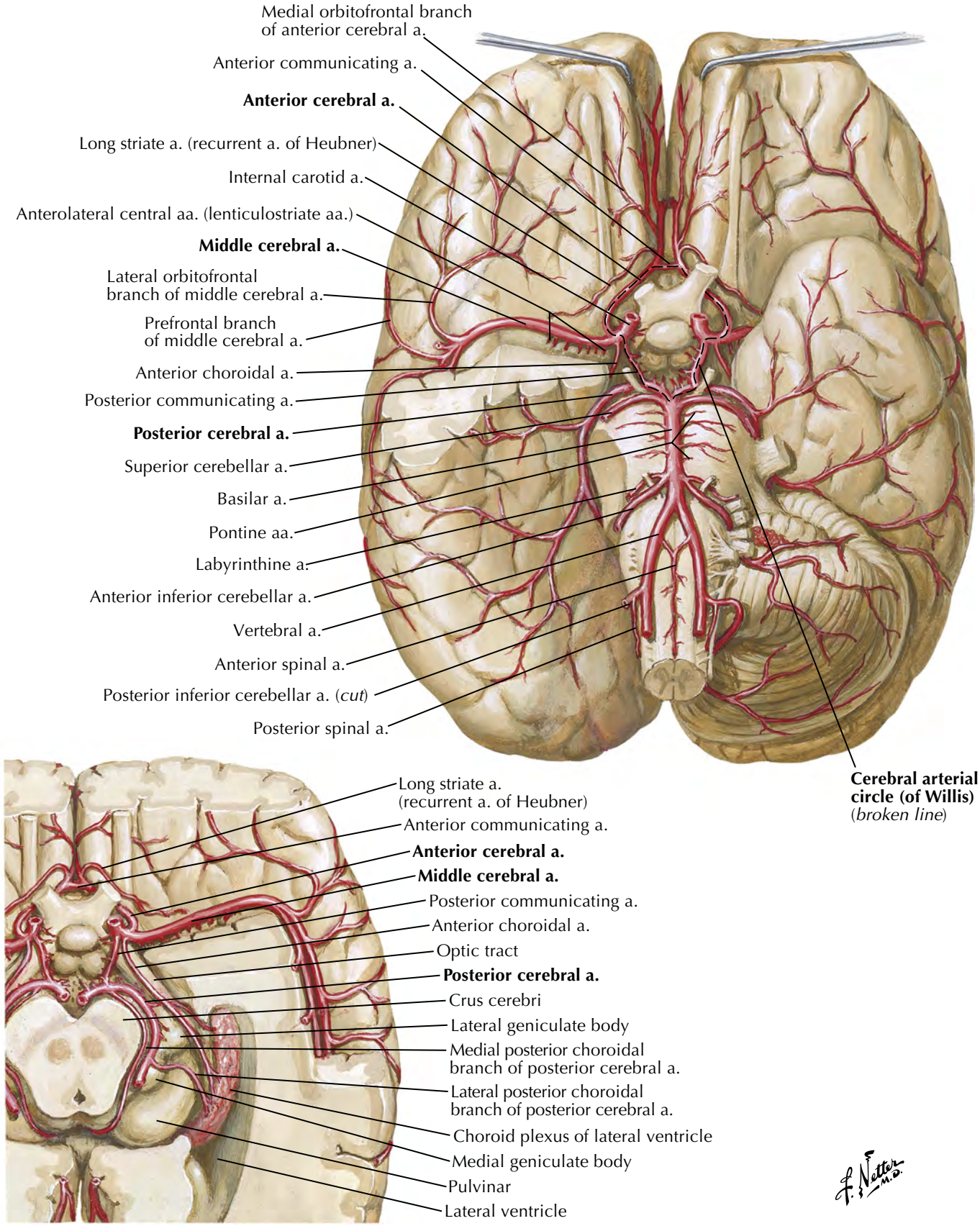




Anastomoses

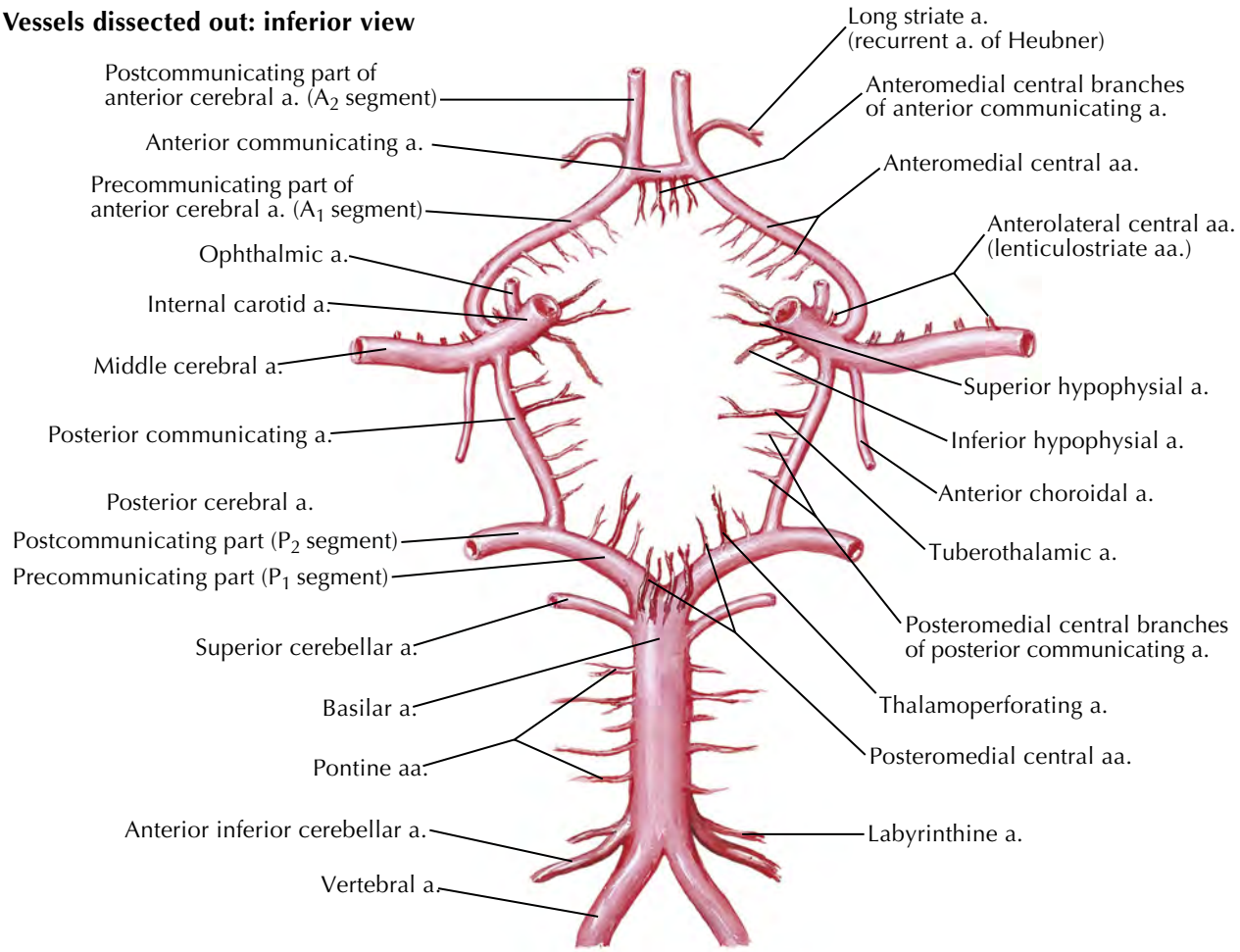
1 Right–Left
2 Internal carotid–Vertebral
3 Internal carotid–External carotid
4 Subclavian–External carotid
5 Subclavian–Vertebral

See also **Plates 164, 167**

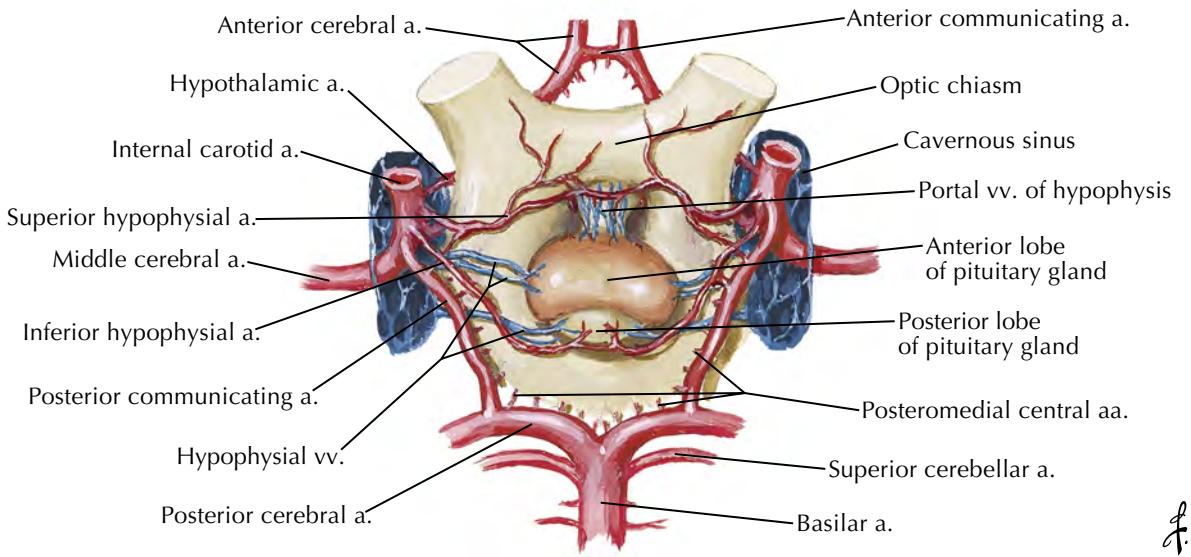


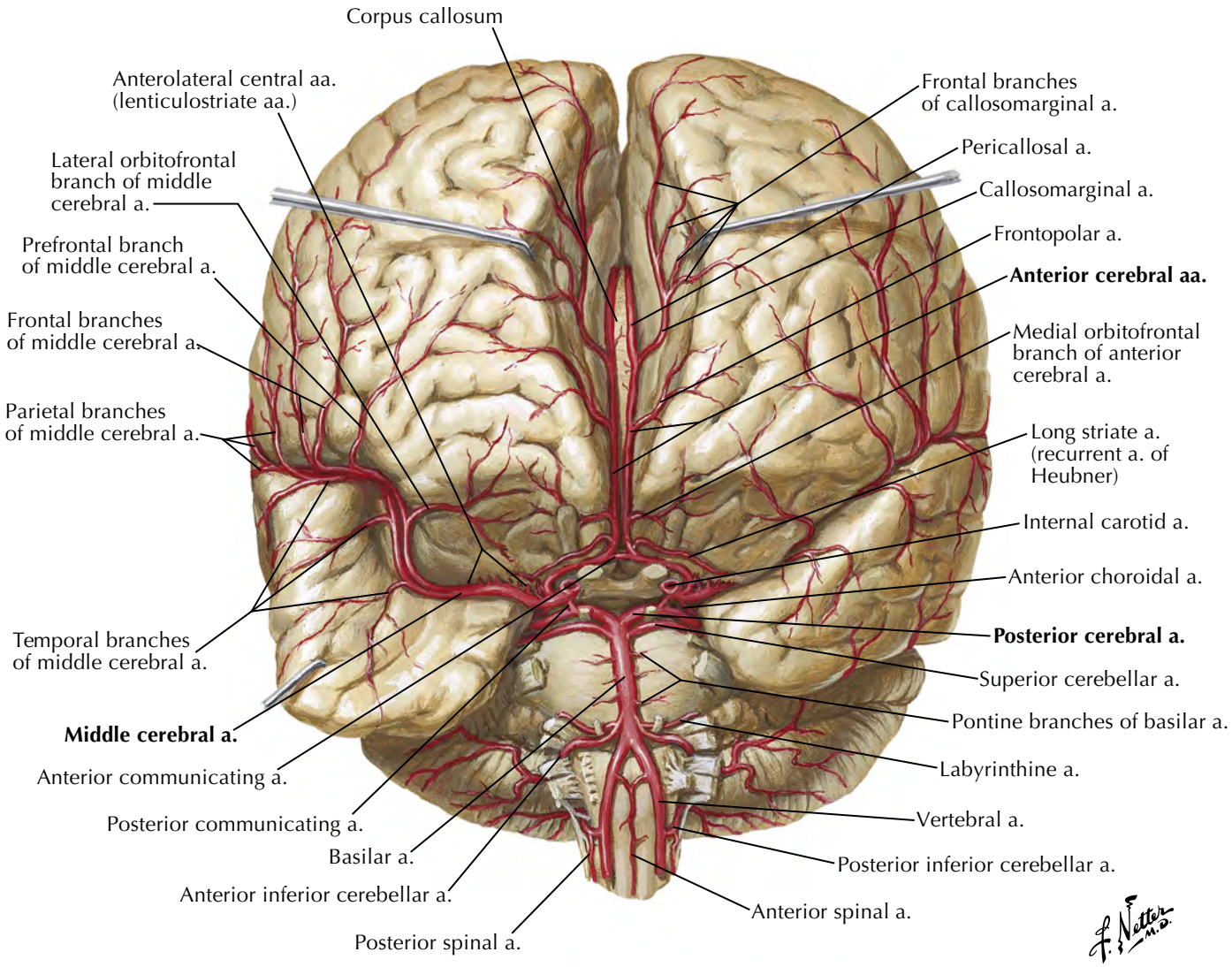
See also **Plate 166**

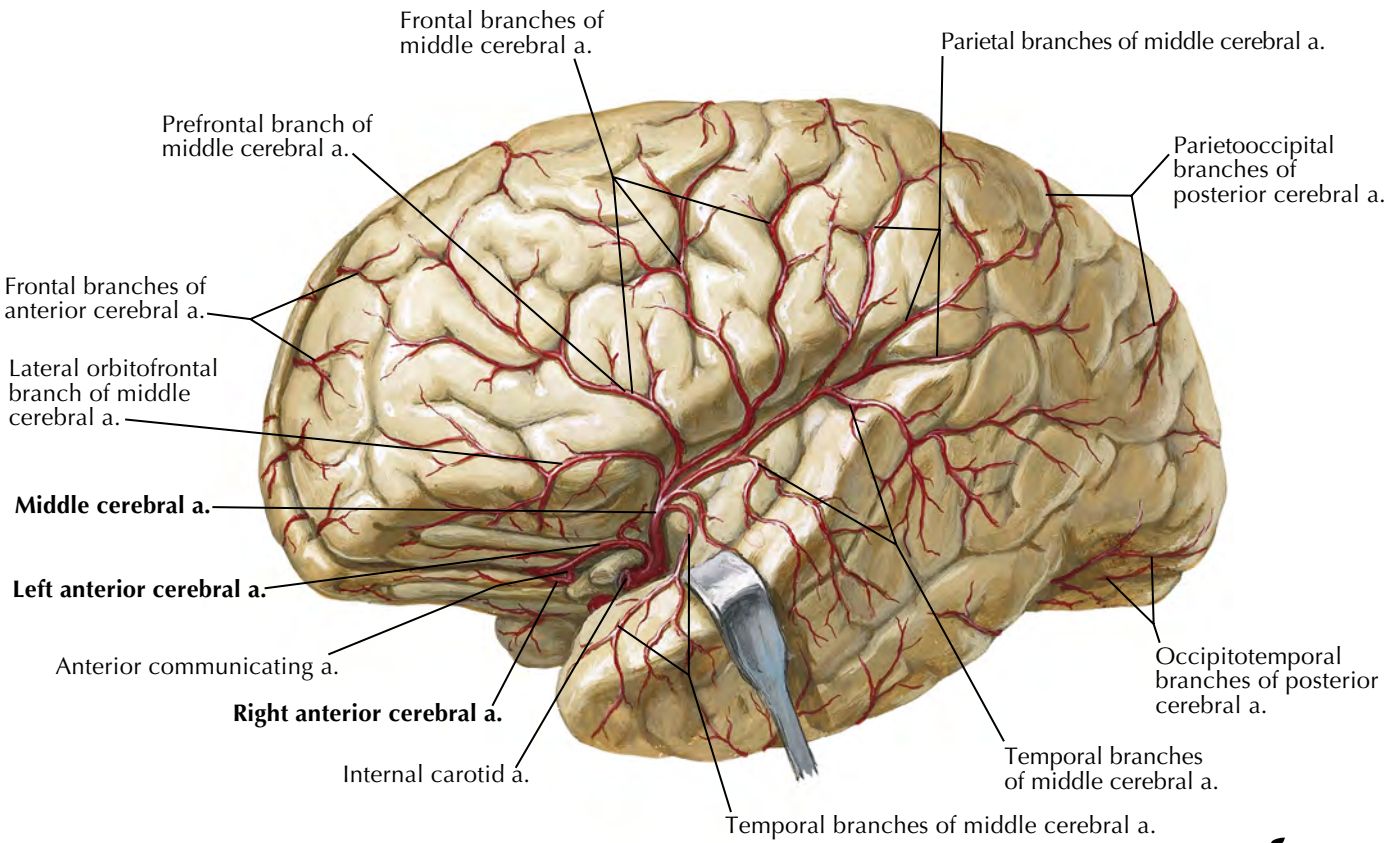
Vessels dissected out: inferior view

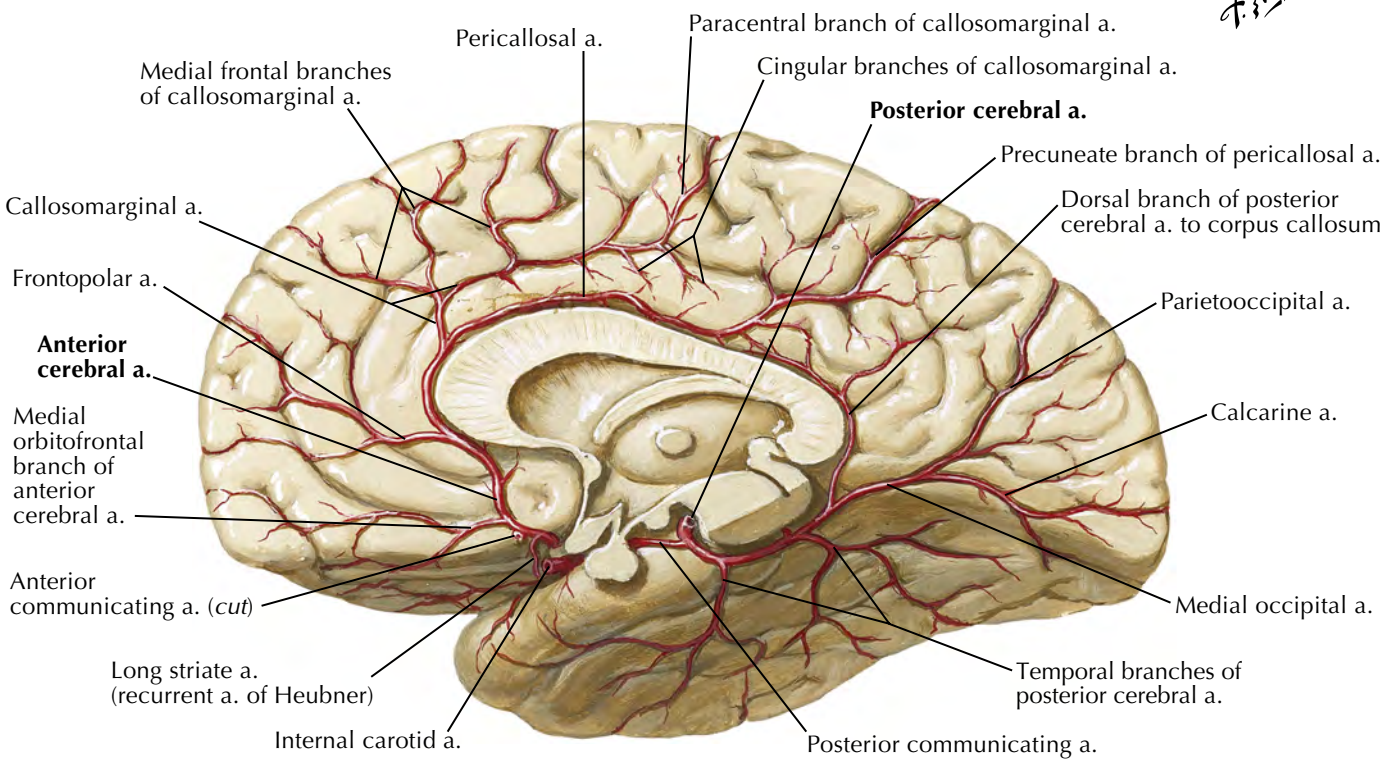


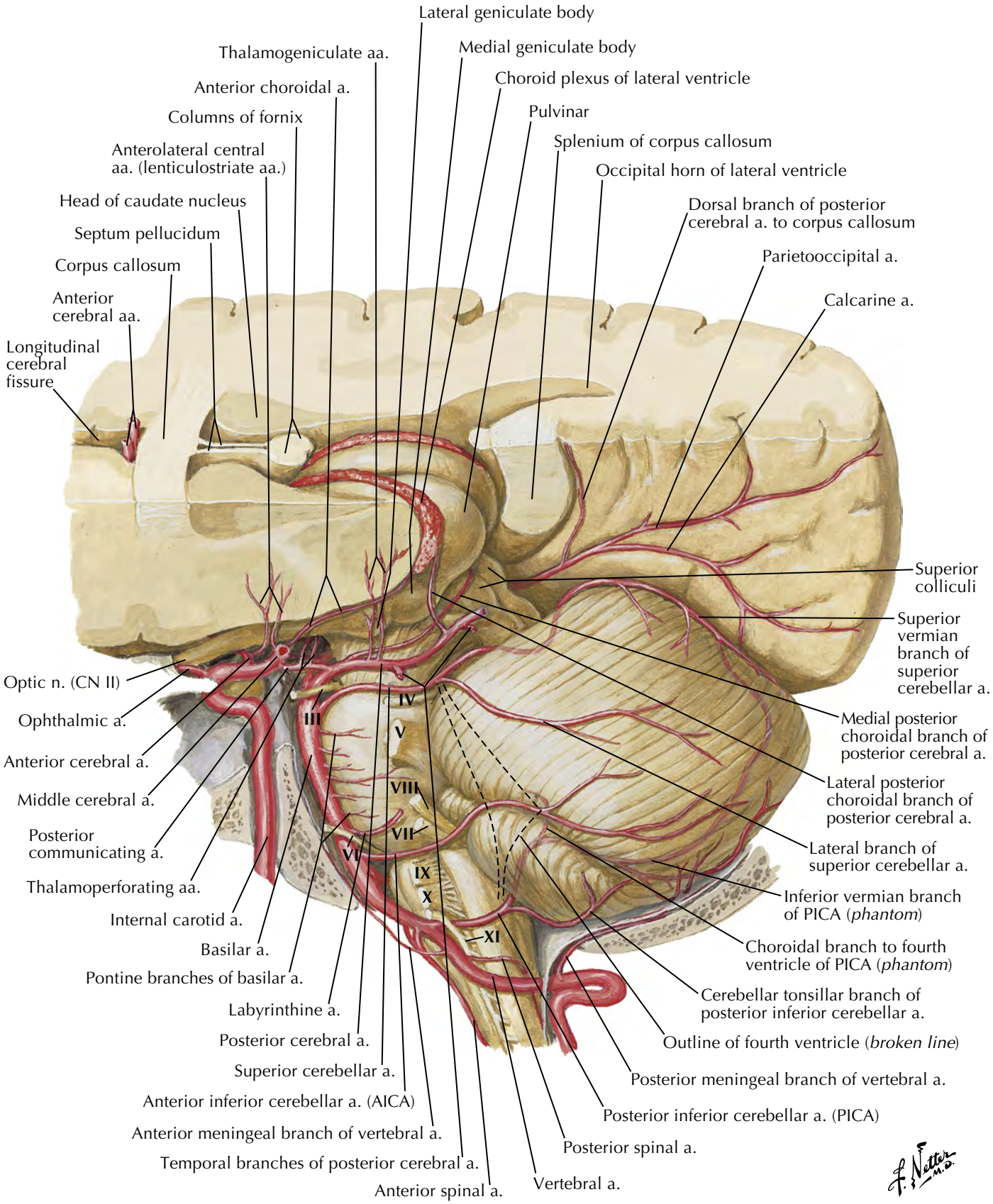
Vessels in situ: inferior view



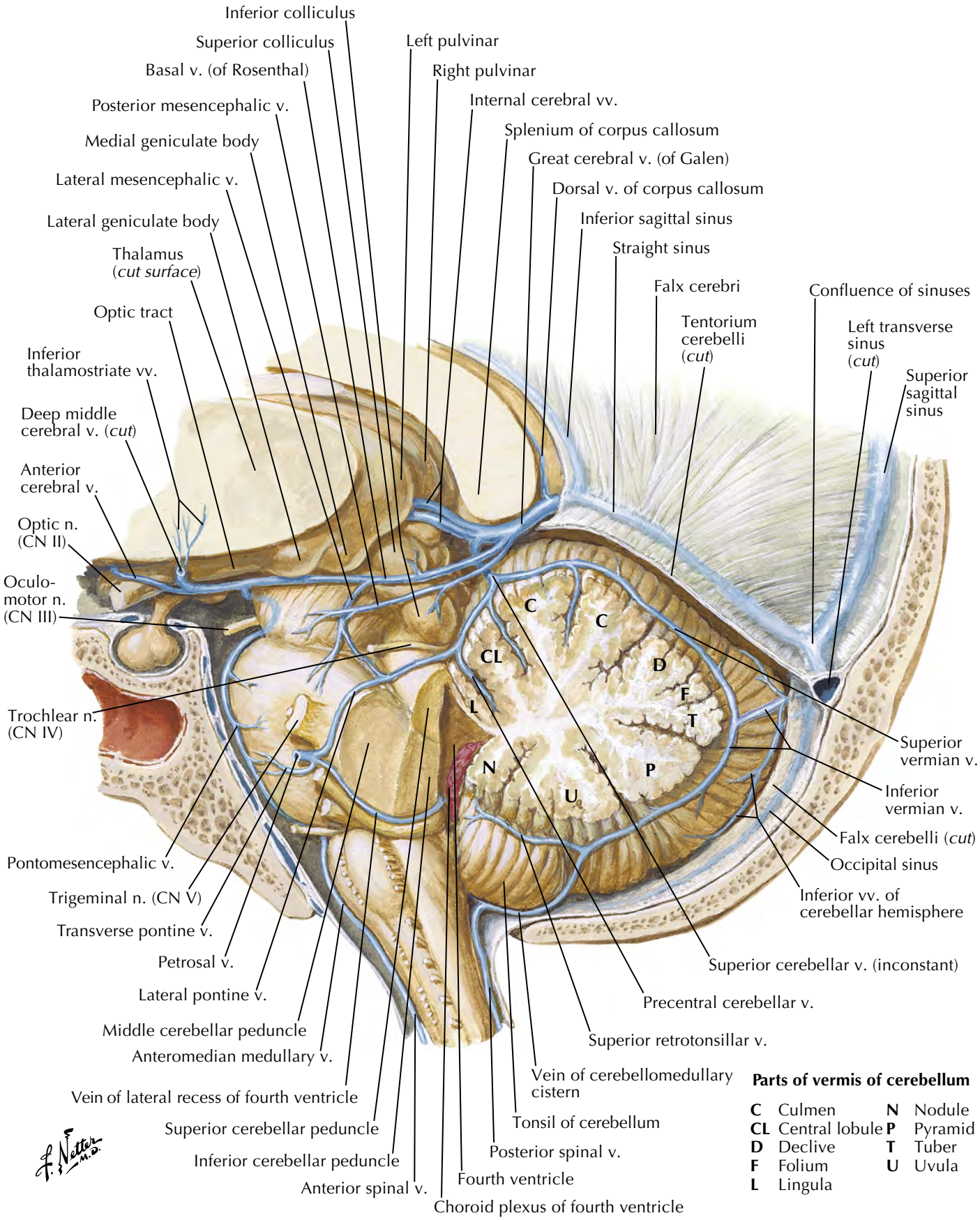

Corpus callosum
Anterolateral central aa. (lenticulostriate aa.)
Lateral orbitofrontal branch of middle cerebral a.
Prefrontal branch of middle cerebral a.
Frontal branches of middle cerebral a.
Parietal branches of middle cerebral a.
Temporal branches of middle cerebral a.
Middle cerebral a.
Anterior communicating a.
Posterior communicating a.
Basilar a.
Anterior inferior cerebellar a.
Posterior spinal a.
Anterior spinal a.
Posterior inferior cerebellar a.
Vertebral a.
Labyrinthine a.
Pontine branches of basilar a.
Superior cerebellar a.
Posterior cerebral a.
Anterior choroidal a.
Internal carotid a.
Long striate a. (recurrent a. of Heubner)
Medial orbitofrontal branch of anterior cerebral a.
Anterior cerebral aa.
Frontopolar a.
Callosomarginal a.
Pericallosal a.
Frontal branches of callosomarginal a.
F. Netter M.D.
Falx cerebri
Corpus striatum
Caudate nucleus
Lentiform nucleus
Anterolateral central aa. (lenticulostriate aa.)
Insula (of Reil)
Frontal and parietal branches of middle cerebral a.
Lateral sulcus (of Sylvius)
Temporal branches of middle cerebral a.
Temporal lobe
Middle cerebral a.
Internal carotid a.
Callosomarginal aa.
Pericallosal aa.
Body of corpus callosum
Internal capsule
Septum pellucidum
Rostrum of corpus callosum
Anterior cerebral aa.
Long striate a. (recurrent a. of Heubner)
Anterior communicating a.
Optic chiasm


Frontal branches of middle cerebral a.
Parietal branches of middle cerebral a.
Prefrontal branch of middle cerebral a.
Parietooccipital branches of posterior cerebral a.
Frontal branches of anterior cerebral a.
Lateral orbitofrontal branch of middle cerebral a.
Middle cerebral a.
Left anterior cerebral a.
Anterior communicating a.
Right anterior cerebral a.
Internal carotid a.
Occipitotemporal branches of posterior cerebral a.
Temporal branches of middle cerebral a.
Temporal branches of middle cerebral a.


Pericallosal a.
Paracentral branch of callosomarginal a.
Medial frontal branches of callosomarginal a.
Cingular branches of callosomarginal a.
Posterior cerebral a.
Precuneate branch of pericallosal a.
Callosomarginal a.
Dorsal branch of posterior cerebral a. to corpus callosum
Frontopolar a.
Parietooccipital a.
Anterior cerebral a.
Calcarine a.
Medial orbitofrontal branch of anterior cerebral a.
Anterior communicating a. (cut)
Medial occipital a.
Long striate a. (recurrent a. of Heubner)
Temporal branches of posterior cerebral a.
Internal carotid a.
Posterior communicating a.


Lateral geniculate body
Medial geniculate body
Thalamogeniculate aa.
Choroid plexus of lateral ventricle
Anterior choroidal a.
Pulvinar
Columns of fornix
Splenium of corpus callosum
Anterolateral central aa. (lenticulostriate aa.)
Occipital horn of lateral ventricle
Head of caudate nucleus
Dorsal branch of posterior cerebral a. to corpus callosum
Septum pellucidum
Parietooccipital a.
Corpus callosum
Calcarine a.
Anterior cerebral aa.
Longitudinal cerebral fissure
Superior colliculi
Superior vermian branch of superior cerebellar a.
Optic n. (CN II)
Ophthalmic a.
Medial posterior choroidal branch of posterior cerebral a.
Anterior cerebral a.
Lateral posterior choroidal branch of posterior cerebral a.
Middle cerebral a.
Posterior communicating a.
Lateral branch of superior cerebellar a.
Thalamoperforating aa.
Inferior vermian branch of PICA (phantom)
Internal carotid a.
Choroidal branch to fourth ventricle of PICA (phantom)
Basilar a.
Pontine branches of basilar a.
Cerebellar tonsillar branch of posterior inferior cerebellar a.
Labyrinthine a.
Outline of fourth ventricle (broken line)
Posterior cerebral a.
Superior cerebellar a.
Posterior meningeal branch of vertebral a.
Anterior inferior cerebellar a. (AICA)
Posterior inferior cerebellar a. (PICA)
Anterior meningeal branch of vertebral a.
Posterior spinal a.
Temporal branches of posterior cerebral a.
Anterior spinal a.
Vertebral a.
III
IV
V
VI
VII
VIII
IX
X
XI

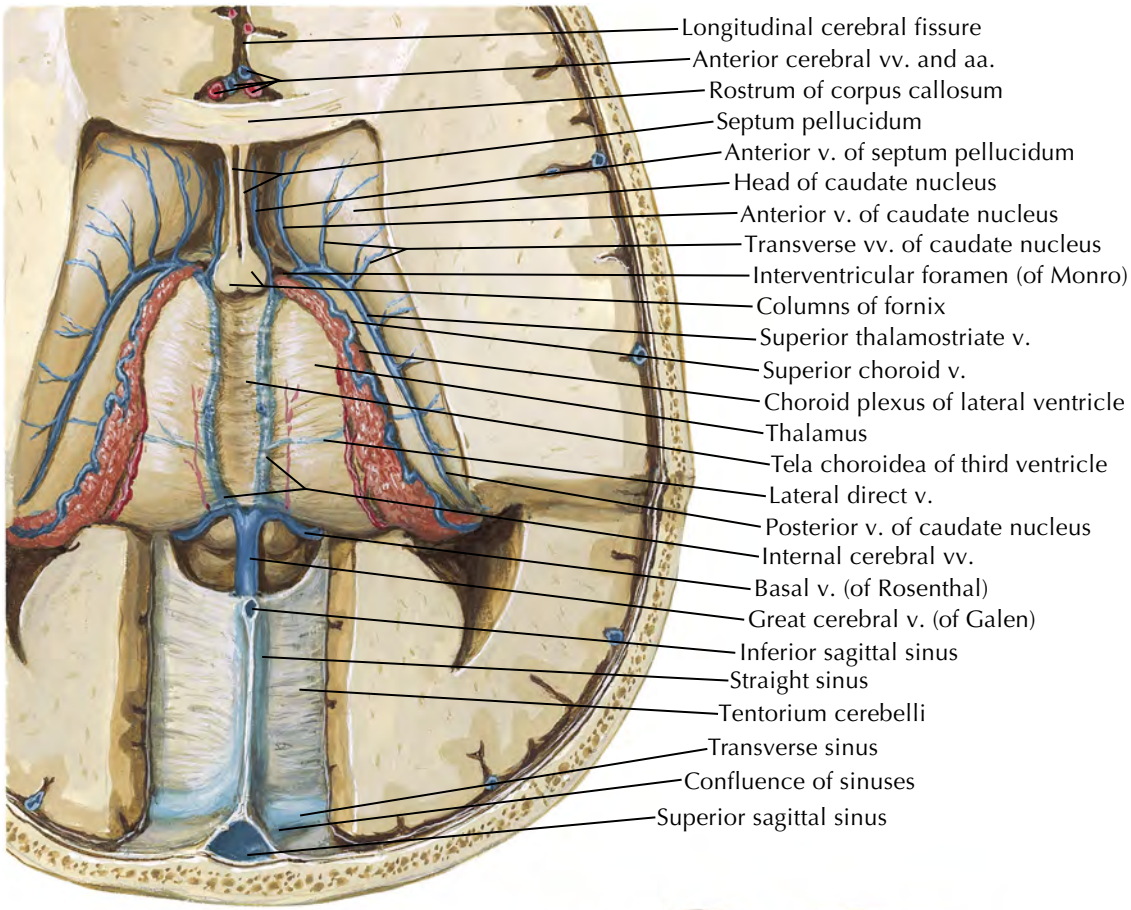
See also **Plate 173**



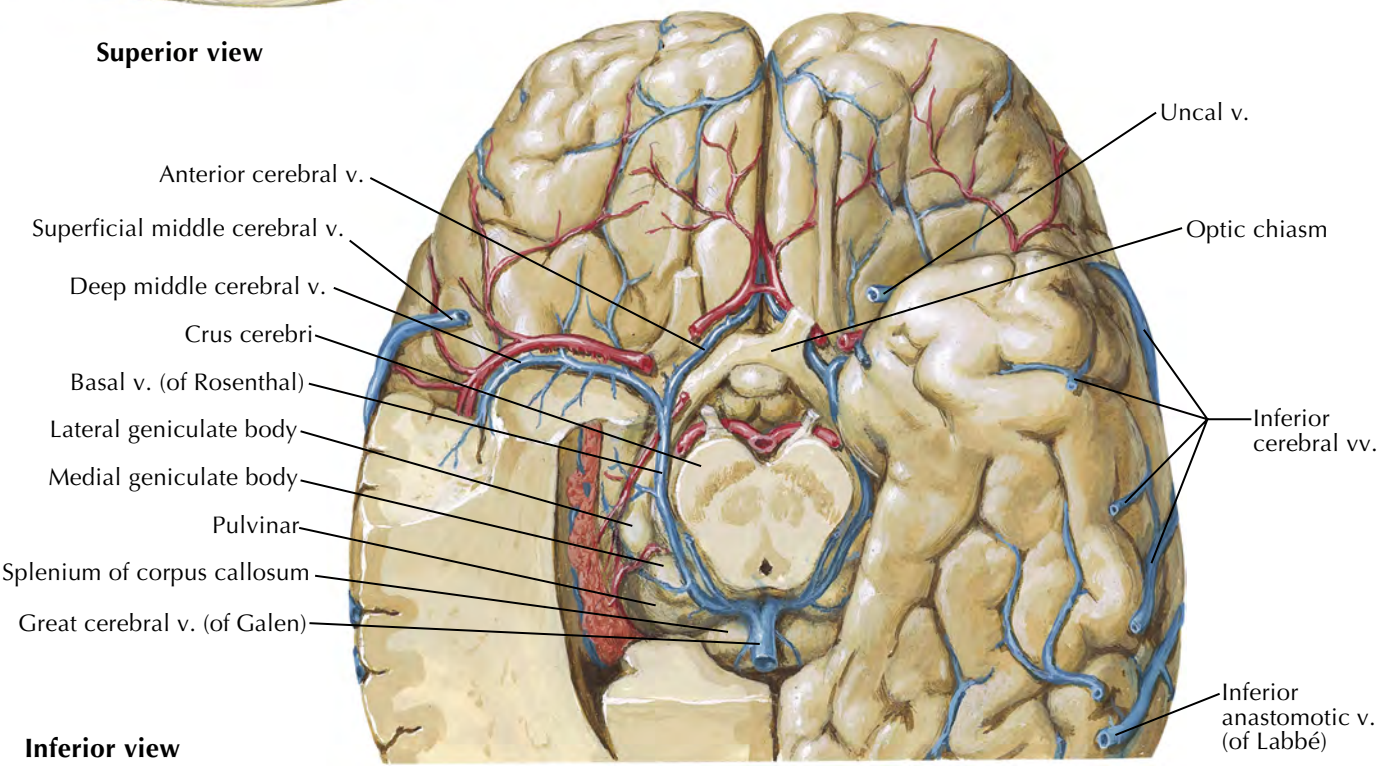
Parts of vermis of cerebellum

C	Culmen	**N**	Nodule
CL	Central lobule	**P**	Pyramid
D	Declive	**T**	Tuber
F	Folium	**U**	Uvula
L	Lingula		

For superficial veins of brain see **Plates 138, 173**



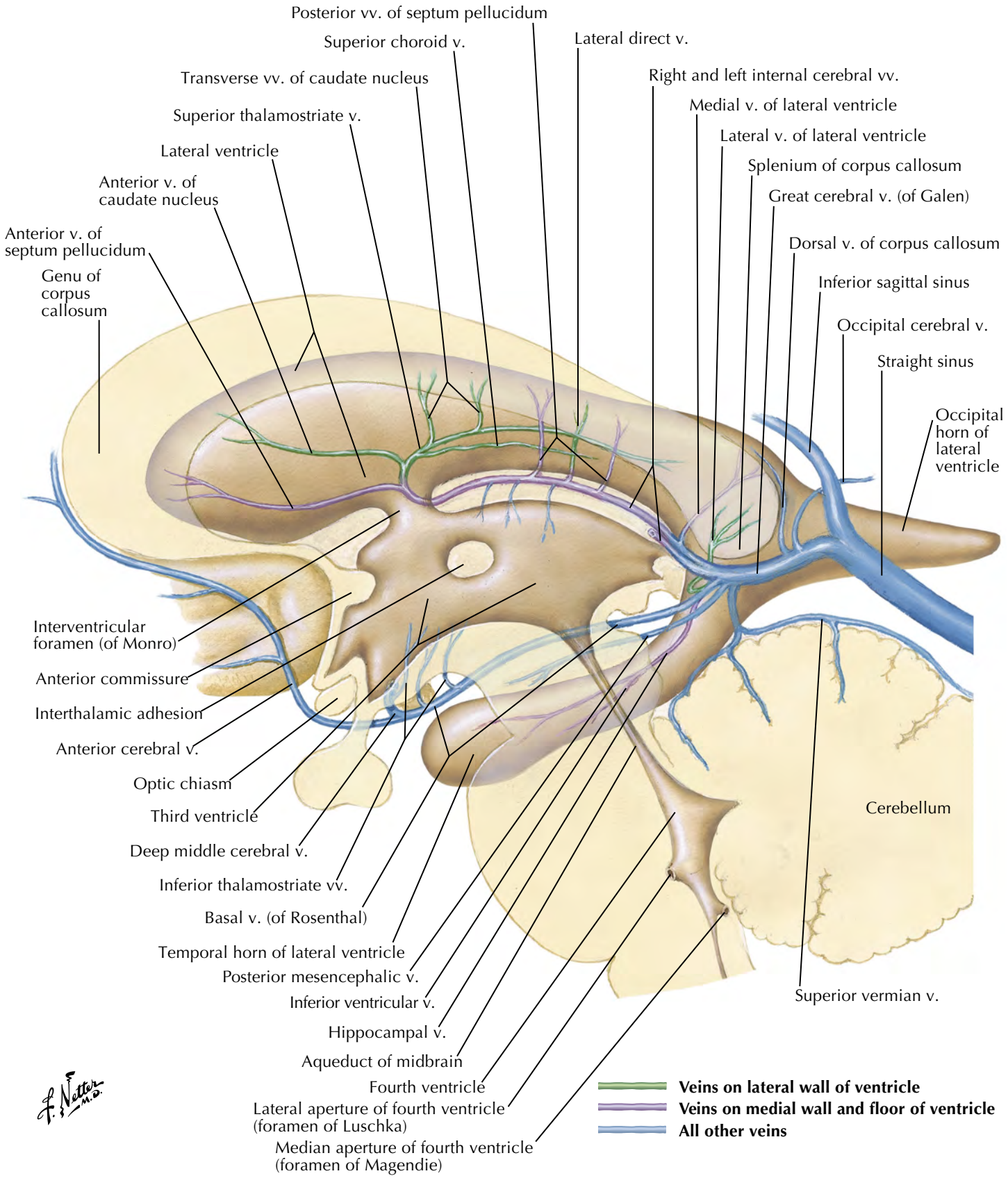
Superior view

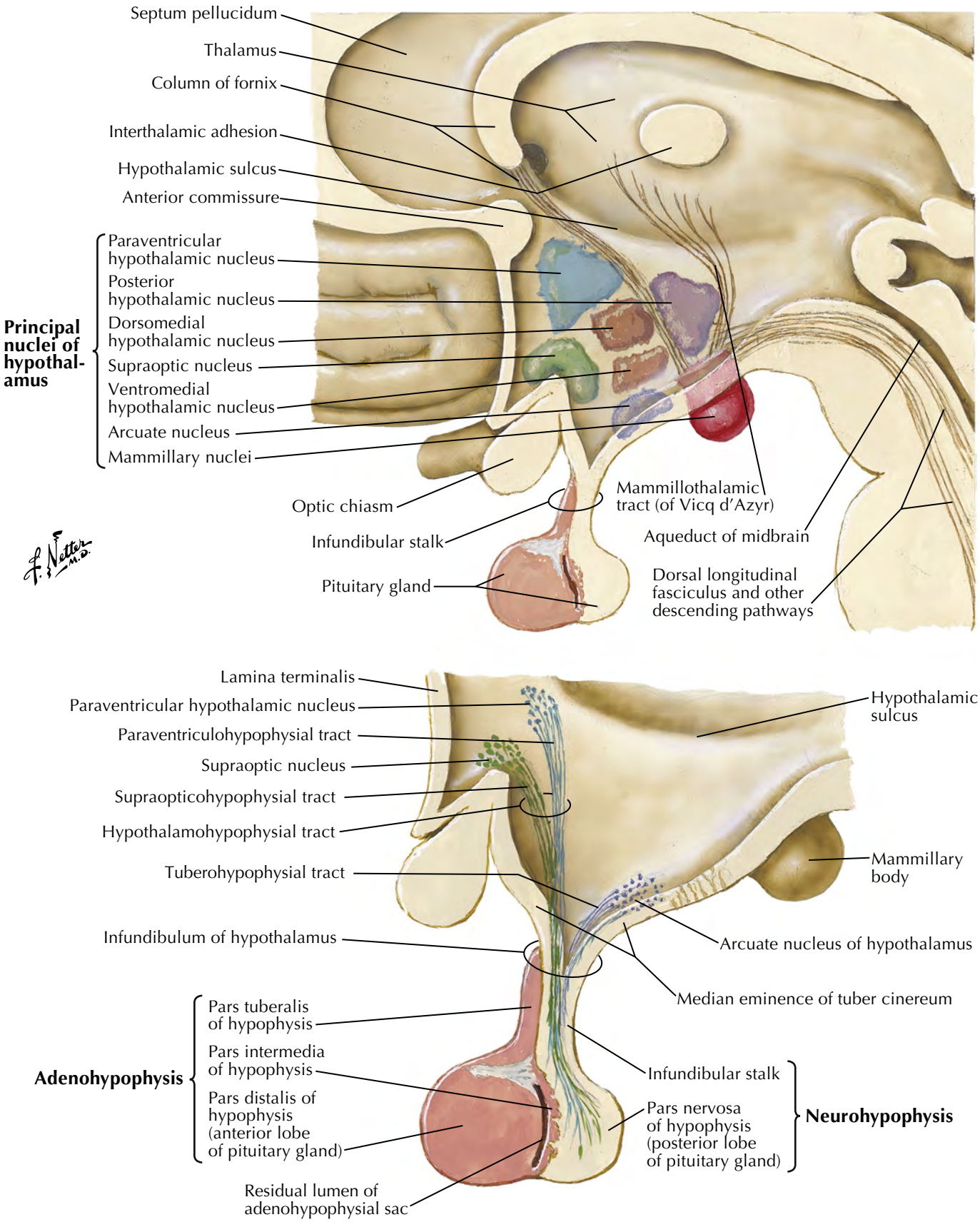


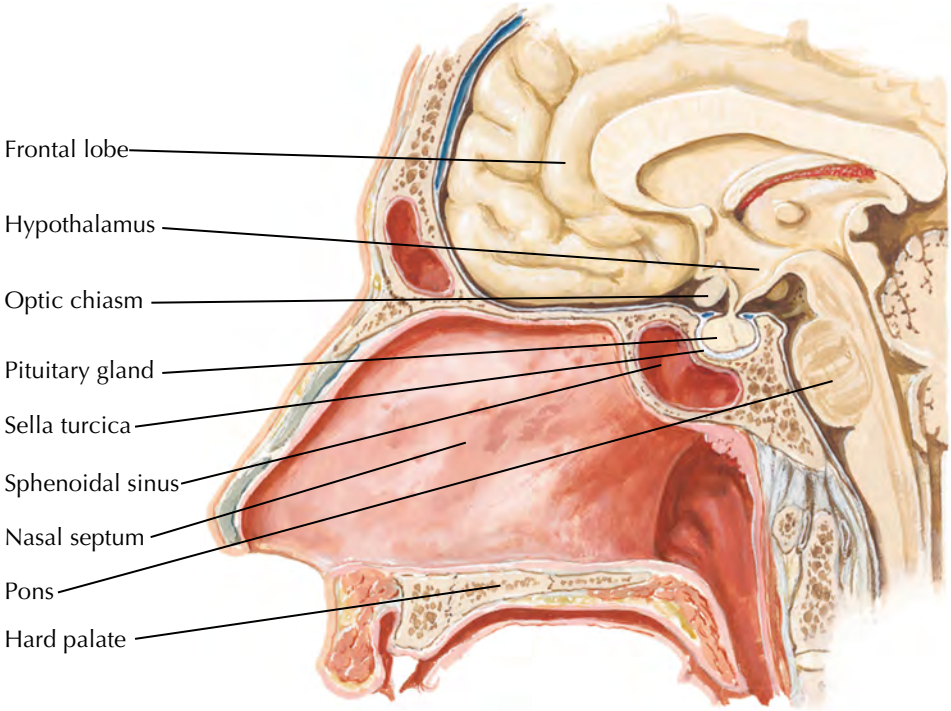
Inferior view

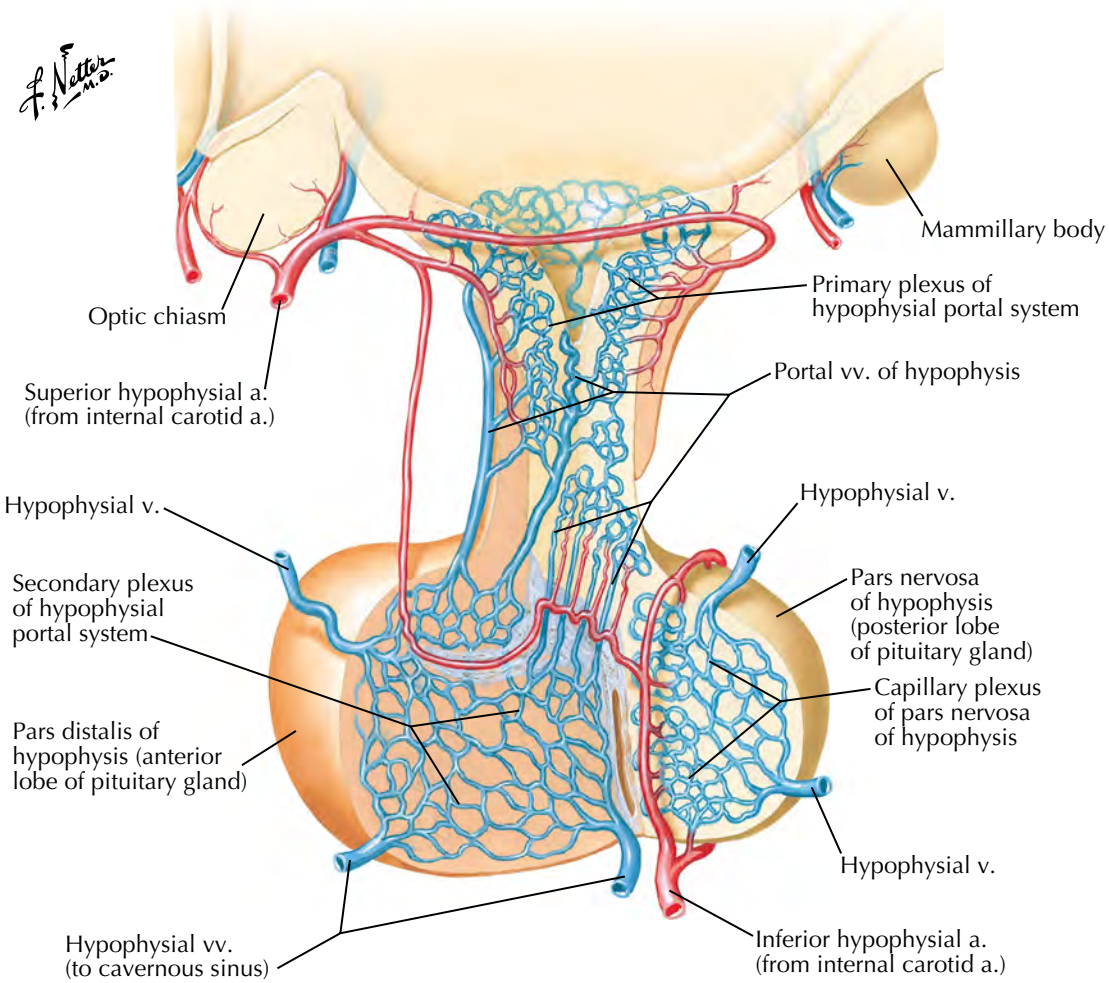
Subependymal Veins of Brain

See also **Plate 171**



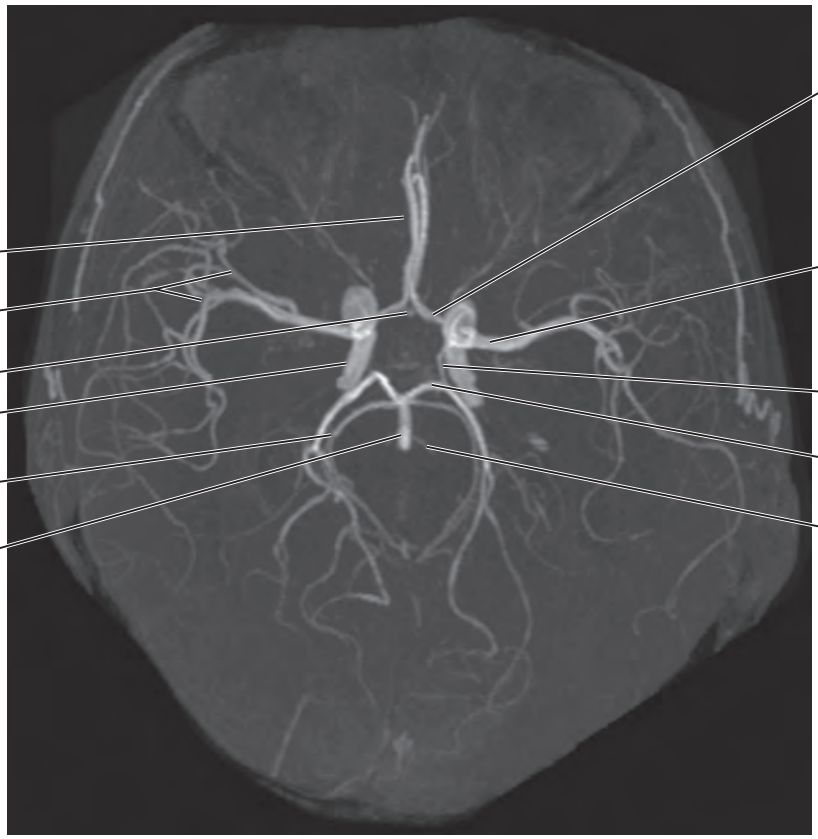

Septum pellucidum
Thalamus
Column of fornix
Interthalamic adhesion
Hypothalamic sulcus
Anterior commissure
Principal nuclei of hypothalamus
Paraventricular hypothalamic nucleus
Posterior hypothalamic nucleus
Dorsomedial hypothalamic nucleus
Supraoptic nucleus
Ventromedial hypothalamic nucleus
Arcuate nucleus
Mammillary nuclei
Optic chiasm
Infundibular stalk
Pituitary gland
Mammillothalamic tract (of Vicq d'Azyr)
Aqueduct of midbrain
Dorsal longitudinal fasciculus and other descending pathways
Lamina terminalis
Paraventricular hypothalamic nucleus
Paraventriculohypophysial tract
Supraoptic nucleus
Supraopticohypophysial tract
Hypothalamohypophysial tract
Tuberohypophysial tract
Infundibulum of hypothalamus
Hypothalamic sulcus
Mammillary body
Arcuate nucleus of hypothalamus
Median eminence of tuber cinereum
Adenohypophysis
Pars tuberalis of hypophysis
Pars intermedia of hypophysis
Pars distalis of hypophysis (anterior lobe of pituitary gland)
Residual lumen of adenohypophysial sac
Infundibular stalk
Pars nervosa of hypophysis (posterior lobe of pituitary gland)
Neurohypophysis


Frontal lobe
Hypothalamus
Optic chiasm
Pituitary gland
Sella turcica
Sphenoidal sinus
Nasal septum
Pons
Hard palate


Mammillary body
Primary plexus of hypophysial portal system
Optic chiasm
Portal vv. of hypophysis
Superior hypophysial a. (from internal carotid a.)
Hypophysial v.
Hypophysial v.
Secondary plexus of hypophysial portal system
Pars nervosa of hypophysis (posterior lobe of pituitary gland)
Capillary plexus of pars nervosa of hypophysis
Pars distalis of hypophysis (anterior lobe of pituitary gland)
Hypophysial v.
Hypophysial vv. (to cavernous sinus)
Inferior hypophysial a. (from internal carotid a.)

See also **Plate BP 31**

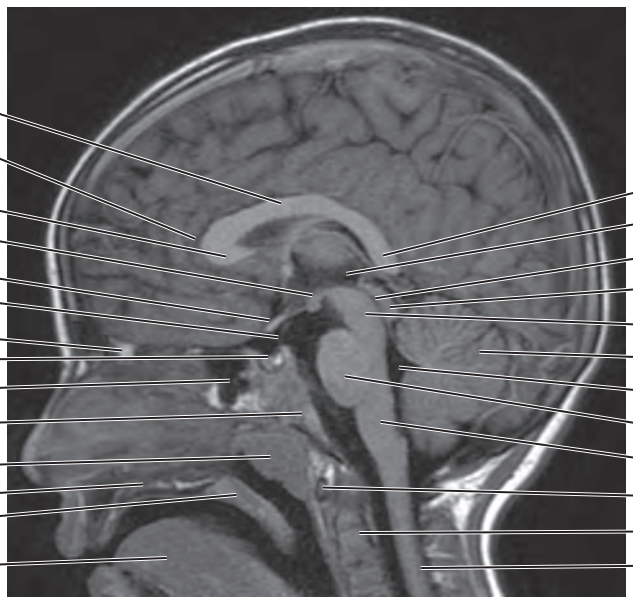
Magnetic resonance angiography (MRA) at level of cerebral arterial circle (3D time-of-flight image without contrast)



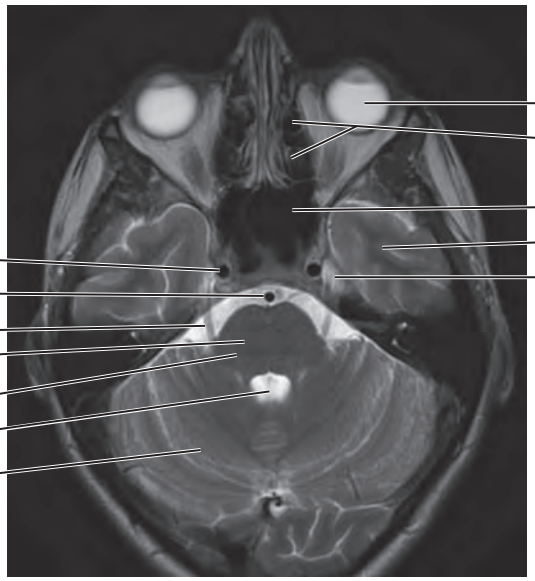
Magnetic resonance venography (MRV) (2D time-of-flight image without contrast)

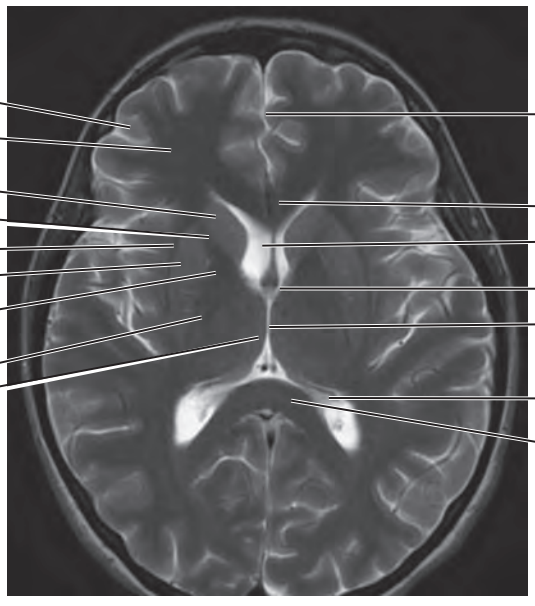
See also **Plate BP 32**

T1-weighted MRI, sagittal view



T2-weighted MRI, axial views without contrast





ANATOMICAL STRUCTURE	CLINICAL COMMENT	PLATE NUMBERS
Nervous System and Sense Organs		
Spinal accessory nerve (CN XI)	Lymph node biopsy in posterior cervical triangle can cause iatrogenic injury of CN XI	56
Cervical plexus	Cervical plexus blocks are performed for neck procedures	56, 57
Trigeminal nerve (CN V)	Branches of CN V are anesthetized for procedures on face or anterior scalp; compression of the nerve may result in painful condition known as trigeminal neuralgia	60, 149
Olfactory nerve (CN I)	One of most commonly injured cranial nerves; can be avulsed at cribriform plate following falls, resulting in anosmia	64, 146
Facial nerve (CN VII)	Idiopathic unilateral facial nerve palsy (Bell's palsy) can result in inability to fully close eye and result in desiccated cornea ipsilaterally	71
Recurrent laryngeal nerve	May be compressed or damaged by procedures in neck (e.g., thyroidectomy), aortic arch aneurysm, or lung cancer, producing hoarseness of voice; identified by (posterior) suspensory ligament of thyroid and/or inferior thyroid artery and/or tracheo-esophageal groove	104, 105
Oculomotor (CN III), trochlear (CN IV), and abducens (CN VI) nerves	Cavernous sinus thrombosis can result in dysfunction of extraocular muscles caused by compression of one, two, or all three nerves; abducens nerve is most commonly affected	131
Superior colliculus and aqueduct of midbrain	Tumor of midbrain can result in compression of aqueduct of midbrain, with resultant hydrocephalus	136
Optic nerve (CN II)	Pituitary gland mass may cause compression at optic chiasm and resulting bitemporal hemianopsia; optic radiations (Meyer's loop) can be affected by temporal lobe tumors; early sign of ophthalmic artery aneurysm is visual loss due to compression of overlying optic nerve.	147, 167
Fovea centralis	Location of highest density of retinal cones, making this part of macula lutea the site of greatest visual acuity and color vision	116
Utricle and saccule	Location of calcium carbonate crystals known as otoconia; accumulation of otoconia in semicircular canals is most common cause of vertigo and is known as benign paroxysmal positional vertigo (BPPV)	124, 125
Lens	Degeneration and opacification, known as cataract, may lead to progressive vision loss	116
Orbital septum	Infections anterior to this structure are known as preseptal/periorbital cellulitis and are milder than infections extending posterior to it, known as orbital cellulitis	110
Anterior segment of eyeball	Ciliary body produces aqueous humor, which flows through iris into anterior chamber and drains through scleral sinus; anterior displacement of lens may obstruct flow of aqueous humor and cause elevated intraocular pressure, a painful, vision-threatening condition known as acute angle closure glaucoma	117, 119
Tympanic membrane	Visualized with otoscope; bulging indicates middle ear infection with effusion; rupture and otorrhea may occur in severe infection; tympanostomy tubes (T-tubes) may be placed in children with recurrent effusive infections	122
External acoustic meatus	May become infected or inflamed in children, a condition known as otitis externa; can be diagnosed with auricle (pinna) pull technique	121
Skeletal System		
Orbit	Most facial trauma involves orbit; traumatic fractures can occur in rim or walls; a "blowout" fracture involves inferior wall and may injure inferior rectus muscle and/or infraorbital nerve; rim fractures affect contours of orbital rim and occur in zygomaticomaxillary fractures	25, 69

ANATOMICAL STRUCTURE	CLINICAL COMMENT	PLATE NUMBERS
Skeletal System—Continued		
Pterion	Intersection of frontal, parietal, temporal, and sphenoid bones; thin, weak region of skull that is susceptible to fracture; frontal branch of middle meningeal artery lies immediately deep to this region and may be injured	27
Asterion	Landmark at posterior end of parietotemporal suture, used in lateral neurosurgical approaches to posterior cranial fossa	27
Temporomandibular joint	Temporomandibular joint disorders are common sources of pain and joint dysfunction; poor replacement results to date; dislocations/subluxations can be reduced via retromolar fossa	42
Cranial sutures	Premature fusion may result in skull deformity known as craniosynostosis; sagittal suture is most often affected	26, 35
Cervical vertebrae	Degenerative changes causing narrowing of intervertebral foramina may result in cervical radiculopathy; C1–C4 and C5–C7 vertebrae are common areas of pathology for children and adults, respectively; neck hyperextension from abrupt deceleration may cause bilateral pedicle fractures in axis (C2 vertebra) known as hangman's fracture; hyperflexion may cause anterior wedge vertebral fracture; axial loads may cause burst fracture; dens axis (odontoid) fractures may occur with either forceful extension or flexion; all fractures are classified as "stable" or "unstable" depending on whether structural integrity of cervical spine has been sufficiently disrupted to permit compression of spinal cord	43–45
Laryngeal cartilages	Thyroid and cricoid cartilages are palpable landmarks of anterior neck used for cricothyrotomy, tracheostomy, and cricoid pressure during airway intubation	103, 106
Hyoid bone	Palpable anterior neck landmark at C3 vertebral level that can be fractured during sporting activities, compromising swallowing and speech; fractures may also indicate strangulation	54
Auditory ossicles	Pathologic conditions involving ossicles (e.g., otosclerosis) can cause conductive hearing loss	121, 122
Muscular System		
Muscles of facial expression	Used to assess function of facial nerve (CN VII) during cranial nerve examination; may become weak or paralyzed with CN VII dysfunction (e.g., Bell's palsy); often targeted with botulinum toxin injections for aesthetics (wrinkles), headache, and teeth grinding	48, 150
Sternocleidomastoid muscle	Important landmark that divides neck into anterior and posterior cervical triangles; palpated to identify "nerve point of neck" for administration of anesthesia to cervical plexus and also used as landmark for insertion of central venous catheters; in children, abnormal shortening or fibrosis of sternocleidomastoid muscle results in head tilt, a condition known as torticollis	56
Sternocleidomastoid and trapezius muscles	Used to assess function of spinal accessory nerve (CN XI) during cranial nerve examination	56, 154
Muscles of mastication	Used to assess function of trigeminal nerve (CN V) during cranial nerve examination; masseter is involved in teeth grinding and associated headaches, which can be treated with botulinum toxin injection	72, 73
Levator veli palatini and musculus uvulae	Used to assess function of vagus nerve (CN X) during cranial nerve examination; contralateral deviation of uvula of soft palate during elevation indicates CN X dysfunction	85
Genioglossus muscle	Used to assess hypoglossal nerve (CN XII) function during cranial nerve examination; tongue deviates to side of lesion when protruded following CN XII injury	88, 155
Styloglossus muscle	Posterosuperior movement covers laryngeal inlet, protecting vocal cords and airway, which is especially crucial if epiglottis has been surgically removed because of malignancy	88, 95, 96

ANATOMICAL STRUCTURE	CLINICAL COMMENT	PLATE NUMBERS
Stapedius muscle	Smallest skeletal muscle in the body, regulates movement of stapes bone to control amplitude of sound	123
Levator palpebrae superioris and superior tarsal muscle	Responsible for elevating eyelid; ptosis indicates pathologic change in oculomotor nerve (CN III) or sympathetic fibers (if only superior tarsal muscle is affected)	110, 112
Extraocular muscles	Used to assess function of oculomotor (CN III), trochlear (CN IV), and abducens (CN VI) nerves during cranial nerve examination; abnormalities in tone result in disconjugate eye movements, a condition known as strabismus	112, 114
Dilator pupillae	Important in assessment of sympathetic function in head; lack of dilation indicates interruption in sympathetic outflow (e.g., Horner's syndrome)	117, 148
Sphincter pupillae	Involved in pupillary light reflex and accommodation reflex	117, 148
Pterygomandibular raphe	Valuable intraoral landmark for inferior alveolar nerve blocks to anesthetize mandibular teeth	96, 97–99
Modiolus of angulus oris	A fibrous intersection of facial muscles, approximately 1 cm lateral to corner of mouth; valuable landmark when considering reconstruction of injured facial muscles associated with oral region	48
Retromolar fossa	Important clinical landmark for reducing dislocated temporomandibular joints; buccal and lingual nerves pass by the retromolar fossa and may be harmed in dental molar implant surgery	39
Cardiovascular System		
Right internal and external jugular veins	Examined to assess right atrial pressure, estimated as height of jugular pulsation above sternal angle (in centimeters) plus 5; right internal jugular vein is preferred because it is in line with superior vena cava	50
Internal jugular vein	Thrombosis may occur secondary to local extension of inflammation from severe pharyngitis, a condition known as Lemierre's syndrome	50
Internal jugular and subclavian veins	Used to obtain venous access via insertion of central venous catheter	50, 100
Inferior thyroid artery	At risk during thyroidectomy; must be preserved to maintain blood supply to parathyroid glands; identified by its redundant loop shape and is landmark to identify recurrent laryngeal nerve	57, 104
Common carotid artery	Palpate in neck to assess carotid pulse; bifurcation typically at C4 vertebral level	58, 165
Internal carotid artery	Common site for atherosclerosis, which may be treated with stent or endarterectomy for stroke prevention; carotid sinus is sensitive to changes in circulating blood volume and may be massaged to induce vagal reaction; internal carotid artery has no branches in neck; classified into seven parts: C1, cervical; C2, petrous; C3, lacerum; C4, cavernous; C5, clinoid; C6, ophthalmic; and C7, communicating	163, 164
Anterior ethmoidal, sphenopalatine, and facial arteries	Anastomosis site of branches of these vessels in nasal vestibule, known as Kiesselbach's plexus or Little's area, is common site of anterior nosebleeds (epistaxis); sphenopalatine artery injury causes posterior nosebleeds	65
Pterygoid venous plexus	Common route for spread of infection due to connections between face, orbit, and venous sinuses; valveless veins allow retrograde flow	100, 115
Ophthalmic artery	Primary source of blood to retina; blindness may occur if artery is occluded	115, 119
Arteries of scalp	Scalp lacerations bleed profusely owing to rich blood supply	24, 127
Superior cerebral veins	May be torn from their junction with superior sagittal sinus, producing subdural hematoma	129, 130, 136
Middle meningeal artery	Trauma to pterion can tear middle meningeal artery (frontal branch), often causing epidural hematoma	128

ANATOMICAL STRUCTURE	CLINICAL COMMENT	PLATE NUMBERS
Cardiovascular System—Continued		
Dural venous sinuses	Infections in head may spread to sinuses, causing dural venous sinus thrombosis; cavernous sinus is most common site	130, 131
Cavernous sinus	Fistula (anastomosis) between internal carotid artery and cavernous sinus may form, especially following trauma	131,167
Carotid sinus	Compressed during carotid sinus massage, which may result in bradycardia and/or hypertension; carotid sinus hypersensitivity, most common among older adults, may cause syncope	157
Cerebral arterial circle of Willis	Common site of aneurysms and important site of collateral cerebral circulation; aneurysmal rupture produces subarachnoid hemorrhage	166
Emissary veins	Valveless veins, which can convey infection extracranially to intracranially and allow alternative route for drainage when dural venous sinuses are obstructed	129
Lymph Vessels and Lymphoid Organs		
Thoracic duct	Thoracic duct may be injured during surgeries to neck and thorax due to multiple and frequent variants; injury in lower neck region is often at junction of left internal jugular and subclavian veins; increased risk during esophageal surgery and left central venous line placement	101, 260
Superior and inferior deep lateral cervical nodes	Palpated during neck examination to assess size and shape; if coalescent, malignancy must be excluded	101, 102
Palatine and pharyngeal tonsils	Palatine tonsils are commonly involved with viral and bacterial infection; exudative lesions combined with fever, lymphadenopathy, and lack of cough suggestive of streptococcal infection (strep throat); enlarged pharyngeal tonsils (adenoids) cause snoring and can cover auditory (eustachian) tube opening, increasing risk of middle ear infections	90
Respiratory System		
Epiglottis	Crucial landmark during endotracheal intubation; bacterial or viral infection (e.g., with *Haemophilus influenzae*) may cause epiglottitis, which presents with respiratory distress, sore throat, and hoarse voice	93–95
Paranasal sinuses (maxillary, ethmoid, frontal, and sphenoid)	Cavities in skull prone to mucosal inflammation due to bacterial or viral infection	67, 69
Nasal septum	Congenital or acquired deviation may lead to nasal obstruction, treated with septoplasty; perforations may occur with cocaine use or in granulomatosis with polyangiitis	37, 69
Digestive System		
Parotid gland	Swelling of gland due to infection (parotitis), such as from viruses or bacteria, may cause pain and compress branches of facial nerve, producing facial muscle weakness; external carotid, superficial temporal, and maxillary arteries also pass through the gland	70, 71
Endocrine System		
Thyroid gland	Enlargement is known as goiter; may be partially or completely removed in malignancy or hyperthyroidism; during examination should move relatively equally bilaterally with hyoid bone and laryngeal cartilages; malignancy may anchor portion of gland and cause asymmetrical movement	103

*Selections were based largely on clinical data and commonly discussed clinical correlations in macroscopic ("gross") anatomy courses.

Cranial nerves are traditionally described as tree-like structures that emerge from the brain and branch peripherally. This matches the direction that action potentials travel in efferent fibers in nerves. It must be remembered that action potentials travel in the opposite direction in afferent fibers within these nerves.

NERVE	ORIGIN	COURSE	BRANCHES	MOTOR	SENSORY
Olfactory nerve (CN I)	Olfactory bulb	Neurons of olfactory mucosa send approximately 20 axon bundles through cribriform plate to synapse on olfactory bulb neurons			SVA (smell): olfactory epithelium
Optic nerve (CN II)	Optic chiasm	Axons of retinal ganglion neurons exit orbit through optic canal to enter cranial cavity			SSA (vision): optic part of retina
Oculomotor nerve (CN III)	Interpeduncular fossa of midbrain	Exits midbrain into posterior cranial fossa and then middle cranial fossa; traverses cavernous sinus to enter orbit via superior orbital fissure	Superior and inferior branches	GSE: medial, superior, and inferior rectus muscles, inferior oblique muscles, and levator palpebrae superioris GVE: ciliary ganglion	
Trochlear nerve (CN IV)	Posterior surface of midbrain	Exits dorsal midbrain, coursing lateral to cerebral peduncle to anterior surface of brain stem; follows medial edge of tentorium cerebelli to enter middle cranial fossa; traverses cavernous sinus to enter orbit via superior orbital fissure		GSE: superior oblique muscle	
Trigeminal nerve (CN V)	Motor and sensory roots (arising from pons)	Exits anterolateral pons into posterior cranial fossa; large sensory and small motor roots enter middle cranial fossa; sensory root forms trigeminal ganglion, which gives rise to ophthalmic, maxillary, and mandibular nerves; motor root passes deep to ganglion and contributes only to mandibular nerve	Ophthalmic, maxillary, and mandibular nerves	SVE: see branches	GSA: see branches
Ophthalmic nerve (CN V_1)	Trigeminal nerve	Exits anterior border of trigeminal ganglion and traverses cavernous sinus to leave cranium through superior orbital fissure into orbit	Lacrimal, frontal, and nasociliary nerves, meningeal branch		GSA: forehead, upper eyelid, conjunctiva
Maxillary nerve (CN V_2)	Trigeminal nerve	Exits trigeminal ganglion, passes through foramen rotundum into pterygopalatine fossa, and enters orbit via inferior orbital fissure	Nasopalatine, pharyngeal, palatine, zygomatic, posterior superior alveolar, and infraorbital nerves, superior posterior nasal and meningeal branches		GSA: midface, nasal cavity, paranasal sinuses, palate, maxillary teeth
Mandibular nerve (CN V_3)	Trigeminal nerve	Exits trigeminal ganglion inferiorly, leaves cranium through foramen ovale and enters infratemporal fossa	Deep temporal, buccal, auriculotemporal, lingual, and inferior alveolar nerves, meningeal branch	SVE: muscles of mastication, mylohyoid and digastric (anterior belly) muscles, tensor tympani, tensor veli palatini	GSA: mandibular teeth, anterior tongue, floor of oral cavity, temporomandibular joint

Continued

NERVE	ORIGIN	COURSE	BRANCHES	MOTOR	SENSORY
Abducens nerve (CN VI)	Medullopontine sulcus (medial to CN VII)	Exits between pons and medulla near midline, pierces dura on clivus and grooves on petrous part of temporal bone to access middle cranial fossa; traverses cavernous sinus to enter orbit through superior orbital fissure		GSE: lateral rectus muscle	
Facial nerve (CN VII)	Motor root and intermediate nerve (sensory root)	Exits laterally between pons and medulla oblongata as a larger motor root and smaller intermediate nerve (carrying SVA, GVE, and GSA fibers); both roots traverse internal acoustic meatus to enter facial canal, in which a sharp turn (genu) occurs just before geniculate (facial) ganglion; facial nerve gives off several branches within facial canal, before it exits through stylomastoid foramen and forms terminal branches within parotid gland	Greater petrosal and posterior auricular nerves, chorda tympani, and temporal, zygomatic, buccal, marginal mandibular, and cervical branches	SVE: muscles of facial expression (including epicranial muscles and platysma), digastric (posterior belly), stylohyoid, and stapedius muscles GVE: pterygopalatine and submandibular ganglia	SVA (taste): anterior tongue GSA: part of external ear
Vestibulocochlear nerve (CN VIII)	Medullopontine sulcus (lateral to CN VII)	Exits brain stem between pons and medulla oblongata, near inferior cerebellar peduncle, and divides into two branches as it traverses posterior cranial fossa	Vestibular and cochlear nerves		SSA: internal ear (see branches)
Cochlear nerve	Vestibulocochlear nerve	Contains processes of cochlear ganglion cells; passes through internal acoustic meatus into internal ear			SSA (hearing): spiral organ of cochlear duct
Vestibular nerve	Vestibulocochlear nerve	Contains processes of vestibular ganglion cells; passes through internal acoustic meatus into internal ear	Superior and inferior branches		SSA (equilibrium and motion): maculae and cristae ampullares of vestibular labyrinth
Glossopharyngeal nerve (CN IX)	Retro-olivary groove of medulla oblongata	Emerges from upper medulla between olive and inferior cerebral peduncle and exits cranium by traversing jugular foramen with vagus and accessory nerves; superior and inferior ganglia for afferent components of CN IX are located just inferior to jugular foramen; passes inferiorly, innervating and following stylopharyngeus muscle, ultimately sending a branch into posterior oral cavity that passes deep to hyoglossus muscle and a branch that enters pharynx by passing between superior and middle pharyngeal constrictors	Tympanic nerve	SVE: stylopharyngeus muscle GVE: otic ganglion	SVA (taste): posterior tongue GVA: carotid body and sinus GSA: posterior tongue, oropharynx, middle ear

NERVE	ORIGIN	COURSE	BRANCHES	MOTOR	SENSORY
Vagus nerve (CN X)	Retro-olivary groove of medulla oblongata (between CN IX and cranial roots of CN XI)	Exits from retro-olivary groove of medulla oblongata to traverse jugular foramen with accessory and glossopharyngeal nerves; initially runs between internal carotid artery and internal jugular vein; courses of right and left vagus nerves differ, with right vagus nerve coursing inferiorly between subclavian artery and vein, at which point right recurrent laryngeal nerve ascends and vagus nerve descends along trachea and root of right lung, forming pulmonary and esophageal plexuses; left vagus nerve descends between left subclavian and common carotid arteries posteriorly to left brachiocephalic vein, and anteriorly to aortic arch, at which point left recurrent laryngeal nerve ascends posteriorly to aorta and rest of vagus nerve descends posteriorly to root of lung, forming pulmonary and esophageal plexuses; vagus nerve fibers continue into abdomen via esophageal plexuses and vagal trunks	Pharyngeal branch, superior and recurrent laryngeal nerves	GVE: thoracic and abdominal visceral ganglia SVE: see branches	GVA: aortic arch and bodies SVA (taste): epiglottis, oropharynx GSA: external ear (also see branches)
Pharyngeal branch of vagus nerve	Vagus nerve	Passes between carotid arteries superficial to middle pharyngeal constrictor		SVE: pharyngeal constrictors; palatoglossus, palatopharyngeus, and salpingopharyngeus muscles; and levator veli palatini	
Superior laryngeal nerve	Vagus nerve	Exits inferior ganglion, passing inferiorly and medially deep to internal carotid artery, dividing into external (motor) branch and internal (sensory) branch that pierces thyrohyoid membrane	Internal and external branches	SVE: cricothyroid muscle	GSA: superior larynx
Recurrent laryngeal nerve	Vagus nerve	On right side, arises anterior to subclavian artery and spirals to run superiorly and posteriorly to common carotid and inferior thyroid arteries, lateral to trachea; on left side, arises inferior to aortic arch, passing posterior to arch and lateral to ligamentum arteriosum to ascend superiorly lateral to trachea; both right and left nerves enter larynx at junction of esophagus and inferior pharyngeal constrictor		SVE: intrinsic muscles of larynx (except cricothyroid), striated muscle of esophagus	GSA: inferior larynx

Continued

NERVE	ORIGIN	COURSE	BRANCHES	MOTOR	SENSORY
Accessory nerve (CN XI)	Cranial and spinal roots	Spinal roots from C1–C5 segments of spinal cord ascend and enter cranium through foramen magnum, where they course with cranial root arising from retro-olivary groove of medulla oblongata; spinal accessory nerve exits from cranium via jugular foramen; it passes inferiorly and posteriorly into upper third of sternocleidomastoid muscle and then inferiorly, crossing occipital triangle to enter trapezius muscle;. vagal communicating branch joins vagus nerve at jugular foramen to innervate larynx, palate, and pharyngeal muscles	Spinal accessory nerve, vagal communicating branch	GSE: trapezius and sternocleidomastoid muscles	
Hypoglossal nerve (CN XII)	Hypoglossal rootlets and hypoglossal communicating branch of C1 spinal nerve	Rootlets from anterolateral sulcus of medulla oblongata exit cranium through hypoglossal canal, then pass inferiorly and anteriorly between vagus and spinal accessory nerves to inferior border of posterior belly of digastric muscle, eventually entering oral cavity by passing between mylohyoid and hyoglossus muscles	Lingual branches and branches conveying fibers from C1 spinal nerve (thyrohoid and geniohyoid branches and superior root of ansa cervicalis)	GSE: intrinsic muscles of tongue and genioglossus, hyoglossus, and styloglossus muscles C1: thyrohyoid, geniohyoid, and omohyoid (superior belly) muscles	

The roots of the cervical plexus are the anterior rami of C1–C4 spinal nerves.

NERVE	ORIGIN	COURSE	BRANCHES	MOTOR	CUTANEOUS SENSORY
Hypoglossal communicating branch	Anterior ramus of C1 spinal nerve	Emerges and briefly adheres to hypoglossal nerve; superior root of ansa cervicalis exits just posterior to greater horn of hyoid bone and descends along carotid sheath, where it joins inferior root at C4–C5 level	Superior root of ansa cervicalis, thyrohyoid and geniohyoid branches of hypoglossal nerve	Omohyoid (superior belly), thyrohyoid, and geniohyoid muscles	
Inferior root of ansa cervicalis	Anterior rami of C2–C3 spinal nerves	Descends along anterolateral carotid sheath, joining superior root at C4–C5 level	Infrahyoid branches	Omohyoid (inferior belly), sternohyoid, and sternothyroid muscles	
Muscular branches of cervical plexus	Anterior rami of C1–C4 spinal nerves	Three loops form along C1–C4 vertebrae that course laterally between levator scapulae and scalenus medius muscle, deep to sternocleidomastoid muscle		Rectus anterior and lateralis capitis, longus capitis and longus colli; scalenus anterior, medius and posterior muscles; levator scapulae	
Phrenic nerve	Anterior rami of C3–C5 spinal nerves	Descends on scalenus anterior muscle deep to inferior belly of omohyoid muscle and transverses cervical and suprascapular vessels; enters thorax between subclavian vein and artery, passing anterior to root of lung and along lateral border of pericardium to pierce diaphragm		Diaphragm	
Lesser occipital nerve	Anterior ramus of C2 spinal nerve	Formed in posterior cervical triangle deep to sternocleidomastoid muscle, ascending along its posterior border; perforates deep fascia at mastoid process, ascending posterior to ear			Temporal, auricular, and mastoid regions
Great auricular nerve	Anterior rami of C2–C3 spinal nerves	Formed in posterior cervical triangle deep to sternocleidomastoid muscle, ascending obliquely between that muscle and platysma	Anterior and posterior branches		Parotid, auricular, and mastoid regions
Transverse cervical nerve	Anterior rami of C2–C3 spinal nerves	Formed in posterior cervical triangle deep to sternocleidomastoid muscle, runs superficial to that muscle, passing deep to external jugular vein	Superior and inferior branches		Anterior and lateral regions of neck
Supraclavicular nerve	Anterior rami of C3–C4 spinal nerves	Formed in posterior cervical triangle deep to mid-third of sternocleidomastoid muscle, passes lateral to external jugular vein, and descends just inferior to clavicle	Medial, intermediate, and lateral supraclavicular nerves		Clavicular and infraclavicular regions

MUSCLE	MUSCLE GROUP	ORIGIN ATTACHMENT	INSERTION ATTACHMENT	INNERVATION	BLOOD SUPPLY	MAIN ACTIONS
Auricularis anterior m.	Facial expression (external ear)	Temporal fascia, epicranial aponeurosis	Anterior part of medial surface of helix of ear	Temporal branches of facial nerve	Posterior auricular and superficial temporal arteries	Elevates and draws auricle forward
Auricularis posterior m.	Facial expression (external ear)	Mastoid process	Inferior part of medial surface of auricle	Posterior auricular nerve (branch of facial nerve)	Posterior auricular and superficial temporal arteries	Retracts and elevates auricle
Auricularis superior m.	Facial expression (external ear)	Temporal fascia, epicranial aponeurosis	Superior part of medial surface of auricle	Temporal branches of facial nerve	Posterior auricular and superficial temporal arteries	Retracts and elevates auricle
Bucinator	Facial expression	Posterior portions of alveolar processes of maxilla and mandible, anterior border of pterygomandibular raphe	Modiolus of angle of mouth	Buccal branches of facial nerve	Facial and maxillary arteries	Compresses cheeks
Ciliary m.	Intrinsic eye (smooth muscle)	Scleral spur	Choroid	Short ciliary nerves (parasympathetic fibers from ciliary ganglion)	Ophthalmic artery	Constricts ciliary body and lens rounds up (accommodation)
Corrugator supercilii	Facial expression	Medial part of supra-orbital margin	Skin of medial half of eyebrow	Temporal branches of facial nerve	Superficial temporal artery	Draws eyebrows inferiorly and medially, produces vertical wrinkles of skin between eyebrows
Cricothyroid m.	Laryngeal	Arch of cricoid cartilage	Inferior border of lamina and inferior horn of thyroid cartilage	External branch of superior laryngeal nerve	Superior and inferior thyroid arteries	Lengthens and tenses vocal ligaments
Depressor anguli oris	Facial expression	Oblique line of mandible	Modiolus of angle of mouth	Marginal mandibular and buccal branches of facial nerve	Inferior labial artery	Depresses angle of mouth
Depressor labii inferioris	Facial expression	External surface of mandible between symphysis and mental foramen	Skin of lower lip	Marginal mandibular branches of facial nerve	Inferior labial artery	Depresses lower lip and draws it laterally
Depressor septi nasi	Facial expression	Incisive fossa of maxilla	Nasal septum and posterior part of ala of nose	Zygomatic and buccal branches of facial nerve	Superior labial artery	Narrows nostril, draws septum inferiorly
Digastric m.	Suprahyoid	*Anterior belly:* digastric fossa of mandible	Intermediate tendon attached to body of hyoid	*Anterior belly:* inferior alveolar nerve (branch of mandibular nerve)	*Anterior belly:* submental artery	Elevates hyoid bone and base of tongue, steadies hyoid bone, opens mouth by depressing mandible
		Posterior belly: mastoid notch of temporal bone		*Posterior belly:* digastric branch of facial nerve	*Posterior belly:* posterior auricular and occipital arteries	
Dilator pupillae	Intrinsic eye (smooth muscle)	Iridal part of retina	Pupillary margin of iris	Long ciliary nerves (sympathetic fibers from superior cervical ganglion)	Ophthalmic artery	Dilates pupil
Frontalis m.	Facial expression (epicranial)	Epicranial aponeurosis (at level of coronal suture)	Skin of frontal region, epicranial aponeurosis	Temporal branches of facial nerve	Superficial temporal artery	Horizontally wrinkles skin of forehead, elevates eyebrows
Genioglossus m.	Extrinsic tongue	Superior mental spine of mandible	Dorsum of tongue, hyoid bone	Hypoglossal nerve (CN XII)	Sublingual and submental arteries	Depresses and protrudes tongue
Geniohyoid m.	Suprahyoid	Inferior mental spine of mandible	Anterior surface of body of hyoid bone	Anterior ramus of C1 spinal nerve (via hypoglossal nerve)	Sublingual artery	Elevates hyoid bone and depresses mandible
Hyoglossus m.	Extrinsic tongue	Body and greater horn of hyoid bone	Margin and inferior surface of tongue	Hypoglossal nerve (CN XII)	Sublingual and submental arteries	Depresses and retracts tongue
Inferior longitudinal lingual m.	Intrinsic tongue	Inferior surface of tongue	Apex of tongue	Hypoglossal nerve (CN XII)	Lingual and facial arteries	Shortens tongue, turns tip and sides inferiorly

MUSCLE	MUSCLE GROUP	ORIGIN ATTACHMENT	INSERTION ATTACHMENT	INNERVATION	BLOOD SUPPLY	MAIN ACTIONS
Inferior oblique m.	Extraocular	Anterior floor of orbit (lateral to nasolacrimal canal)	Sclera lateral to corneoscleral junction	Oculomotor nerve (CN III)	Ophthalmic artery	Abducts, elevates, and laterally rotates eyeball
Inferior pharyngeal constrictor	Circular pharyngeal	Oblique line of thyroid cartilage, cricoid cartilage	Pharyngeal raphe	Vagus nerve (via pharyngeal plexus)	Ascending pharyngeal and superior thyroid arteries	Constricts wall of pharynx during swallowing
Inferior rectus m.	Extraocular	Common tendinous ring	Sclera inferior to corneoscleral junction	Oculomotor nerve (CN III)	Ophthalmic artery	Depresses, adducts, and laterally rotates eyeball
Lateral cricoarytenoid m.	Laryngeal	Arch of cricoid cartilage	Muscular process of arytenoid cartilage	Recurrent laryngeal nerve	Superior and inferior thyroid arteries	Adducts vocal folds
Lateral pterygoid m.	Mastication	*Superior head:* infratemporal surface of greater wing of sphenoid bone	Pterygoid fovea of mandible, capsule and articular disc of temporomandibular joint	Mandibular nerve (CN V_3)	Maxillary artery	*Bilaterally:* protrudes mandible
		Inferior head: lateral pterygoid plate				*Unilaterally and alternately:* produces side-to-side grinding
Lateral rectus m.	Extraocular	Common tendinous ring	Sclera lateral to corneoscleral junction	Abducens nerve (CN VI)	Ophthalmic artery	Abducts eyeball
Levator anguli oris	Facial expression	Canine fossa of maxilla	Modiolus of angle of mouth	Zygomatic and buccal branches of facial nerve	Superior labial artery	Elevates angle of mouth
Levator nasolabialis (levator labii superioris alaeque nasi)	Facial expression	Superior part of frontal process of maxilla	Major alar cartilage, skin of nose, lateral part of upper lip	Zygomatic and buccal branches of facial nerve	Superior labial and angular arteries	Elevates upper lip and dilates nostril
Levator labii superioris	Facial expression	Maxilla superior to infraorbital foramen	Skin of upper lip	Zygomatic and buccal branches of facial nerve	Superior labial and angular arteries	Elevates upper lip, dilates nares
Levator palpebrae superioris	Extraocular	Lesser wing of sphenoid bone (anterior to optic canal)	Superior tarsus	Oculomotor nerve (CN III)	Ophthalmic artery	Elevates upper eyelid
Levator veli palatini	Palatal	Petrous part of temporal bone, auditory tube	Palatine aponeurosis	Vagus nerve (via pharyngeal plexus)	Ascending and descending palatine arteries	Elevates soft palate during swallowing
Longus capitis m.	Anterior vertebral	Anterior tubercles of transverse processes of C3–C6 vertebrae	Inferior surface of basilar part of occipital bone	Anterior rami of C1–C3 spinal nerves	Ascending cervical, ascending pharyngeal and vertebral arteries	Flexes head
Longus colli m.	Anterior vertebral	*Vertical portion:* C5–T3 vertebrae	*Vertical portion:* C2–C4 vertebrae	Anterior rami of C2–C8 spinal nerves	Ascending pharyngeal, ascending cervical and vertebral arteries	*Bilaterally:* flex and assist in rotating cervical vertebrae and head
		Inferior oblique portion: T1–T3 vertebrae	*Inferior oblique portion:* anterior tubercles of transverse processes of C3–C6 vertebrae			*Unilaterally:* laterally flexes vertebral column
		Superior oblique portion: anterior tubercles of transverse processes of C3–C5 vertebrae	*Superior oblique portion:* anterior tubercle of atlas			
Masseter	Mastication	Zygomatic arch	Ramus of mandible, coronoid process	Mandibular nerve (CN V_3)	Transverse facial, masseteric, and facial arteries	Elevates and protrudes mandible; deep fibers retract it

Continued

MUSCLE	MUSCLE GROUP	ORIGIN ATTACHMENT	INSERTION ATTACHMENT	INNERVATION	BLOOD SUPPLY	MAIN ACTIONS
Medial pterygoid m.	Mastication	Medial surface of lateral pterygoid plate, pyramidal process of palatine bone, maxillary tuberosity	Medial surface of ramus and angle of mandible (inferior to mandibular foramen)	Mandibular nerve (V_3)	Facial and maxillary arteries	Bilaterally: protrudes and elevates mandible Unilaterally and alternately: produces side-to-side movements
Medial rectus m.	Extraocular	Common tendinous ring	Sclera medial to corneoscleral junction	Oculomotor nerve (CN III)	Ophthalmic artery	Adducts eyeball
Mentalis m.	Facial expression	Incisive fossa of mandible	Skin of chin	Marginal mandibular branch of facial nerve	Inferior labial artery	Elevates and protrudes lower lip
Middle pharyngeal constrictor	Circular pharyngeal	Stylohyoid ligament, horns of hyoid bone	Pharyngeal raphe	Vagus nerve (via pharyngeal plexus)	Ascending pharyngeal and ascending palatine arteries, tonsillar branches of facial artery, dorsal lingual branches of lingual artery	Constricts wall of pharynx during swallowing
Musculus uvulae	Palatal	Posterior nasal spine (of palatine bone), palatine aponeurosis	Mucosa of uvula of palate	Vagus nerve (via pharyngeal plexus)	Ascending and descending palatine arteries	Shortens, elevates, and retracts uvula of the palate
Mylohyoid m.	Suprahyoid	Mylohyoid line of mandible	Median raphe of mylohyoid, body of hyoid bone	Inferior alveolar nerve (branch of mandibular nerve)	Sublingual and submental arteries	Elevates hyoid bone, base of tongue, floor of mouth; depresses mandible
Nasalis m.	Facial expression	Canine eminence (superior and lateral to incisive fossa of maxilla)	Aponeurosis on nasal cartilages	Buccal branches of facial nerve	Superior labial artery, septal and lateral nasal branches of facial artery	Draws ala of nose toward nasal septum, compresses nostrils; alar part opens nostrils
Oblique arytenoid m.	Laryngeal	Arytenoid cartilage	Opposite arytenoid cartilage	Recurrent laryngeal nerve	Superior and inferior thyroid arteries	Closes intercartilaginous portion of rima glottidis
Occipitalis m.	Facial expression (epicranial)	Lateral two-thirds of superior nuchal line, mastoid process	Skin of occipital region, epicranial aponeurosis	Posterior auricular nerve (branch of facial nerve)	Posterior auricular and occipital arteries	Moves scalp backward
Omohyoid m.	Infrahyoid	*Inferior belly:* superior border of scapula, superior transverse scapular ligament *Superior belly:* body of hyoid bone	Intermediate tendon of omohyoid	*Inferior belly:* ansa cervicalis (C2–C3) *Superior belly:* ansa cervicalis (C1)	Lingual and superior thyroid arteries	Steadies and depresses hyoid bone
Orbicularis oculi m.	Facial expression	Medial orbital margin, medial palpebral ligament, lacrimal bone	Skin around orbit, lateral palpebral ligament, upper and lower eyelids	Temporal and zygomatic branches of facial nerve	Facial and superficial temporal arteries	Closes eyelids
Orbicularis oris m.	Facial expression	Maxilla and mandible, perioral skin and muscles	Modiolus of angle of mouth	Buccal and marginal mandibular branches of facial nerve	Inferior and superior labial arteries	Compression, contraction, and protrusion of lips
Palatoglossus m.	Palatal	Palatine aponeurosis	Margin of tongue	Vagus nerve (via pharyngeal plexus)	Ascending pharyngeal artery, palatine branches of facial and maxillary arteries	Elevates posterior tongue, depresses palate
Palatopharyngeus m.	Palatal	Hard palate, palatine aponeurosis	Lateral pharyngeal wall	Vagus nerve (via pharyngeal plexus)	Ascending and descending palatine arteries	Tenses soft palate; pulls walls of pharynx superiorly, anteriorly, and medially during swallowing

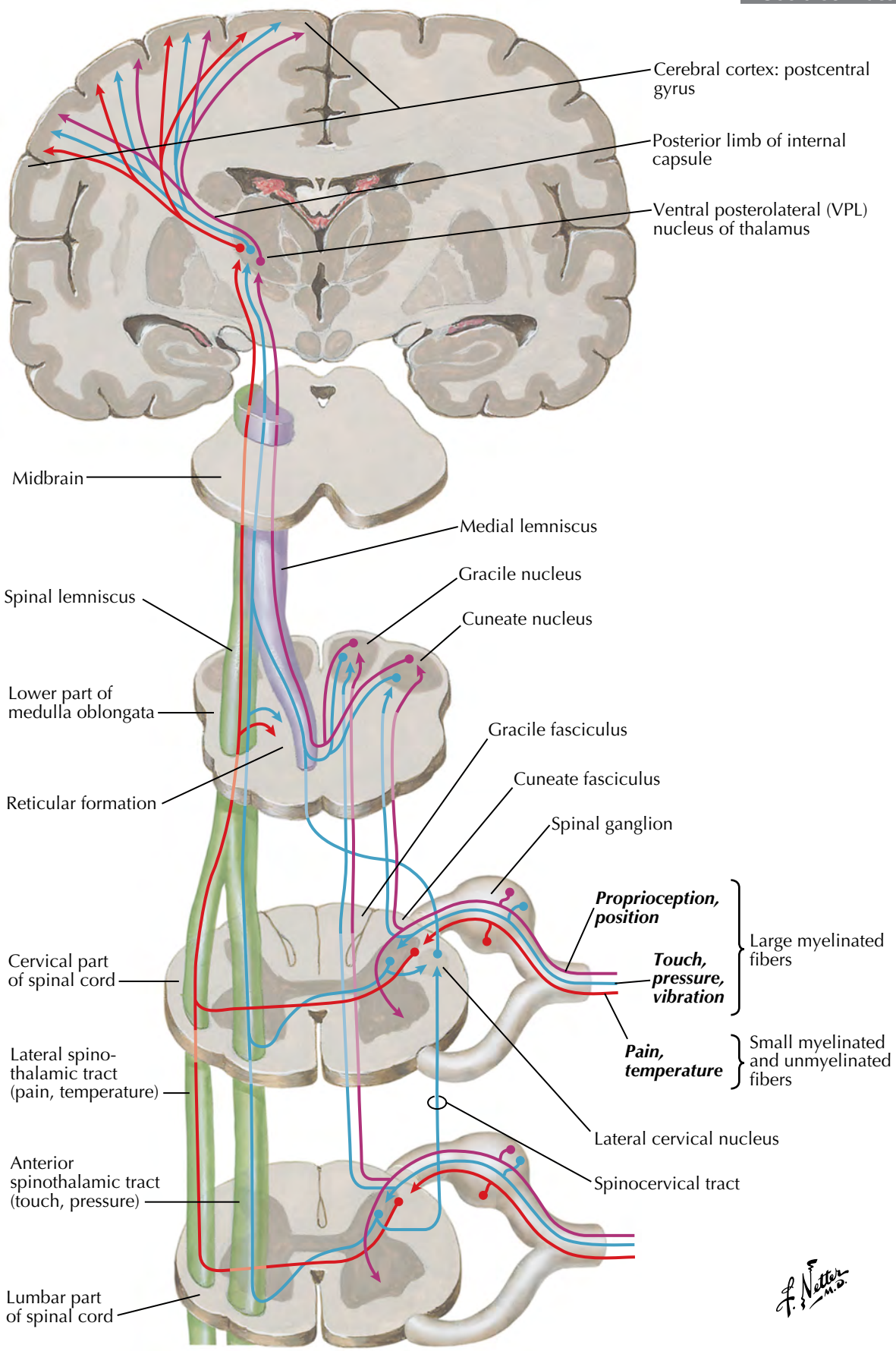
MUSCLE	MUSCLE GROUP	ORIGIN ATTACHMENT	INSERTION ATTACHMENT	INNERVATION	BLOOD SUPPLY	MAIN ACTIONS
Platysma	Facial expression (neck)	Skin of infraclavicular region	Mandible, muscles of lower lip	Cervical branch of facial nerve	Submental and suprascapular arteries	Tenses skin of neck
Posterior cricoarytenoid m.	Laryngeal	Posterior surface of lamina of cricoid cartilage	Muscular process of arytenoid cartilage	Recurrent laryngeal nerve	Superior and inferior thyroid arteries	Abducts vocal folds
Procerus m.	Facial expression	Fascia covering inferior part of nasal bone and superior part of lateral nasal cartilage	Skin medial and superior to eyebrow	Temporal and zygomatic branches of facial nerve	Angular artery, lateral nasal branches of facial artery	Draws down medial angle of eyebrows, produces transverse wrinkles over bridge of nose
Rectus anterior capitis m.	Anterior vertebral	Lateral mass of atlas	Basilar part of occipital bone	Anterior rami of C1–C2 spinal nerves	Vertebral and ascending pharyngeal arteries	Flexes head
Rectus lateralis capitis m.	Anterior vertebral	Superior surface of transverse process of atlas	Inferior surface of jugular process of occipital bone	Anterior rami of C1–C2 spinal nerves	Vertebral, occipital, and ascending pharyngeal arteries	Flexes head laterally to same side
Risorius m.	Facial expression	Fascia over masseter	Modiolus of angle of mouth	Buccal branches of facial nerve	Superior labial artery	Retracts angle of mouth
Salpingopharyngeus m.	Longitudinal pharyngeal	Auditory tube	Lateral pharyngeal wall	Vagus nerve (via pharyngeal plexus)	Ascending pharyngeal artery	Elevates pharynx and larynx during swallowing and speaking
Scalenus anterior m.	Lateral vertebral	Anterior tubercles of transverse processes of C3–C6 vertebrae	Scalene tubercle on 1st rib	Anterior rami of C5–C8 spinal nerves	Ascending cervical artery	Elevates 1st rib, bends neck
Scalenus medius m.	Lateral vertebral	Posterior tubercles of transverse processes of C2–C7 vertebrae	Superior surface of 1st rib (behind subclavian groove)	Anterior rami of C3–C7 spinal nerves	Ascending cervical artery	Elevates 1st rib, bends neck
Scalenus posterior m.	Lateral vertebral	Posterior tubercles of transverse processes of C4–C6 vertebrae	External surface of 2nd rib	Anterior rami of C5–C8 spinal nerves	Ascending cervical artery, superficial branch of transverse cervical artery	Elevates 2nd rib, bends neck
Sphincter pupillae	Intrinsic eye (smooth muscle)	Circular smooth muscle of iris that passes around pupil	Blends with dilator pupillae fibers	Short ciliary nerves (parasympathetic fibers from ciliary ganglion)	Ophthalmic artery	Constricts pupil
Stapedius m.	Middle ear	Pyramidal eminence of temporal bone (in tympanic cavity)	Stapes	Nerve to stapedius muscle (branch of facial nerve)	Posterior auricular, anterior tympanic, and middle meningeal arteries	Pulls stapes posteriorly to lessen oscillation of tympanic membrane
Sternocleidomastoid m.	Neck	*Sternal head:* anterior surface of manubrium sterni	Lateral surface of mastoid process; lateral half of superior nuchal line of occipital bone	Spinal accessory nerve (CN XI)	Superior thyroid, occipital, suprascapular, and posterior auricular arteries	*Bilaterally:* flexes head, elevates thorax
		Clavicular head: medial third of superior surface of clavicle				*Unilaterally:* turns face toward opposite side
Sternohyoid m.	Infrahyoid	Posterior surface of manubrium sterni, posterior sternoclavicular ligament, sternal end of clavicle	Medial part of inferior border of body of hyoid bone	Ansa cervicalis (C1–C3)	Superior thyroid and lingual arteries	Depresses larynx and hyoid bone, steadies hyoid bone
Sternothyroid m.	Infrahyoid	Posterior surface of manubrium sterni, posterior border of 1st costal cartilage	Oblique line of thyroid cartilage	Ansa cervicalis (C1–C3)	Cricothyroid branch of superior thyroid artery	Depresses larynx and thyroid cartilage
Styloglossus m.	Extrinsic tongue	Styloid process of temporal bone, stylohyoid ligament	Margin and inferior surface of tongue	Hypoglossal nerve (CN XII)	Sublingual artery	Retracts tongue and draws it up for swallowing
Stylohyoid m.	Suprahyoid	Posterior border of styloid process of temporal bone	Body of hyoid bone (at junction with greater horn)	Stylohyoid branch of facial nerve	Facial and occipital arteries	Elevates and retracts hyoid bone

Continued

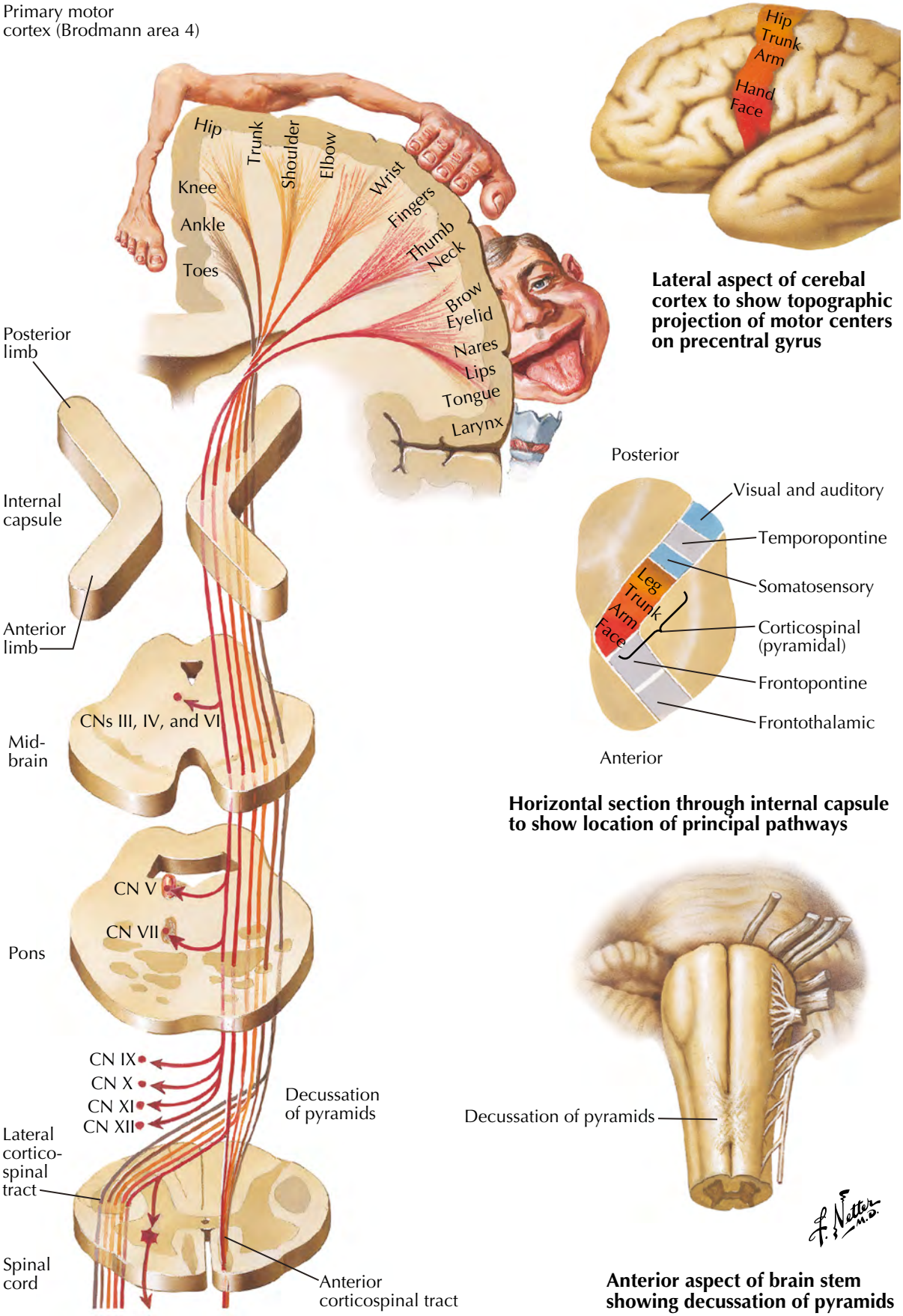
MUSCLE	MUSCLE GROUP	ORIGIN ATTACHMENT	INSERTION ATTACHMENT	INNERVATION	BLOOD SUPPLY	MAIN ACTIONS
Stylopharyngeus m.	Longitudinal pharyngeal	Medial surface of styloid process of temporal bone	Pharyngeal wall, posterior border of thyroid cartilage	Glossopharyngeal nerve (CN IX)	Ascending pharyngeal and ascending palatine arteries, tonsillar branches of facial artery, dorsal lingual branches of lingual artery	Elevates pharynx and larynx during swallowing and speaking
Superior longitudinal lingual m.	Intrinsic tongue	Submucosa of posterior part of dorsum of tongue	Apex of tongue; (unites with muscle of opposite side)	Hypoglossal nerve (CN XII)	Deep lingual branch of lingual artery, facial artery	Shortens tongue, turns tip and sides superiorly
Superior oblique m.	Extraocular	Body of sphenoid bone (above optic canal)	Sclera superior to corneoscleral junction (after passing through trochlea)	Trochlear nerve (CN IV)	Ophthalmic artery	Abducts, depresses, and medially rotates eyeball
Superior pharyngeal constrictor	Circular pharyngeal	Pterygoid hamulus, pterygomandibular raphe, mylohyoid line of mandible	Pharyngeal raphe	Vagus nerve (via pharyngeal plexus)	Ascending pharyngeal and ascending palatine arteries, tonsillar branches of facial artery, dorsal branches of lingual artery	Constricts wall of pharynx during swallowing
Superior rectus m.	Extraocular	Common tendinous ring	Sclera superior to corneoscleral junction	Oculomotor nerve (CN III)	Ophthalmic artery	Elevates, adducts, and medially rotates eyeball
Temporalis m.	Mastication	Temporal fossa, deep layer of temporal fascia	Coronoid process, ramus of mandible	Deep temporal nerves (branches of mandibular nerve)	Superficial temporal and maxillary arteries	Elevates mandible; posterior fibers retract mandible
Tensor tympani	Middle ear	Cartilage of auditory tube	Handle of malleus	Mandibular nerve (CN V_3)	Superior tympanic artery	Tenses tympanic membrane by drawing it medially
Tensor veli palatini	Palatal	Scaphoid fossa of medial pterygoid plate, spine of sphenoid bone, auditory tube	Palatine aponeurosis	Mandibular nerve (CN V_3)	Ascending and descending palatine arteries	Tenses soft palate, opens auditory tube during swallowing and yawning
Thyroarytenoid m.	Laryngeal	Internal surface of thyroid cartilage	Muscular process of arytenoid cartilage	Recurrent laryngeal nerve	Superior and inferior thyroid arteries	Shortens and relaxes vocal cords, sphincter of vestibule
Thyrohyoid m.	Infrahyoid	Oblique line of thyroid cartilage	Inferior border of body and greater horn of hyoid bone	Anterior ramus of C1 spinal nerve (via hypoglossal nerve)	Superior thyroid artery	Depresses larynx and hyoid bone, elevates larynx when hyoid bone is fixed
Transverse arytenoid m.	Laryngeal	Arytenoid cartilage	Opposite arytenoid cartilage	Recurrent laryngeal nerve	Superior and inferior thyroid arteries	Closes intercartilaginous portion of rima glottidis
Transversus linguae m.	Intrinsic tongue	Septum of tongue	Dorsum and margin of tongue	Hypoglossal nerve (CN XII)	Deep lingual branch of lingual artery, facial artery	Narrows and elongates tongue
Verticalis linguae m.	Intrinsic tongue	Mucosa of anterior part of dorsum of tongue	Inferior surface of tongue	Hypoglossal nerve (CN XII)	Deep lingual branch of lingual artery, facial artery	Flattens and broadens tongue
Vocalis m.	Laryngeal	Vocal process of arytenoid cartilage	Vocal ligament	Recurrent laryngeal nerve	Superior and inferior thyroid arteries	Tenses anterior part of vocal ligament, relaxes posterior part of vocal ligament
Zygomaticus major m.	Facial expression	Zygomatic arch	Modiolus of angle of mouth	Zygomatic and buccal branches of facial nerve	Superior labial artery	Draws angle of mouth posteriorly and superiorly
Zygomaticus minor m.	Facial expression	Zygomatic arch	Modiolus of angle of mouth, upper lip	Zygomatic and buccal branches of facial nerve	Superior labial artery	Elevates upper lip

Variations in spinal nerve contributions to the innervation of muscles, their arterial supply, their attachments, and their actions are common themes in human anatomy. Therefore, expect differences between texts and realize that anatomical variation is normal.

See also **Plate BP 40**

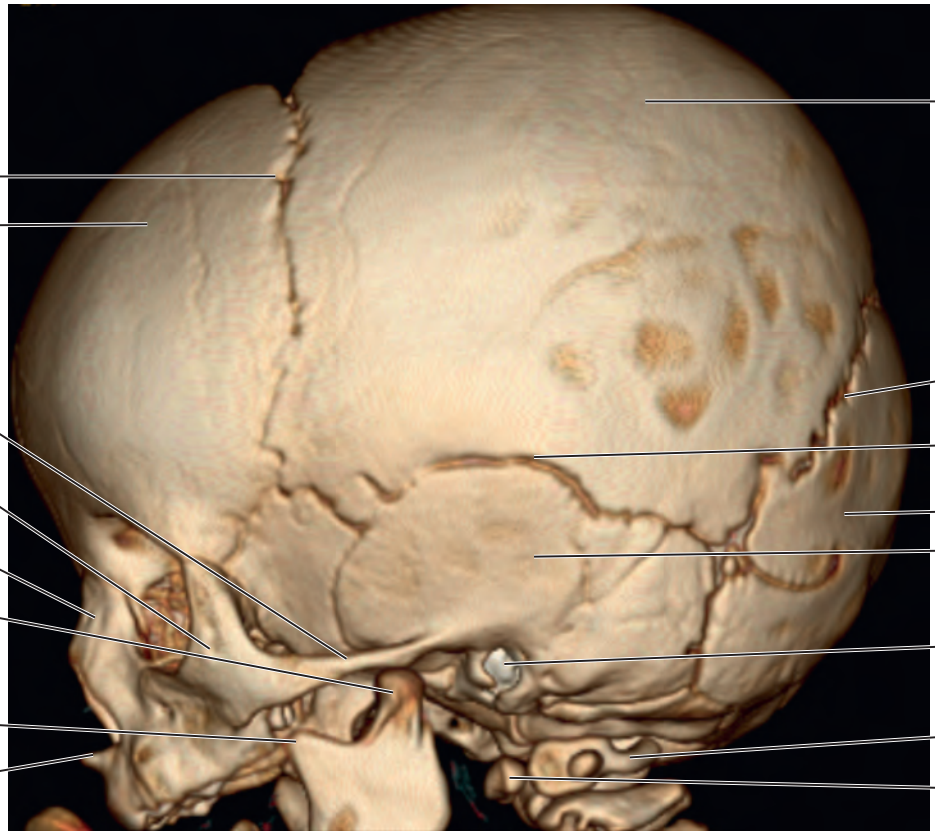


See also **Plate BP 40**

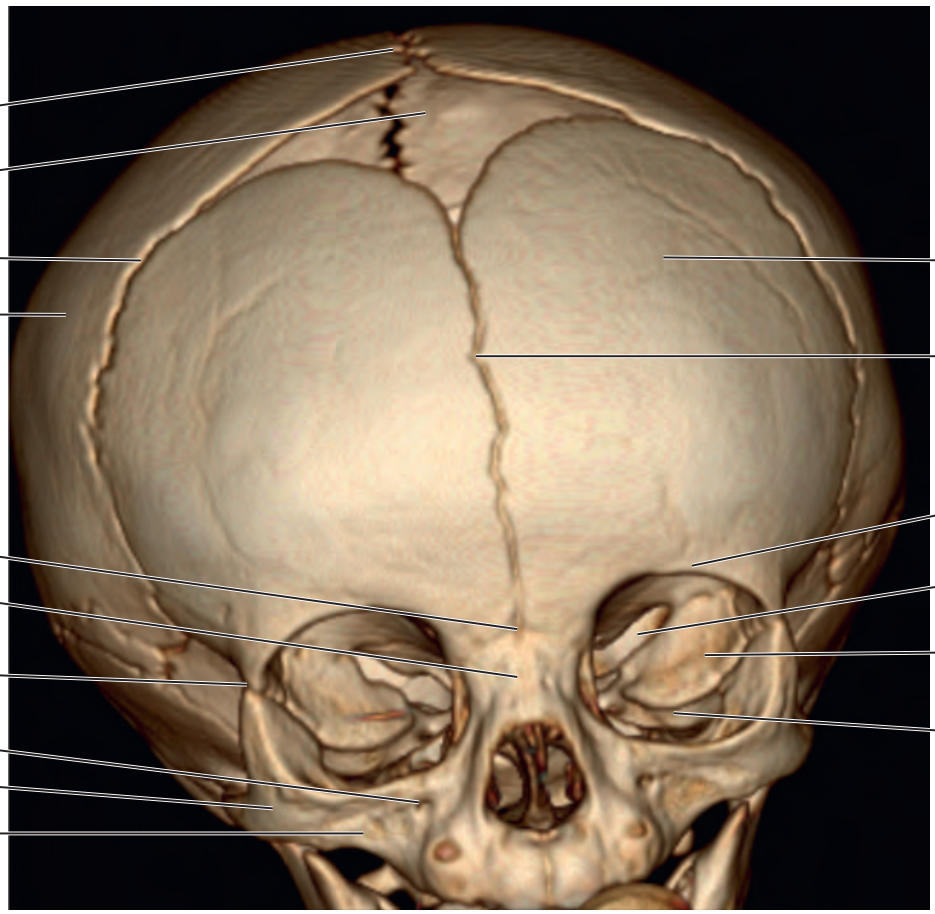


See also **Plates 35, 56**

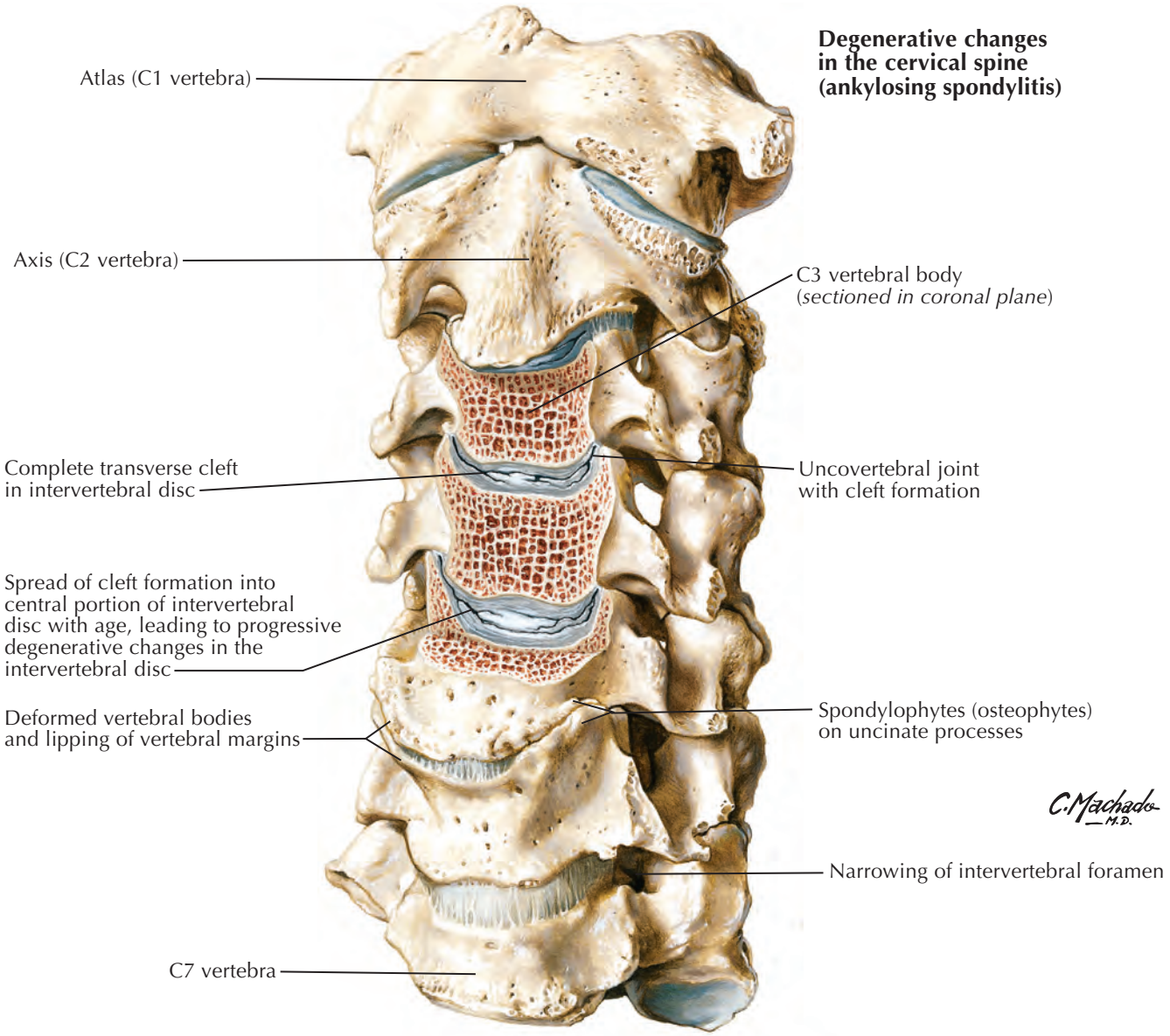
CT 3D child skull reconstruction, lateral view



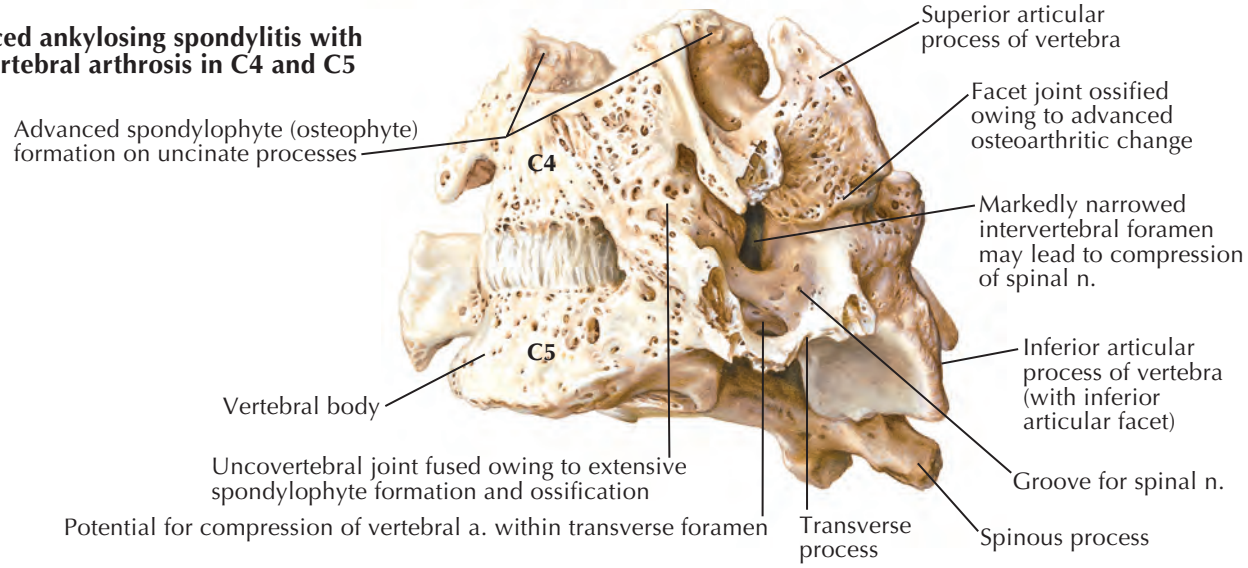
CT 3D child skull reconstruction, frontal view

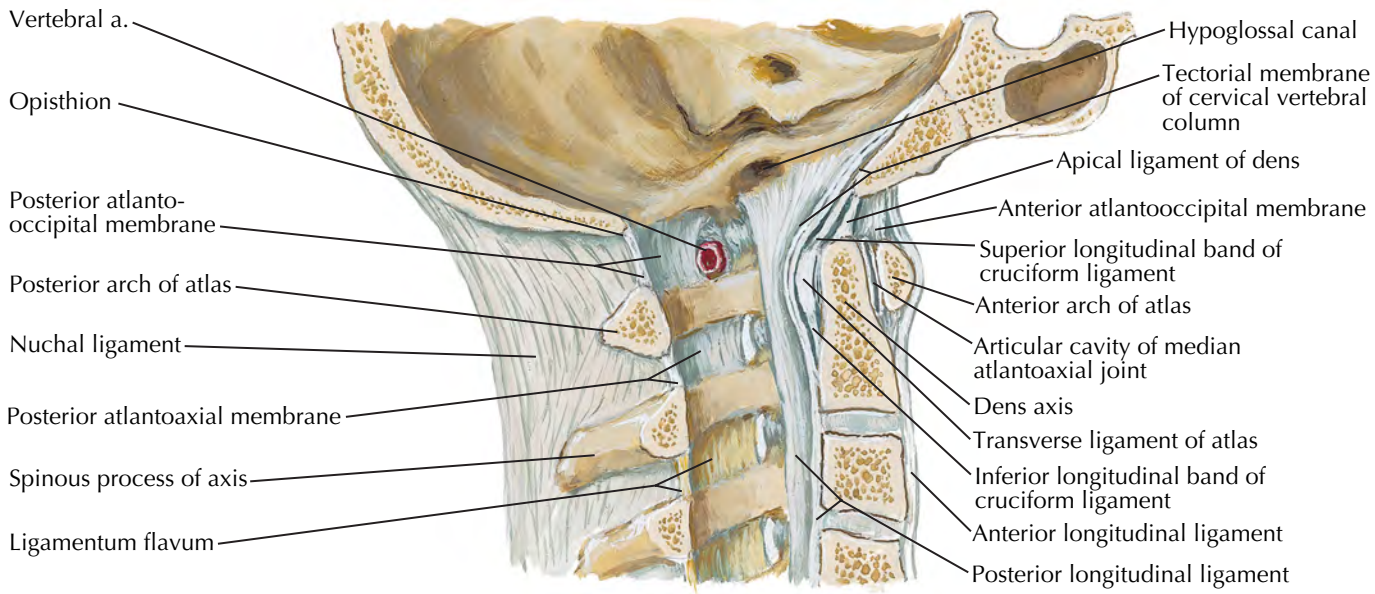


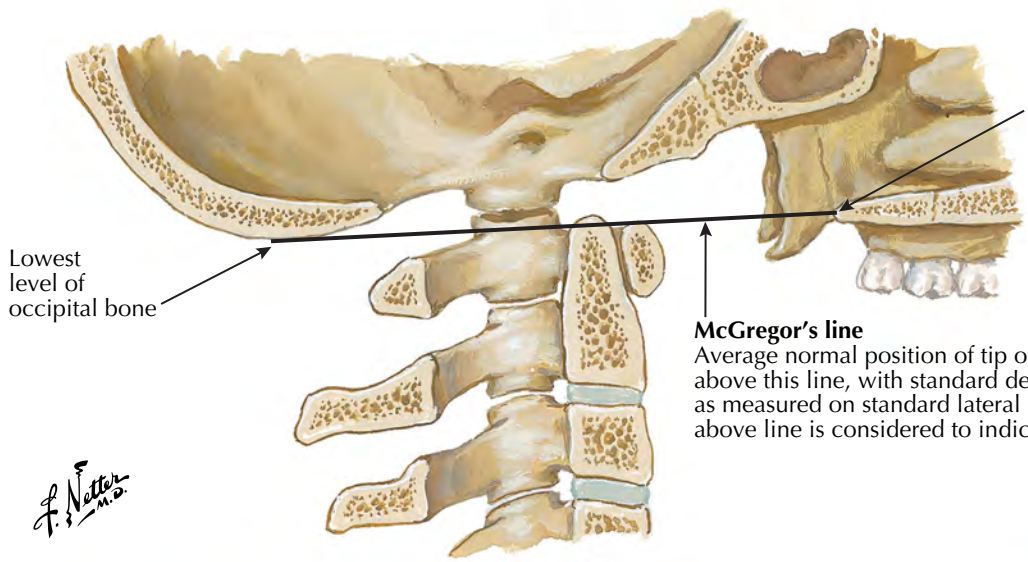
Degenerative changes in the cervical spine (ankylosing spondylitis)



Advanced ankylosing spondylitis with uncovertebral arthrosis in C4 and C5



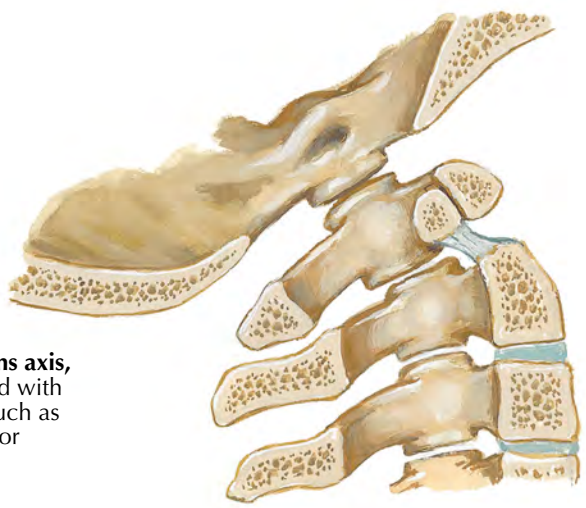




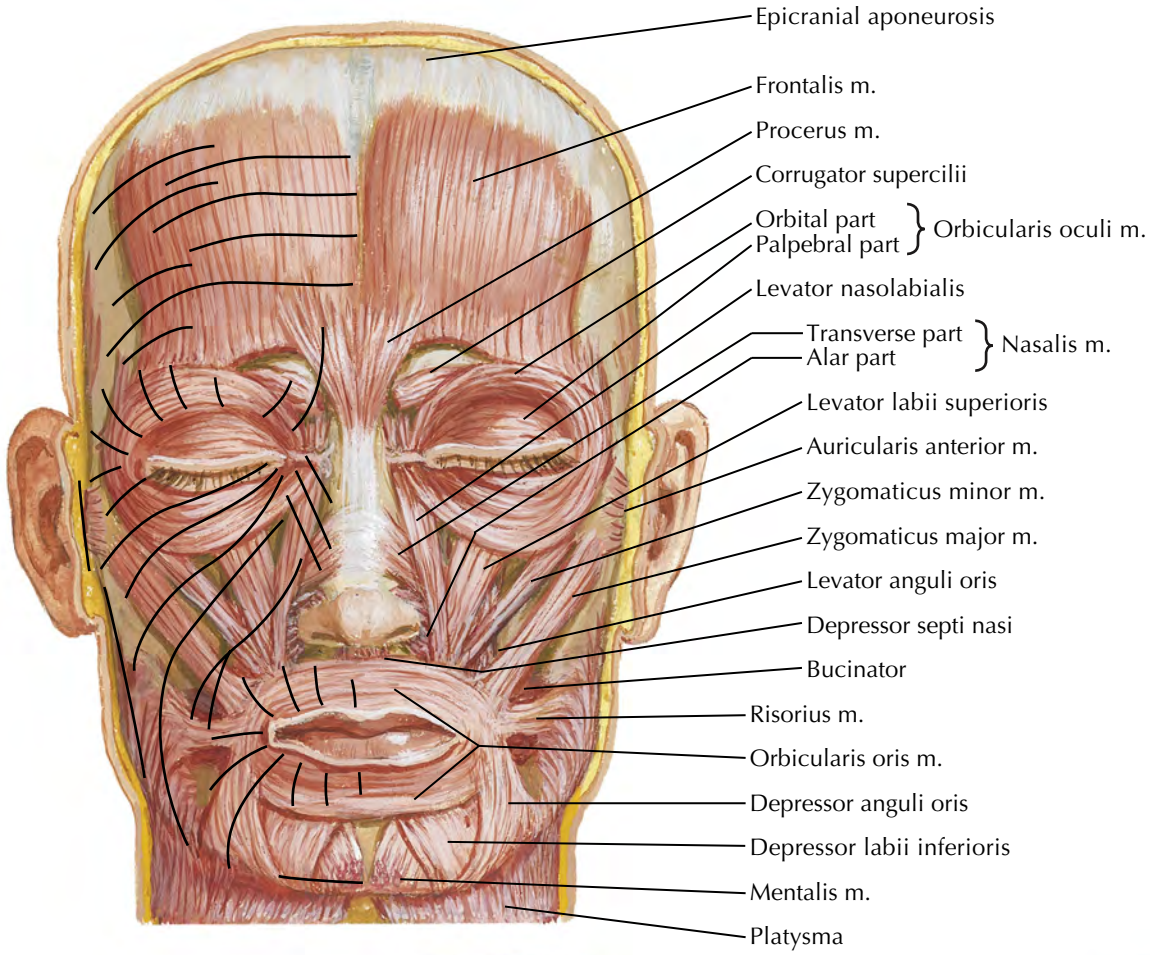
McGregor's line
Average normal position of tip of dens axis is 1.32 mm above this line, with standard deviation of ±2.6 mm as measured on standard lateral radiograph. Tip >4.5 mm above line is considered to indicate basilar impression.

Hypoplastic dens

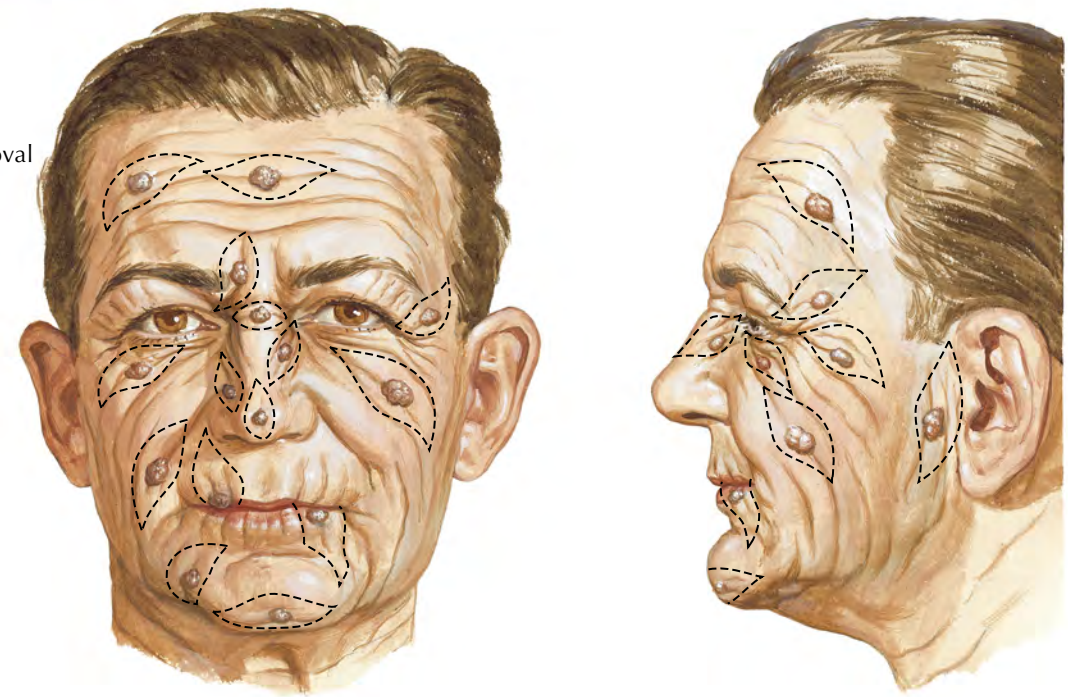
Abnormalities of dens axis, most often associated with skeletal dysplasias such as Klippel-Feil, Down, or Morquio syndromes

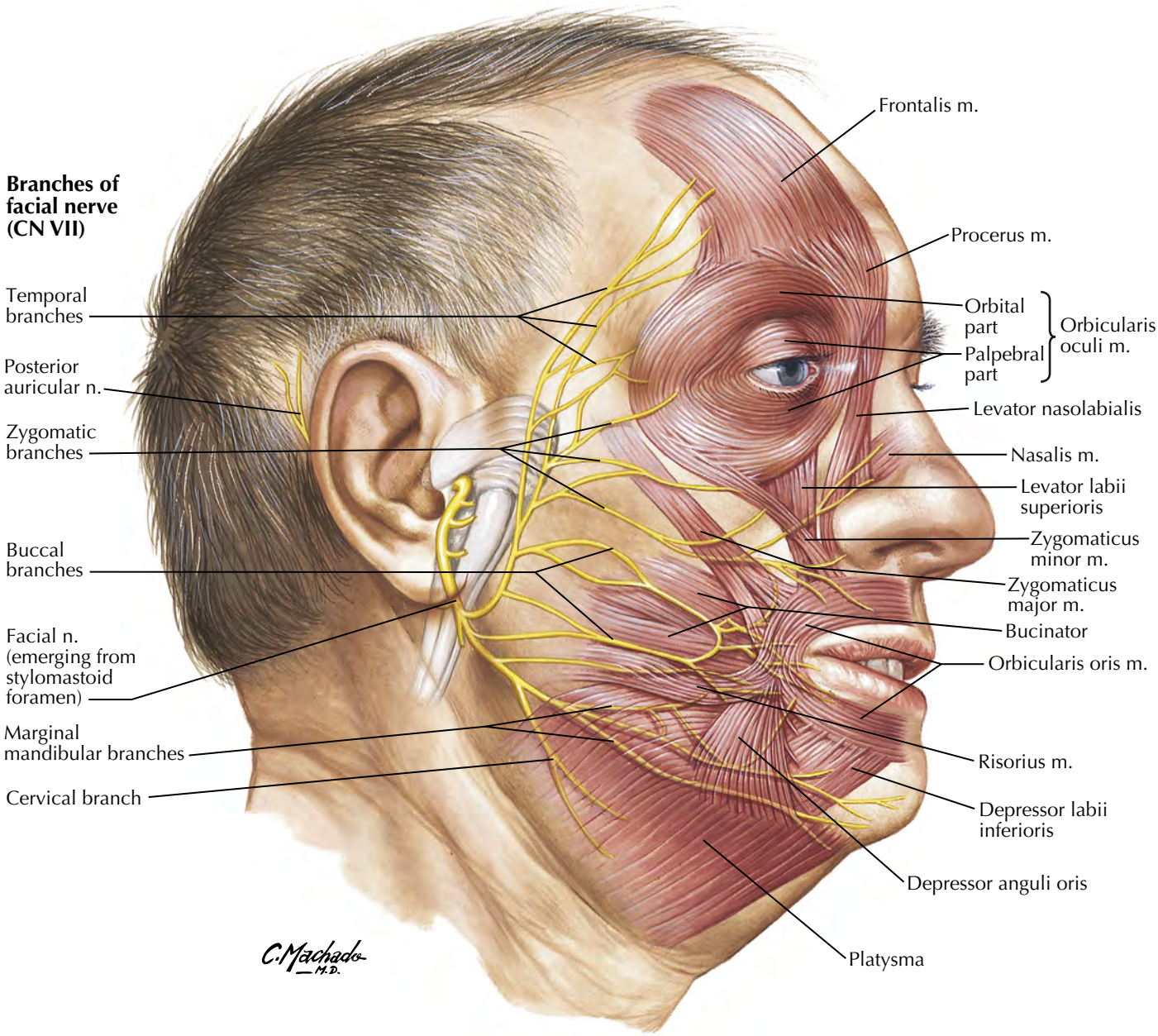


Os odontoideum with fibrous union and narrowing of vertebral canal with head in extension



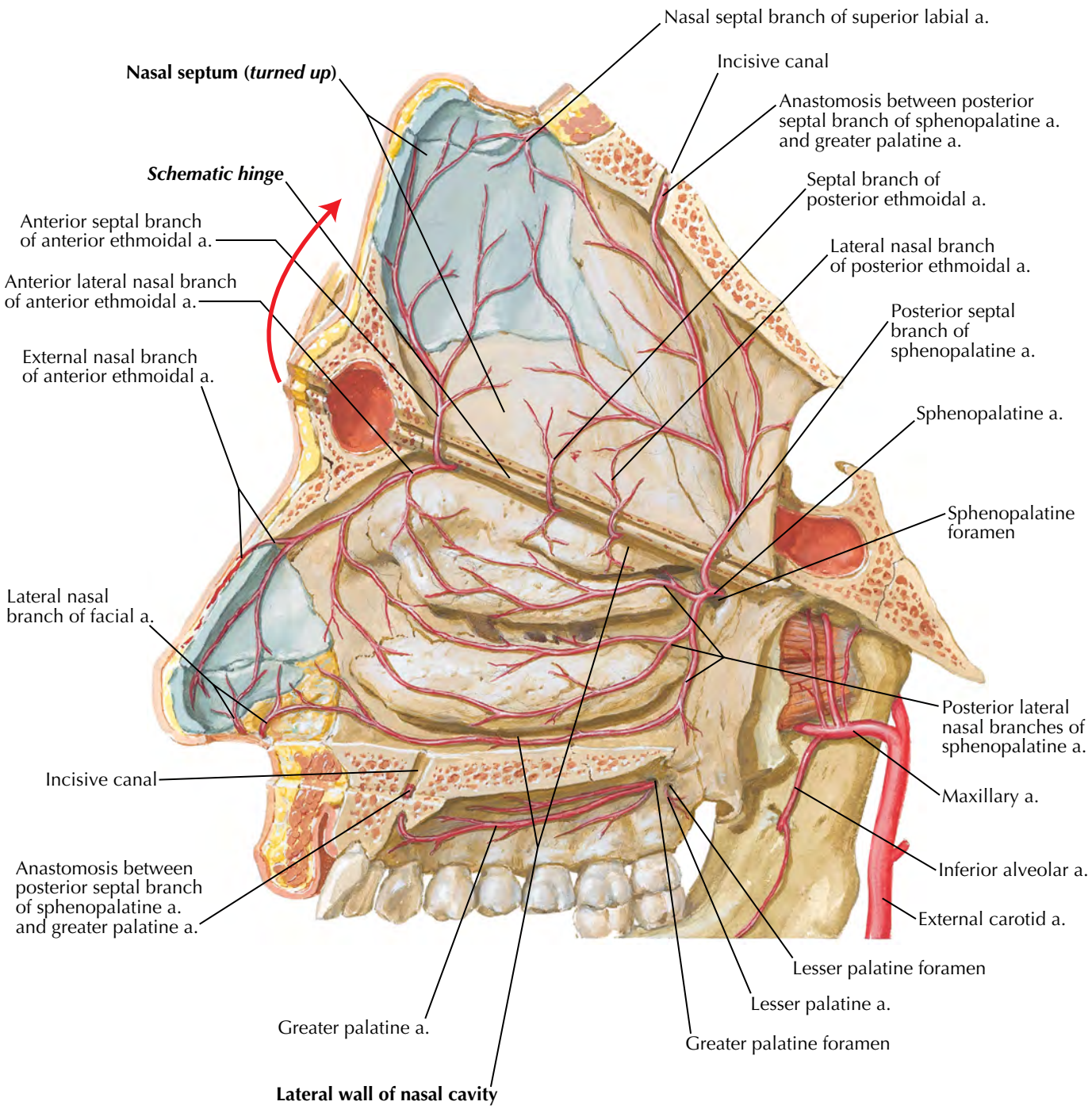
Course of wrinkle lines (Langer's lines) of skin is transverse to fiber direction of facial muscles. Elliptical incisions for removal of skin tumors conform to direction of wrinkle lines.

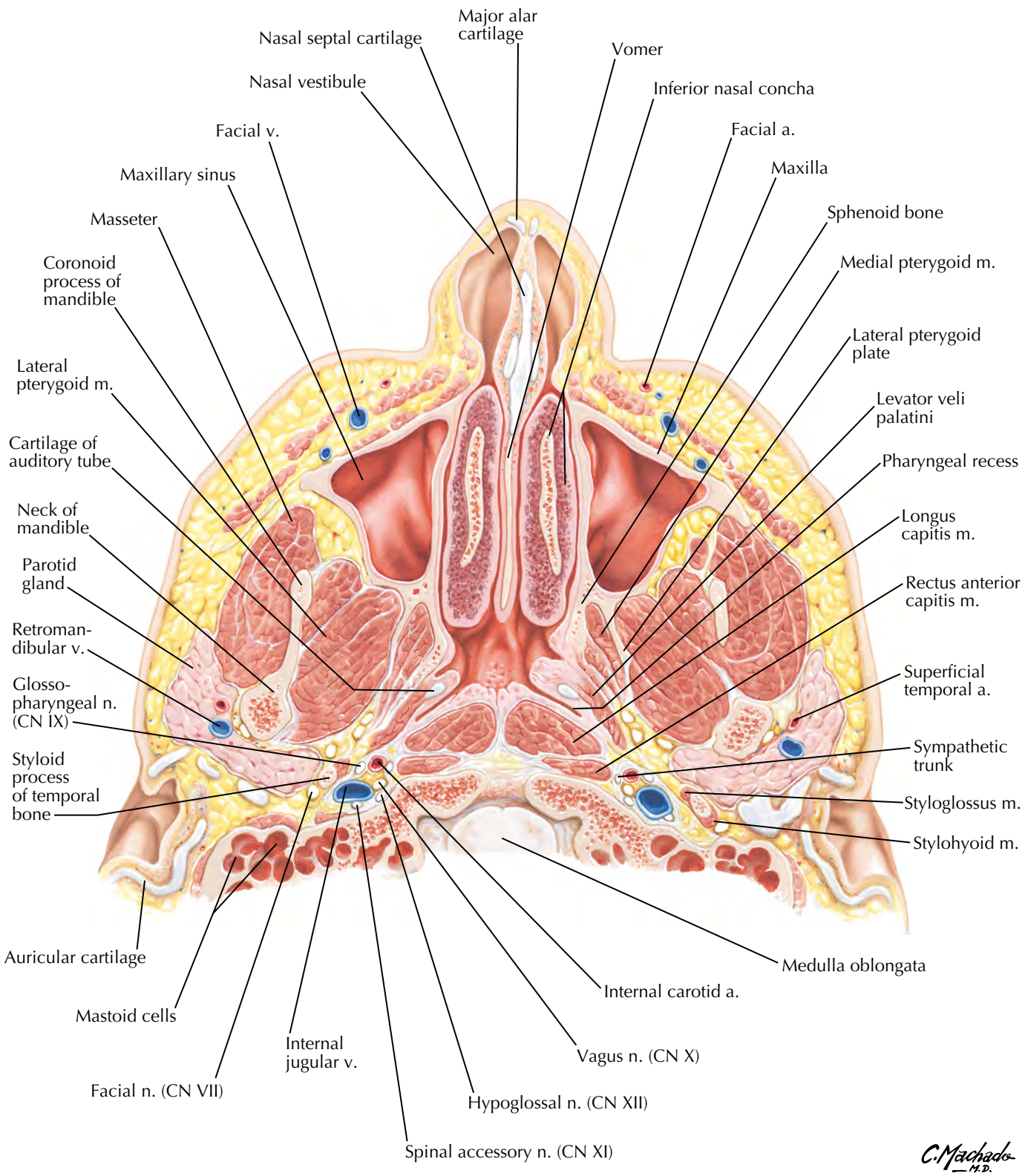



Branches of facial nerve (CN VII)
Temporal branches
Posterior auricular n.
Zygomatic branches
Buccal branches
Facial n. (emerging from stylomastoid foramen)
Marginal mandibular branches
Cervical branch
Frontalis m.
Procerus m.
Orbital part
Palpebral part
Orbicularis oculi m.
Levator nasolabialis
Nasalis m.
Levator labii superioris
Zygomaticus minor m.
Zygomaticus major m.
Bucinator
Orbicularis oris m.
Risorius m.
Depressor labii inferioris
Depressor anguli oris
Platysma
C. Machado M.D.

Arteries of Nasal Cavity: Bony Nasal Septum Turned Up

See also **Plates 65, 74, 81**




Major alar cartilage
Nasal septal cartilage
Vomer
Nasal vestibule
Inferior nasal concha
Facial v.
Facial a.
Maxillary sinus
Maxilla
Masseter
Sphenoid bone
Coronoid process of mandible
Medial pterygoid m.
Lateral pterygoid plate
Lateral pterygoid m.
Levator veli palatini
Cartilage of auditory tube
Pharyngeal recess
Neck of mandible
Longus capitis m.
Parotid gland
Rectus anterior capitis m.
Retroman-dibular v.
Superficial temporal a.
Glosso-pharyngeal n. (CN IX)
Sympathetic trunk
Styloid process of temporal bone
Styloglossus m.
Stylohyoid m.
Medulla oblongata
Auricular cartilage
Internal carotid a.
Mastoid cells
Internal jugular v.
Vagus n. (CN X)
Facial n. (CN VII)
Hypoglossal n. (CN XII)
Spinal accessory n. (CN XI)
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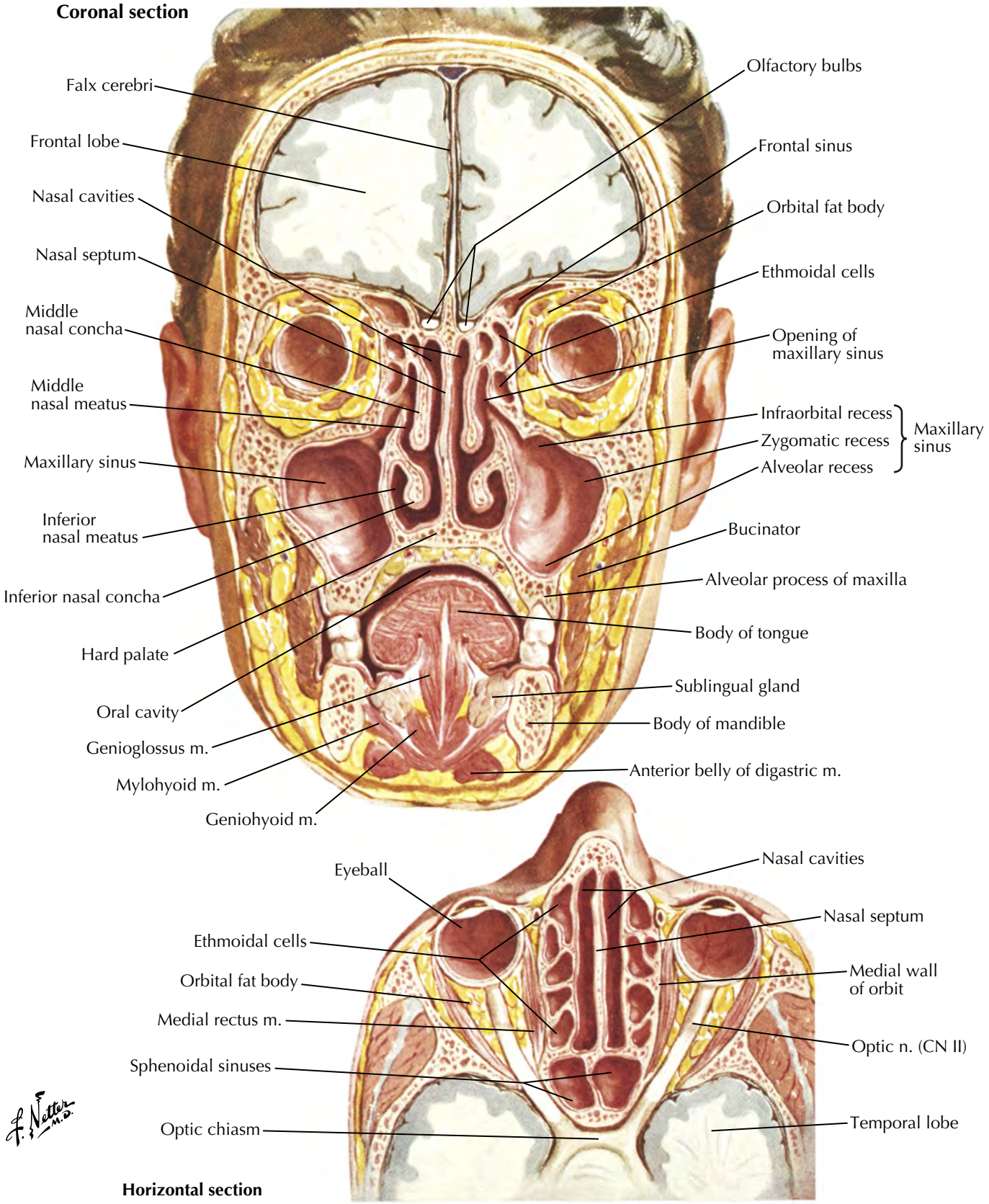
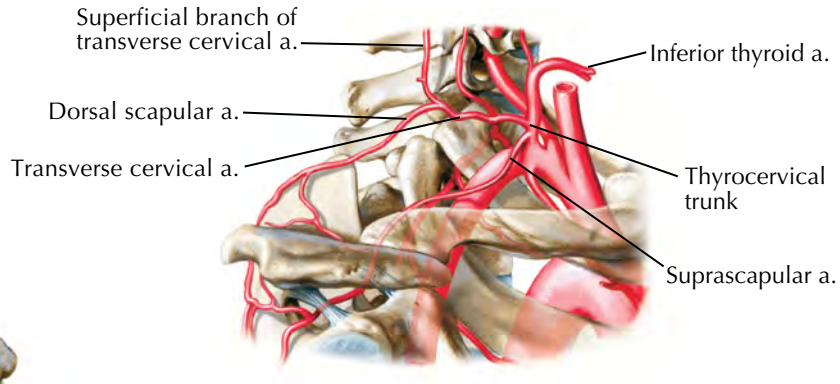
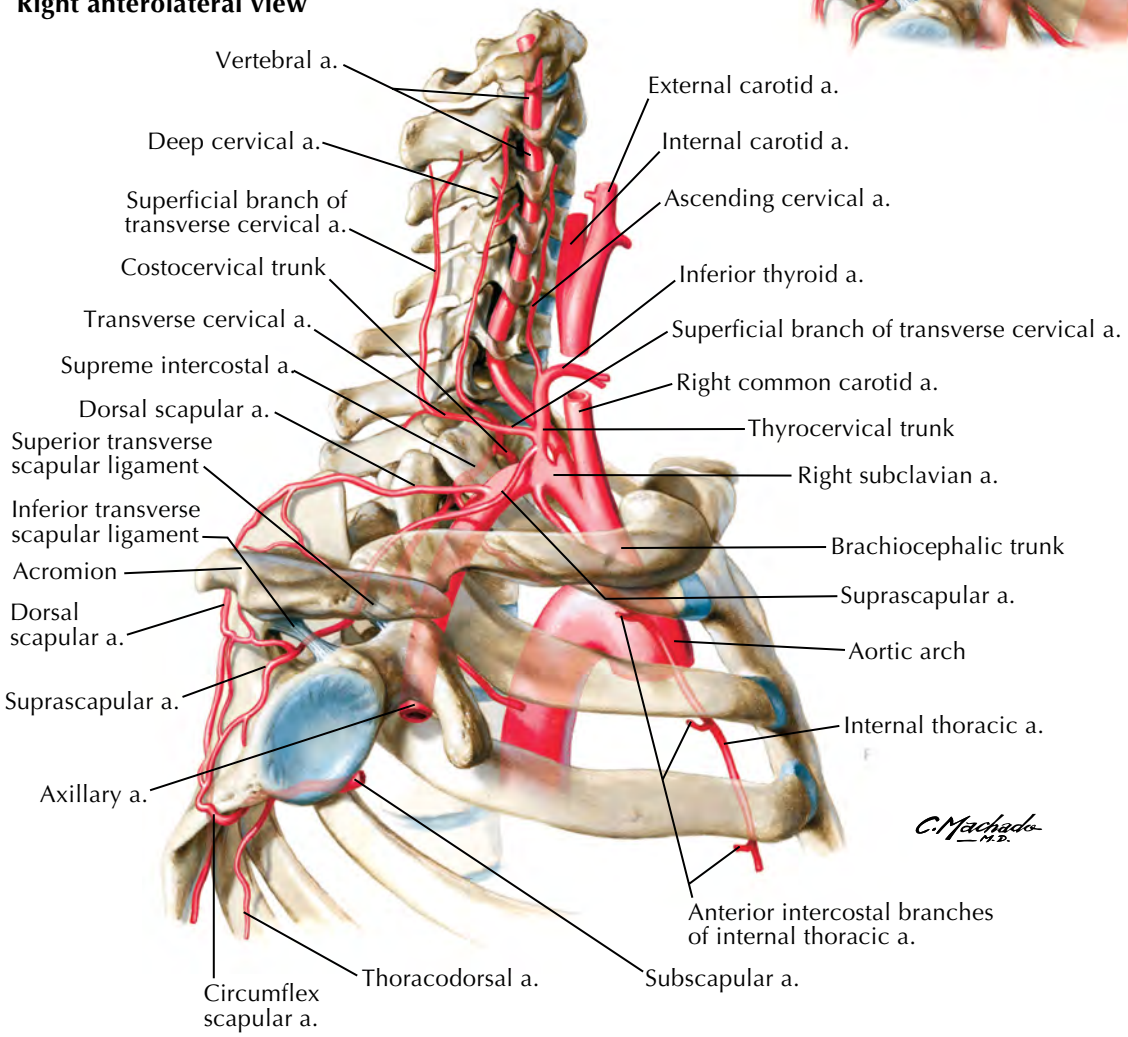
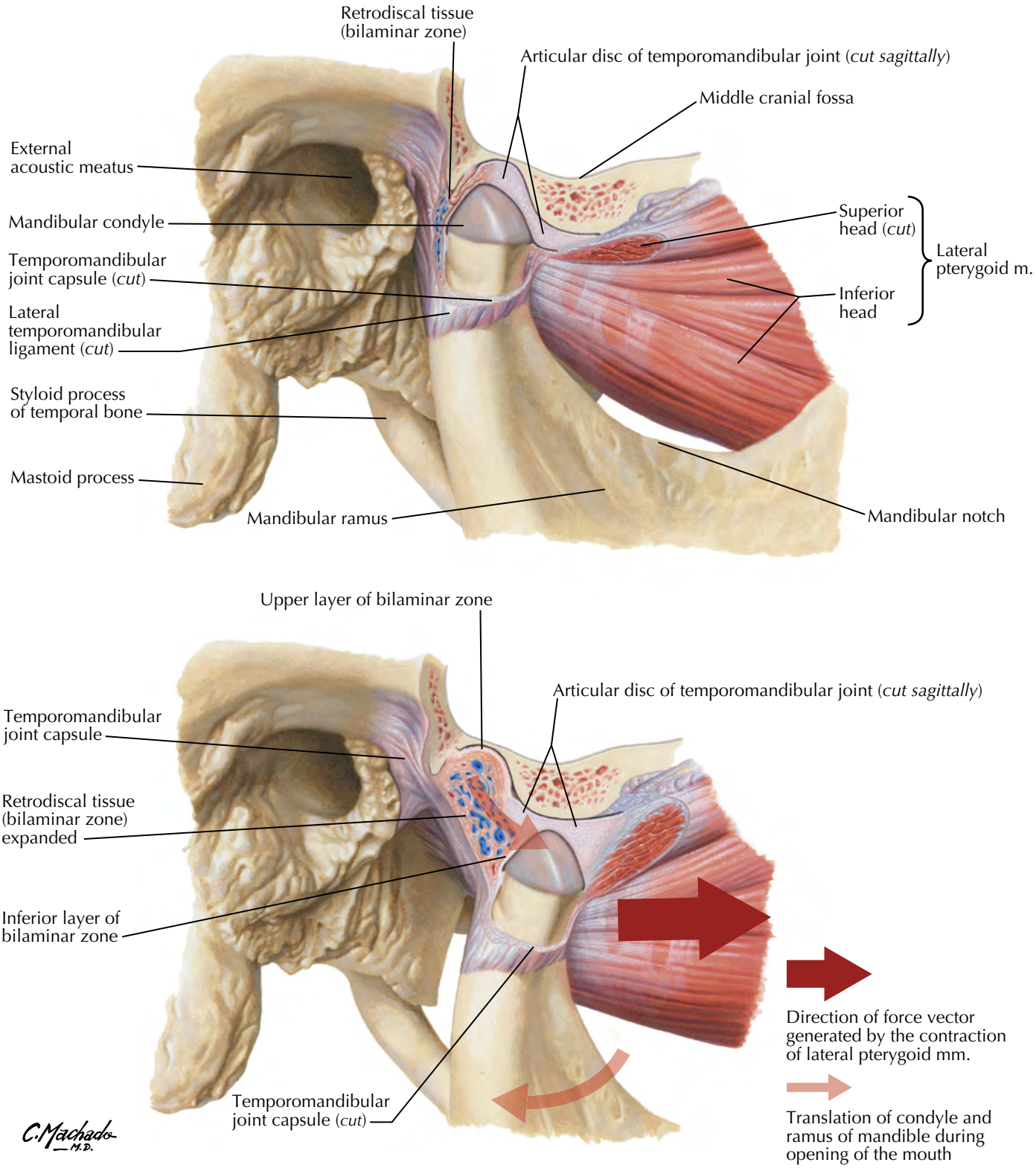

Coronal section
Falx cerebri
Frontal lobe
Nasal cavities
Nasal septum
Middle nasal concha
Middle nasal meatus
Maxillary sinus
Inferior nasal meatus
Inferior nasal concha
Hard palate
Oral cavity
Genioglossus m.
Mylohyoid m.
Geniohyoid m.
Olfactory bulbs
Frontal sinus
Orbital fat body
Ethmoidal cells
Opening of maxillary sinus
Infraorbital recess
Zygomatic recess
Alveolar recess
Maxillary sinus
Bucinator
Alveolar process of maxilla
Body of tongue
Sublingual gland
Body of mandible
Anterior belly of digastric m.
Eyeball
Ethmoidal cells
Orbital fat body
Medial rectus m.
Sphenoidal sinuses
Optic chiasm
Nasal cavities
Nasal septum
Medial wall of orbit
Optic n. (CN II)
Temporal lobe
Horizontal section

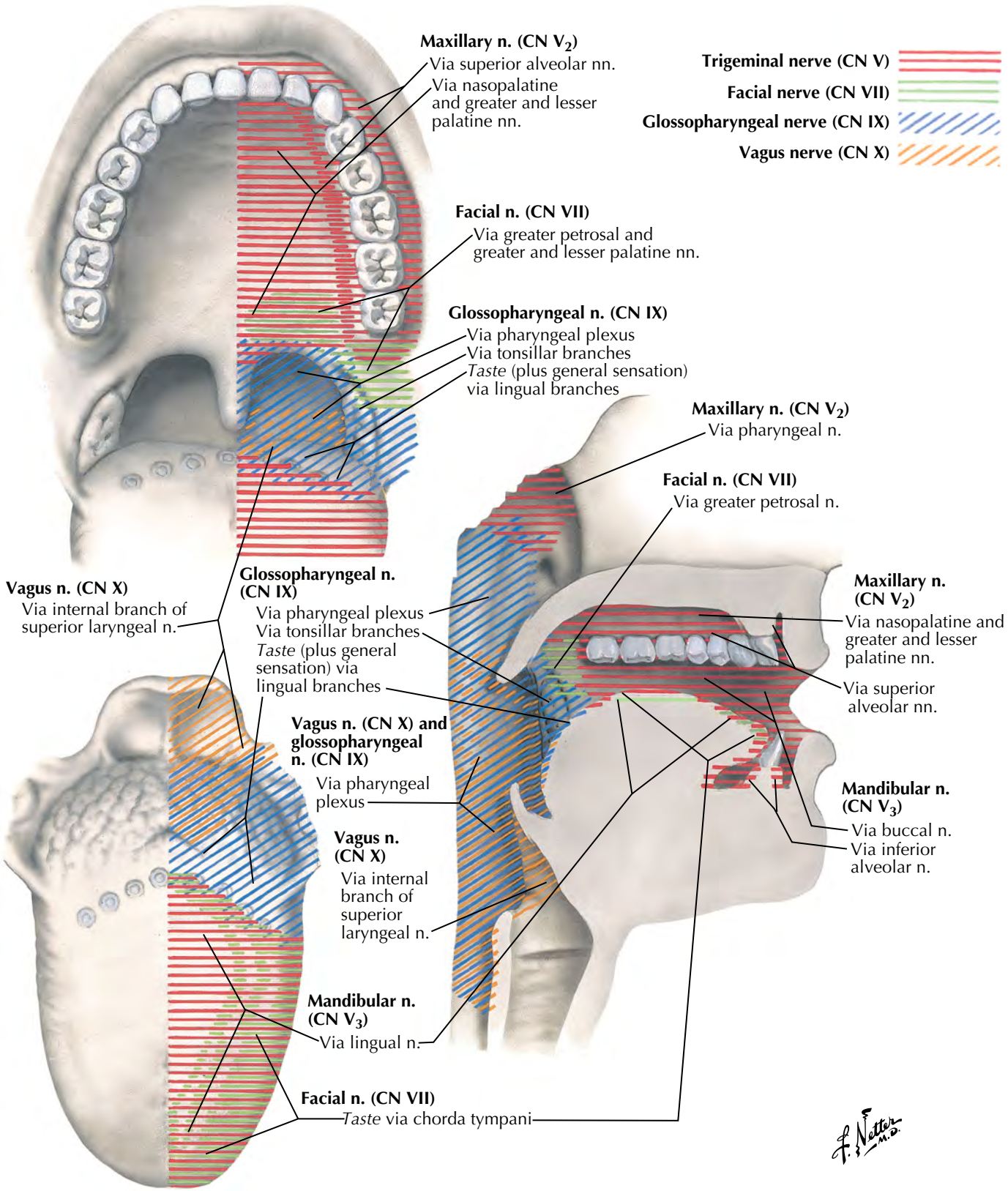
Common origin of superficial branch and dorsal scapular artery from transverse cervical artery (~30%)



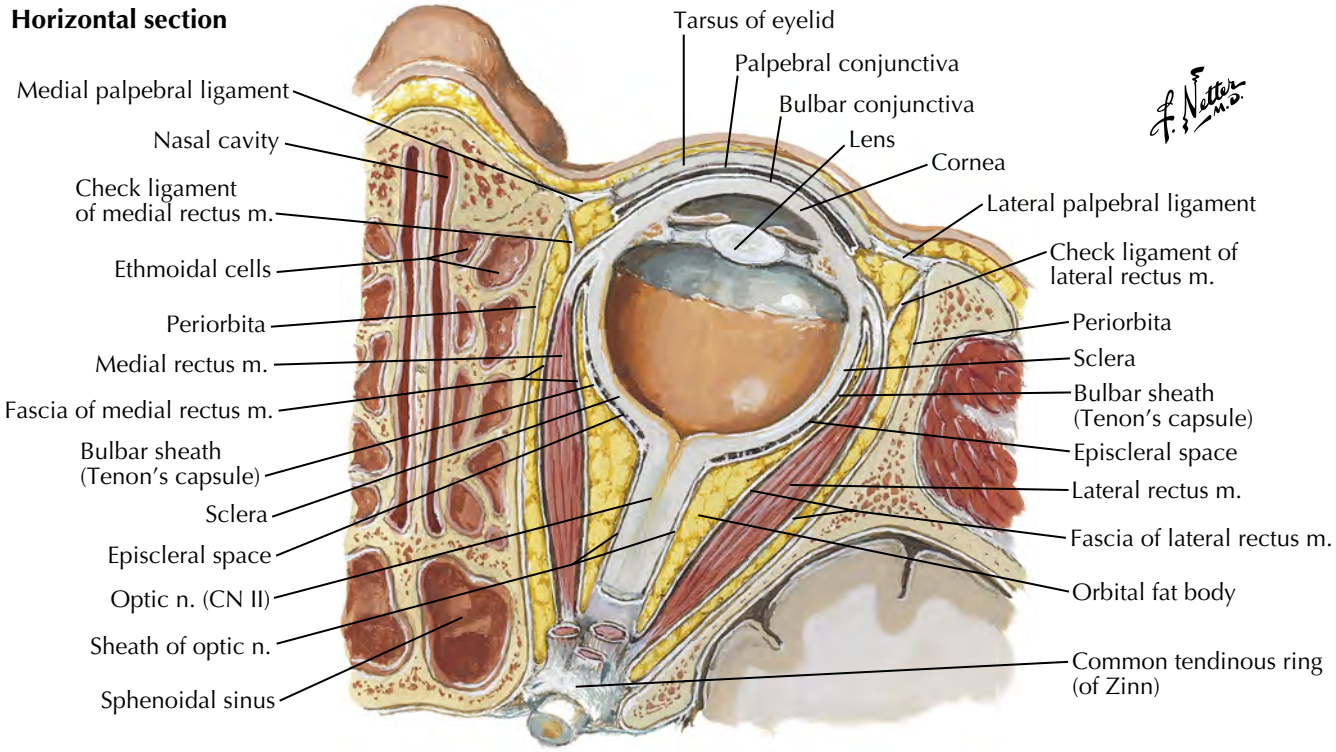
Right anterolateral view



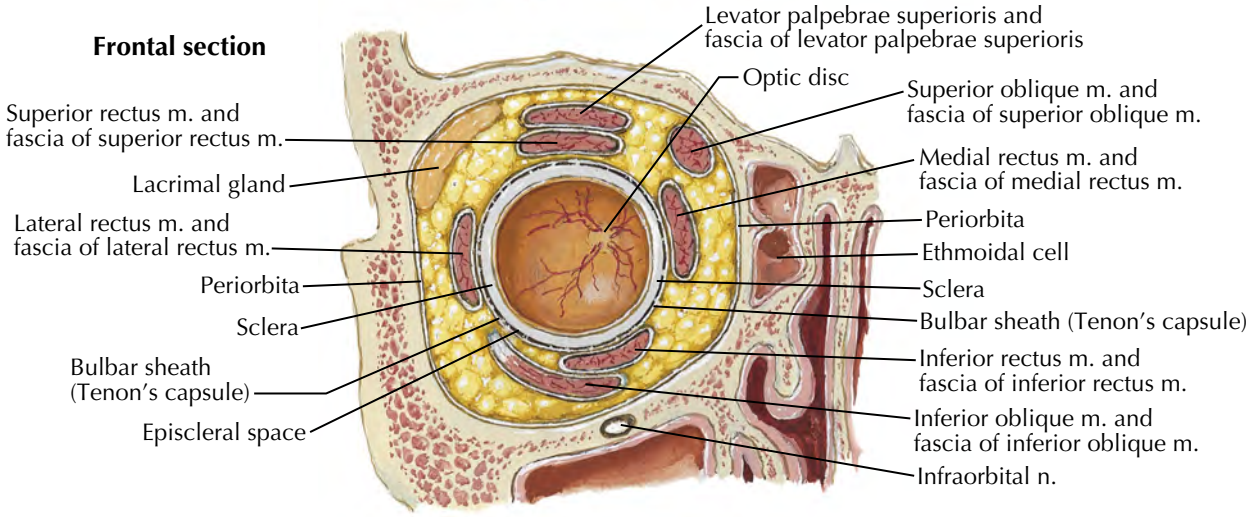

Retrodiscal tissue (bilaminar zone)
Articular disc of temporomandibular joint (cut sagittally)
Middle cranial fossa
External acoustic meatus
Mandibular condyle
Temporomandibular joint capsule (cut)
Lateral temporomandibular ligament (cut)
Styloid process of temporal bone
Mastoid process
Mandibular ramus
Superior head (cut)
Inferior head
Lateral pterygoid m.
Mandibular notch
Upper layer of bilaminar zone
Articular disc of temporomandibular joint (cut sagittally)
Temporomandibular joint capsule
Retrodiscal tissue (bilaminar zone) expanded
Inferior layer of bilaminar zone
Temporomandibular joint capsule (cut)
Direction of force vector generated by the contraction of lateral pterygoid mm.
Translation of condyle and ramus of mandible during opening of the mouth
C. Machado M.D.


Trigeminal nerve (CN V)
Facial nerve (CN VII)
Glossopharyngeal nerve (CN IX)
Vagus nerve (CN X)
Maxillary n. (CN V2)
Via superior alveolar nn.
Via nasopalatine and greater and lesser palatine nn.
Facial n. (CN VII)
Via greater petrosal and greater and lesser palatine nn.
Glossopharyngeal n. (CN IX)
Via pharyngeal plexus
Via tonsillar branches
Taste (plus general sensation) via lingual branches
Maxillary n. (CN V2)
Via pharyngeal n.
Facial n. (CN VII)
Via greater petrosal n.
Vagus n. (CN X)
Via internal branch of superior laryngeal n.
Glossopharyngeal n. (CN IX)
Via pharyngeal plexus
Via tonsillar branches
Taste (plus general sensation) via lingual branches
Maxillary n. (CN V2)
Via nasopalatine and greater and lesser palatine nn.
Via superior alveolar nn.
Vagus n. (CN X) and glossopharyngeal n. (CN IX)
Via pharyngeal plexus
Mandibular n. (CN V3)
Via buccal n.
Via inferior alveolar n.
Vagus n. (CN X)
Via internal branch of superior laryngeal n.
Mandibular n. (CN V3)
Via lingual n.
Facial n. (CN VII)
Taste via chorda tympani

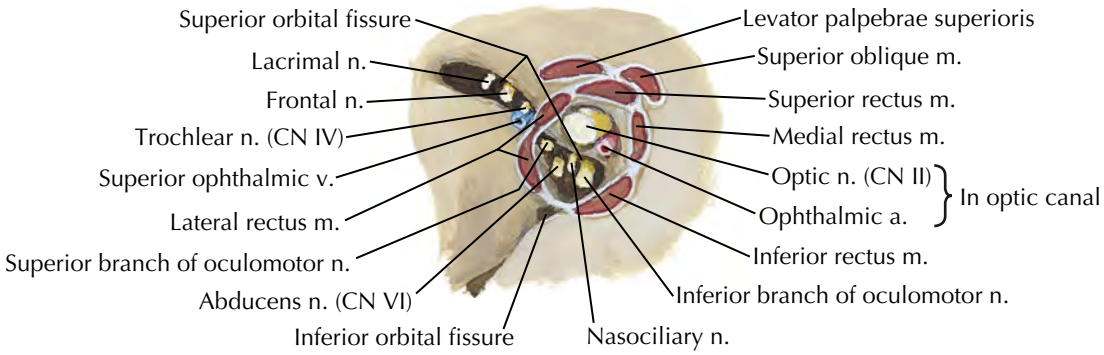
Horizontal section



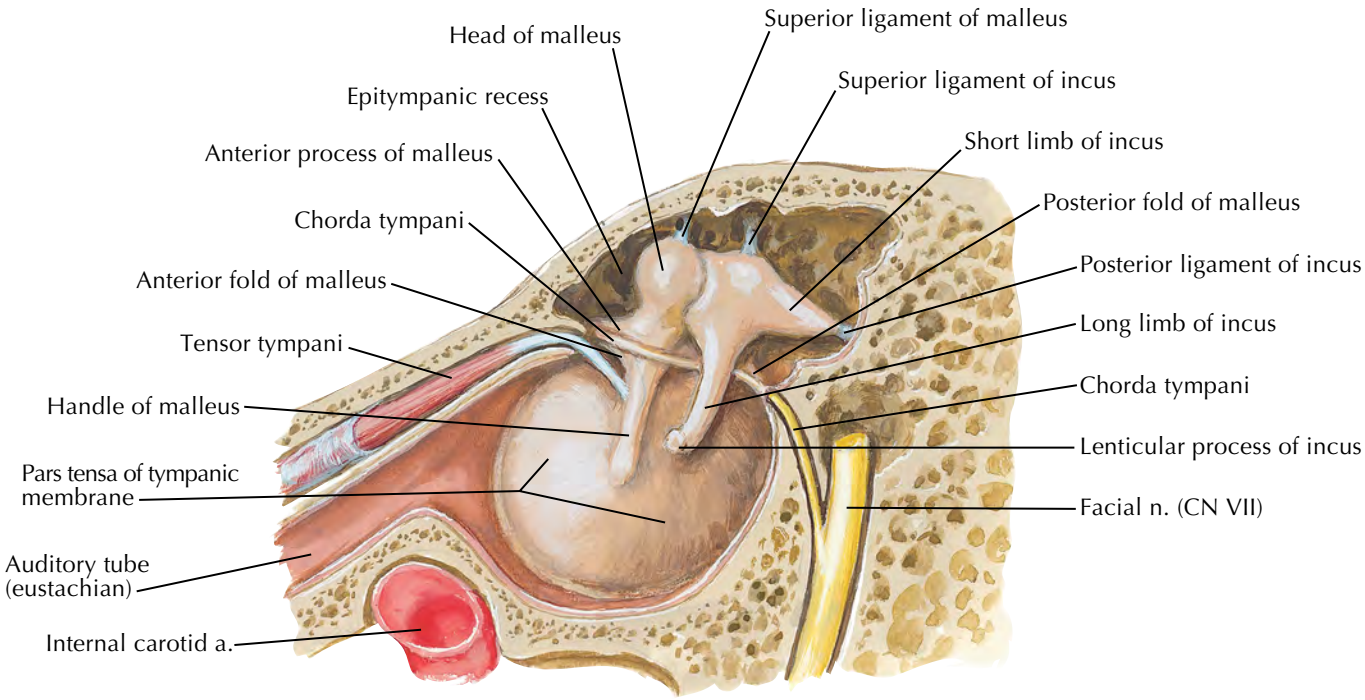
Frontal section



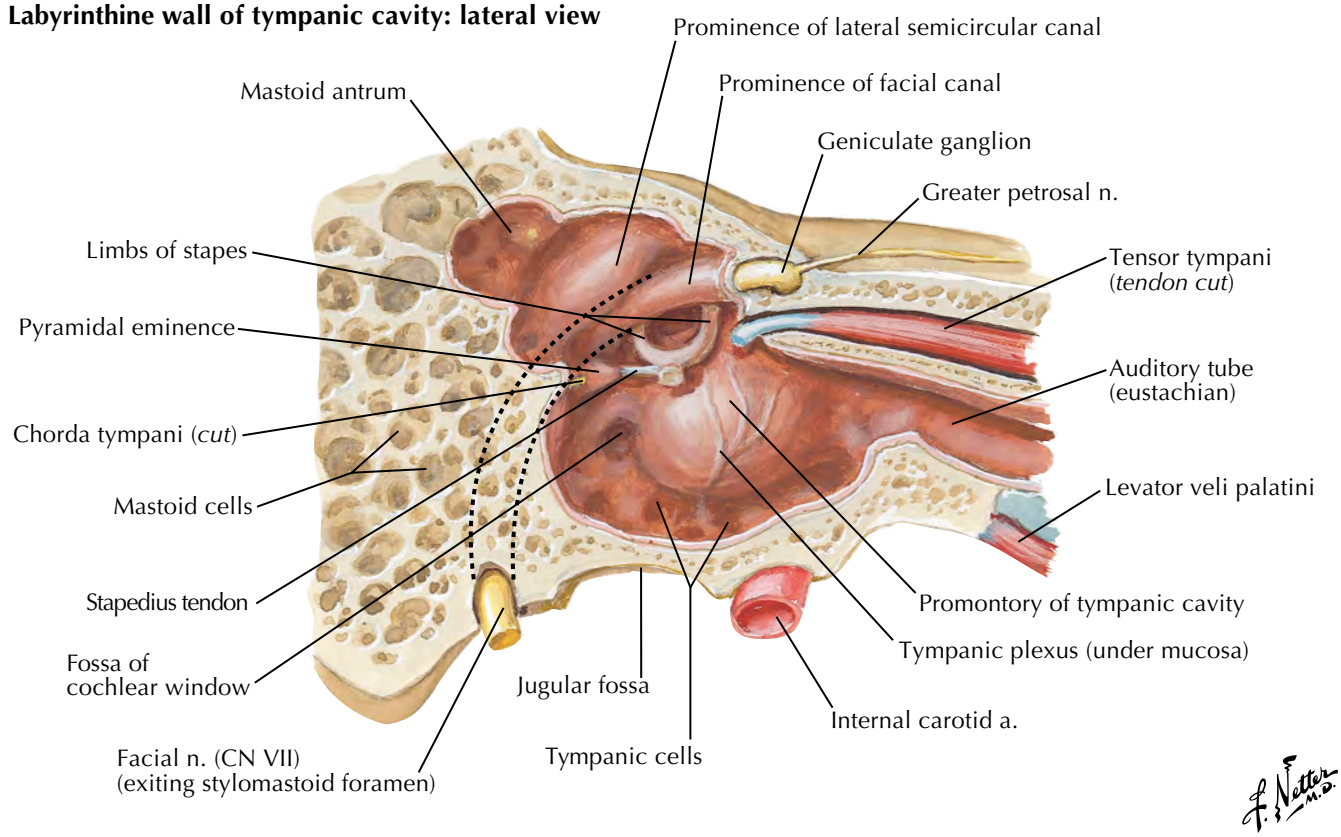
Muscle attachments and nerves and vessels entering orbit



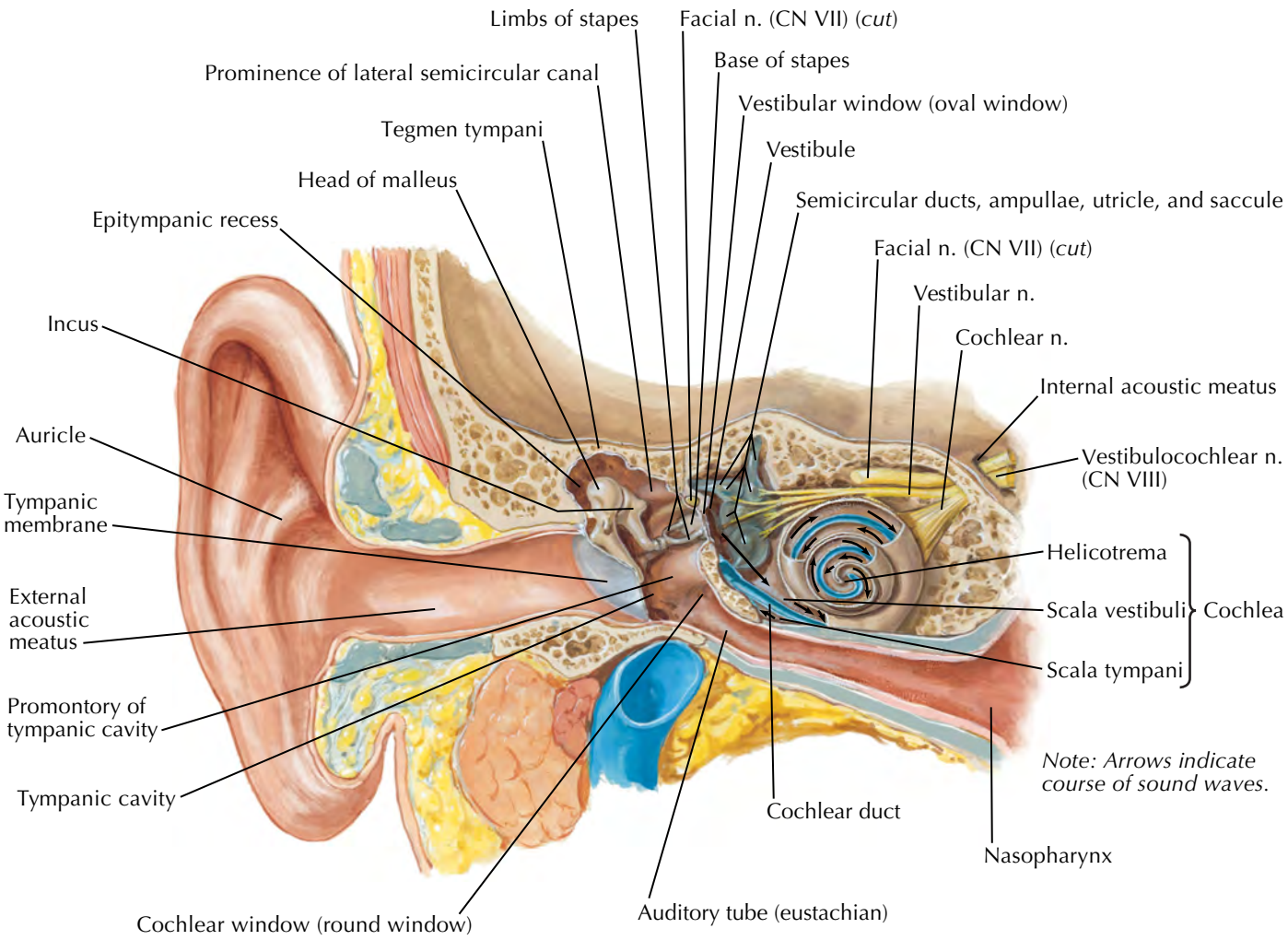
Lateral wall of tympanic cavity: medial (internal) view



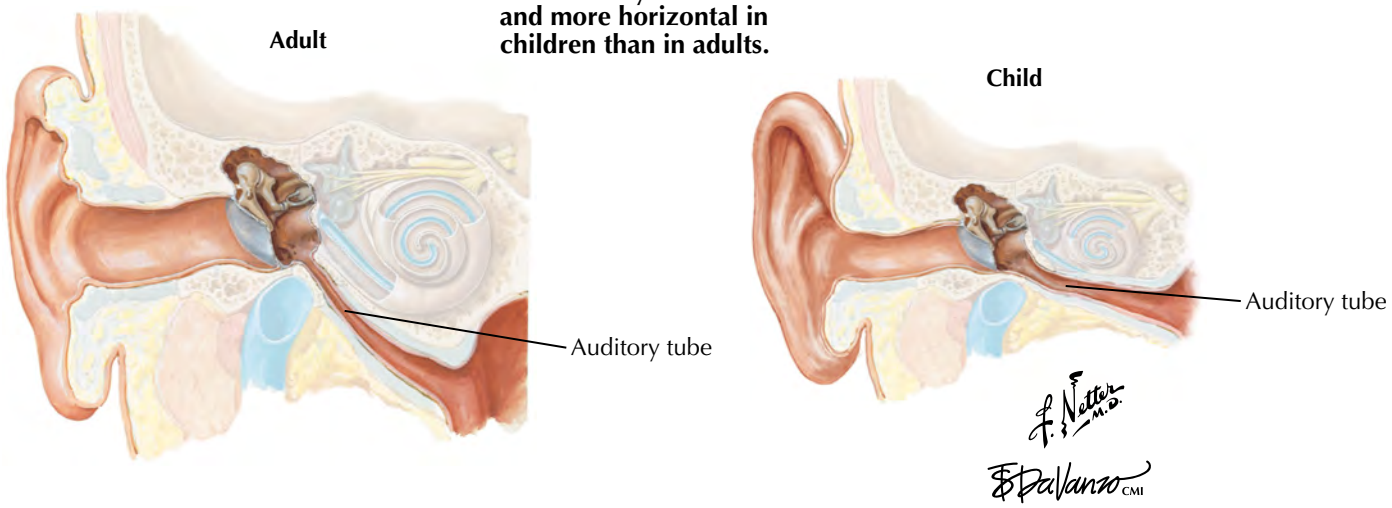
Labyrinthine wall of tympanic cavity: lateral view



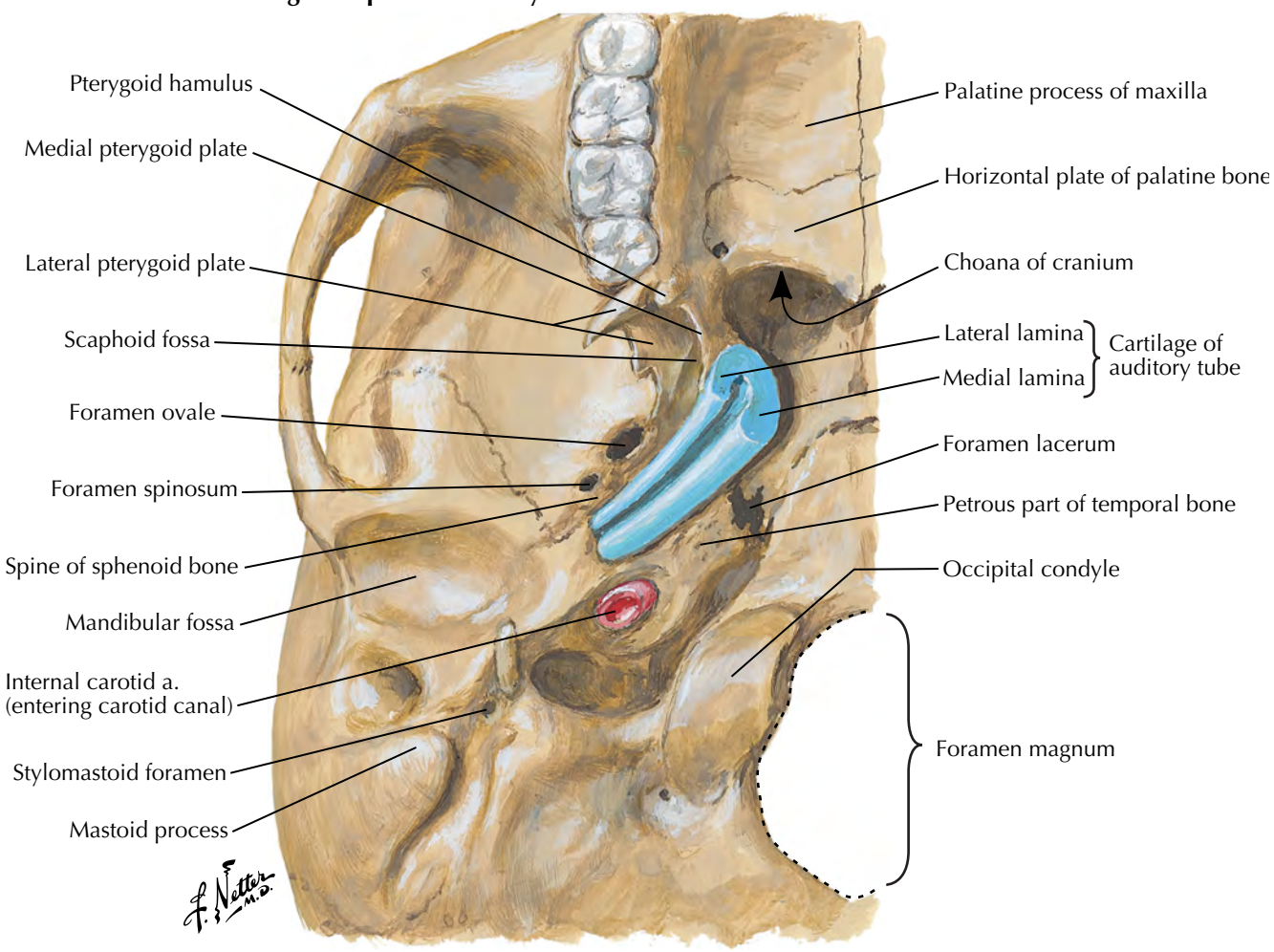
Pediatric ear: frontal section



The auditory tube is shorter and more horizontal in children than in adults.



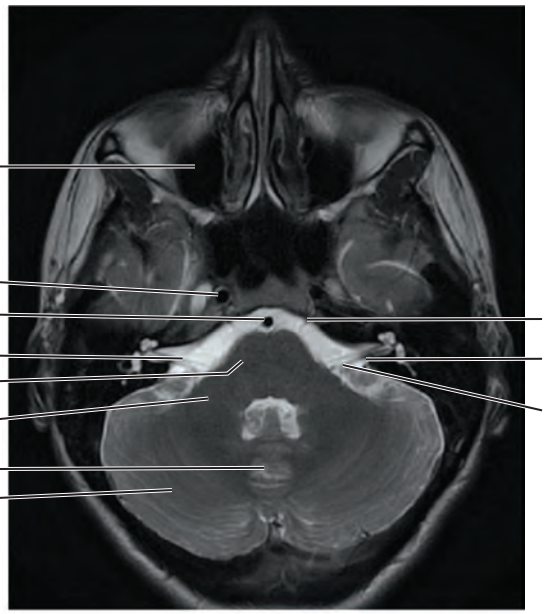
Cartilaginous part of auditory tube at base of skull: inferior view



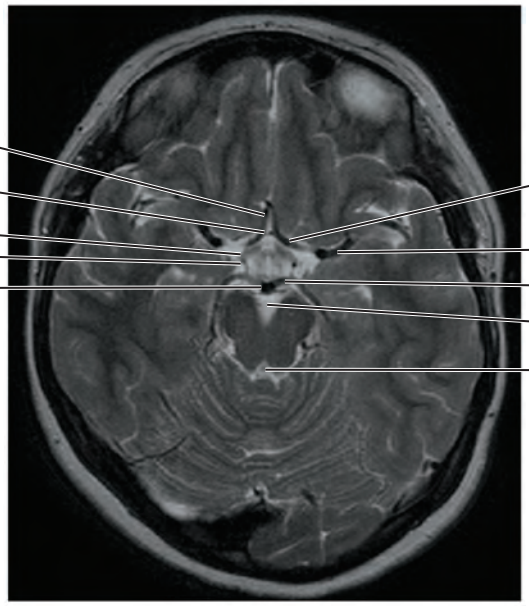
Superior cerebral v.
Superior sagittal sinus
Internal cerebral v.
Great cerebral v. (of Galen)
Straight sinus
Transverse sinus
Sigmoid sinus
Internal jugular v.

Anterior cerebral a.
Anterior communicating a.
Middle cerebral a.
Posterior cerebral a.
Basilar a.
Internal carotid a.
Vertebral a.

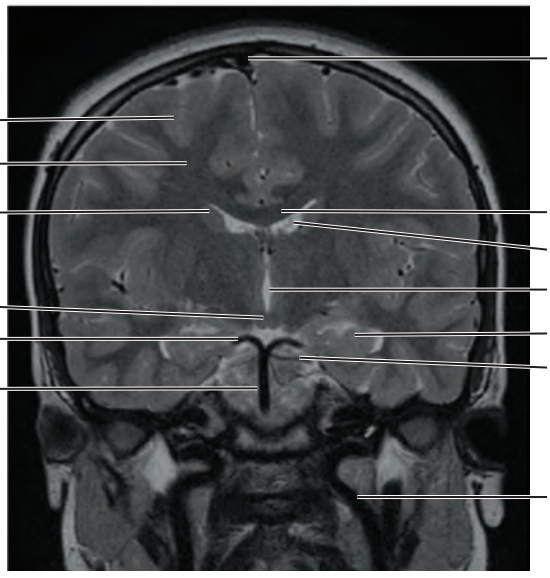
T2-weighted axial brain MRI without contrast



T2-weighted axial brain MRI without contrast



T2-weighted coronal brain MRI without contrast



BACK 3

Surface Anatomy	178	**Structures with High Clinical Significance**	Table 3.1
Vertebral Column	179–185	**Muscles**	Tables 3.2–3.4
Spinal Cord	186–194	**Electronic Bonus Plates**	BP 33–BP 40
Muscles and Nerves	195–199		
Cross-Sectional Anatomy	200–201		

ELECTRONIC BONUS PLATES

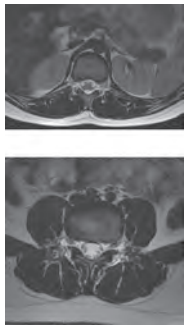
BP 33 Ligaments of Vertebral Column

BP 34 Cervical Spine: Radiographs

BP 35 Cervical Spine: MRI and Radiograph

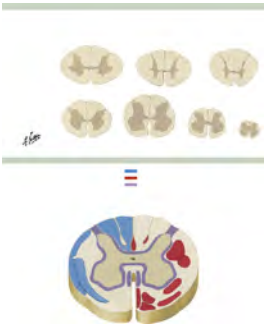
BP 36 Thoracolumbar Spine: Lateral Radiograph

BP 37 Lumbar Vertebrae: Radiographs



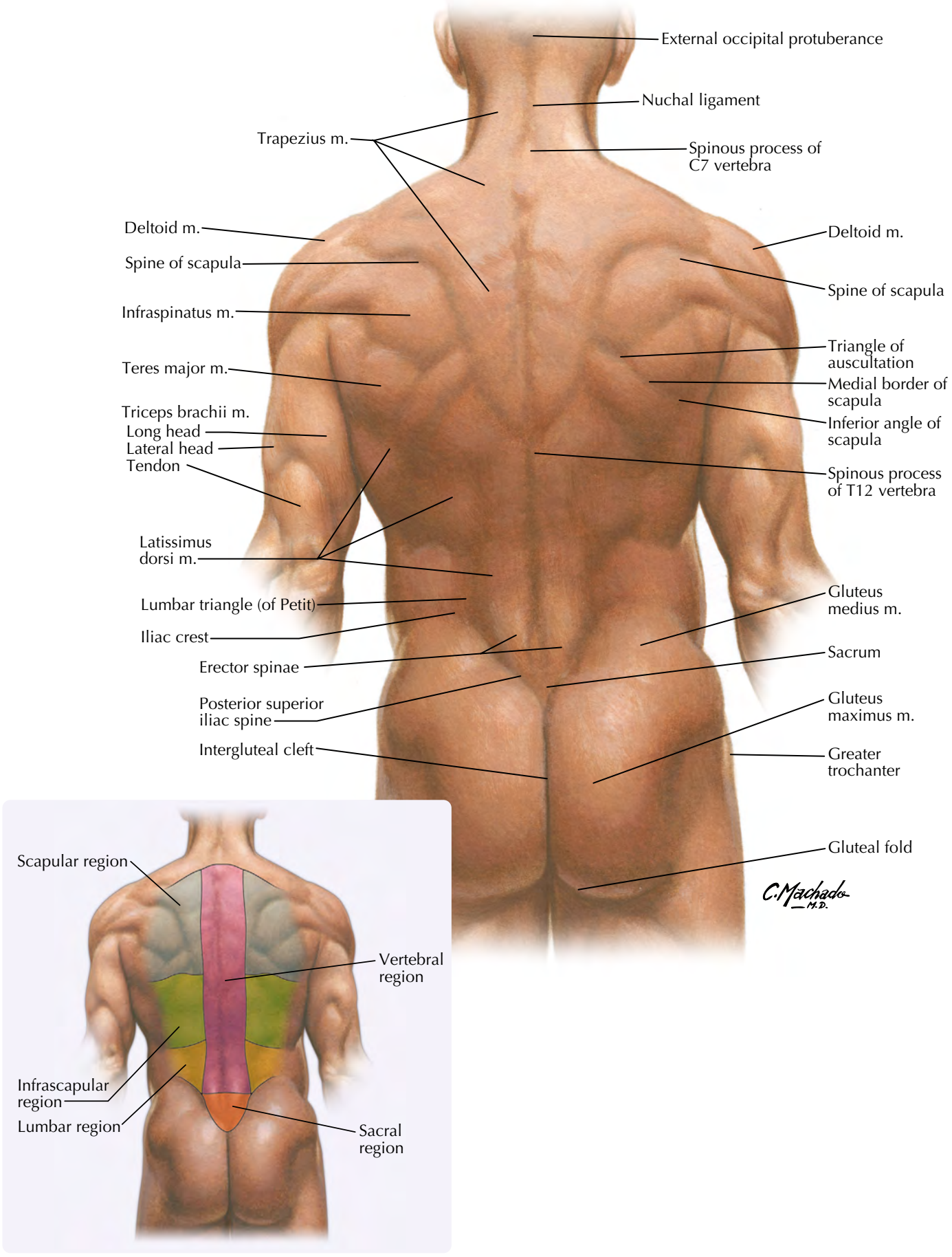
BP 38 Lumbar Spine: MRIs

BP 39 Vertebral Veins: Detail Showing Venous Communications

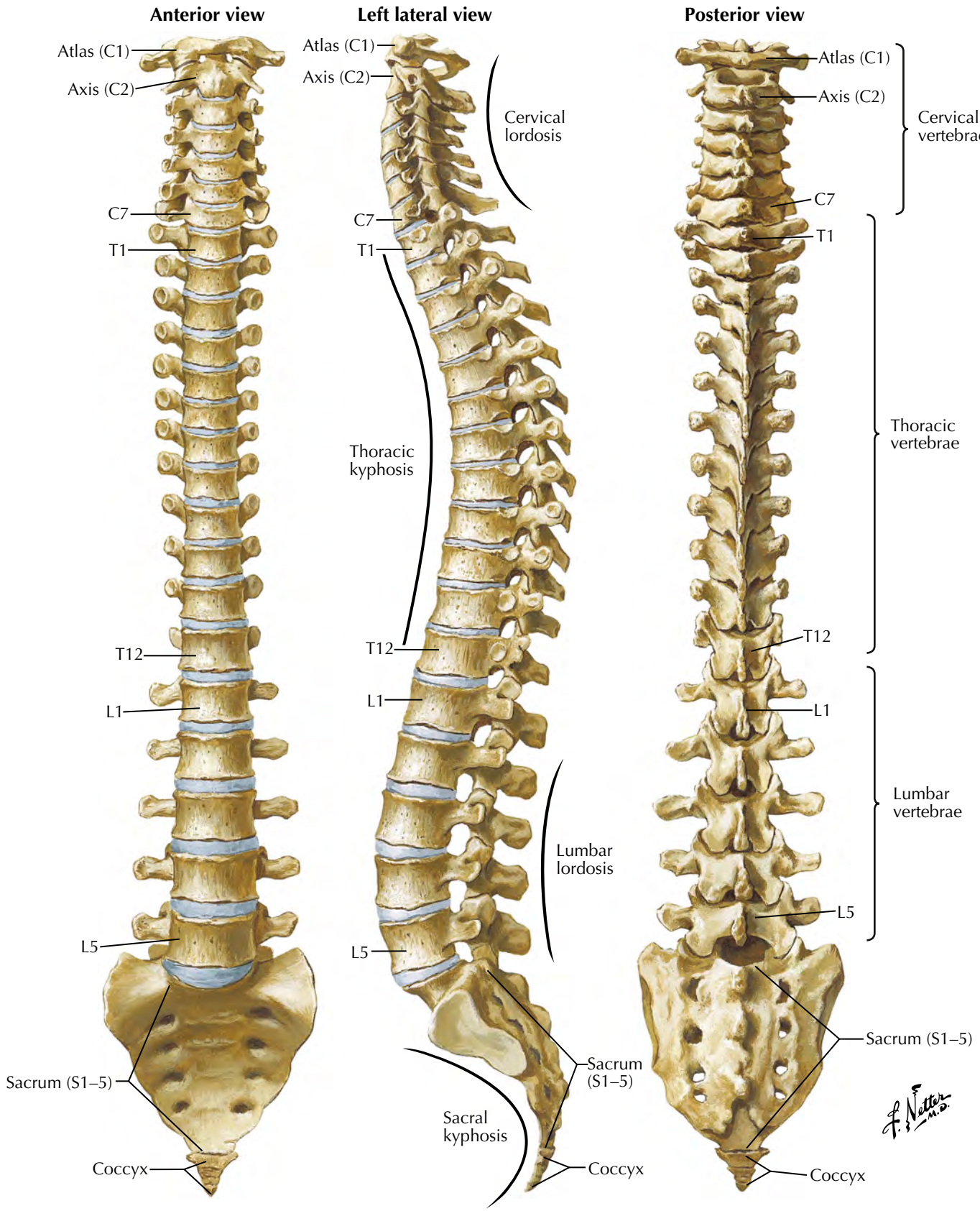


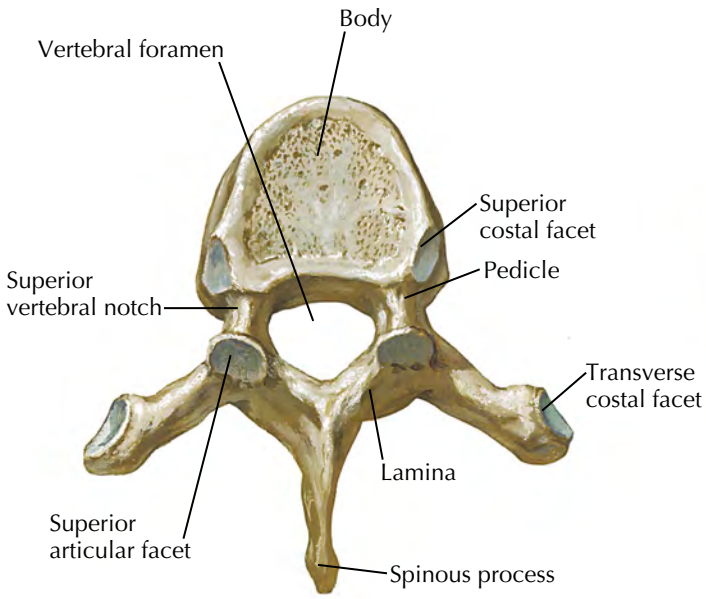
BP 40 Spinal Cord Cross Sections: Fiber Tracts

See also **Plates 179, 188, 195**

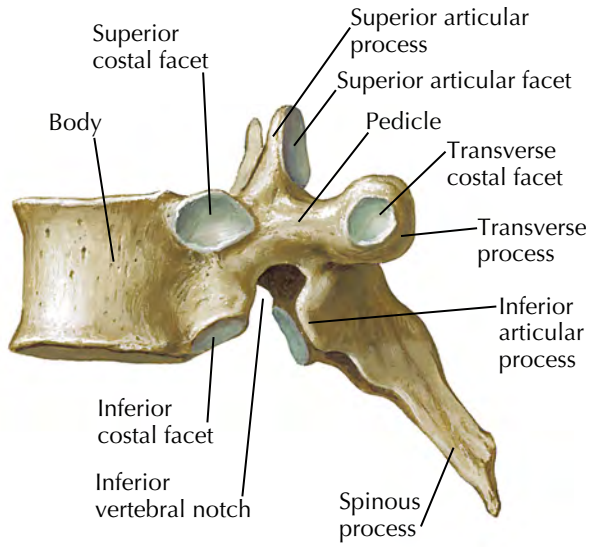


See also **Plates 45, 203, 268, BP 36**

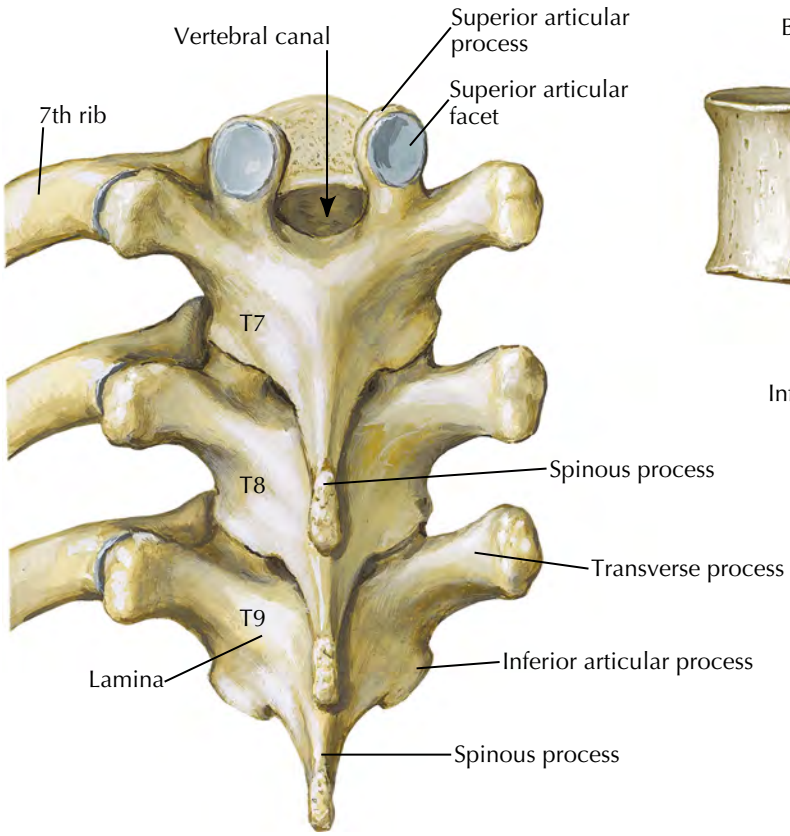




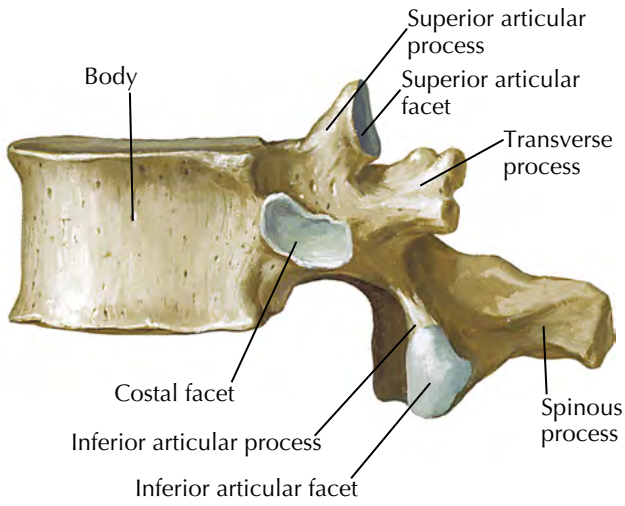
T6 vertebra (superior view)



T6 vertebra (lateral view)

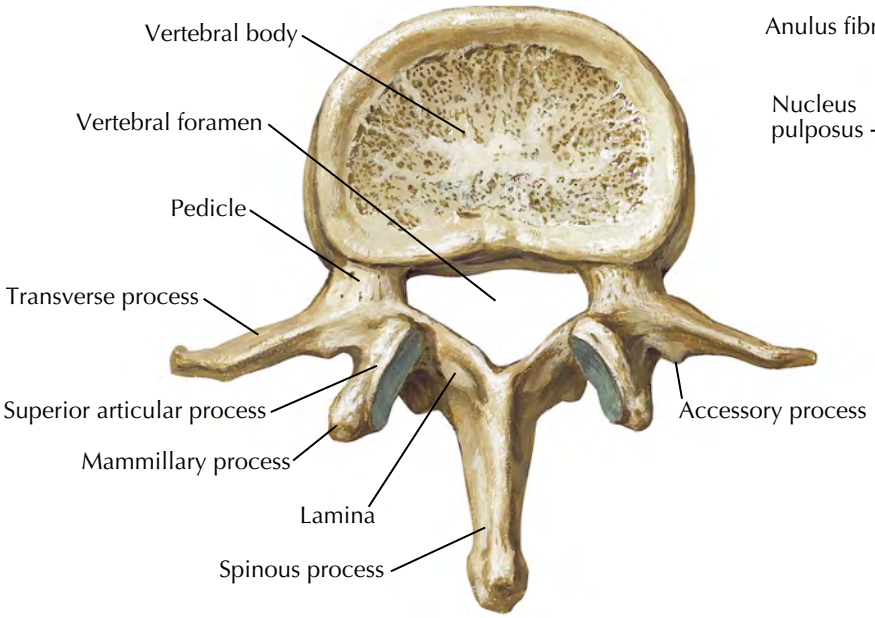


T7, T8, and T9 vertebrae (posterior view)

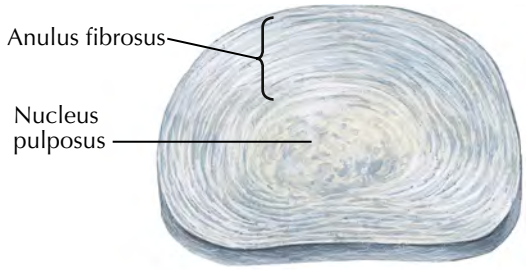


T12 vertebra (lateral view)

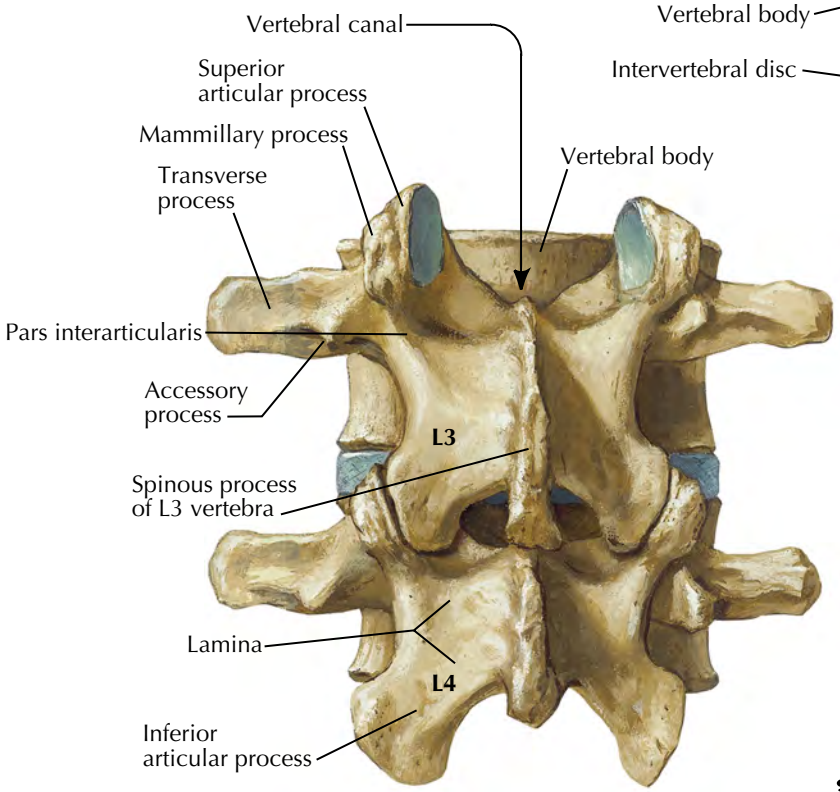
See also **Plates BP 33, BP 37**



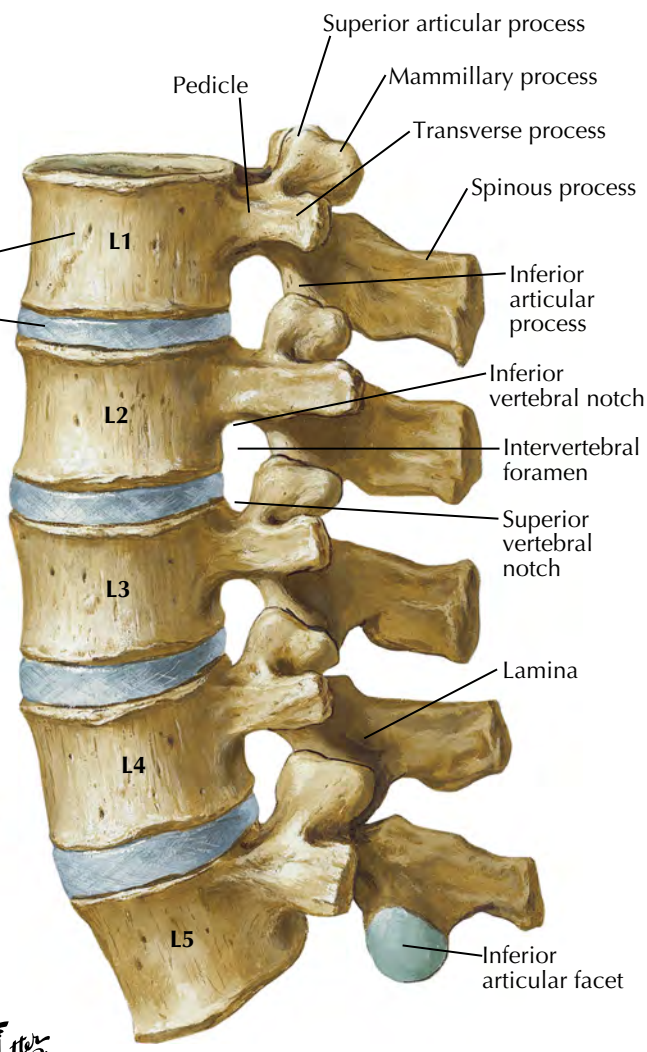
L2 vertebra (superior view)



Intervertebral disc



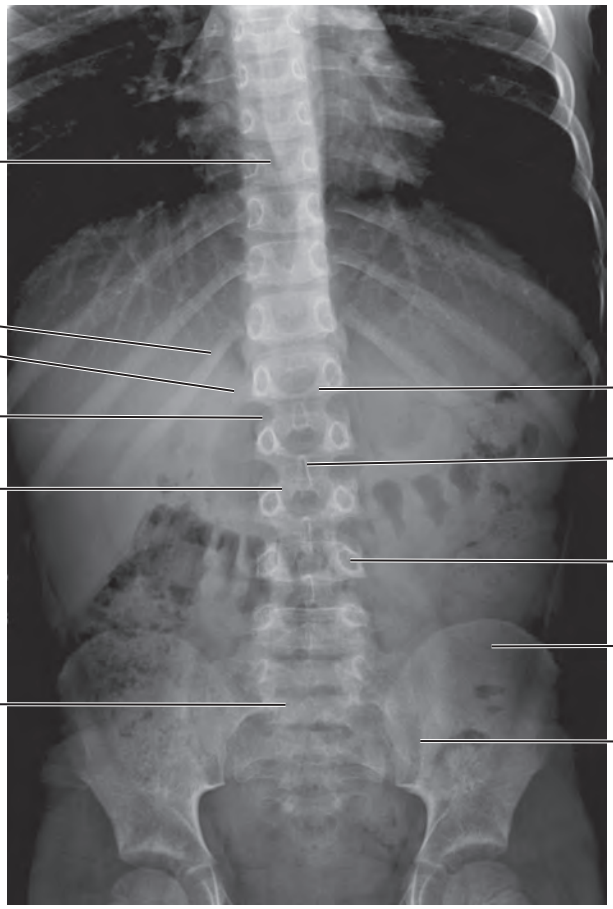
L3 and L4 vertebrae (posterior view)



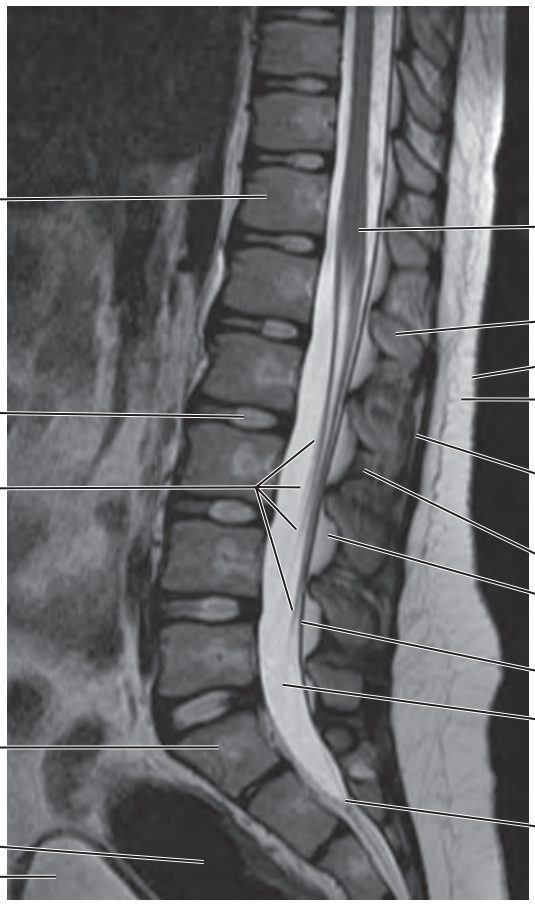
Lumbar vertebrae (left lateral view)

See also **Plates 179, 268, BP 36**

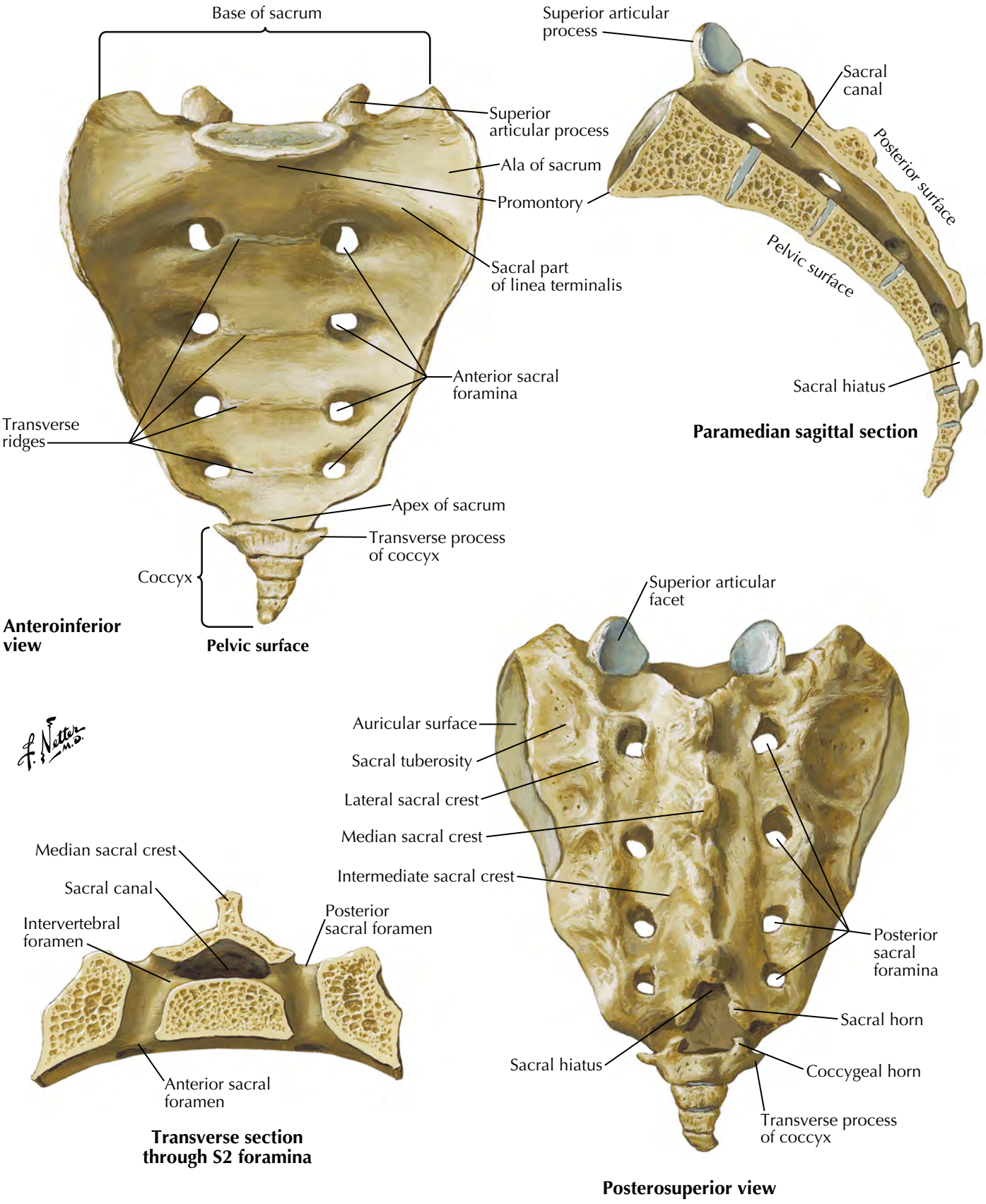
Anteroposterior radiograph of thoracolumbar spine



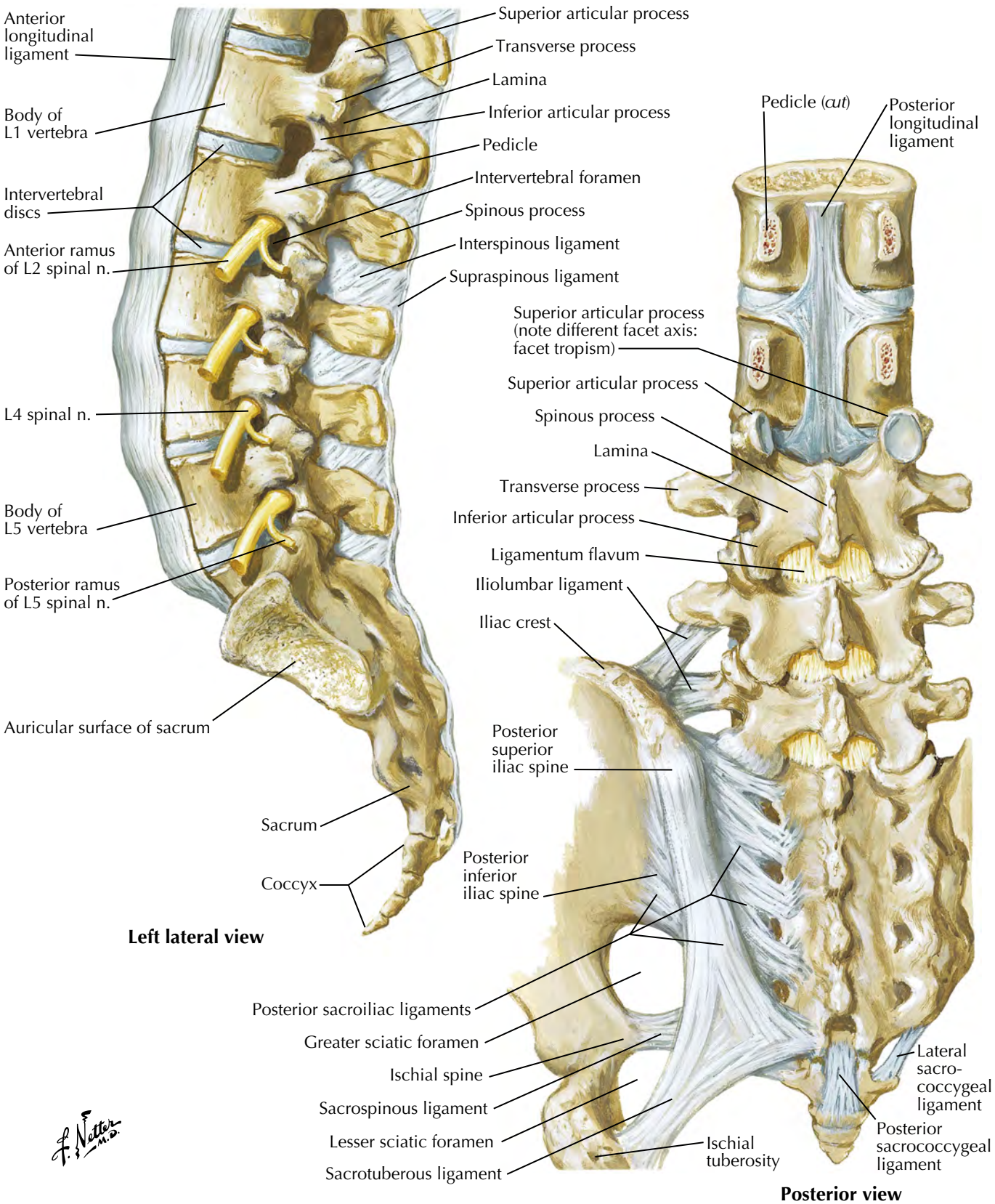
T2-weighted sagittal MRI of lumbar spine



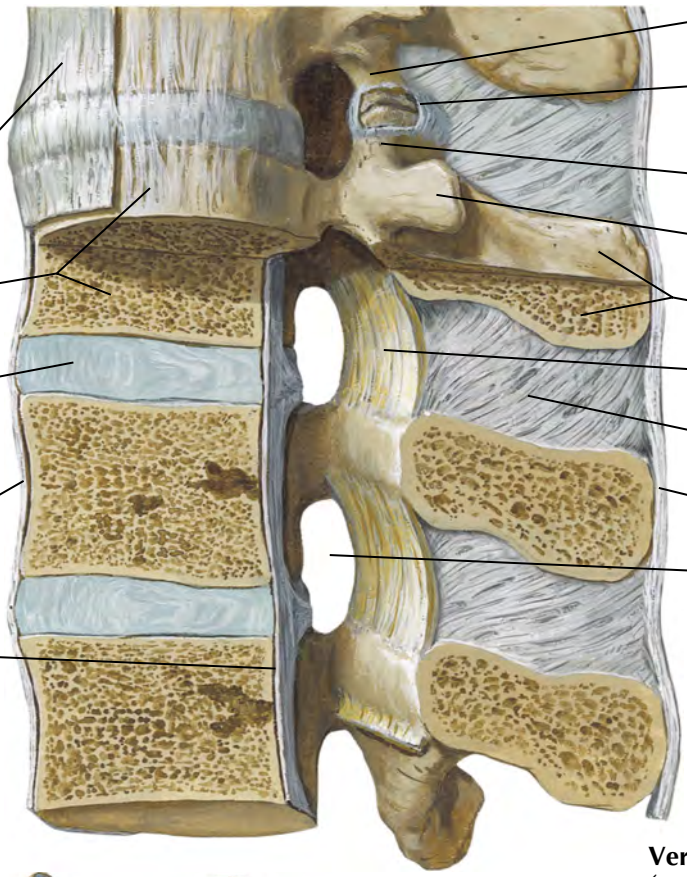
See also **Plates 353, 357, BP 37**



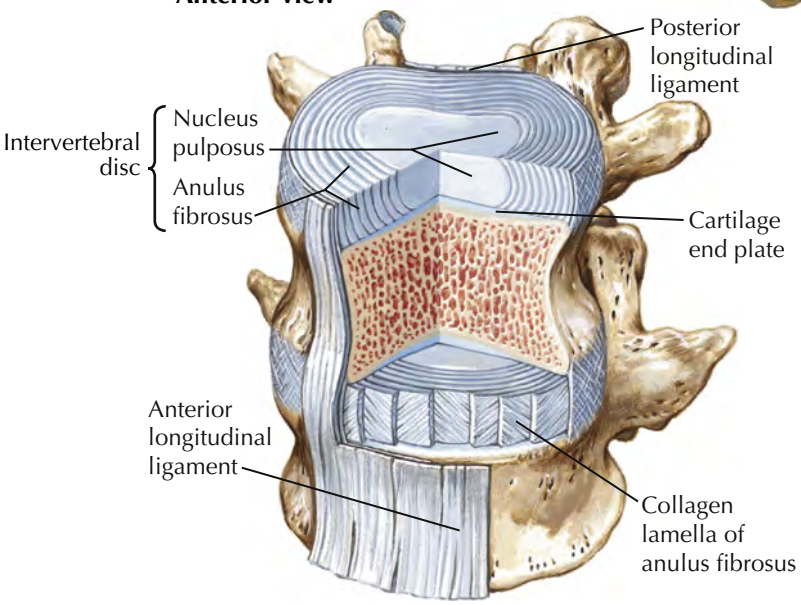
See also **Plate BP 33**



Left lateral view
(*partially sectioned in median plane*)

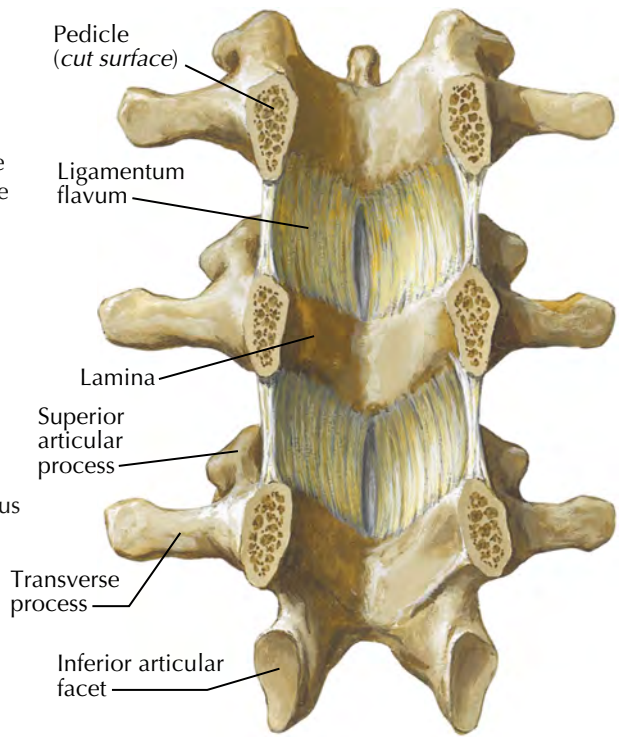


Anterior view

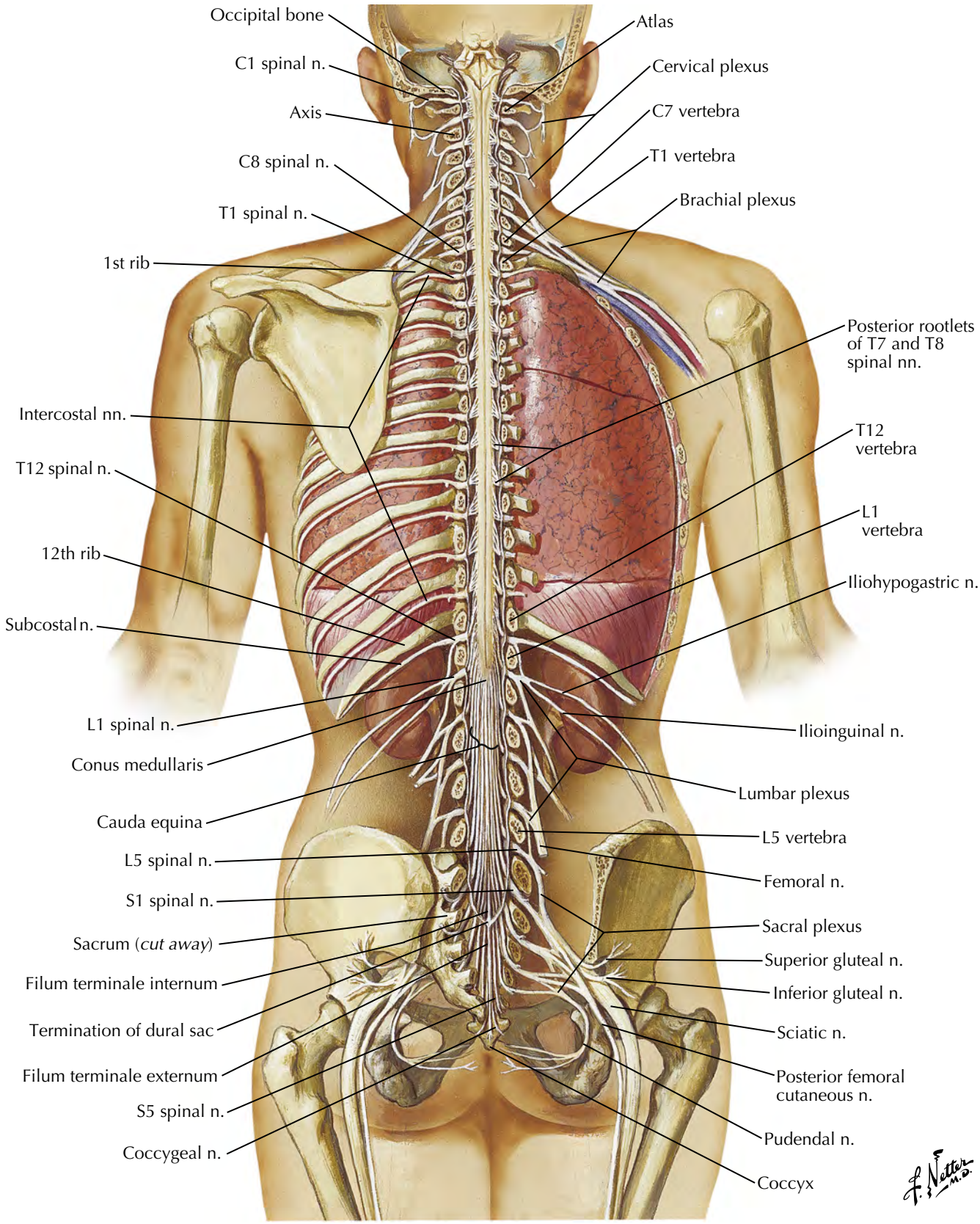


Intervertebral disc composed of central nuclear zone of collagen and hydrated proteoglycans surrounded by concentric lamellae of collagen fibers

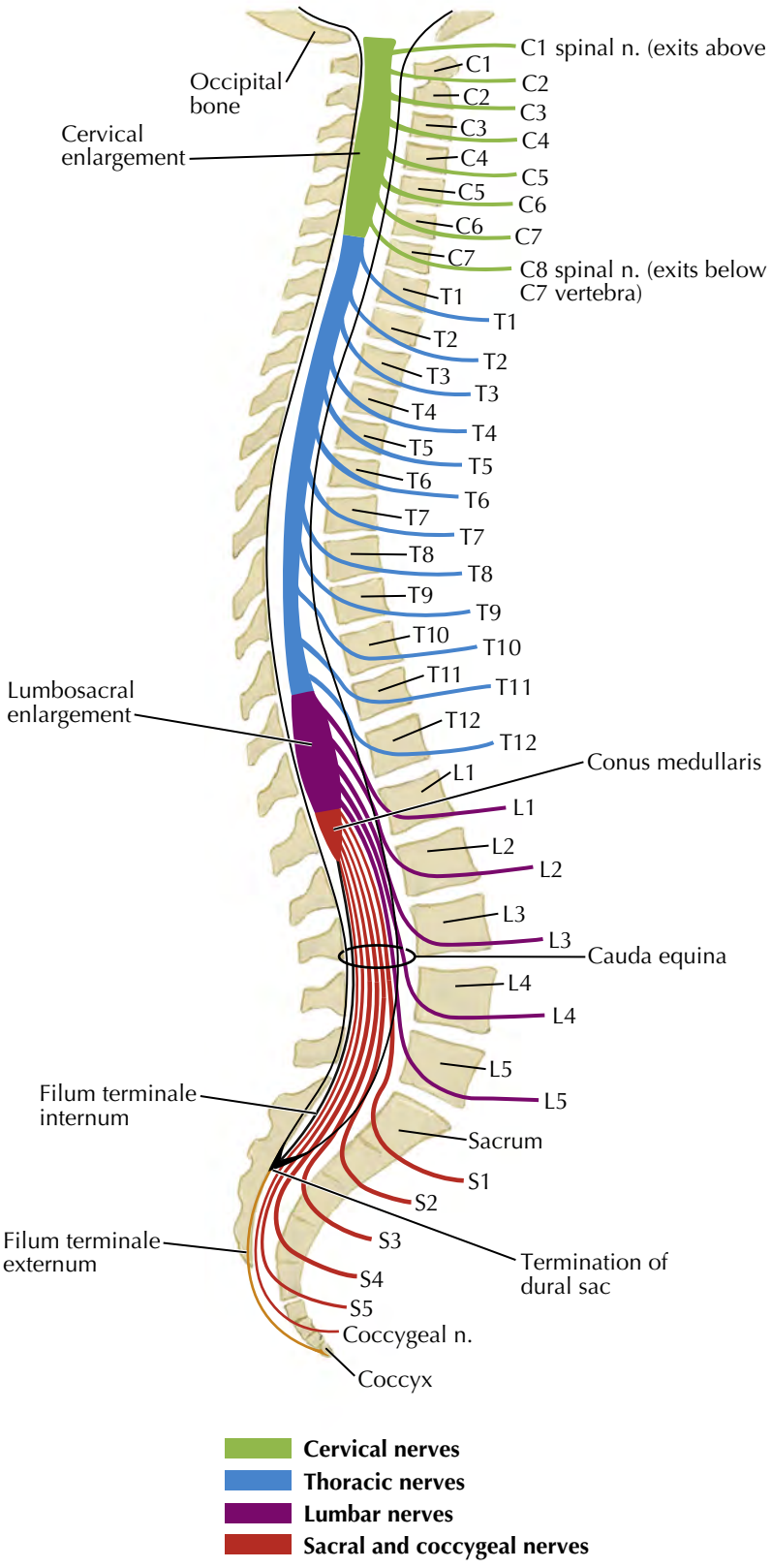
Vertebral arches (anterior view)

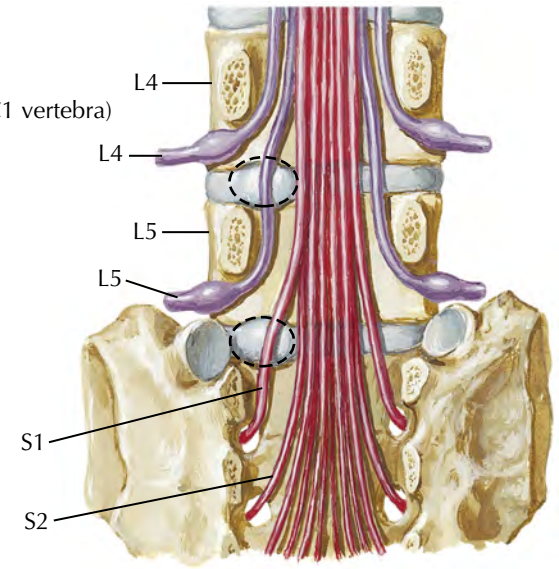


See also **Plates 156, 439, 507, 508**

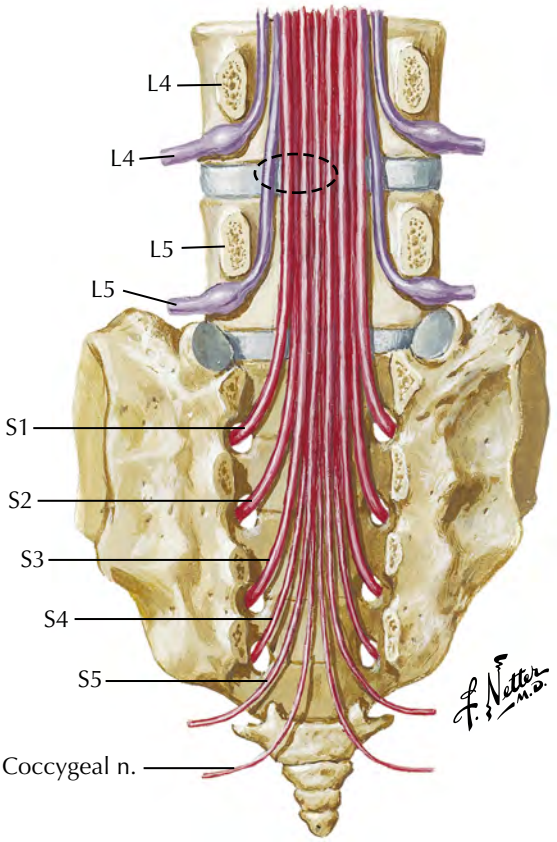


See also **Plate 188**

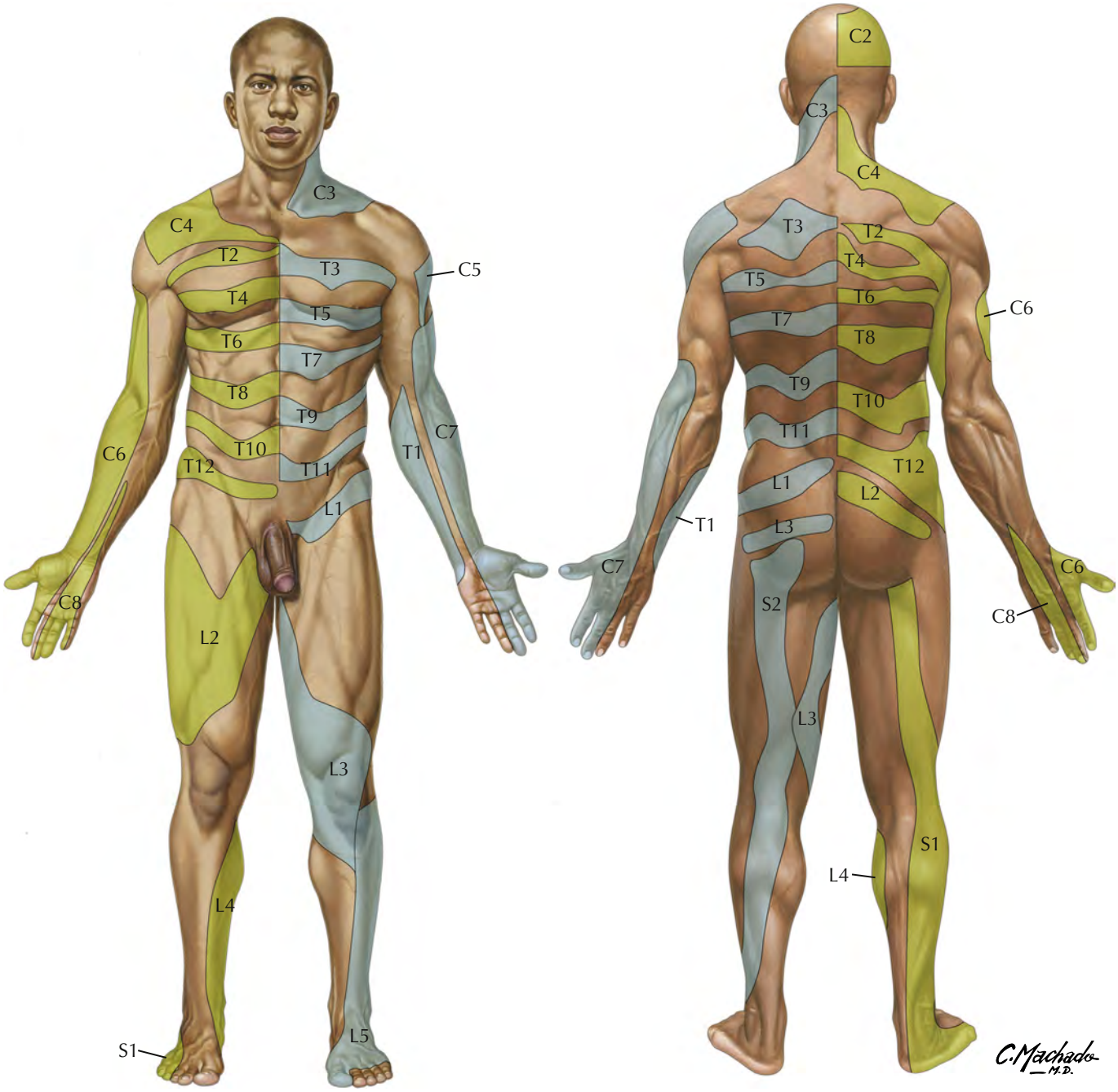




Lumbar disc protrusion does not usually affect nerve exiting above disc. Lateral protrusion (*dashed oval*) of L4/5 intervertebral disc affects L5 spinal nerve roots, not L4 spinal nerve roots. Protrusion of L5/S1 intervertebral disc affects S1 spinal nerve roots, not L5 spinal nerve roots.



Medial protrusion of L4/5 intervertebral disc (*dashed oval*) rarely affects L4 spinal nerve roots but might affect L5 spinal nerve roots and sometimes S1–4 spinal nerve roots.



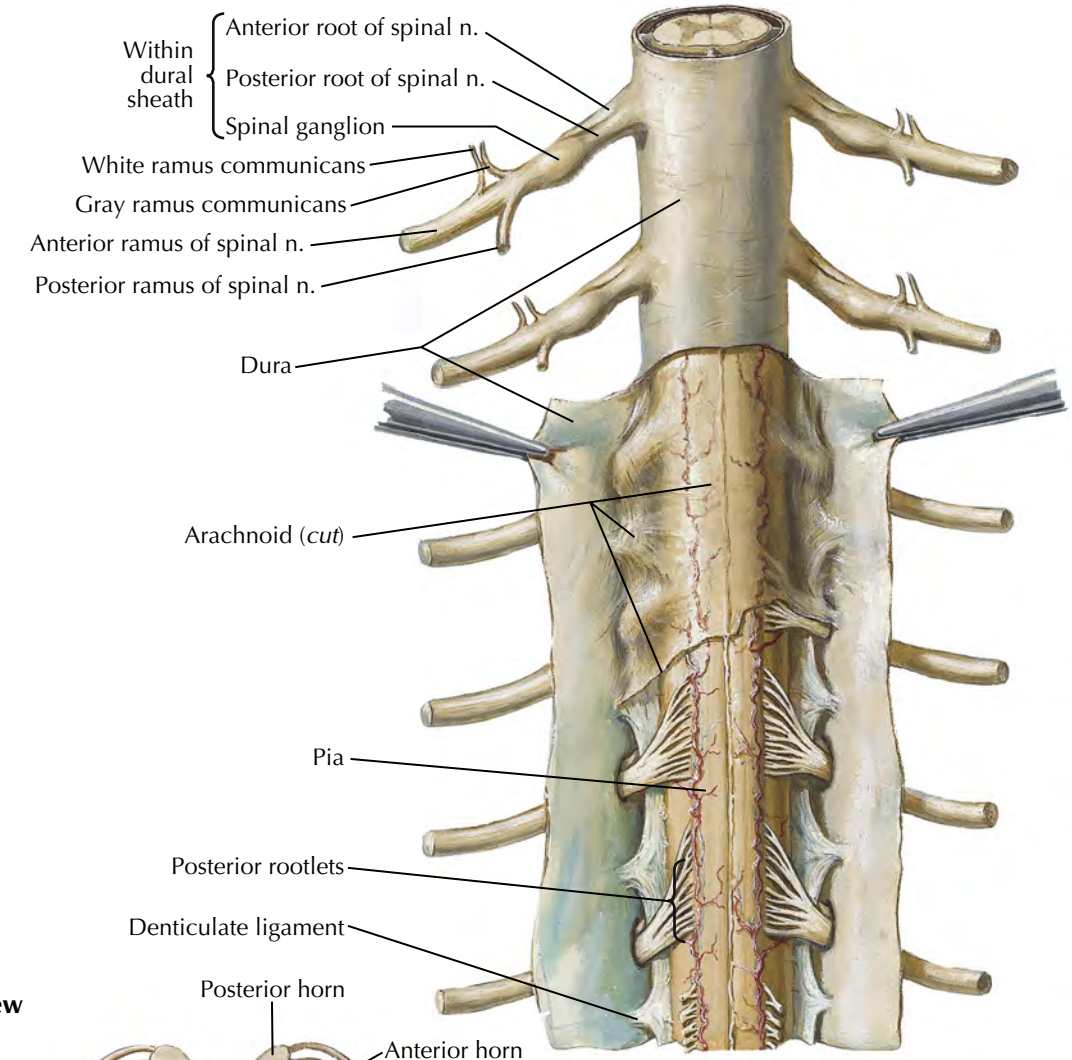
Levels of principal dermatomes

C4	Level of clavicles	**T10**	Level of umbilicus
C5, C6, C7	Lateral surfaces of upper limbs	**L1**	Inguinal region and proximal anterior thigh
C8, T1	Medial surfaces of upper limbs	**L1, L2, L3, L4**	Anteromedial lower limb and gluteal region
C6	Lateral digits	**L4, L5, S1**	Foot
C6, C7, C8	Hand	**L4**	Medial leg
C8	Medial digits	**L5, S1**	Posterolateral lower limb and dorsum of foot
T4	Level of nipples	**S1**	Lateral foot

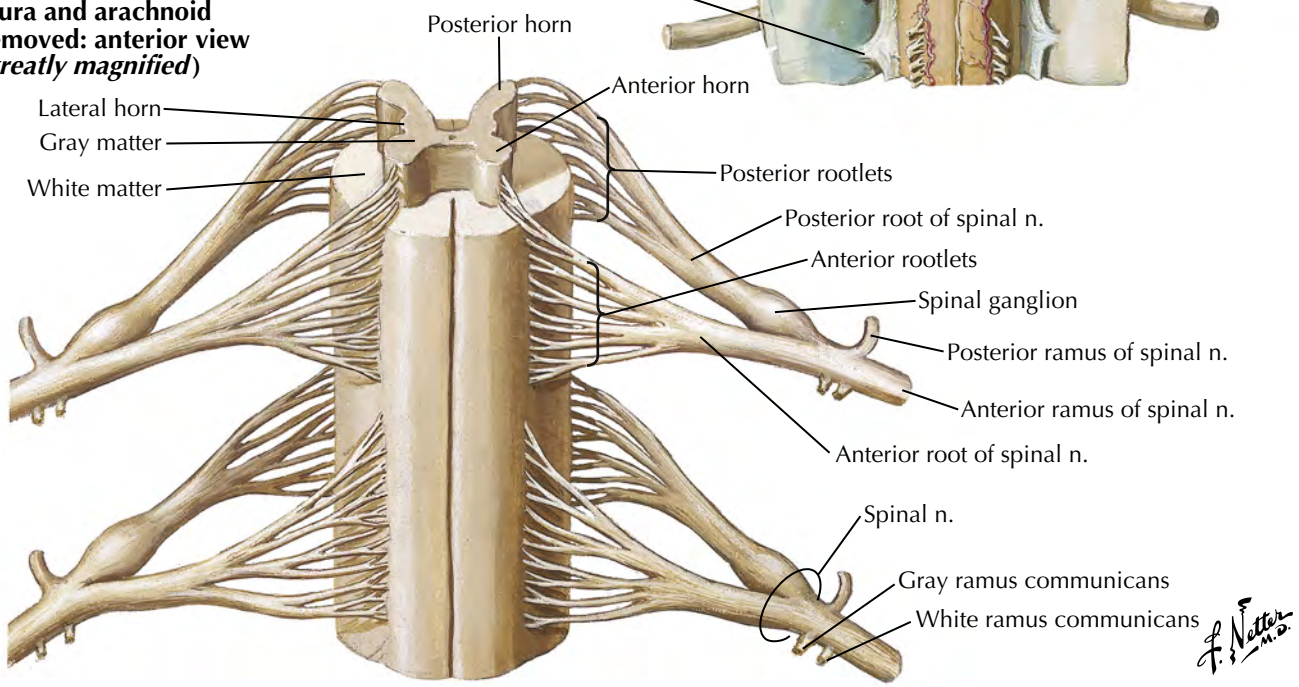
Schematic based on Lee MW, McPhee RW, Stringer MD. An evidence-based approach to human dermatomes. Clin Anat. 2008; 21(5):363–373. doi: 10.1002/ca.20636. PMID: 18470936. Please note that these areas are not absolute and vary from person to person. S3, S4, S5, and Co supply the perineum but are not shown for reasons of clarity. Of note, the dermatomes are larger than illustrated as the figure is based on best evidence; gaps represent areas in which the data are inconclusive.

See also **Plate BP 40**

Posterior view

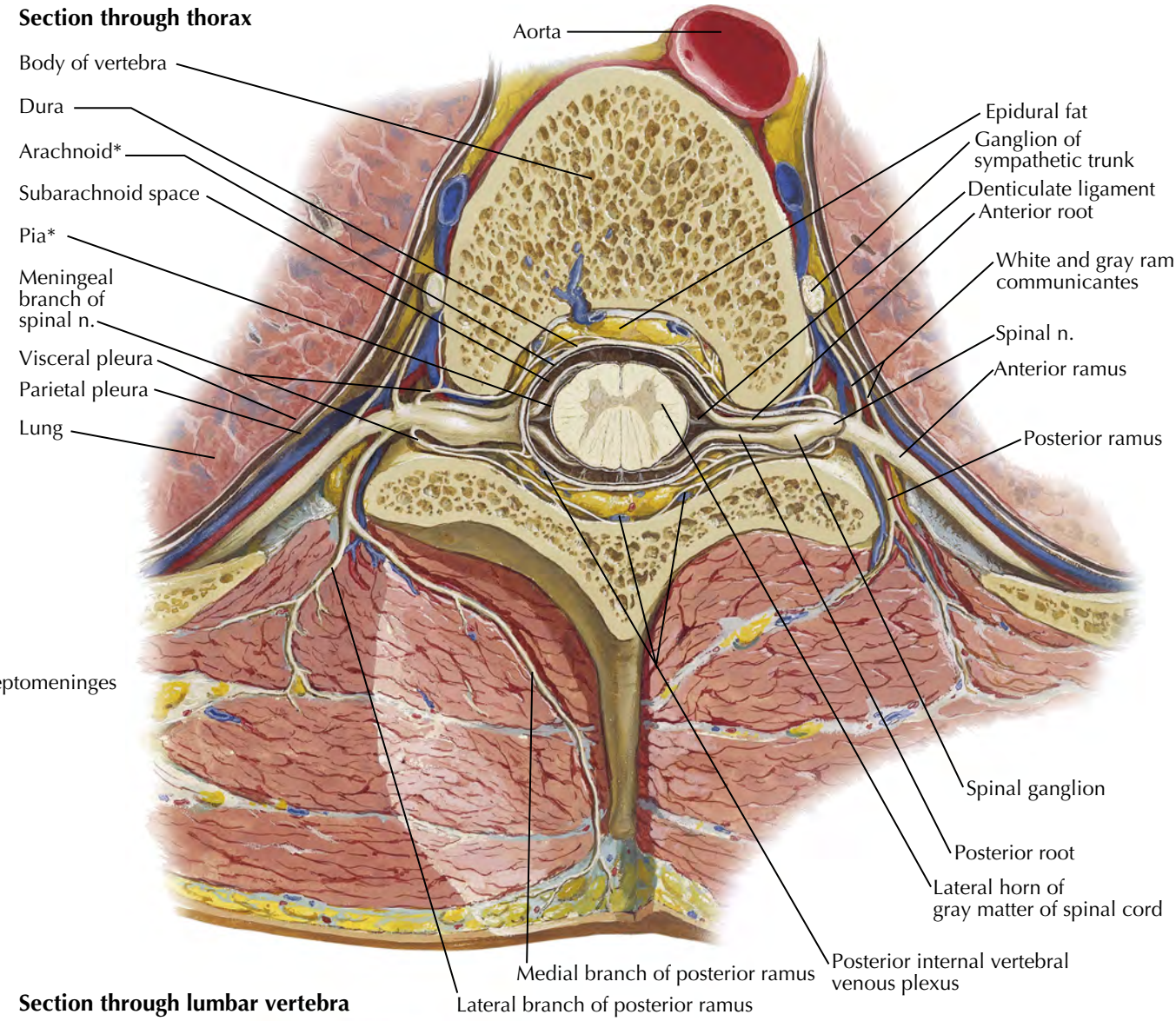


Dura and arachnoid removed: anterior view (*greatly magnified*)



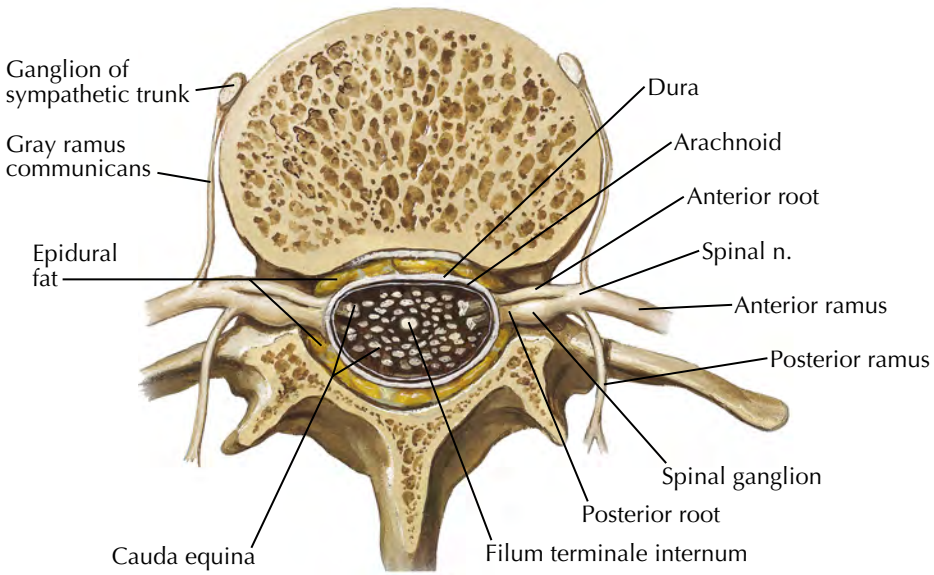
See also **Plate BP 40**

Section through thorax

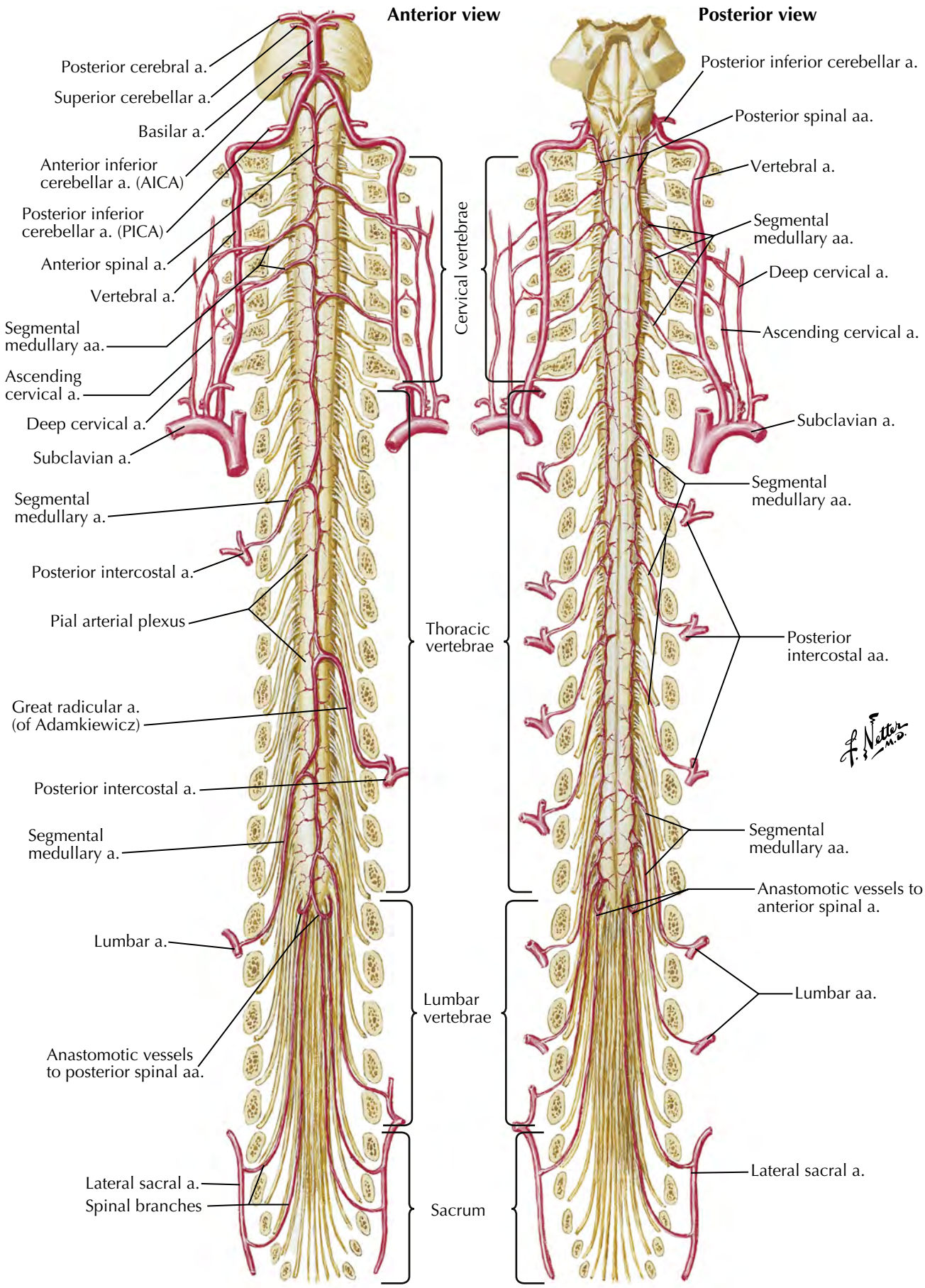


*Leptomeninges

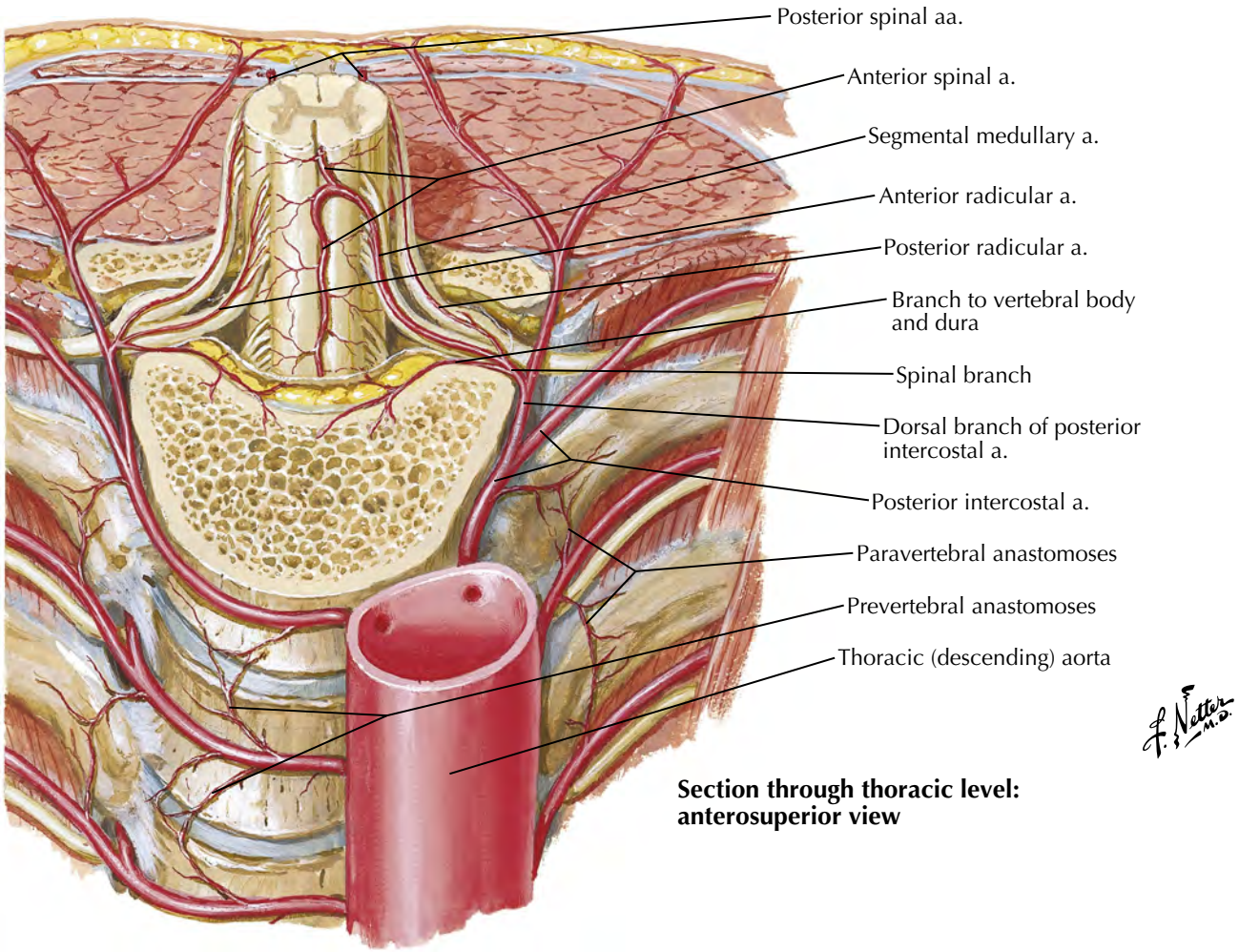
Section through lumbar vertebra



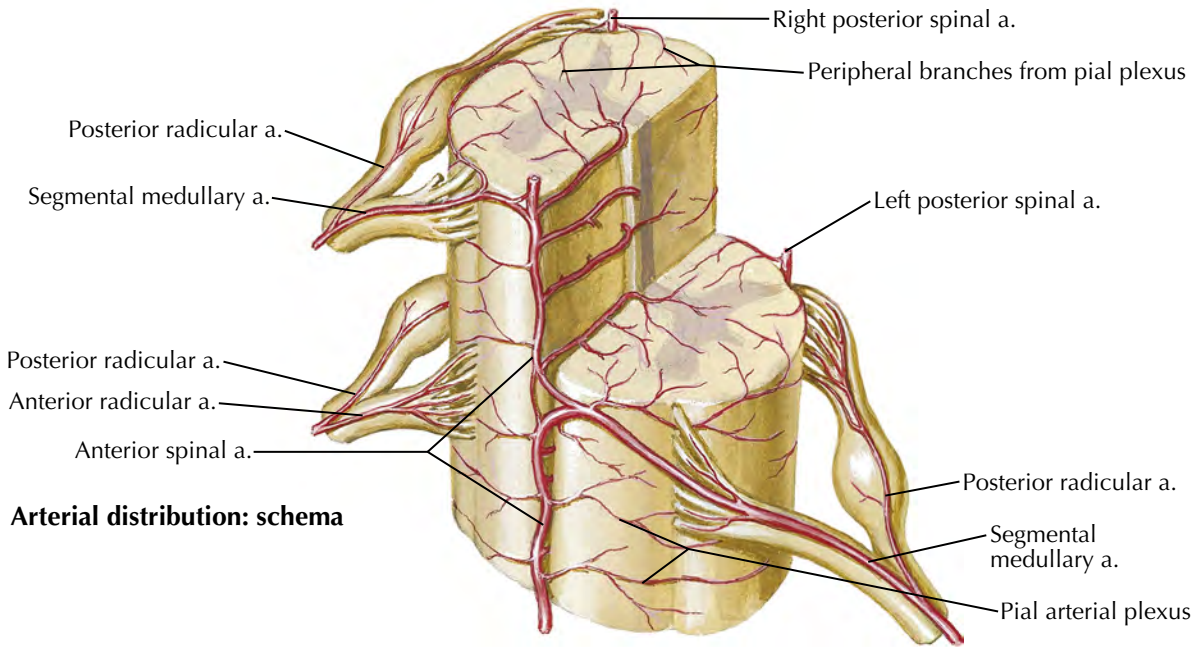
Arteries of Spinal Cord: Schema



Note: All spinal nerve roots have associated radicular or segmental medullary arteries. Most roots have radicular arteries (see Plate 192). Both types of arteries run along roots, but radicular arteries end before reaching anterior or posterior spinal arteries; larger segmental medullary arteries continue on to supply a segment of these arteries.

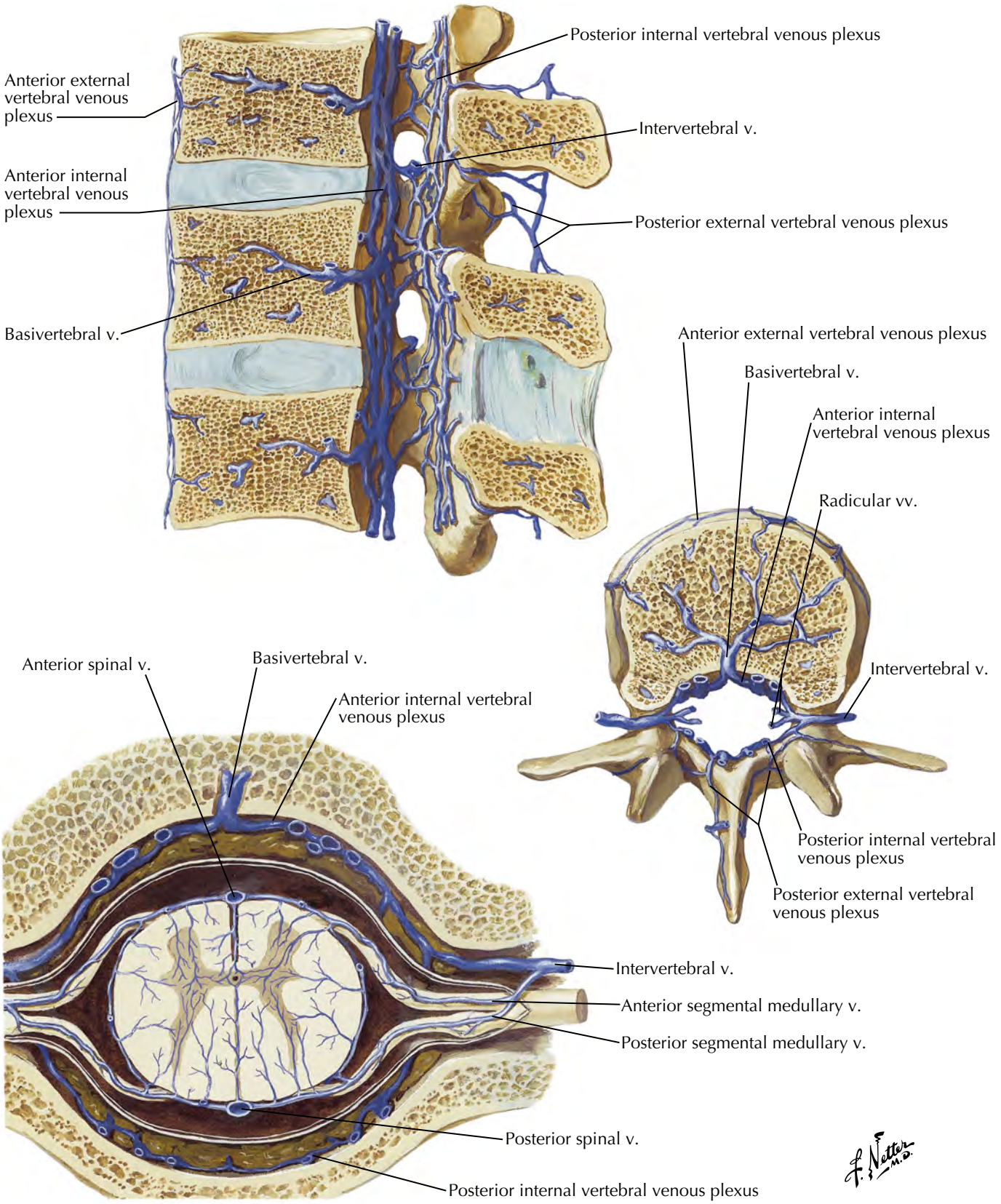


Section through thoracic level: anterosuperior view

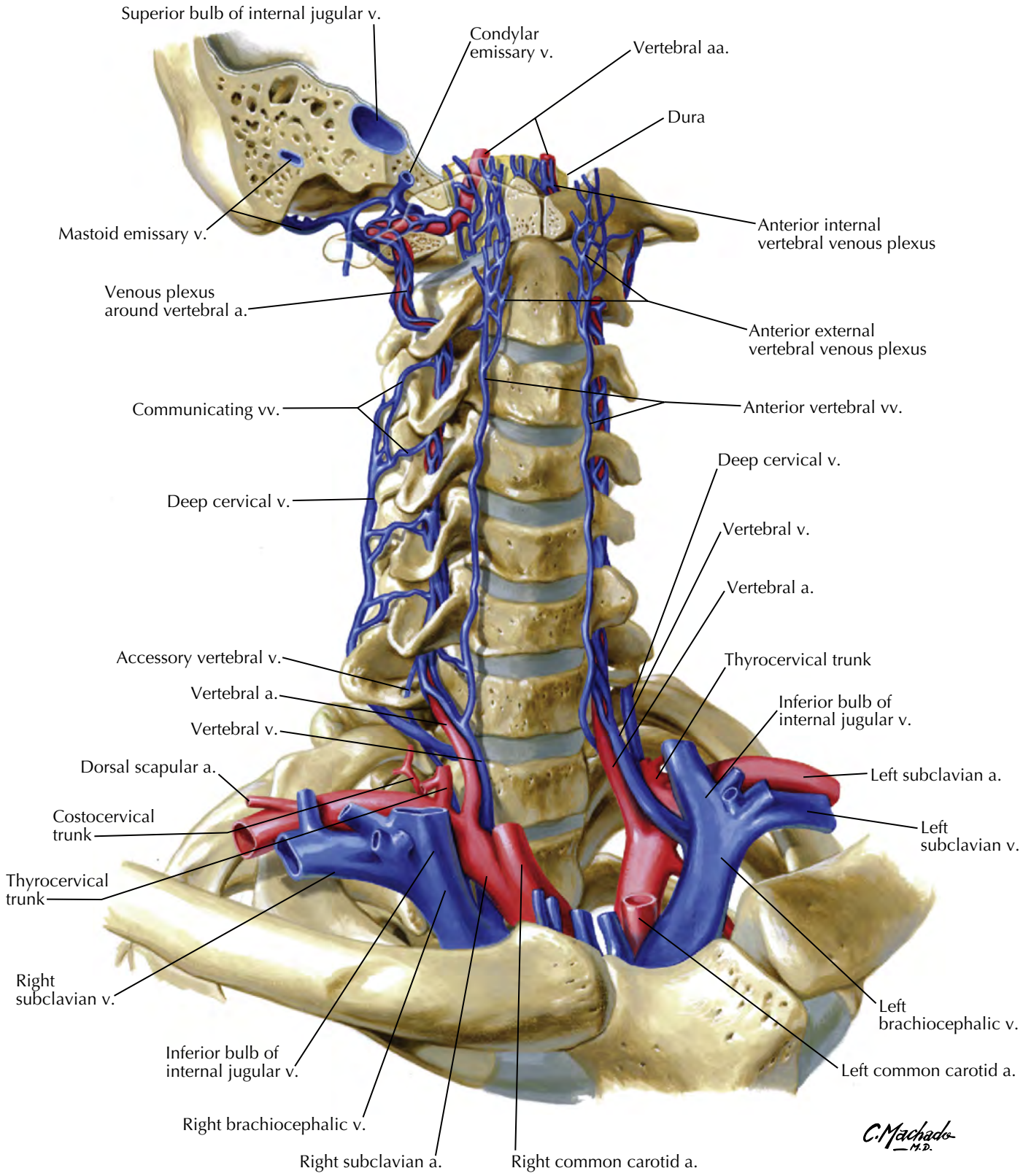


Arterial distribution: schema

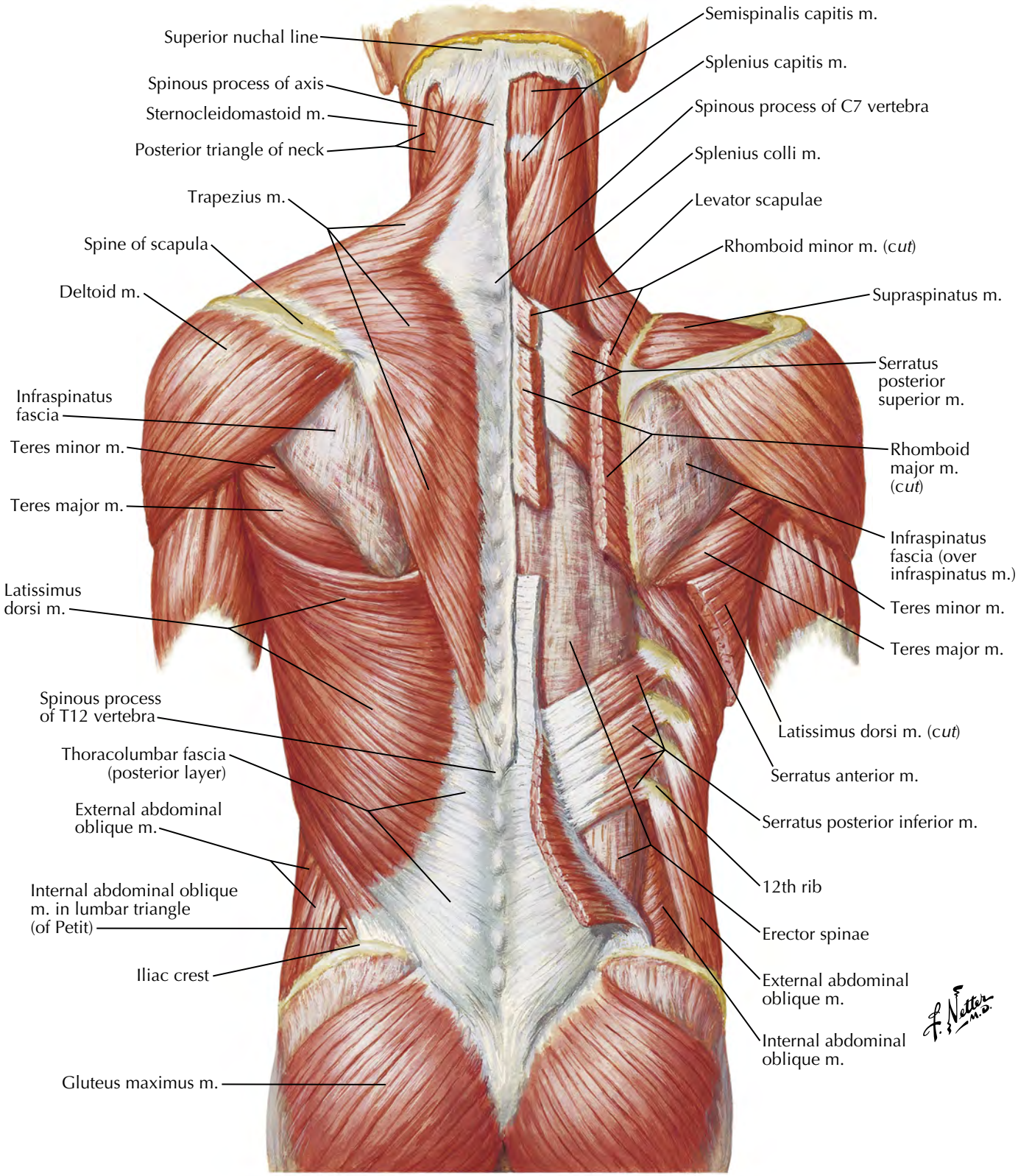
See also **Plate BP 39**



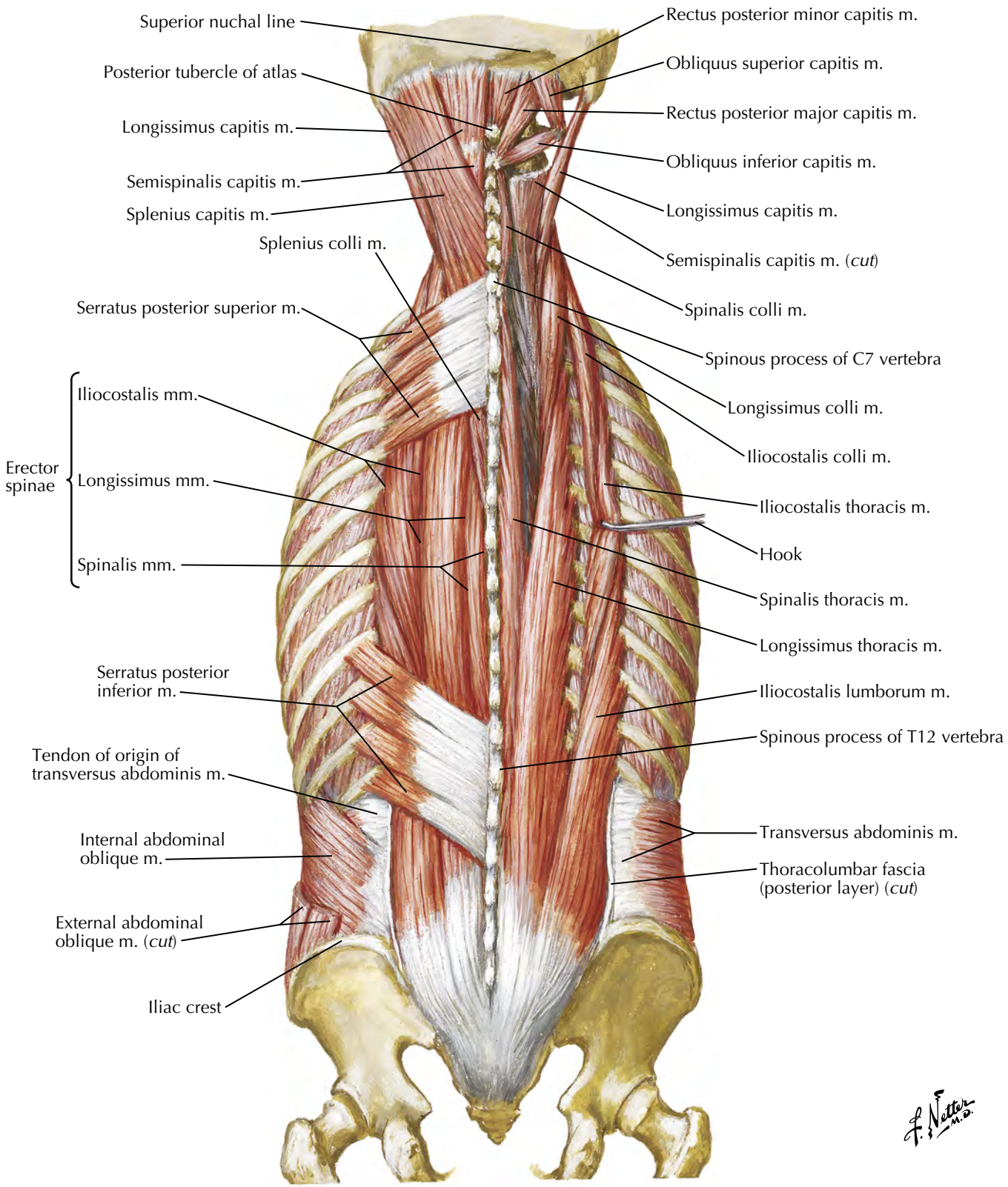
See also **Plate BP 39**



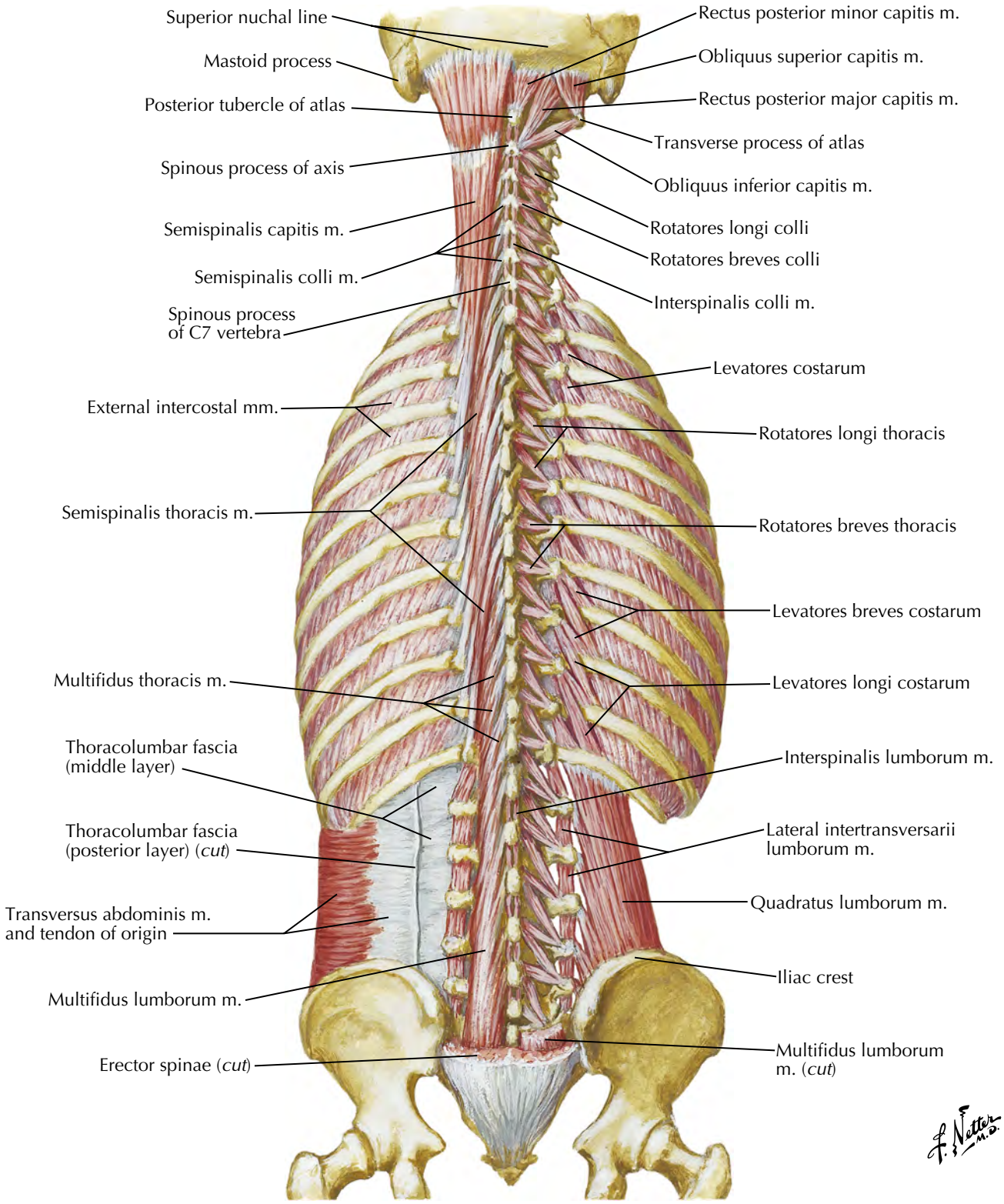
See also **Plates 54, 200, 275**

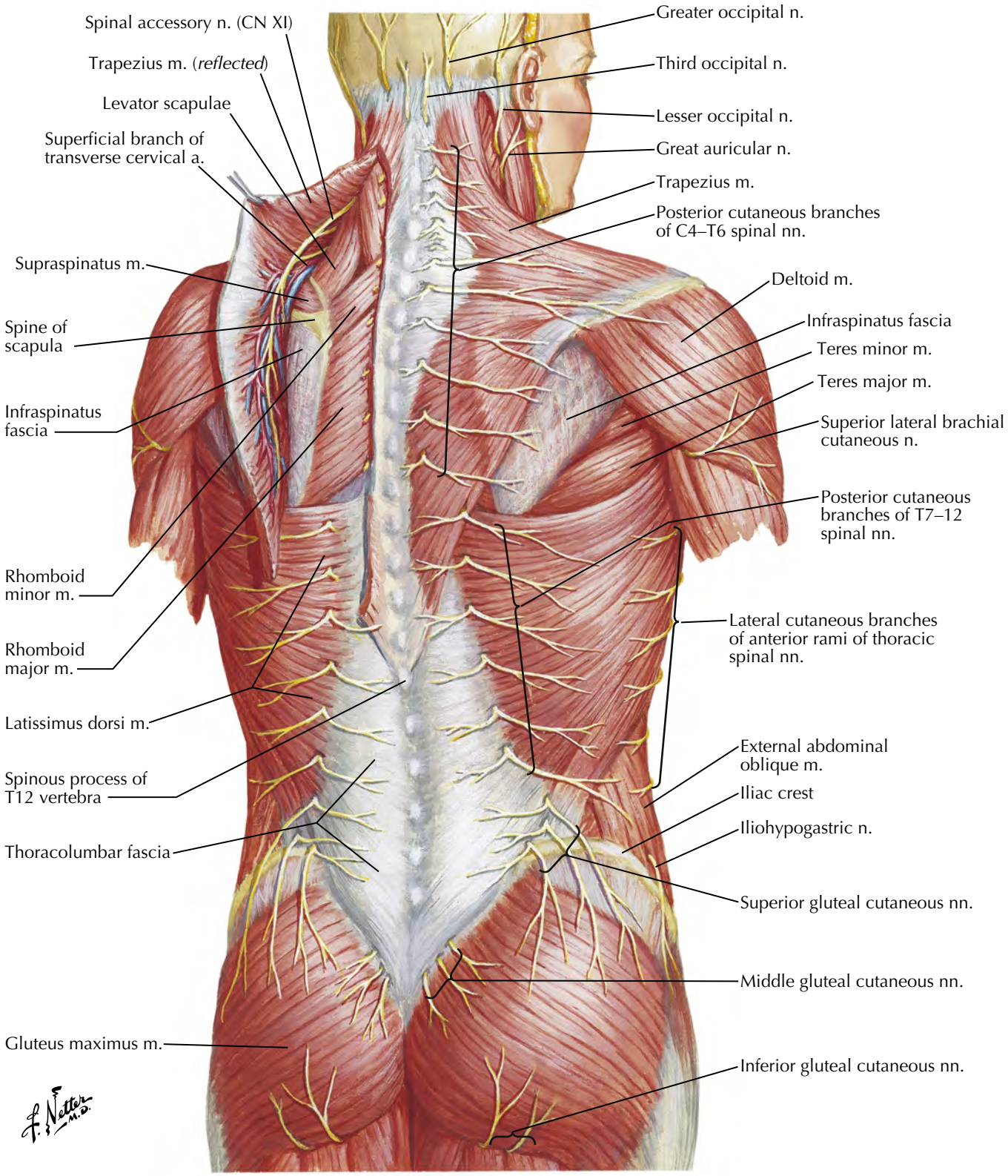


See also **Plate 200**

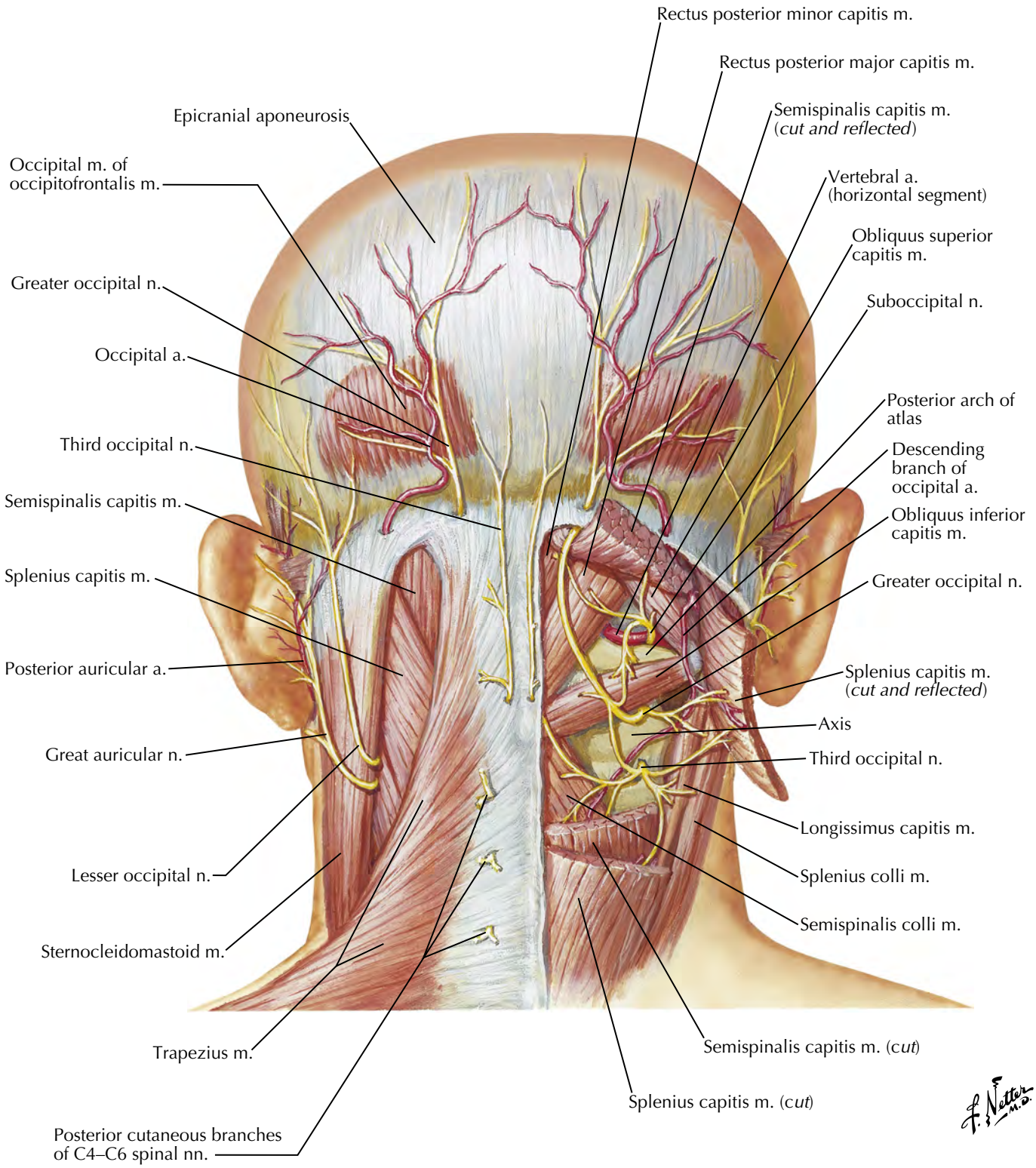


See also **Plate 200**

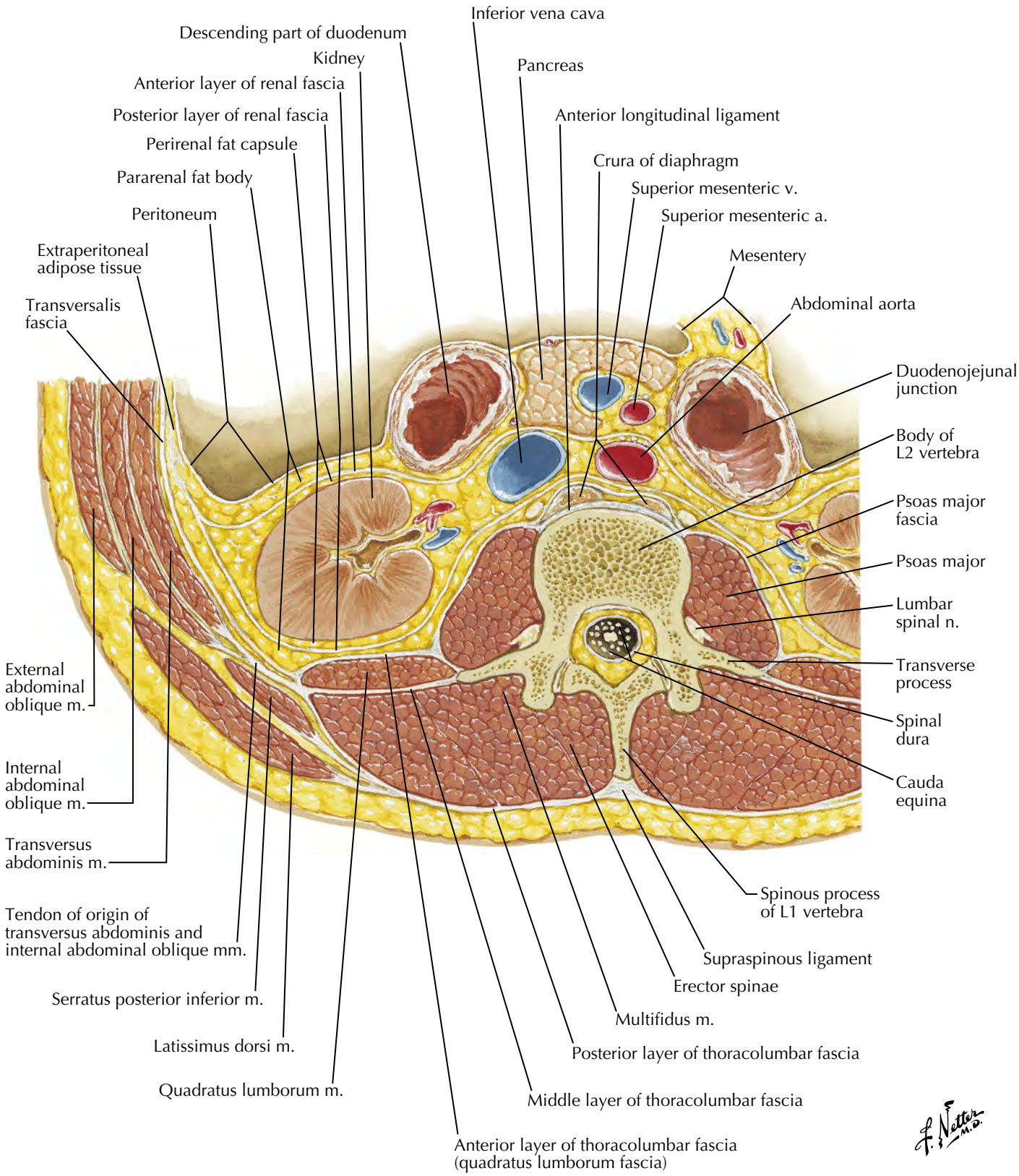



Spinal accessory n. (CN XI)
Trapezius m. (*reflected*)
Levator scapulae
Superficial branch of transverse cervical a.
Supraspinatus m.
Spine of scapula
Infraspinatus fascia
Rhomboid minor m.
Rhomboid major m.
Latissimus dorsi m.
Spinous process of T12 vertebra
Thoracolumbar fascia
Gluteus maximus m.
Greater occipital n.
Third occipital n.
Lesser occipital n.
Great auricular n.
Trapezius m.
Posterior cutaneous branches of C4–T6 spinal nn.
Deltoid m.
Infraspinatus fascia
Teres minor m.
Teres major m.
Superior lateral brachial cutaneous n.
Posterior cutaneous branches of T7–12 spinal nn.
Lateral cutaneous branches of anterior rami of thoracic spinal nn.
External abdominal oblique m.
Iliac crest
Iliohypogastric n.
Superior gluteal cutaneous nn.
Middle gluteal cutaneous nn.
Inferior gluteal cutaneous nn.

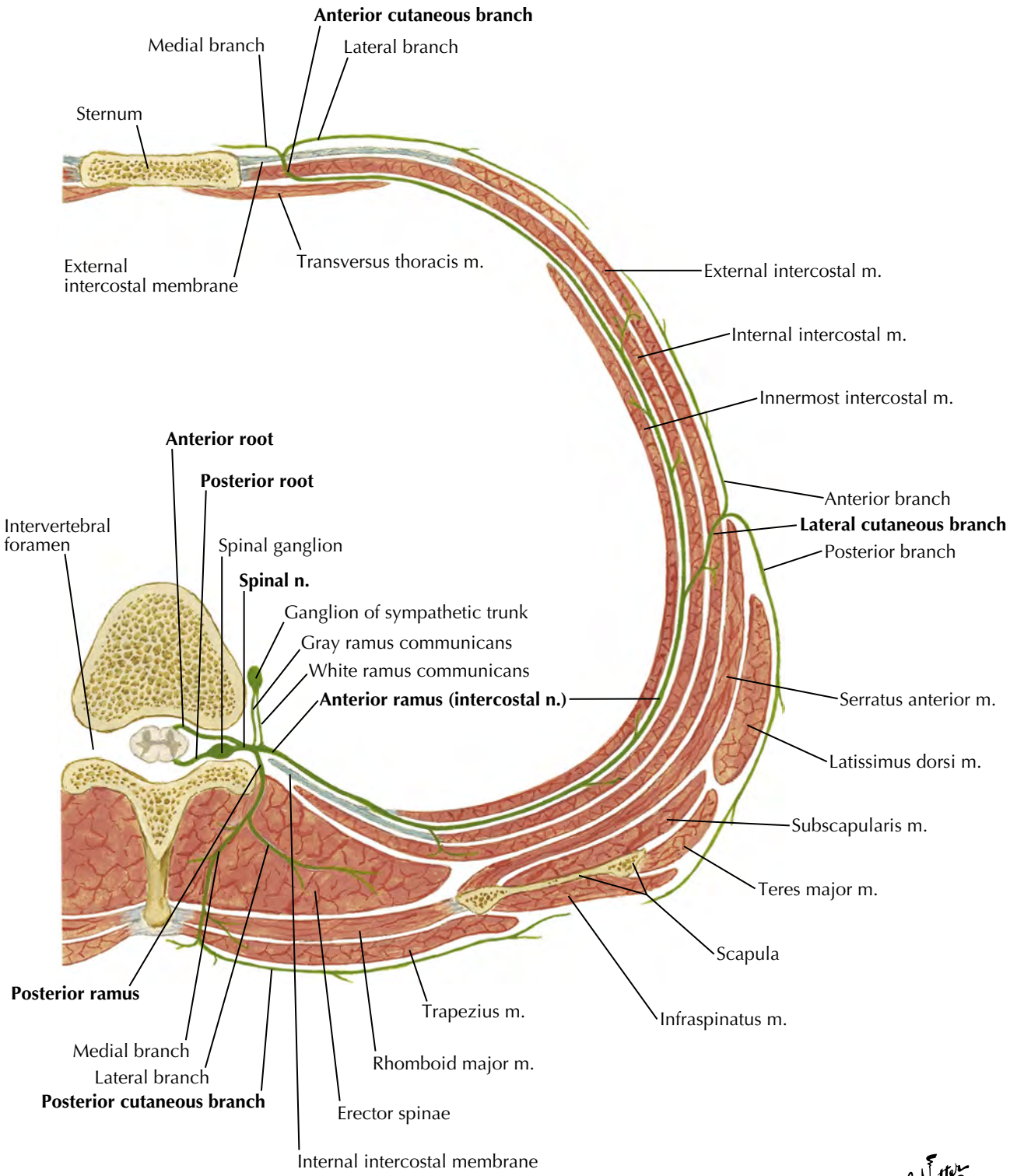
See also **Plates 54, 56**



See also **Plates 330, 331, 337**



See also **Plates 6, 279**



Note: In lower thoracic region, lateral branch of posterior ramus is longer, and motor and cutaneous; medial branch is shorter and motor only.

ANATOMICAL STRUCTURE	CLINICAL COMMENT	PLATE NUMBERS
Nervous System and Sense Organs		
Conus medullaris	Is inferior limit of spinal cord; can lie as inferior as L4 vertebra in neonates and as superior as T12 in adults (average is L1–L2); necessary to determine its location in procedures such as lumbar puncture; in adults, start at L2 or lower	186
Cauda equina	Lumbar and sacral nerve roots may be anesthetized with anesthesia injected into subarachnoid space (spinal block)	186, 187
Spinal meninges	Access to epidural and subarachnoid spaces is necessary for clinical procedures such as epidural anesthesia and lumbar puncture; meningitis is a life-threatening infection	182, 190
Skeletal System		
Spinous processes	Palpable landmarks used to assess spinal curvatures and determine location of spinal cord for procedures such as lumbar puncture and injection of spinal anesthesia	178, 195
Spinous process of C7 vertebra (vertebra prominens)	Most prominent spinous process in cervical region; often used to begin counting vertebrae	178, 180
Intervertebral disc	Age-related changes may produce herniation of nucleus pulposus, causing back pain; occurs most commonly in lower lumbar regions of vertebral column	181, 187
Lamina of vertebral arch	Surgically removed in laminectomy to gain access to vertebral canal and spinal cord	181
Intervertebral foramen	May become narrowed by age-related changes (e.g., osteophyte formation) or changes in intervertebral disc height, producing compression of its contents	181, 184, 185
Sacral hiatus	Provides access to epidural space for administration of caudal epidural anesthesia	183
Fifth lumbar vertebra	Spondylolysis is clinical condition in which vertebral body separates from part of its vertebral arch bearing inferior articulating process (defect is through pars interarticularis); if this occurs bilaterally, L5 vertebral body and transverse process may slide forward over sacrum, giving rise to spondylolisthesis	184
L5–S1 intervertebral disc	Most common level of intervertebral disc herniation, which may result in nerve compression and lower back pain associated with pain and weakness in ipsilateral lower limb (sciatica)	184, 187
Vertebral foramen	May be congenitally stenotic in cervical region, or narrowed by arthritic changes in lumbar vertebrae; can lead to back pain, sciatica, numbness or tingling, and weakness in lower limbs	180, 181
Muscular System		
Trapezius muscle	Responsible for holding scapula against thoracic wall against gravity; drooping of shoulder may indicate injury to spinal accessory nerve	195
Deep (or intrinsic) back muscles	Microscopic stretching or tearing of muscle fibers produces back strain, a common cause of low back pain	196, 197
Cardiovascular System		
Arteries of spinal cord	Narrowing or damage caused by atherosclerosis, vertebral fractures, or vertebral dislocations may cause ischemia of spinal cord	191
Vertebral venous plexuses	Mostly valveless veins along vertebral column allow retrograde flow and can act as conduits for metastasis of cancer cells to spine, lungs, and brain	194, BP 39

*Selections were based largely on clinical data and commonly discussed clinical correlations in macroscopic ("gross") anatomy courses.

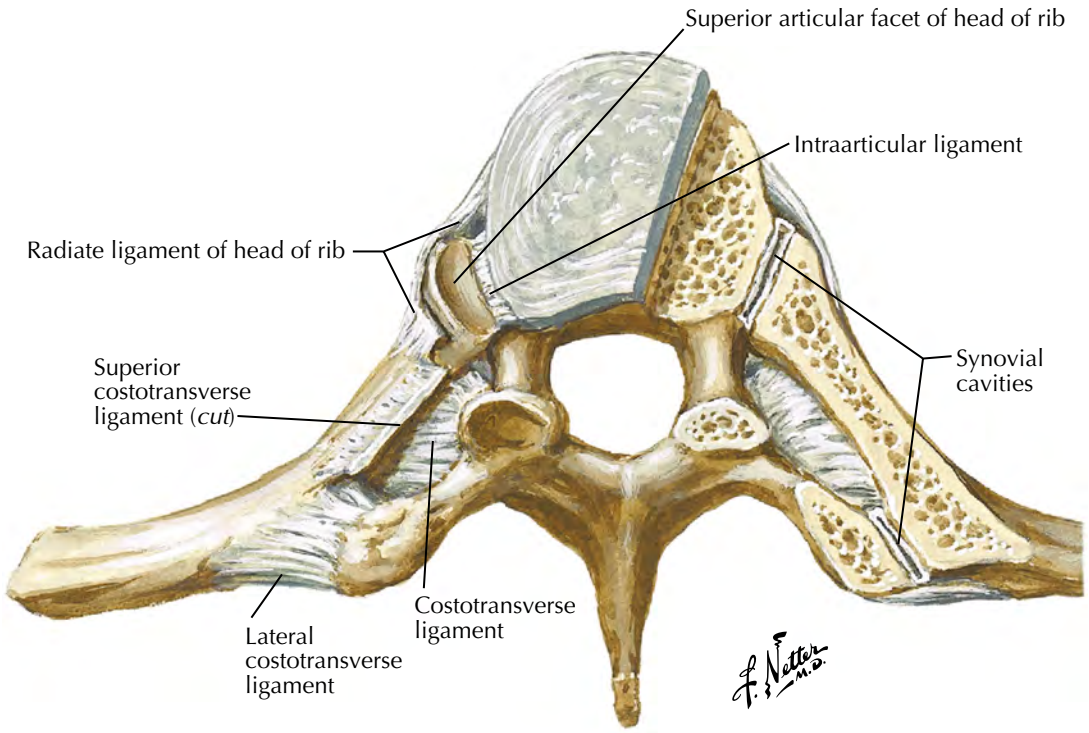
MUSCLE	MUSCLE GROUP	SUPERIOR ATTACHMENT	INFERIOR ATTACHMENT	INNERVATION	BLOOD SUPPLY	MAIN ACTIONS
Iliocostalis mm.	Deep back (erector spinae)	*Colli muscle:* posterior tubercles of C4–C6 vertebrae	*Colli muscle:* angles of ribs 3–6	Posterior rami of spinal nerves	*Cervical portions:* occipital, deep cervical, and vertebral arteries	Extend and laterally bend vertebral column and head
		Thoracis muscle: angles of ribs 1–6	*Thoracis muscle:* angles of ribs 7–12		*Thoracic portions:* dorsal branches of posterior intercostal and subcostal arteries	
		Lumborum muscle: ribs 4–12, transverse processes of L1–L4 vertebrae	*Lumborum muscle:* sacrum (via erector spinae aponeurosis), iliac crest		*Lumbar portions:* dorsal branches of lumbar and lateral sacral arteries	
Interspinalis mm.	Deep back	*Colli muscle:* spinous processes of C2–C7 vertebrae	Spinous processes of vertebrae subjacent to vertebrae of muscle origin	Posterior rami of spinal nerves	*Cervical portions:* occipital, deep cervical, and vertebral arteries	Aid in extension of vertebral column
		Thoracis muscle: spinous processes of T1–T2 and T11–T12 vertebrae			*Thoracic portions:* dorsal branches of posterior intercostal and subcostal arteries	
		Lumborum muscle: spinous processes of L1–L4 vertebrae			*Lumbar portions:* dorsal branches of lumbar arteries	
Intertransversarii mm.	Deep back	*Medial muscles:* transverse processes of C1–C7 and T10–T12 vertebrae, mammillary processes of L1–L4 vertebrae	*Medial muscles:* transverse processes of subjacent cervical and thoracic vertebrae, mammillary processes of subjacent lumbar vertebrae	*Medial muscles:* posterior rami of spinal nerves	*Cervical portions:* occipital, deep cervical, and vertebral arteries	Assist in lateral flexion of vertebral column
					Thoracic portions: dorsal branches of posterior intercostal and subcostal arteries	
		Lateral and anterior muscles: transverse processes of C1–C7 and L1–L4 vertebrae	*Lateral and anterior muscles:* transverse processes of subjacent vertebrae	*Lateral and anterior muscles:* anterior rami of spinal nerves	*Lumbar portions:* dorsal branches of lumbar arteries	
Latissimus dorsi m.	Superficial back	Spinous processes of T7–T12 vertebrae, posterior layer of thoracolumbar fascia (and thus to L1–L5 vertebrae and iliac crest), ribs 10–12	Intertubercular sulcus of humerus	Thoracodorsal nerve	Thoracodorsal artery, dorsal perforating branches of 9th, 10th, and 11th posterior intercostal, subcostal, and first three lumbar arteries	Extends, adducts, and medially rotates humerus
Levator scapulae	Superficial back	Transverse processes of atlas and axis, posterior tubercles of transverse processes of C3–C4 vertebrae	Medial border of scapula (superior to spine)	Anterior rami of C3–C4 spinal nerves, dorsal scapular nerve	Dorsal scapular and transverse and ascending cervical arteries	Elevates scapula medially, inferiorly rotates glenoid fossa
Longissimus mm.	Deep back (erector spinae)	*Capitis muscle:* mastoid process	*Capitis muscle:* transverse processes of C4–T4 vertebrae	Posterior rami of spinal nerves	*Cervical portions:* occipital, deep cervical, and vertebral arteries	Extend and laterally bend vertebral column and head
		Colli muscle: transverse processes of C2–C6 vertebrae	*Colli muscle:* transverse processes of T1–T5 vertebrae		*Thoracic portions:* dorsal branches of posterior intercostal and subcostal arteries	
		Thoracis muscle: transverse processes of T1–T12 vertebrae, ribs 5–12, accessory and transverse processes of L1–L5 vertebrae	*Thoracis muscle:* spinous processes of L1–L5 vertebrae, posterior surface of sacrum, iliac tuberosity, posterior sacroiliac ligament		*Lumbar portions:* dorsal branches of lumbar and lateral sacral arteries	

MUSCLE	MUSCLE GROUP	SUPERIOR ATTACHMENT	INFERIOR ATTACHMENT	INNERVATION	BLOOD SUPPLY	MAIN ACTIONS
Multifidus mm.	Deep back (transversospinales)	Spinous processes of C2–L5 vertebrae (2–5 levels above muscle insertion)	*Colli muscle:* superior articular processes of C4–C7 vertebrae	Posterior rami of spinal nerves	*Cervical portions:* occipital, deep cervical, and vertebral arteries	Stabilize spine
			Thoracis muscle: transverse processes of T1–T12 vertebrae		*Thoracic portions:* dorsal branches of posterior intercostal and subcostal arteries	
			Lumborum muscle: mammillary processes of L1–L5 vertebrae, sacrum, iliac crest		*Lumbar portions:* dorsal branches of lumbar and lateral sacral arteries	
Obliquus inferior capitis m.	Suboccipital	Transverse process of atlas	Spinous process of axis	Suboccipital nerve	Vertebral artery and occipital arteries	Rotates atlas to turn face to same side
Obliquus superior capitis m.	Suboccipital	Lateral part of inferior nuchal line	Transverse process of atlas	Suboccipital nerve	Vertebral and occipital arteries	Extends and bends head laterally
Rectus posterior major capitis m.	Suboccipital	Middle part of inferior nuchal line	Spinous process of axis	Suboccipital nerve	Vertebral and occipital arteries	Extends and rotates head to same side
Rectus posterior minor capitis m.	Suboccipital	Medial part of inferior nuchal line	Posterior tubercle of atlas	Suboccipital nerve	Vertebral and occipital arteries	Extends head
Rhomboid major m.	Superficial back	Spinous processes of T2–T5 vertebrae	Medial border of scapula (inferior to spine of scapula)	Dorsal scapular nerve	Dorsal scapular artery *OR* deep branch of transverse cervical artery, dorsal perforating branches of upper five or six posterior intercostal arteries	Fixes scapula to thoracic wall and retracts and rotates it to depress glenoid fossa
Rhomboid minor m.	Superficial back	Nuchal ligament, spinous processes of C7 and T1 vertebrae	Medial border of scapula (at spine of scapula)	Dorsal scapular nerve	Dorsal scapular artery *OR* deep branch of transverse cervical artery, dorsal perforating branches of upper five or six posterior intercostal arteries	Fixes scapula to thoracic wall and retracts and rotates it to depress glenoid fossa
Rotatores	Deep back (transversospinales)	*Colli muscle:* spinous processes of cervical vertebrae	*Colli muscle:* superior articular processes of cervical vertebrae 1 or 2 levels below vertebra of muscle origin	Posterior rami of spinal nerves	*Cervical portions:* occipital, deep cervical, and vertebral arteries	Stabilize, extend, and rotate spine
		Thoracis muscle: spinous processes and laminae of T1–T11 vertebrae	*Thoracis muscle:* transverse processes of T2–T12 vertebrae (brevis muscles insert into adjacent vertebra; longus muscles into vertebra 2 levels down)		*Thoracic portions:* dorsal branches of posterior intercostal and subcostal arteries	
		Lumborum muscle: spinous processes of lumbar vertebrae	*Lumborum muscle:* mammillary processes of lumbar vertebrae 2 levels down		*Lumbar portions:* dorsal branches of lumbar arteries	

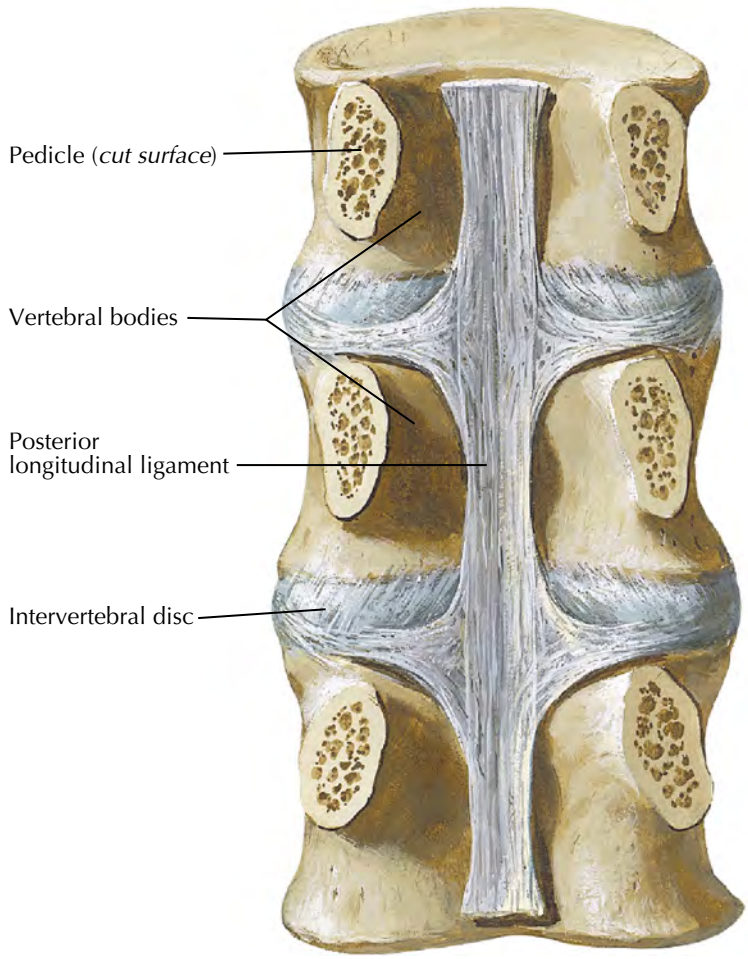
MUSCLE	MUSCLE GROUP	SUPERIOR ATTACHMENT	INFERIOR ATTACHMENT	INNERVATION	BLOOD SUPPLY	MAIN ACTIONS
Semispinalis mm.	Deep back (transversospinales)	*Capitis muscle:* occipital bone (between superior and inferior nuchal lines)	*Capitis muscle:* superior articular processes of C4–C7 vertebrae, transverse processes of T1–T6 vertebrae	Posterior rami of spinal nerves	*Cervical portions:* occipital, deep cervical, and vertebral arteries	Extend head and neck and rotate them to opposite side
		Colli muscle: spinous processes of C2–C5 vertebrae	*Colli muscle:* transverse processes of T1–T6 vertebrae			
		Thoracis muscle: spinous processes of C6–T4 vertebrae	*Thoracis muscle:* transverse processes of T6–T10 vertebrae		*Thoracic portions:* dorsal branches of posterior intercostal arteries	
Serratus posterior inferior m.	Superficial back	Inferior aspect of ribs 9–12	Spinous processes of T11–L2 vertebrae	Anterior rami of T9–T12 spinal nerves	Posterior intercostal arteries	Depresses ribs
Serratus posterior superior m.	Superficial back	Nuchal ligament, spinous processes of C7–T3 vertebrae	Superior aspect of ribs 2–5	Anterior rami of T2–T5 spinal nerves	Posterior intercostal arteries	Elevates ribs
Spinalis mm.	Deep back (erector spinae)	*Capitis muscle:* external occipital protuberance	*Capitis muscle:* spinous processes of C7 and T1 vertebrae	Posterior rami of spinal nerves	*Cervical portions:* occipital, deep cervical, and vertebral arteries	Extend and laterally bend vertebral column and head
		Colli muscle: spinous processes of C2–C4 vertebrae	*Colli muscle:* spinous processes of C7–T2 vertebrae		*Thoracic portions:* dorsal branches of posterior intercostal and subcostal arteries	
		Thoracis muscle: spinous processes of T2–T8 vertebrae	*Thoracis muscle:* spinous processes of T11–L2 vertebrae		*Lumbar portions:* dorsal branches of lumbar and lateral sacral arteries	
Splenius capitis m.	Spinotransversales	Mastoid process of temporal bone, lateral one-third of superior nuchal line	Nuchal ligament, spinous processes of C7–T4 vertebrae	Posterior rami of C2–C3 spinal nerves	Occipital artery and deep cervical arteries	*Bilaterally:* extends head
						Unilaterally: laterally bends (flexes) and rotates face to same side
Splenius colli m.	Spinotransversales	Transverse processes of C1–C3 vertebrae	Spinous processes of T3–T6 vertebrae	Posterior rami of C4–C6 spinal nerves	Occipital and deep cervical arteries	*Bilaterally:* extends neck
						Unilaterally: laterally bends (flexes) and rotates neck toward same side
Trapezius m.	Superficial back	*Descending part:* superior nuchal line, external occipital protuberance, nuchal ligament	*Descending part:* lateral one-third of clavicle	Spinal accessory nerve (CN XI)	Transverse cervical and posterior intercostal arteries	Elevates, retracts, and rotates scapula; lower fibers depress scapula
		Transverse part: spinous processes of C7–T3 vertebrae	*Transverse part:* acromion			
		Ascending part: spinous processes of T4–T12 vertebrae	*Ascending part:* spine of scapula			

Variations in spinal nerve contributions to the innervation of muscles, their arterial supply, their attachments, and their actions are common themes in human anatomy. Therefore, expect differences between texts and realize that anatomical variation is normal.

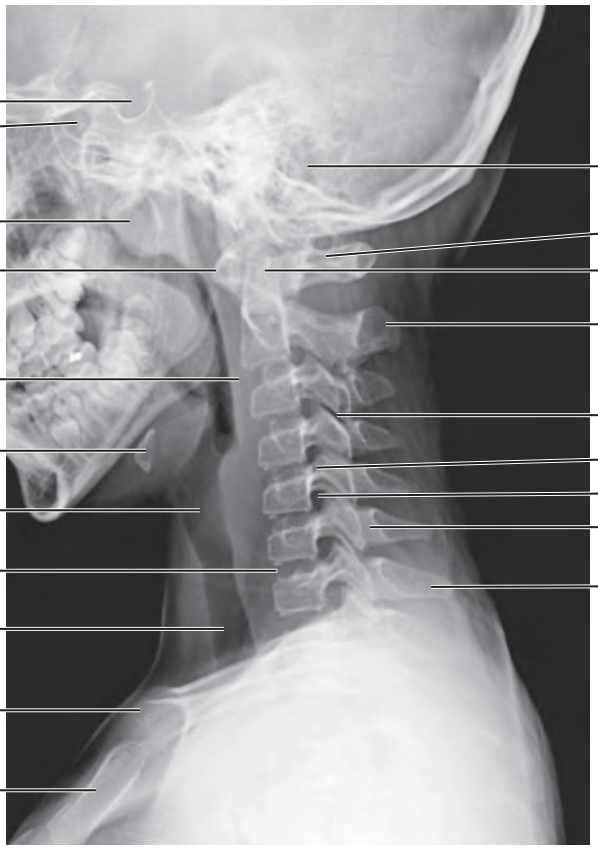
Thoracic vertebra: superior view of transverse section



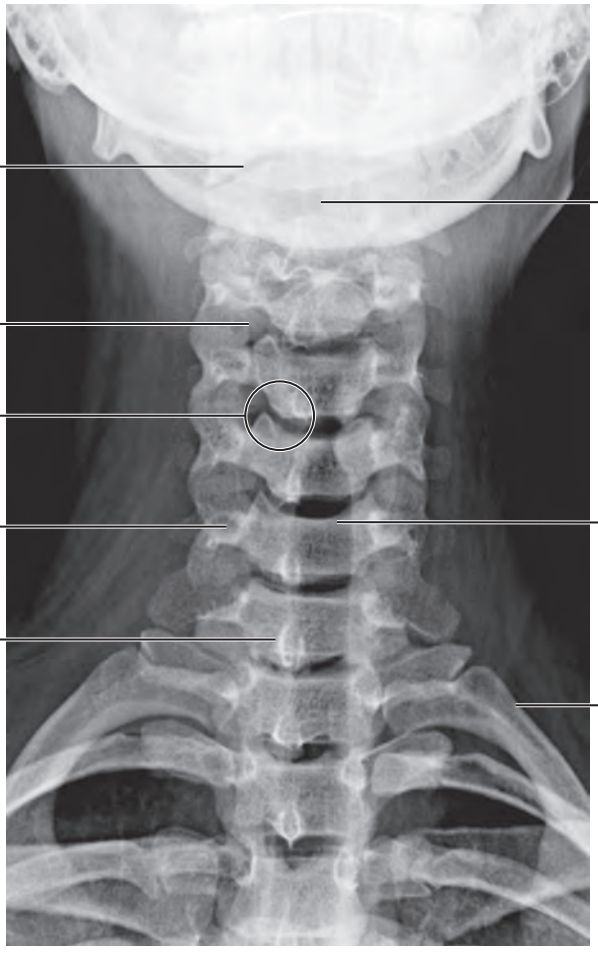
Lumbar vertebral bodies: posterior view (*pedicles sectioned*)



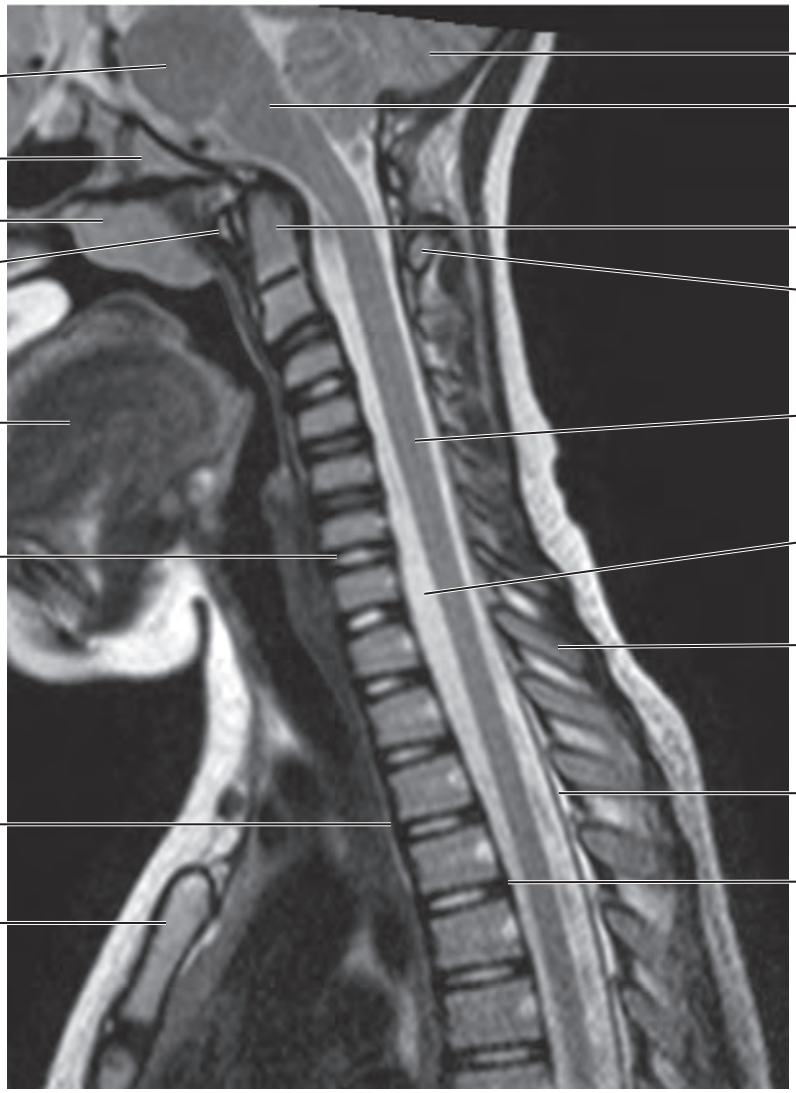
Lateral view



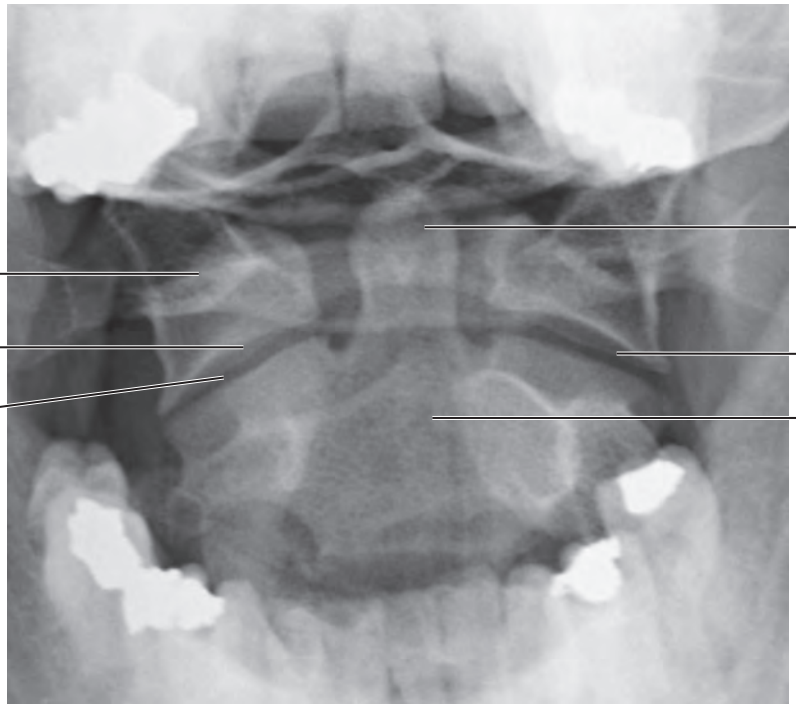
Anteroposterior view



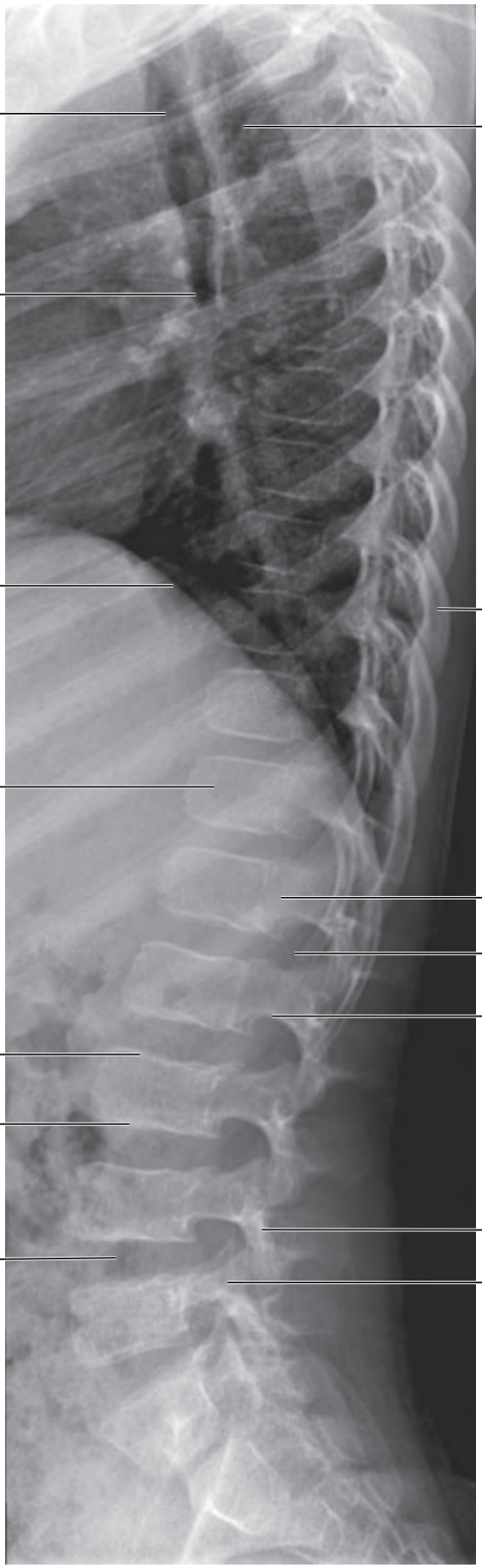
Sagittal T2-weighted MRI of cervical spine, without contrast



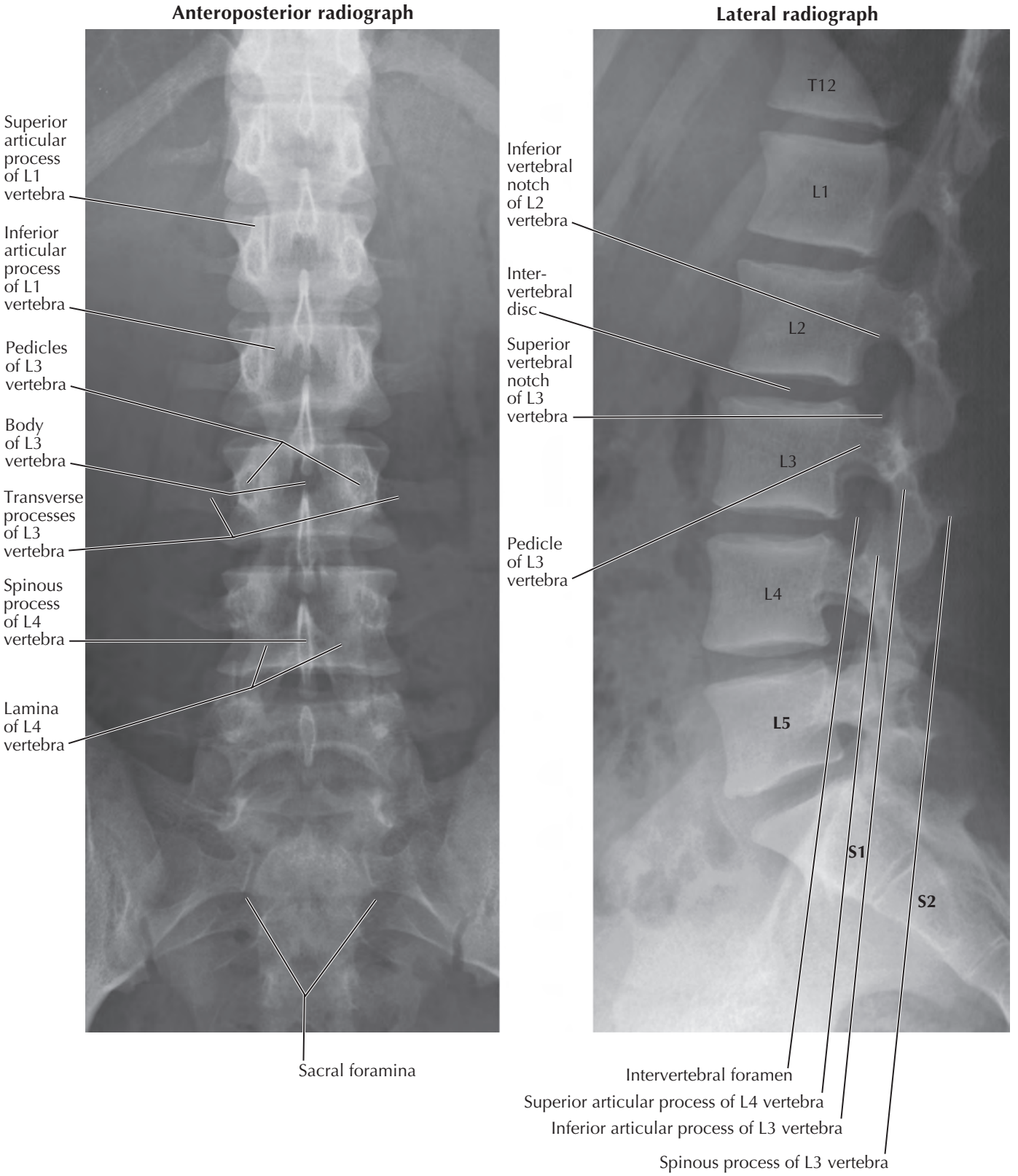
Open-mouth radiograph of cervical spine



Lateral radiograph of thoracolumbar spine

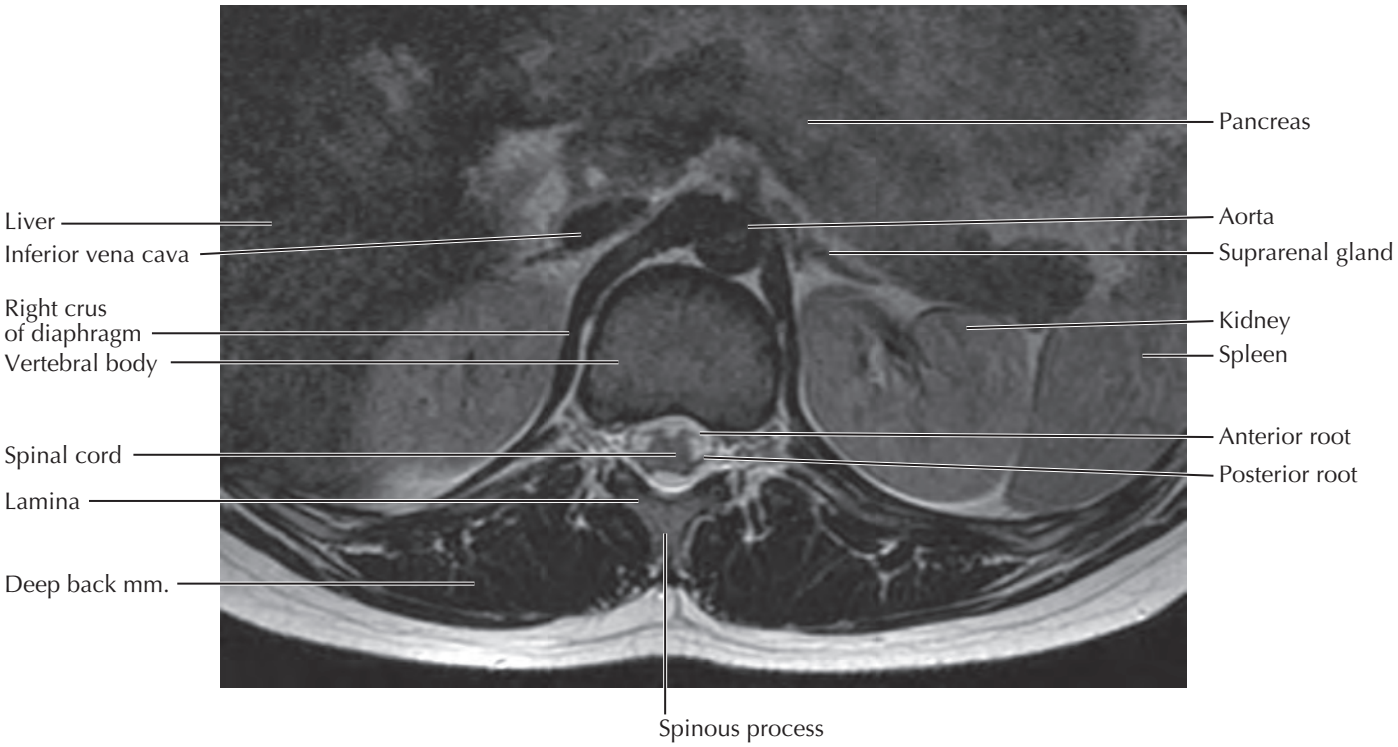


Radiographs of lumbar vertebrae

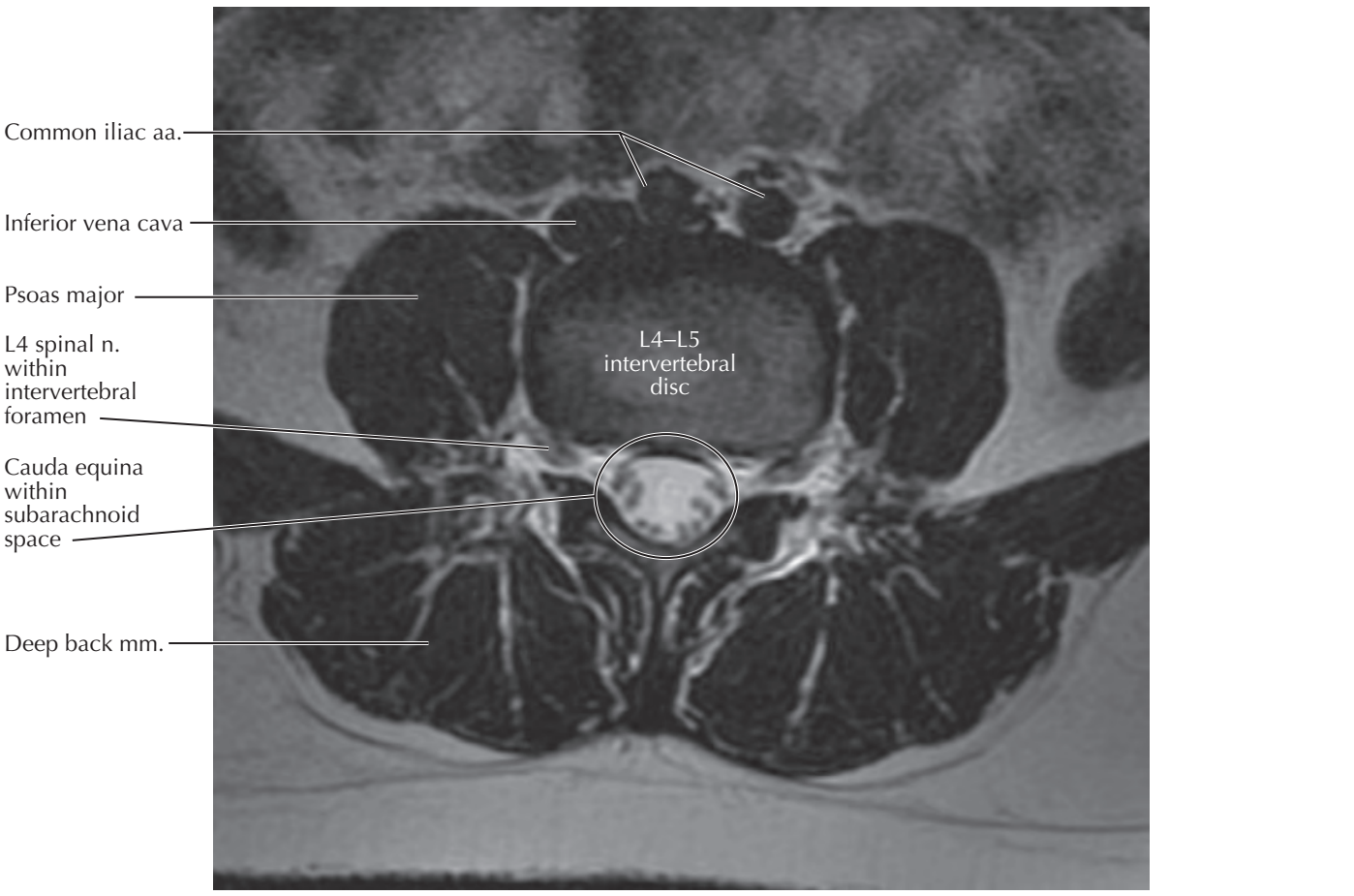


Note: *The vertebral bodies are numbered.*

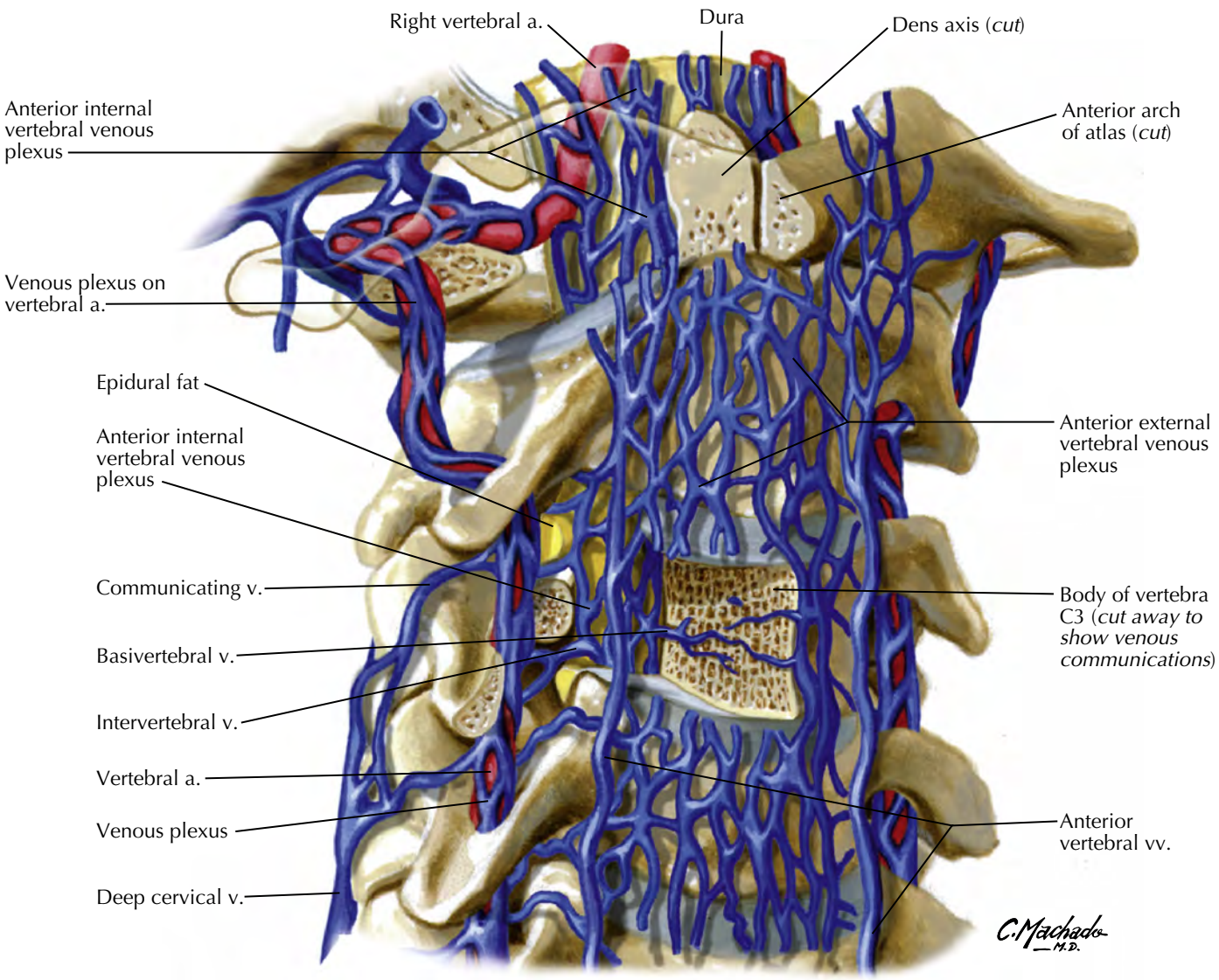
Axial T2-weighted MRI section through upper lumbar level, without contrast



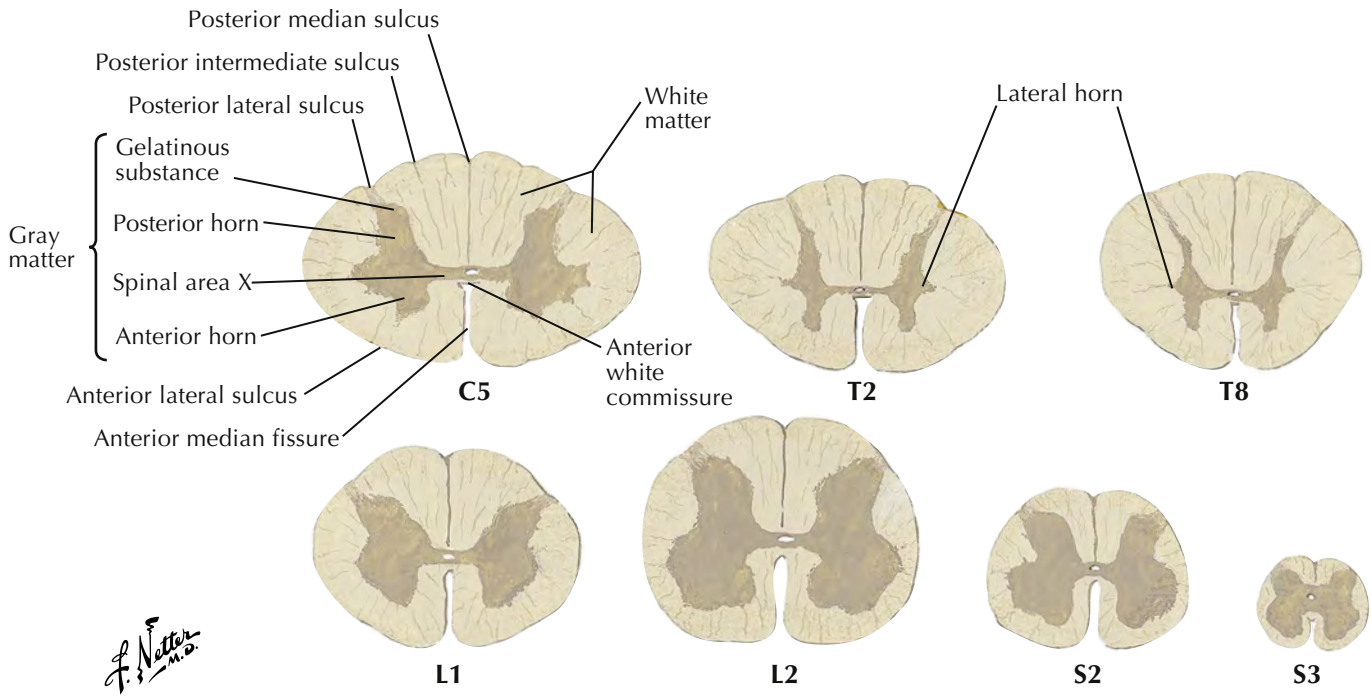
Axial T2-weighted MRI section through lower lumbar level, without contrast



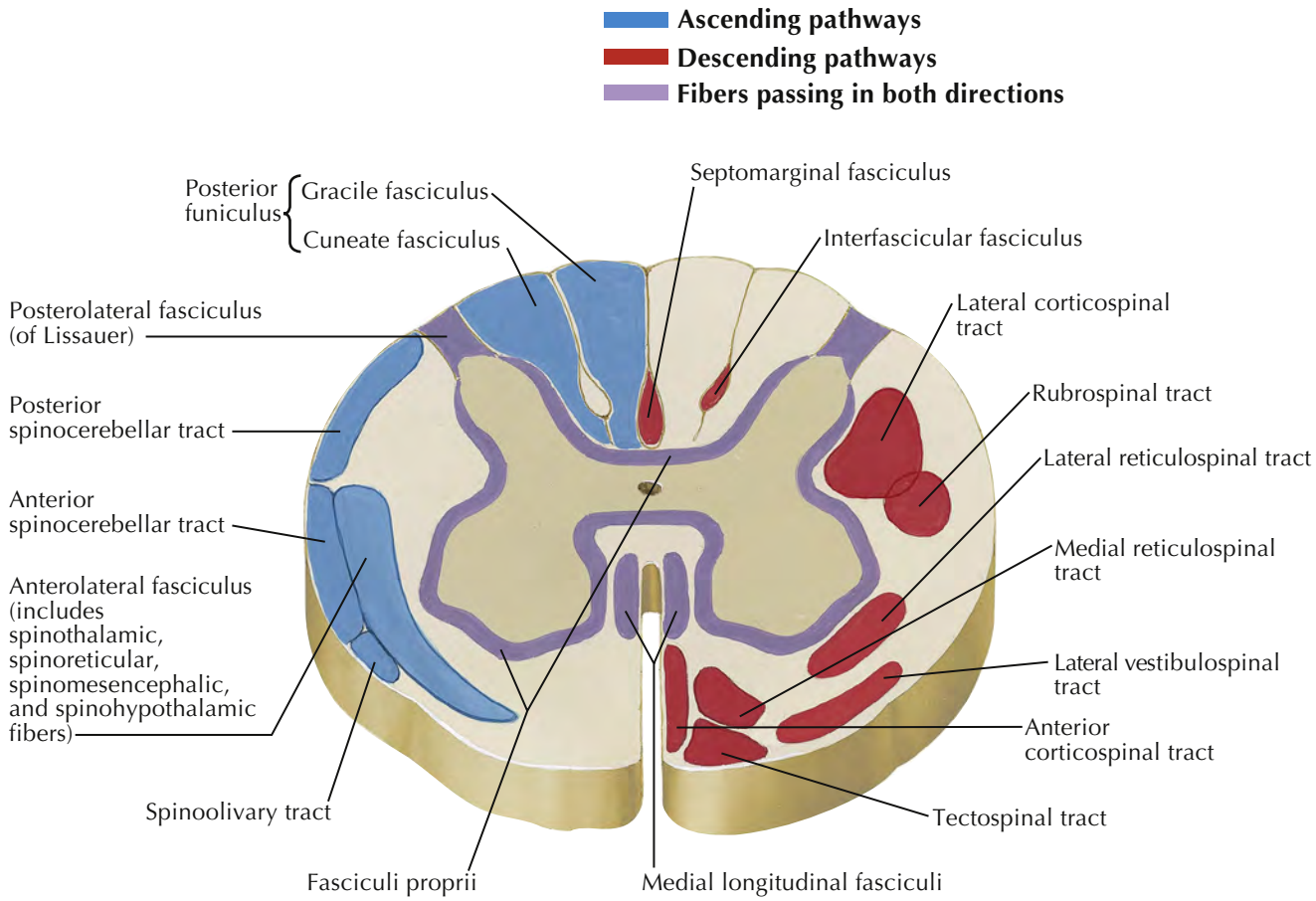
See also **Plates 193, 194**



Sections through spinal cord at various levels



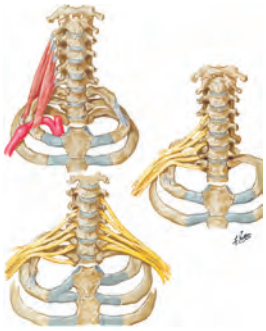
Principal fiber tracts of spinal cord



THORAX 4

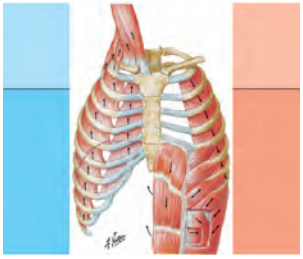
Surface Anatomy	202	**Mediastinum**	251–261
Thoracic Skeleton	203–204	**Cross-Sectional Anatomy**	262–266
Mammary Glands	205–208	**Structures with High Clinical Significance**	Tables 4.1–4.3
Thoracic Wall and Diaphragm	209–216	**Muscles**	Table 4.4
Lungs, Trachea, and Bronchi	217–230	**Electronic Bonus Plates**	BP 41–BP 52
Heart	231–250		

ELECTRONIC BONUS PLATES



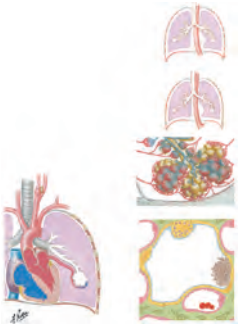
BP 41 Cervical Ribs and Related Variations

BP 42 Muscle Attachments of Ribs

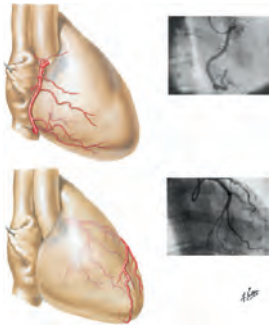


BP 43 Muscles of Respiration

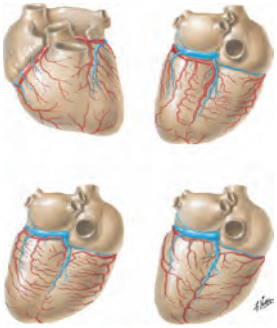
BP 44 Intrapulmonary Airways: Schema



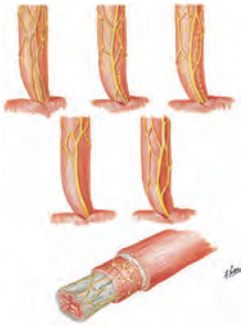
BP 45 Anatomy of Ventilation and Respiration



BP 46 Coronary Arteries: Right Anterolateral Views with Arteriograms

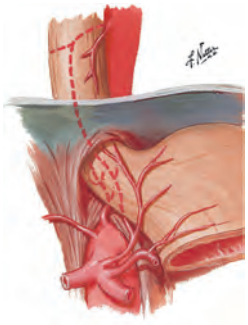


BP 47 Coronary Arteries and Cardiac Veins: Variations



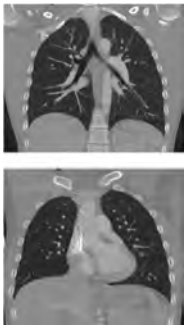
BP 48 Intrinsic Nerves and Variations in Nerves of Esophagus

ELECTRONIC BONUS PLATES—*cont'd*

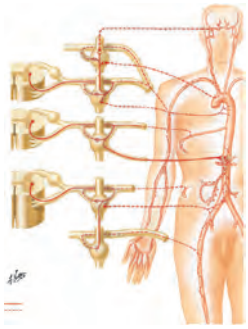


BP 49 Arteries of Esophagus: Variations

BP 50 Thorax: Coronal Section

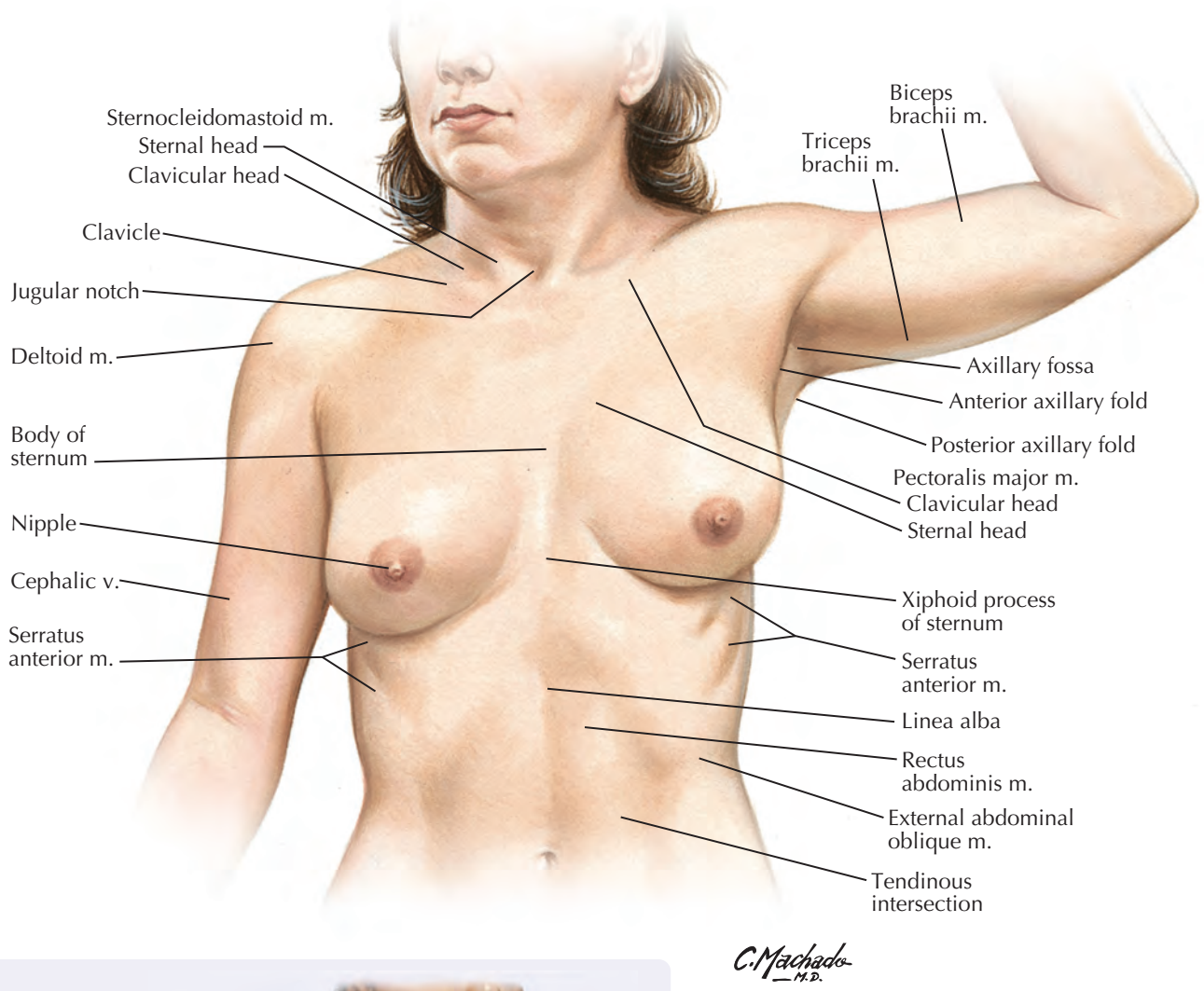


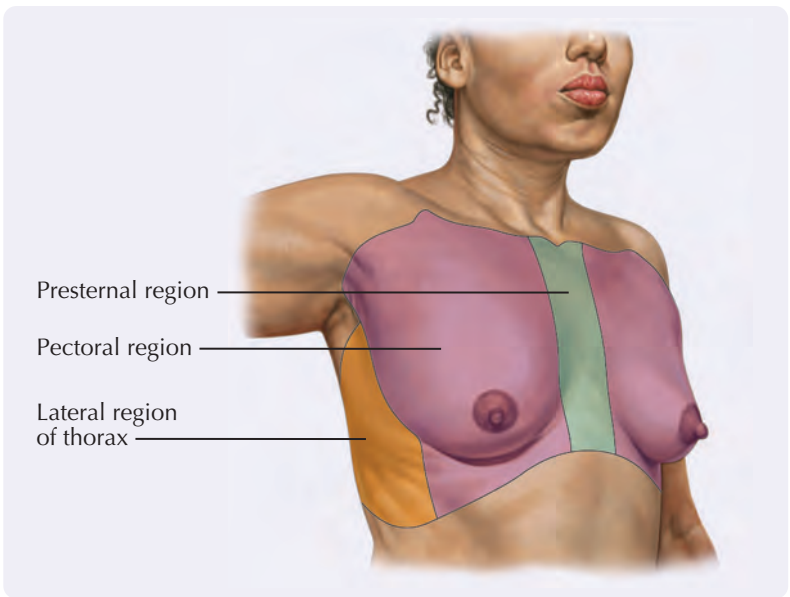
BP 51 Thorax: Coronal CTs

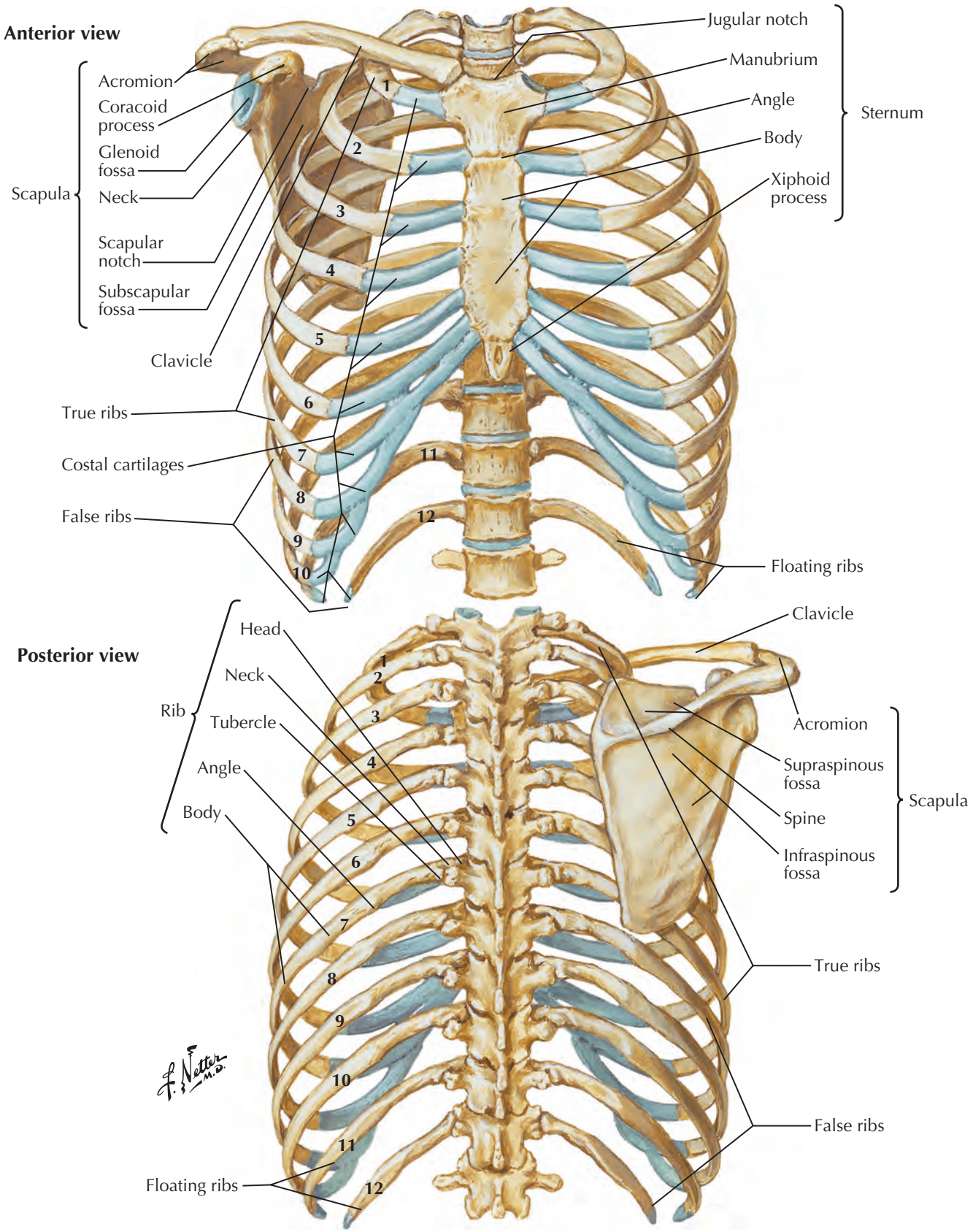


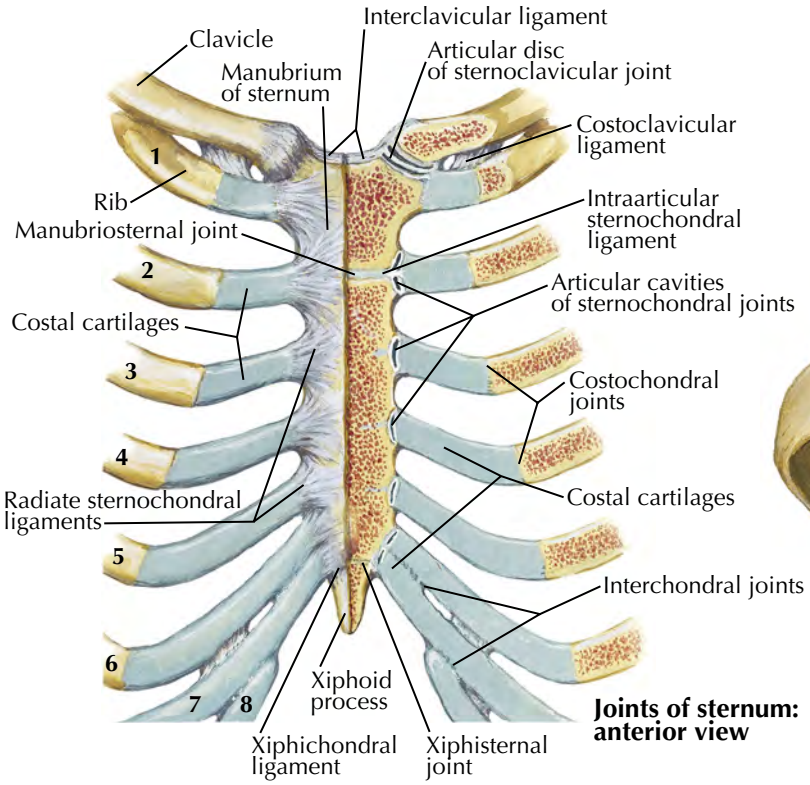
BP 52 Innervation of Blood Vessels: Schema

See also **Plates 188, 209**

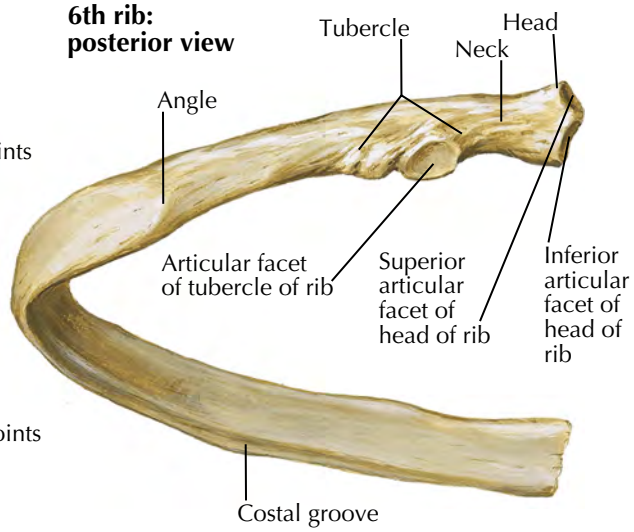





Anterior view
Acromion
Coracoid process
Glenoid fossa
Scapula
Neck
Scapular notch
Subscapular fossa
Clavicle
True ribs
Costal cartilages
False ribs
Jugular notch
Manubrium
Angle
Body
Xiphoid process
Sternum
Floating ribs
1
2
3
4
5
6
7
8
9
10
11
12
Posterior view
Rib
Head
Neck
Tubercle
Angle
Body
Clavicle
Acromion
Supraspinous fossa
Spine
Infraspinous fossa
Scapula
True ribs
False ribs
Floating ribs

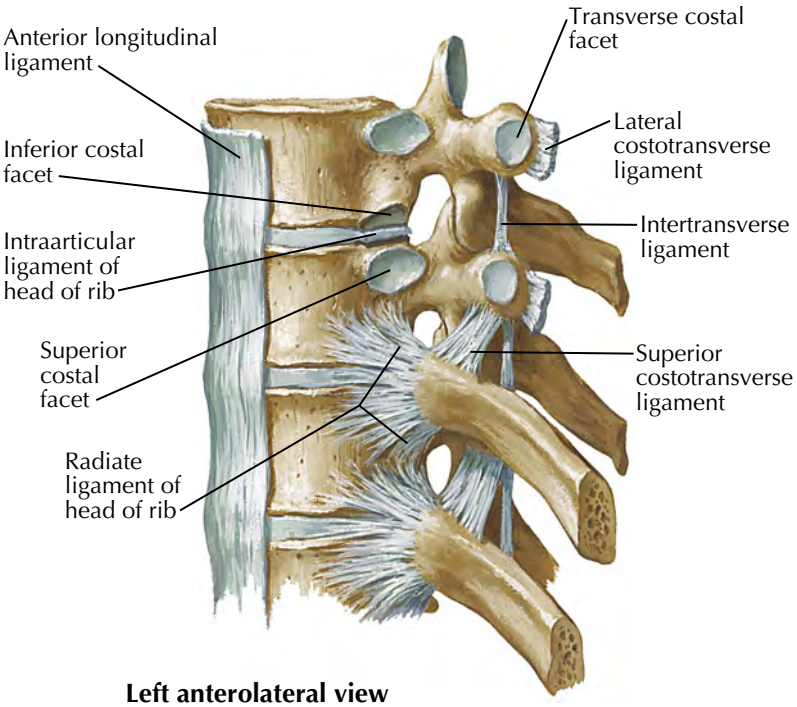


Joints of sternum: anterior view

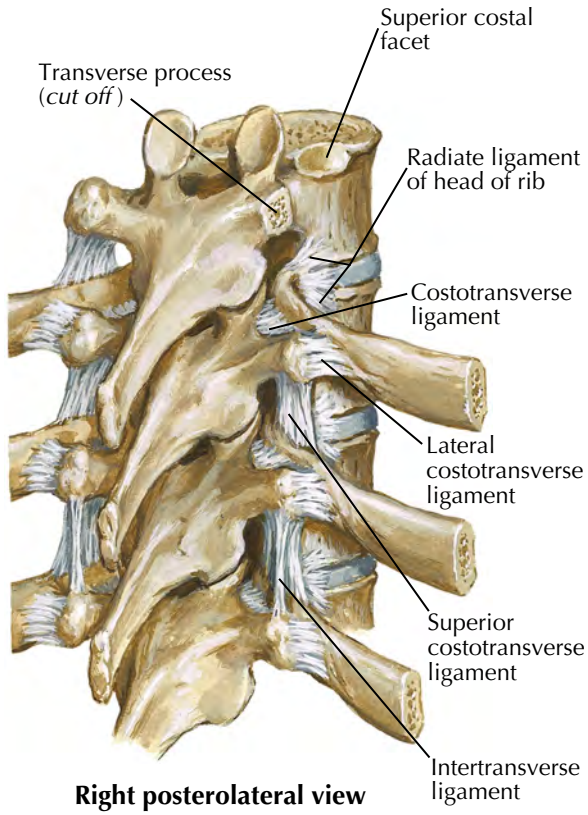


6th rib: posterior view

Note: The head of a typical rib articulates with the superior costal facet of the thoracic vertebra of the same number (by its inferior articular facet), the inferior costal facet of the vertebra above (by its superior articular facet), and the intervertebral disc between the two vertebrae. The costal tubercle articulates with the transverse process of the vertebra of the same number.

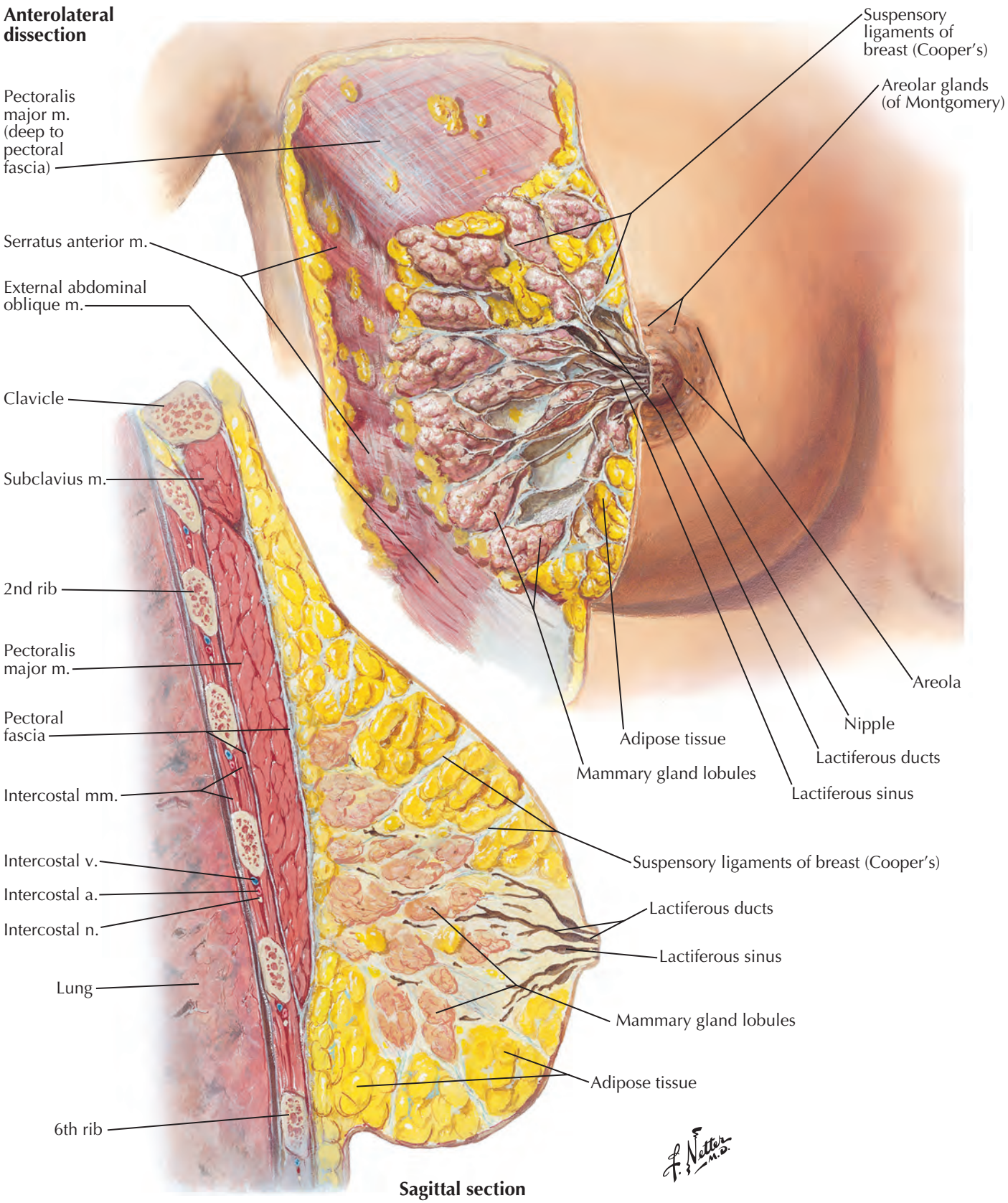


Left anterolateral view

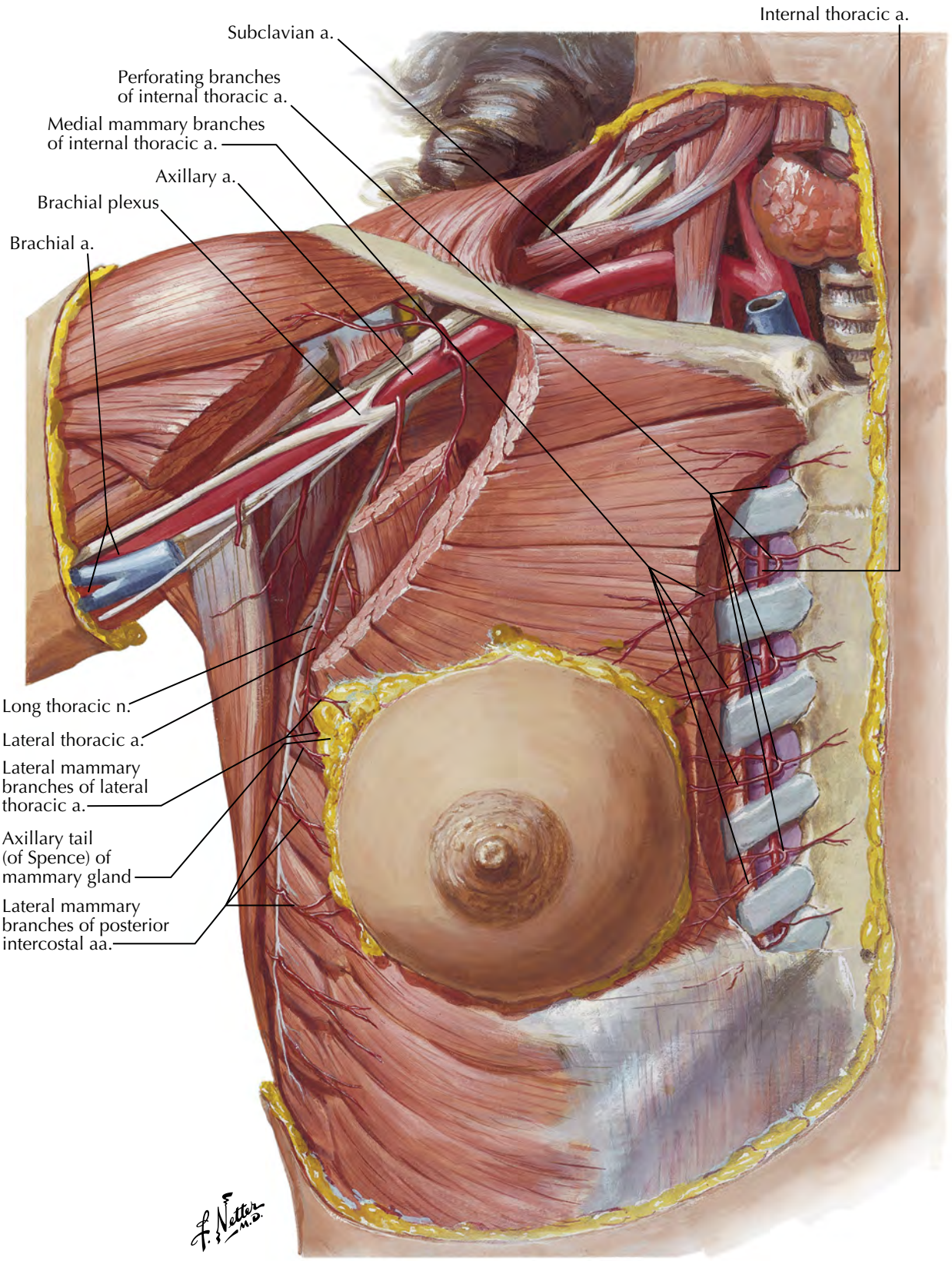


Right posterolateral view

Anterolateral dissection

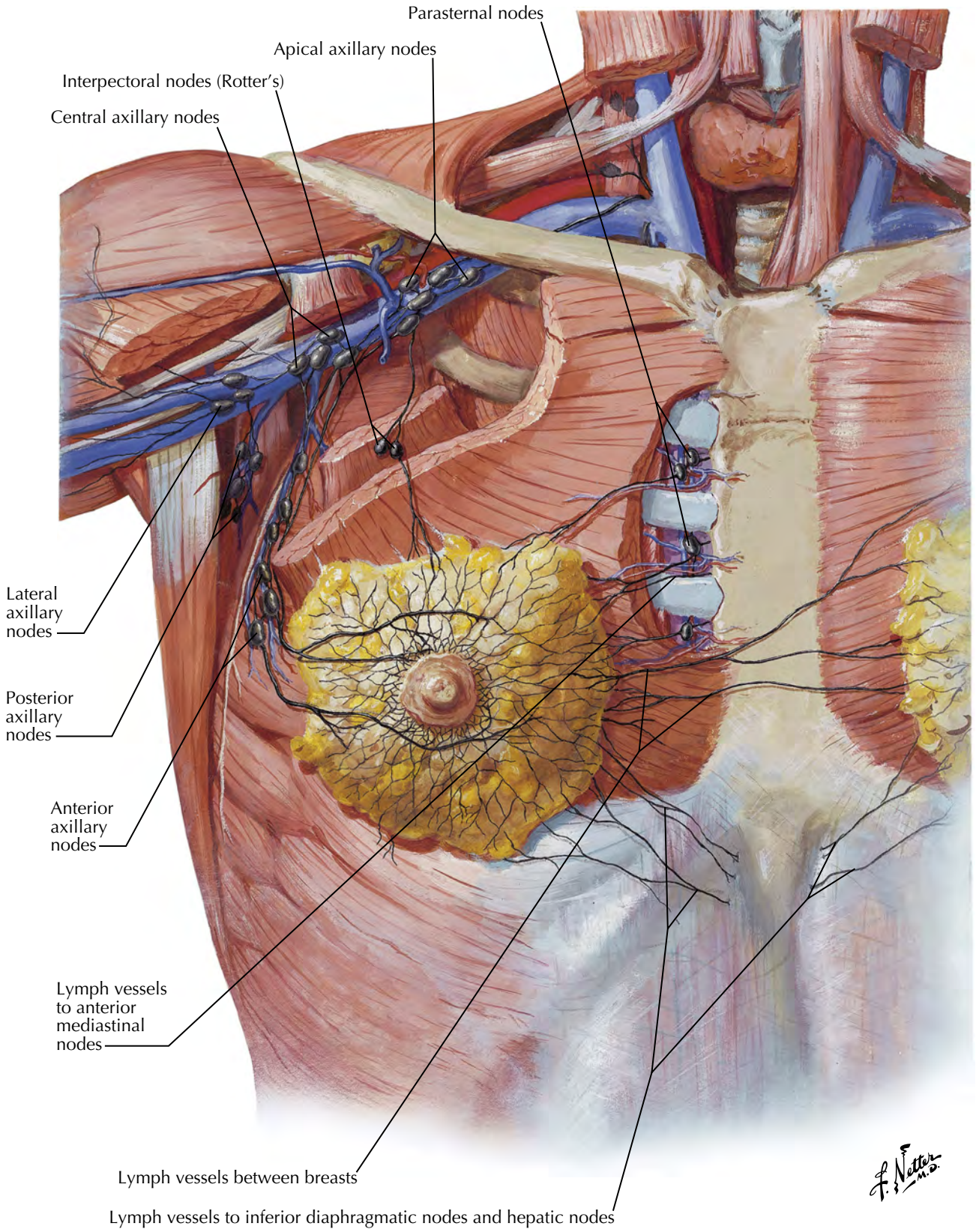


Sagittal section

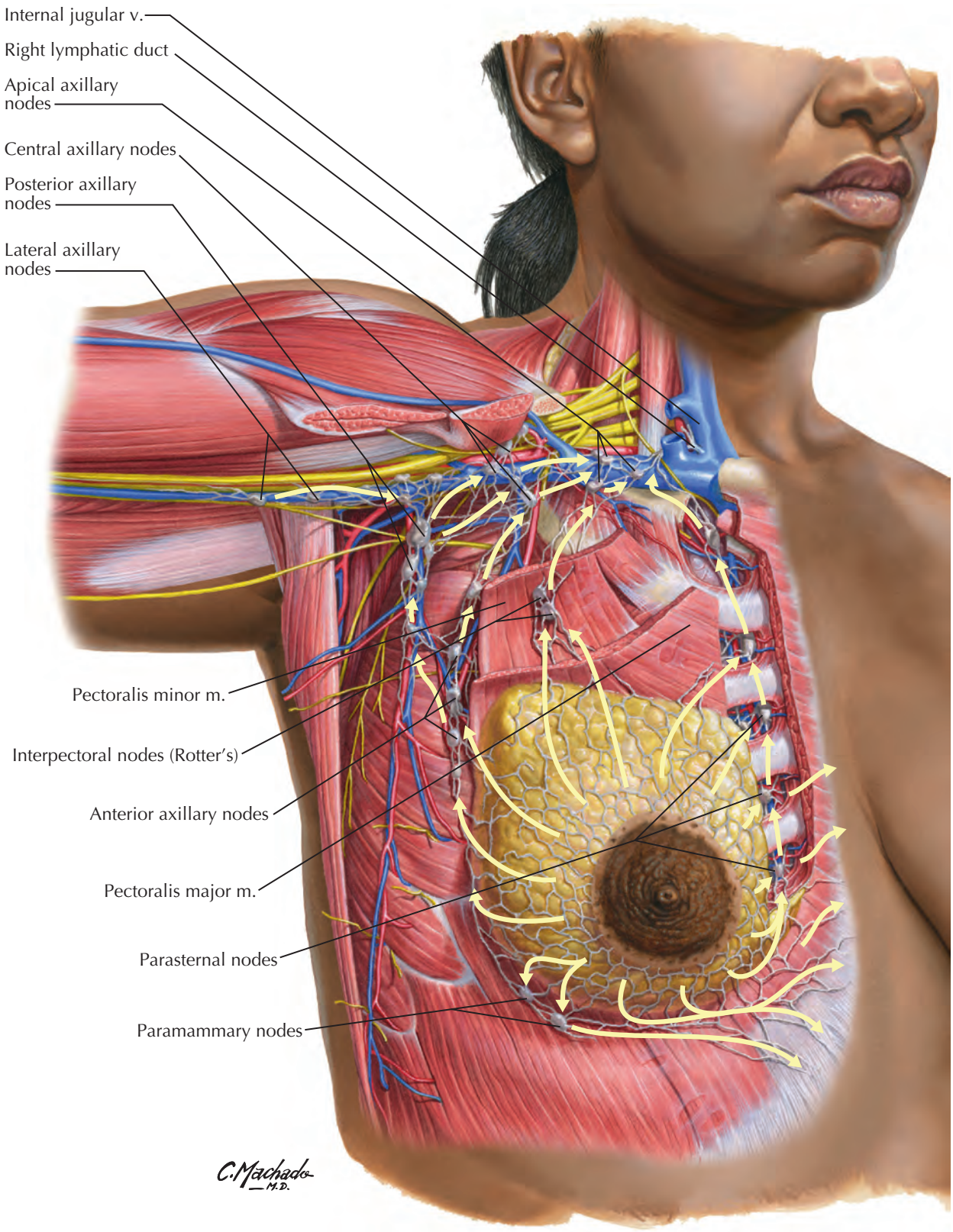

Internal thoracic a.
Subclavian a.
Perforating branches of internal thoracic a.
Medial mammary branches of internal thoracic a.
Axillary a.
Brachial plexus
Brachial a.
Long thoracic n.
Lateral thoracic a.
Lateral mammary branches of lateral thoracic a.
Axillary tail (of Spence) of mammary gland
Lateral mammary branches of posterior intercostal aa.

Lymph Vessels and Lymph Nodes of Breast

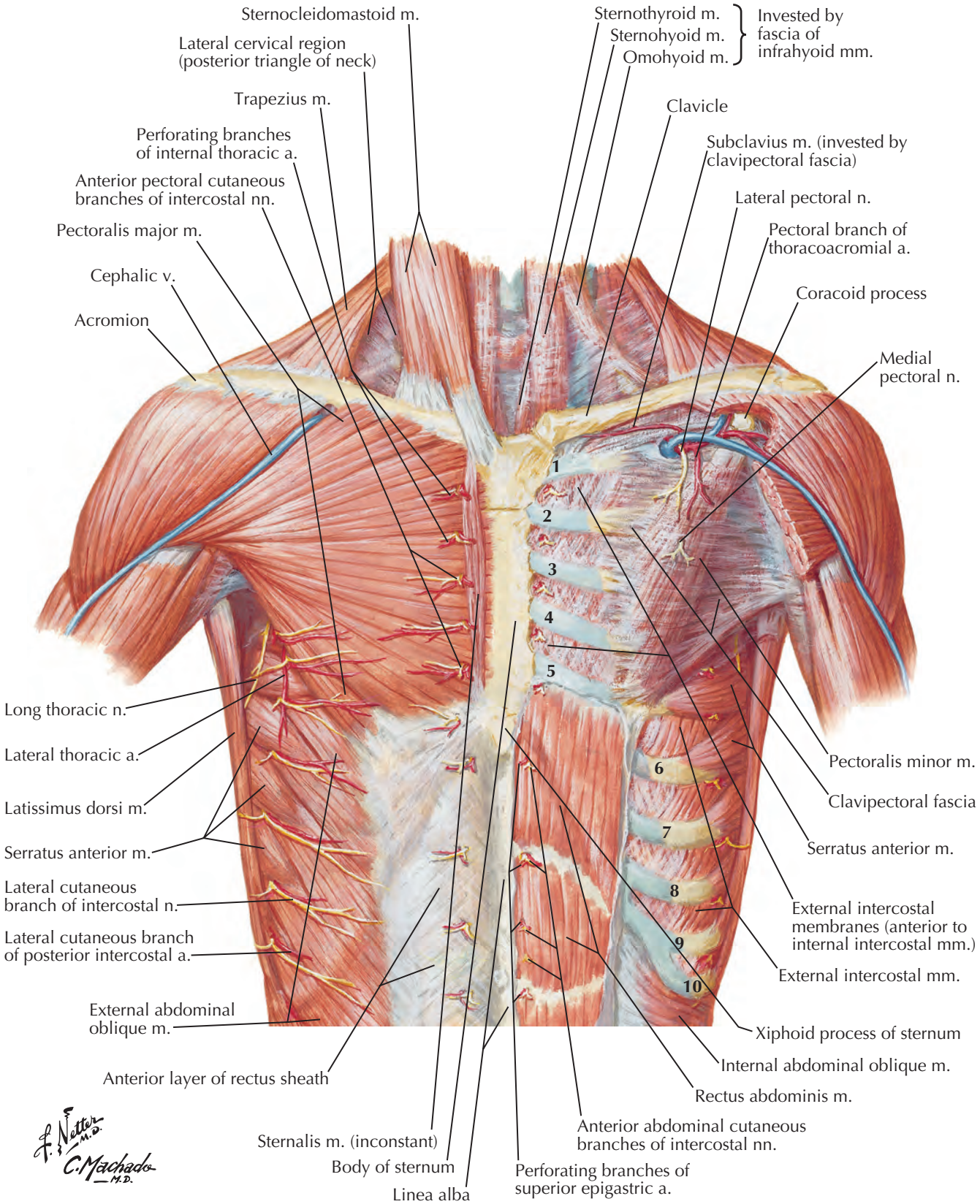
See also **Plate 208**



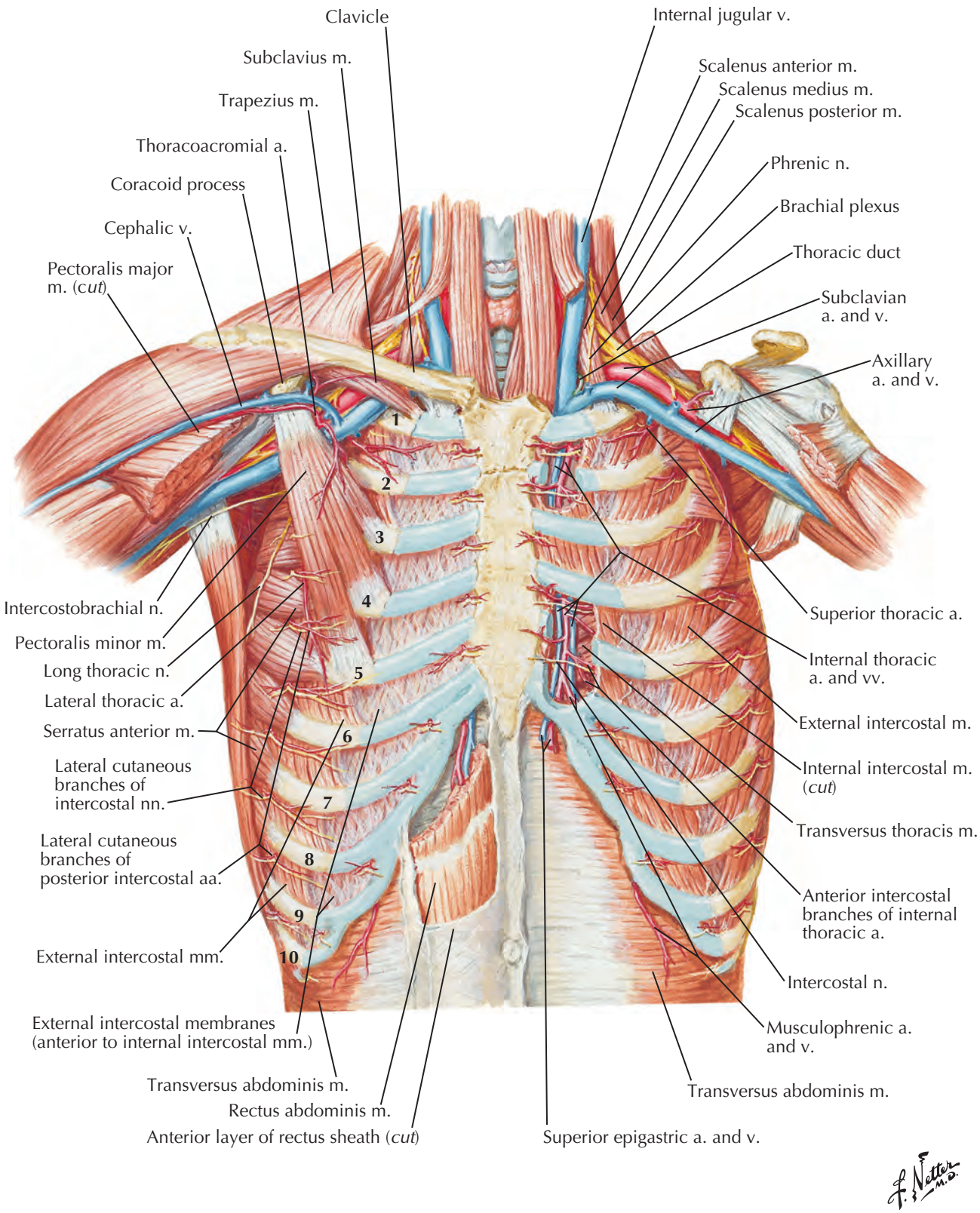
See also **Plate 207**



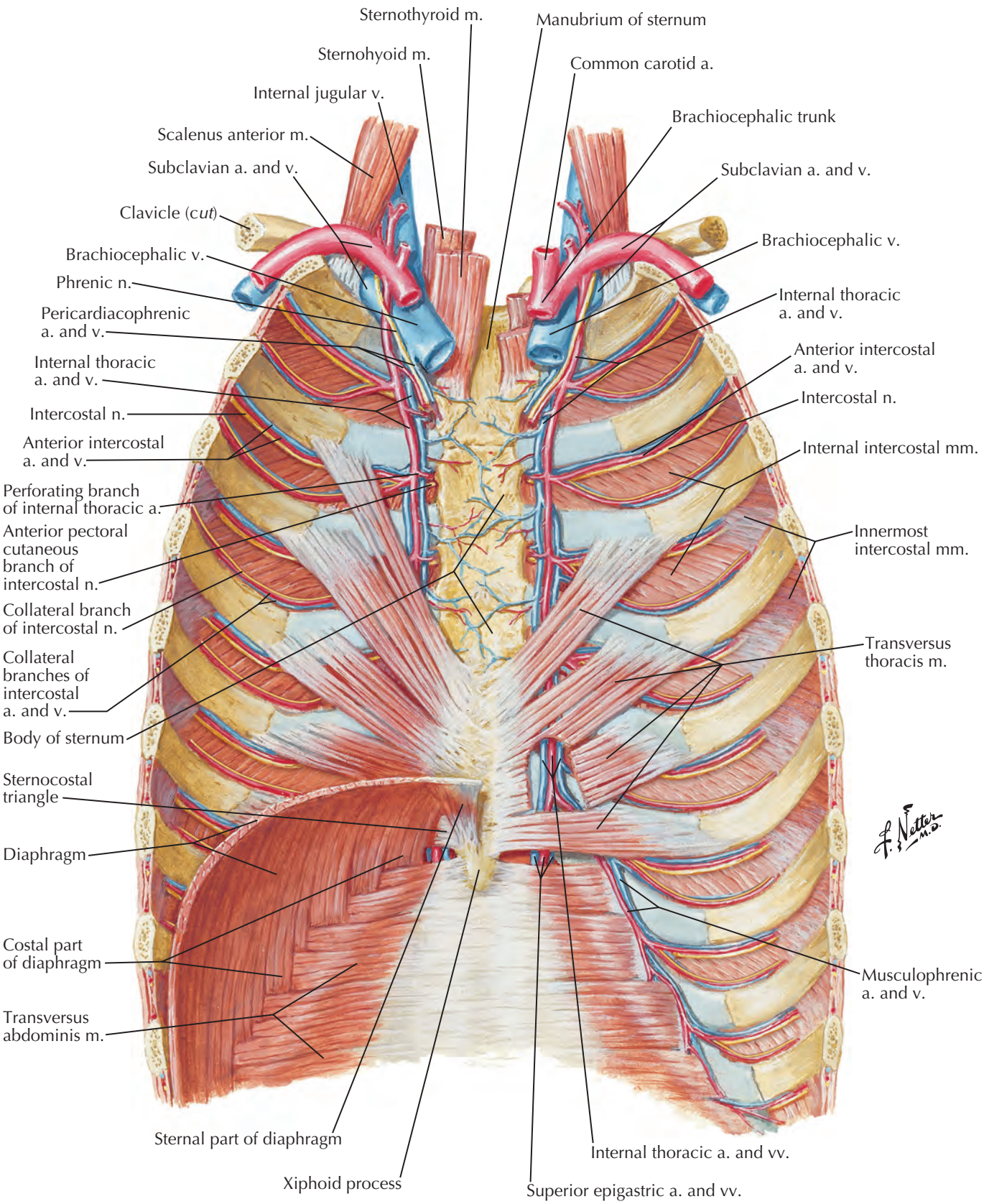
See also **Plates BP 42, BP 43**



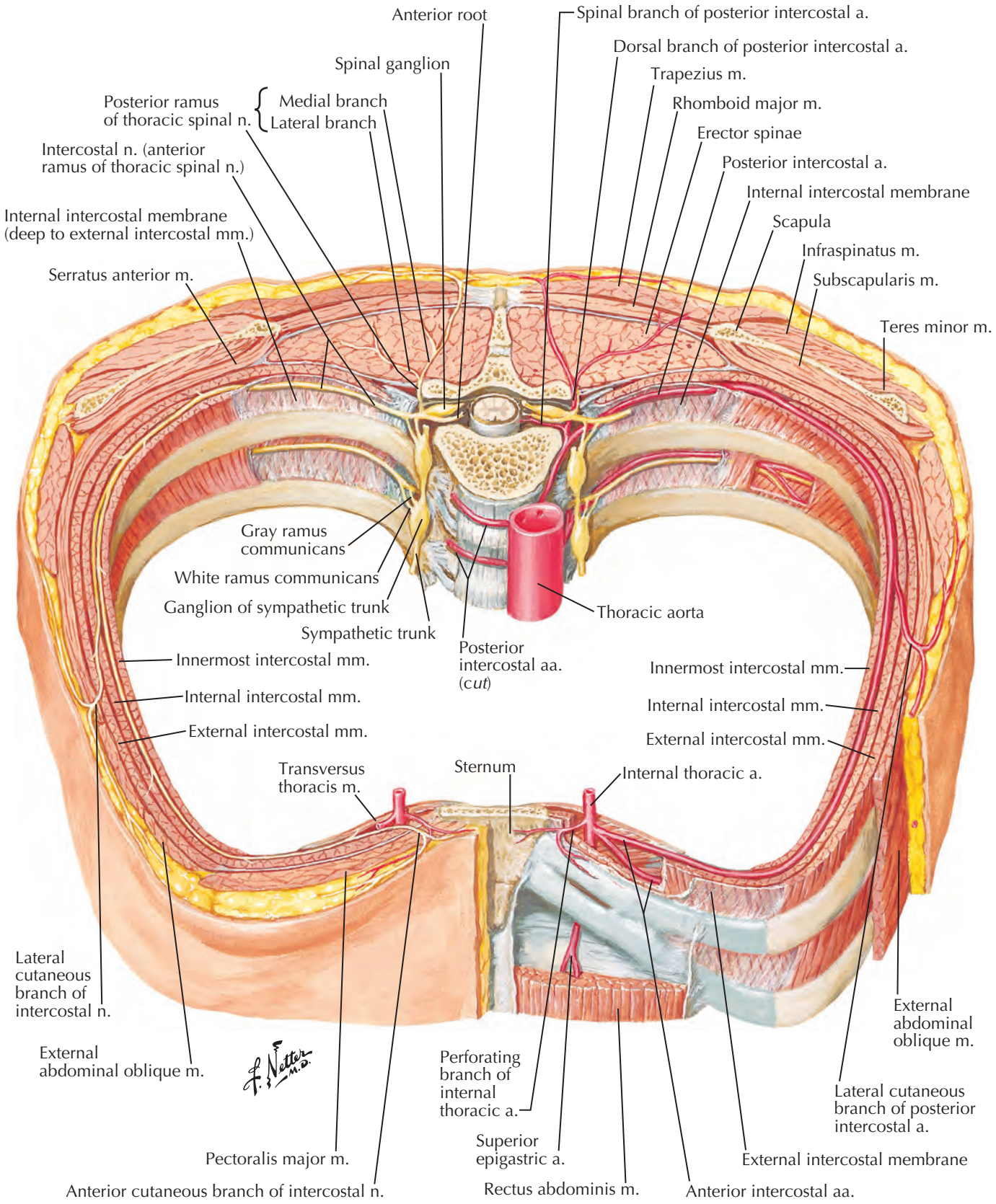
See also **Plates BP 41, BP 42**



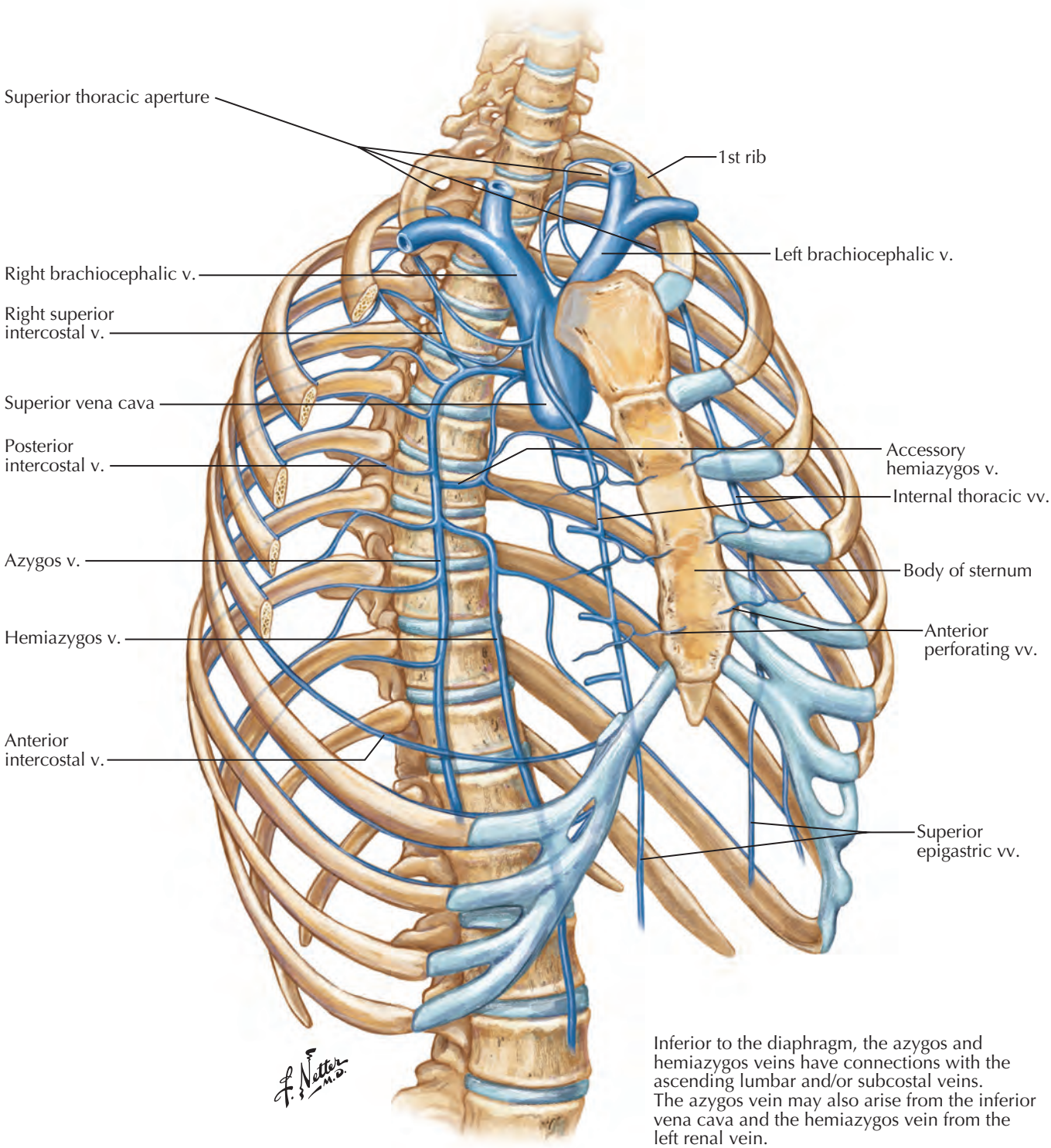
See also **Plate BP 42**



See also **Plates 279, 287**

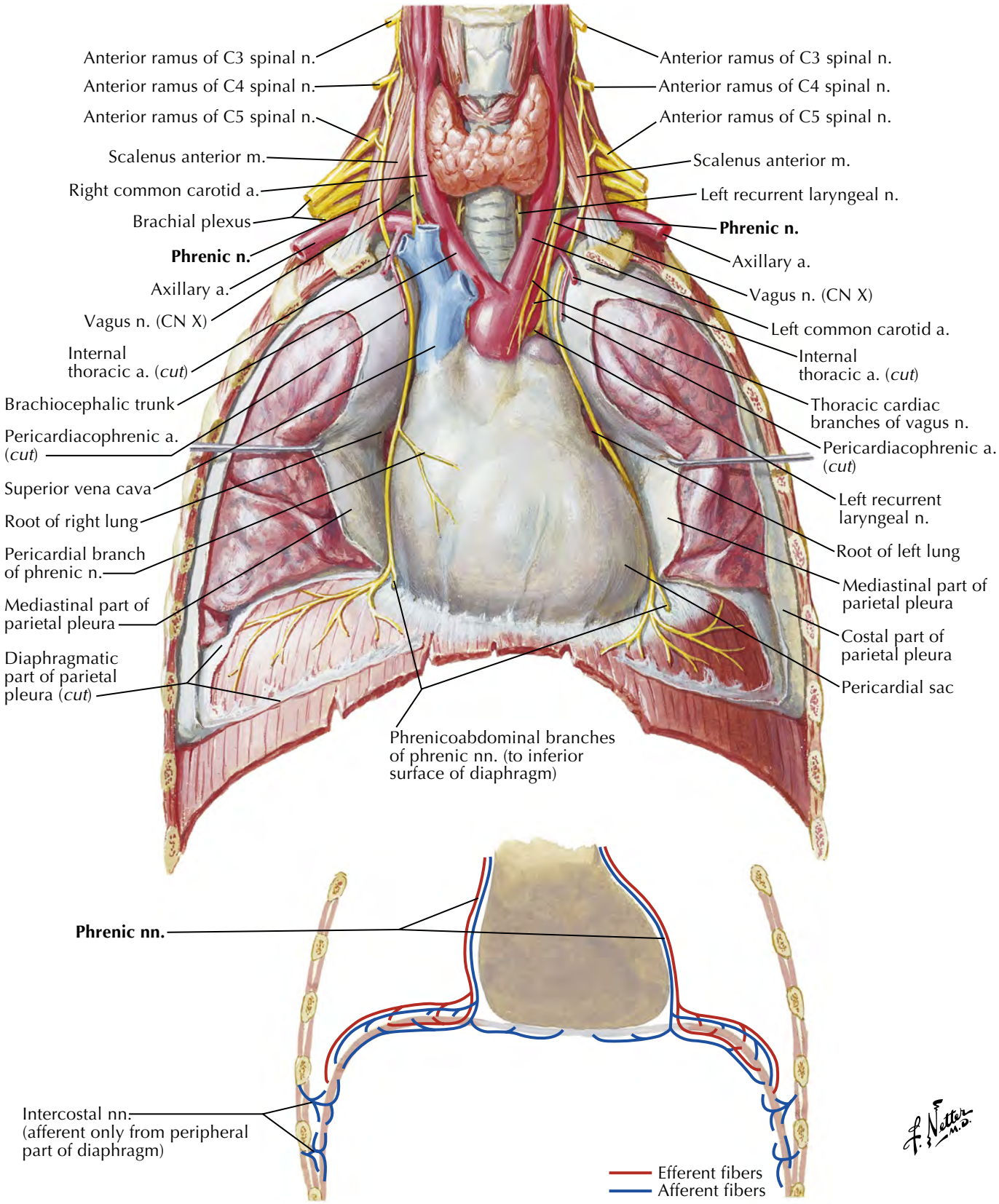


See also **Plates 234, 259, 277**

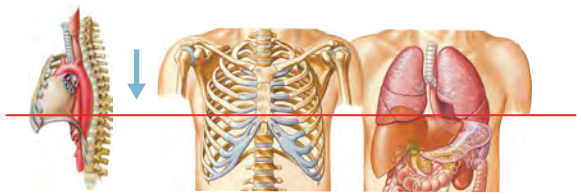


Inferior to the diaphragm, the azygos and hemiazygos veins have connections with the ascending lumbar and/or subcostal veins. The azygos vein may also arise from the inferior vena cava and the hemiazygos vein from the left renal vein.

See also **Plates 56, 103**

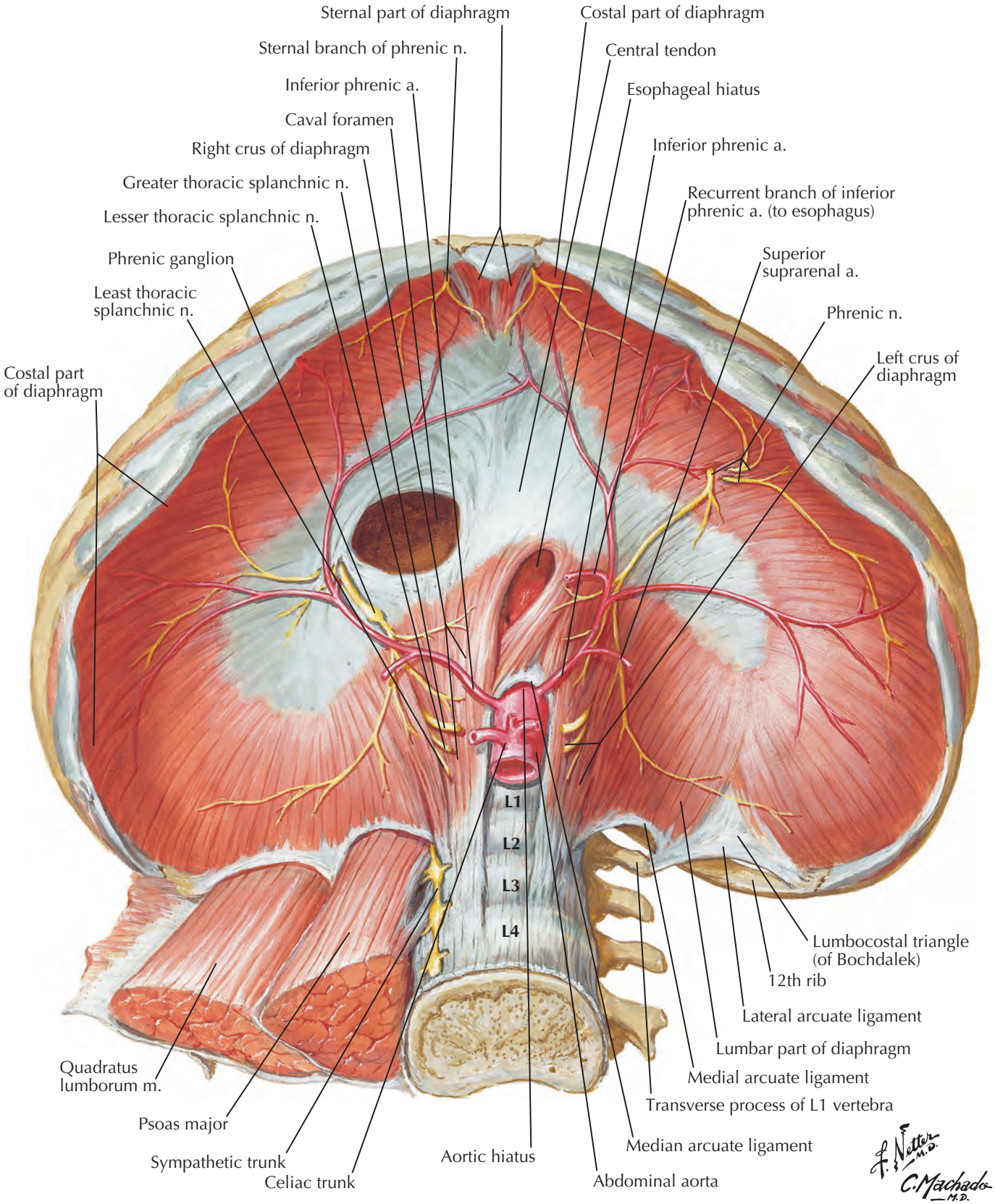


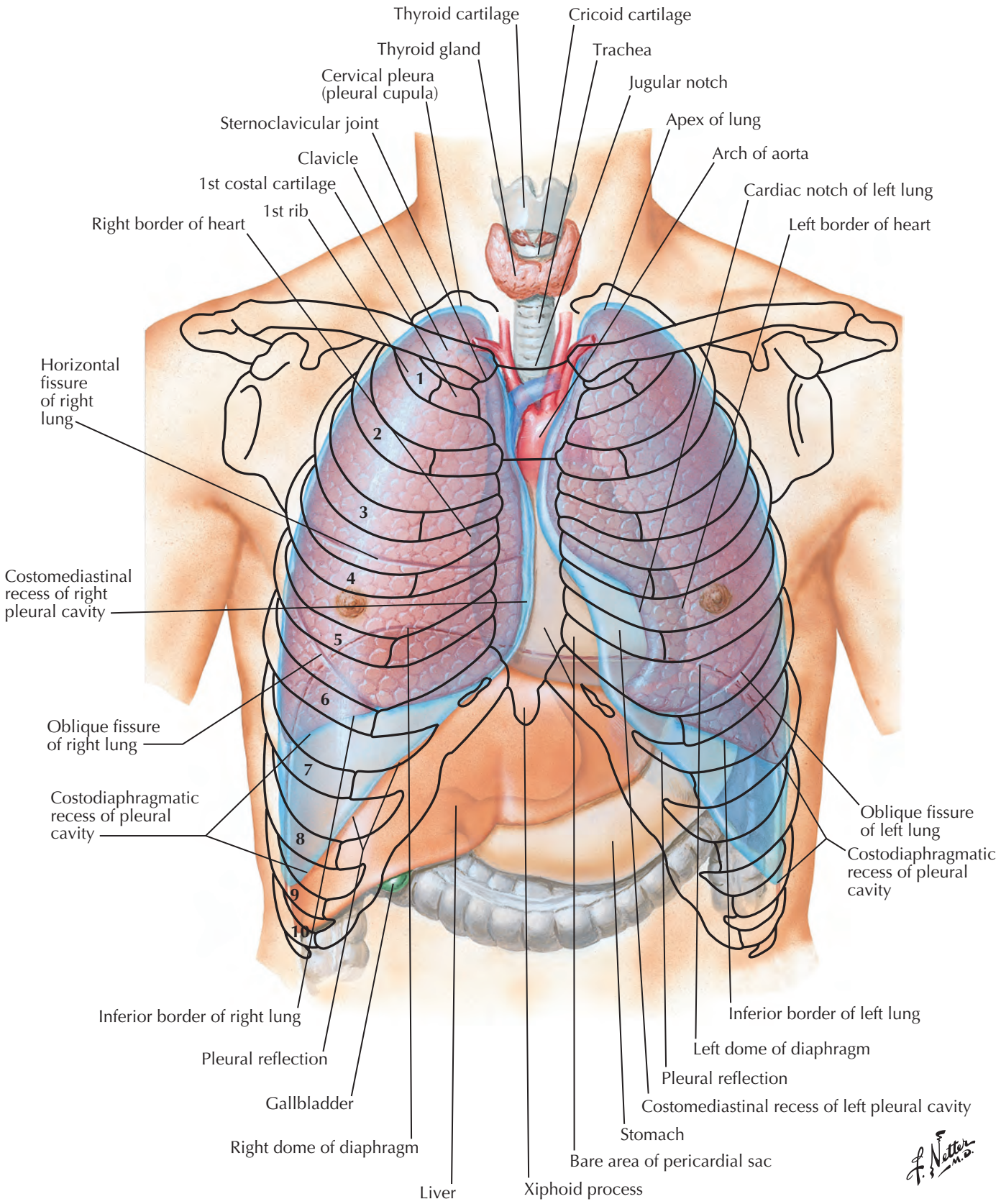
See also **Plates 253, 254**

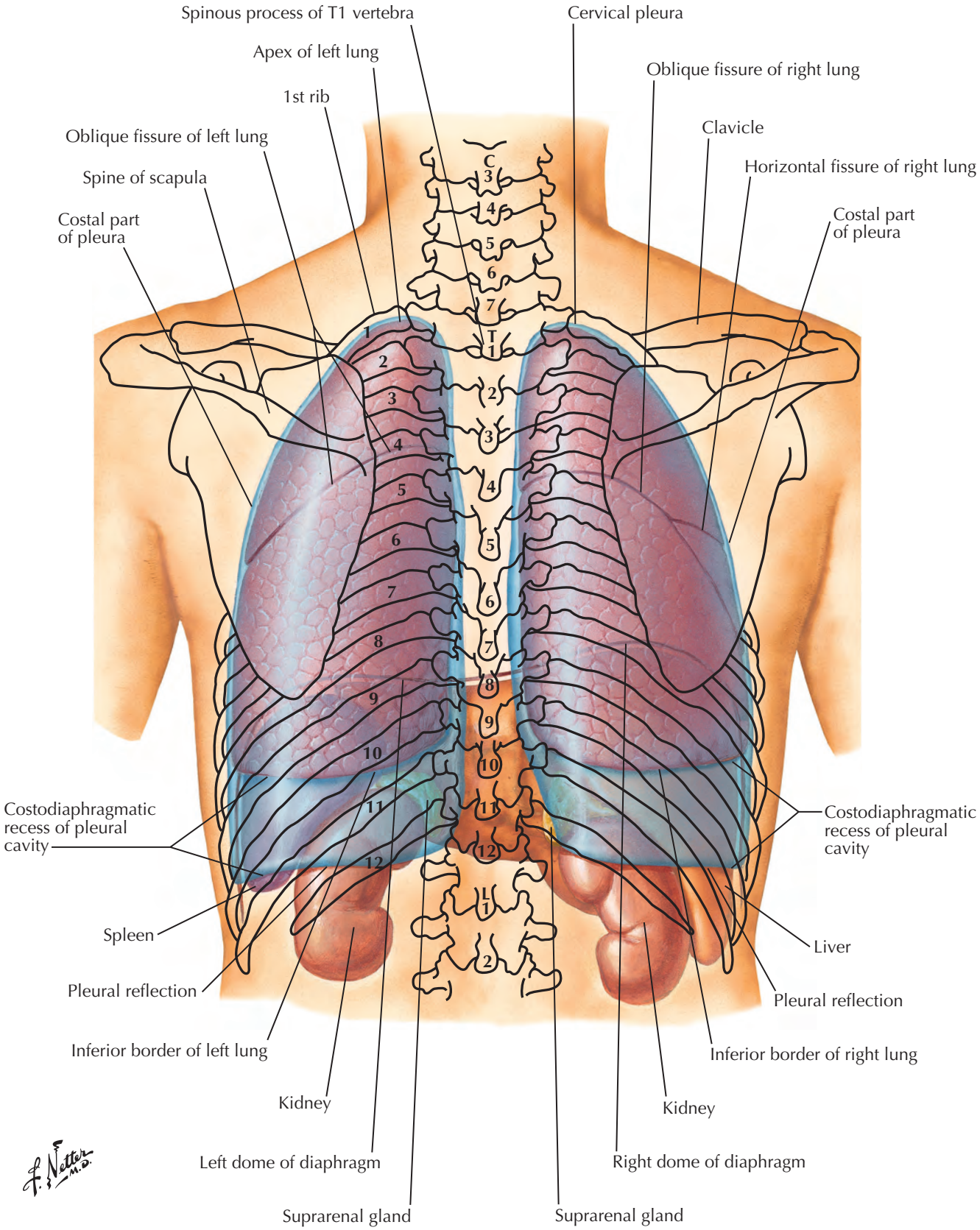


Central tendon (covered by pericardium)
5th costal cartilage
Internal thoracic a. and vv.
Costomediastinal recess of pleural cavity
Pericardial sac
Pericardiacophrenic a. and v.
Phrenic n.
Mediastinal part of pleura
Pericardial sac (*cut*)
Central tendon
Diaphragmatic part of pleura (*cut away*)
Sternum
Anterior mediastinum
Costomediastinal recess of pleural cavity
Internal thoracic a. and vv.
Inferior vena cava
Costodiaphragmatic recess of pleural cavity
Mediastinal part of pleura
Pericardial sac (*cut*)
Pericardiacophrenic a.
Phrenic n.
Diaphragmatic part of pleura (*cut away*)
Central tendon
Thoracic duct
Azygos v.
Costal part of pleura
Greater thoracic splanchnic n.
Sympathetic trunk
T8/T9 intervertebral disc
Descending aorta
Esophagus
Mediastinal part of pleura
Hemiazygos v.
Greater thoracic splanchnic n.
Sympathetic trunk

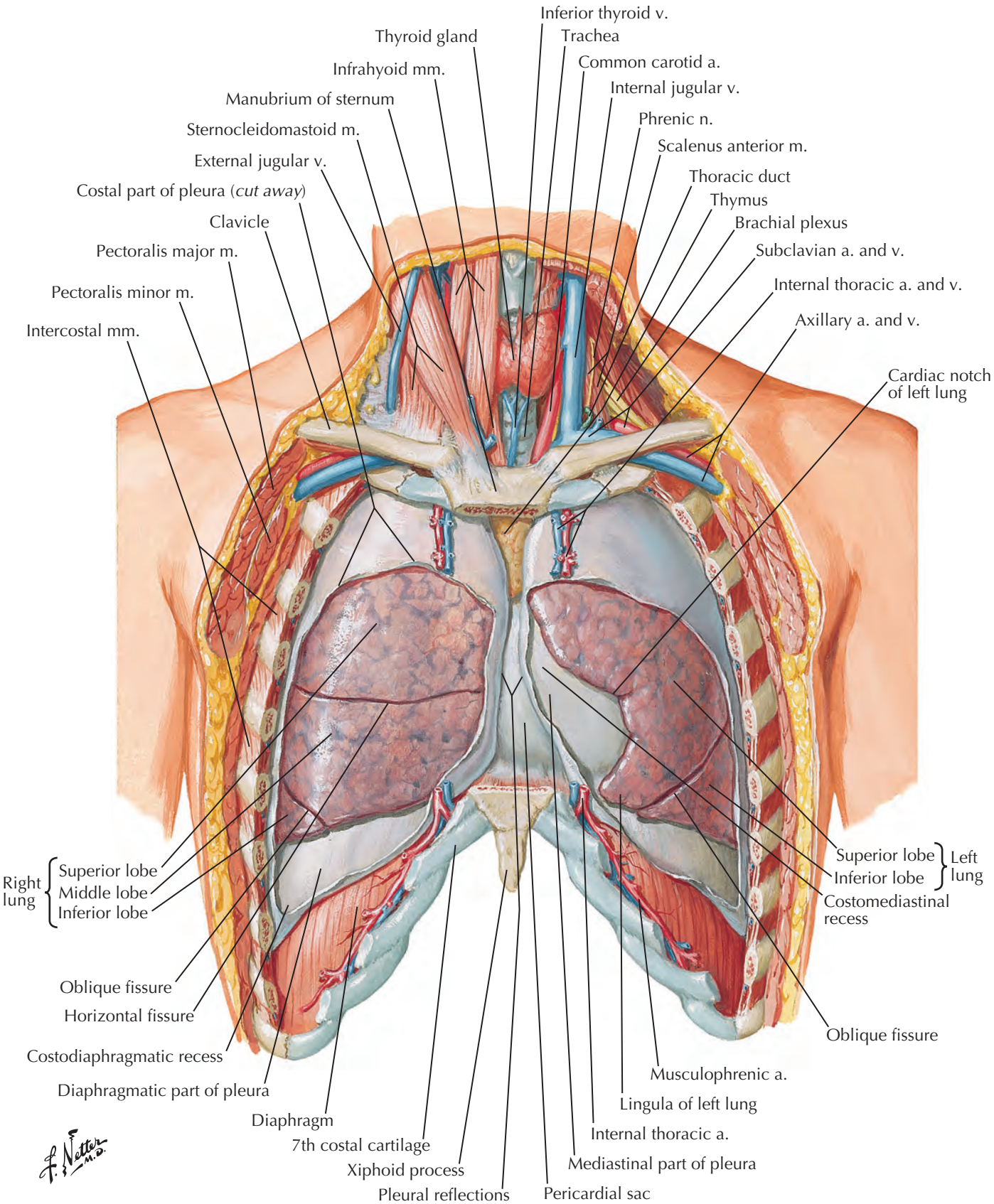
See also **Plates 283, 284**



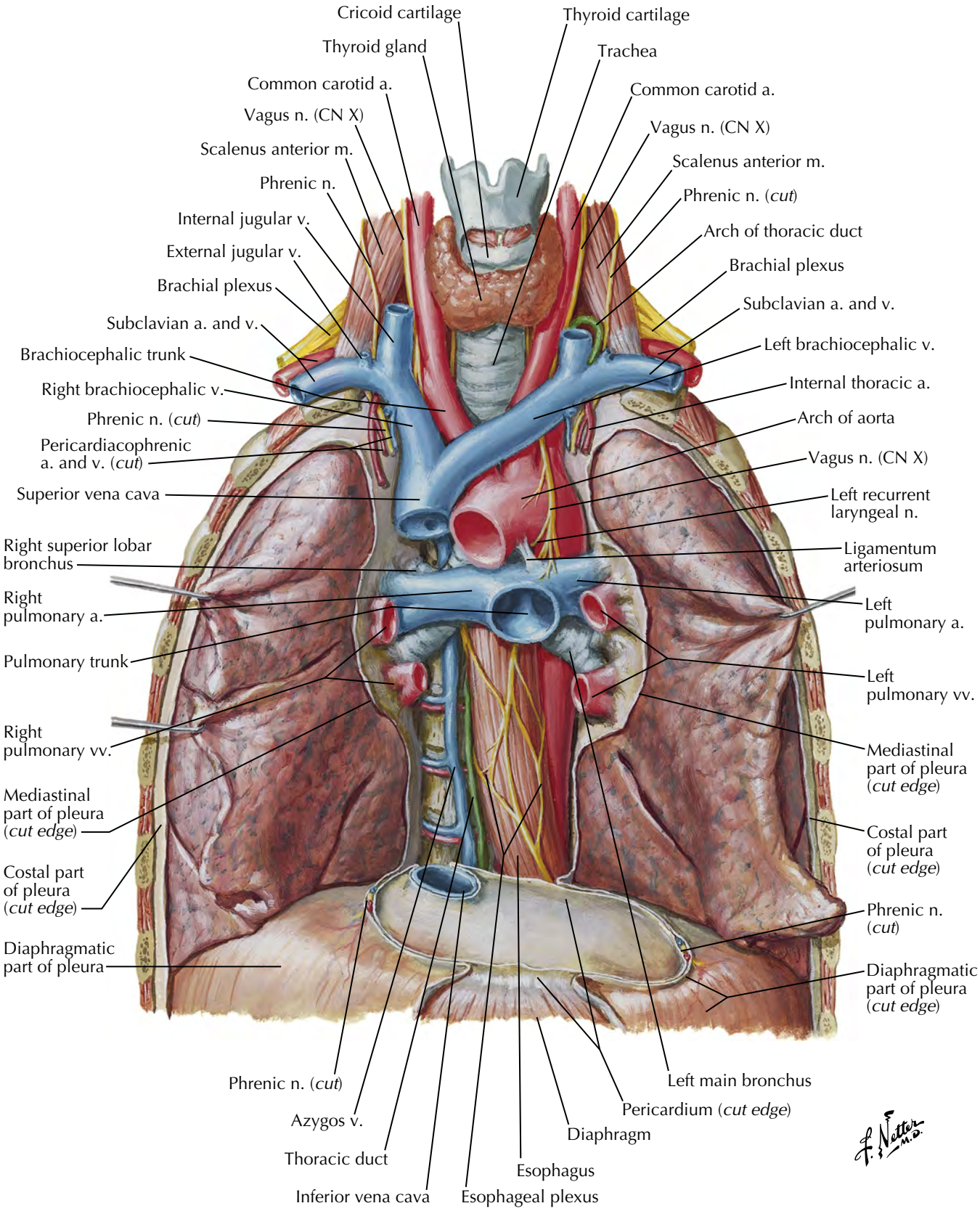

Thyroid cartilage
Cricoid cartilage
Thyroid gland
Trachea
Cervical pleura (pleural cupula)
Jugular notch
Sternoclavicular joint
Apex of lung
Clavicle
Arch of aorta
1st costal cartilage
Cardiac notch of left lung
1st rib
Right border of heart
Left border of heart
Horizontal fissure of right lung
1
2
3
4
5
6
7
8
9
10
Costomediastinal recess of right pleural cavity
Oblique fissure of right lung
Costodiaphragmatic recess of pleural cavity
Oblique fissure of left lung
Costodiaphragmatic recess of pleural cavity
Inferior border of right lung
Inferior border of left lung
Pleural reflection
Left dome of diaphragm
Pleural reflection
Gallbladder
Costomediastinal recess of left pleural cavity
Stomach
Right dome of diaphragm
Bare area of pericardial sac
Liver
Xiphoid process

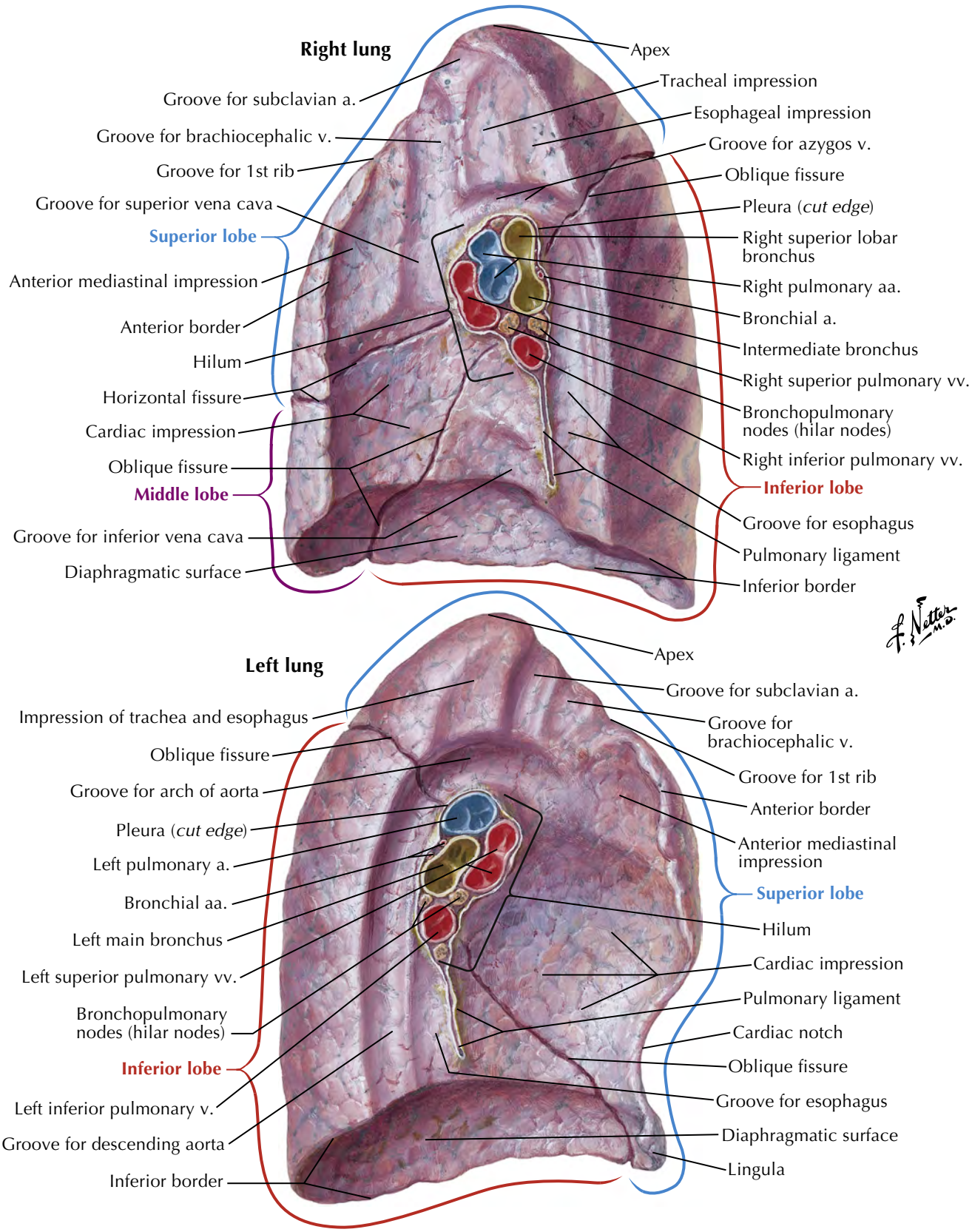

Spinous process of T1 vertebra
Apex of left lung
1st rib
Oblique fissure of left lung
Spine of scapula
Costal part of pleura
Cervical pleura
Oblique fissure of right lung
Clavicle
Horizontal fissure of right lung
Costal part of pleura
C 3
4
5
6
7
T 1
2
3
4
5
6
7
8
9
10
11
12
L 1
2
Costodiaphragmatic recess of pleural cavity
Spleen
Pleural reflection
Inferior border of left lung
Kidney
Left dome of diaphragm
Suprarenal gland
Costodiaphragmatic recess of pleural cavity
Liver
Pleural reflection
Inferior border of right lung
Kidney
Right dome of diaphragm
Suprarenal gland

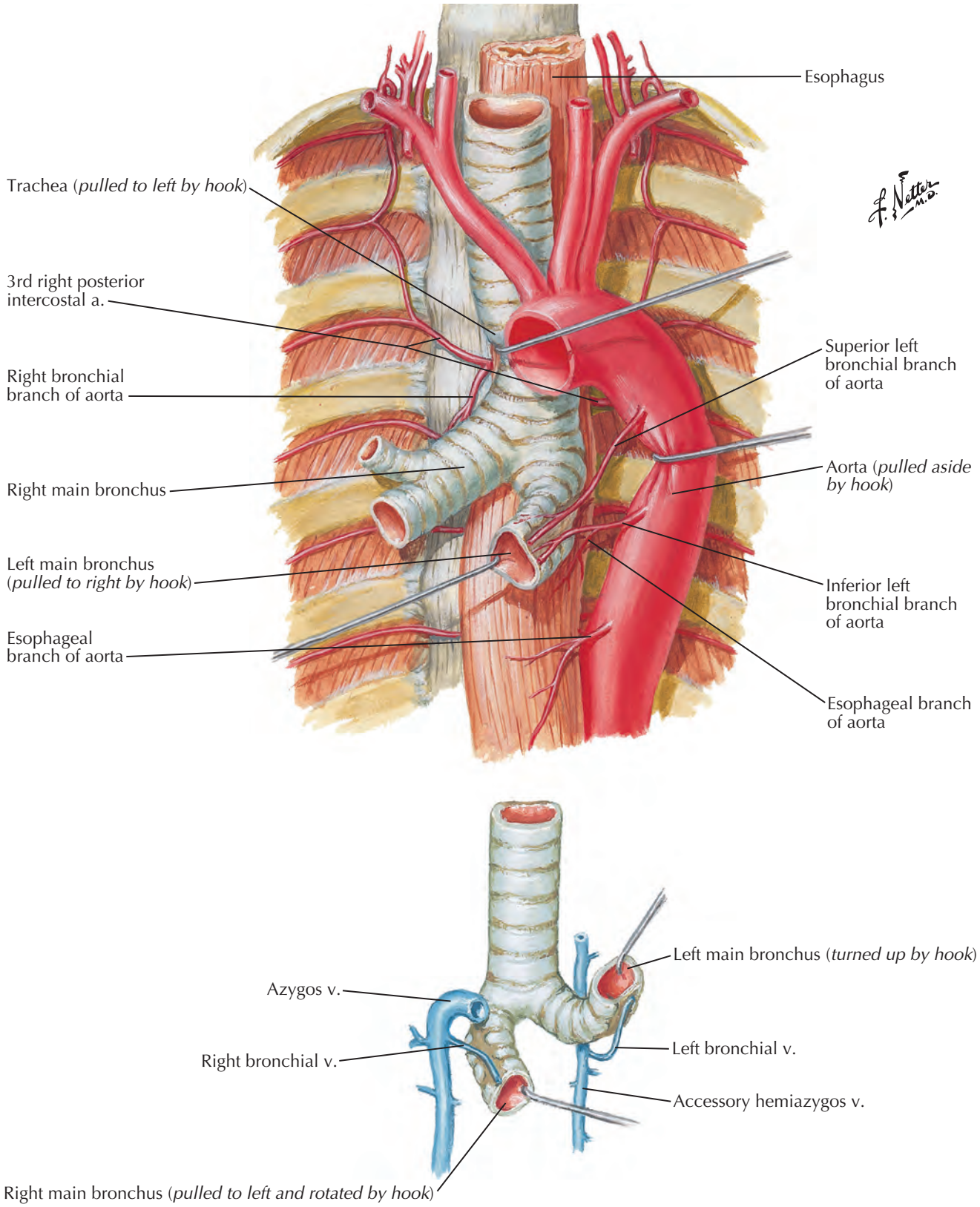
See also **Plate 17**



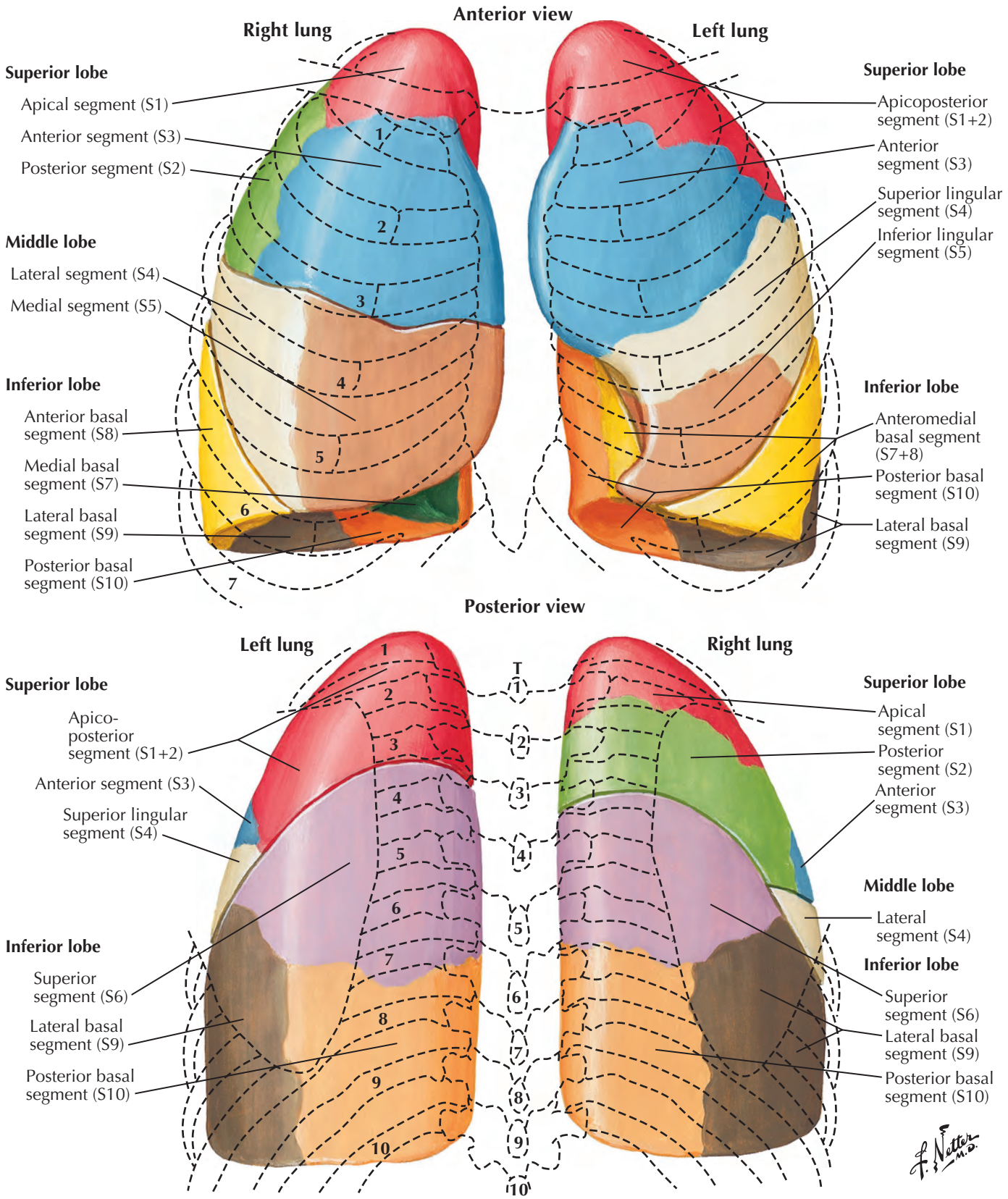
See also **Plate 227**




Right lung
Apex
Tracheal impression
Esophageal impression
Groove for azygos v.
Oblique fissure
Pleura (cut edge)
Right superior lobar bronchus
Right pulmonary aa.
Bronchial a.
Intermediate bronchus
Right superior pulmonary vv.
Bronchopulmonary nodes (hilar nodes)
Right inferior pulmonary vv.
Inferior lobe
Groove for esophagus
Pulmonary ligament
Inferior border
Groove for subclavian a.
Groove for brachiocephalic v.
Groove for 1st rib
Groove for superior vena cava
Superior lobe
Anterior mediastinal impression
Anterior border
Hilum
Horizontal fissure
Cardiac impression
Oblique fissure
Middle lobe
Groove for inferior vena cava
Diaphragmatic surface
Left lung
Apex
Groove for subclavian a.
Groove for brachiocephalic v.
Groove for 1st rib
Anterior border
Anterior mediastinal impression
Superior lobe
Hilum
Cardiac impression
Pulmonary ligament
Cardiac notch
Oblique fissure
Groove for esophagus
Diaphragmatic surface
Lingula
Impression of trachea and esophagus
Oblique fissure
Groove for arch of aorta
Pleura (cut edge)
Left pulmonary a.
Bronchial aa.
Left main bronchus
Left superior pulmonary vv.
Bronchopulmonary nodes (hilar nodes)
Inferior lobe
Left inferior pulmonary v.
Groove for descending aorta
Inferior border

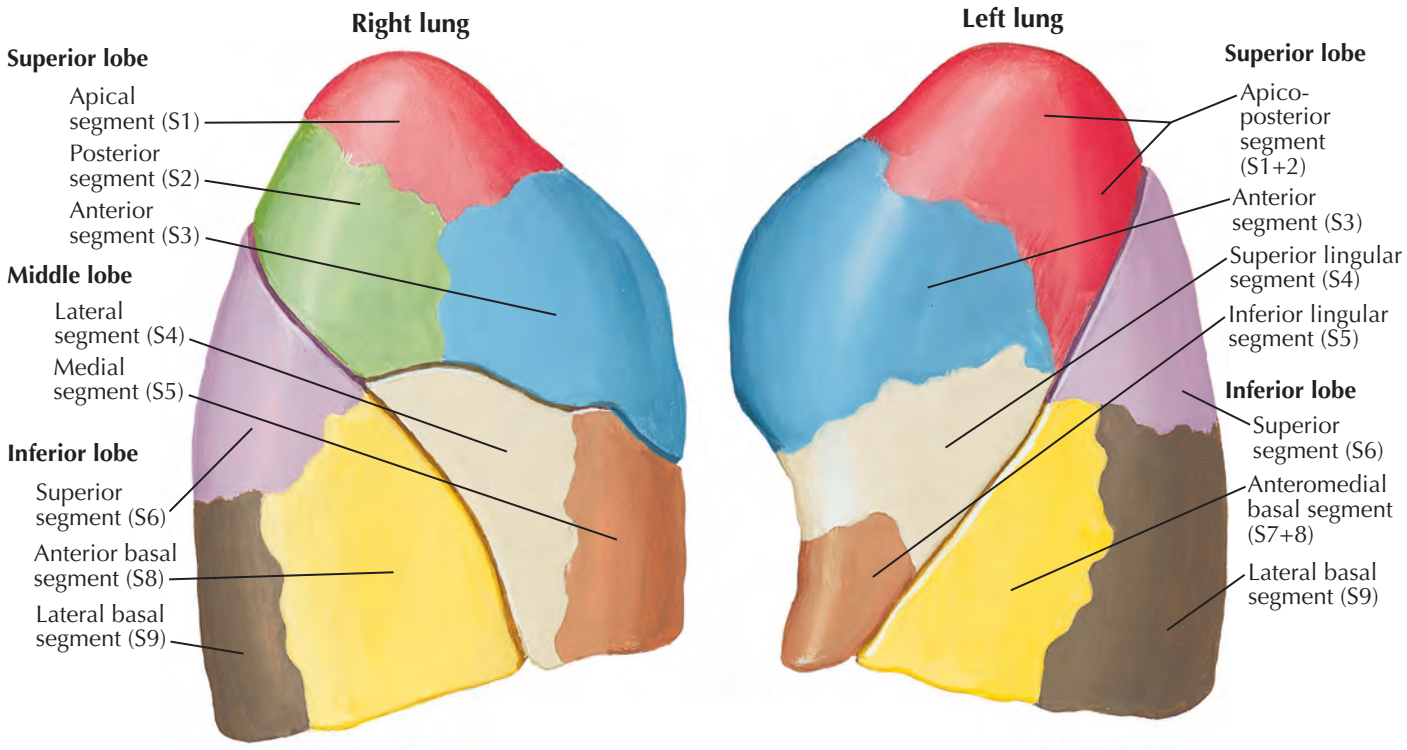

Esophagus
Trachea (*pulled to left by hook*)
3rd right posterior intercostal a.
Right bronchial branch of aorta
Right main bronchus
Left main bronchus (*pulled to right by hook*)
Esophageal branch of aorta
Superior left bronchial branch of aorta
Aorta (*pulled aside by hook*)
Inferior left bronchial branch of aorta
Esophageal branch of aorta
Left main bronchus (*turned up by hook*)
Azygos v.
Right bronchial v.
Left bronchial v.
Accessory hemiazygos v.
Right main bronchus (*pulled to left and rotated by hook*)

See also **Plate 226**

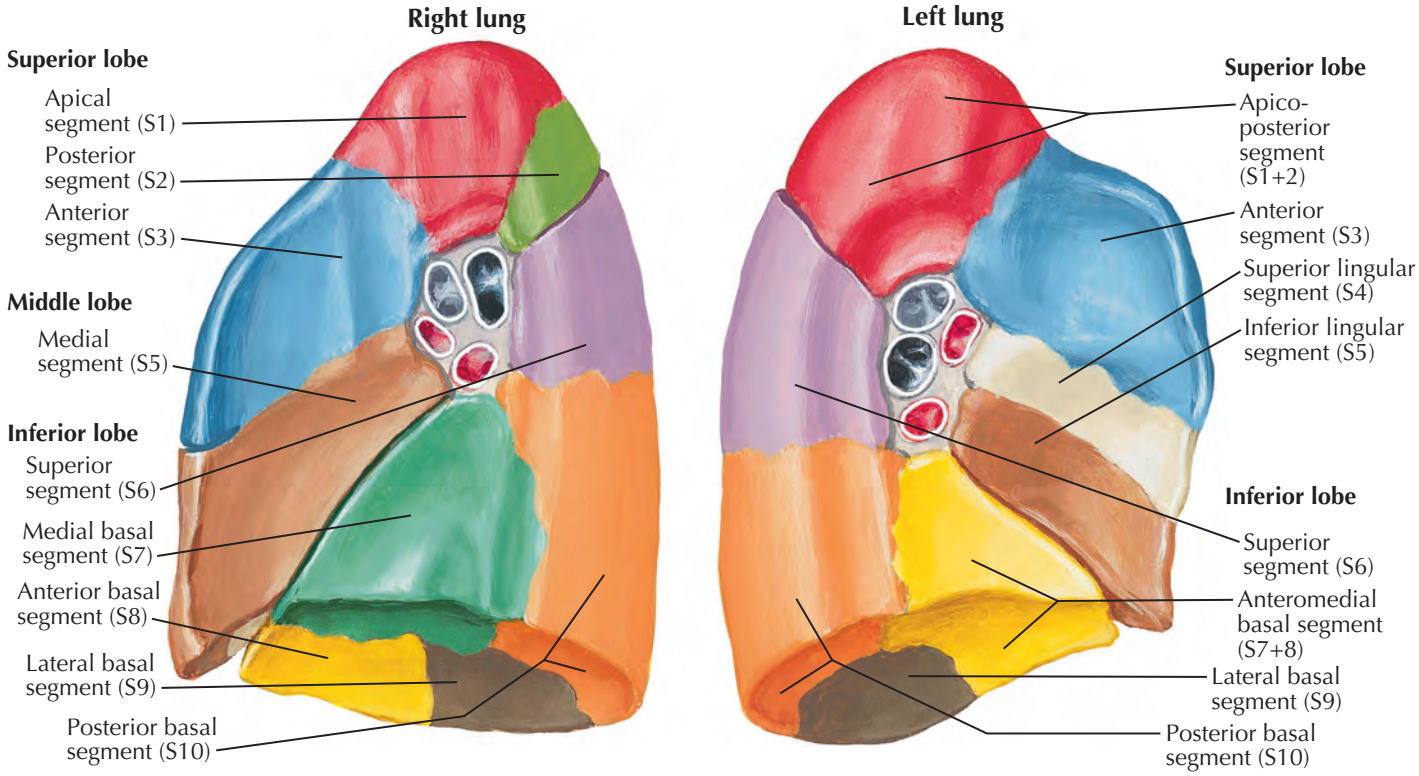


See also **Plate 226**

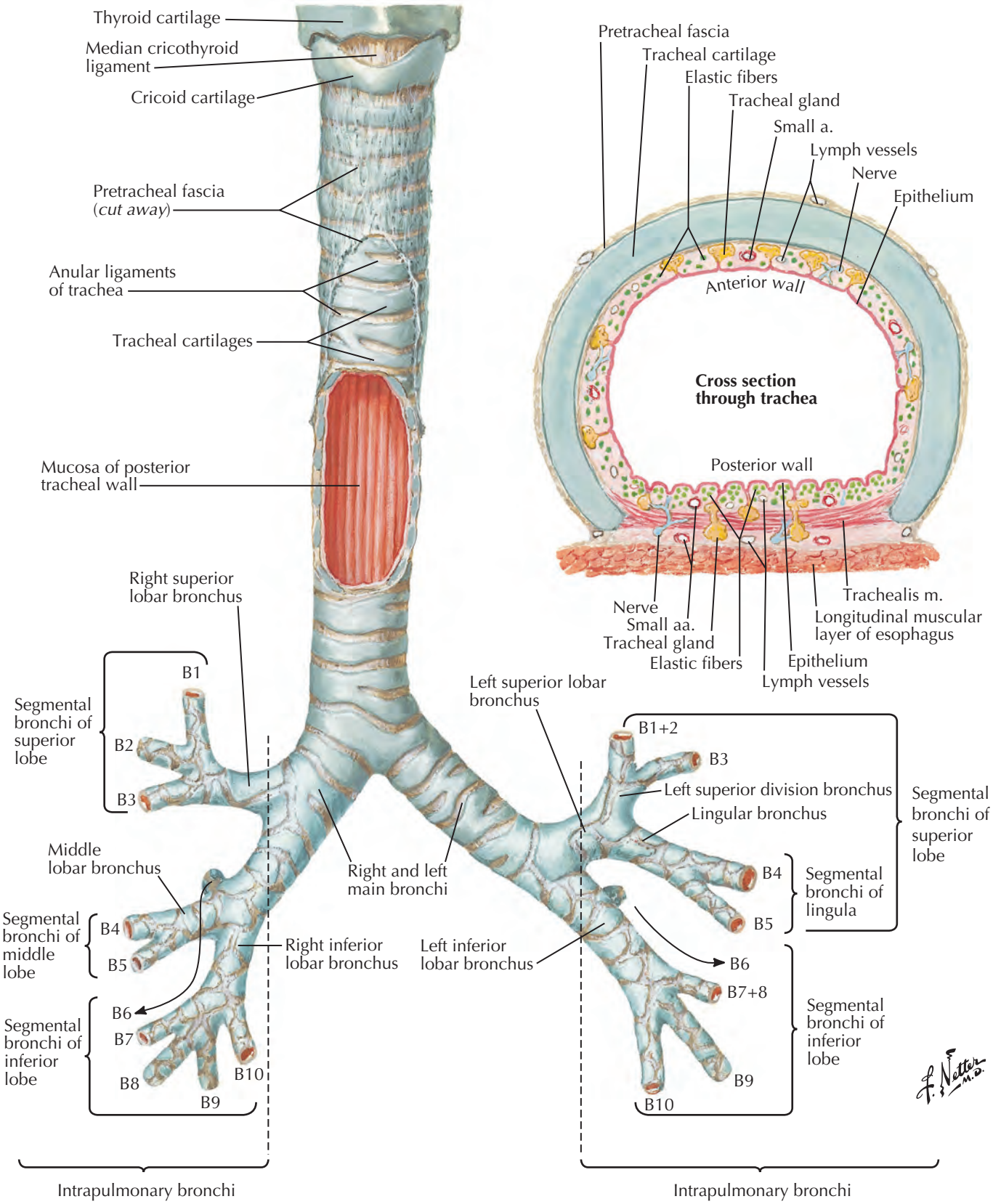
Lateral views

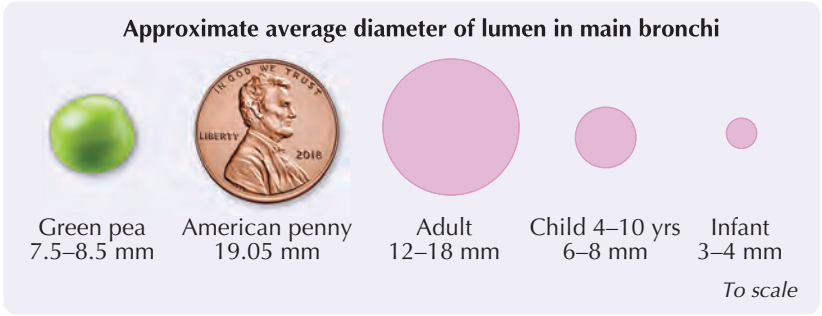


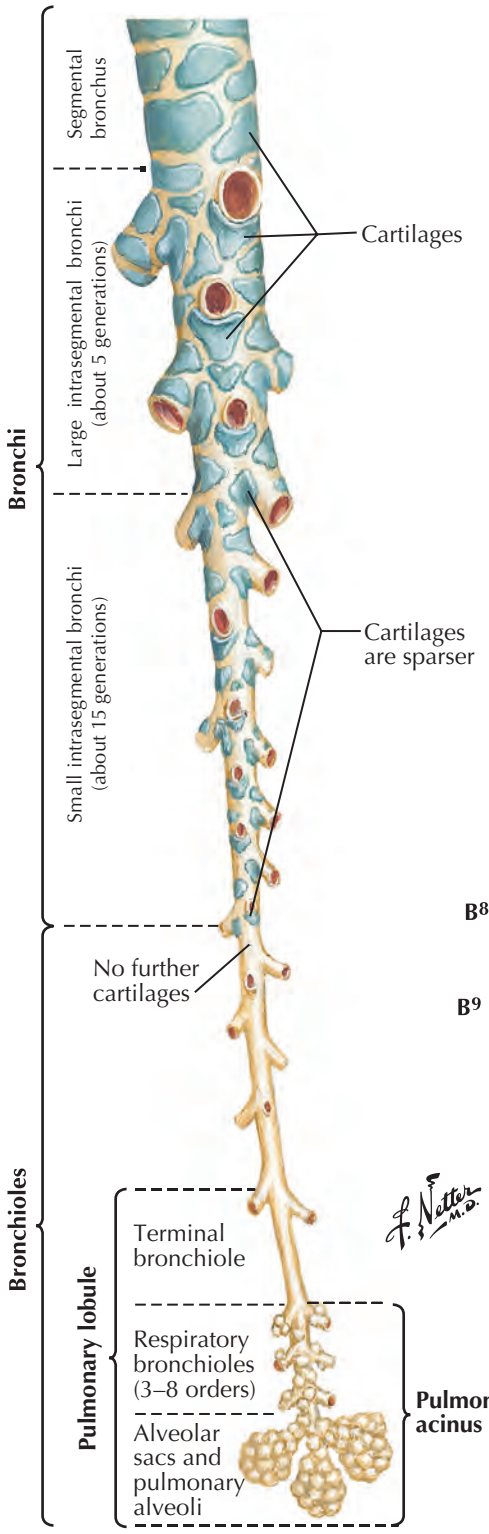
Medial views



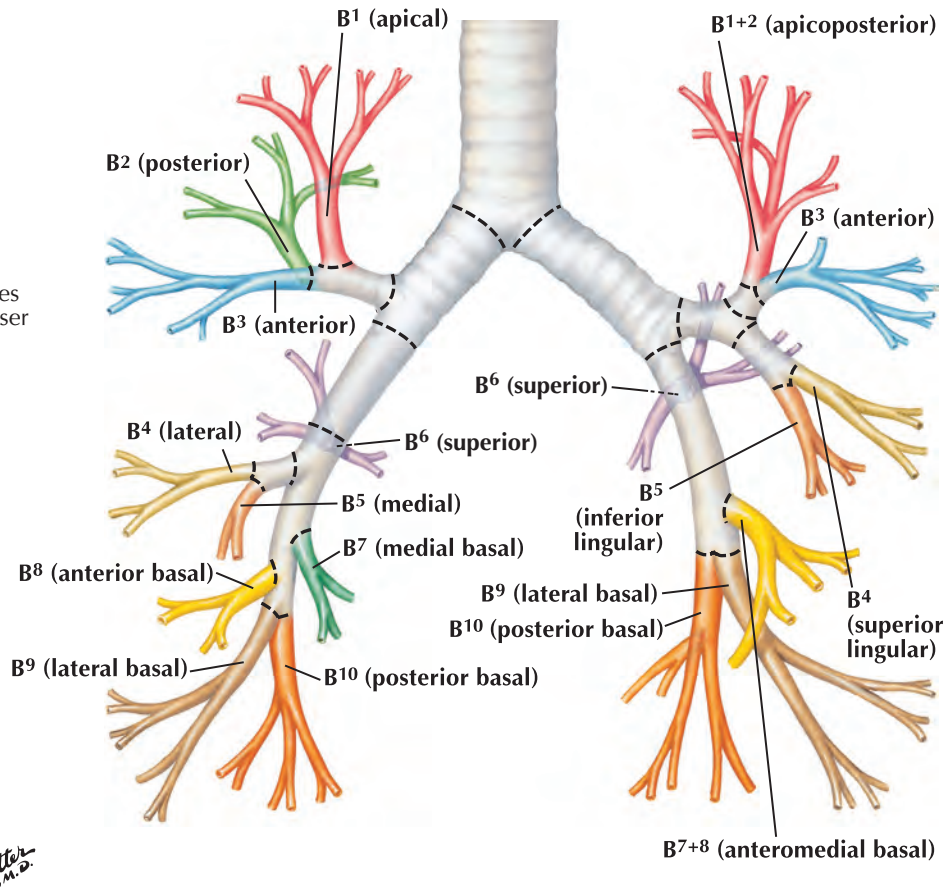
See also **Plates 97, 222, 230**



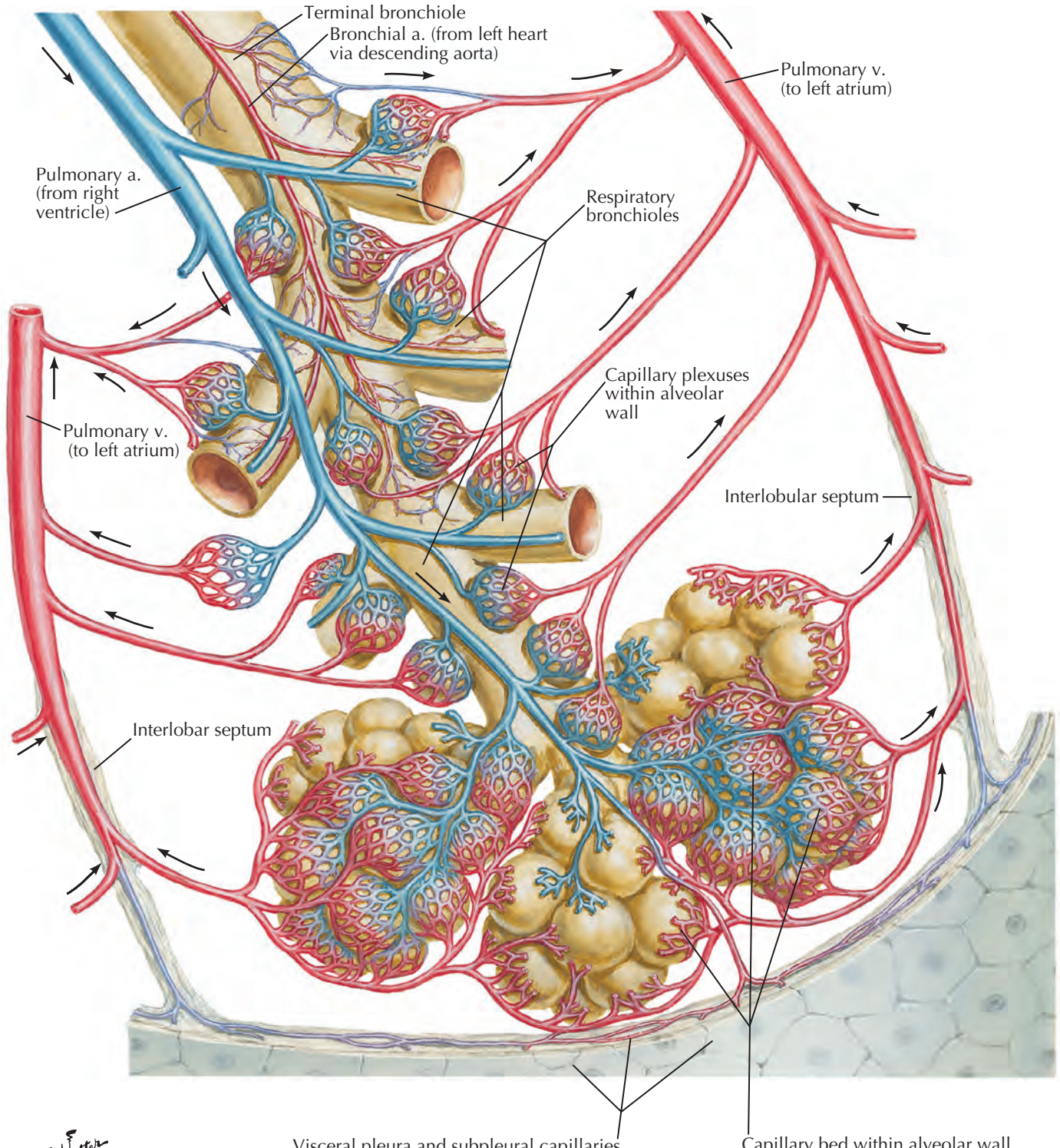




Subdivisions of intrapulmonary airways

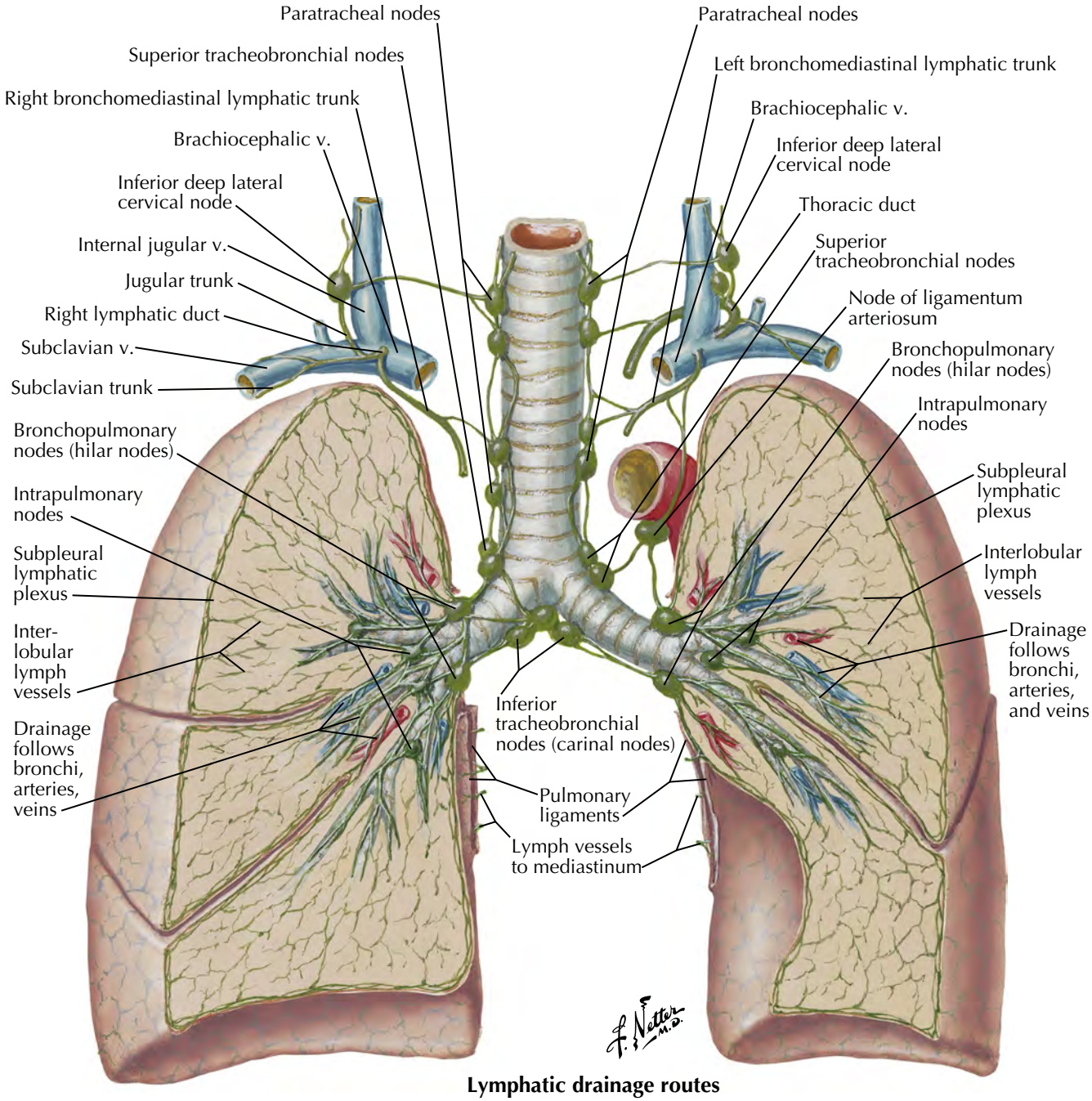


Nomenclature in common usage for bronchopulmonary segments (Plates 223 and 224) is that of Jackson and Huber, and segmental bronchi are named accordingly. Bronchial subdivisions as far as the 5th or 6th generations also are shown but not labelled. Segmental bronchi (B) are numbered from 1 to 10 in each lung, corresponding to the pulmonary segments. In the left lung, B^1 and B^2 are combined, as are B^7 and B^8. Variations of the standard bronchial pattern shown here are common, especially in peripheral airways.



Pulmonary arteries and their branches distribute segmentally with the bronchi.
Pulmonary veins and their tributaries drain intersegmentally.

See also **Plates 101, 260, BP 51**

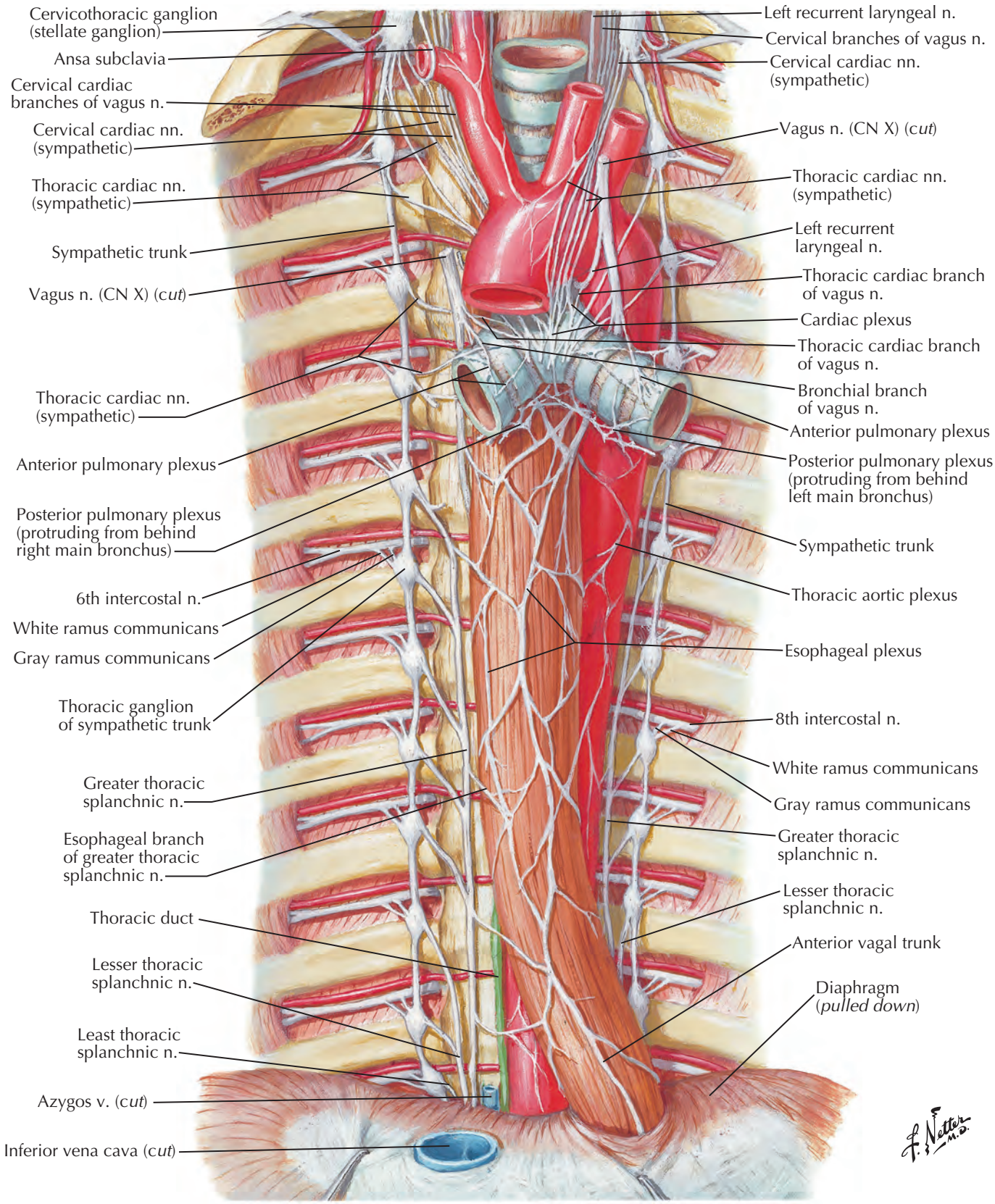


Lymphatic drainage routes

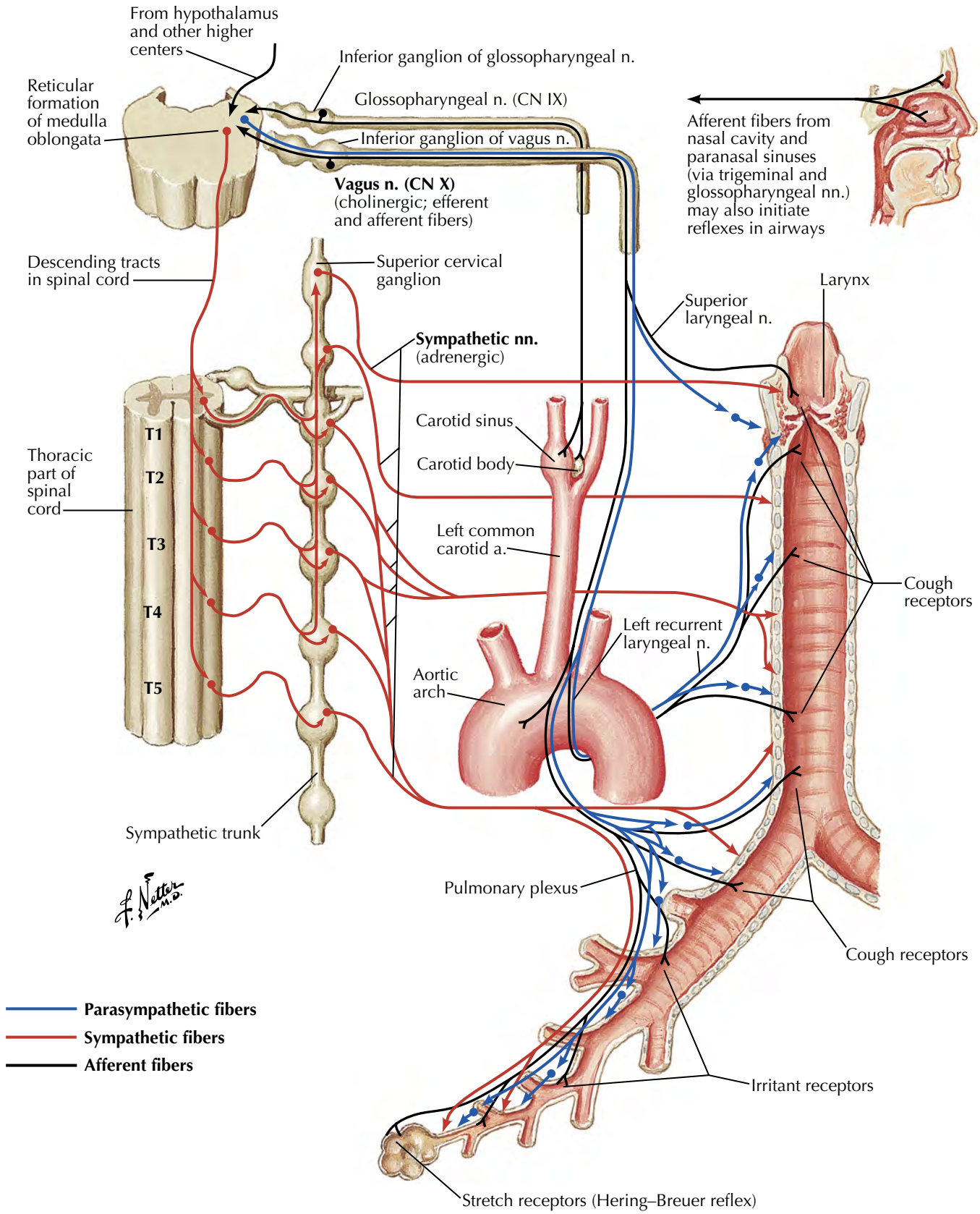
Right lung: All lobes drain to intrapulmonary and bronchopulmonary nodes, then to inferior tracheobronchial nodes, right superior tracheobronchial nodes, and right paratracheal nodes on the way to the brachiocephalic vein via the right bronchomediastinal and jugular trunks.

Left lung: The superior lobe drains to intrapulmonary and bronchopulmonary nodes, then to inferior tracheobronchial nodes, left superior tracheobronchial nodes, left paratracheal nodes and the node of the ligamentum arteriosum on the way to the brachiocephalic vein via the left bronchomediastinal trunk and thoracic duct. The intrapulmonary and bronchopulmonary nodes of the left lung also drain to right superior tracheo-bronchial nodes, where the lymph follows the same route as lymph from the right lung.

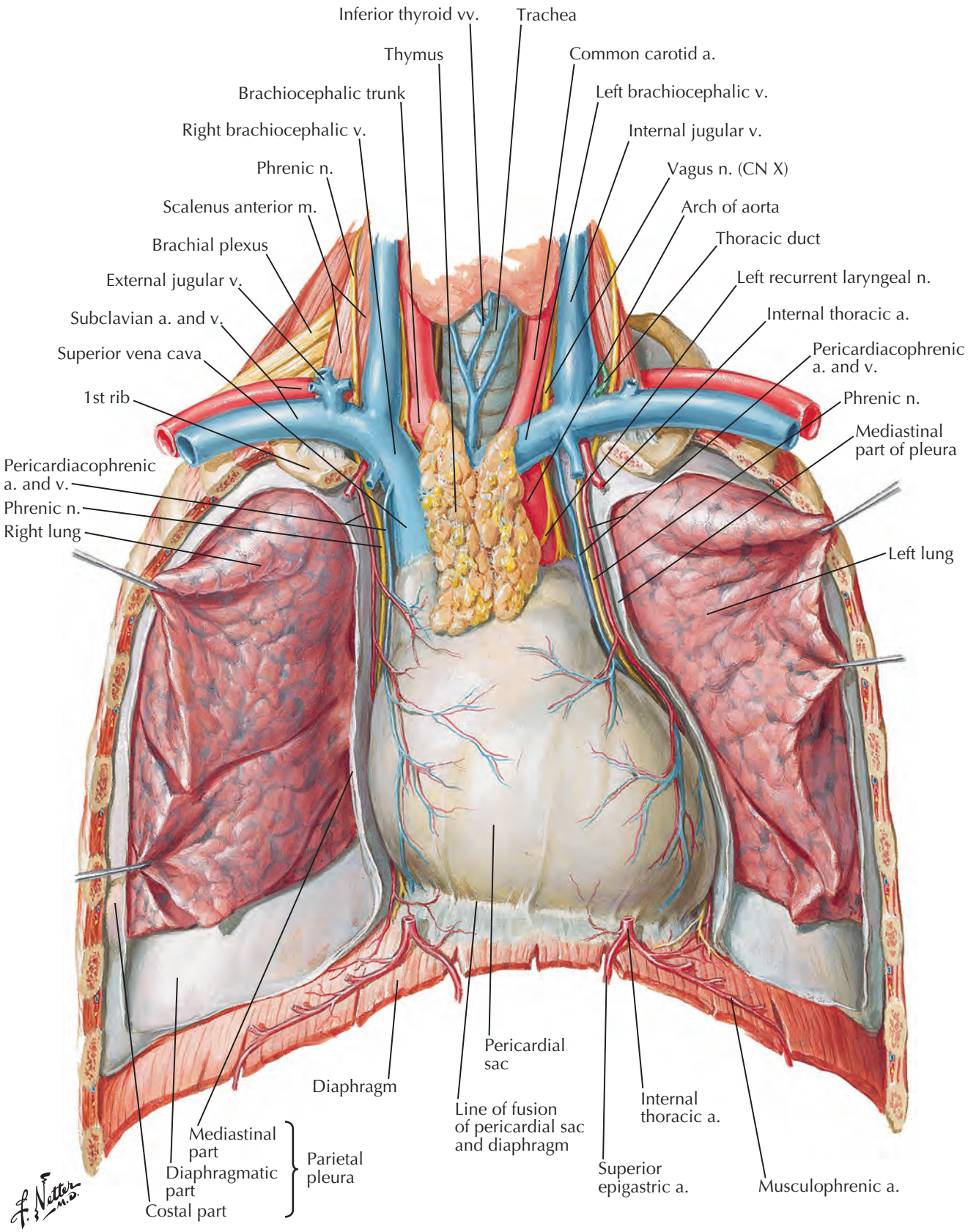
See also **Plates 249, BP 52**



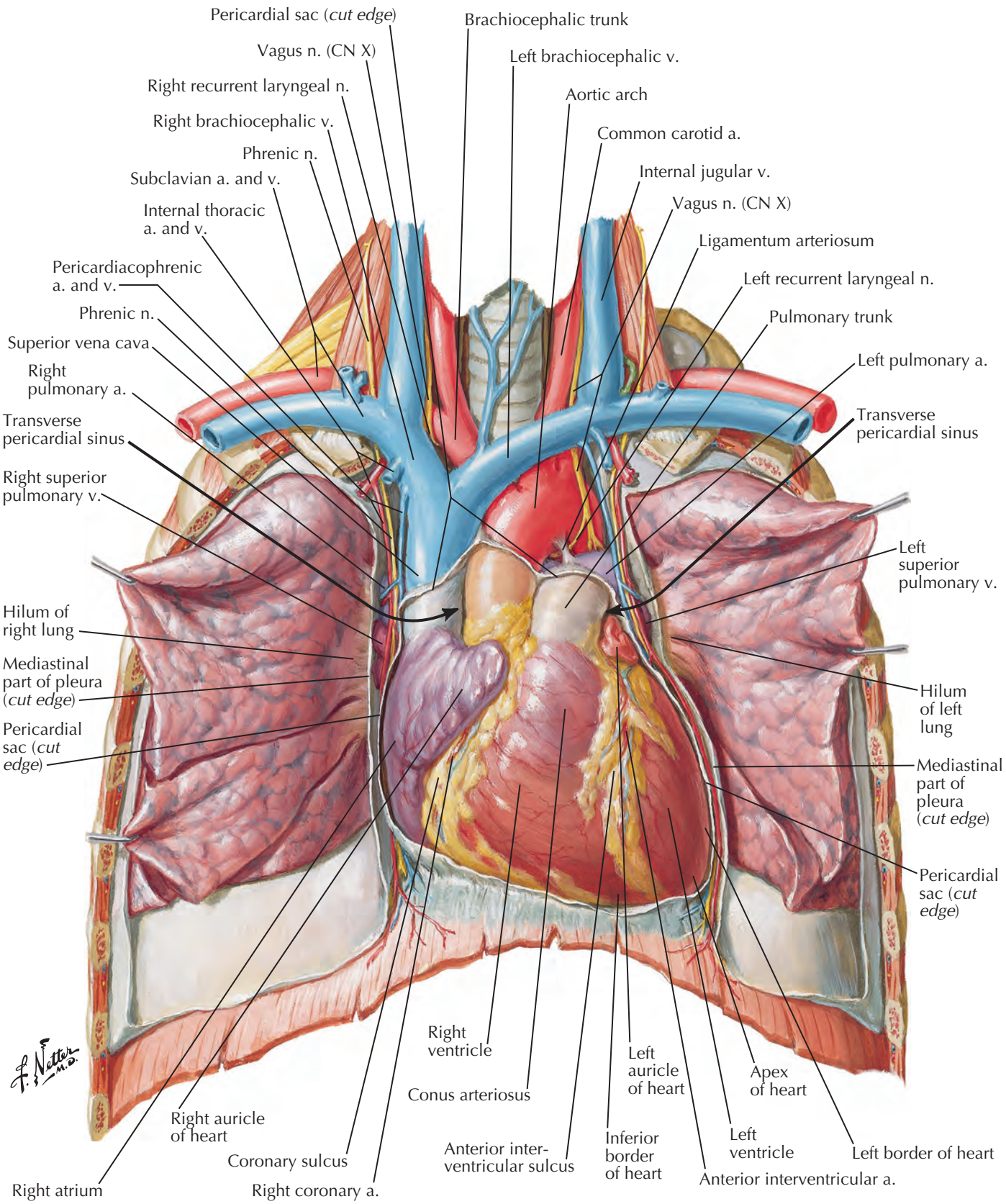
See also **Plate 250**

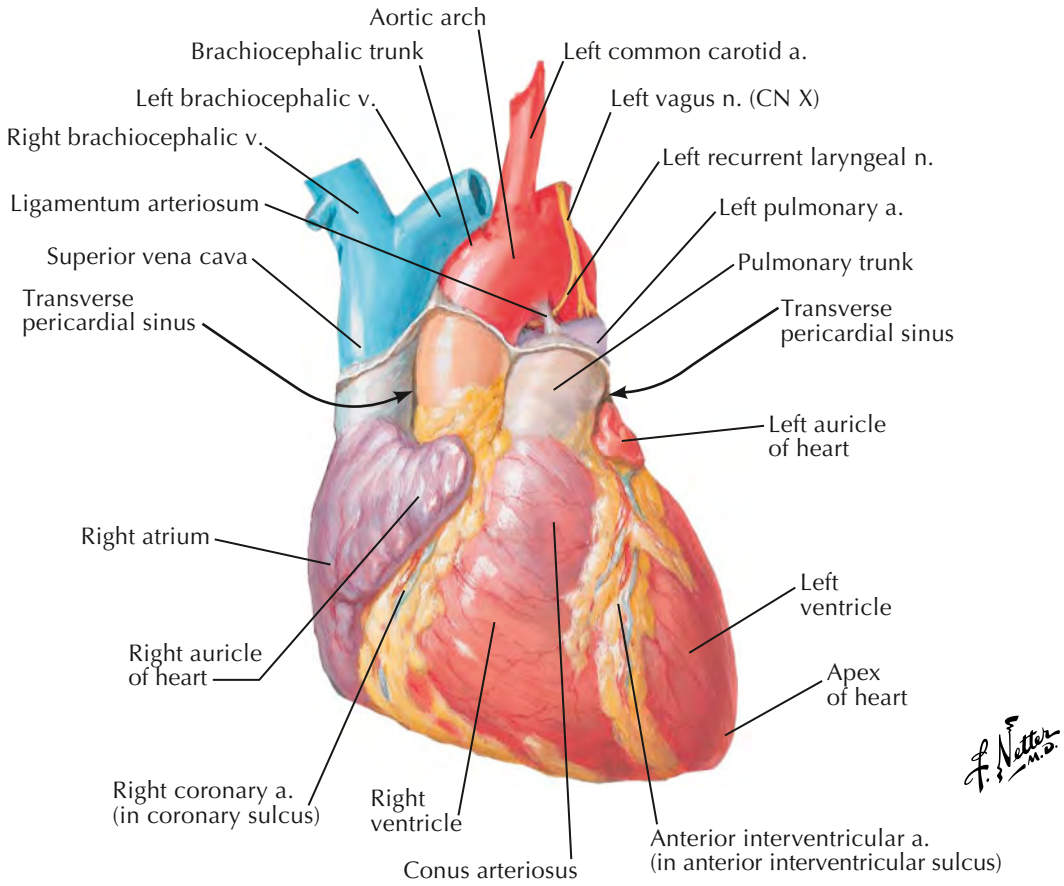


See also **Plates 233, 236**

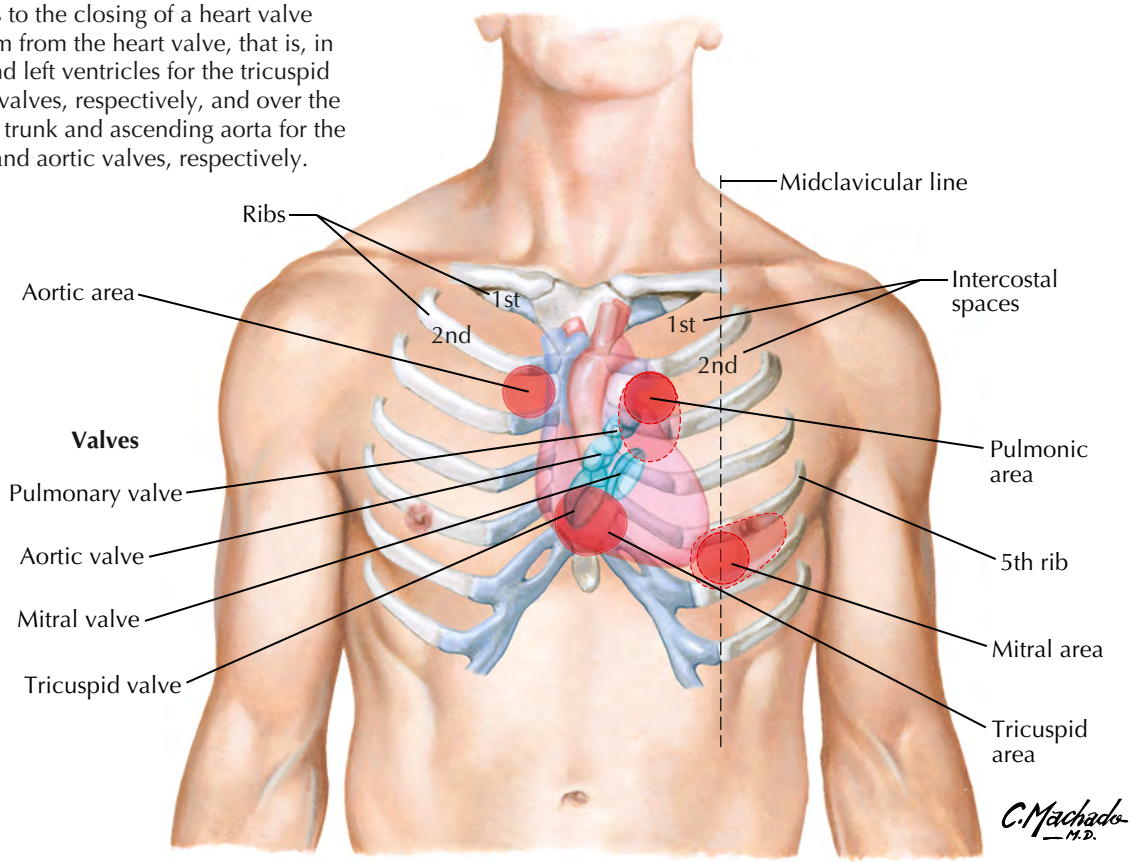


See also **Plates 236, BP 51**



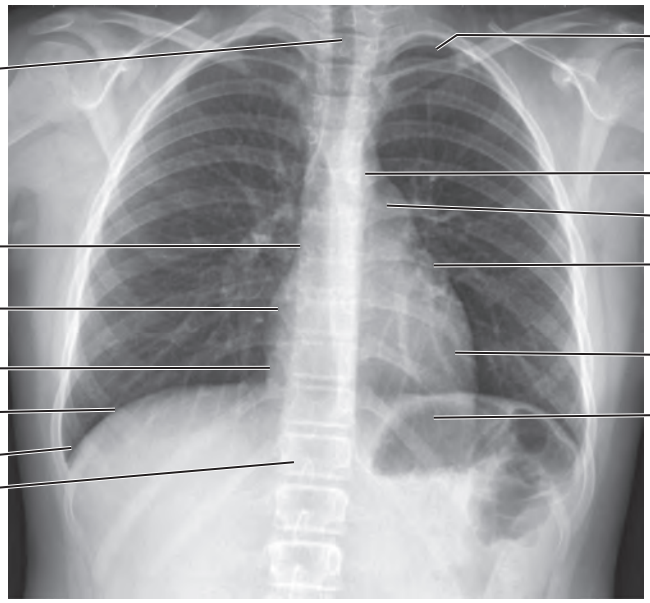


Precordial areas of auscultation:
One listens to the closing of a heart valve downstream from the heart valve, that is, in the right and left ventricles for the tricuspid and mitral valves, respectively, and over the pulmonary trunk and ascending aorta for the pulmonic and aortic valves, respectively.

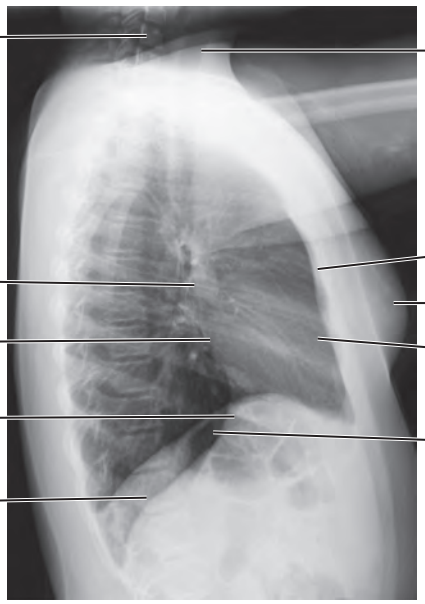


See also **Plates 233, BP 51**

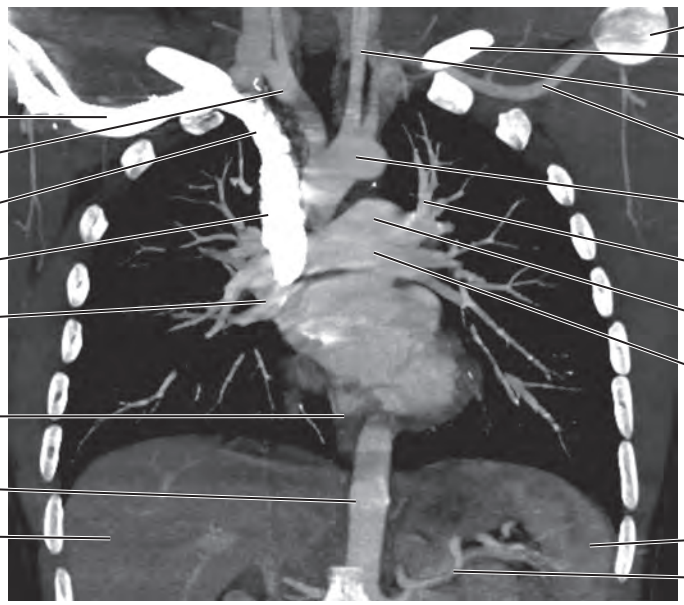
Radiograph: posteroanterior view

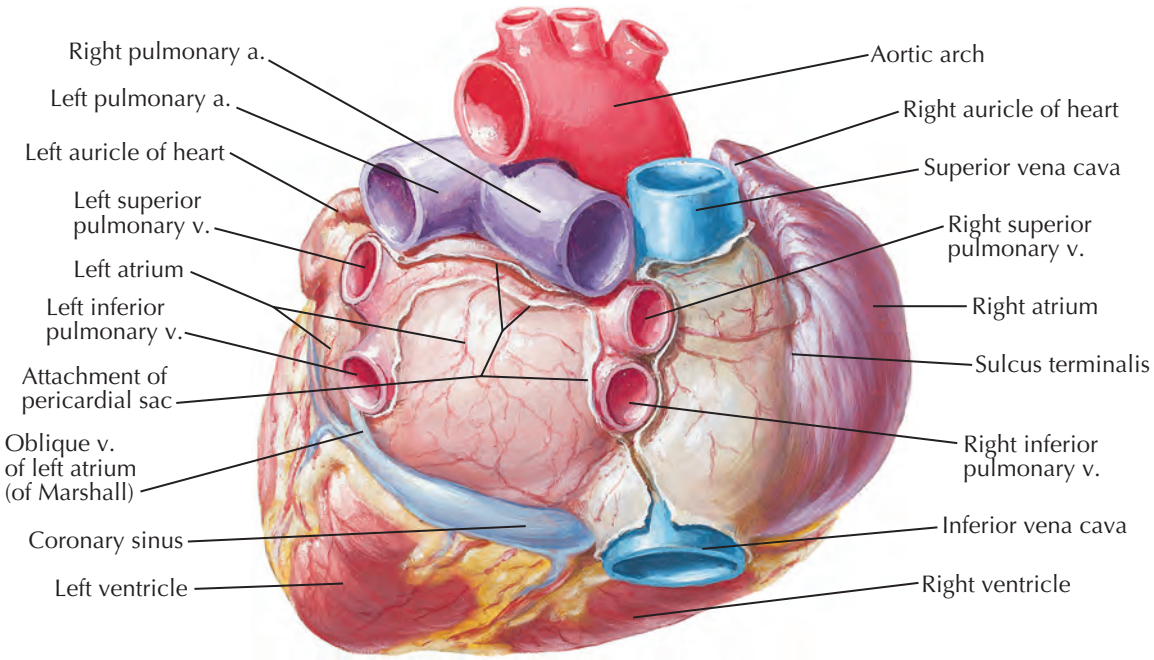


Radiograph: lateral view

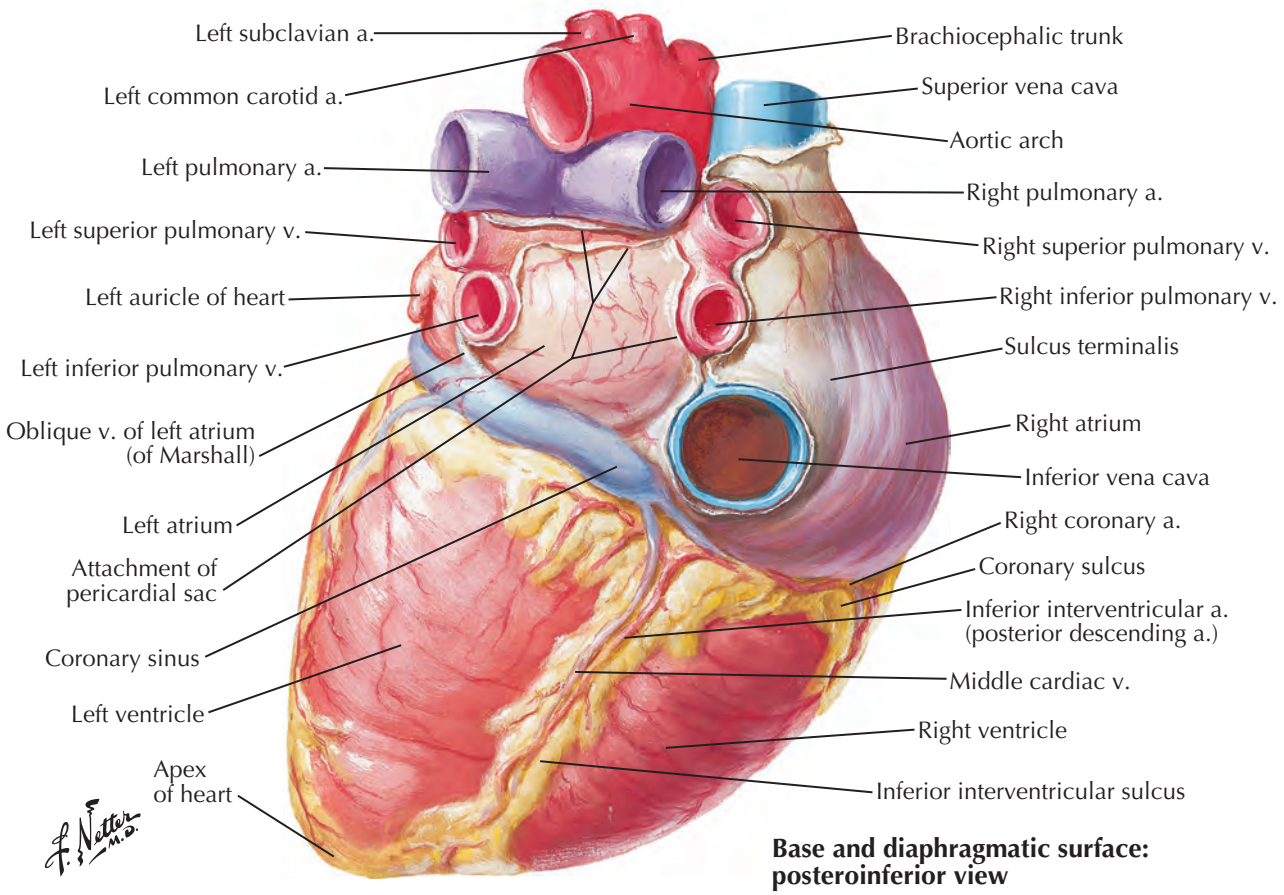


CT angiogram: coronal view





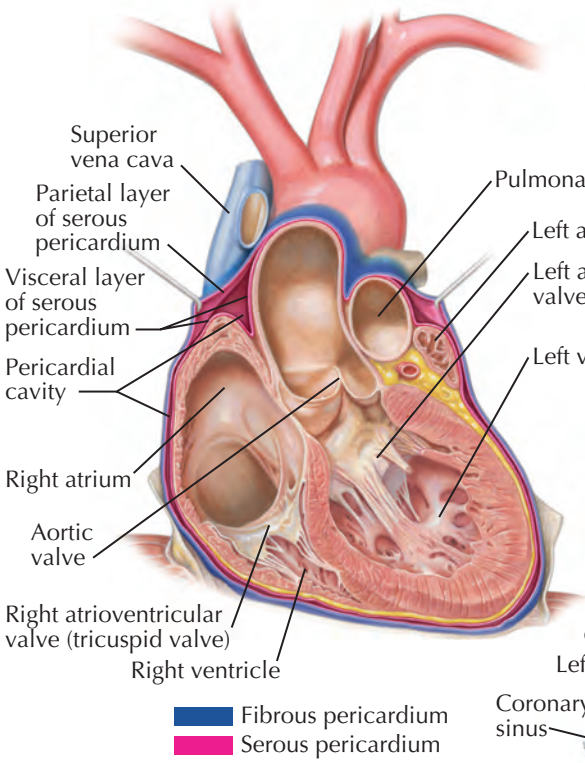
Base of heart: posterior view



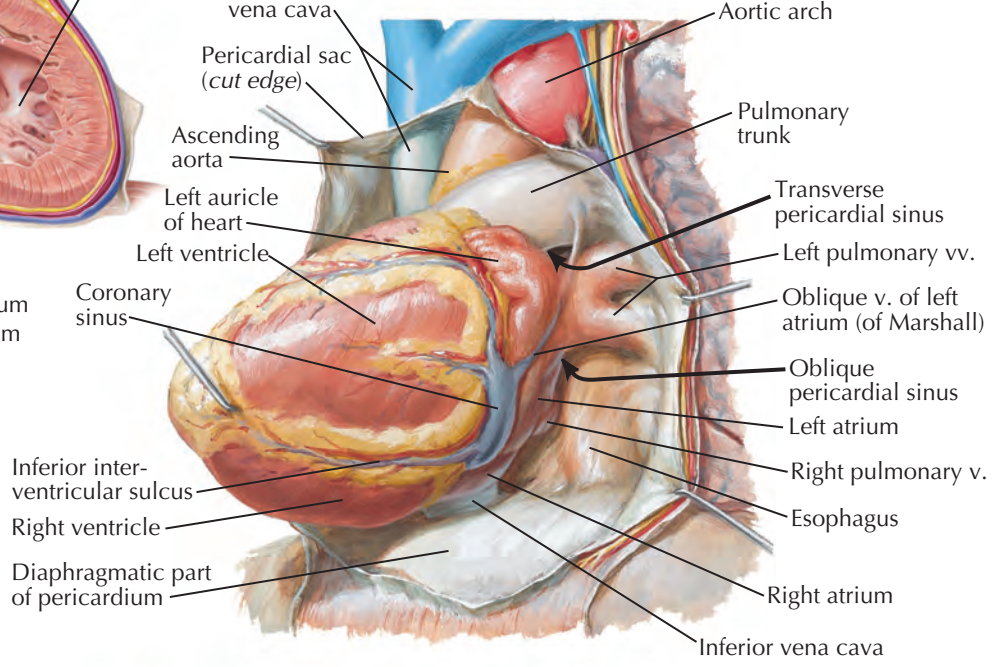
Base and diaphragmatic surface: posteroinferior view

See also **Plates 231, 232**

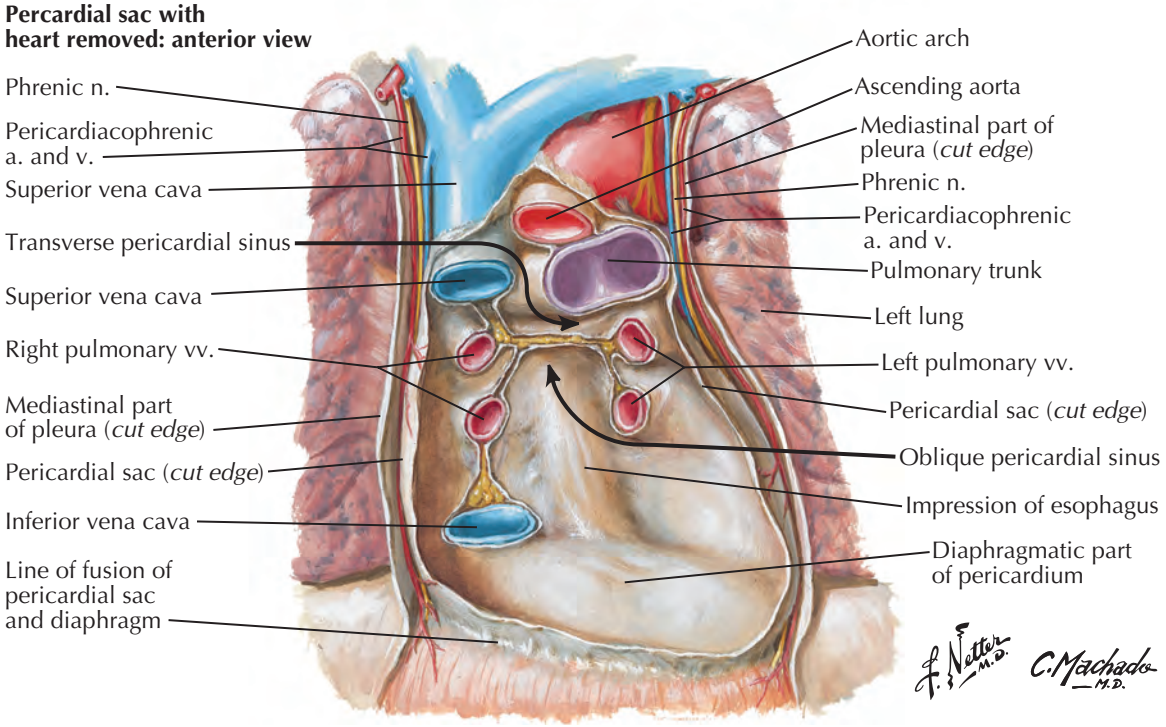
Coronal view



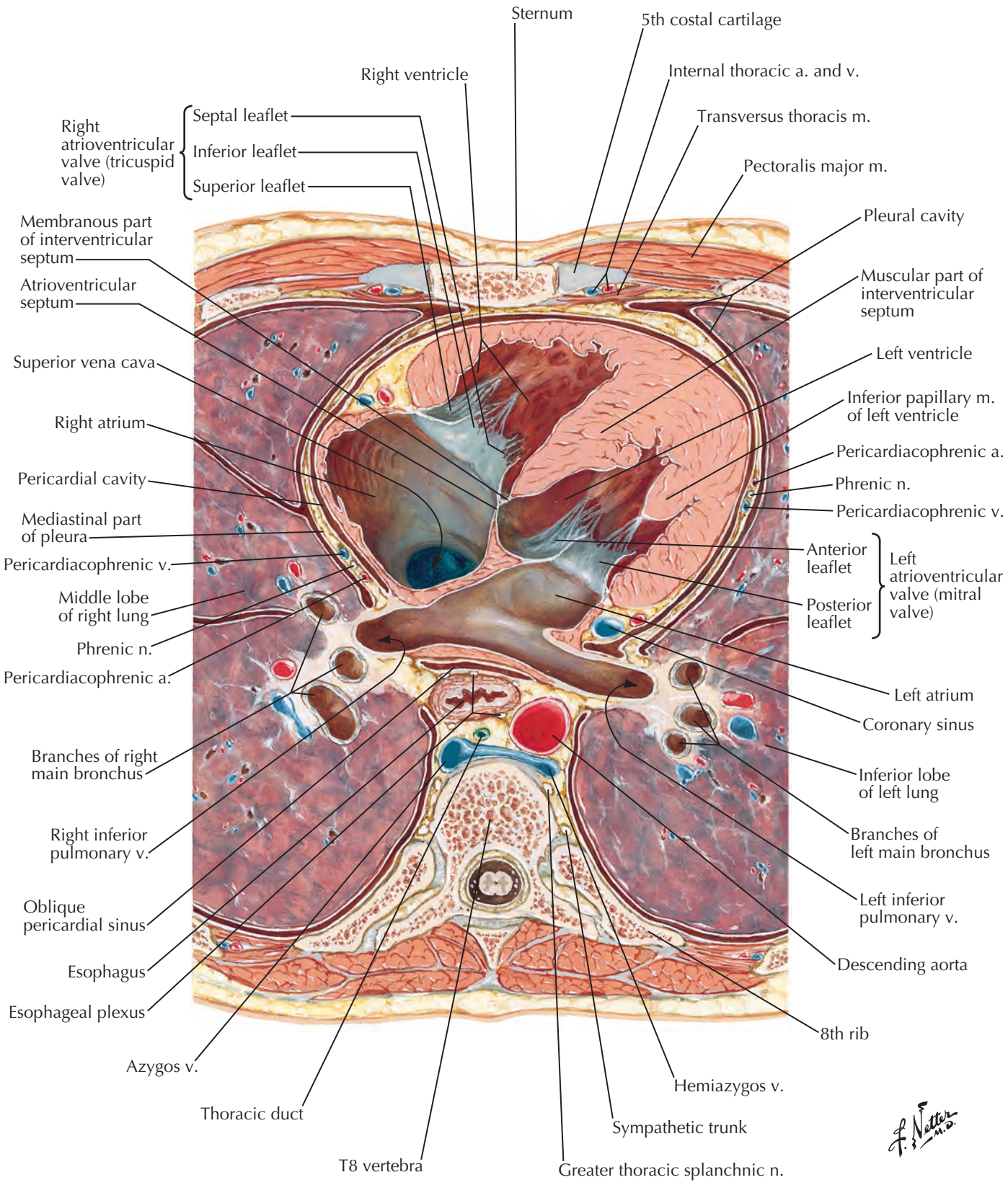
Heart drawn out of opened pericardial sac: left lateral view



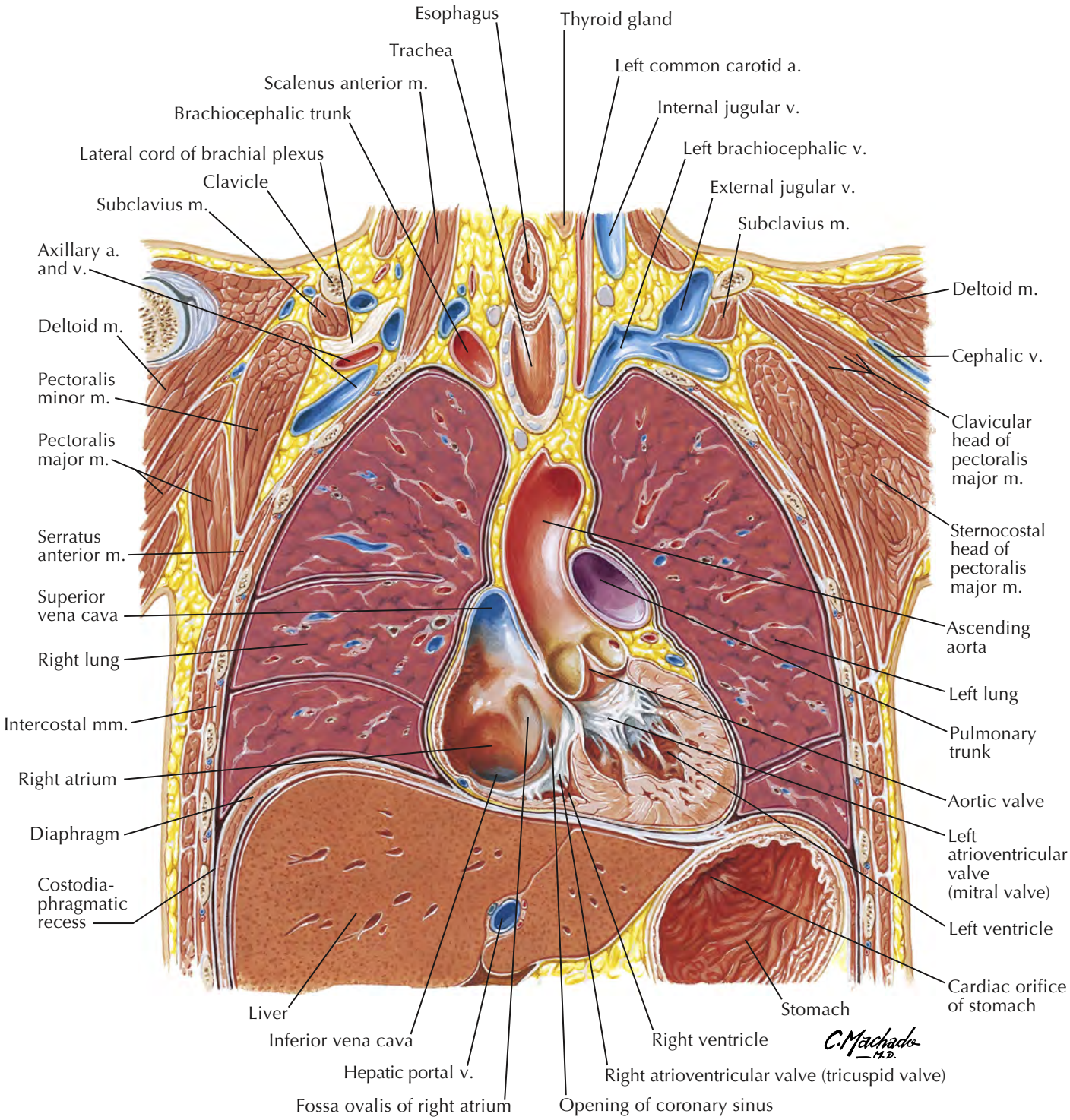
Percardial sac with heart removed: anterior view



F. Netter M.D. C. Machado M.D.

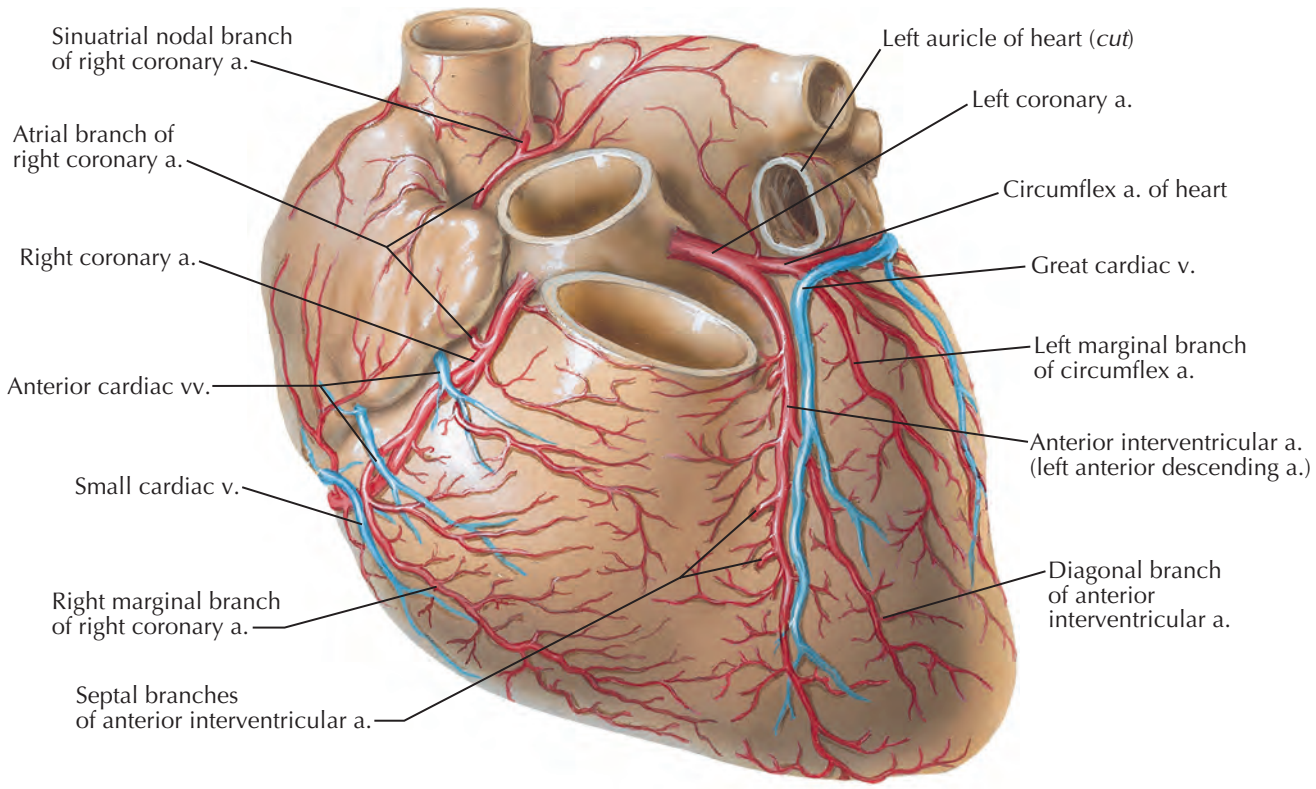

Sternum
5th costal cartilage
Right ventricle
Internal thoracic a. and v.
Right atrioventricular valve (tricuspid valve)
Septal leaflet
Inferior leaflet
Superior leaflet
Transversus thoracis m.
Pectoralis major m.
Membranous part of interventricular septum
Atrioventricular septum
Pleural cavity
Muscular part of interventricular septum
Superior vena cava
Left ventricle
Right atrium
Inferior papillary m. of left ventricle
Pericardial cavity
Pericardiacophrenic a.
Phrenic n.
Pericardiacophrenic v.
Mediastinal part of pleura
Pericardiacophrenic v.
Anterior leaflet
Posterior leaflet
Left atrioventricular valve (mitral valve)
Middle lobe of right lung
Phrenic n.
Pericardiacophrenic a.
Left atrium
Coronary sinus
Branches of right main bronchus
Inferior lobe of left lung
Right inferior pulmonary v.
Branches of left main bronchus
Oblique pericardial sinus
Left inferior pulmonary v.
Esophagus
Descending aorta
Esophageal plexus
8th rib
Azygos v.
Hemiazygos v.
Thoracic duct
Sympathetic trunk
T8 vertebra
Greater thoracic splanchnic n.

See also **Plate BP 50**

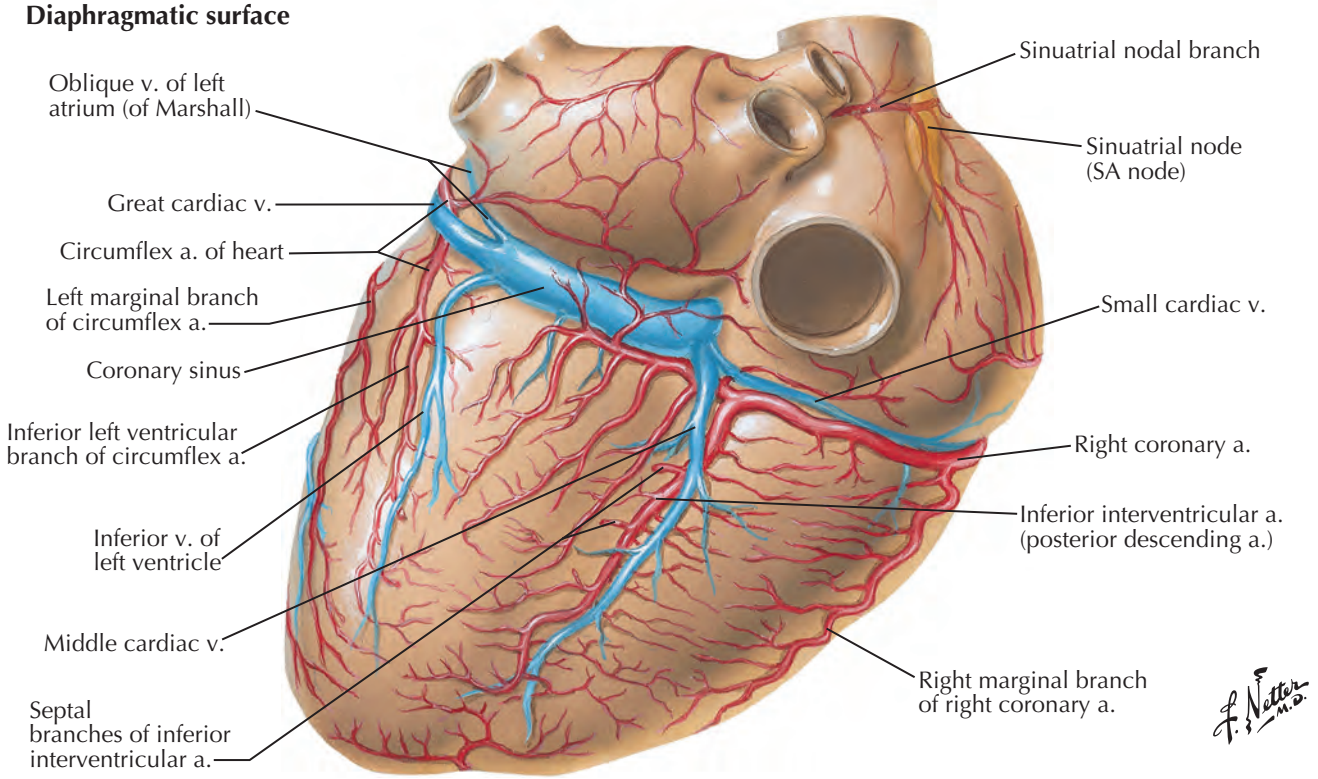


See also **Plate BP 47**

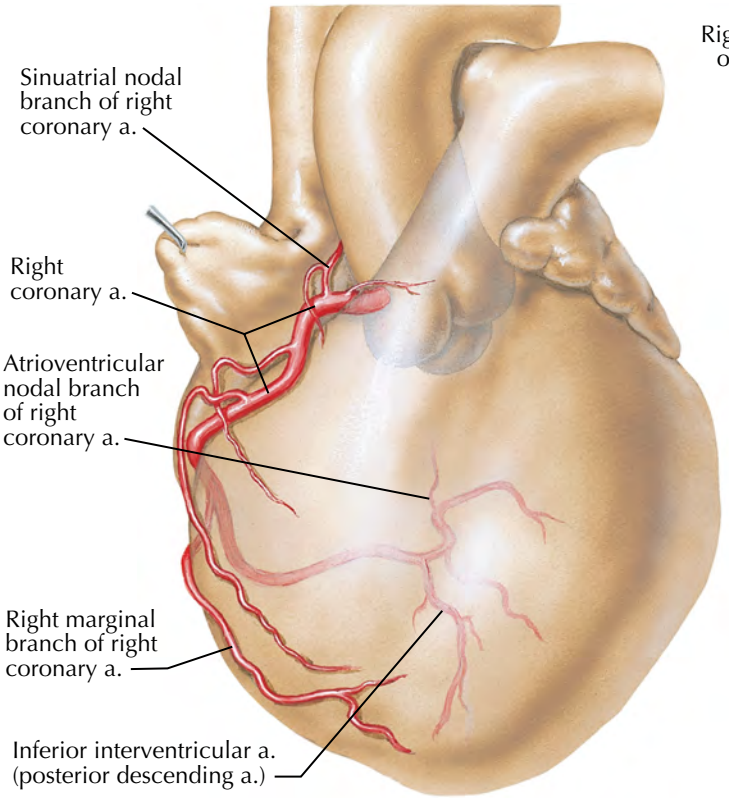
Sternocostal surface

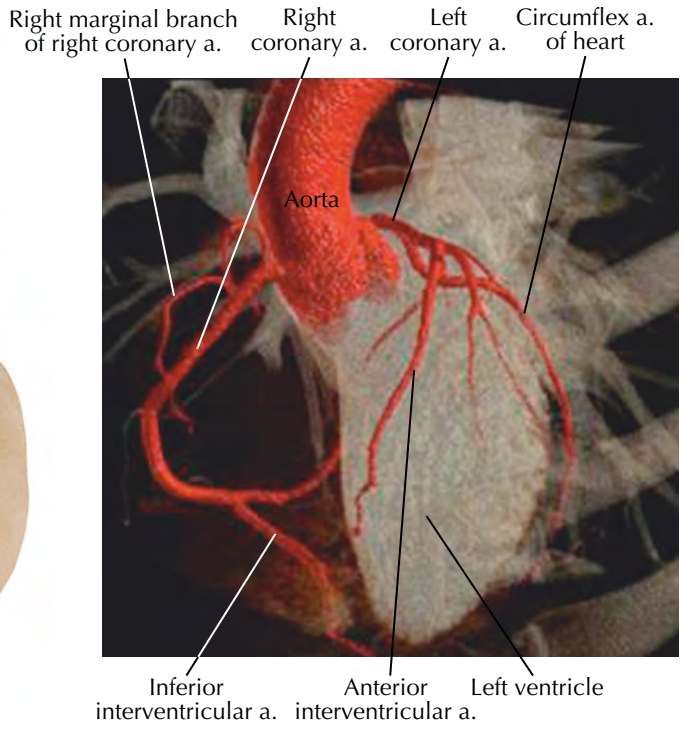


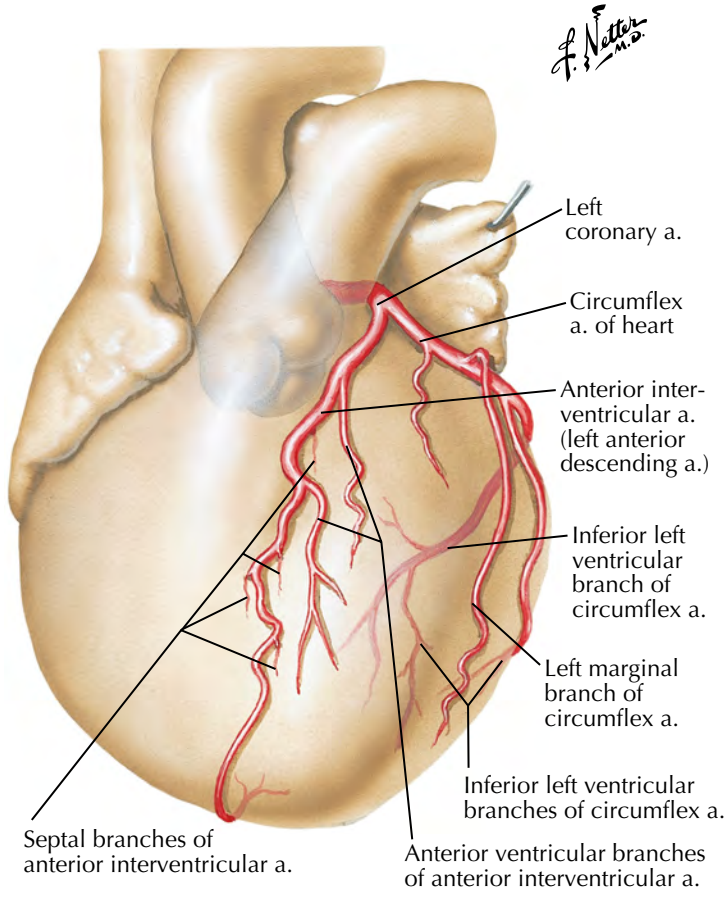
Diaphragmatic surface



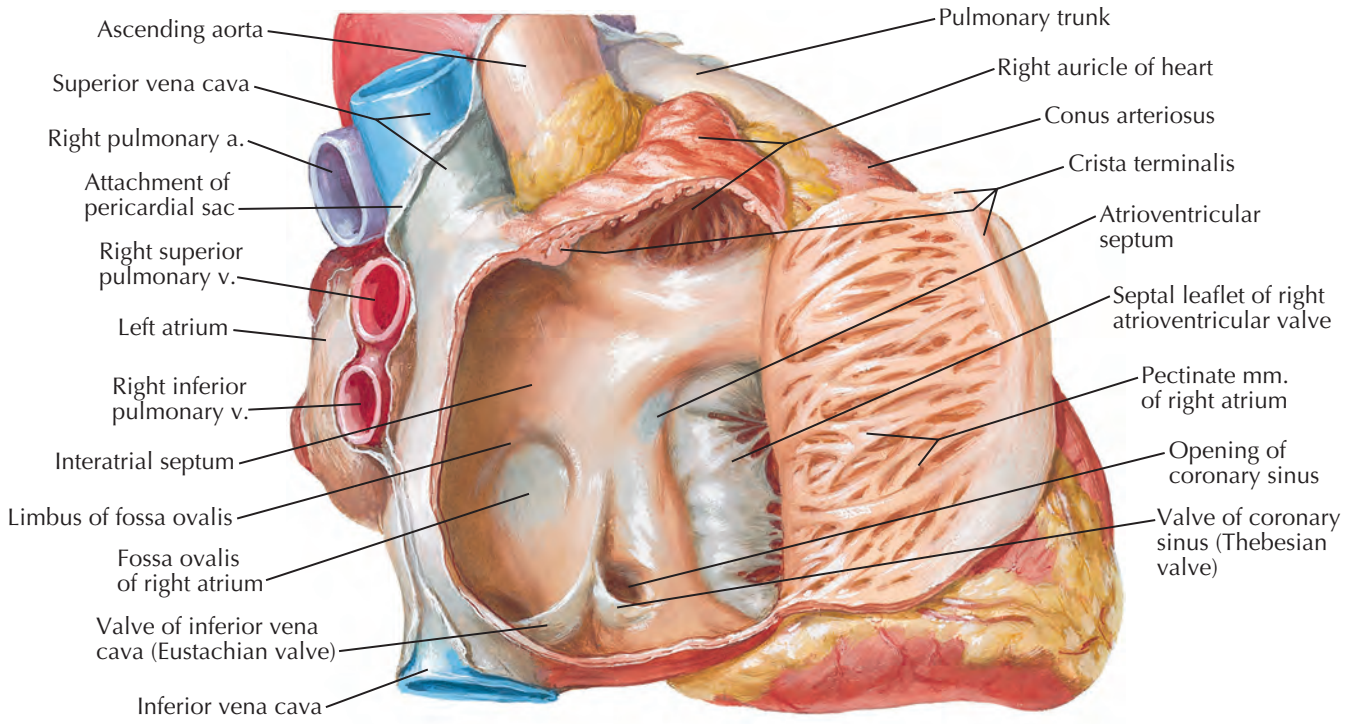
See also **Plate BP 46**



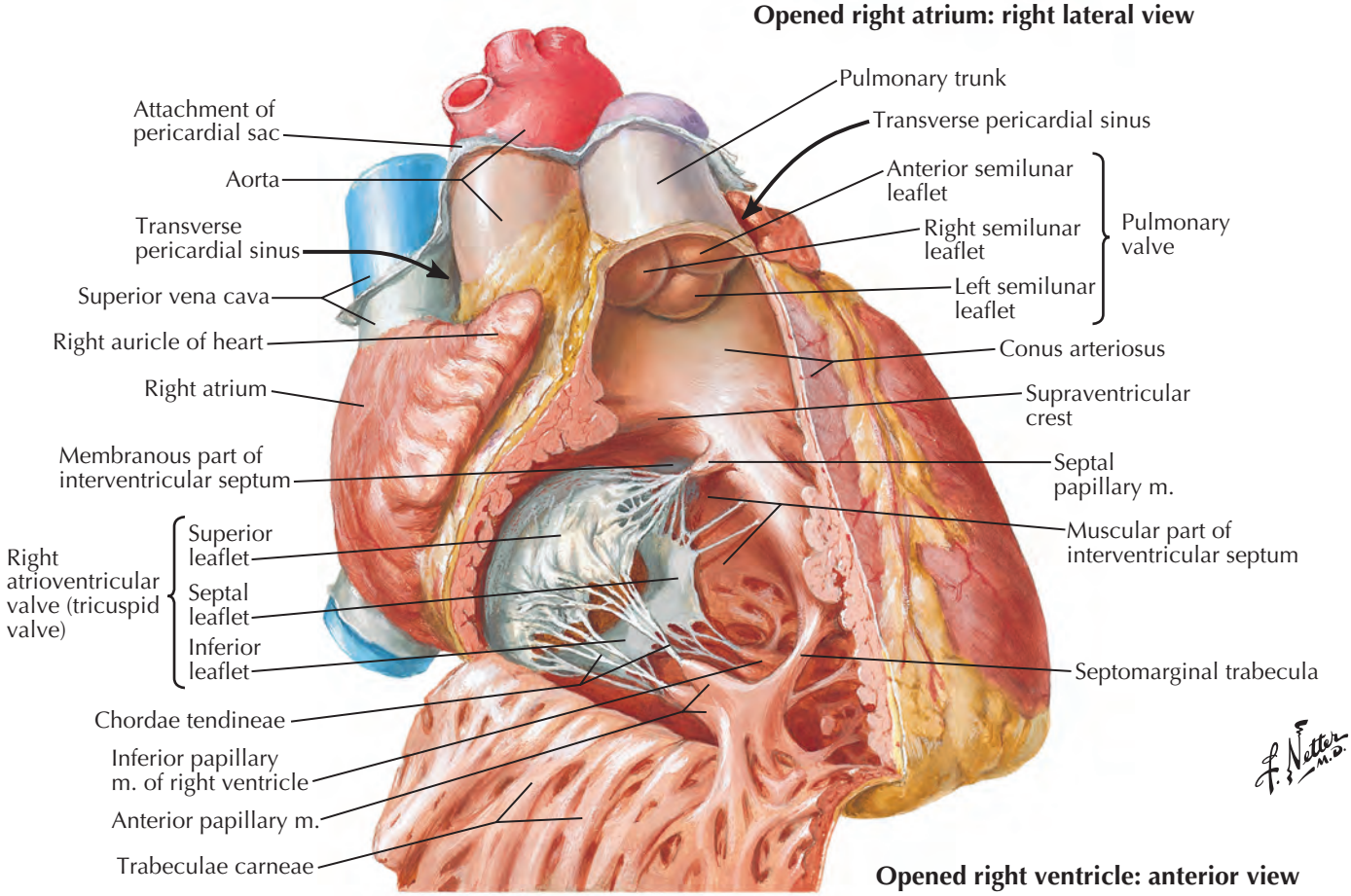




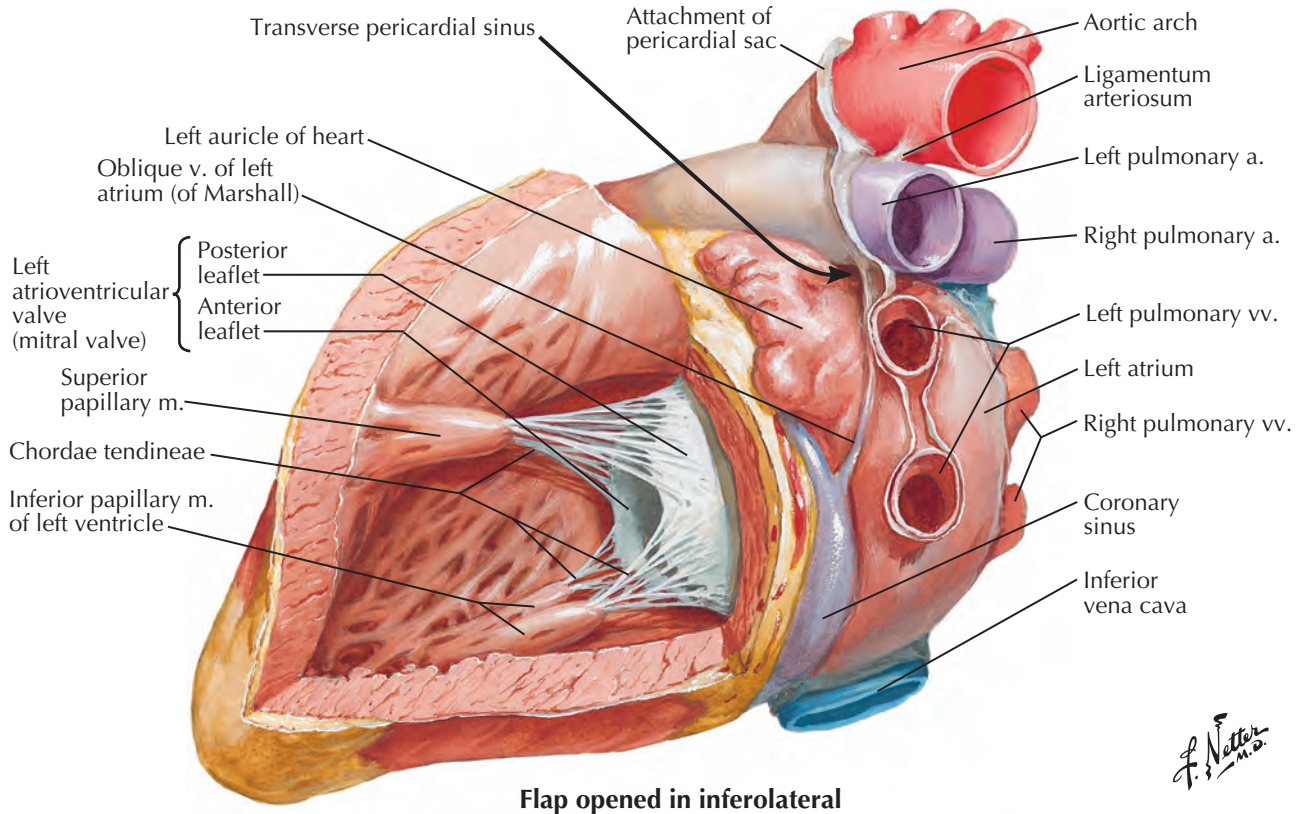
See also **Plate 246**



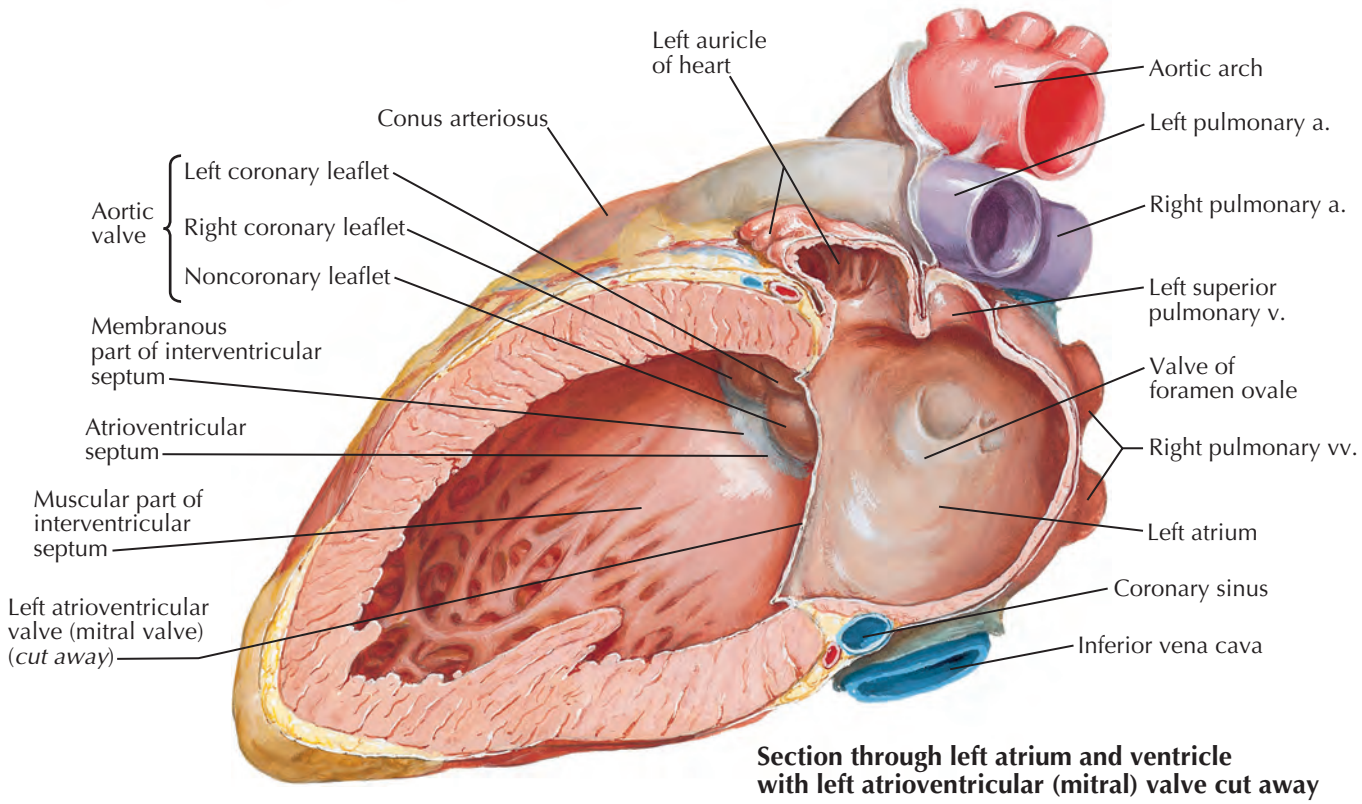
Opened right atrium: right lateral view



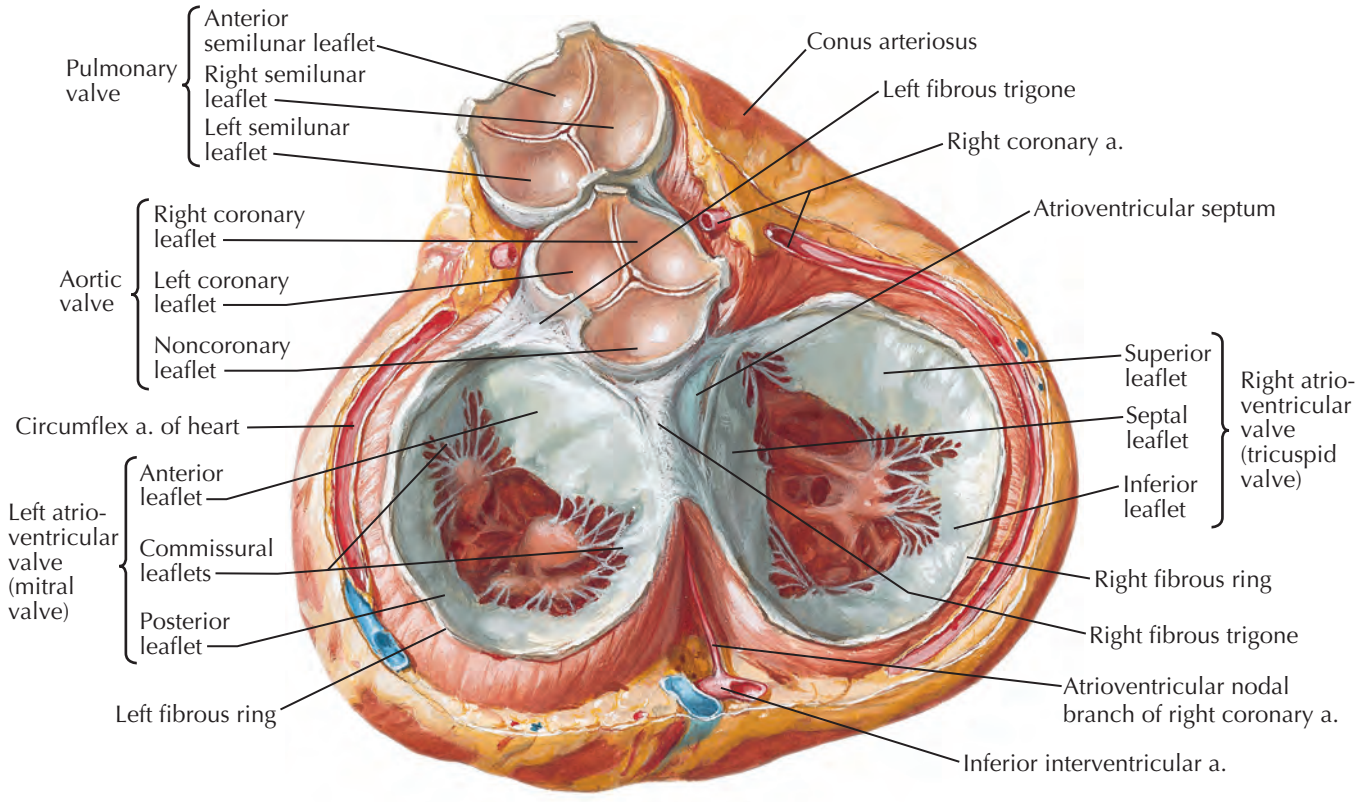
Opened right ventricle: anterior view



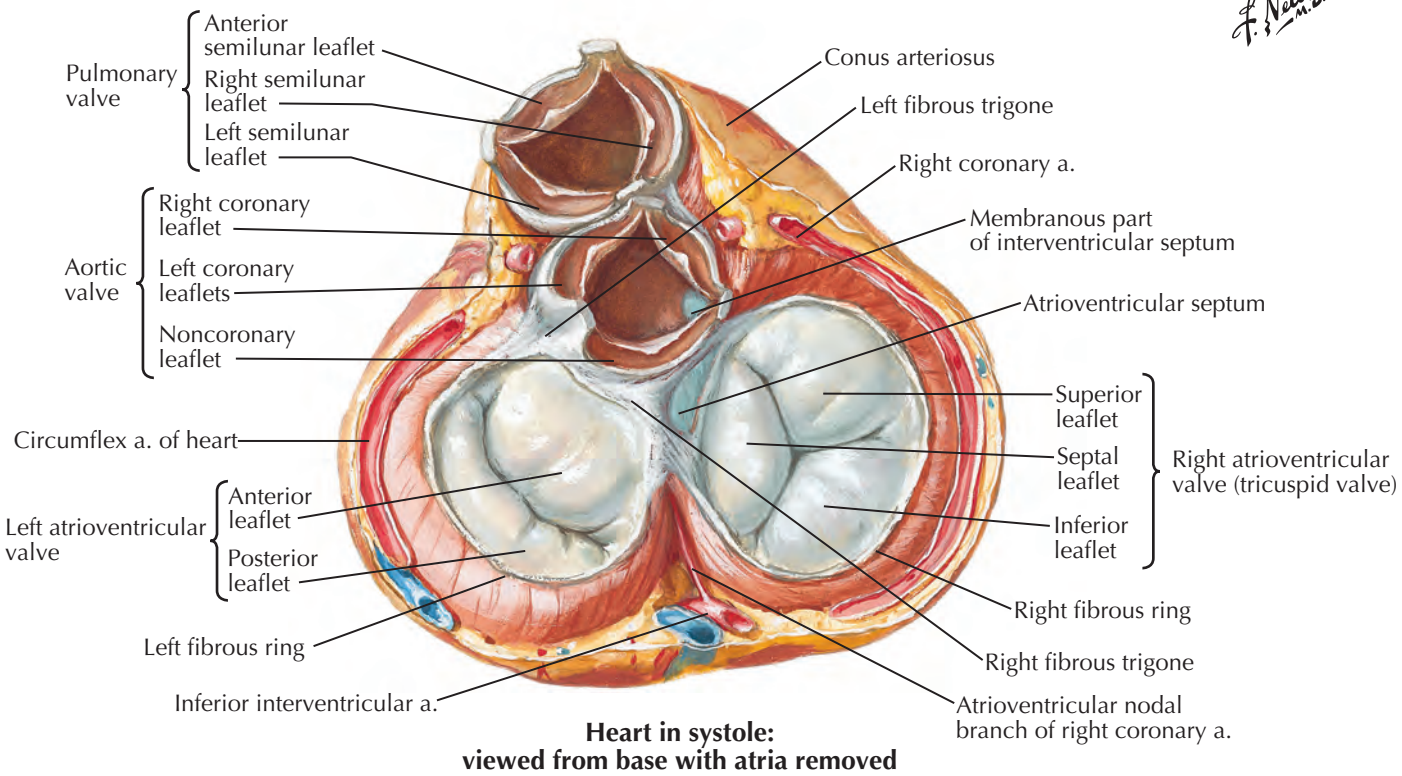
Flap opened in inferolateral wall of left ventricle



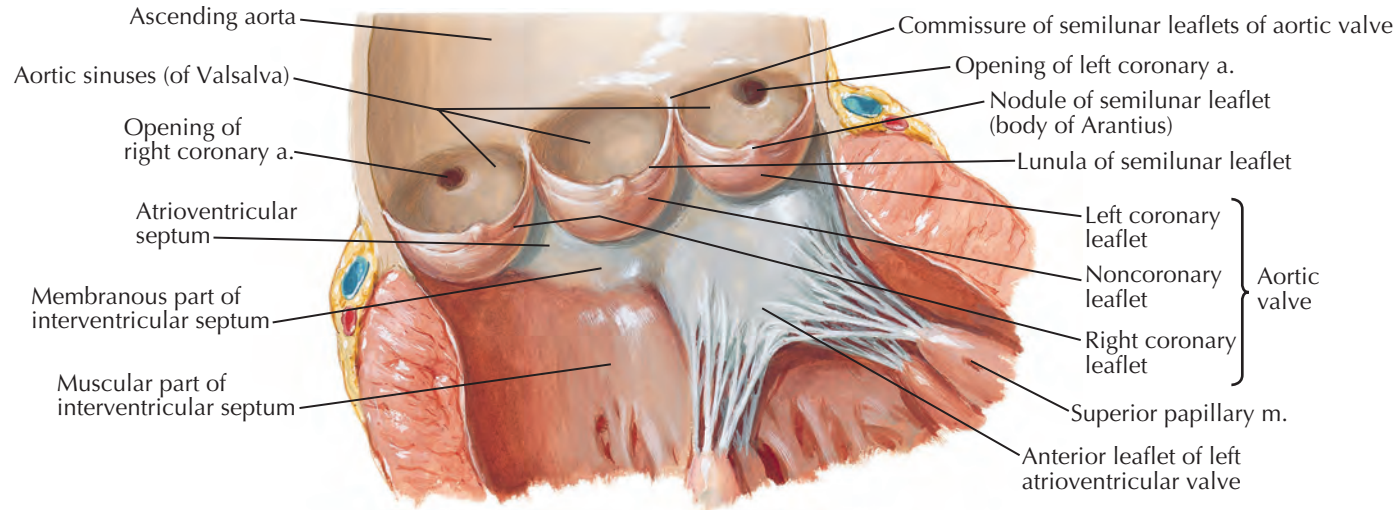
Section through left atrium and ventricle with left atrioventricular (mitral) valve cut away



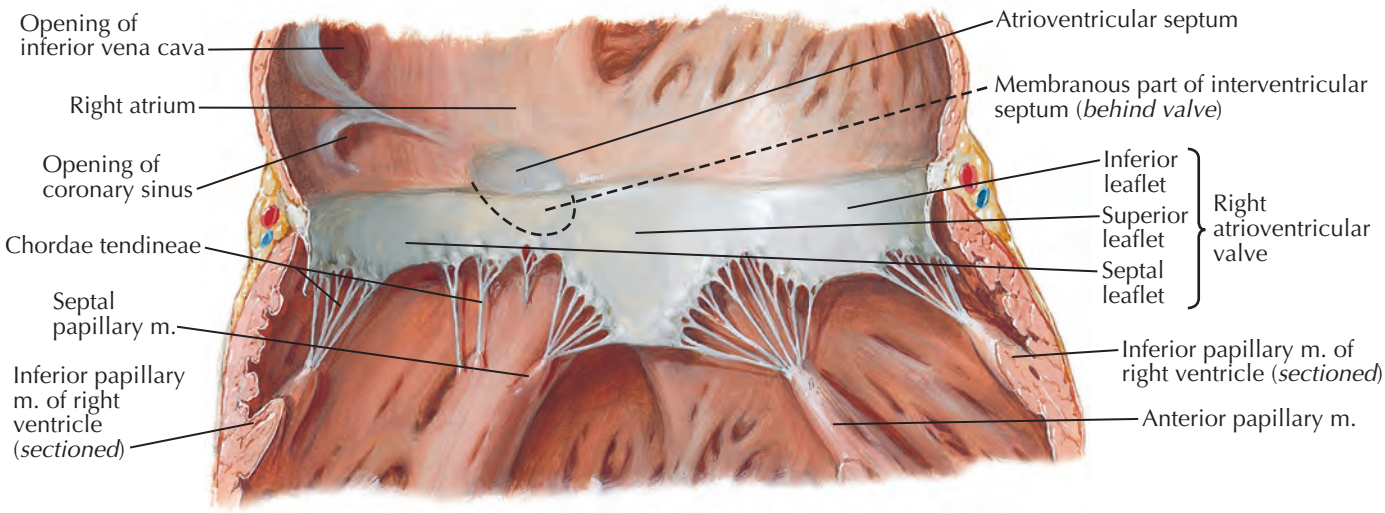
Heart in diastole:
viewed from base with atria removed



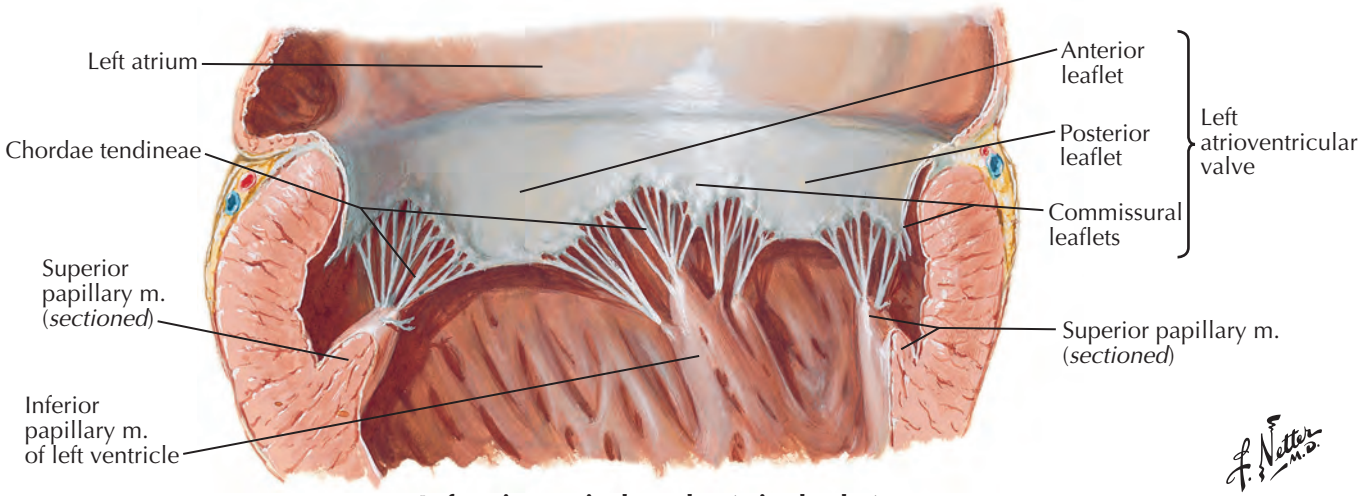
Heart in systole:
viewed from base with atria removed



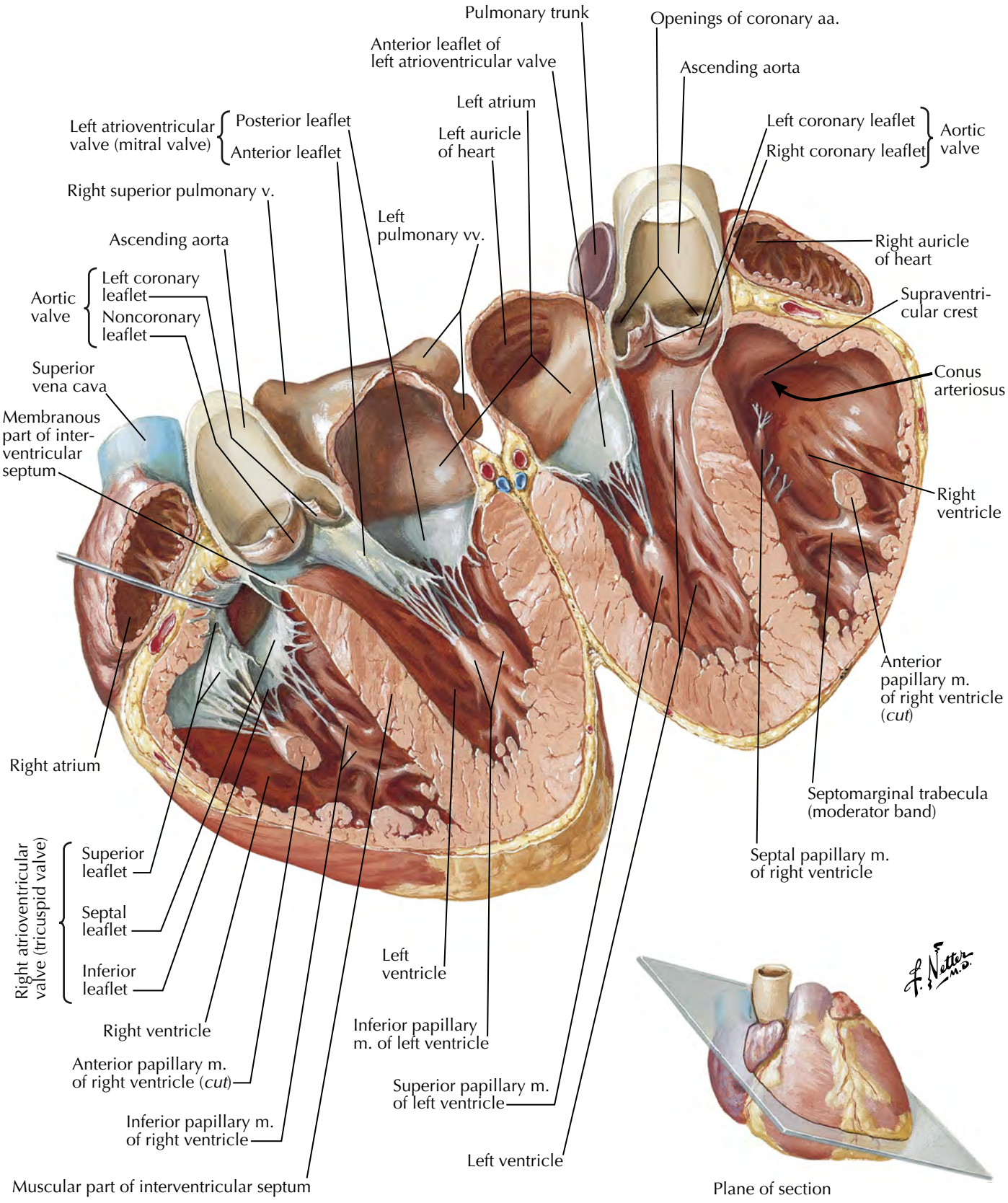
Aortic valve



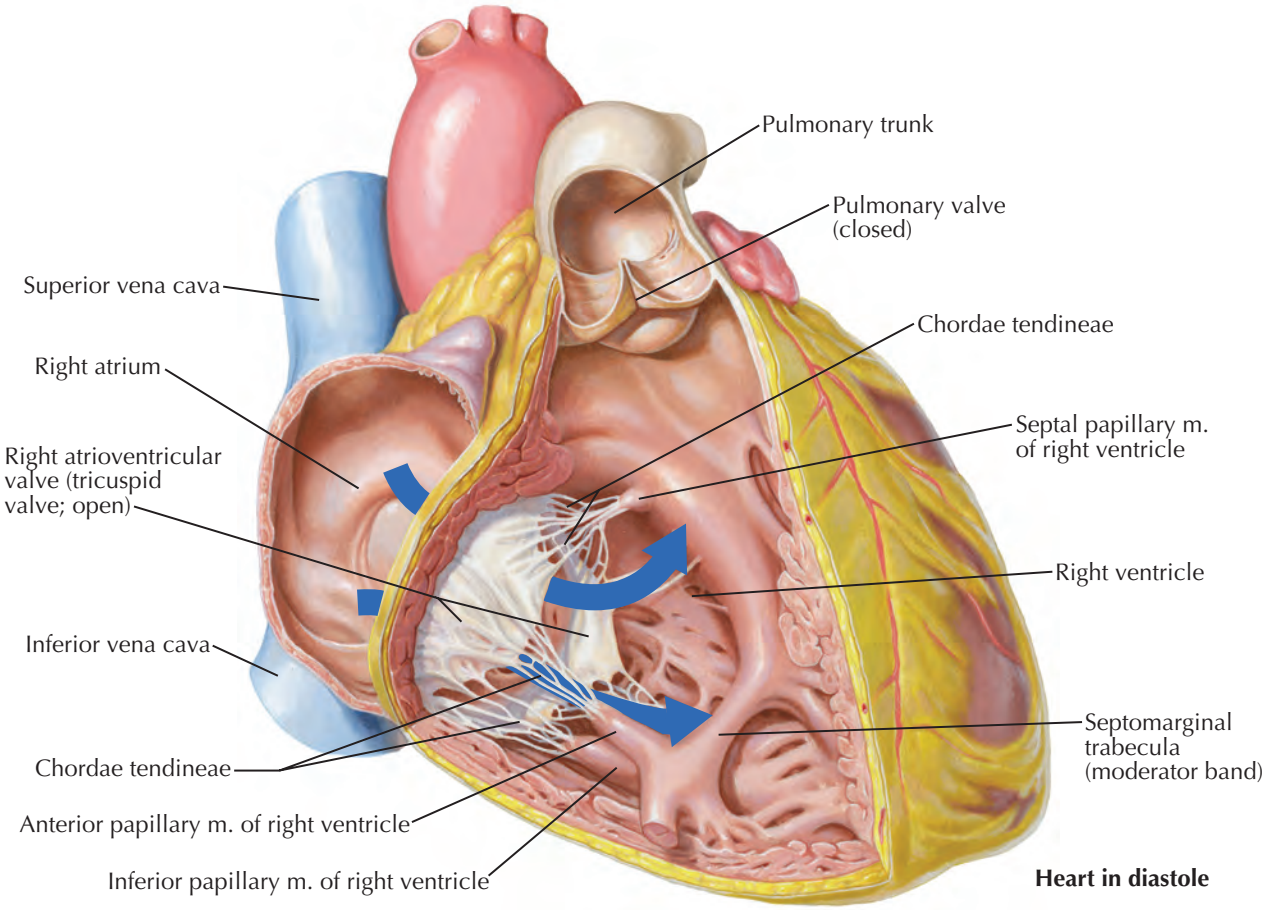
Right atrioventricular valve (tricuspid valve)



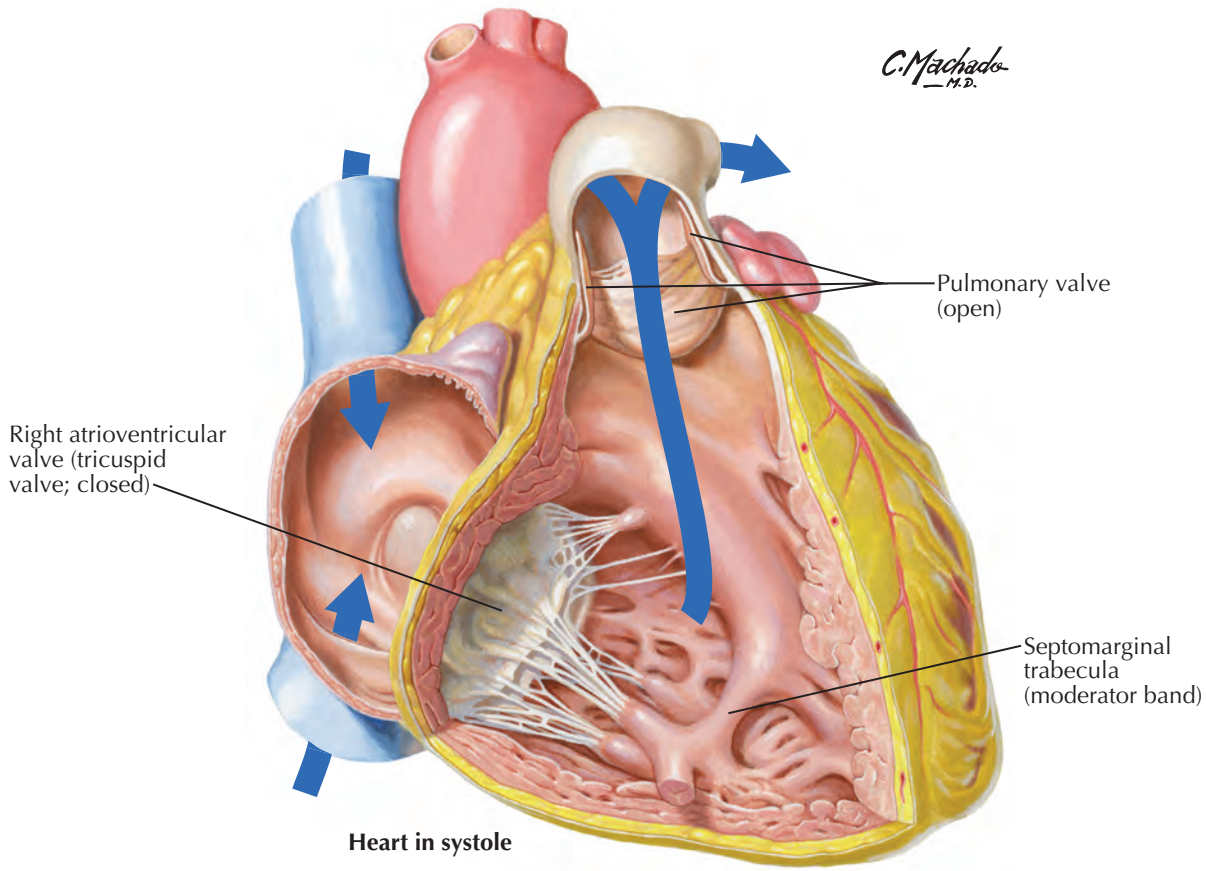
Left atrioventricular valve (mitral valve)


Pulmonary trunk
Openings of coronary aa.
Anterior leaflet of left atrioventricular valve
Ascending aorta
Left atrium
Left atrioventricular valve (mitral valve)
Posterior leaflet
Anterior leaflet
Left auricle of heart
Left coronary leaflet
Right coronary leaflet
Aortic valve
Right superior pulmonary v.
Left pulmonary vv.
Ascending aorta
Right auricle of heart
Aortic valve
Left coronary leaflet
Noncoronary leaflet
Supraventricular crest
Superior vena cava
Conus arteriosus
Membranous part of interventricular septum
Right ventricle
Anterior papillary m. of right ventricle (cut)
Right atrium
Septomarginal trabecula (moderator band)
Septal papillary m. of right ventricle
Right atrioventricular valve (tricuspid valve)
Superior leaflet
Septal leaflet
Inferior leaflet
Left ventricle
Right ventricle
Inferior papillary m. of left ventricle
Anterior papillary m. of right ventricle (cut)
Superior papillary m. of left ventricle
Inferior papillary m. of right ventricle
Left ventricle
Muscular part of interventricular septum
Plane of section

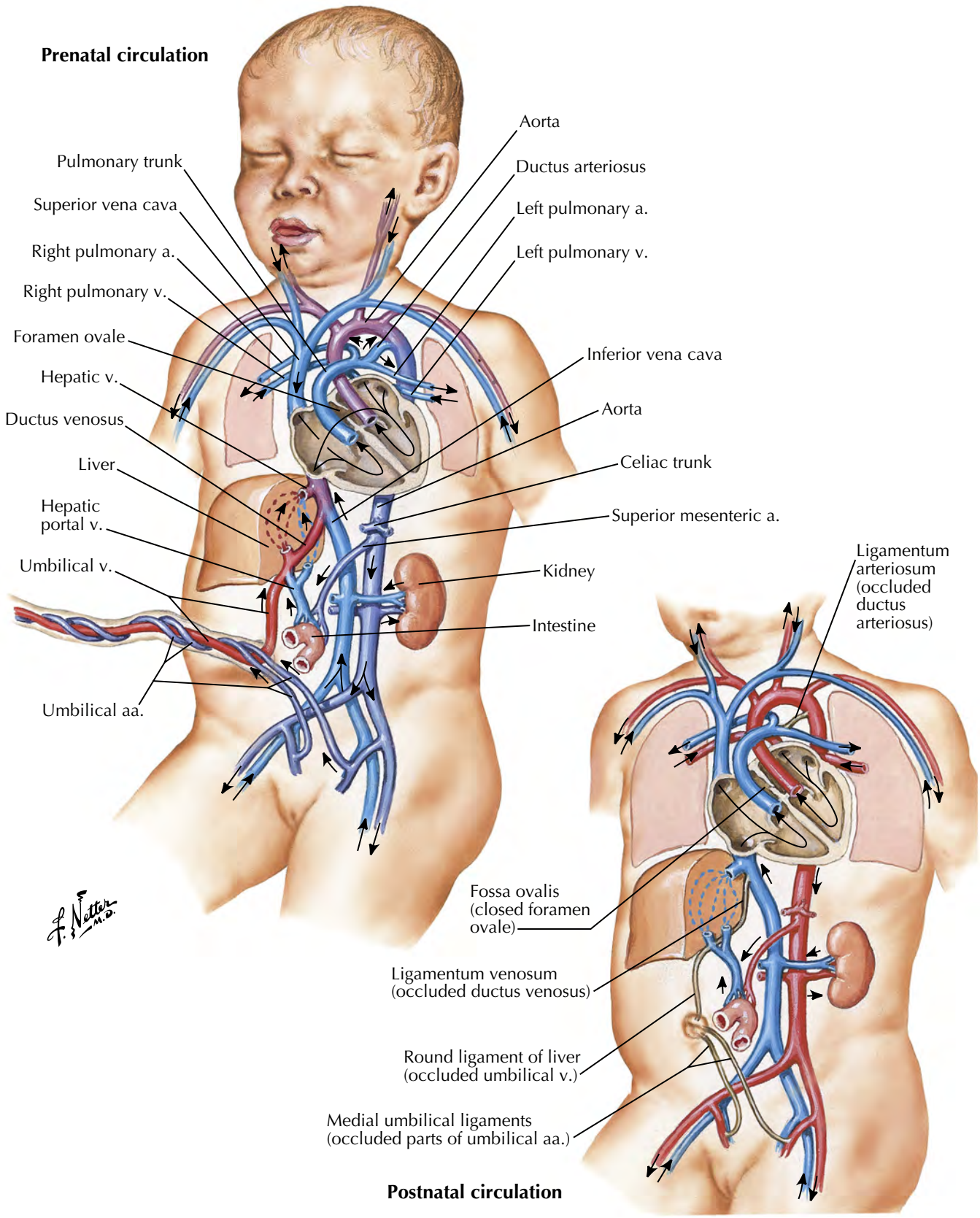
See also **Plate 241**



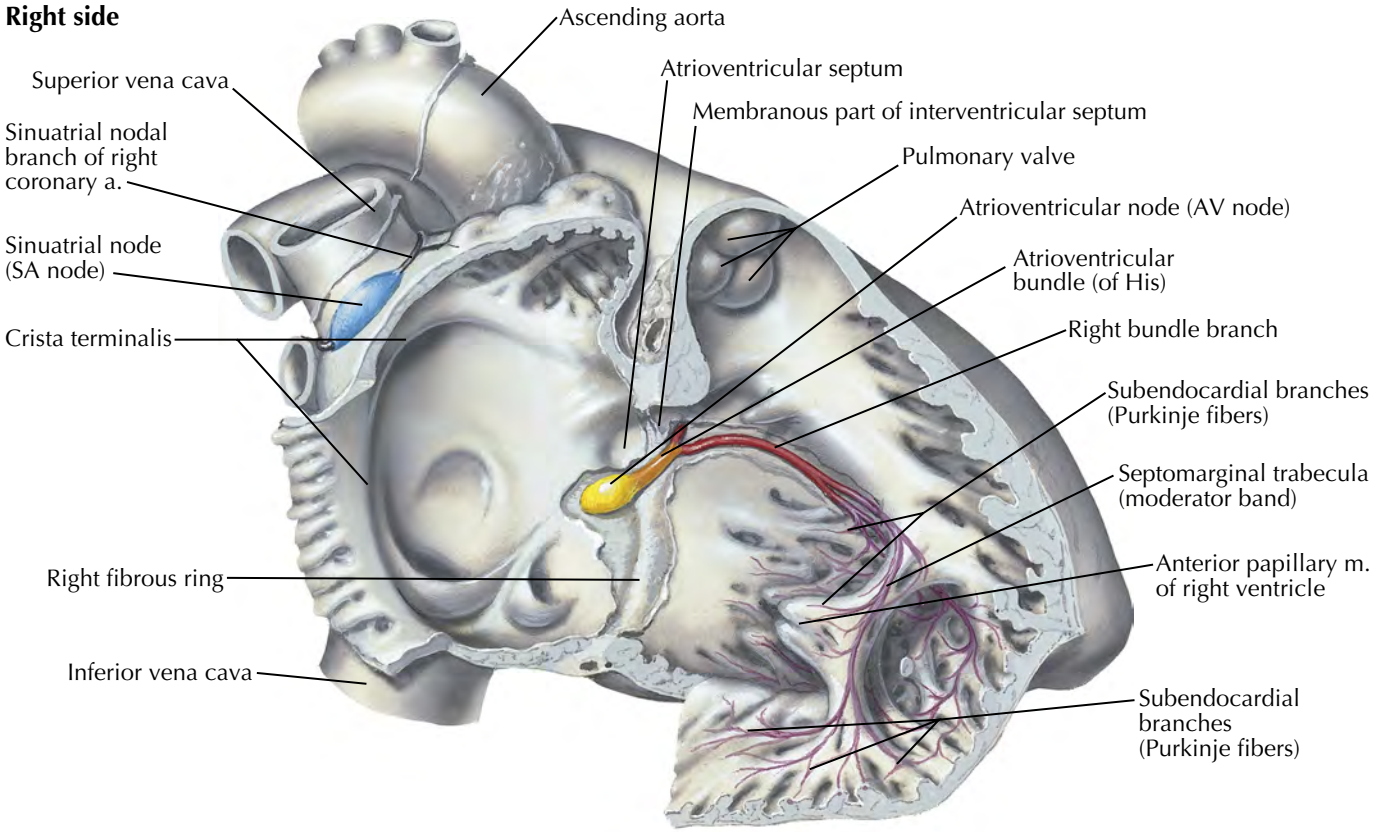
Heart in diastole



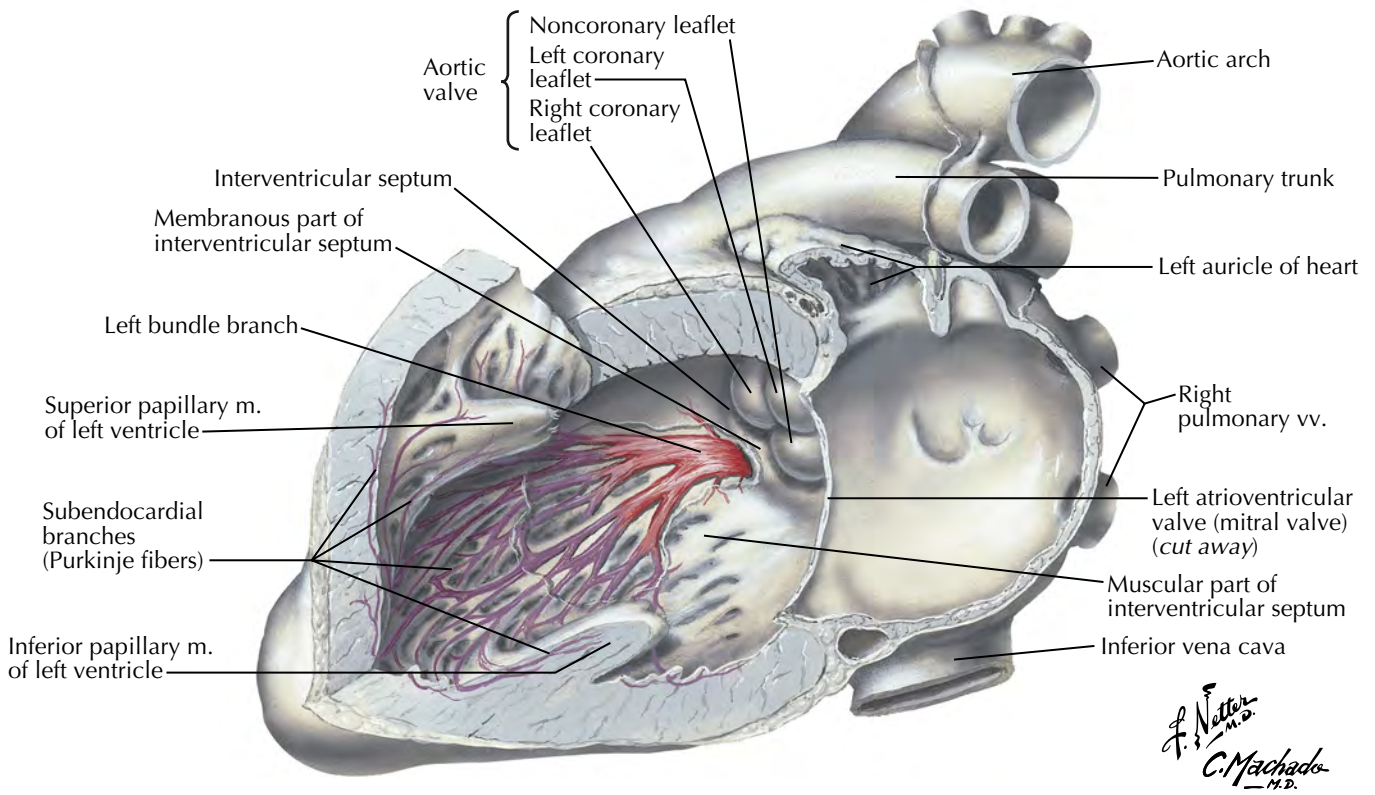
Heart in systole


Prenatal circulation
Aorta
Pulmonary trunk
Ductus arteriosus
Superior vena cava
Left pulmonary a.
Right pulmonary a.
Left pulmonary v.
Right pulmonary v.
Foramen ovale
Inferior vena cava
Hepatic v.
Aorta
Ductus venosus
Celiac trunk
Liver
Superior mesenteric a.
Hepatic portal v.
Kidney
Umbilical v.
Intestine
Umbilical aa.
Ligamentum arteriosum (occluded ductus arteriosus)
Fossa ovalis (closed foramen ovale)
Ligamentum venosum (occluded ductus venosus)
Round ligament of liver (occluded umbilical v.)
Medial umbilical ligaments (occluded parts of umbilical aa.)
Postnatal circulation

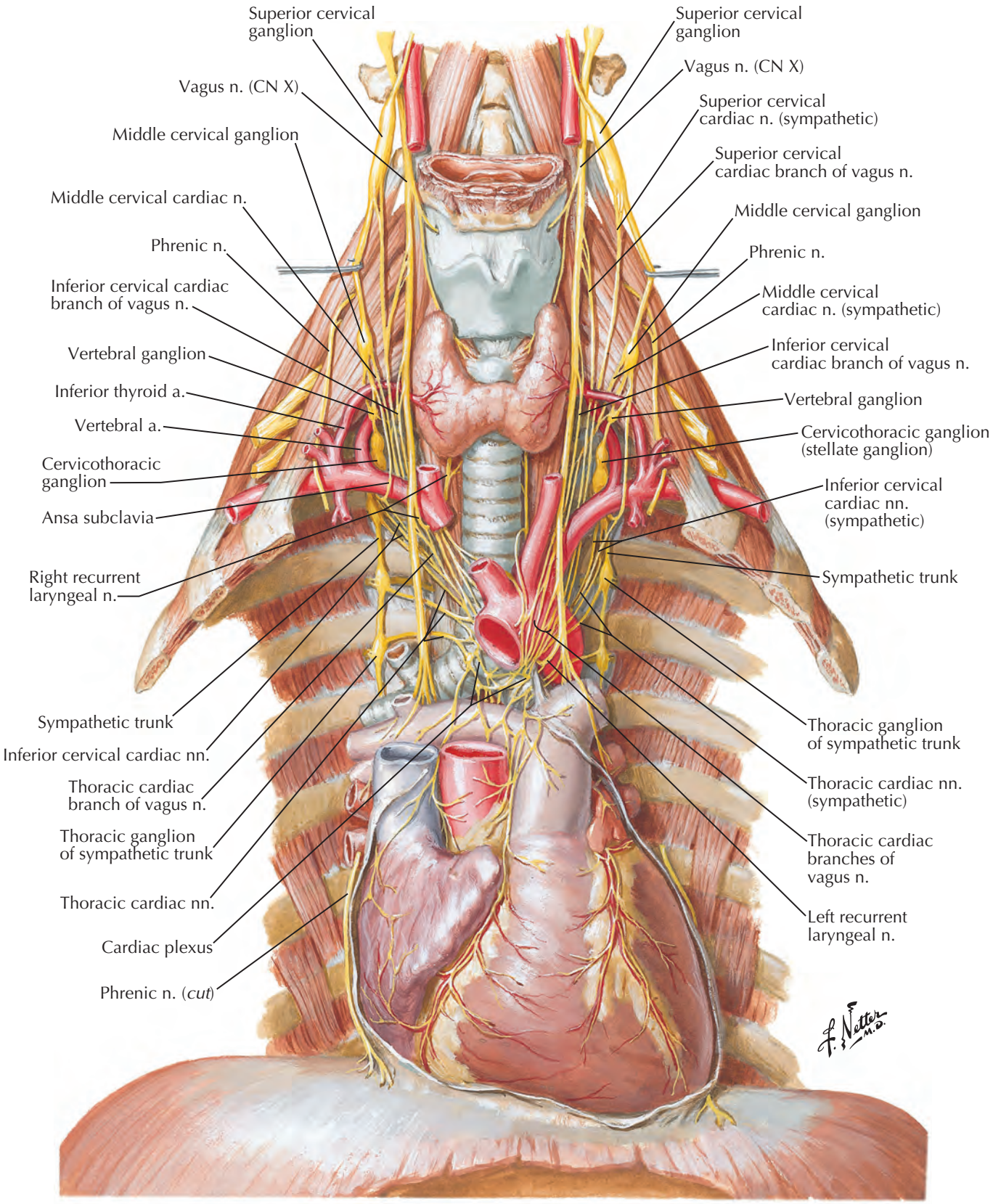
Right side



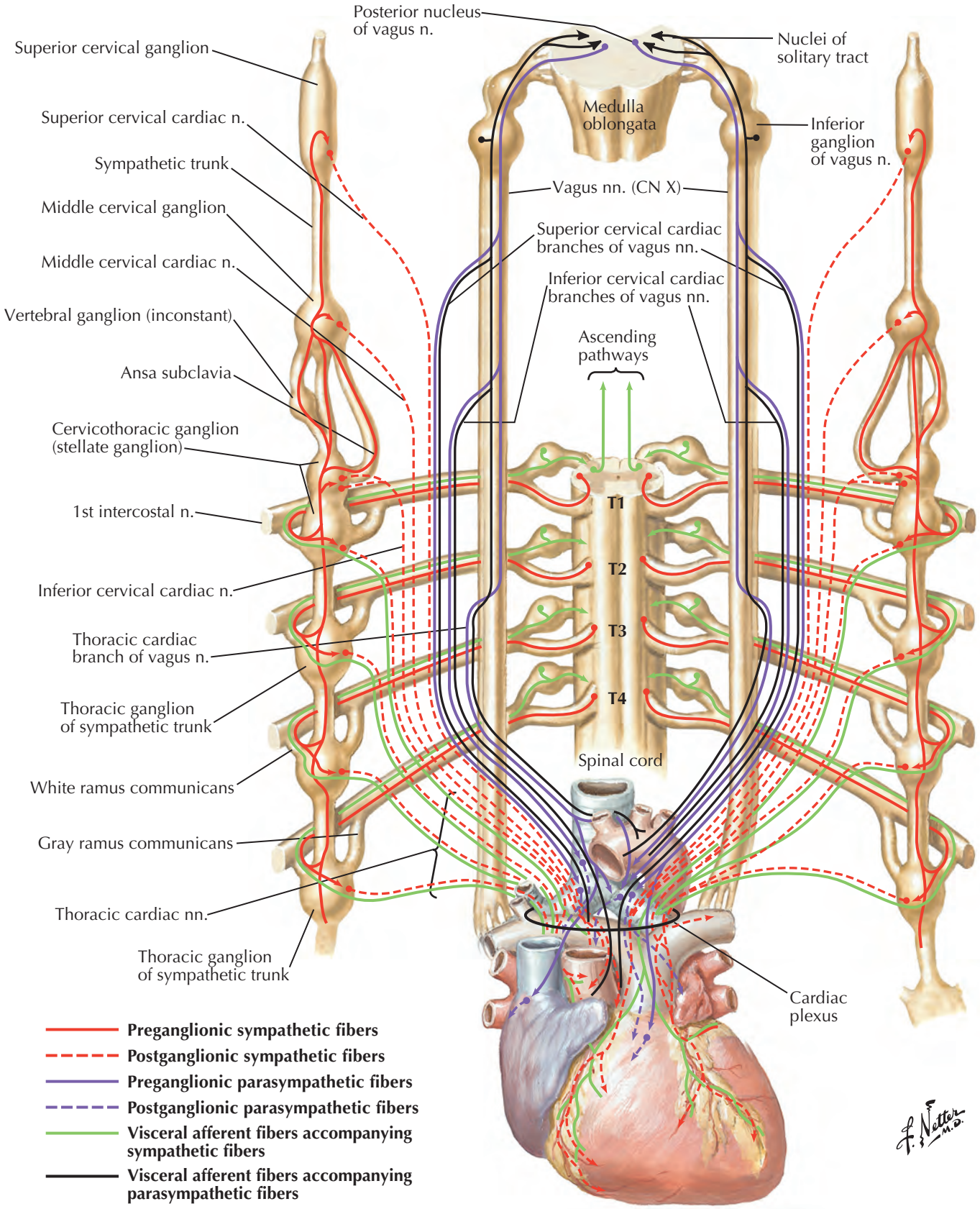
Left side

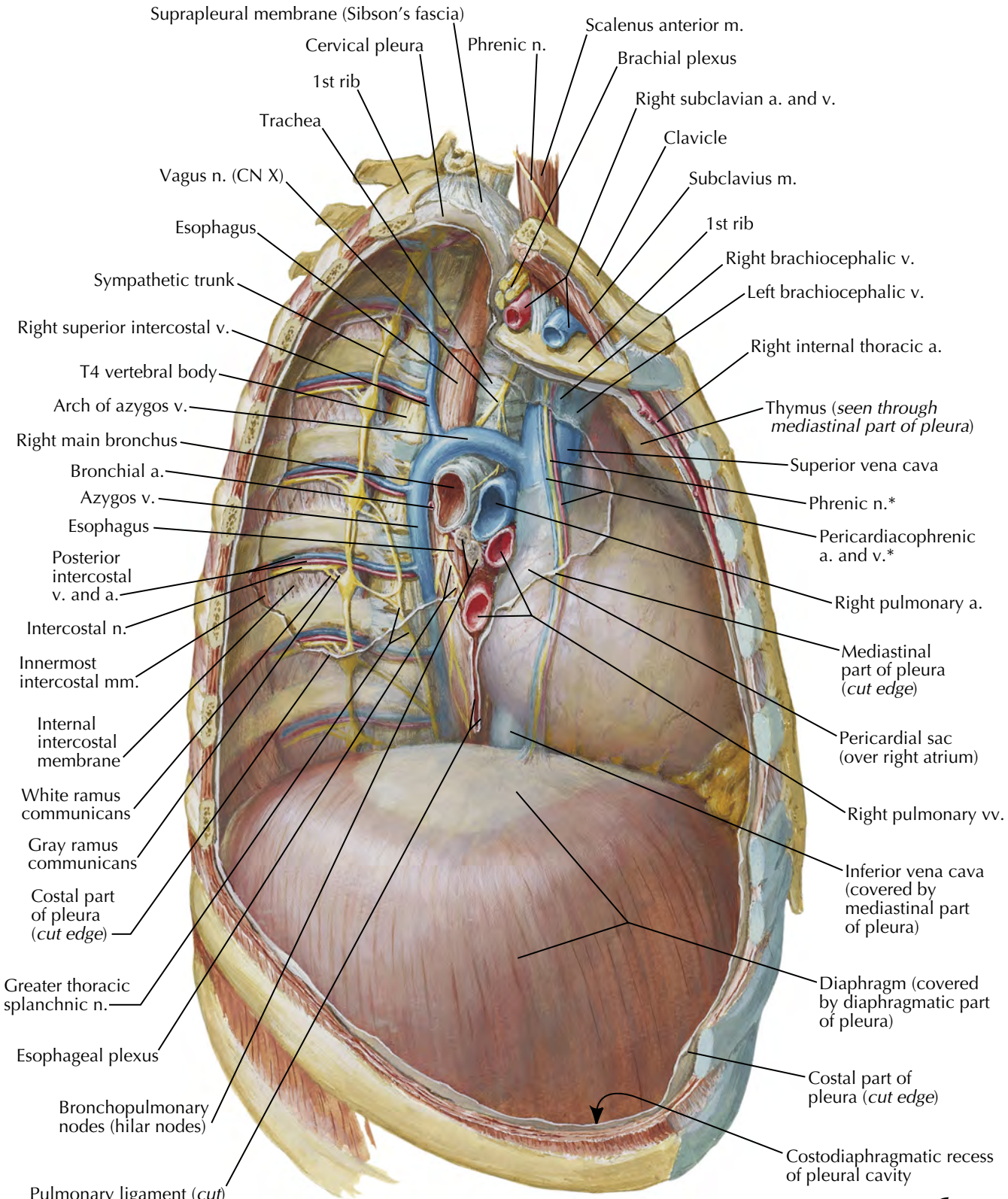


See also **Plate 229**

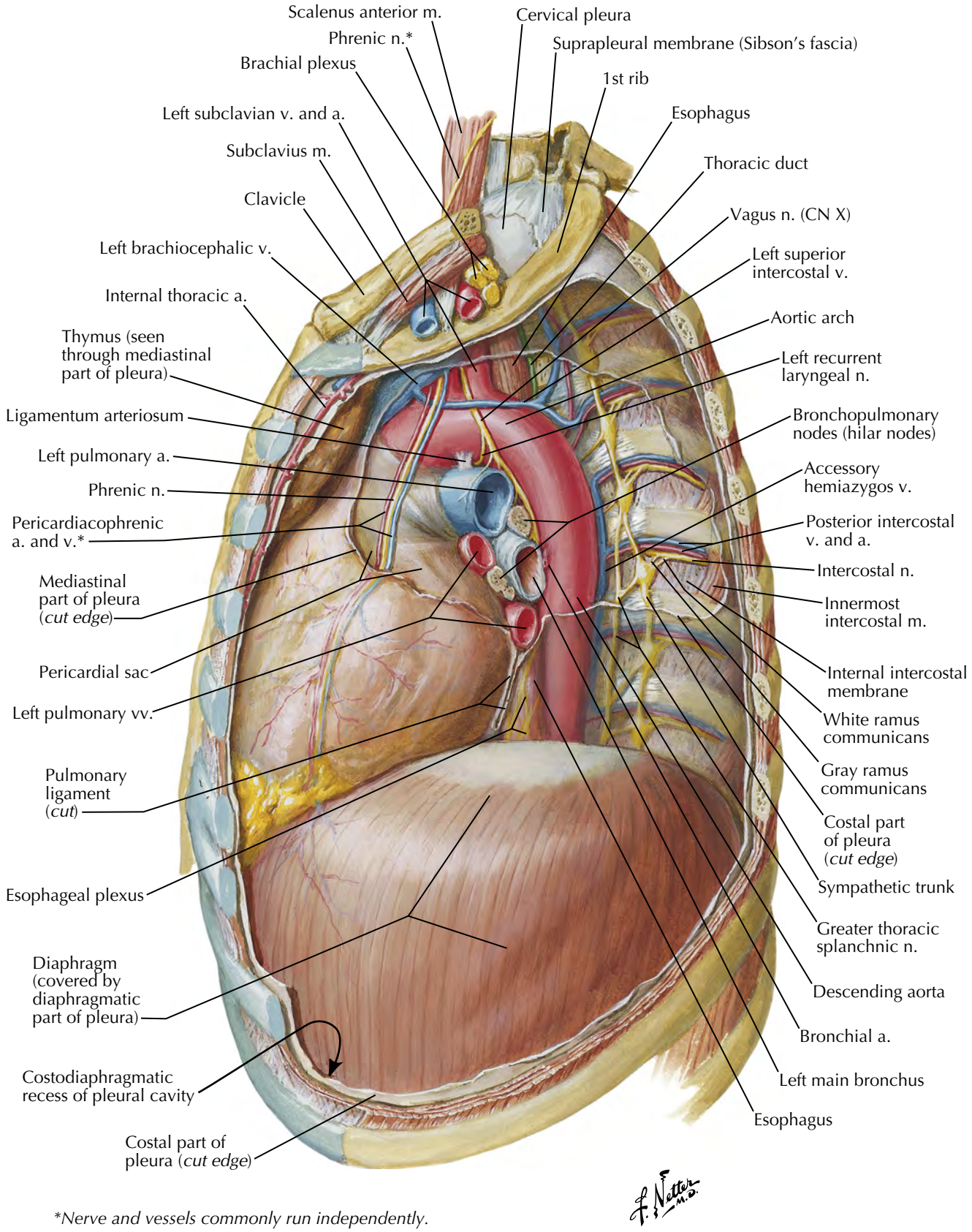


See also **Plate 230**



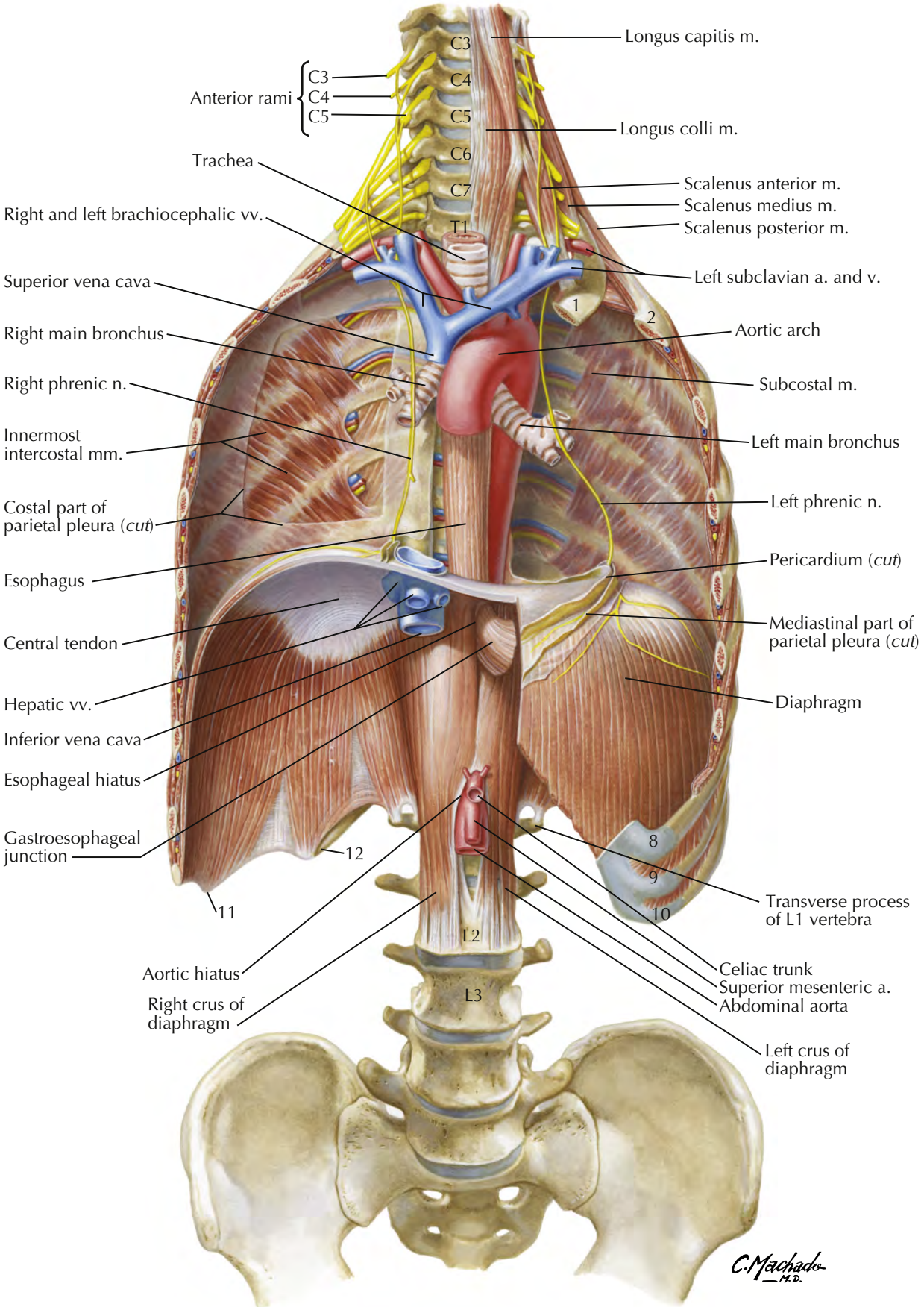


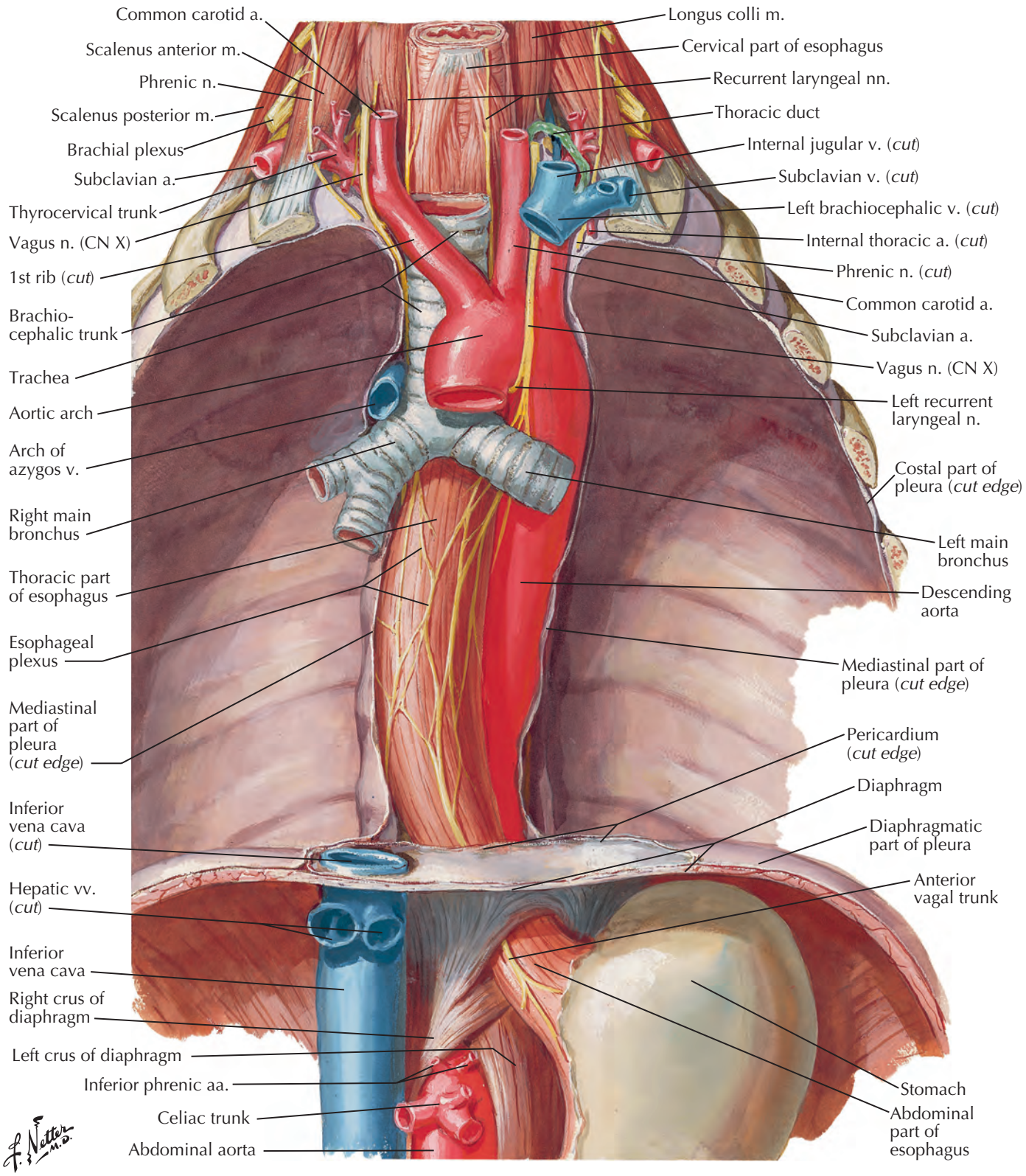
*Nerve and vessels commonly run independently.

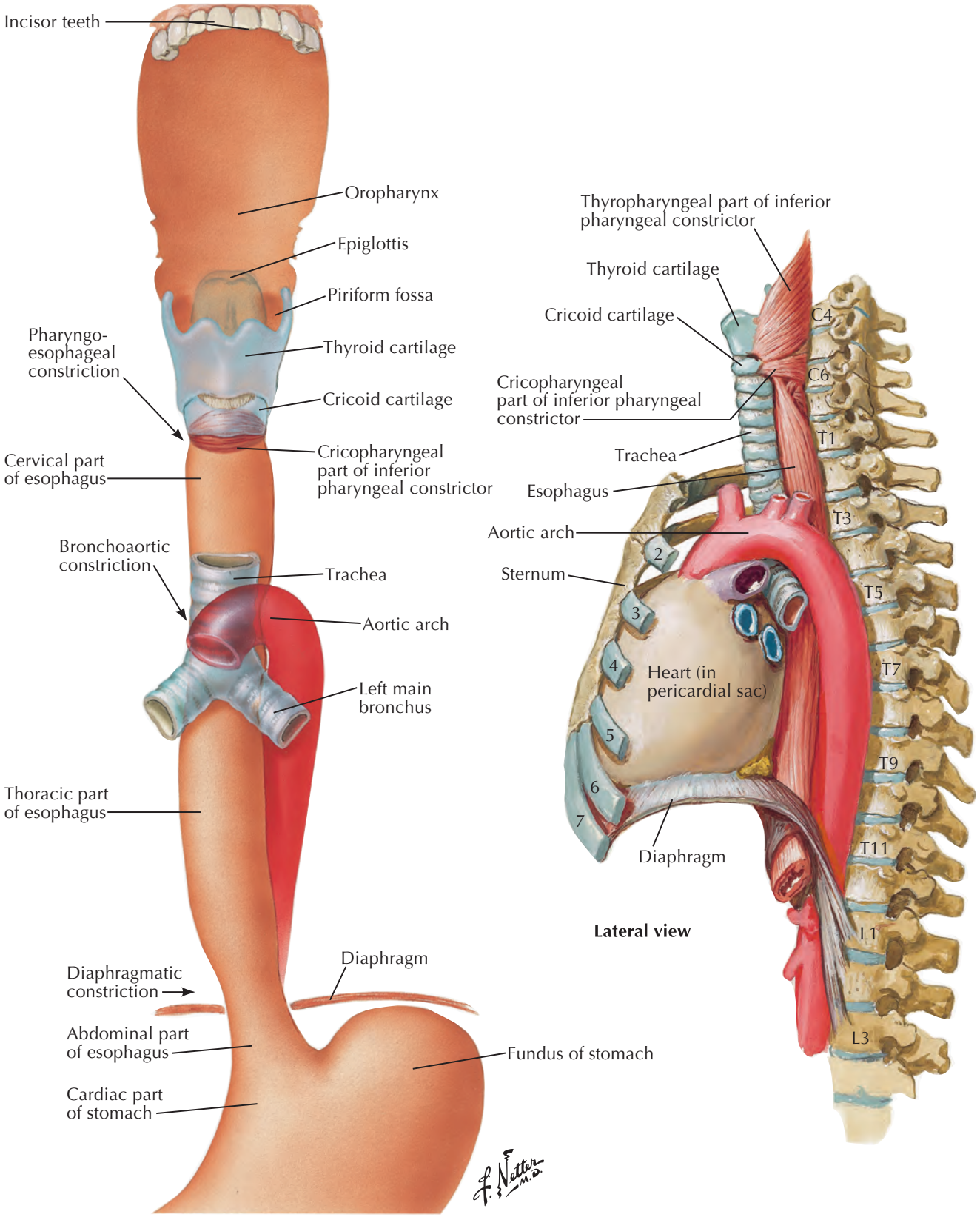


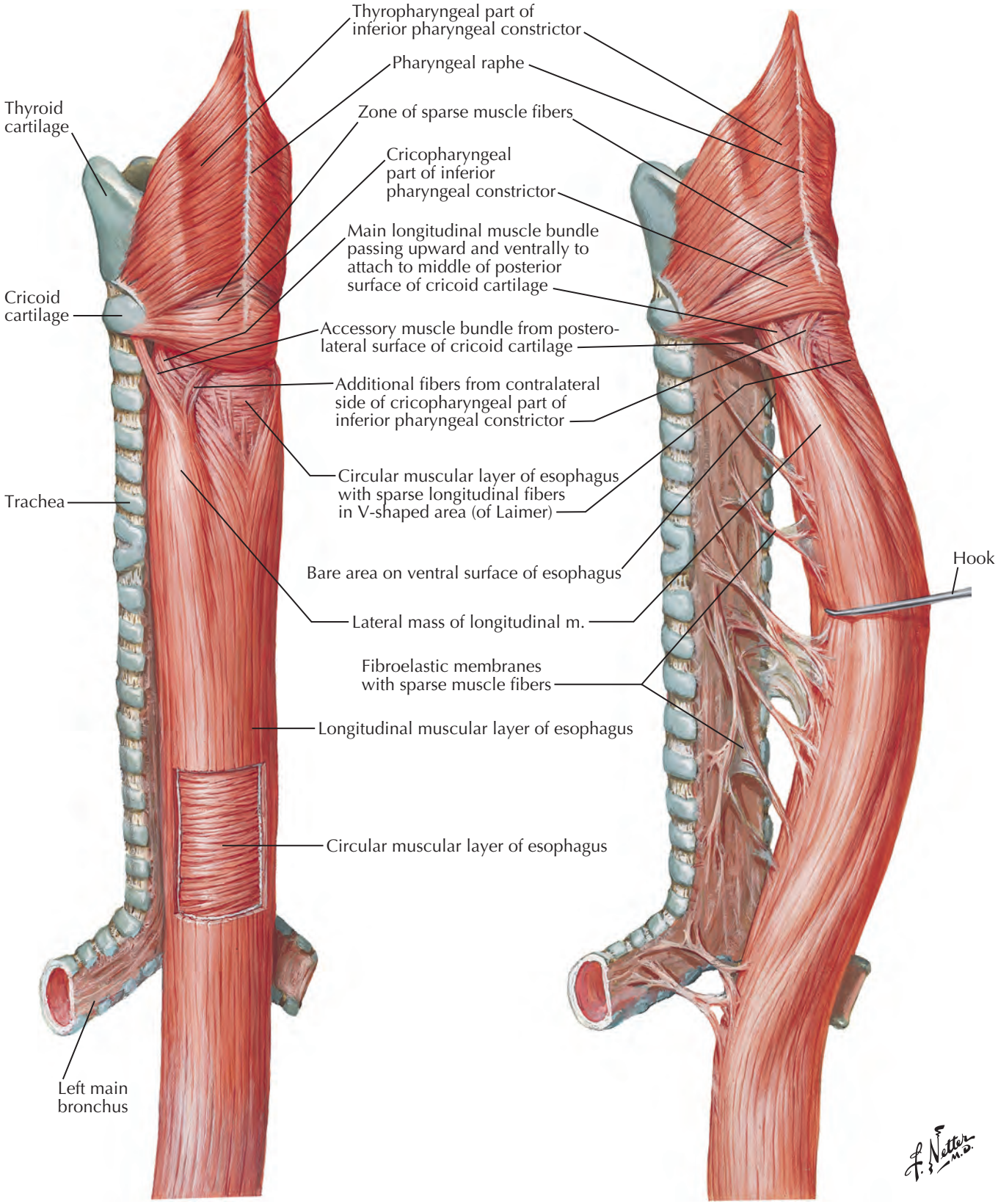
*Nerve and vessels commonly run independently.

See also **Plates 56, 57, 251, 252**



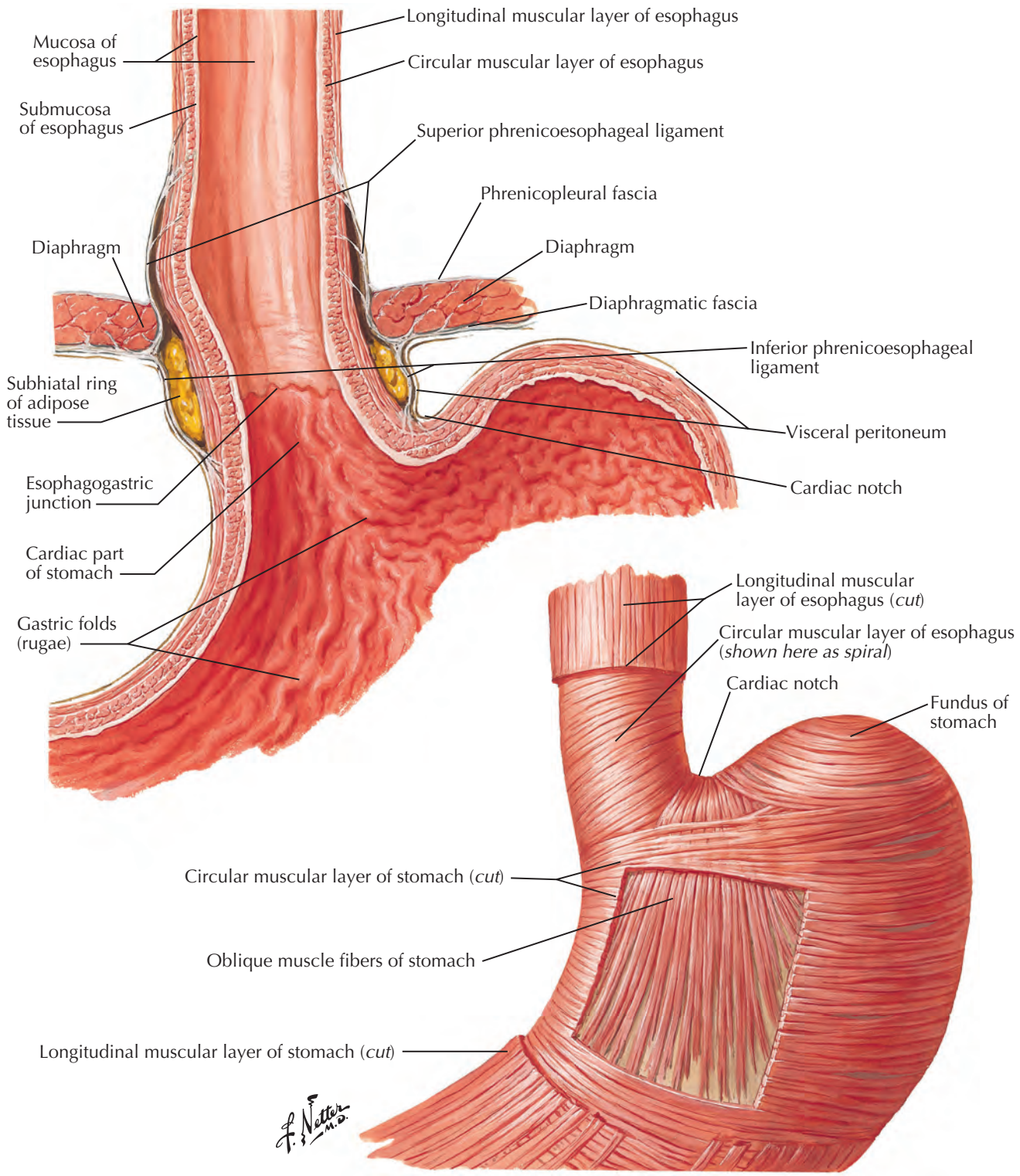

Common carotid a.
Scalenus anterior m.
Phrenic n.
Scalenus posterior m.
Brachial plexus
Subclavian a.
Thyrocervical trunk
Vagus n. (CN X)
1st rib (cut)
Brachio-cephalic trunk
Trachea
Aortic arch
Arch of azygos v.
Right main bronchus
Thoracic part of esophagus
Esophageal plexus
Mediastinal part of pleura (cut edge)
Inferior vena cava (cut)
Hepatic vv. (cut)
Inferior vena cava
Right crus of diaphragm
Left crus of diaphragm
Inferior phrenic aa.
Celiac trunk
Abdominal aorta
Longus colli m.
Cervical part of esophagus
Recurrent laryngeal nn.
Thoracic duct
Internal jugular v. (cut)
Subclavian v. (cut)
Left brachiocephalic v. (cut)
Internal thoracic a. (cut)
Phrenic n. (cut)
Common carotid a.
Subclavian a.
Vagus n. (CN X)
Left recurrent laryngeal n.
Costal part of pleura (cut edge)
Left main bronchus
Descending aorta
Mediastinal part of pleura (cut edge)
Pericardium (cut edge)
Diaphragm
Diaphragmatic part of pleura
Anterior vagal trunk
Stomach
Abdominal part of esophagus


Incisor teeth
Oropharynx
Epiglottis
Piriform fossa
Pharyngo-esophageal constriction
Thyroid cartilage
Cricoid cartilage
Cricopharyngeal part of inferior pharyngeal constrictor
Cervical part of esophagus
Bronchoaortic constriction
Trachea
Aortic arch
Left main bronchus
Thoracic part of esophagus
Diaphragm
Diaphragmatic constriction
Abdominal part of esophagus
Fundus of stomach
Cardiac part of stomach
Thyropharyngeal part of inferior pharyngeal constrictor
Thyroid cartilage
Cricoid cartilage
Cricopharyngeal part of inferior pharyngeal constrictor
Trachea
Esophagus
Aortic arch
Sternum
Heart (in pericardial sac)
Diaphragm
C4
C6
T1
T3
T5
T7
T9
T11
L1
L3
2
3
4
5
6
7
Lateral view

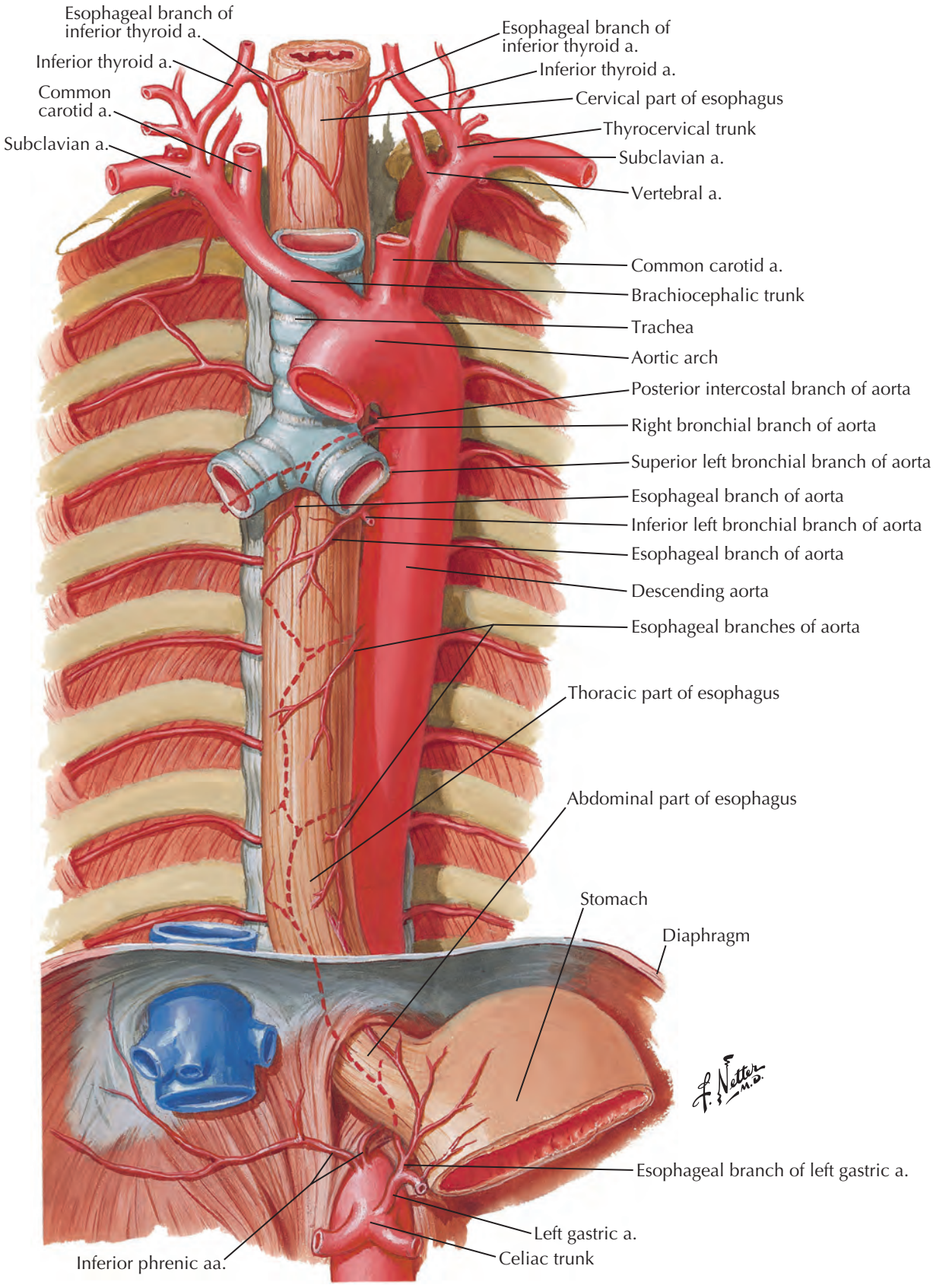


Posterolateral view

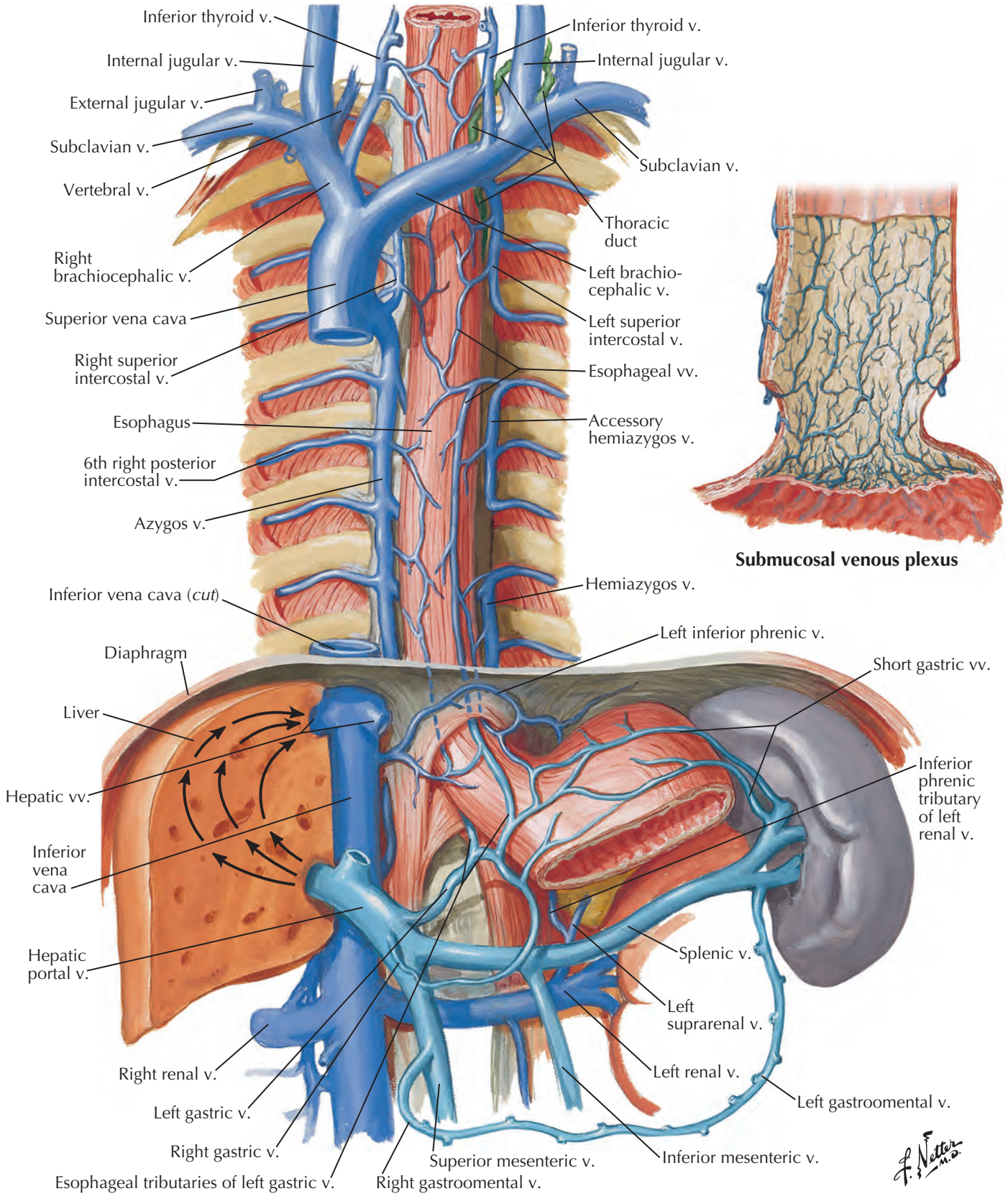
See also **Plate 295**



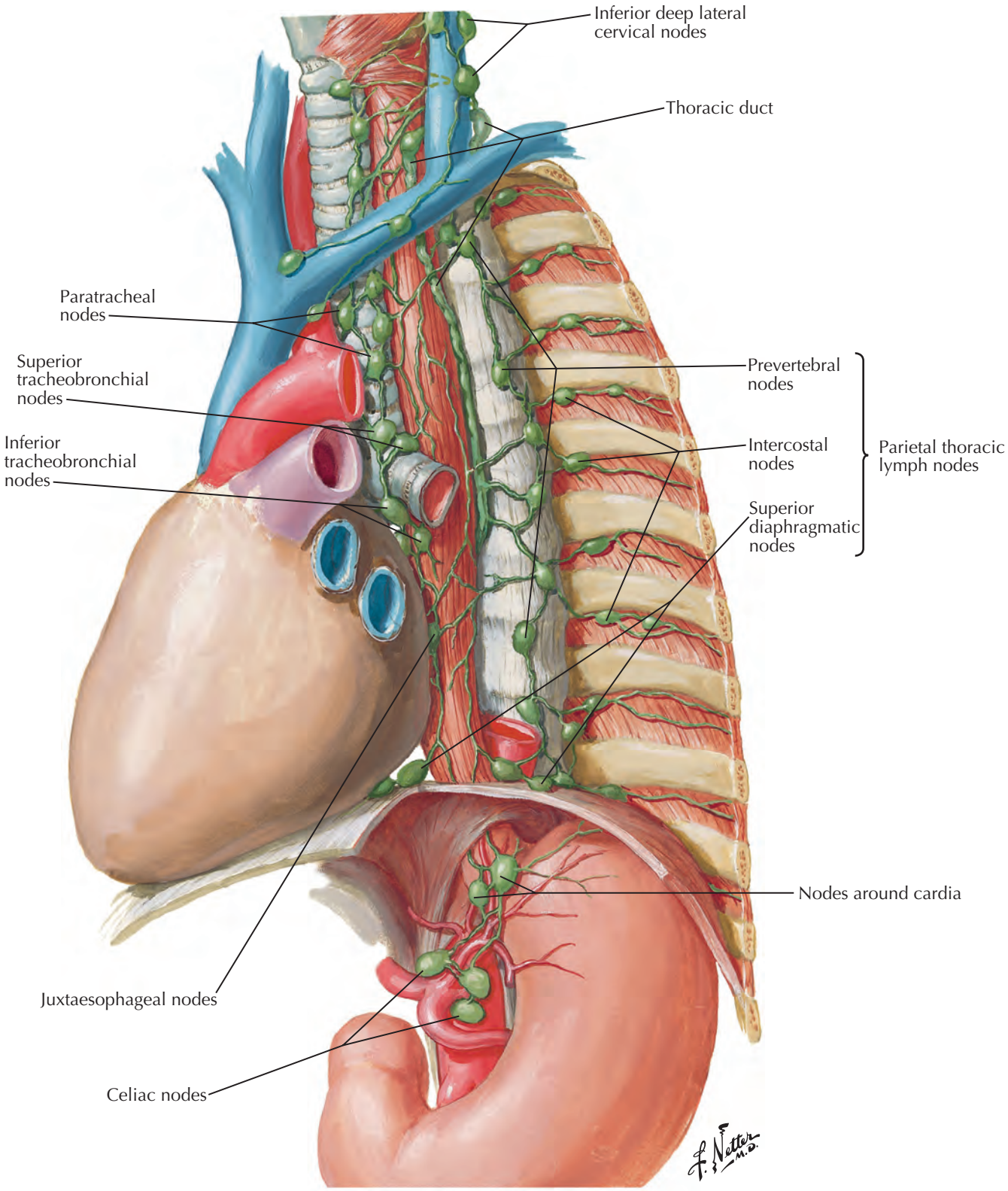
See also **Plates 222, 310, BP 49**



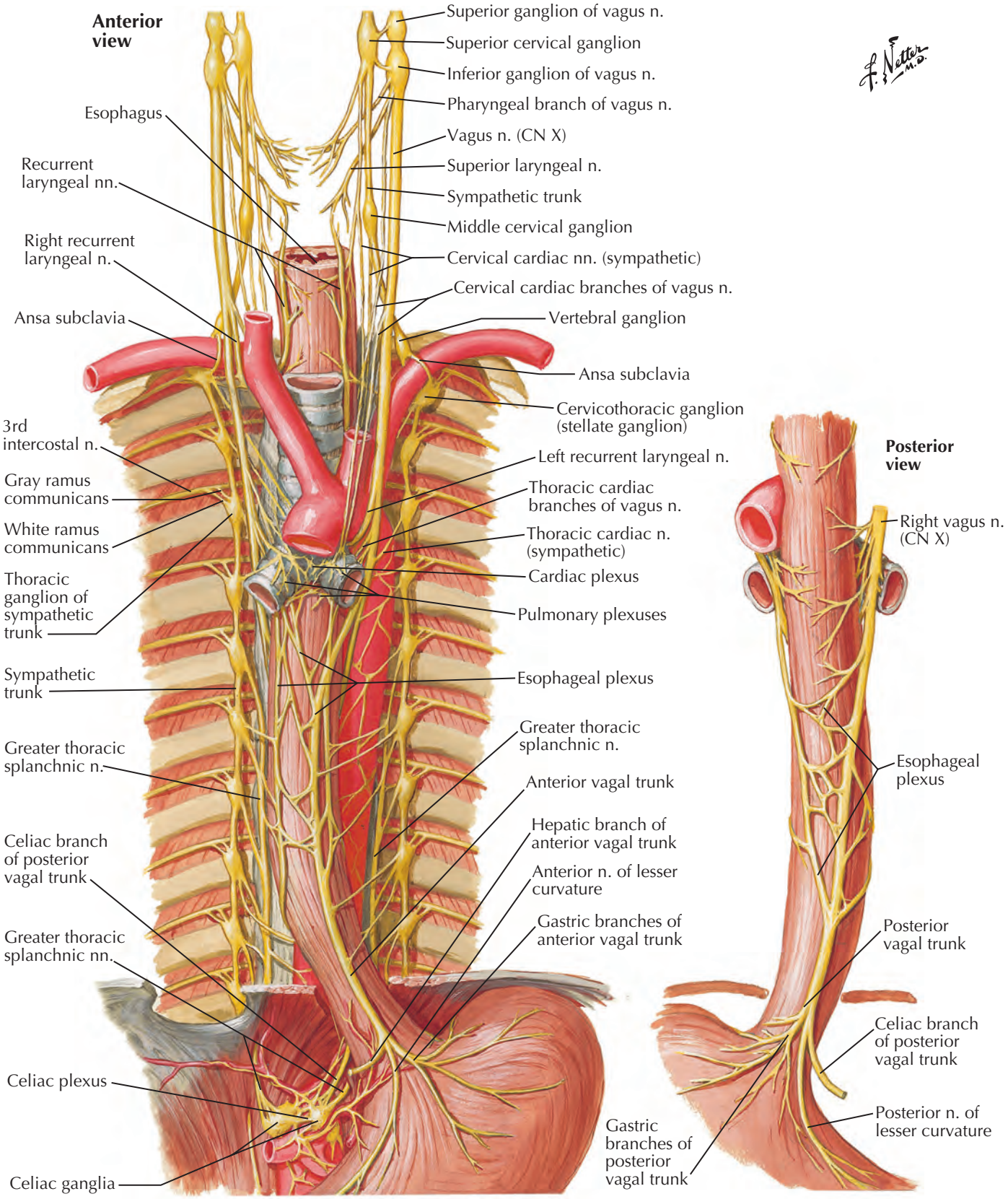
See also **Plate 213**



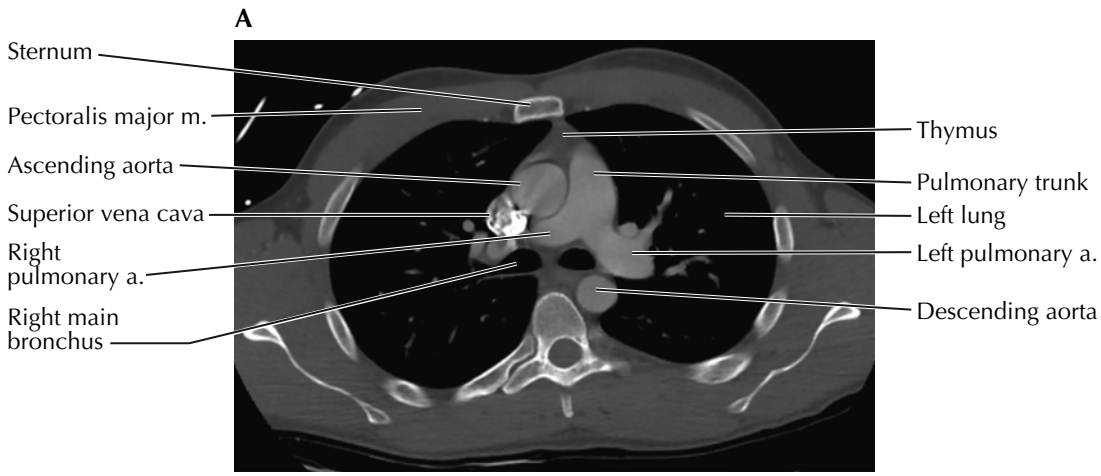
See also **Plate 228**

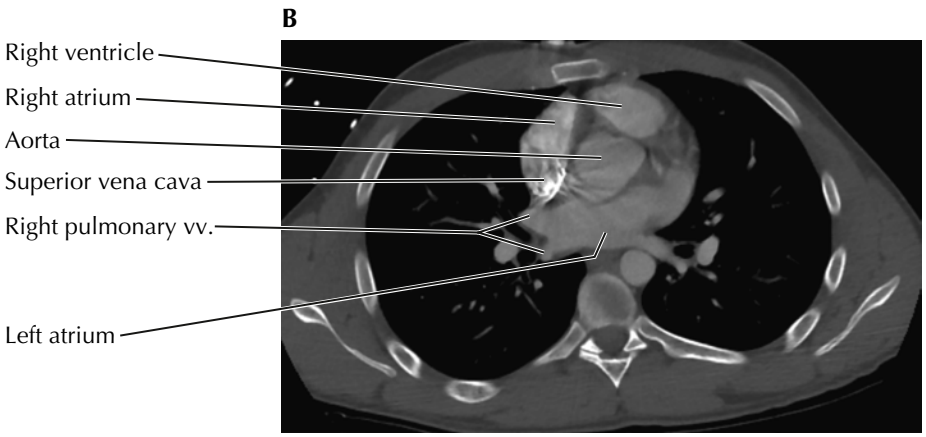


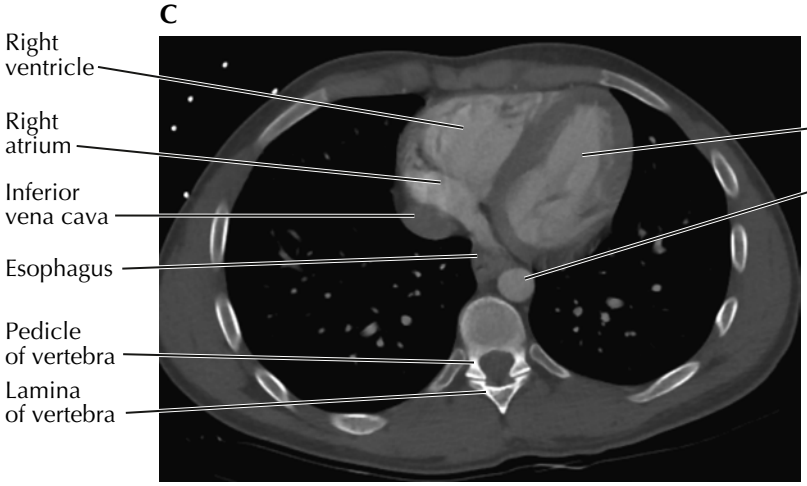
See also **Plates 320, 321, BP 48**

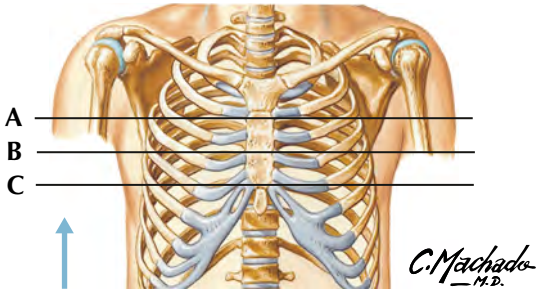


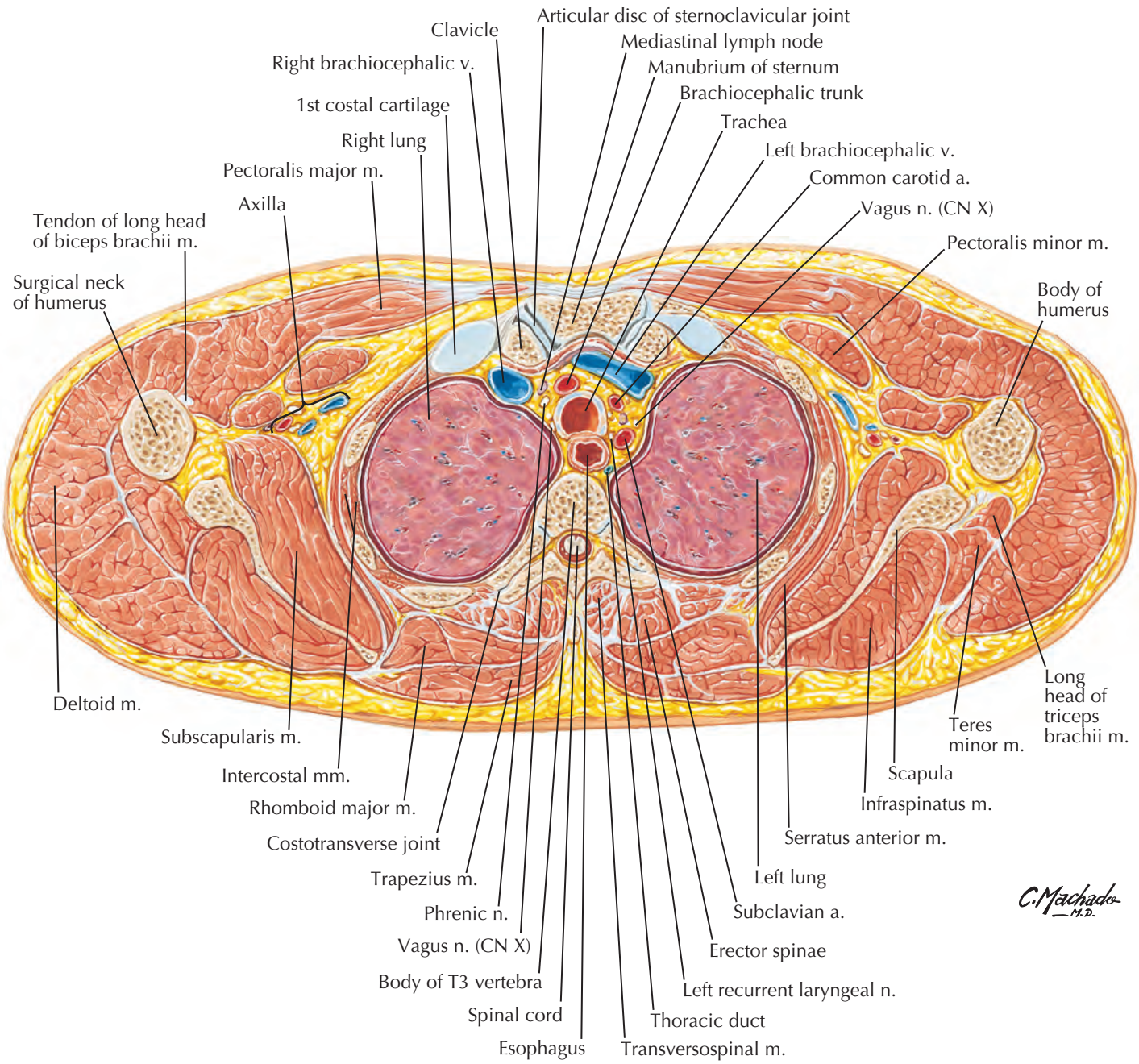
Axial CT images of the thorax from superior (A) to inferior (C)

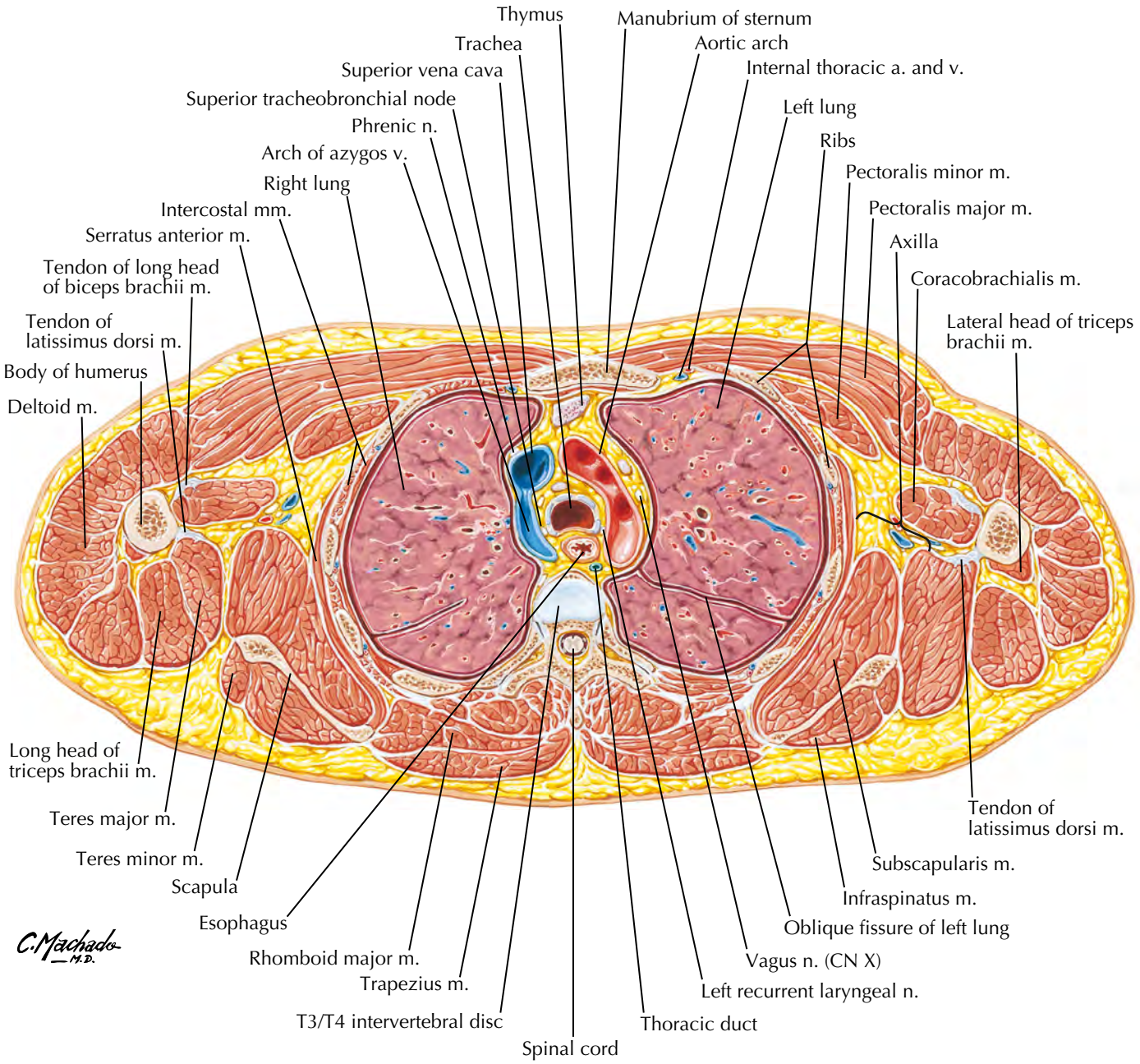


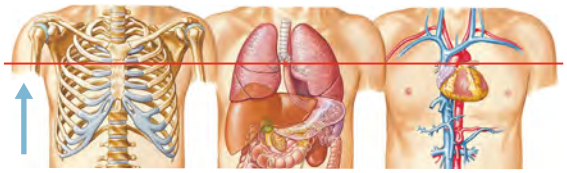


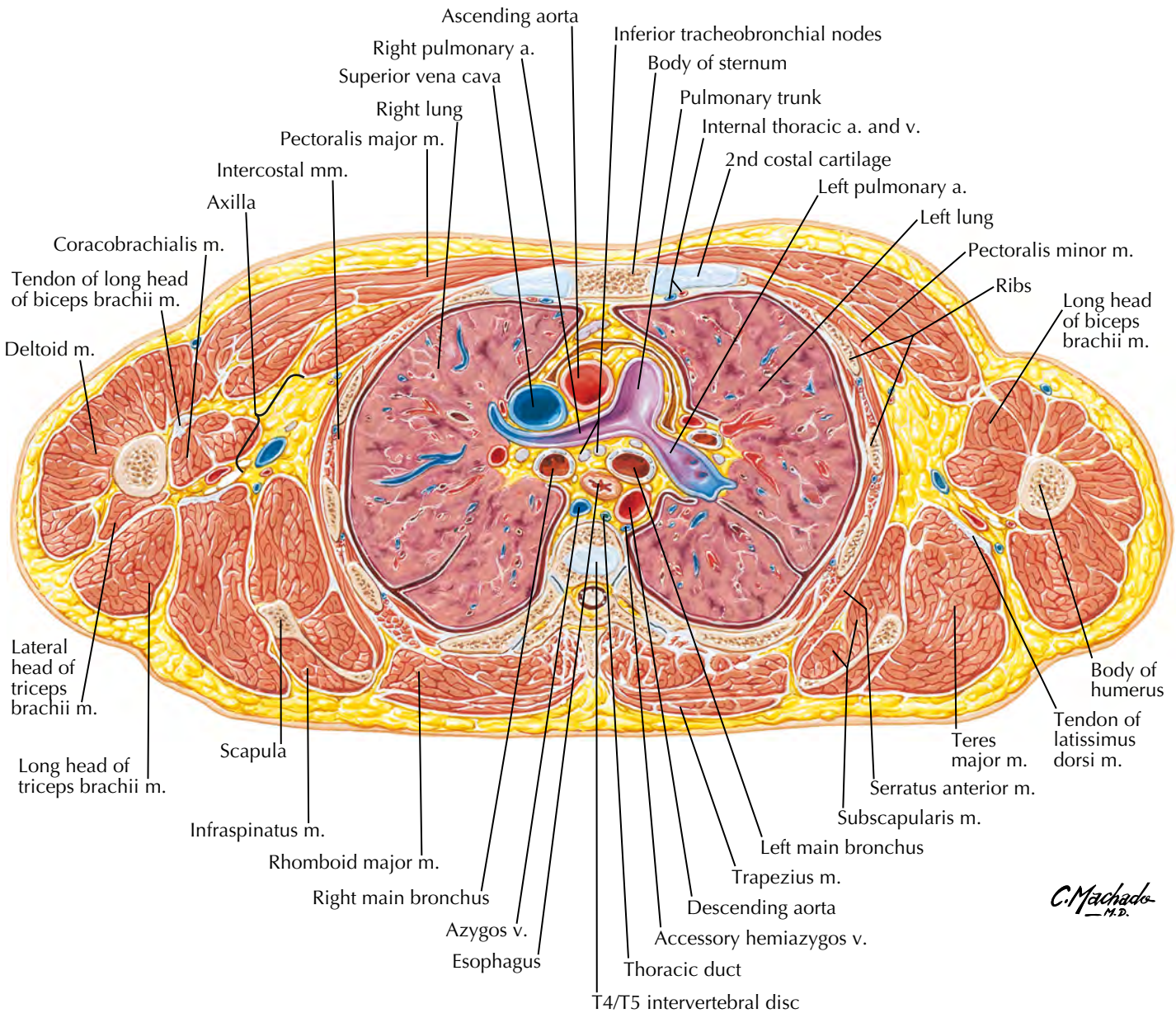


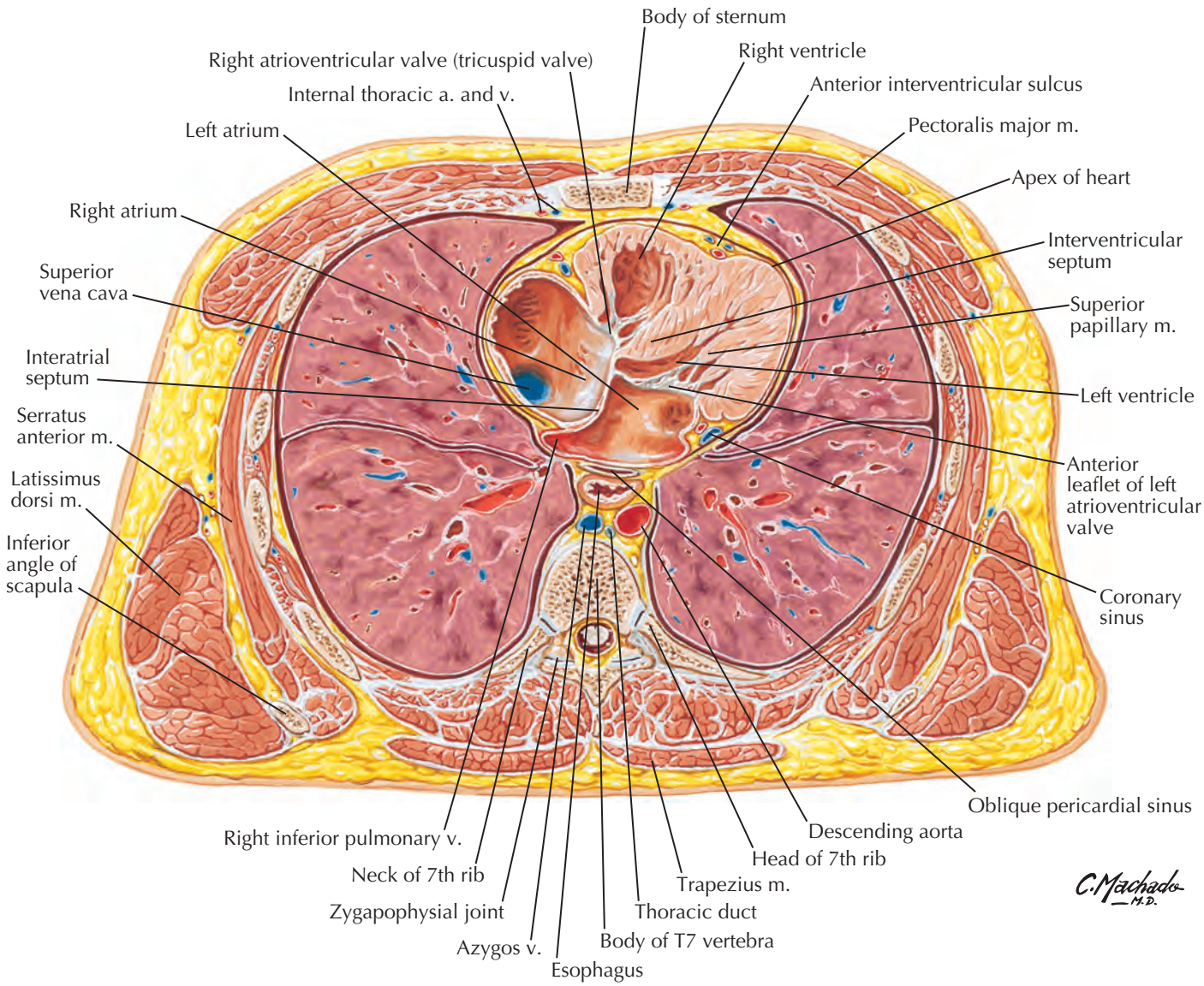



Articular disc of sternoclavicular joint
Clavicle
Mediastinal lymph node
Right brachiocephalic v.
Manubrium of sternum
Brachiocephalic trunk
1st costal cartilage
Trachea
Right lung
Left brachiocephalic v.
Pectoralis major m.
Common carotid a.
Axilla
Vagus n. (CN X)
Tendon of long head of biceps brachii m.
Pectoralis minor m.
Surgical neck of humerus
Body of humerus
Deltoid m.
Long head of triceps brachii m.
Teres minor m.
Subscapularis m.
Scapula
Intercostal mm.
Infraspinatus m.
Rhomboid major m.
Serratus anterior m.
Costotransverse joint
Left lung
Trapezius m.
Subclavian a.
Phrenic n.
Erector spinae
Vagus n. (CN X)
Left recurrent laryngeal n.
Body of T3 vertebra
Thoracic duct
Spinal cord
Transversospinal m.
Esophagus


Thymus
Manubrium of sternum
Trachea
Aortic arch
Superior vena cava
Internal thoracic a. and v.
Superior tracheobronchial node
Left lung
Phrenic n.
Ribs
Arch of azygos v.
Pectoralis minor m.
Right lung
Pectoralis major m.
Intercostal mm.
Axilla
Serratus anterior m.
Coracobrachialis m.
Tendon of long head of biceps brachii m.
Lateral head of triceps brachii m.
Tendon of latissimus dorsi m.
Body of humerus
Deltoid m.
Long head of triceps brachii m.
Tendon of latissimus dorsi m.
Teres major m.
Subscapularis m.
Teres minor m.
Infraspinatus m.
Scapula
Oblique fissure of left lung
Esophagus
Vagus n. (CN X)
Rhomboid major m.
Left recurrent laryngeal n.
Trapezius m.
T3/T4 intervertebral disc
Thoracic duct
Spinal cord
C. Machado M.D.




Ascending aorta
Right pulmonary a.
Superior vena cava
Right lung
Pectoralis major m.
Intercostal mm.
Axilla
Coracobrachialis m.
Tendon of long head of biceps brachii m.
Deltoid m.
Lateral head of triceps brachii m.
Long head of triceps brachii m.
Scapula
Infraspinatus m.
Rhomboid major m.
Right main bronchus
Azygos v.
Esophagus
T4/T5 intervertebral disc
Thoracic duct
Accessory hemiazygos v.
Descending aorta
Trapezius m.
Left main bronchus
Subscapularis m.
Serratus anterior m.
Teres major m.
Tendon of latissimus dorsi m.
Body of humerus
Long head of biceps brachii m.
Ribs
Pectoralis minor m.
Left lung
Left pulmonary a.
2nd costal cartilage
Internal thoracic a. and v.
Pulmonary trunk
Body of sternum
Inferior tracheobronchial nodes


Body of sternum
Right ventricle
Right atrioventricular valve (tricuspid valve)
Internal thoracic a. and v.
Anterior interventricular sulcus
Left atrium
Pectoralis major m.
Apex of heart
Right atrium
Interventricular septum
Superior vena cava
Superior papillary m.
Interatrial septum
Left ventricle
Serratus anterior m.
Anterior leaflet of left atrioventricular valve
Latissimus dorsi m.
Inferior angle of scapula
Coronary sinus
Oblique pericardial sinus
Descending aorta
Right inferior pulmonary v.
Head of 7th rib
Neck of 7th rib
Trapezius m.
Zygapophysial joint
Thoracic duct
Azygos v.
Body of T7 vertebra
Esophagus
C. Machado M.D.

ANATOMICAL STRUCTURE	CLINICAL COMMENT	PLATE NUMBERS
Nervous System and Sense Organs		
Long thoracic nerve	May be damaged during chest tube placement or mastectomy, resulting in winged scapula (denervation of serratus anterior muscle)	206, 209
Intercostal nerve	Site of local anesthetic nerve block for procedures such as thoracostomy or to alleviate pain caused by herpes zoster (shingles)	211, 212
Spinal (posterior root) ganglion	Can house dormant varicella zoster virus, which, when activated, can result in herpes zoster (shingles)	212
Phrenic nerve	Surgical injury to phrenic nerve may cause ipsilateral paralysis of diaphragm; diaphragmatic irritation may manifest as shoulder pain because of referral to C3–C5 spinal levels	214, 216, 232
Recurrent laryngeal nerve	The left nerve takes a circuitous path around aorta and may rarely become compressed by large thoracic aortic aneurysm or enlarged left atrium, producing hoarse voice (Ortner's syndrome); more often, these branches are affected by malignancies, such as those of thyroid gland	252, 254
Thoracic cardiac nerves (sympathetic)	Pain of myocardial ischemia referred to upper thoracic dermatomes; may be perceived as somatic pain in thorax and medial upper limb	250
Skeletal System		
Ribs	Rib fractures may cause respiratory dysfunction, predispose to pneumonia, and injure underlying structures (e.g., liver and spleen); severe fractures may breach pleural space and cause pneumothorax; flail chest occurs when multiple fractures in adjacent ribs create "floating" area of thorax with paradoxical motion during inspiration	203
Costochondral and sternochondral (sternocostal) joints	Frequent sites of pain and tenderness after thoracic wall injury or excessive weightlifting (costochondritis); generally reproducible with palpation of joints	204
Clavicles	Common sites of fracture, often after falling onto outstretched limb or onto shoulder; fractures typically occur in middle third; supraclavicular nerve block relieves pain associated with fracture	203
Sternal angle (of Louis)	Surface landmark for counting ribs (2nd pair of ribs articulate between manubrium and body of sternum) and intercostal spaces; divides superior from inferior mediastinum, and marks transition from aortic arch to descending thoracic aorta	203
Superior thoracic aperture	Compression of neurovascular structures (inferior trunk of brachial plexus and great vessels) that traverse superior thoracic aperture may produce thoracic outlet syndrome	213
Intercostal spaces	Relationship of intercostal neurovascular bundle to ribs is crucial when placing chest tube to relieve pneumothorax or hemothorax, or needles to anesthetize nerves; tubes should be inserted along superior margin of ribs to avoid these bundles; of note, however, intercostal nerve may have collateral branch running along superior border of lower rib, which can result in pain	210, 238
Median cricothyroid ligament	Also known as cricothyroid membrane; site of cricothyrotomy, an emergency procedure to establish surgical airway	53, 103
Muscular System		
Diaphragm	Widening of esophageal hiatus at T8 vertebral level or congenital defect allows for protrusion of stomach into thorax (hiatal hernia), which increases incidence of gastroesophageal reflux	216, 257

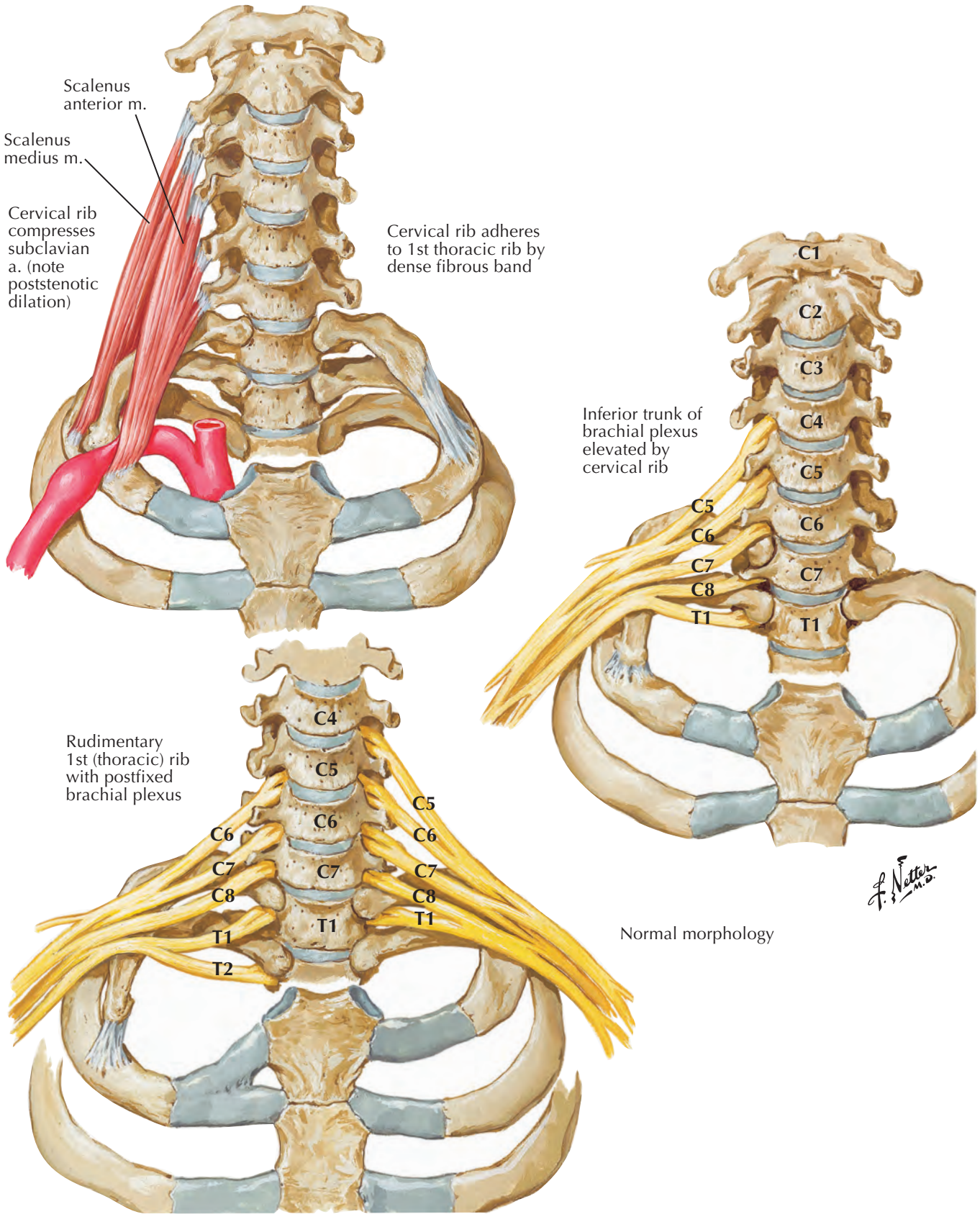
ANATOMICAL STRUCTURE	CLINICAL COMMENT	PLATE NUMBERS
Cardiovascular System		
Internal thoracic artery	Commonly used for coronary artery bypass grafts, most often for anterior interventricular artery (left anterior descending artery)	211, 212
Pulmonary arteries	Thromboemboli, most often from pelvic and femoral sources, may obstruct pulmonary arteries (pulmonary embolus), leading to hypoxemia, hemodynamic compromise, and pulmonary infarction	220, 227
Pericardium	Pericardial space can contain small amounts of physiologic fluid (15–50 mL); effusion may compromise heart function (cardiac tamponade); pericardial sac can expand and become quite large with slow, progressive fluid accumulation	231, 236
Coronary arteries	Fixed atherosclerotic disease may cause myocardial ischemia to manifest as thoracic pain; rupture and thrombosis of atherosclerotic plaque is main cause of acute myocardial infarction; severity and outcomes depend on amount of myocardium that vessel subtends, with proximal lesions of large vessels being most morbid	239
Pulmonary veins	Atrial fibrillation, a common arrhythmia, is believed to originate from within pulmonary veins; electrical ablation of this arrhythmia creates rings of fibrosis around pulmonary veins as they enter left atrium, thereby preventing propagation of electrical signals into heart	242, 247
Foramen ovale	Provides channel for interatrial flow (right-to-left shunt) during fetal development; remains patent in approximately one in four adults and may provide route for venous microthromboses to enter left side of heart and cause ischemic stroke	242
Interventricular septum	Ventricular septal defect is common congenital cardiac defect, most often involving membranous portion of septum; myocardial infarction in territory of anterior interventricular artery (left anterior descending artery), especially if not promptly treated, may generate sufficient ischemia of septum to cause perforation	242, 245
Heart valves	Valvular disease (e.g., aortic stenosis, mitral insufficiency) is common, especially among older adults, and may cause progressive heart failure	243
Aortic valve	1% of population has bicuspid aortic valve (i.e., containing two rather than three leaflets), which predisposes to aortic stenosis and insufficiency and is also associated with aortic aneurysm	243, 244
Sinuatrial node	Primary cardiac pacemaker, which generates action potentials that propagate through cardiac conduction system; aging, infiltrative diseases, and heart surgery may cause sinus node dysfunction, resulting in bradycardia	248
Atrioventricular node	Conducts action potentials from atria to ventricles; intrinsic refractory period prevents rapid atrial rhythms from causing equivalent tachycardia of ventricles; dysfunction secondary to fibrosis, medications, cardiac surgery may result in heart block; when block is complete, atria and ventricles have independent rhythms	248
Ligamentum arteriosum	Remnant of ductus arteriosus, which connects pulmonary and systemic circulations during fetal development; lack of ductus closure after birth may cause exertional dyspnea, pulmonary vascular disease, or heart failure; acts as landmark to identify left recurrent laryngeal nerve looping inferior to ligament	232, 247
Thoracic aorta	Lies naturally to left of vertebral column in thorax and commences at T4 vertebral level, where aortic arch terminates; congenital coarctation (narrowing) of aorta may cause hypertension in children and young adults; significant difference in blood pressure between upper and lower extremities is suggestive	258
Thoracic aorta	Aneurysm (enlargement) may occur secondary to age and atherosclerotic risk factors (such as tobacco abuse and hypertension), connective tissue disorders, in association with bicuspid aortic valve, or from infection (e.g., syphilis). Large aneurysm can rupture or dissect; the latter occurs when a tear in intimal layer allows blood to propagate into a false lumen between intima and media	258

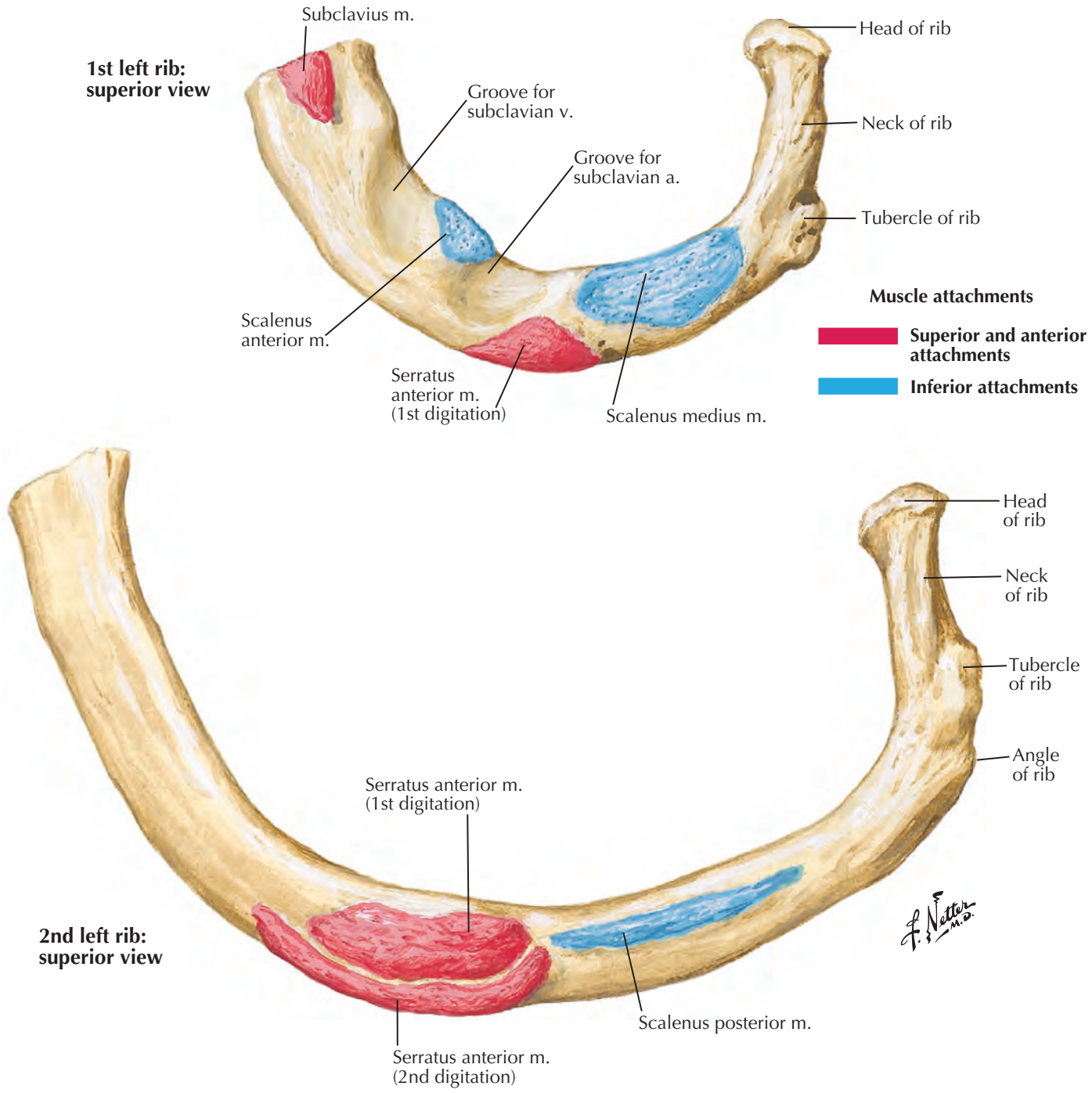
ANATOMICAL STRUCTURE	CLINICAL COMMENT	PLATE NUMBERS
Cardiovascular System—Continued		
Azygos vein	Drains posterior thorax and provides important collateral channel between inferior vena cava and superior vena cava	259
Lymph Vessels and Lymphoid Organs		
Lymph vessels of breast	Metastatic spread of cancer cells from mammary gland to axilla and thorax via lymphatics draining breast	208
Axillary nodes	Primary nodes that receive lymphatic drainage from upper limb, thoracic wall, and breast; commonly enlarged in patients with breast cancer	207, 208
Respiratory System		
Pleura	Air or gas (spontaneous or traumatic) can leak into pleural space between visceral pleura and parietal pleura and compress lung, a condition known as pneumothorax; if severe enough to compromise venous return to heart, resulting in hypotension and dyspnea, condition is known as tension pneumothorax	217–220
Cervical pleura	Extends into neck superior to anterior aspect of angled 1st rib or to level of 1st rib posteriorly; it may therefore be punctured during neck procedures, producing pneumothorax	69, 217
Tracheal bifurcation	Important landmark when assessing position of endotracheal tube, which should terminate 4–5 cm above; often at T4–T5 vertebral level; right main bronchus is shorter, more vertical, and wider; therefore, aspirated objects more often enter right side; left main bronchus lies over esophagus and posterior to left atrium of heart	225
Apex of lung	Pancoast tumor (bronchogenic carcinoma of apex of lung) may compress sympathetic trunk, resulting in Horner's syndrome (ipsilateral miosis, ptosis, anhidrosis, facial flushing); apex is susceptible to pneumothorax from needles introduced in lower neck region	217, 251
Reproductive System		
Mammary gland	Breast cancer is most common malignancy in women; most common type originates in lactiferous duct and can either be localized within duct (ductal carcinoma in situ) or invasive into adjoining tissues (invasive ductal carcinoma)	205

*Selections were based largely on clinical data and commonly discussed clinical correlations in macroscopic ("gross") anatomy courses.

MUSCLE	MUSCLE GROUP	ORIGIN ATTACHMENT	INSERTION ATTACHMENT	INNERVATION	BLOOD SUPPLY	MAIN ACTIONS
Diaphragm	Diaphragm	Xiphoid process, costal cartilages 7–12, L1–L3 vertebrae	Central tendon	Phrenic nerve	Pericardiacophrenic, musculophrenic, posterior intercostal, and superior and inferior phrenic arteries	Draws central tendon down and forward during inspiration
External intercostal mm.	Thoracic wall	Lower borders of ribs	Upper borders of subjacent ribs	Intercostal nerves	Posterior intercostal arteries, supreme intercostal artery, internal thoracic artery, musculophrenic artery	Support intercostal spaces in inspiration and expiration, elevate ribs in inspiration
Innermost intercostal mm.	Thoracic wall	Lower borders of ribs	Upper borders of subjacent ribs	Intercostal nerves	Posterior intercostal arteries, supreme intercostal artery, internal thoracic artery, musculophrenic artery	Prevent pushing out or drawing in of intercostal spaces in inspiration and expiration, lower ribs in forced expiration
Internal intercostal mm.	Thoracic wall	Costal grooves, lower borders of costal cartilages	Upper borders of subjacent ribs	Intercostal nerves	Posterior intercostal arteries, supreme intercostal artery, internal thoracic artery, musculophrenic artery	Prevent pushing out or drawing in of intercostal spaces in inspiration and expiration, lower ribs in forced expiration
Levatores costarum	Thoracic wall	Transverse processes of C7–T11 vertebrae	Subjacent ribs (between tubercle and angle)	Posterior rami of thoracic spinal nerves	Posterior intercostal arteries	Elevate ribs
Pectoralis major m.	Pectoral region	*Clavicular part:* sternal half of clavicle *Sternal part:* anterior surface of sternum, cartilages of true ribs *Abdominal part:* aponeurosis of external abdominal oblique muscle	Lateral lip of intertubercular sulcus of humerus	Medial and lateral pectoral nerves	Pectoral branch of thoracoacromial artery, internal thoracic artery	Flexes, adducts, and medially rotates arm
Pectoralis minor m.	Pectoral region	External surface of upper margin of ribs 3–5	Coracoid process of scapula	Medial and lateral pectoral nerves	Pectoral branch of thoracoacromial artery, superior and lateral thoracic arteries	Lowers lateral angle of scapula and protracts scapula
Serratus anterior m.	Shoulder	Lateral surfaces of ribs 1–9	Costal surface of medial border of scapula	Long thoracic nerve	Lateral thoracic artery	Protracts and rotates scapula and holds it against thoracic wall
Subclavius m.	Shoulder	Upper border of 1st rib and costal cartilage	Inferior surface of middle one-third of clavicle	Subclavian nerve	Clavicular branch of thoracoacromial artery	Anchors and depresses clavicle
Subcostal mm.	Thoracic wall	Internal surfaces of lower ribs near their angles	Superior borders of ribs that are the 2nd or 3rd below the muscle origin	Intercostal nerves	Posterior intercostal arteries, musculophrenic artery	Depress ribs
Transversus thoracis m.	Thoracic wall	Internal surfaces of costal cartilages 2–6	Posterior surface of lower sternum	Intercostal nerves	Internal thoracic artery	Depresses ribs and costal cartilages

Variations in spinal nerve contributions to the innervation of muscles, their arterial supply, their attachments, and their actions are common themes in human anatomy. Therefore, expect differences between texts and realize that anatomical variation is normal.


Scalenus anterior m.
Scalenus medius m.
Cervical rib compresses subclavian a. (note poststenotic dilation)
Cervical rib adheres to 1st thoracic rib by dense fibrous band
Inferior trunk of brachial plexus elevated by cervical rib
C1
C2
C3
C4
C5
C5
C6
C6
C7
C7
C8
T1
T1
Rudimentary 1st (thoracic) rib with postfixed brachial plexus
C4
C5
C6
C7
C8
T1
T2
C5
C6
C7
C8
T1
F. Netter M.D.
Normal morphology


1st left rib:
superior view
Subclavius m.
Groove for
subclavian v.
Groove for
subclavian a.
Scalenus
anterior m.
Serratus
anterior m.
(1st digitation)
Scalenus medius m.
Head of rib
Neck of rib
Tubercle of rib
Muscle attachments
Superior and anterior
attachments
Inferior attachments
2nd left rib:
superior view
Serratus anterior m.
(1st digitation)
Serratus anterior m.
(2nd digitation)
Scalenus posterior m.
Head
of rib
Neck
of rib
Tubercle
of rib
Angle
of rib

See Plates 54, 210, 211

Muscles of inspiration

Accessory muscles

Sternocleidomastoid m. (elevates sternum and clavicle)

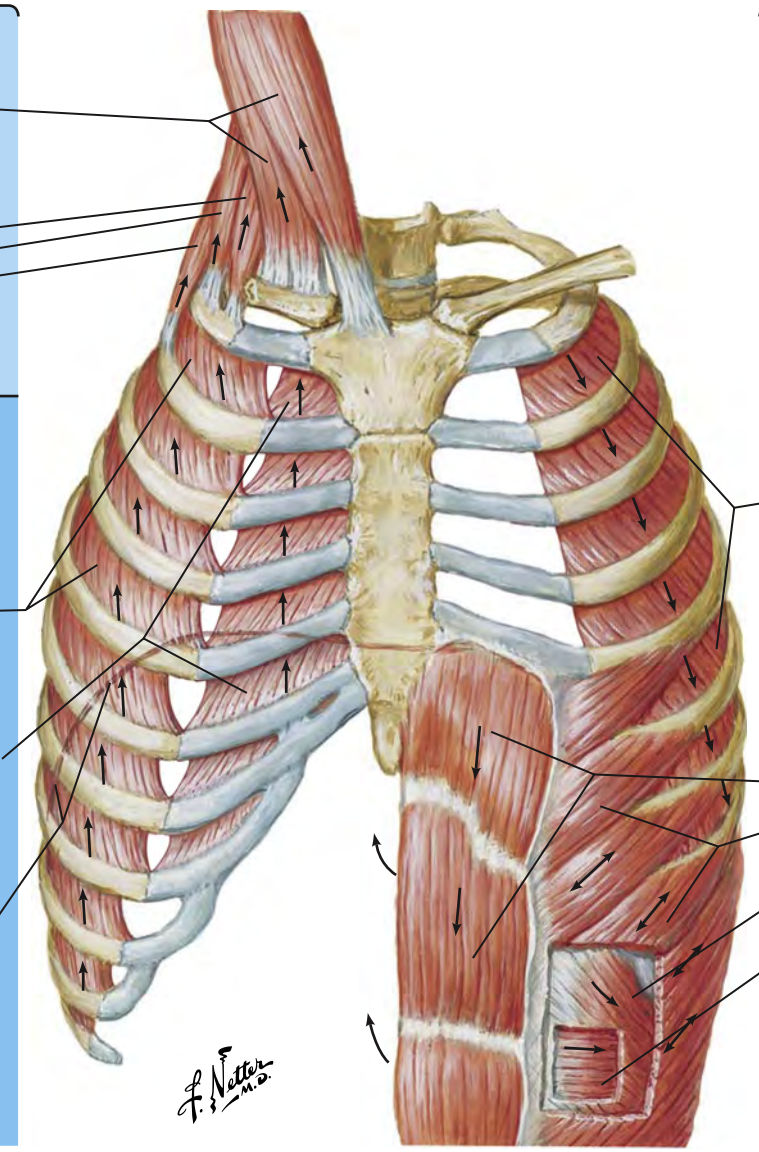
Scalenus mm. (elevate and fix upper ribs)
Scalenus anterior m.
Scalenus medius m.
Scalenus posterior m.

Principal muscles

External intercostal mm. (elevate ribs, thus increasing width of thoracic cavity and aiding deep inspiration)

Interchondral parts of internal intercostal mm. (also elevate ribs and aid with deep inspiration)

Diaphragm (domes descend, thus increasing vertical dimension of thoracic cavity; also elevates lower ribs)



Muscles of expiration

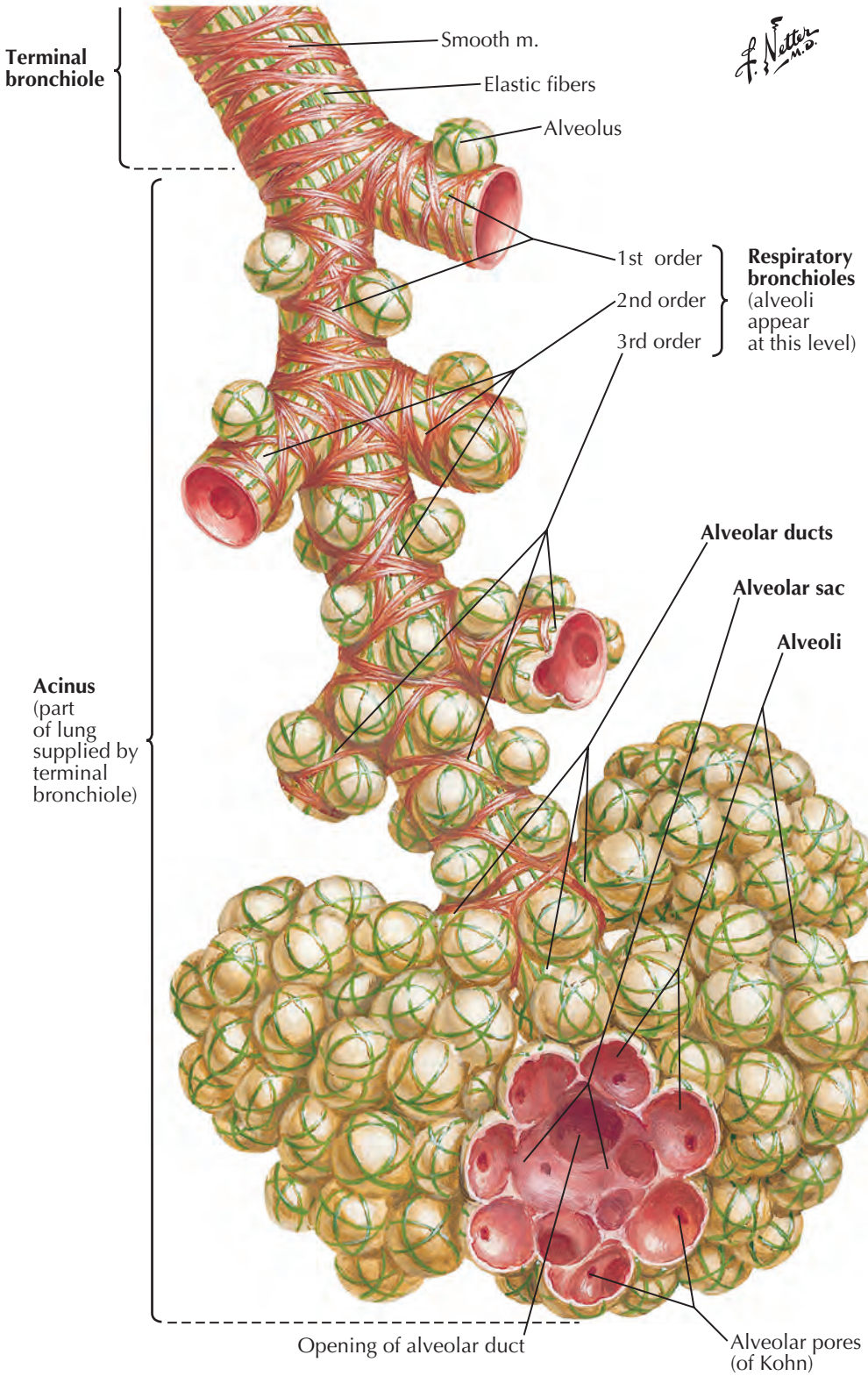
Quiet breathing

Expiration results from passive recoil of lungs and rib cage

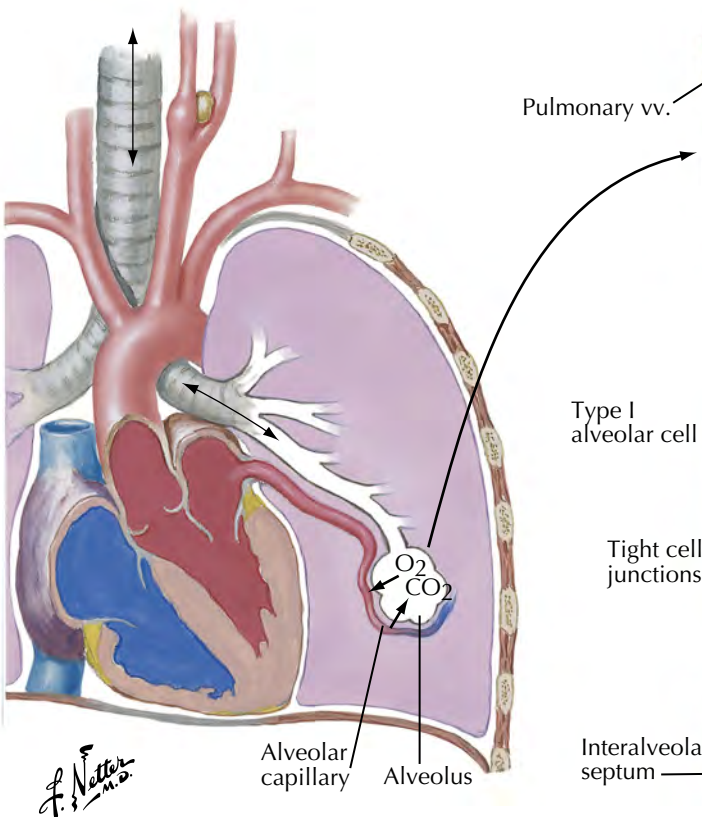
Active breathing

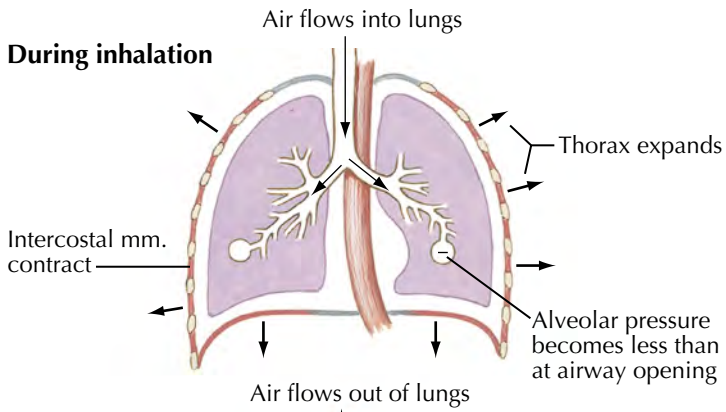
Internal intercostal mm., except interchondral part (aid forced expiration)

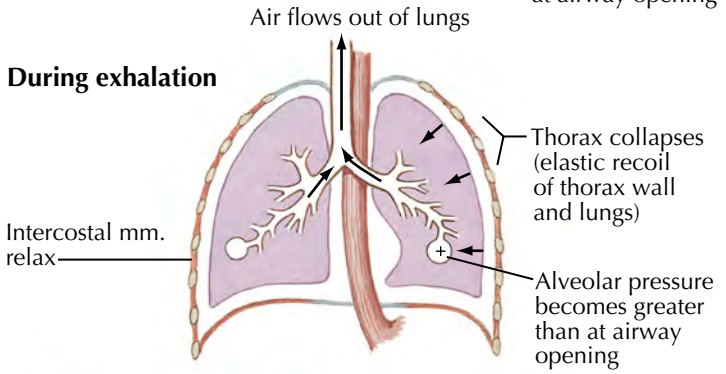
Abdominal mm. (depress lower ribs, compress abdominal contents, thus pushing up diaphragm, aiding forced expiration)
Rectus abdominis m.
External abdominal oblique m.
Internal abdominal oblique m.
Transversus abdominis m.

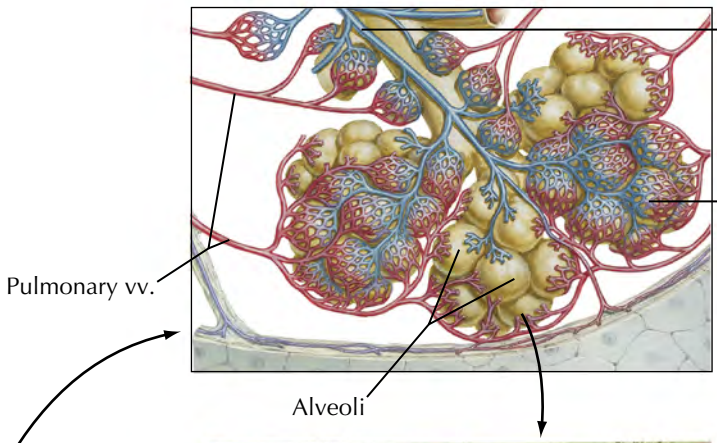


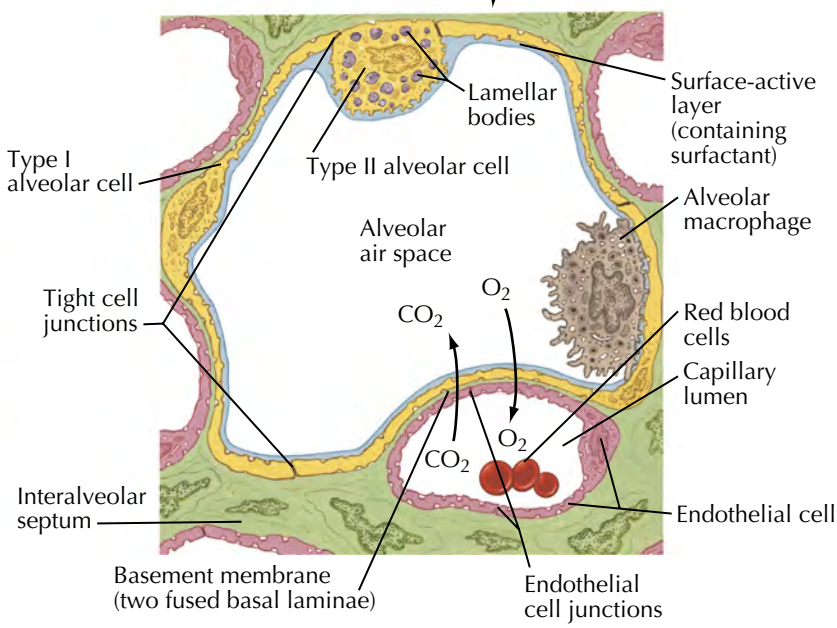
Structure of intrapulmonary airways


O_2
CO_2
Alveolar capillary
Alveolus

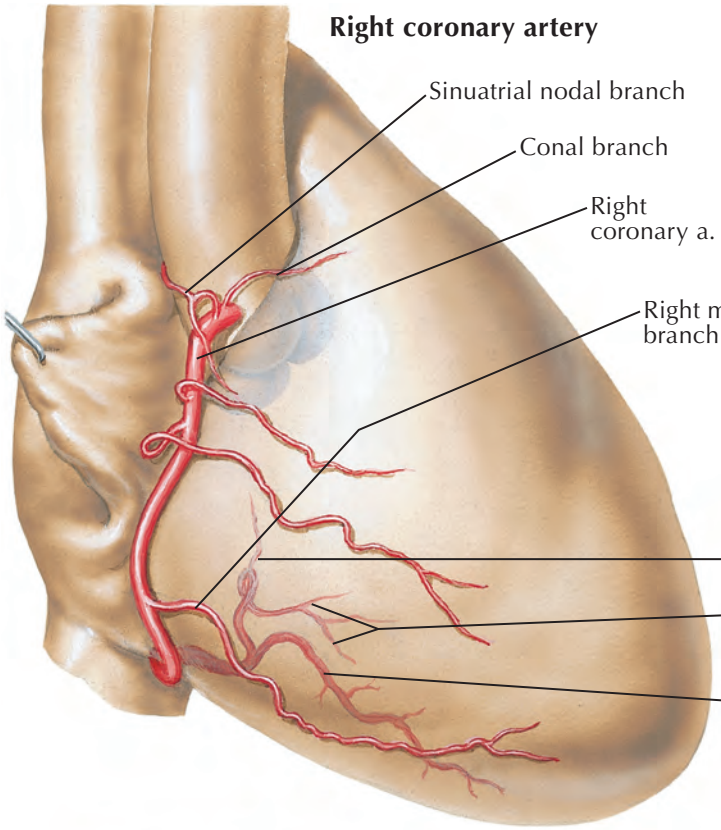

Air flows into lungs
During inhalation
Thorax expands
Intercostal mm. contract
Alveolar pressure becomes less than at airway opening

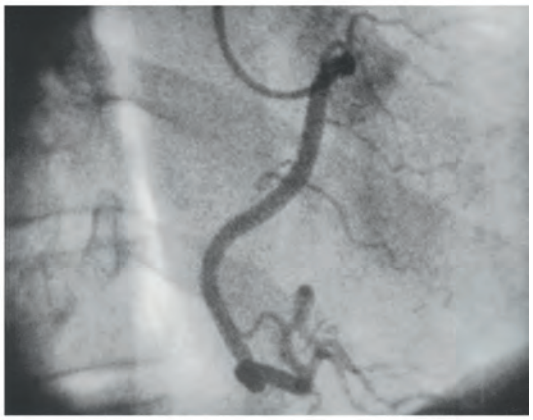

Air flows out of lungs
During exhalation
Thorax collapses (elastic recoil of thorax wall and lungs)
Intercostal mm. relax
Alveolar pressure becomes greater than at airway opening


Pulmonary a.
Capillary plexus
Pulmonary vv.
Alveoli


Surface-active layer (containing surfactant)
Lamellar bodies
Type II alveolar cell
Type I alveolar cell
Alveolar macrophage
Alveolar air space
Tight cell junctions
O_2
CO_2
Red blood cells
Capillary lumen
O_2
CO_2
Interalveolar septum
Endothelial cell
Basement membrane (two fused basal laminae)
Endothelial cell junctions

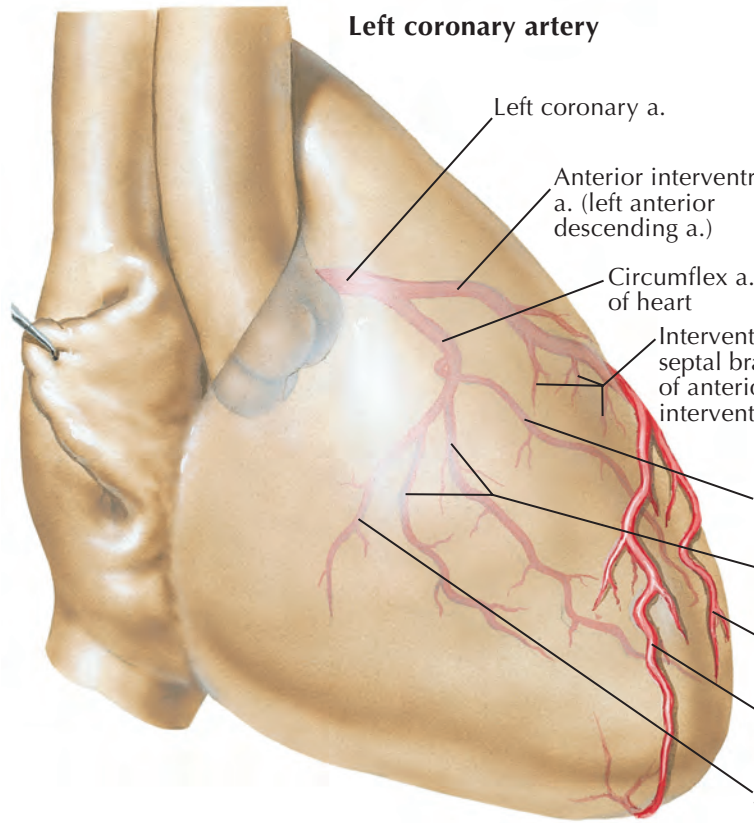
Right coronary artery

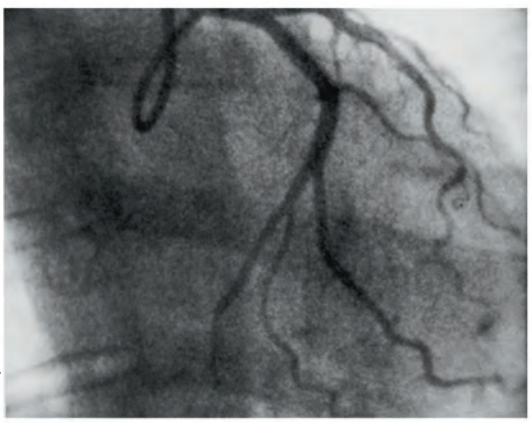




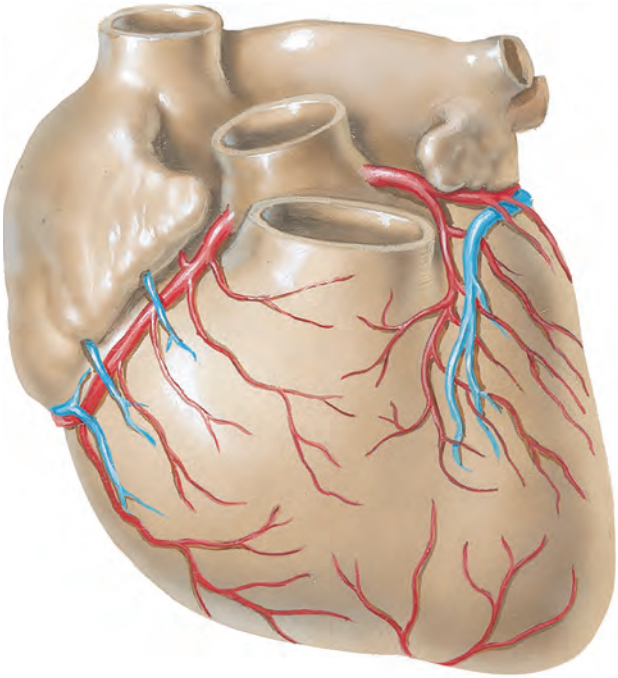
Arteriogram

Left coronary artery

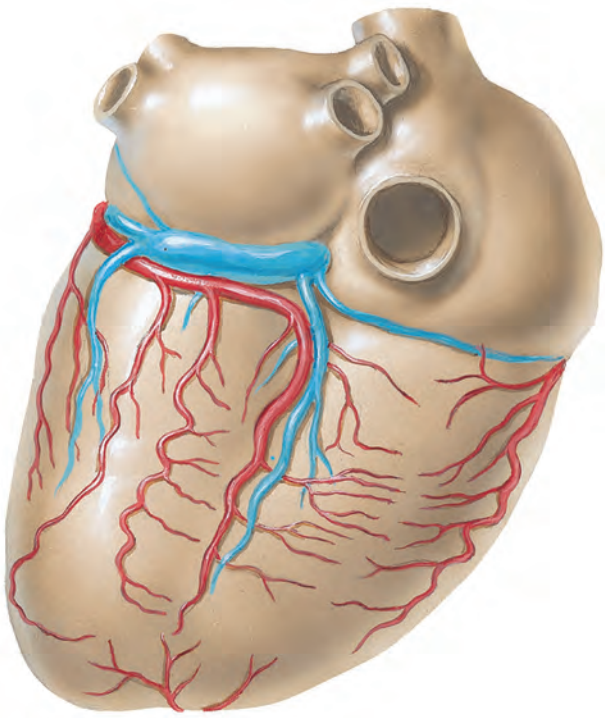




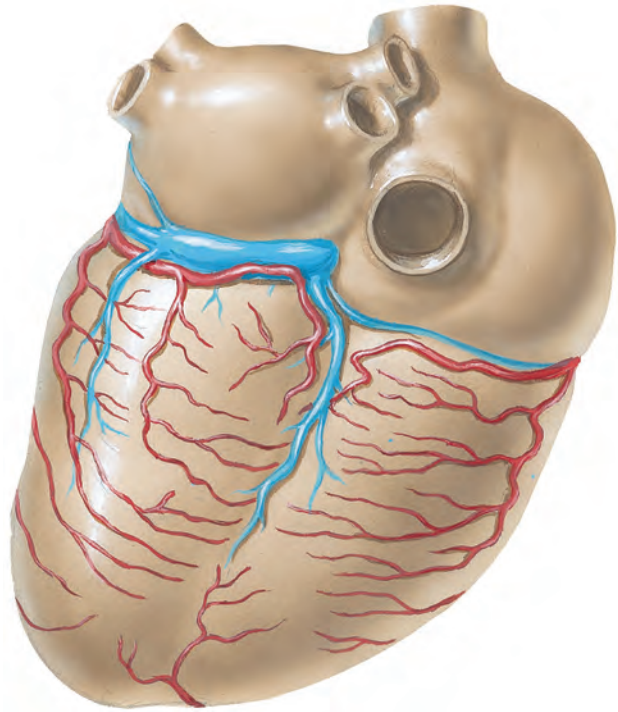
Arteriogram



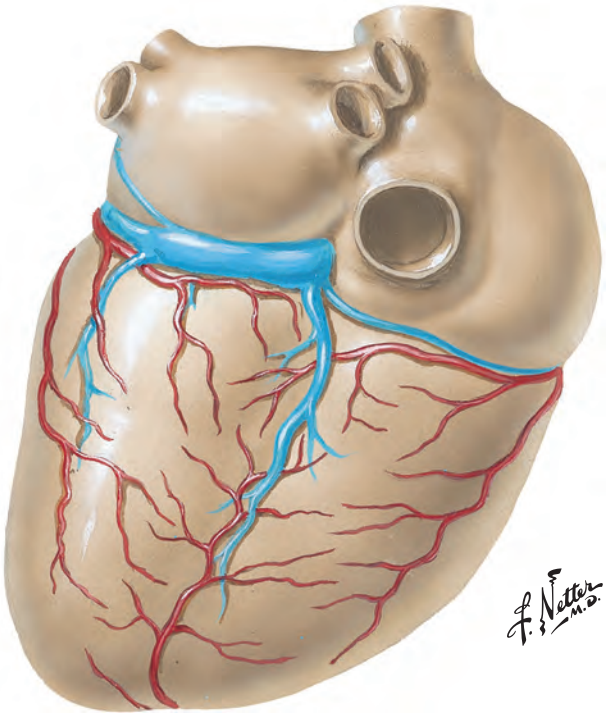
Anterior interventricular artery (left anterior descending artery) is very short. Apical part of anterior surface of heart is supplied by branches from inferior interventricular artery (posterior descending artery) curving around apex.



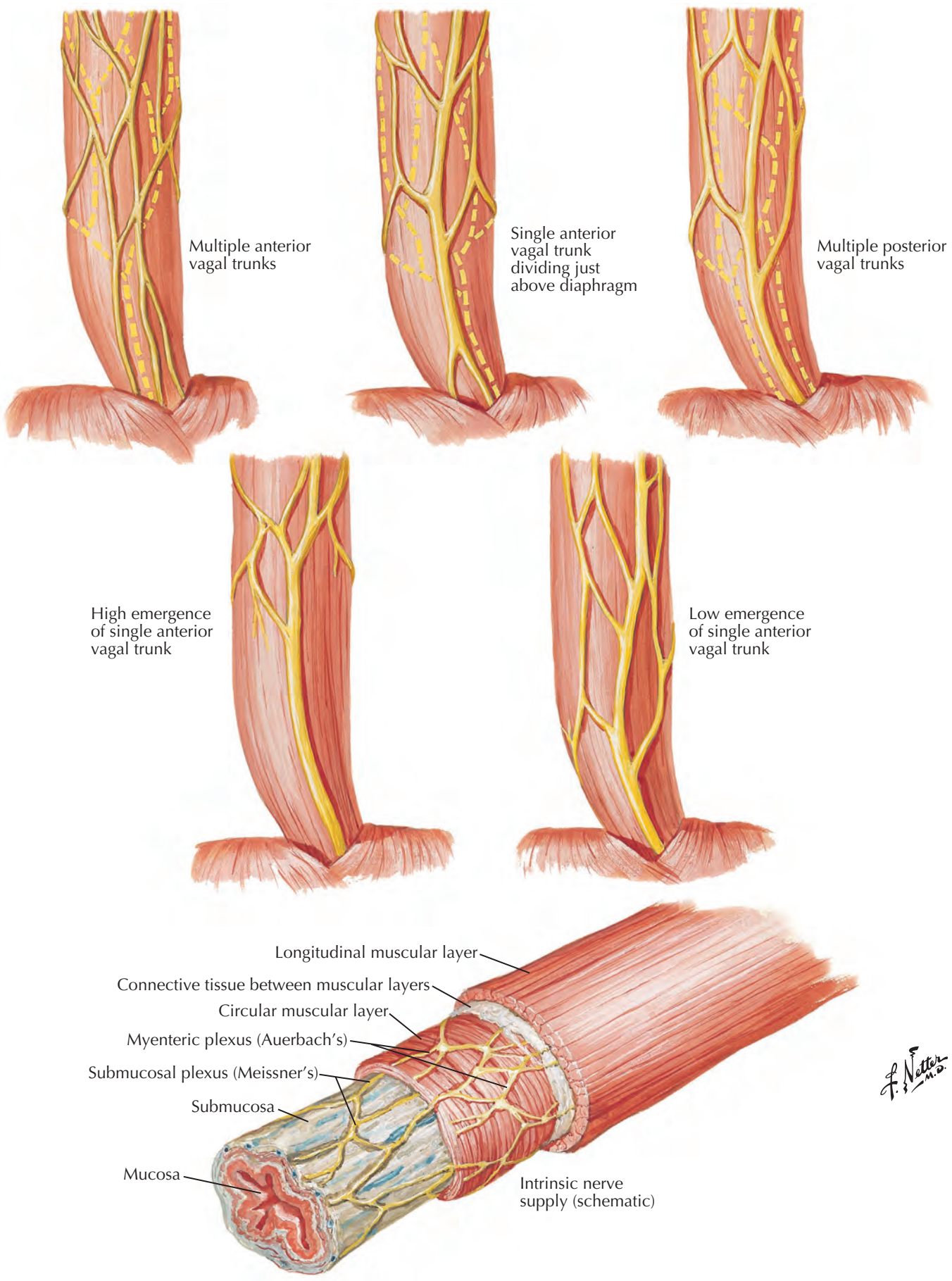
Inferior interventricular artery (posterior descending artery) is derived from circumflex artery of heart instead of from right coronary artery.

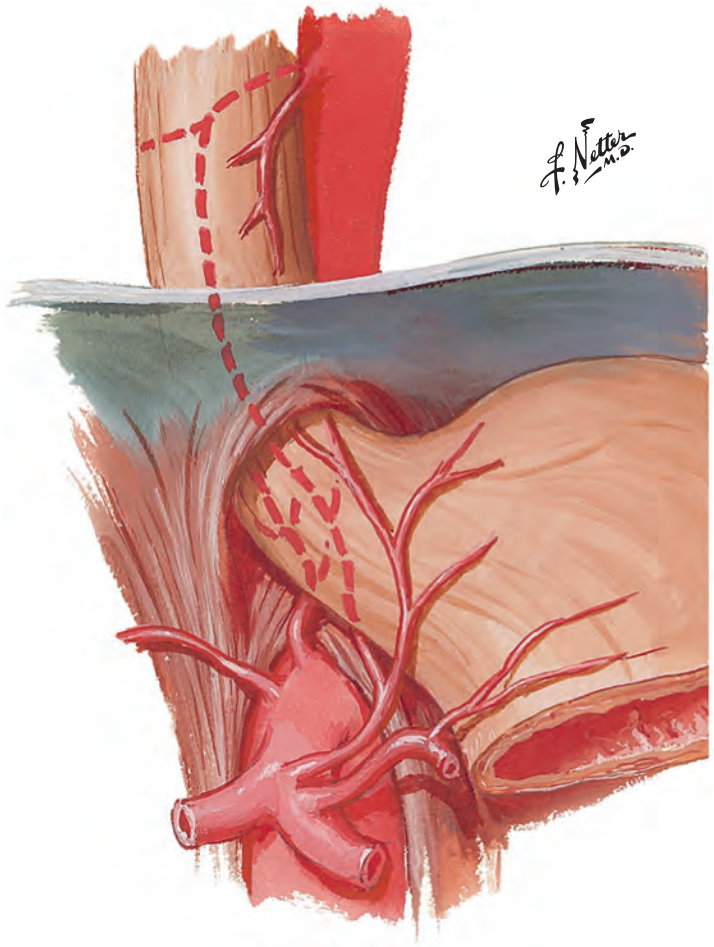


Inferior interventricular artery (posterior descending artery) is absent. Area is supplied chiefly by small branches from circumflex artery of heart and from right coronary artery.

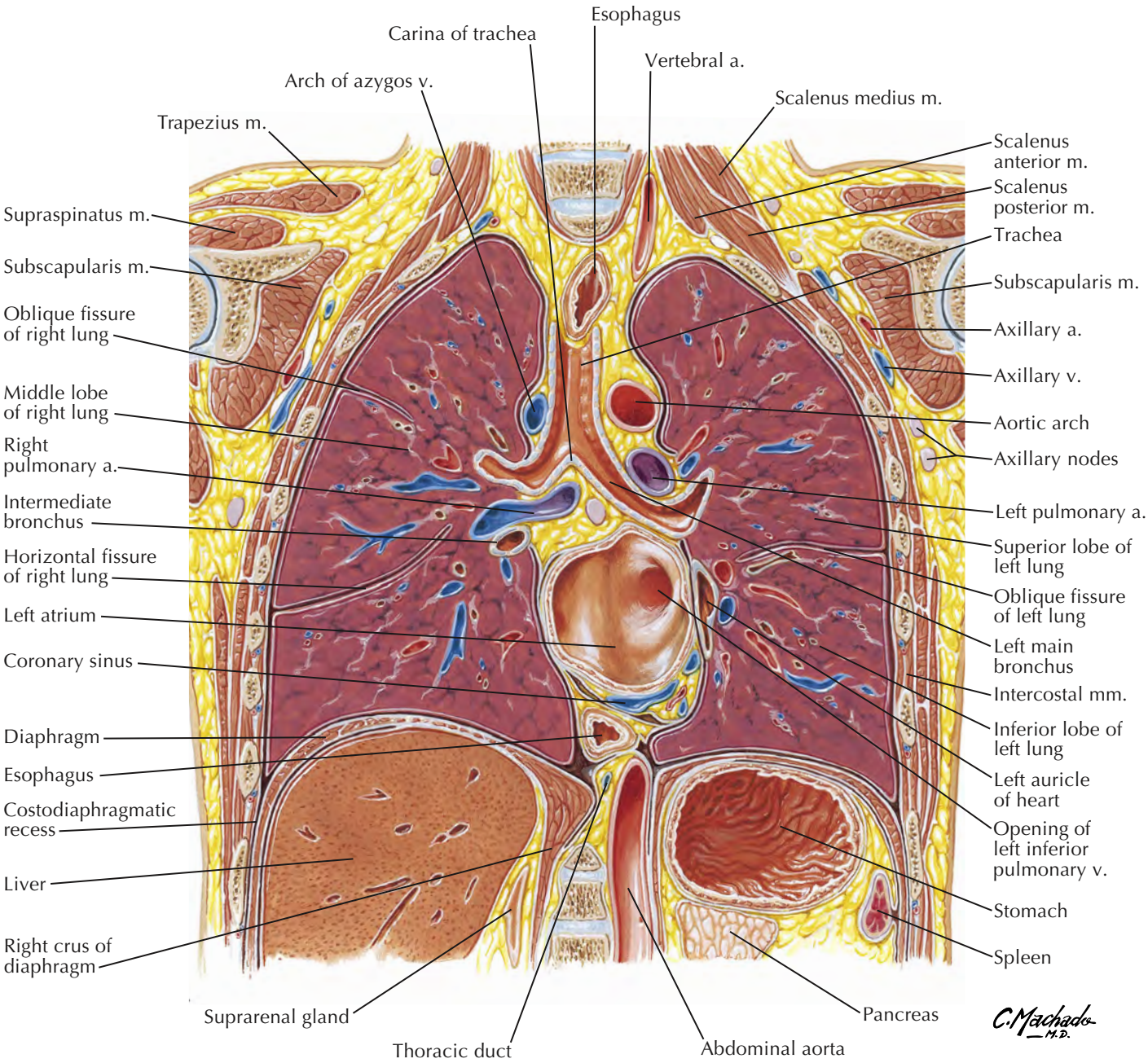


Inferior interventricular artery (posterior descending artery) is absent. Area is supplied chiefly by elongated anterior interventricular artery (left anterior descending artery) curving around apex of heart.

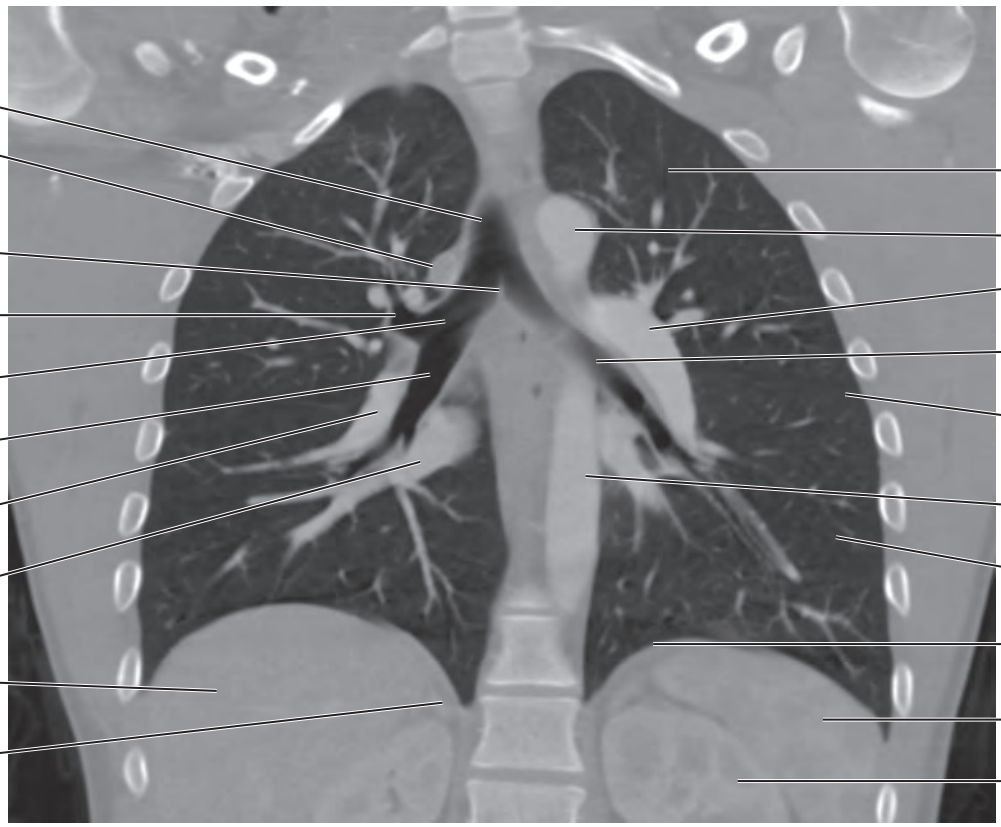

Multiple anterior vagal trunks
Single anterior vagal trunk dividing just above diaphragm
Multiple posterior vagal trunks
High emergence of single anterior vagal trunk
Low emergence of single anterior vagal trunk
Longitudinal muscular layer
Connective tissue between muscular layers
Circular muscular layer
Myenteric plexus (Auerbach's)
Submucosal plexus (Meissner's)
Submucosa
Mucosa
Intrinsic nerve supply (schematic)



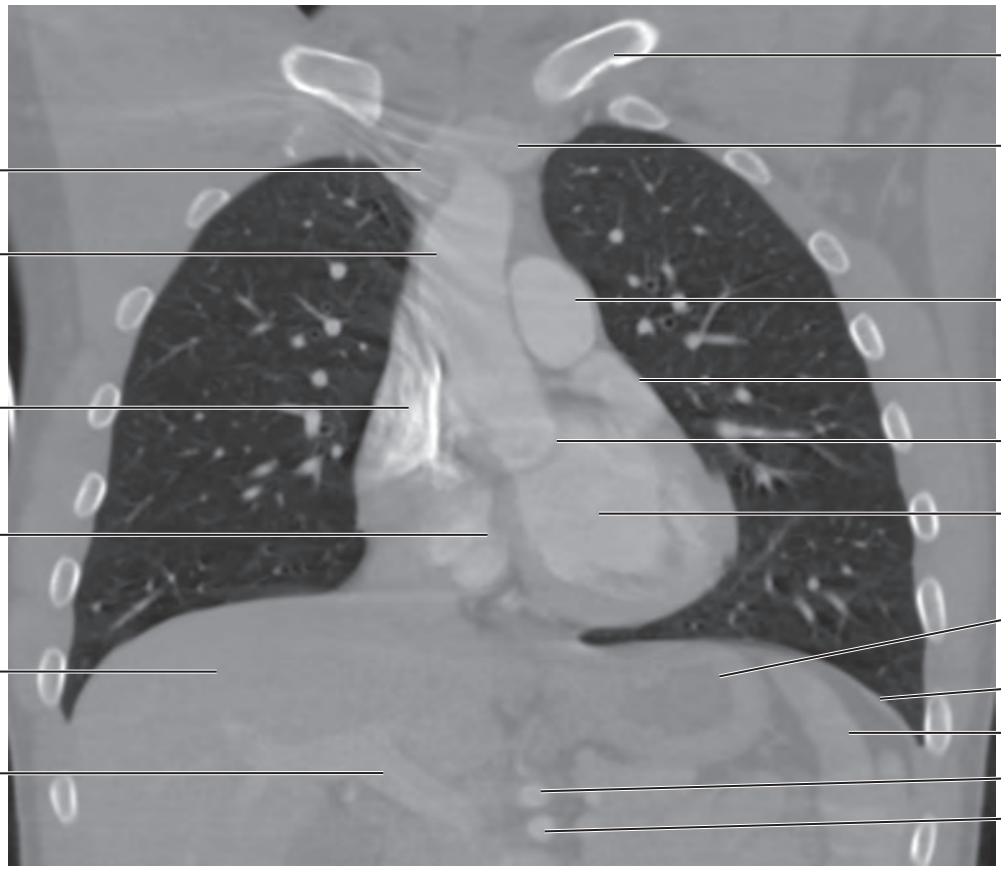
Common variations: Esophageal branches may originate from left inferior phrenic artery and/or directly from celiac trunk. Branches to abdominal esophagus may also come from splenic or short gastric arteries.

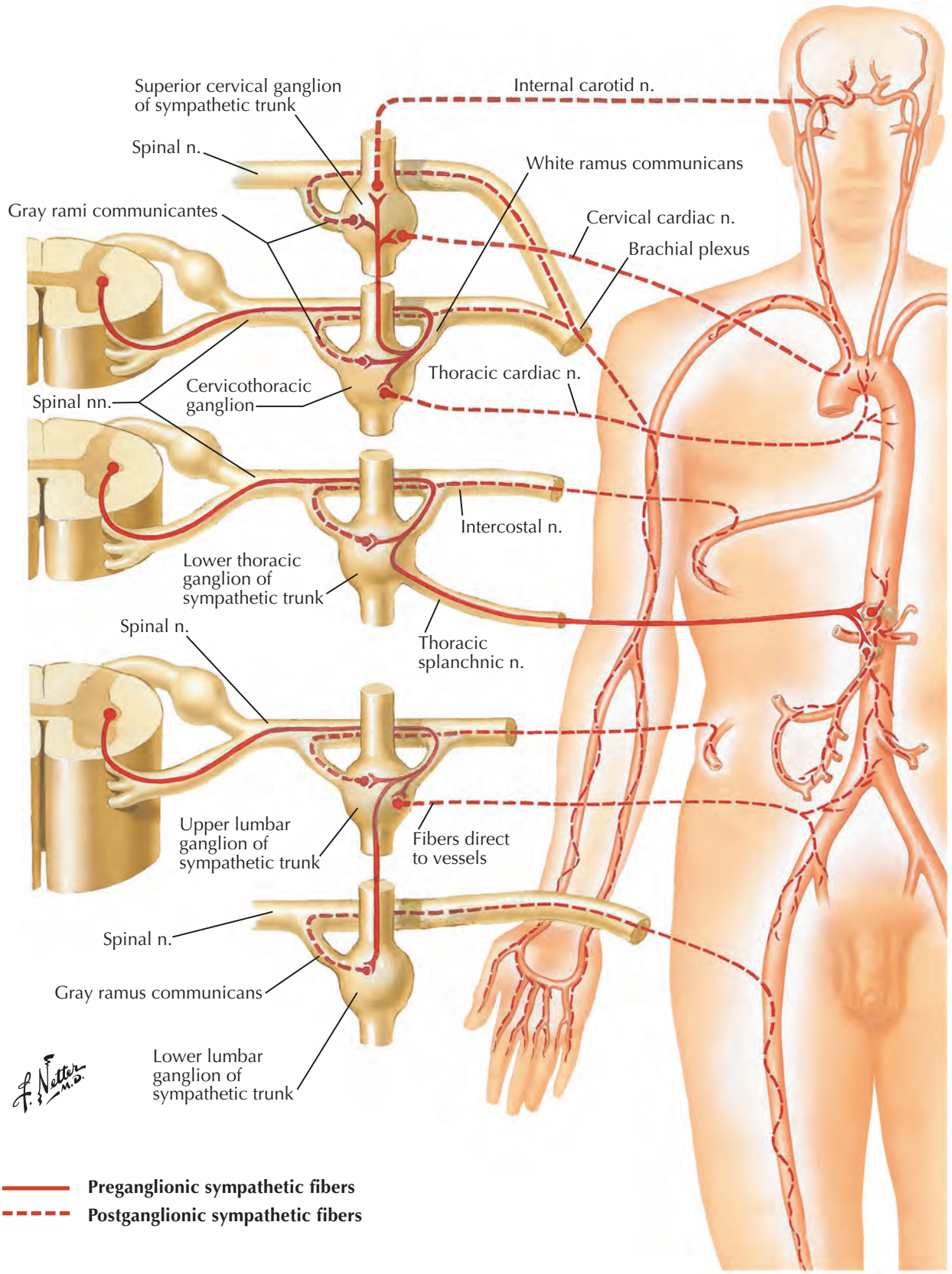

Esophagus
Carina of trachea
Vertebral a.
Arch of azygos v.
Scalenus medius m.
Trapezius m.
Scalenus anterior m.
Scalenus posterior m.
Supraspinatus m.
Trachea
Subscapularis m.
Subscapularis m.
Oblique fissure of right lung
Axillary a.
Axillary v.
Middle lobe of right lung
Aortic arch
Right pulmonary a.
Axillary nodes
Intermediate bronchus
Left pulmonary a.
Horizontal fissure of right lung
Superior lobe of left lung
Left atrium
Oblique fissure of left lung
Coronary sinus
Left main bronchus
Intercostal mm.
Diaphragm
Inferior lobe of left lung
Esophagus
Left auricle of heart
Costodiaphragmatic recess
Opening of left inferior pulmonary v.
Liver
Stomach
Right crus of diaphragm
Spleen
Suprarenal gland
Pancreas
Thoracic duct
Abdominal aorta
C. Machado M.D.

Contrast windowed to accentuate lungs and bones



Contrast windowed to accentuate lungs and bones



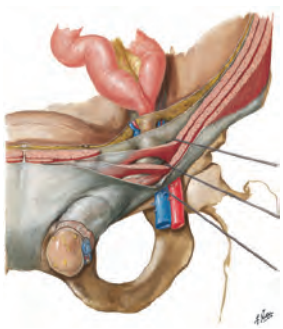

Superior cervical ganglion of sympathetic trunk
Internal carotid n.
Spinal n.
White ramus communicans
Gray rami communicantes
Cervical cardiac n.
Brachial plexus
Thoracic cardiac n.
Spinal nn.
Cervicothoracic ganglion
Intercostal n.
Lower thoracic ganglion of sympathetic trunk
Spinal n.
Thoracic splanchnic n.
Upper lumbar ganglion of sympathetic trunk
Fibers direct to vessels
Spinal n.
Gray ramus communicans
Lower lumbar ganglion of sympathetic trunk
Preganglionic sympathetic fibers
Postganglionic sympathetic fibers

ABDOMEN 5

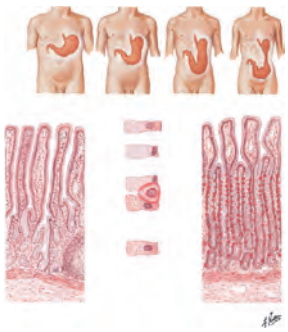
Surface Anatomy	267	**Kidneys and Suprarenal Glands**	330–343
Abdominal Wall	268–287	**Lymphatics**	344
Peritoneal Cavity	288–293	**Regional Imaging**	345–346
Stomach and Intestines	294–301	**Cross-Sectional Anatomy**	347–351
Liver, Gallbladder, Pancreas, and Spleen	302–307	**Structures with High Clinical Significance**	Tables 5.1–5.3
Visceral Vasculature	308–318	**Muscles**	Table 5.4
Visceral Nerves and Plexuses	319–329	**Electronic Bonus Plates**	BP 53–BP 83

ELECTRONIC BONUS PLATES

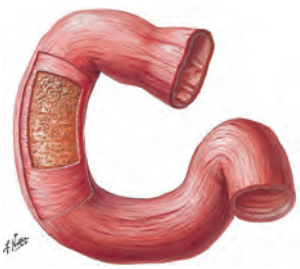
BP 53 Inguinal and Femoral Regions



BP 54 Indirect Inguinal Hernia

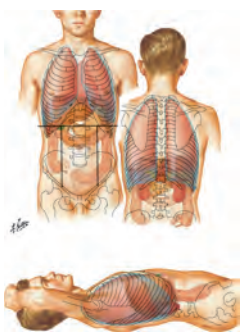


BP 55 Variations in Position and Contour of Stomach in Relation to Body Habitus



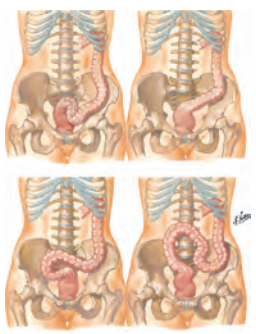
BP 56 Layers of Duodenal Wall

BP 57 CT and MRCP Showing Vermiform Appendix, Gallbladder, and Ducts; Nerve Branches on Hepatic Artery



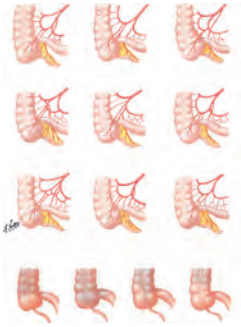
BP 58 Topography of Liver

BP 59 Variations in Form of Liver

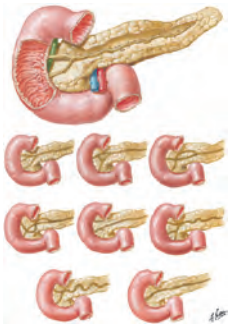


BP 60 Sigmoid Colon: Variations in Position

ELECTRONIC BONUS PLATES—*cont'd*



BP 61 Variations in Arterial Supply to Cecum and Posterior Peritoneal Attachment of Cecum

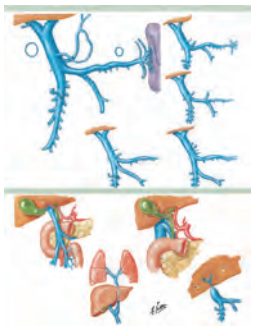


BP 62 Variations in Pancreatic Duct

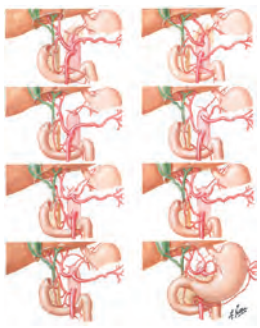
BP 63 Variations in Cystic, Hepatic, and Pancreatic Ducts

BP 64 Variations in Cystic Arteries

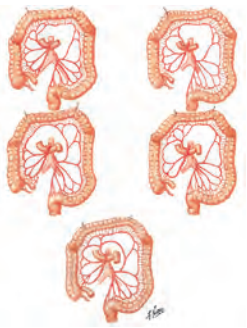
BP 65 Variations in Hepatic Arteries



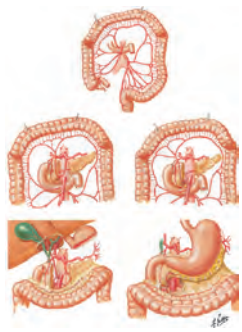
BP 66 Variations and Anomalies of Hepatic Portal Vein



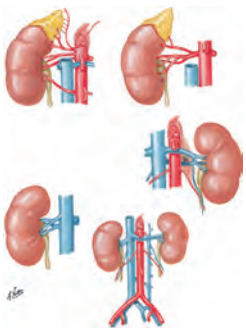
BP 67 Variations in Celiac Trunk



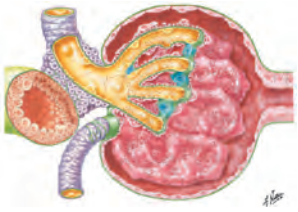
BP 68 Variations in Colic Arteries



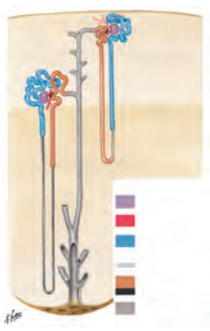
BP 69 Variations in Colic Arteries (continued)



BP 70 Variations in Renal Artery and Vein



BP 71 Histology of Renal Corpuscle

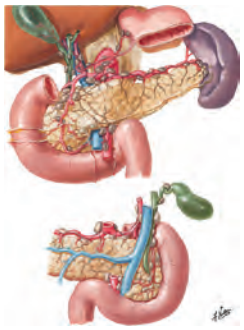


BP 72 Nephron and Collecting Tubule: Schema

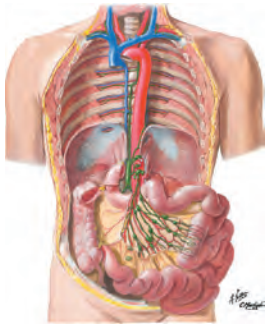
ELECTRONIC BONUS PLATES—*cont'd*

BP 73 Blood Vessels in Parenchyma of Kidney: Schema

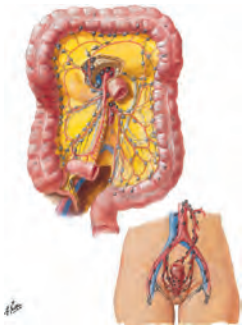
BP 74 Lymph Vessels and Lymph Nodes of Stomach



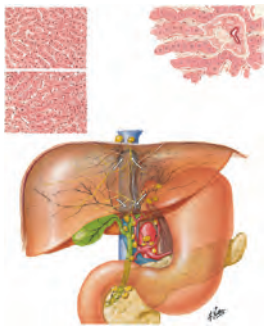
BP 75 Lymph Vessels and Lymph Nodes of Pancreas



BP 76 Lymph Vessels and Lymph Nodes of Small Intestine

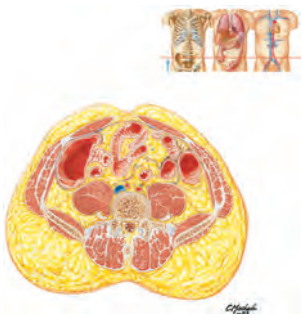


BP 77 Lymph Vessels and Lymph Nodes of Large Intestine



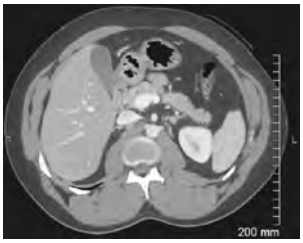
BP 78 Lymph Vessels and Lymph Nodes of Liver

BP 79 Schematic Cross Section of Abdomen at T12 Vertebral Level

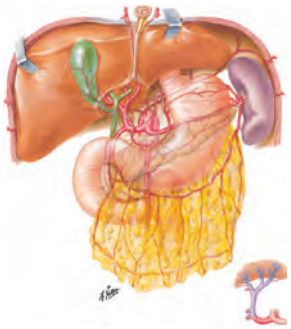


BP 80 Transverse Section of Abdomen: L5 Vertebral Level, Near Transtubercular Plane

BP 81 Transverse Section of Abdomen: S1 Vertebral Level, Anterior Superior Iliac Spine

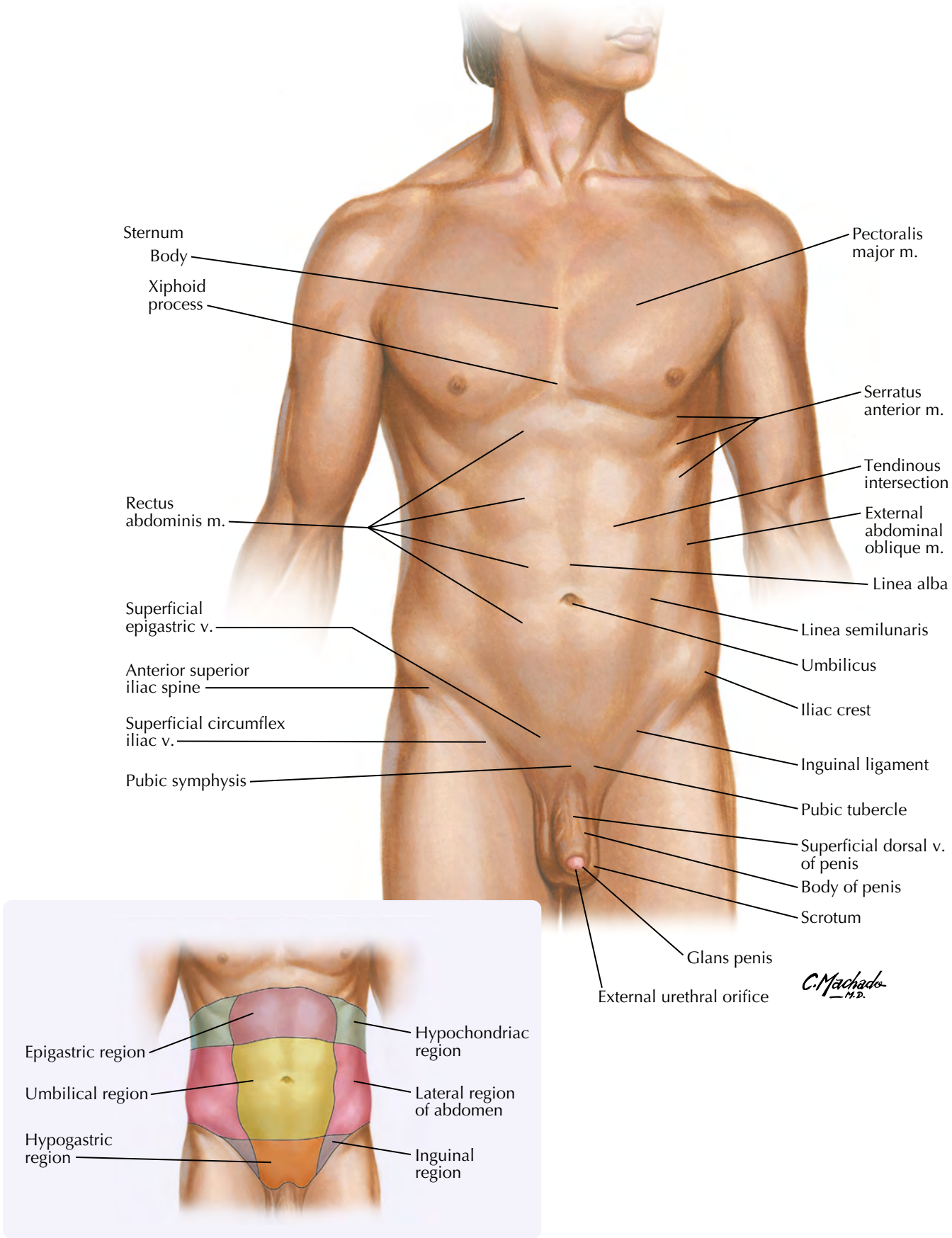


BP 82 Axial CT Image of Upper Abdomen

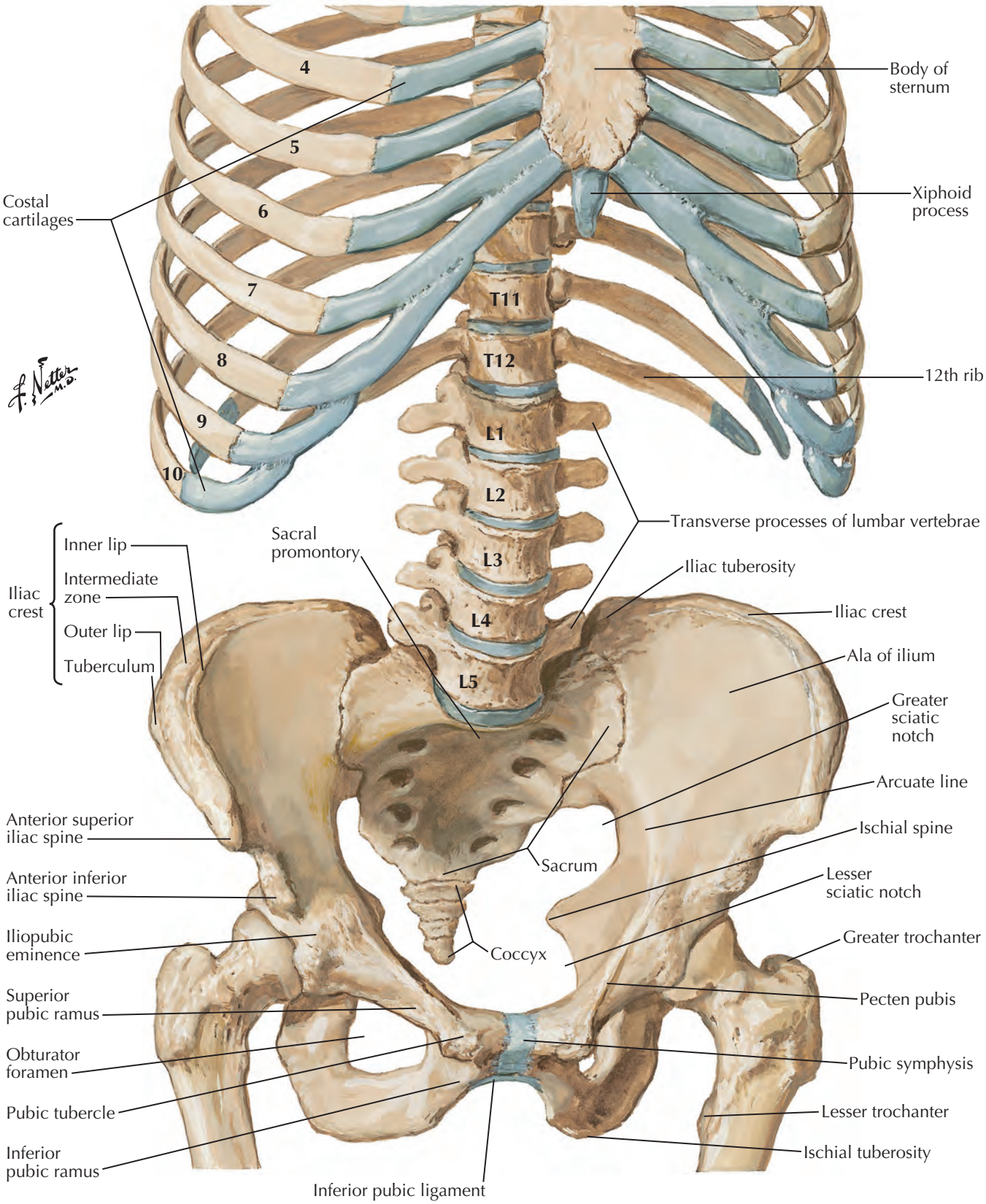


BP 83 Arterial Variations and Collateral Supply of Liver and Gallbladder

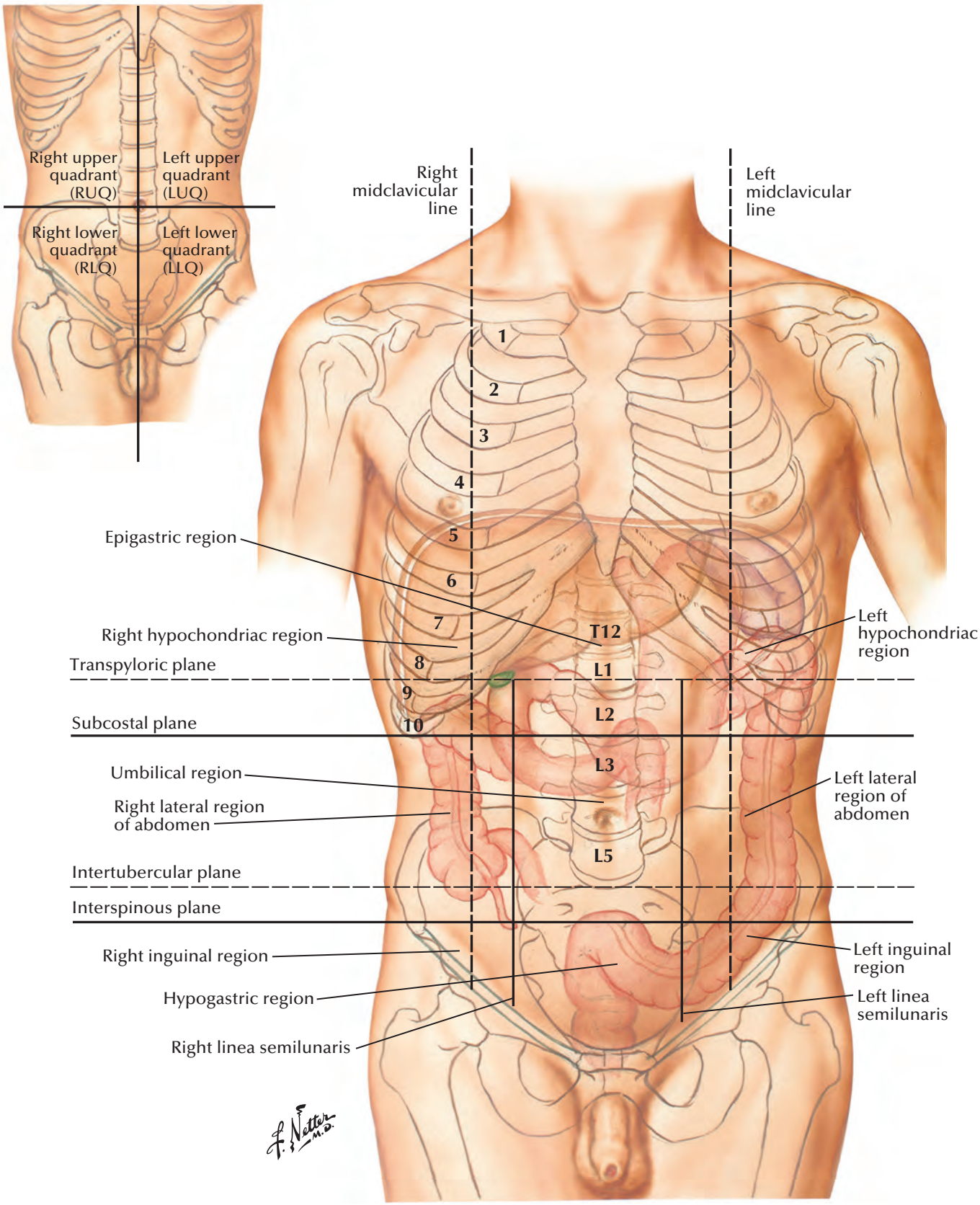
See also **Plates 188, 270**



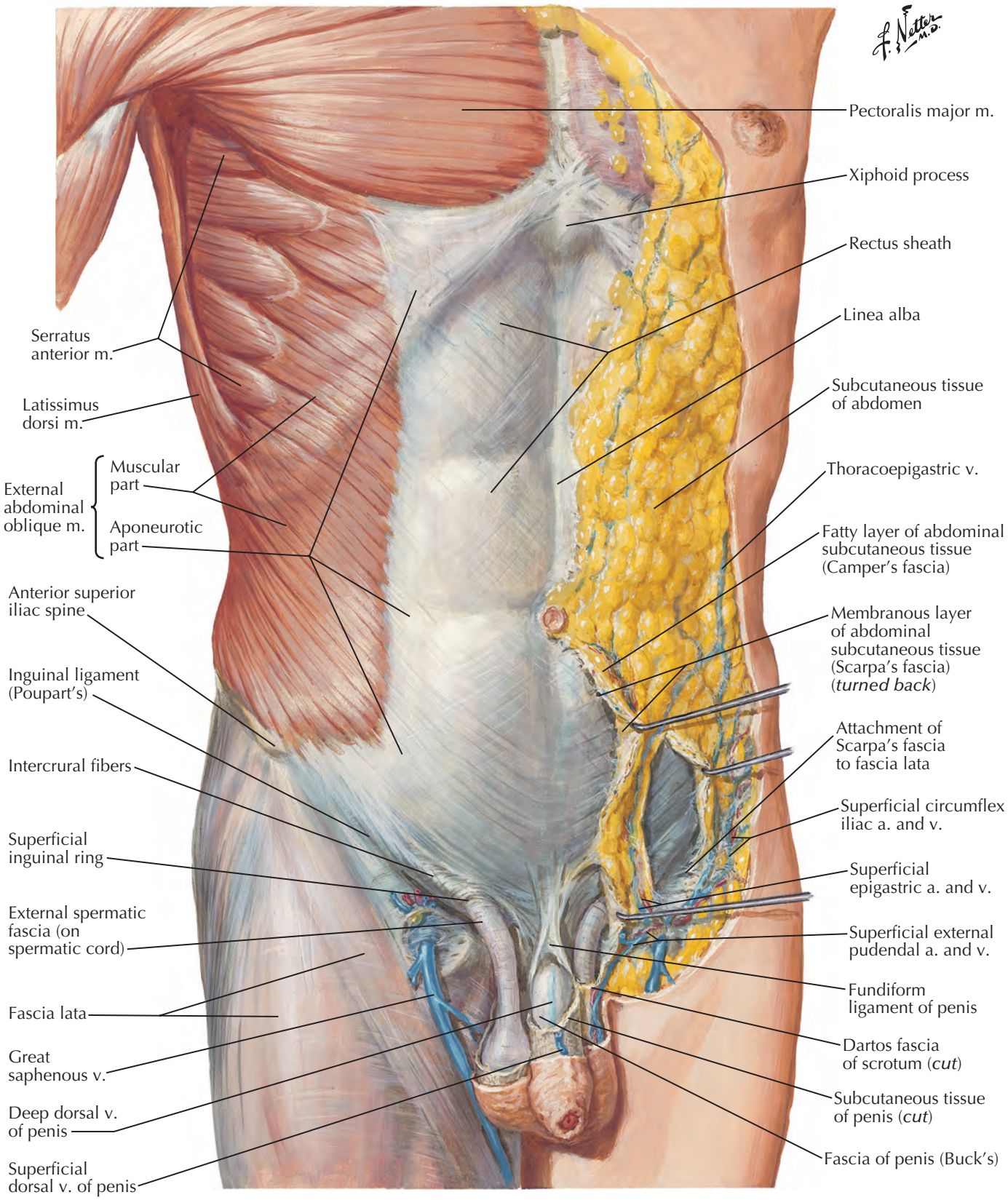
See also **Plates 203, 353**



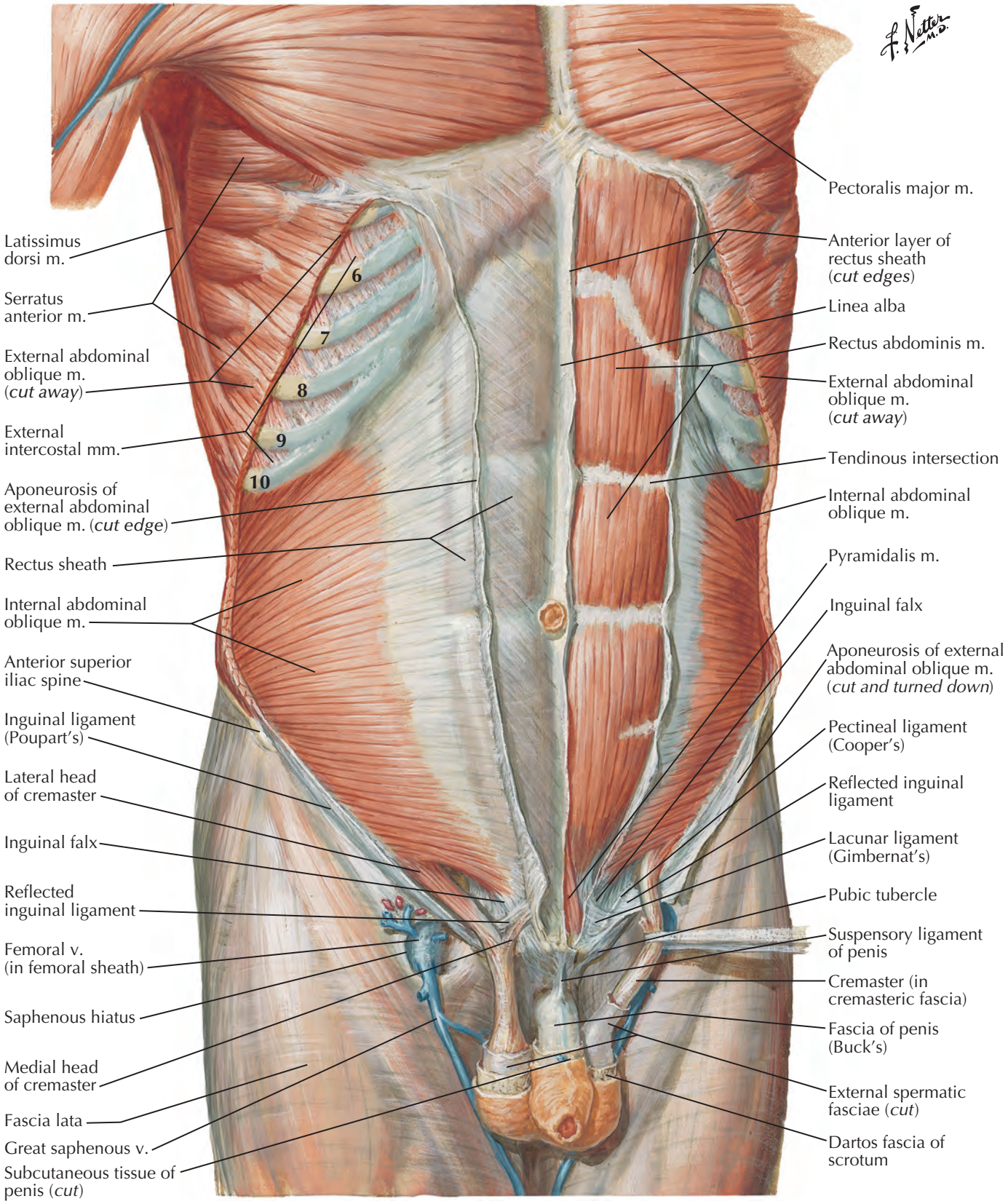
See also **Plates 217, BP 70**



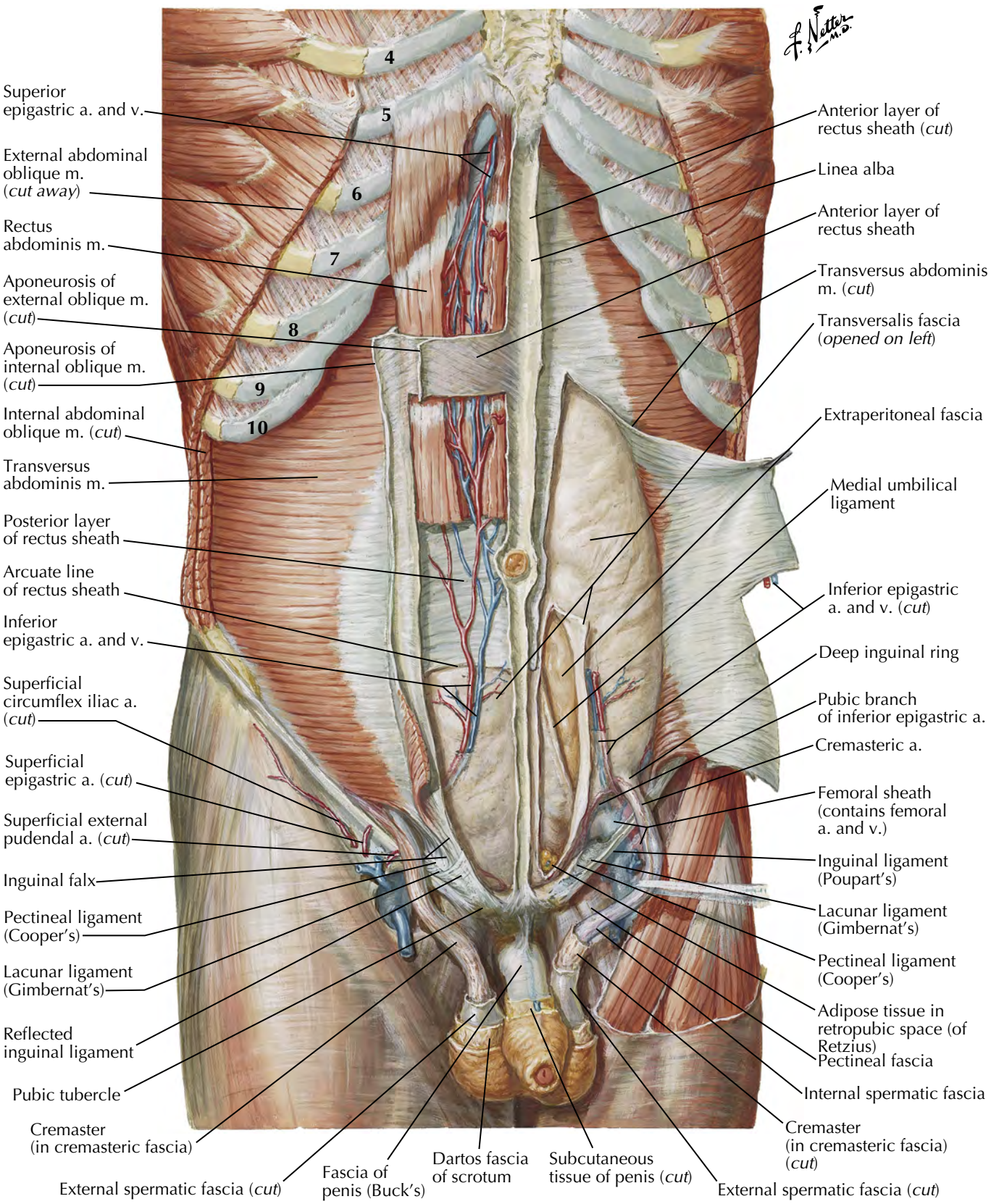
See also **Plates 277, 352, BP 53**



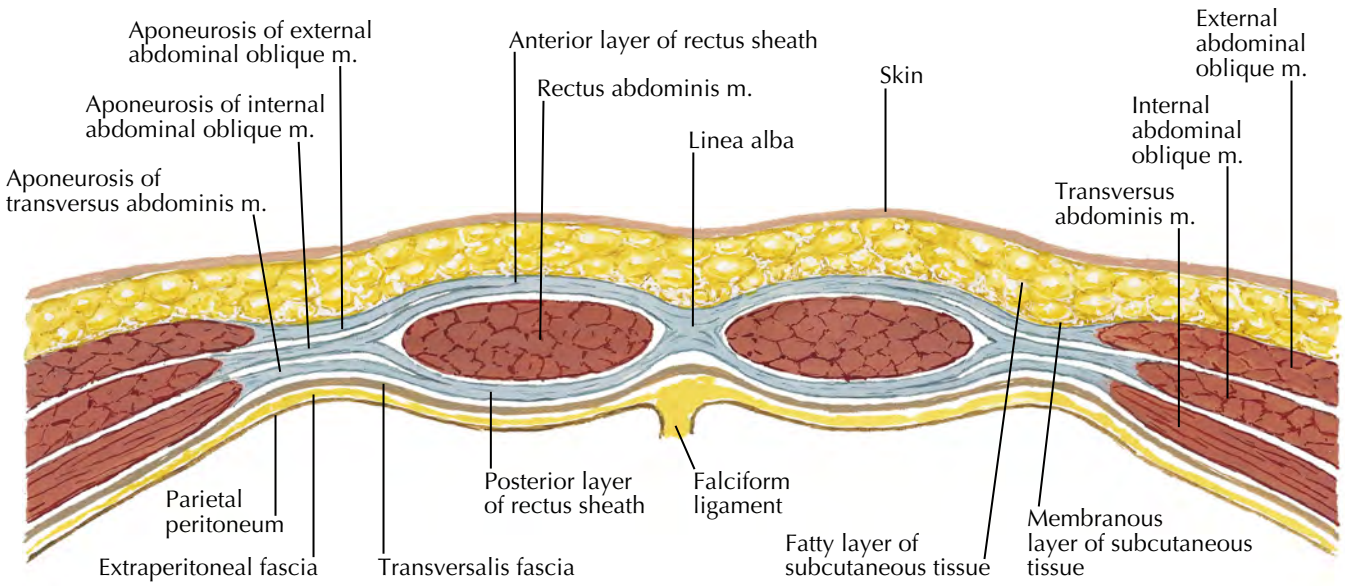
See also **Plates 209, 210, BP 53**



See also **Plates 210, 276, BP 54**

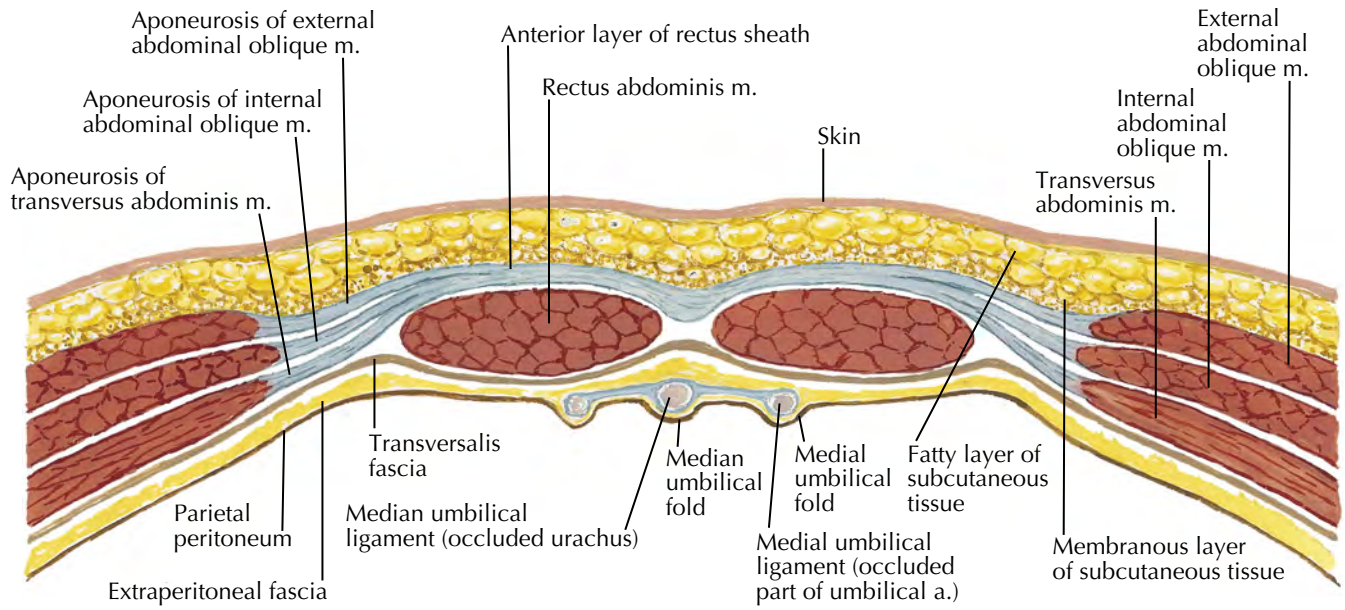


Section superior to arcuate line of rectus sheath



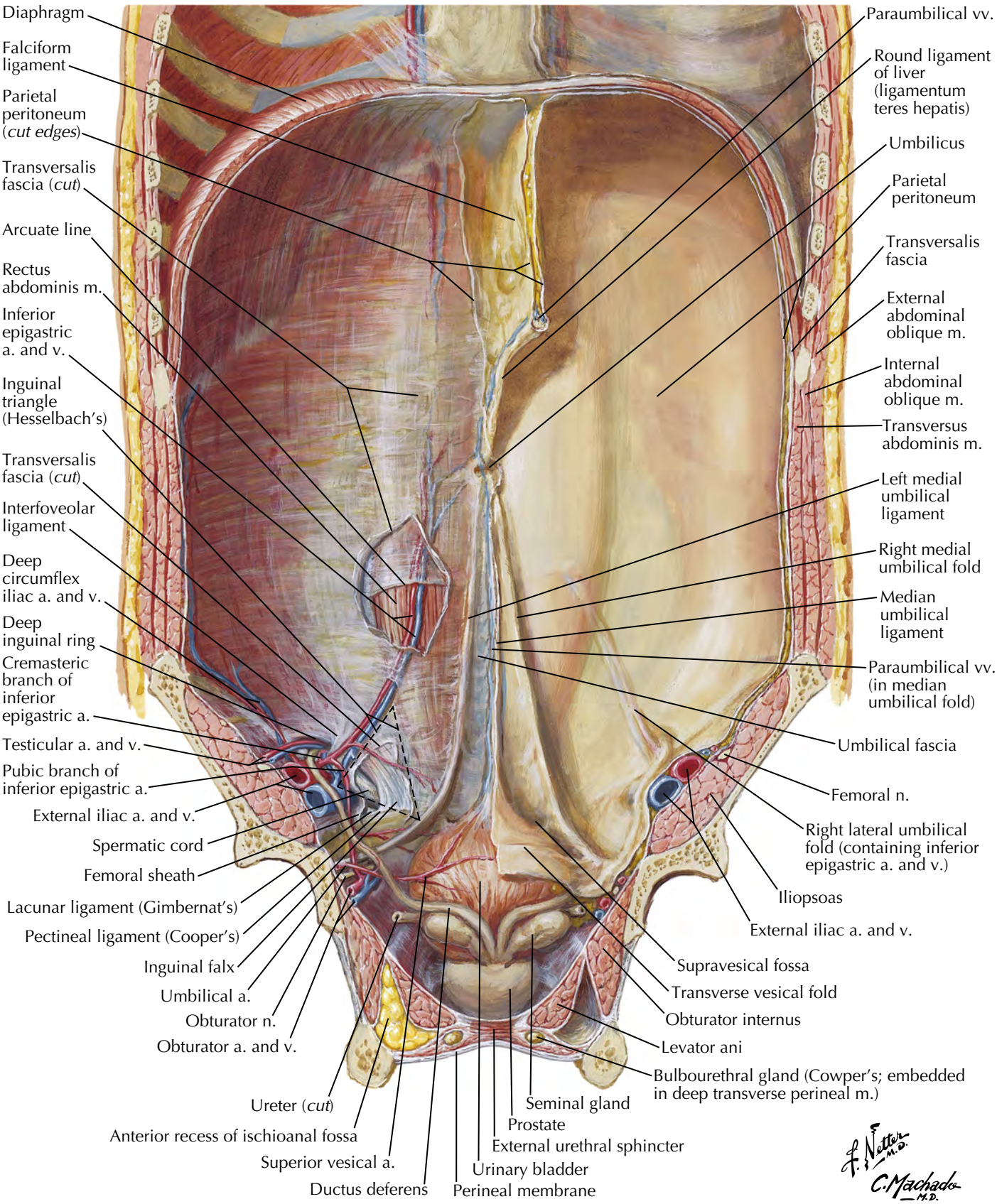
Aponeurosis of internal abdominal oblique muscle splits to form anterior and posterior layers of rectus sheath. Aponeurosis of external abdominal oblique muscle joins anterior layer; aponeurosis of transversus abdominis muscle joins posterior layer. Anterior and posterior layers of rectus sheath unite medially to form linea alba.

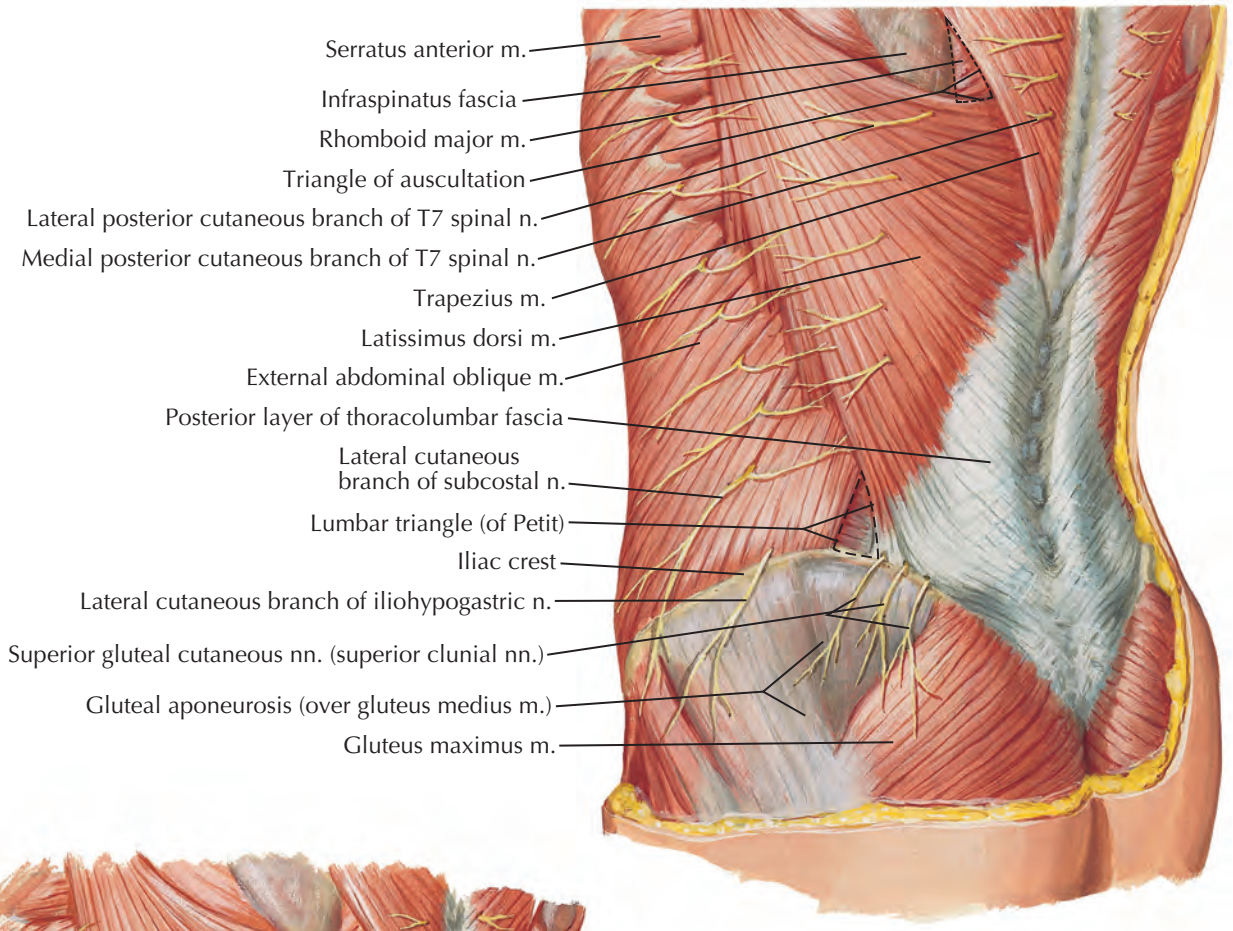
Section inferior to arcuate line of rectus sheath

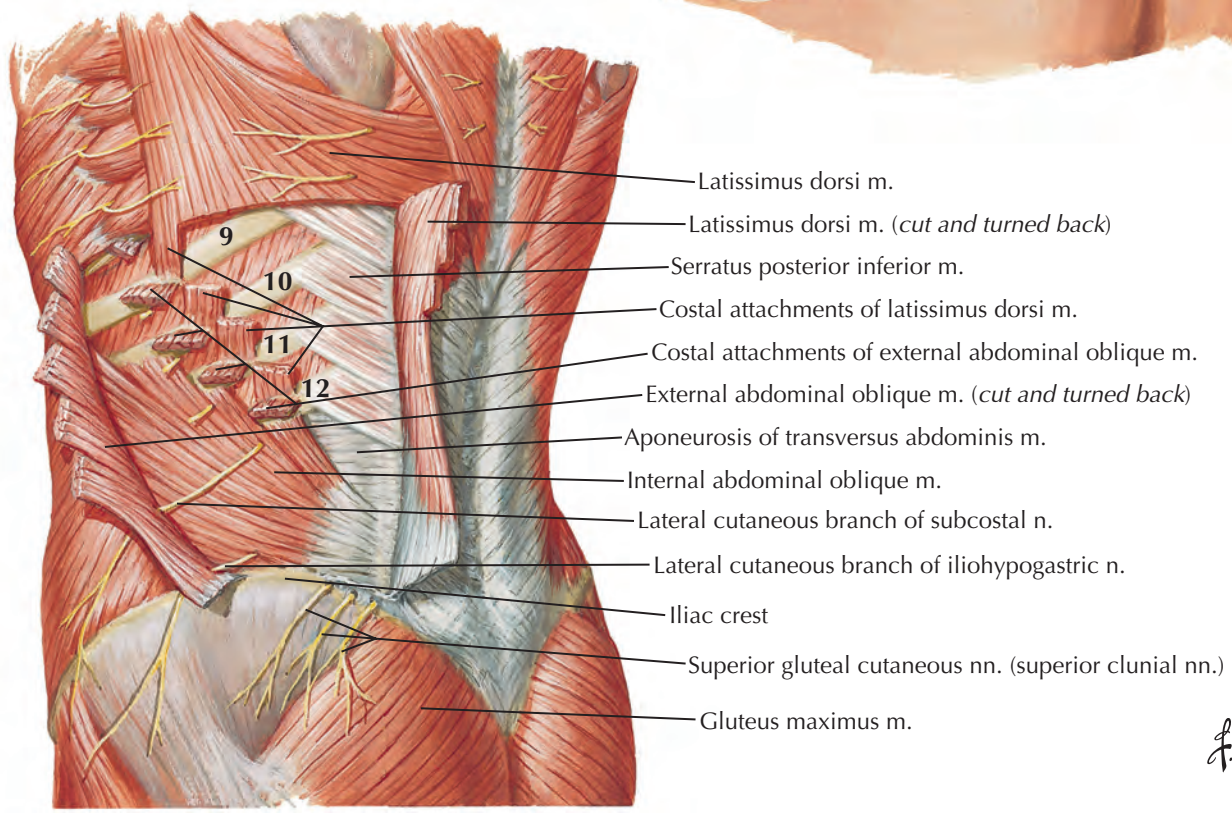


Aponeurosis of internal abdominal oblique muscle does not split at this level but passes completely anterior to rectus abdominis muscle and is fused there with both the aponeurosis of external abdominal oblique muscle and that of transversus abdominis muscle. Thus, the posterior layer of the rectus sheath is absent below arcuate line, leaving only transversalis fascia.

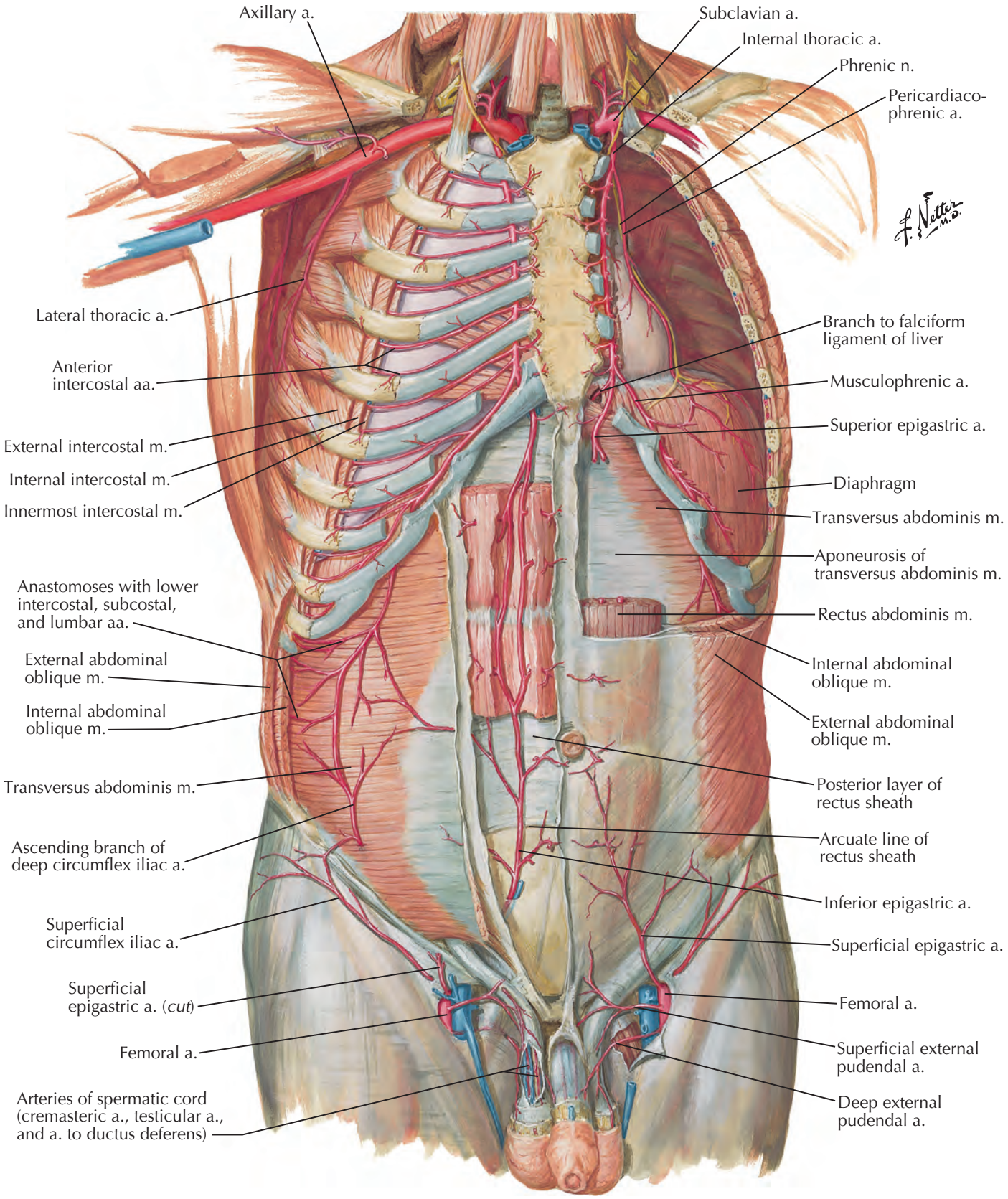
See also **Plate 385**



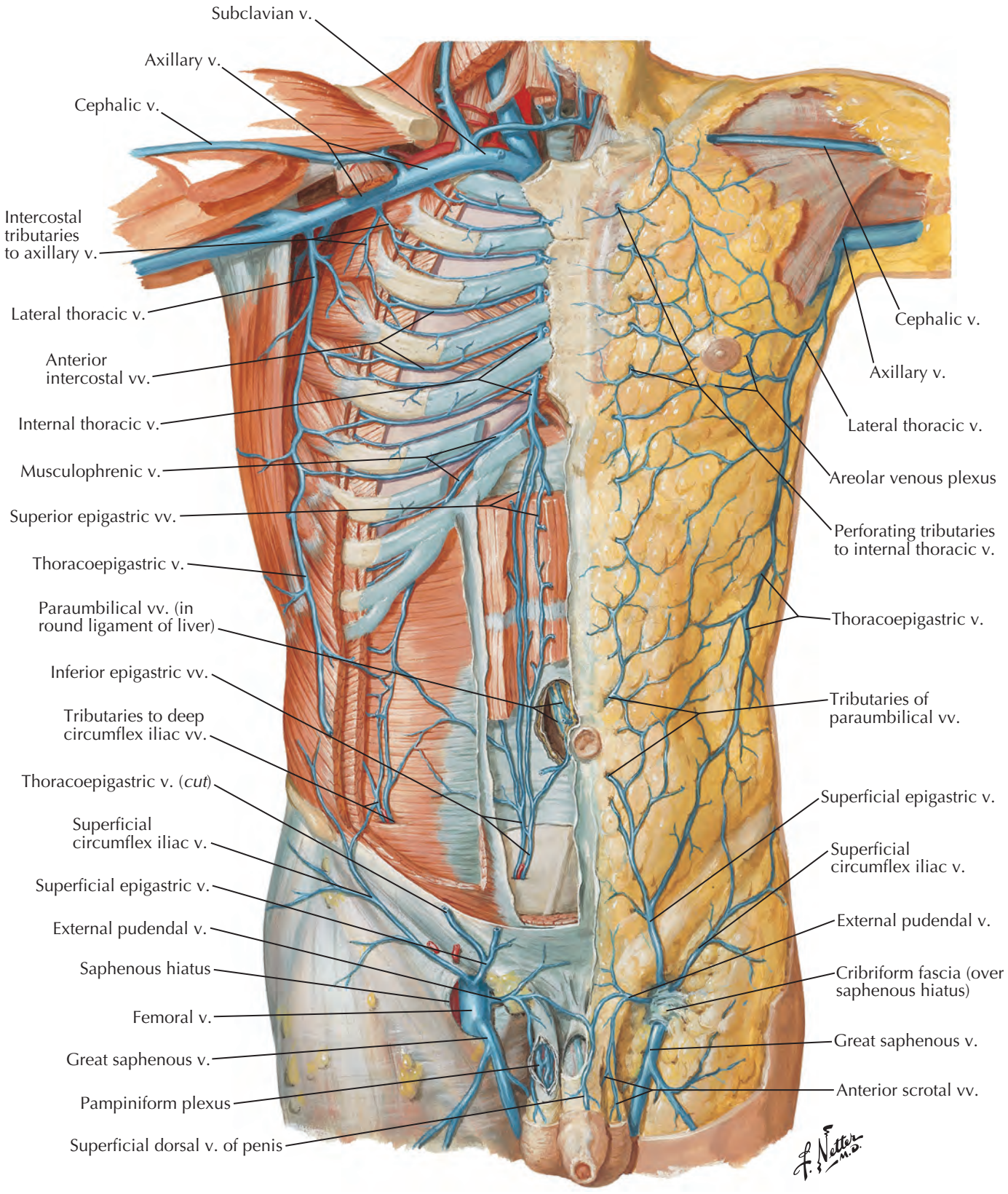

Serratus anterior m.
Infraspinatus fascia
Rhomboid major m.
Triangle of auscultation
Lateral posterior cutaneous branch of T7 spinal n.
Medial posterior cutaneous branch of T7 spinal n.
Trapezius m.
Latissimus dorsi m.
External abdominal oblique m.
Posterior layer of thoracolumbar fascia
Lateral cutaneous branch of subcostal n.
Lumbar triangle (of Petit)
Iliac crest
Lateral cutaneous branch of iliohypogastric n.
Superior gluteal cutaneous nn. (superior clunial nn.)
Gluteal aponeurosis (over gluteus medius m.)
Gluteus maximus m.


9
10
11
12
Latissimus dorsi m.
Latissimus dorsi m. (*cut and turned back*)
Serratus posterior inferior m.
Costal attachments of latissimus dorsi m.
Costal attachments of external abdominal oblique m.
External abdominal oblique m. (*cut and turned back*)
Aponeurosis of transversus abdominis m.
Internal abdominal oblique m.
Lateral cutaneous branch of subcostal n.
Lateral cutaneous branch of iliohypogastric n.
Iliac crest
Superior gluteal cutaneous nn. (superior clunial nn.)
Gluteus maximus m.

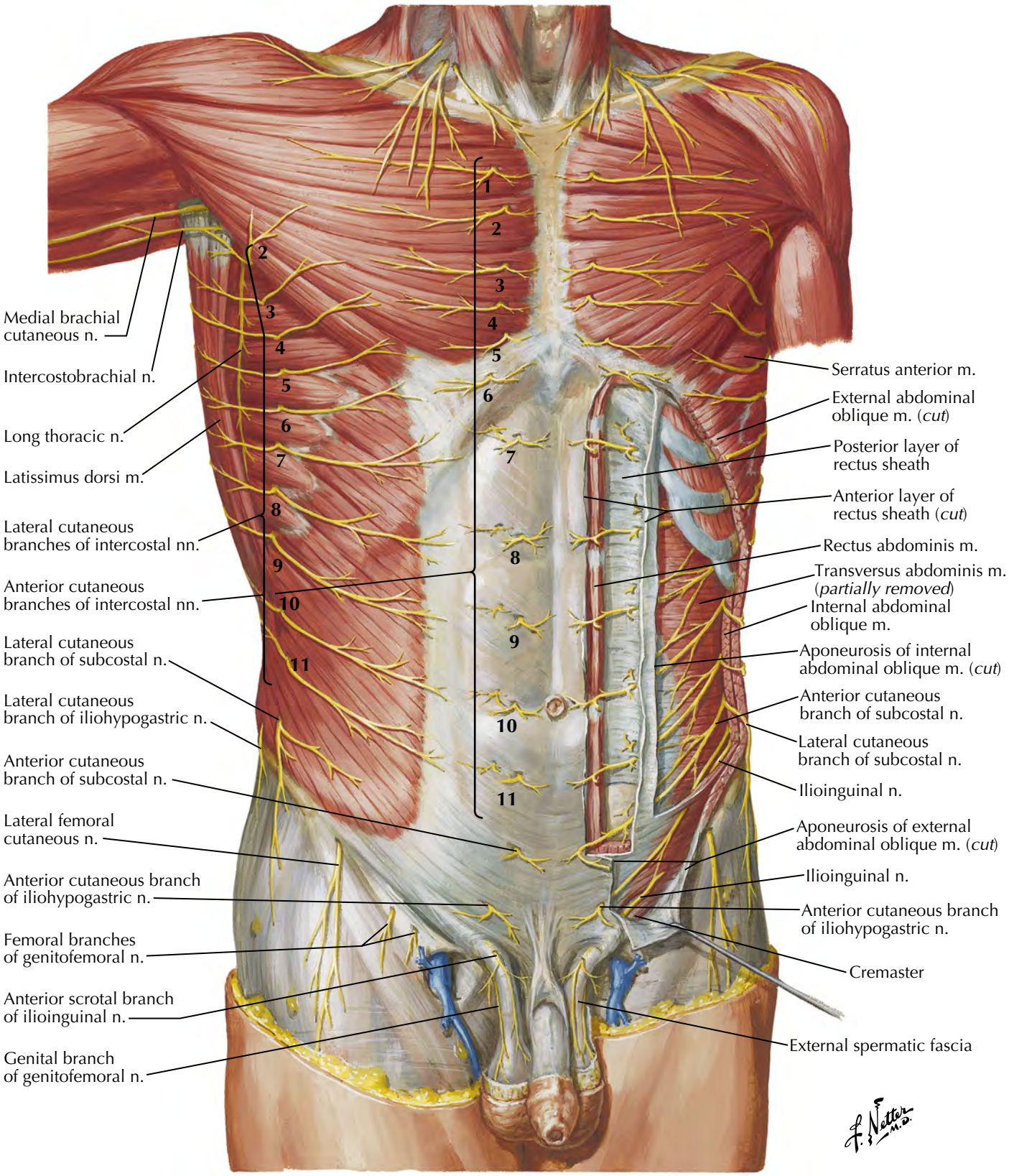
See also **Plate 272**



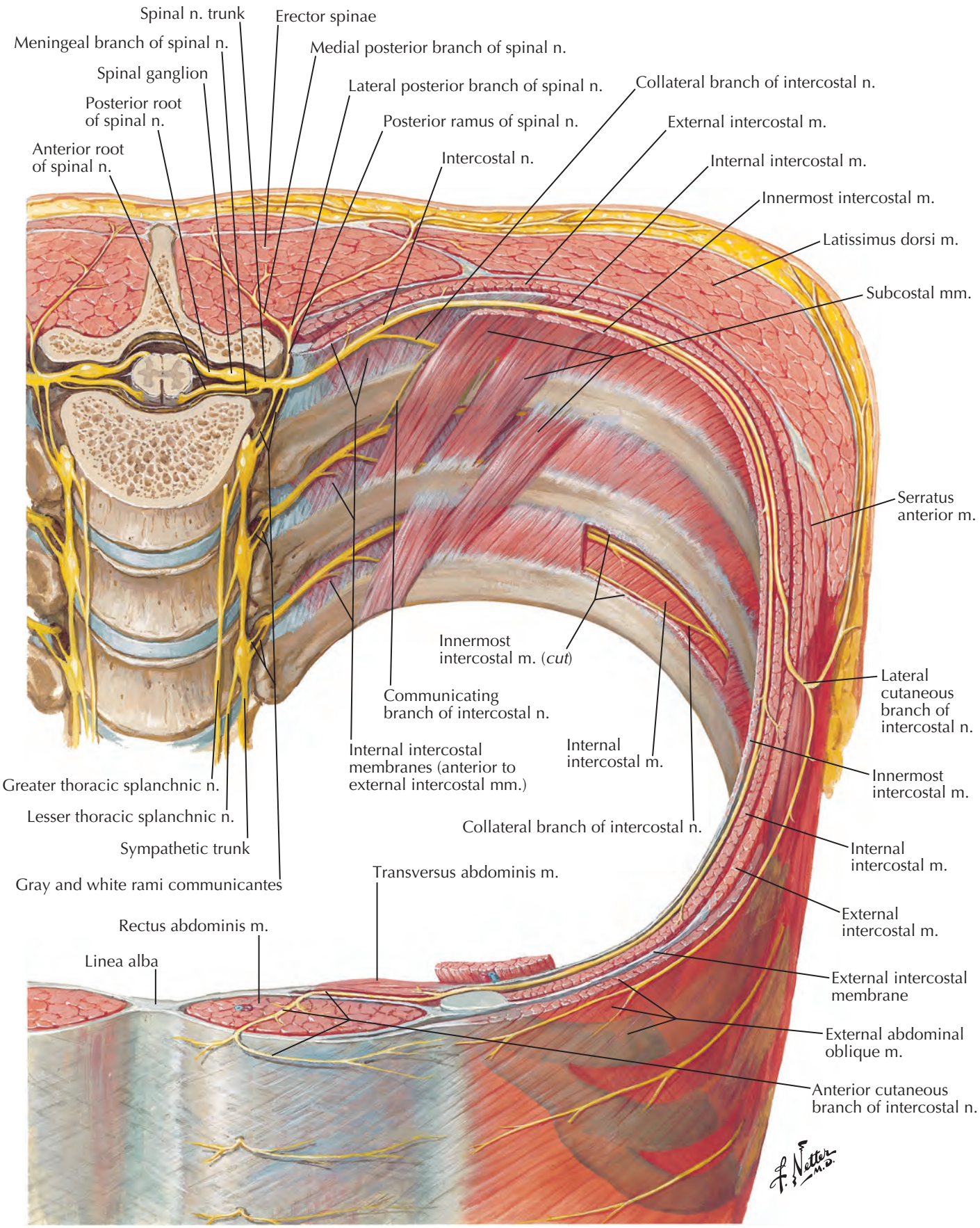
See also **Plates 270, 272**



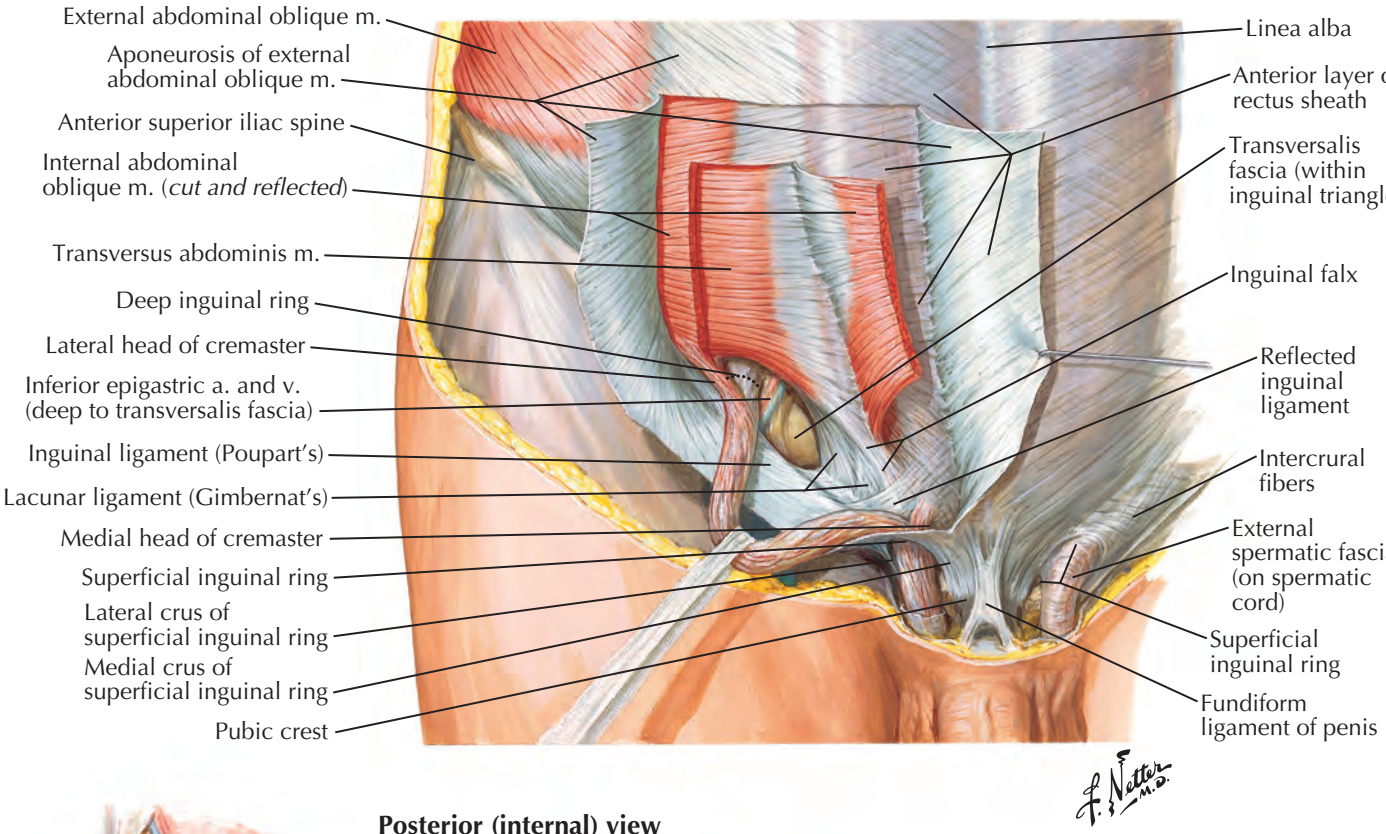
See also **Plates 188, 201, 209, 279**



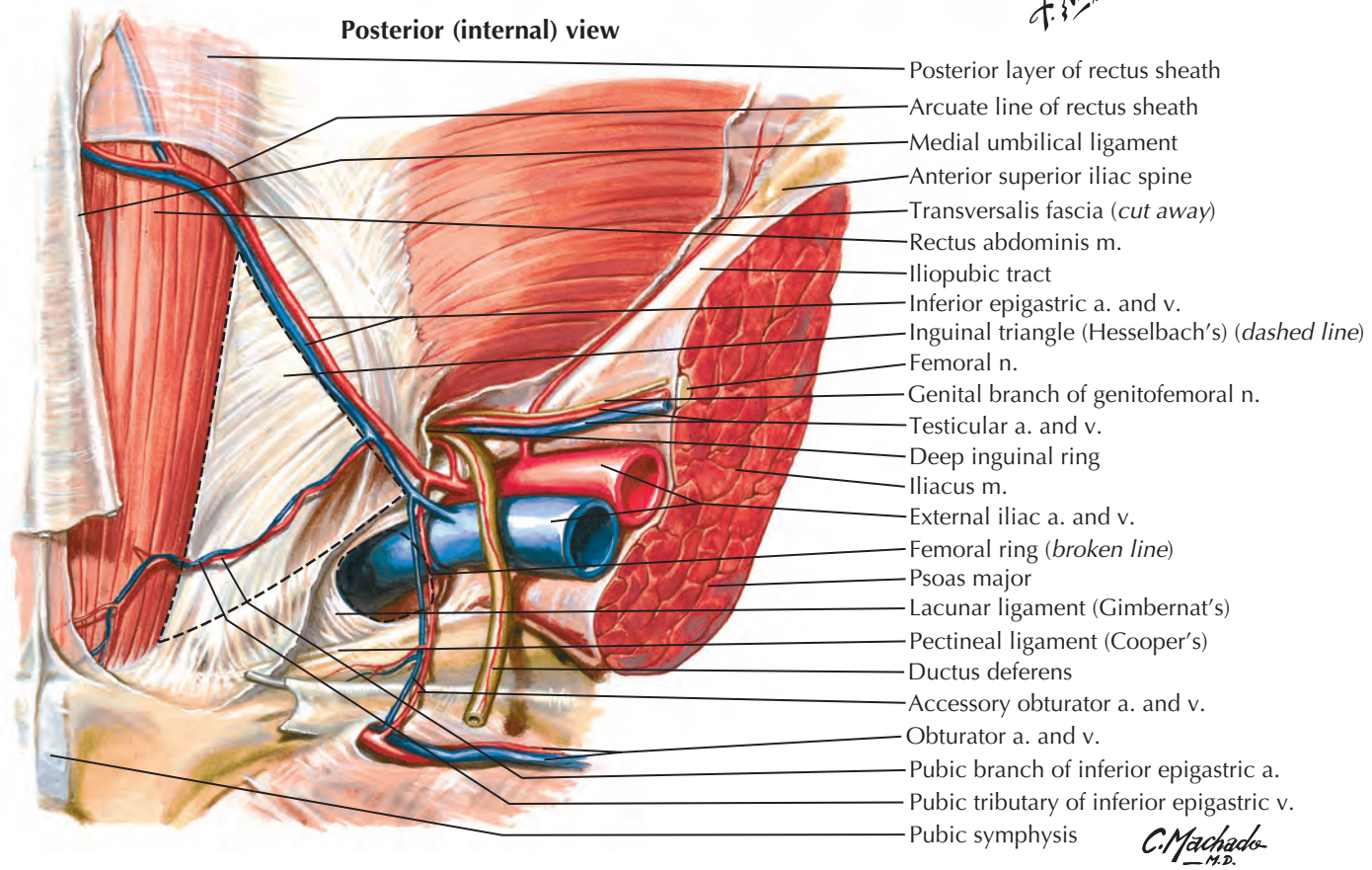
See also **Plates 272, 274**



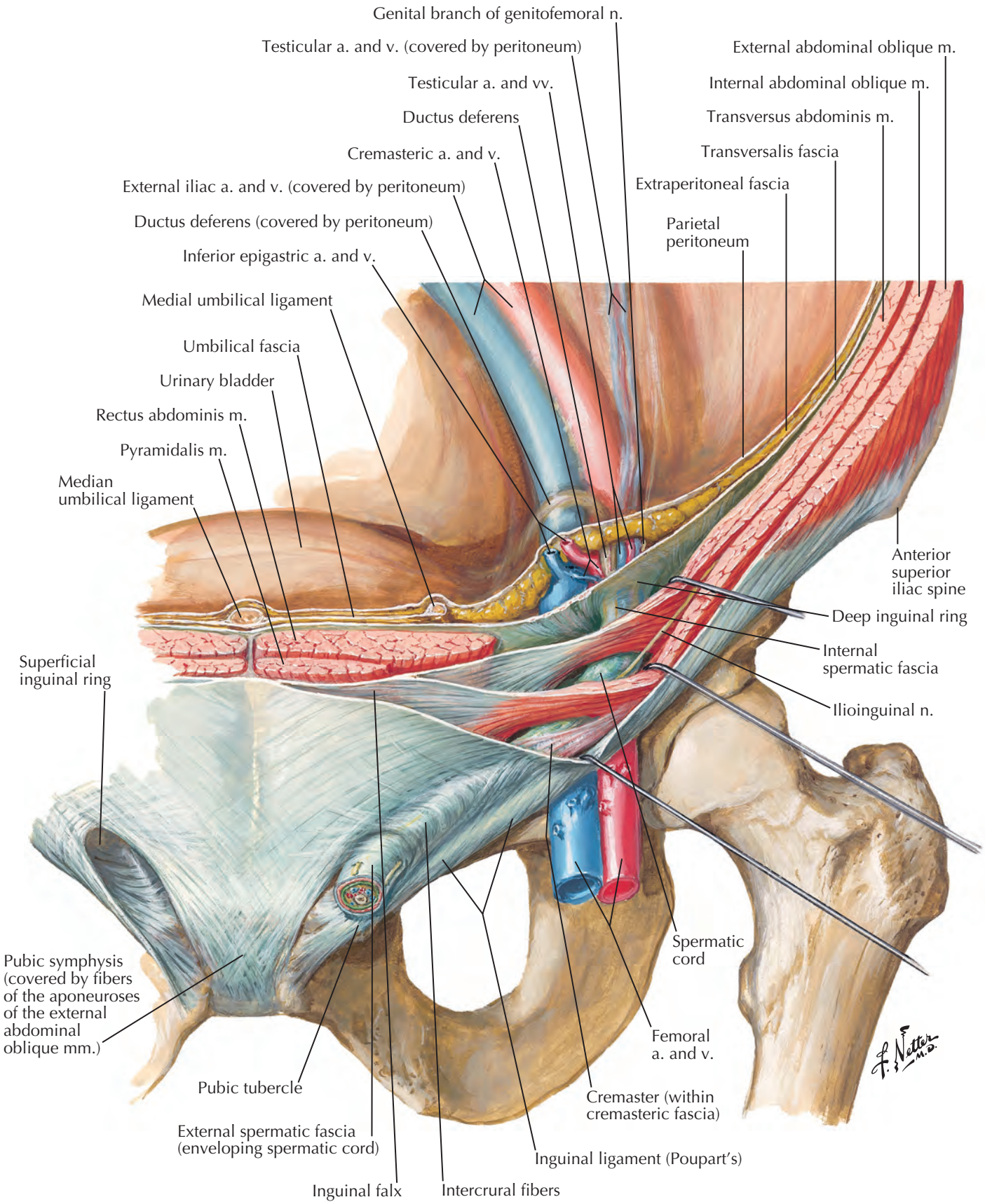
Anterior view

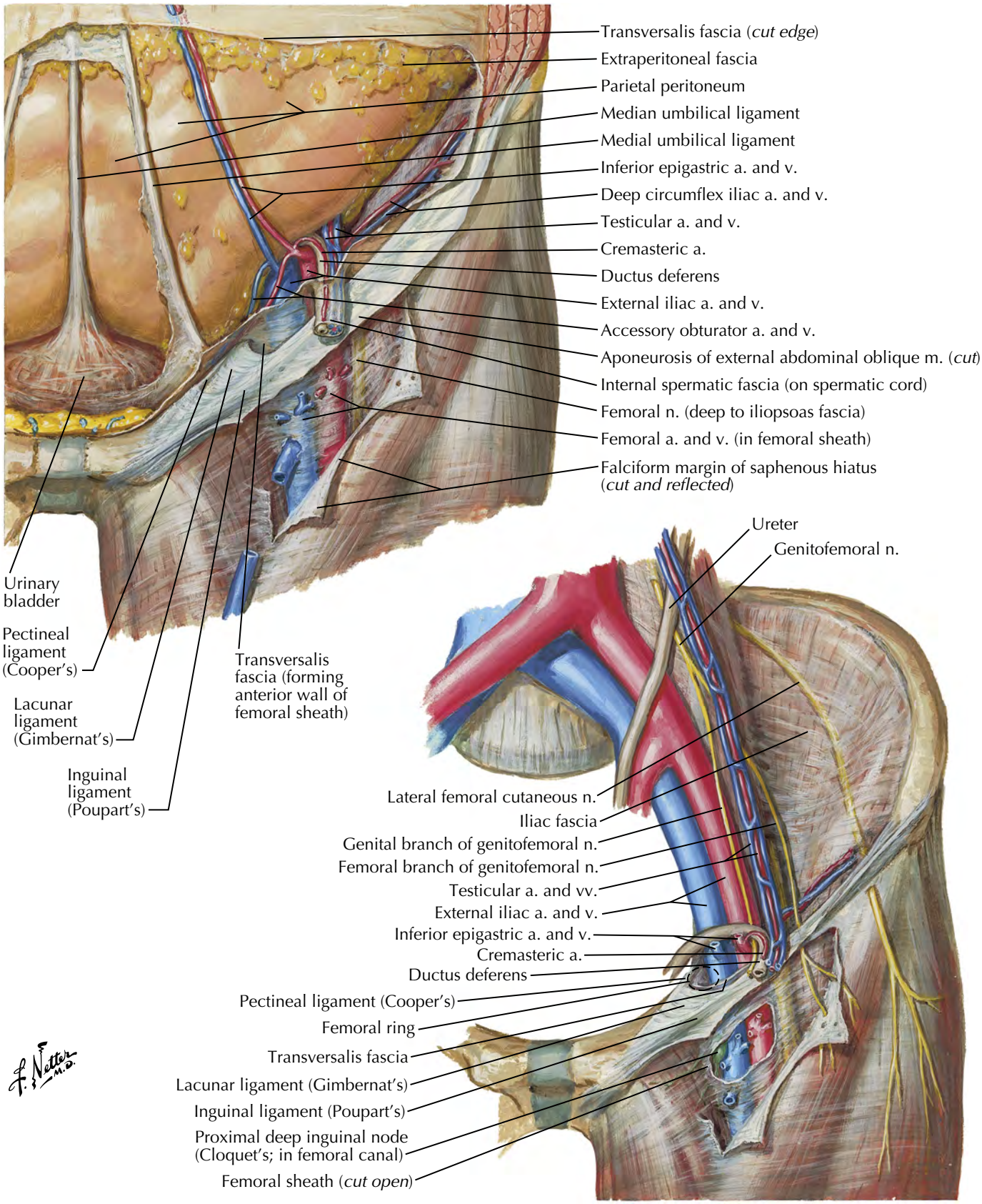


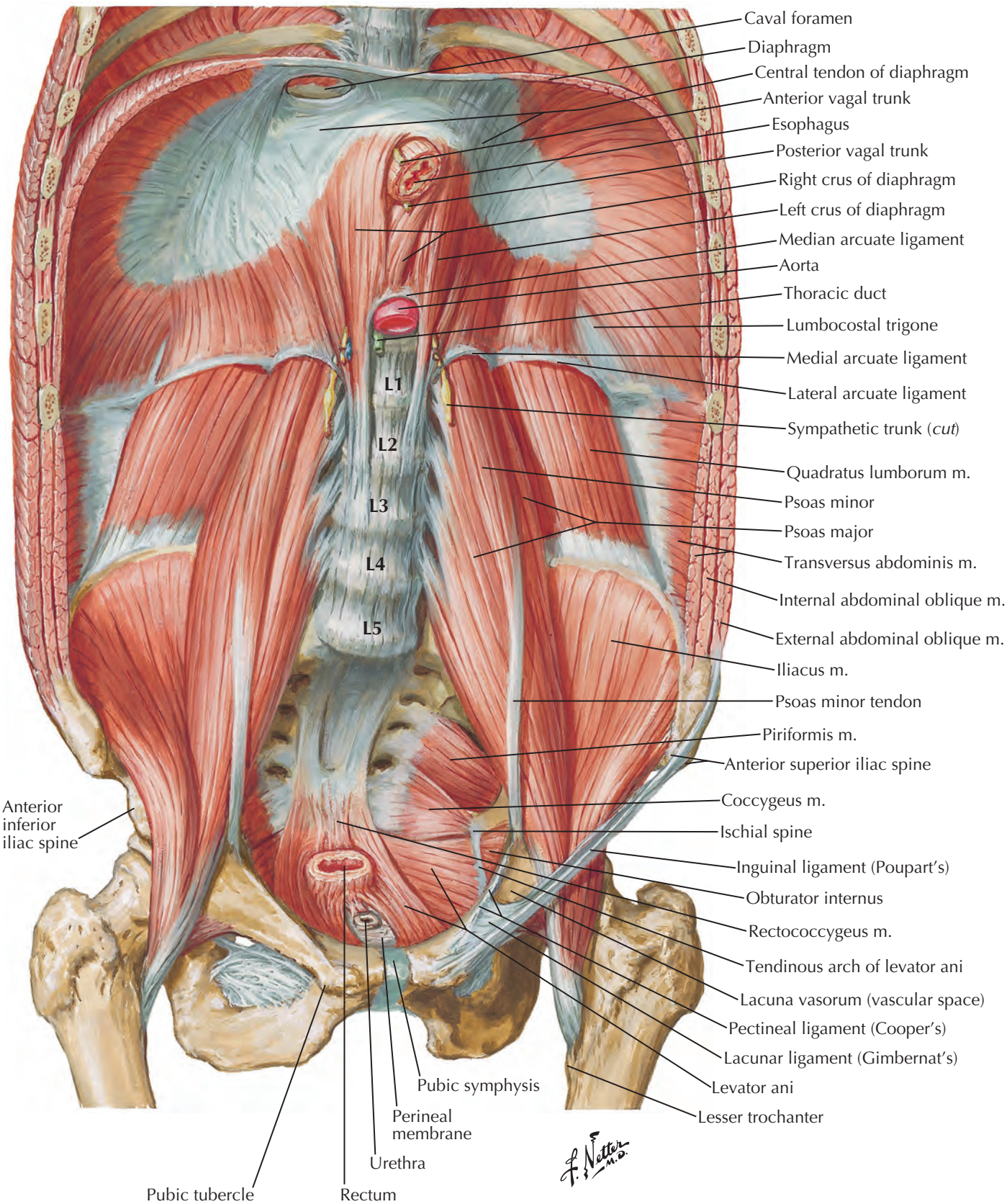
Posterior (internal) view



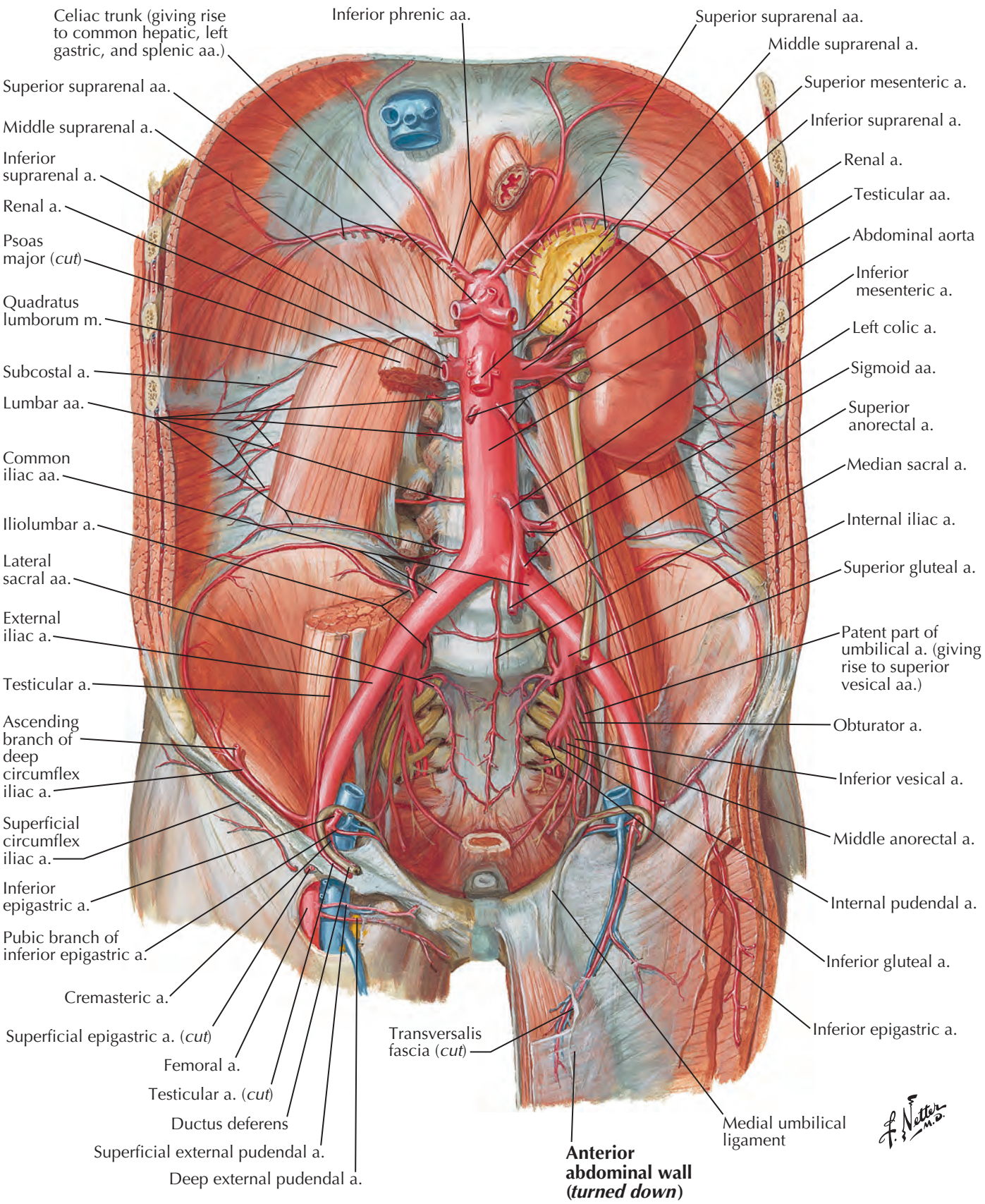
See also **Plates 270, 278, BP 54**



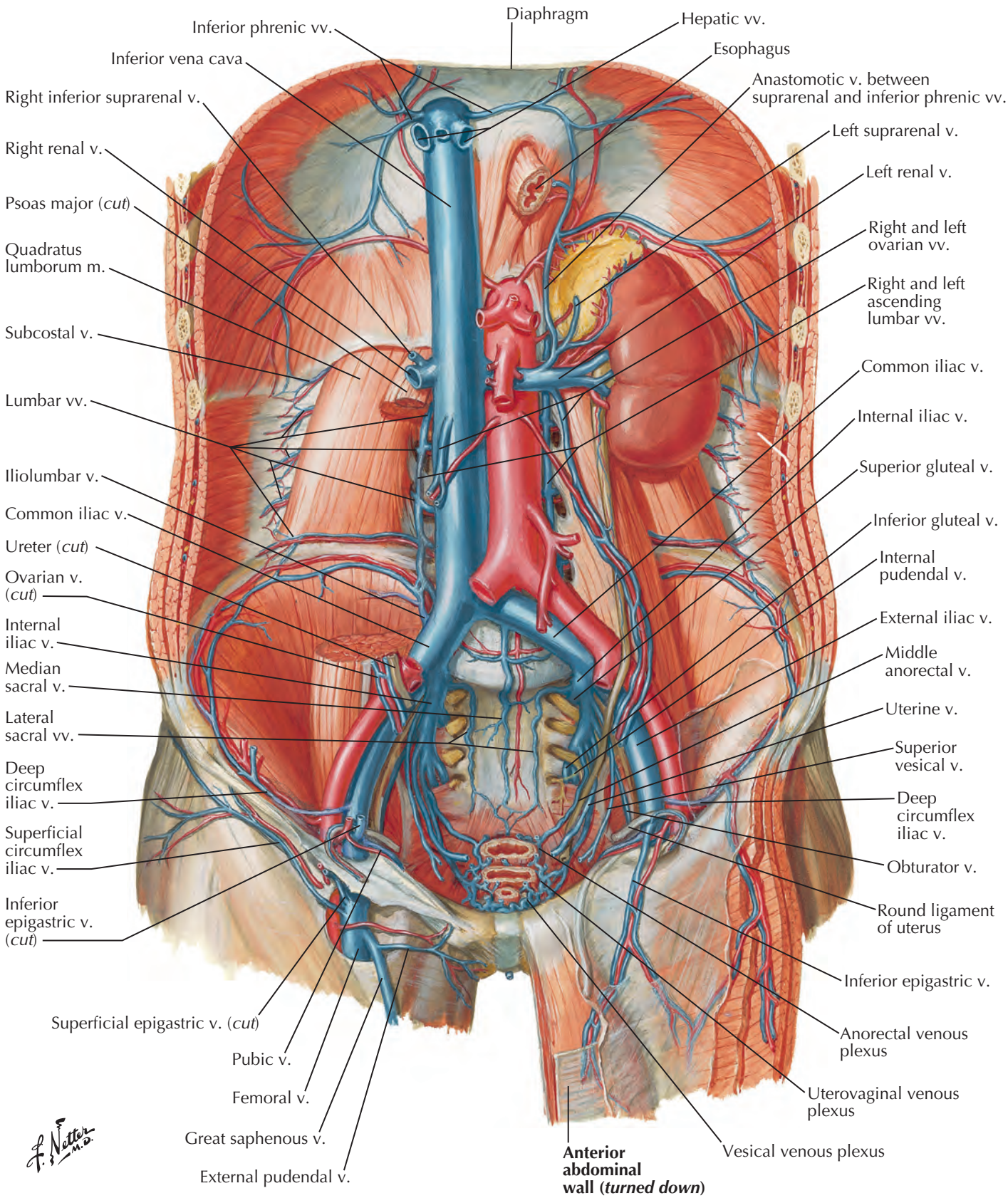

Transversalis fascia (*cut edge*)
Extraperitoneal fascia
Parietal peritoneum
Median umbilical ligament
Medial umbilical ligament
Inferior epigastric a. and v.
Deep circumflex iliac a. and v.
Testicular a. and v.
Cremasteric a.
Ductus deferens
External iliac a. and v.
Accessory obturator a. and v.
Aponeurosis of external abdominal oblique m. (*cut*)
Internal spermatic fascia (on spermatic cord)
Femoral n. (deep to iliopsoas fascia)
Femoral a. and v. (in femoral sheath)
Falciform margin of saphenous hiatus (*cut and reflected*)
Urinary bladder
Pectineal ligament (Cooper's)
Lacunar ligament (Gimbernat's)
Inguinal ligament (Poupart's)
Transversalis fascia (forming anterior wall of femoral sheath)
Ureter
Genitofemoral n.
Lateral femoral cutaneous n.
Iliac fascia
Genital branch of genitofemoral n.
Femoral branch of genitofemoral n.
Testicular a. and vv.
External iliac a. and v.
Inferior epigastric a. and v.
Cremasteric a.
Ductus deferens
Pectineal ligament (Cooper's)
Femoral ring
Transversalis fascia
Lacunar ligament (Gimbernat's)
Inguinal ligament (Poupart's)
Proximal deep inguinal node (Cloquet's; in femoral canal)
Femoral sheath (*cut open*)


Caval foramen
Diaphragm
Central tendon of diaphragm
Anterior vagal trunk
Esophagus
Posterior vagal trunk
Right crus of diaphragm
Left crus of diaphragm
Median arcuate ligament
Aorta
Thoracic duct
Lumbocostal trigone
Medial arcuate ligament
Lateral arcuate ligament
Sympathetic trunk (cut)
Quadratus lumborum m.
Psoas minor
Psoas major
Transversus abdominis m.
Internal abdominal oblique m.
External abdominal oblique m.
Iliacus m.
Psoas minor tendon
Piriformis m.
Anterior superior iliac spine
Coccygeus m.
Ischial spine
Inguinal ligament (Poupart's)
Obturator internus
Rectococcygeus m.
Tendinous arch of levator ani
Lacuna vasorum (vascular space)
Pectineal ligament (Cooper's)
Lacunar ligament (Gimbernat's)
Levator ani
Lesser trochanter
L1
L2
L3
L4
L5
Anterior inferior iliac spine
Pubic tubercle
Rectum
Urethra
Perineal membrane
Pubic symphysis

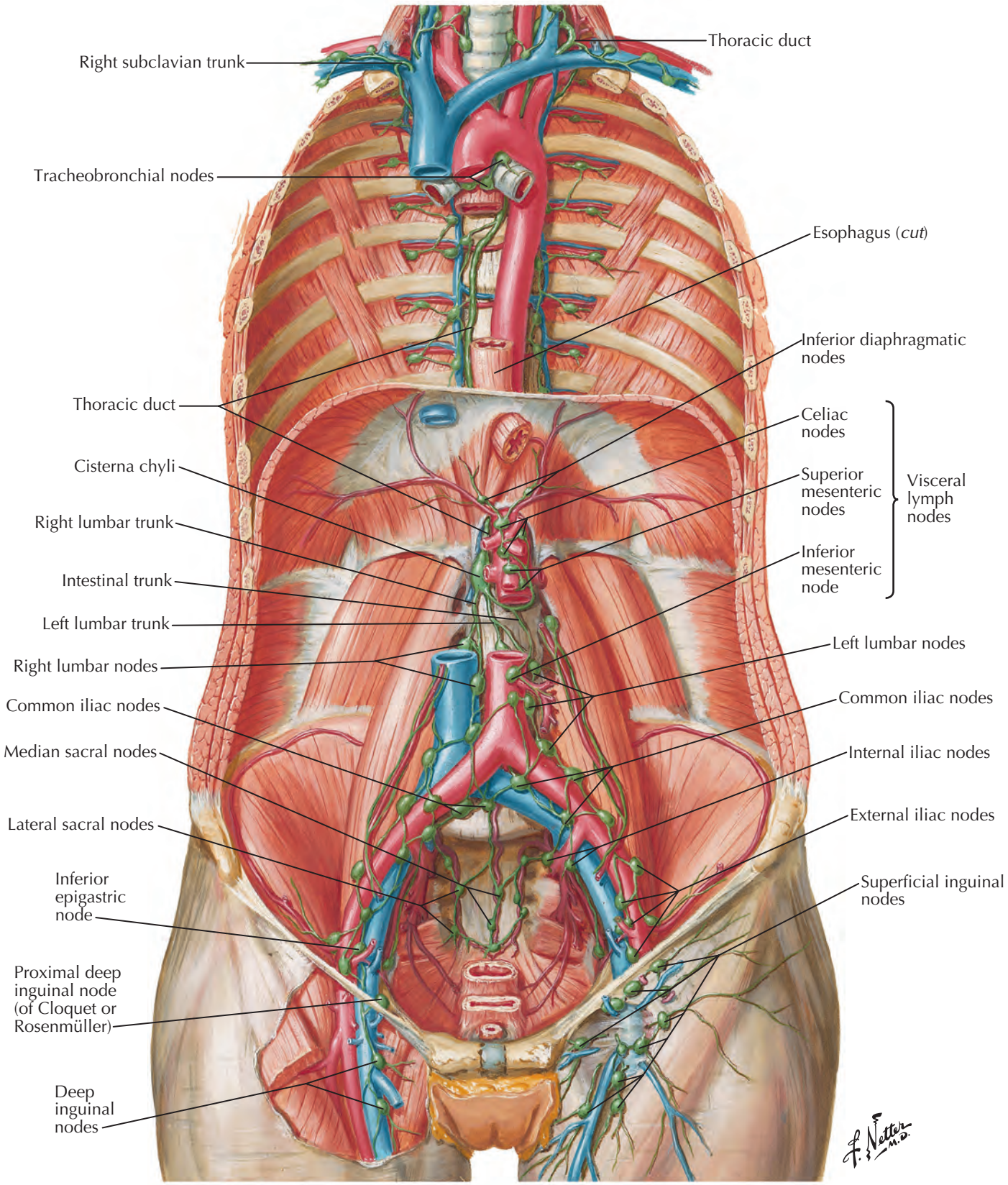
See also **Plates 216, 403, 404**



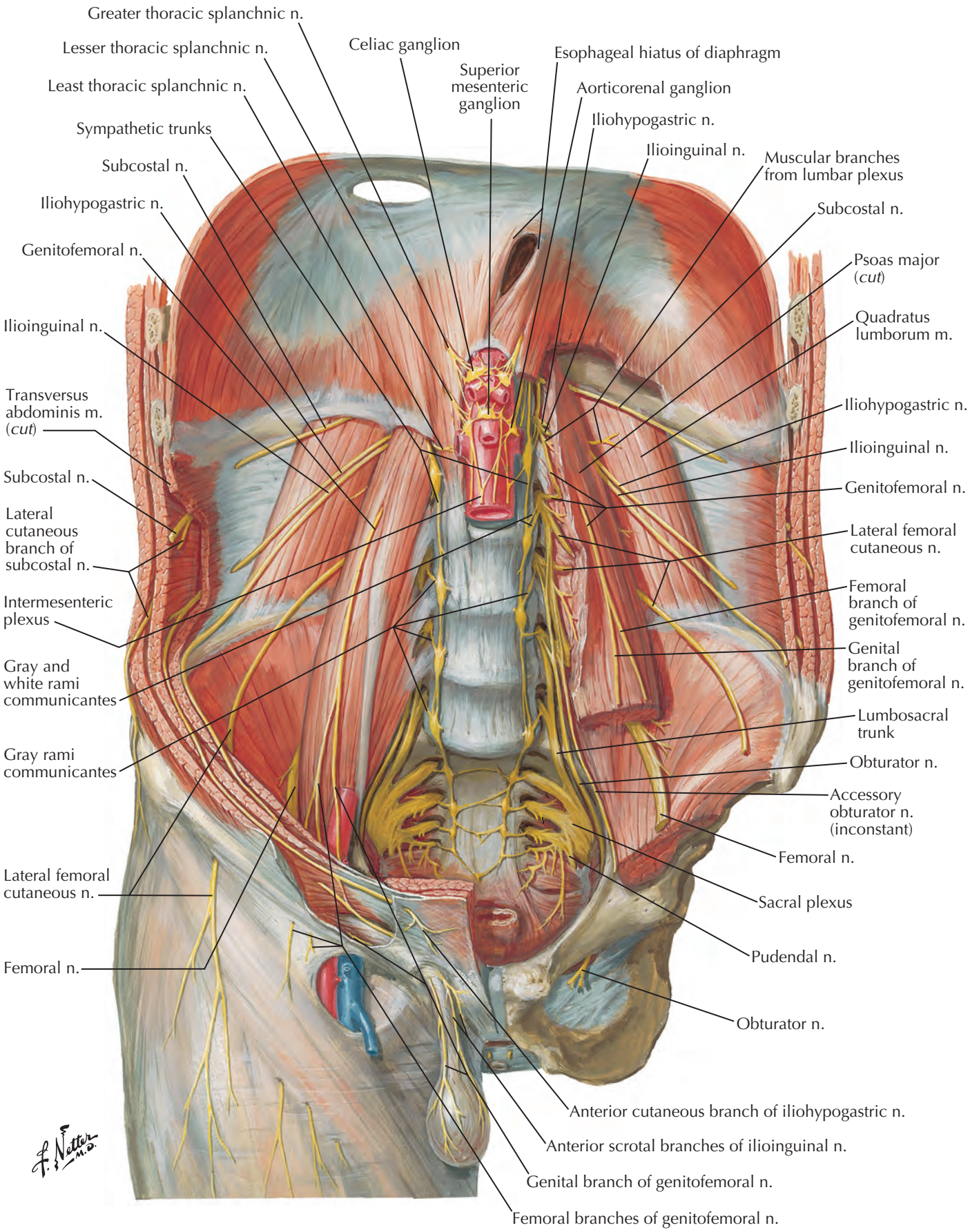
See also **Plates 402, 403**

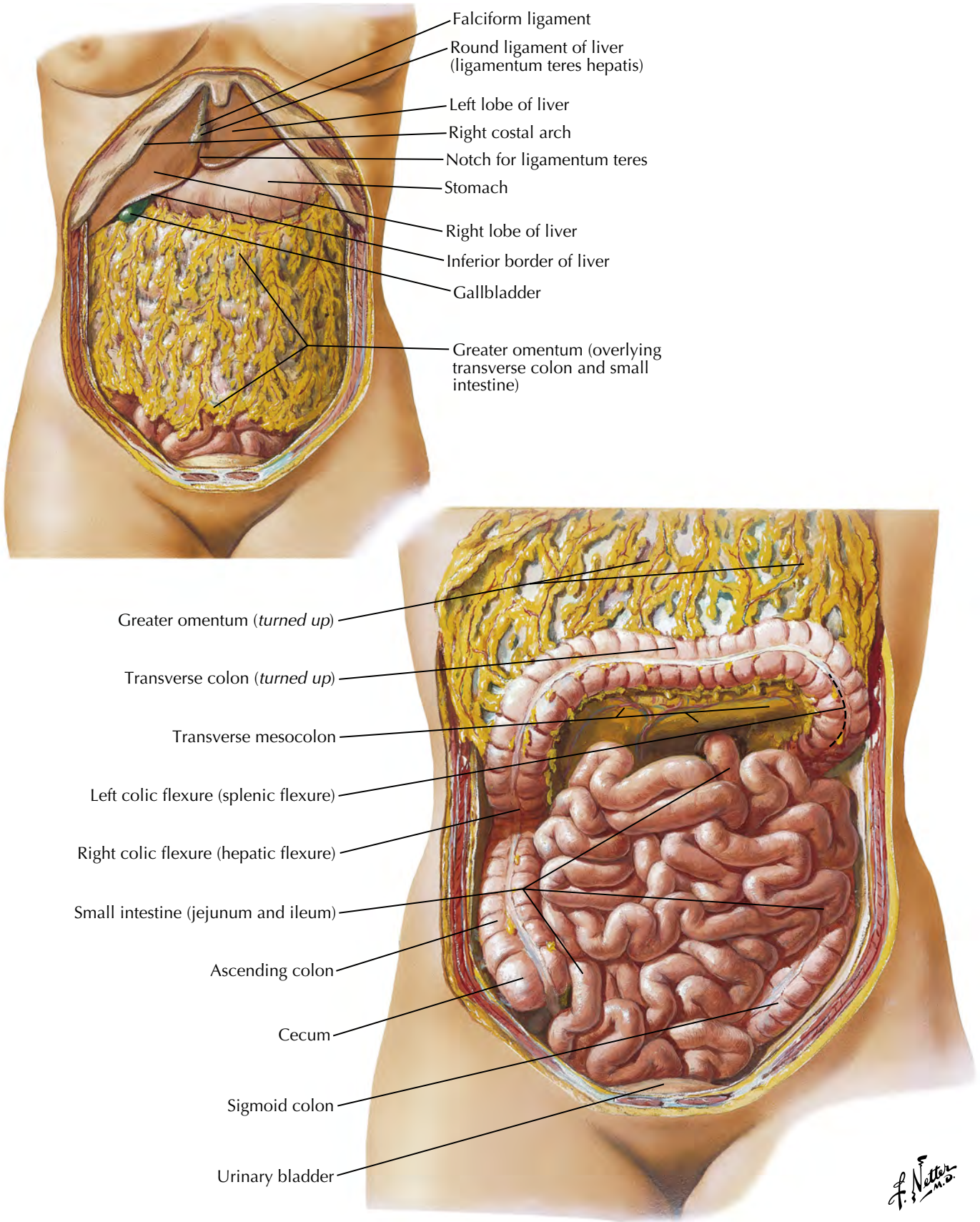


See also **Plates 338, 408**

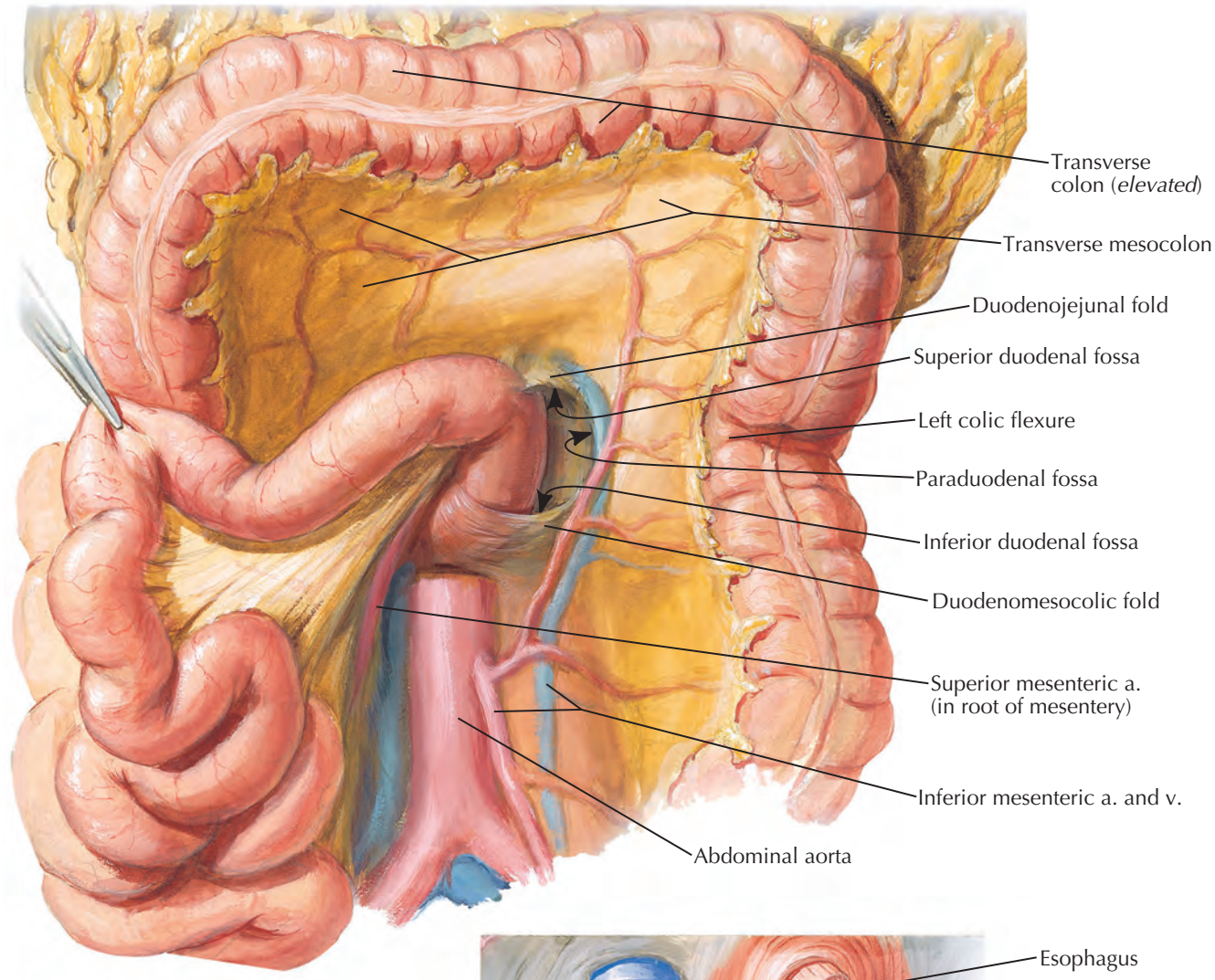


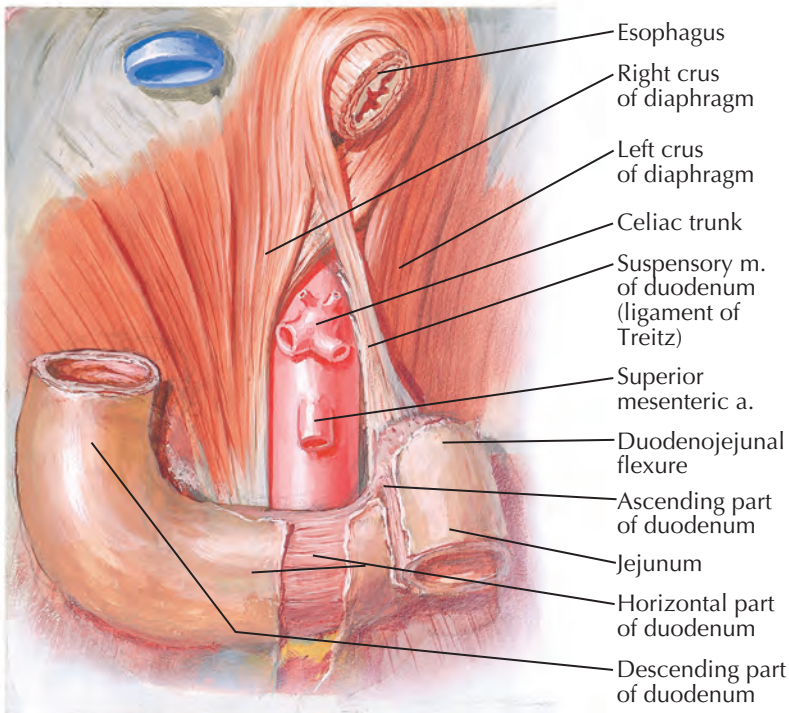
See also **Plates 216, 412**




Falciform ligament
Round ligament of liver (ligamentum teres hepatis)
Left lobe of liver
Right costal arch
Notch for ligamentum teres
Stomach
Right lobe of liver
Inferior border of liver
Gallbladder
Greater omentum (overlying transverse colon and small intestine)
Greater omentum (*turned up*)
Transverse colon (*turned up*)
Transverse mesocolon
Left colic flexure (splenic flexure)
Right colic flexure (hepatic flexure)
Small intestine (jejunum and ileum)
Ascending colon
Cecum
Sigmoid colon
Urinary bladder

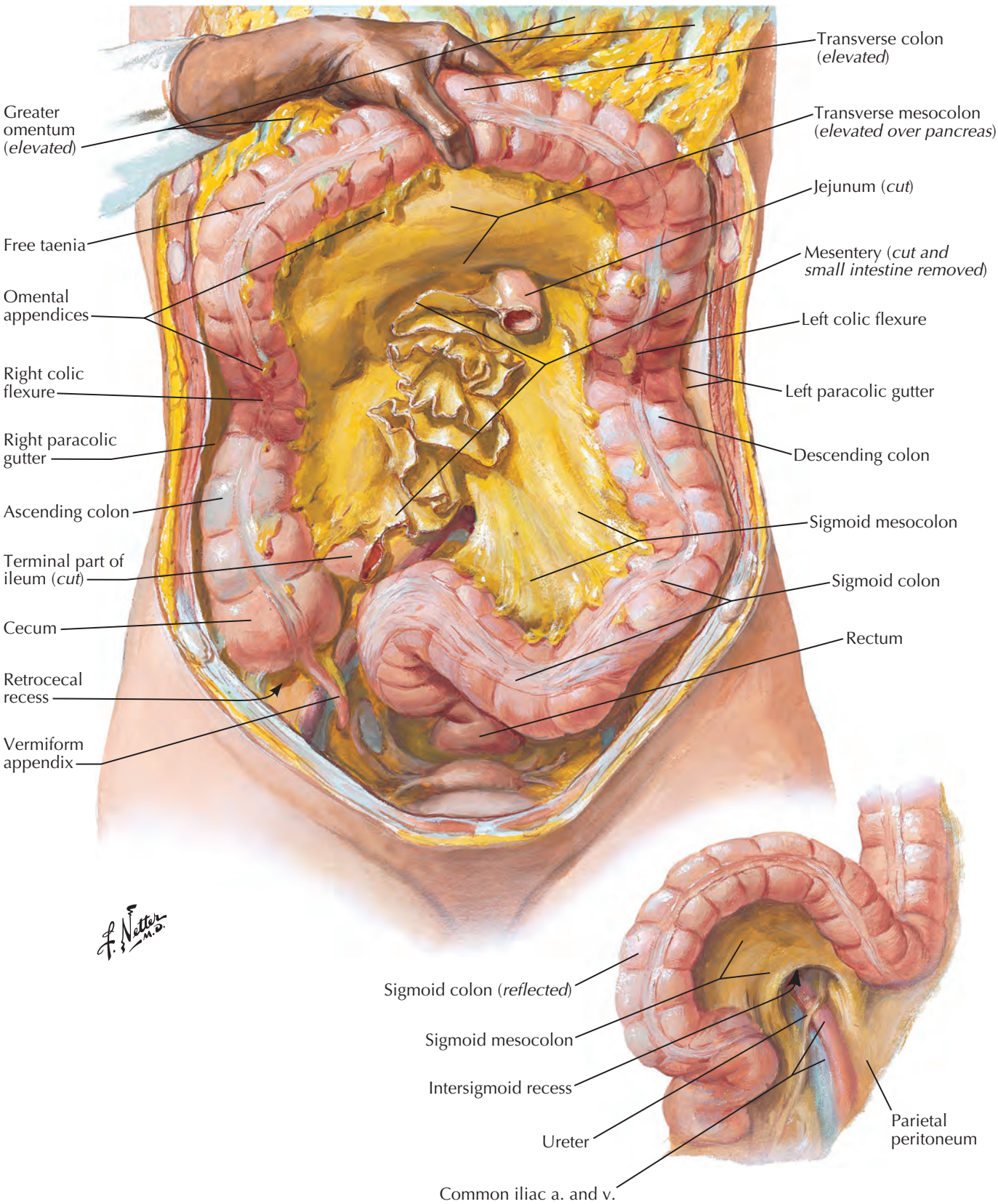
See also **Plate 306**



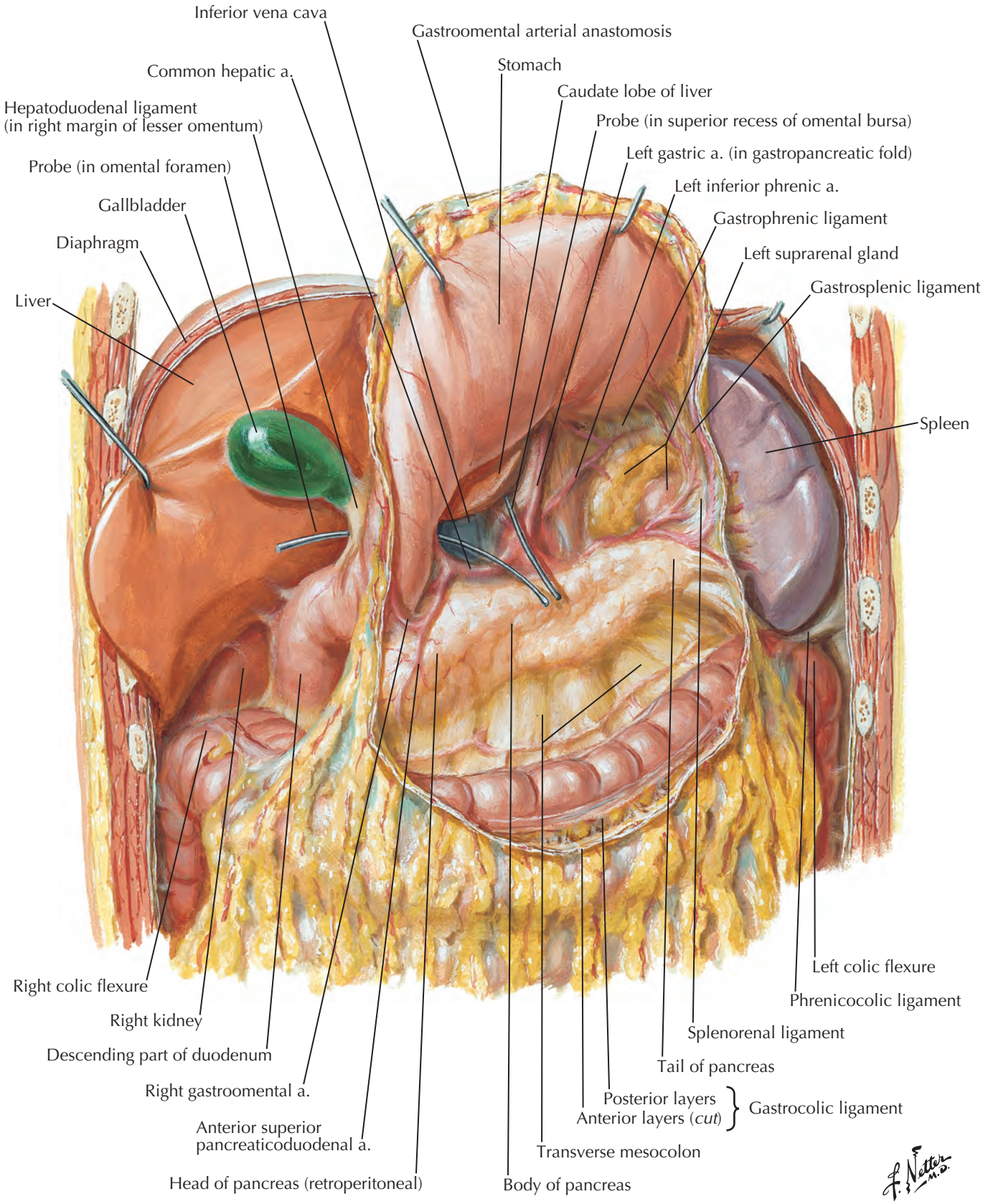


Exposure of suspensory muscle of duodenum

See also **Plates 314, BP 60**

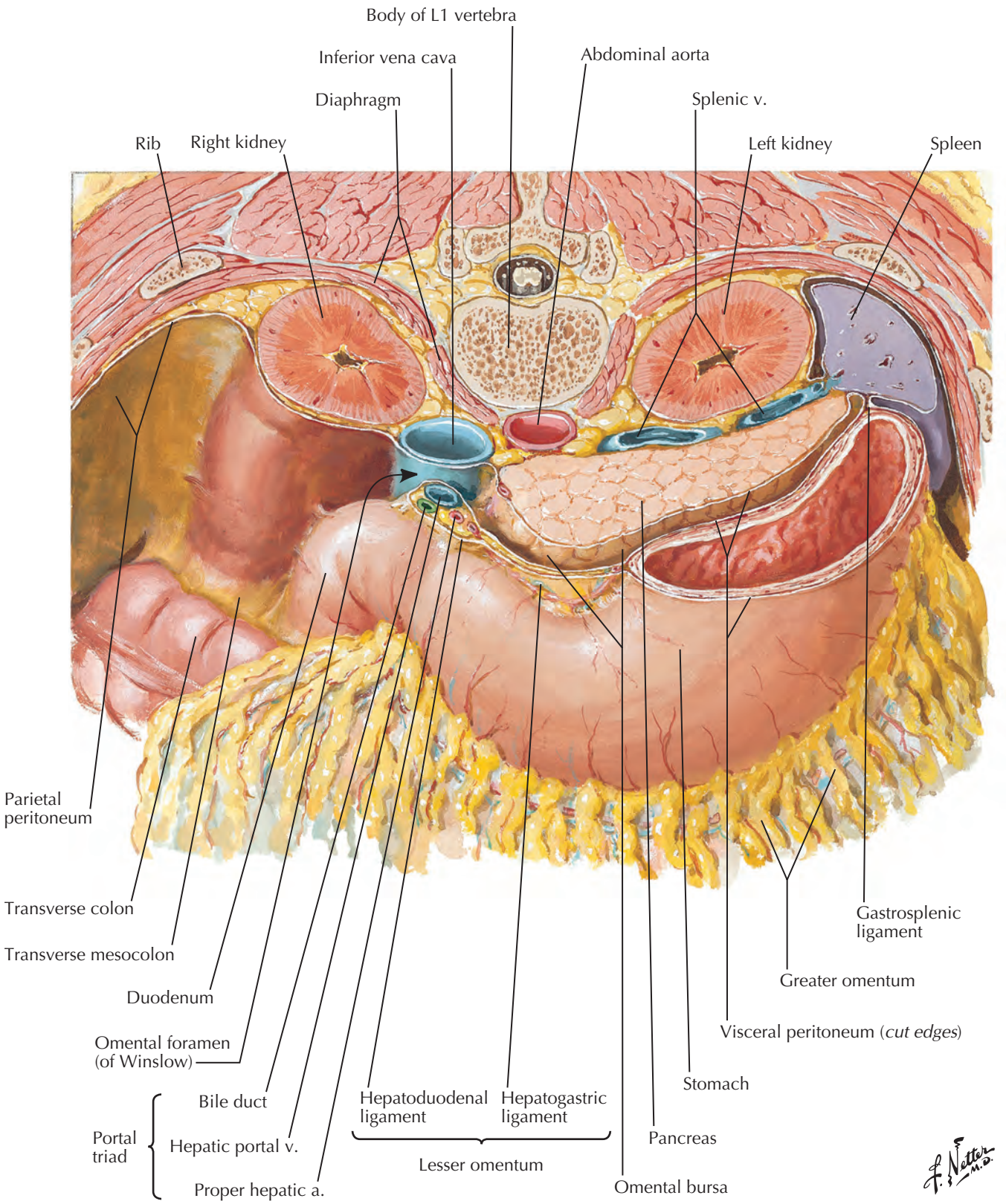


See also **Plates 306, 310**

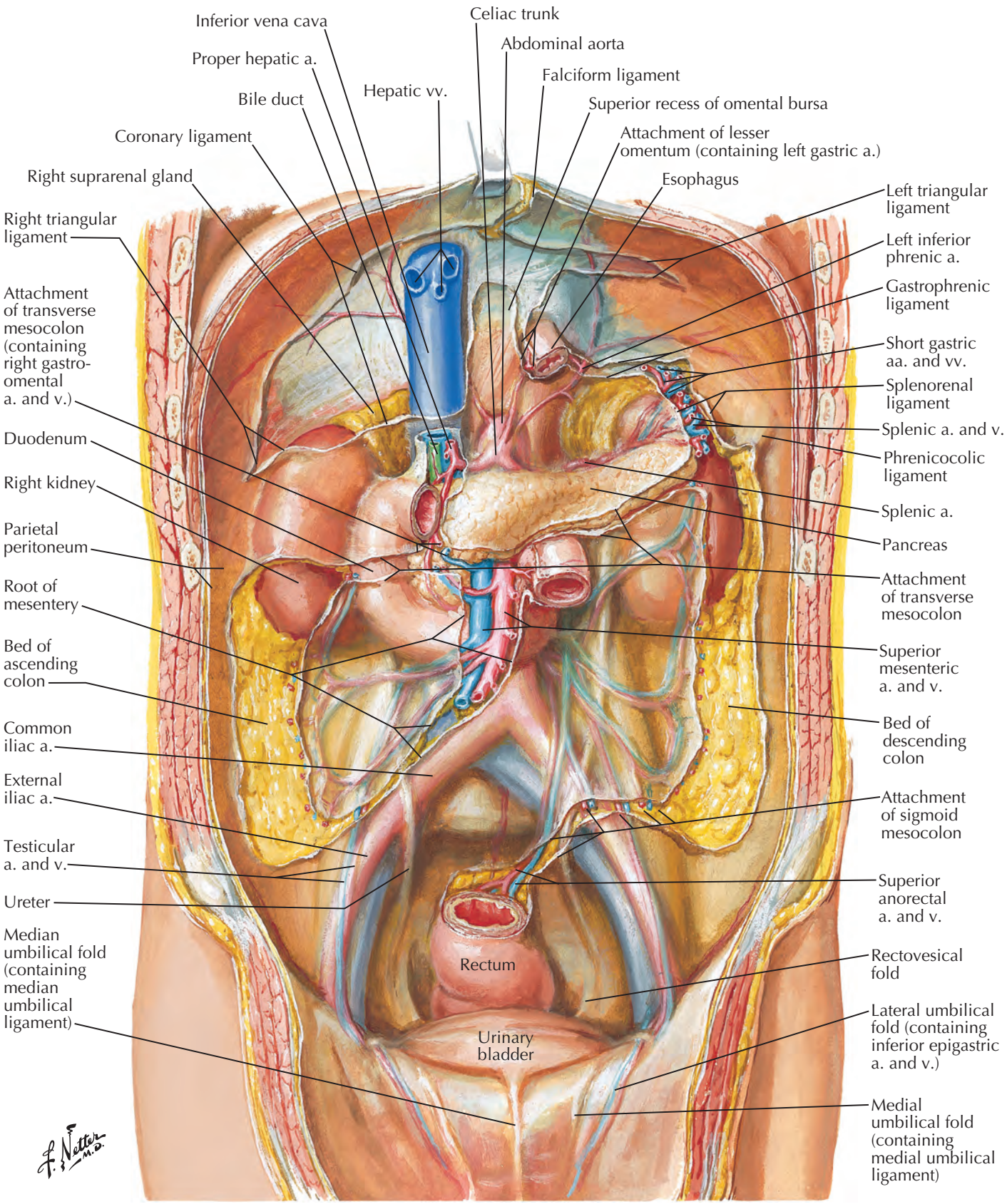


Omental Bursa: Cross Section

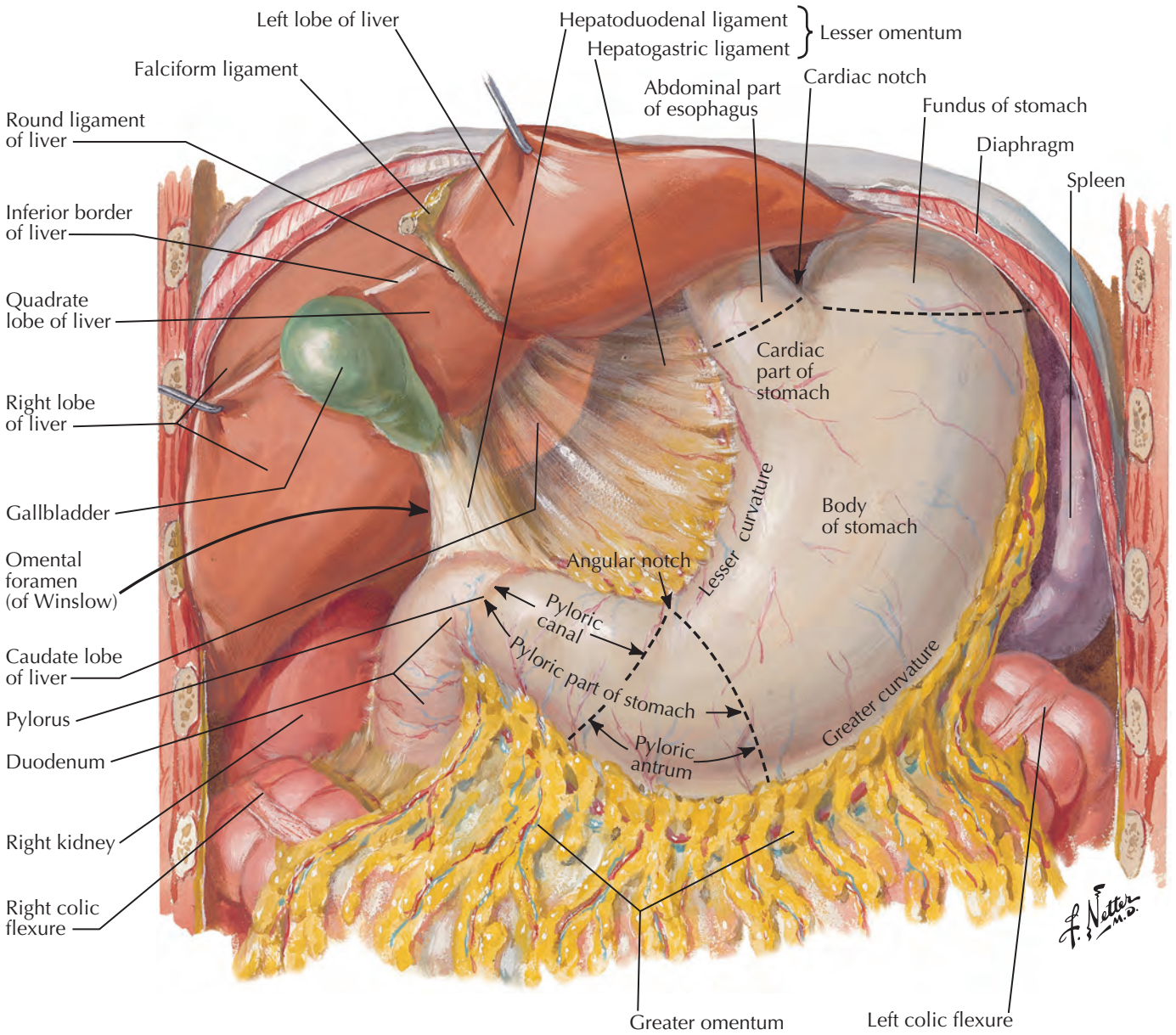
See also **Plate 294**



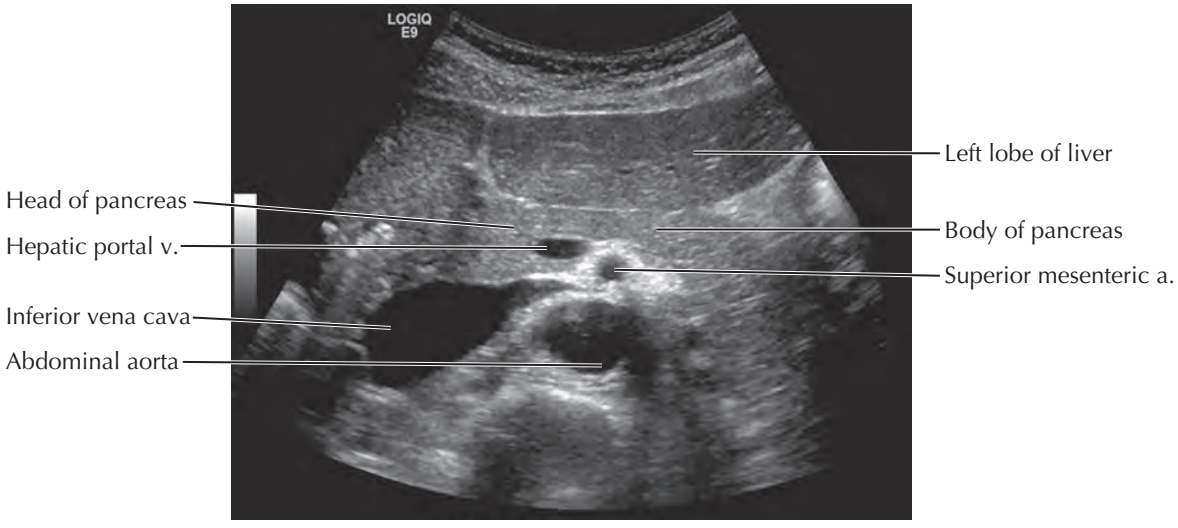
See also **Plate 296**



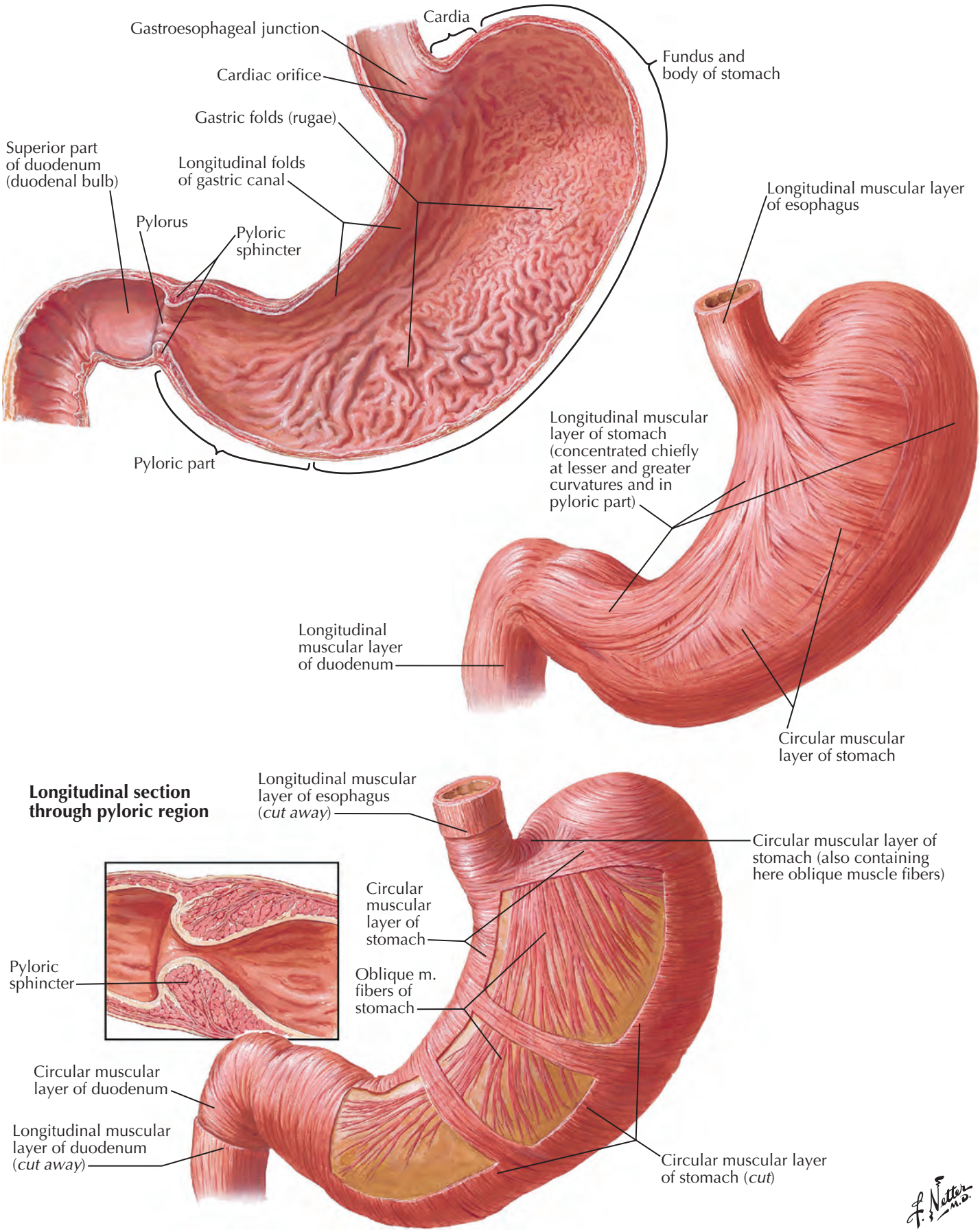
See also **Plate BP 55**



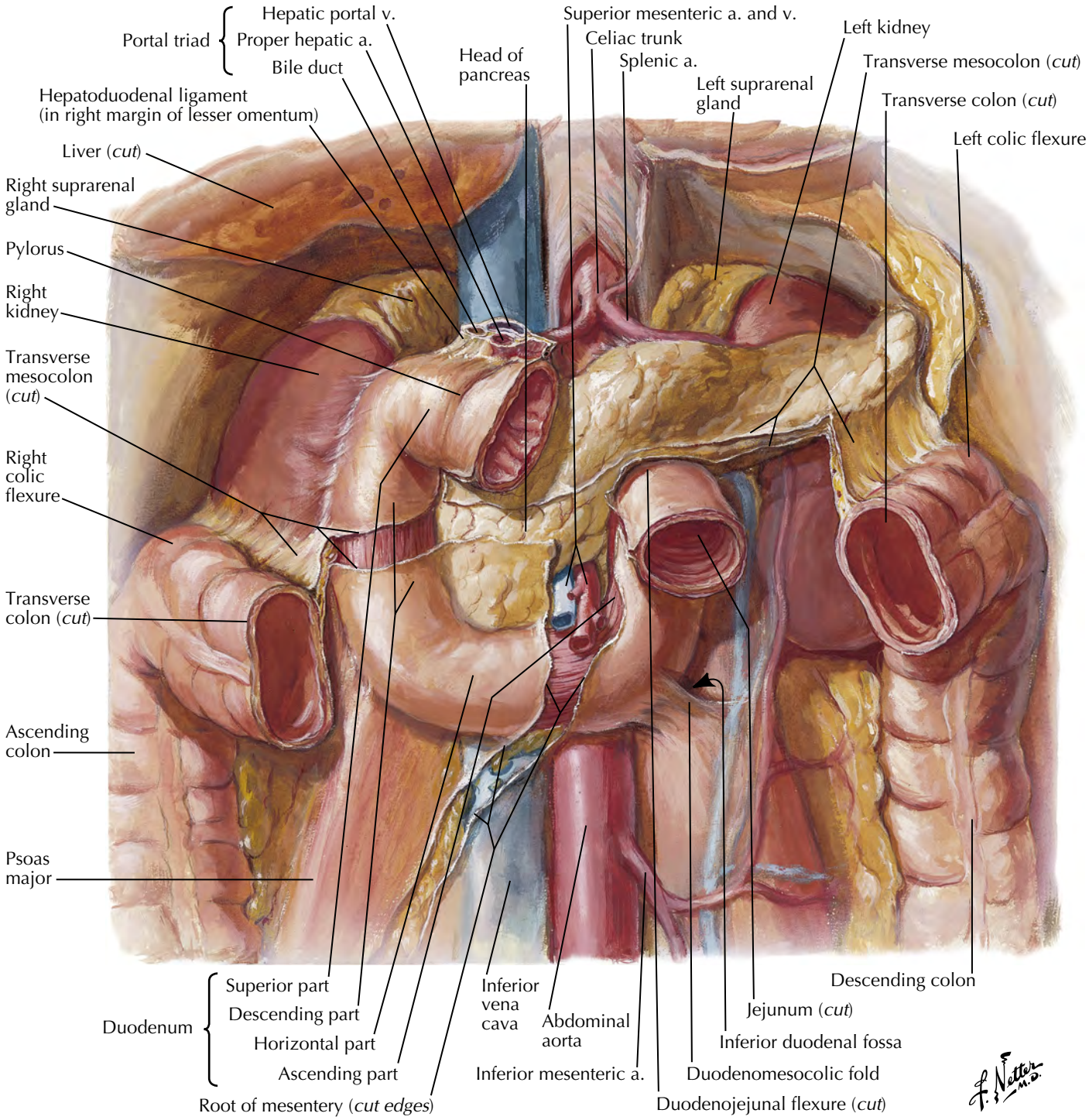
Transverse gray-scale ultrasound image of midabdomen



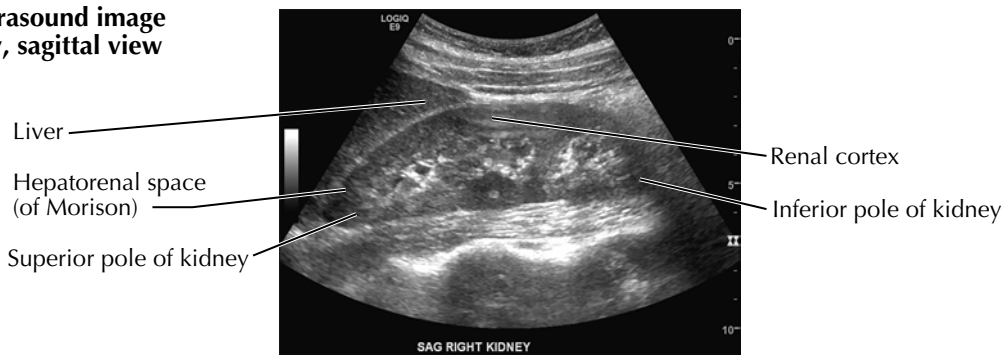
See also **Plate BP 55**



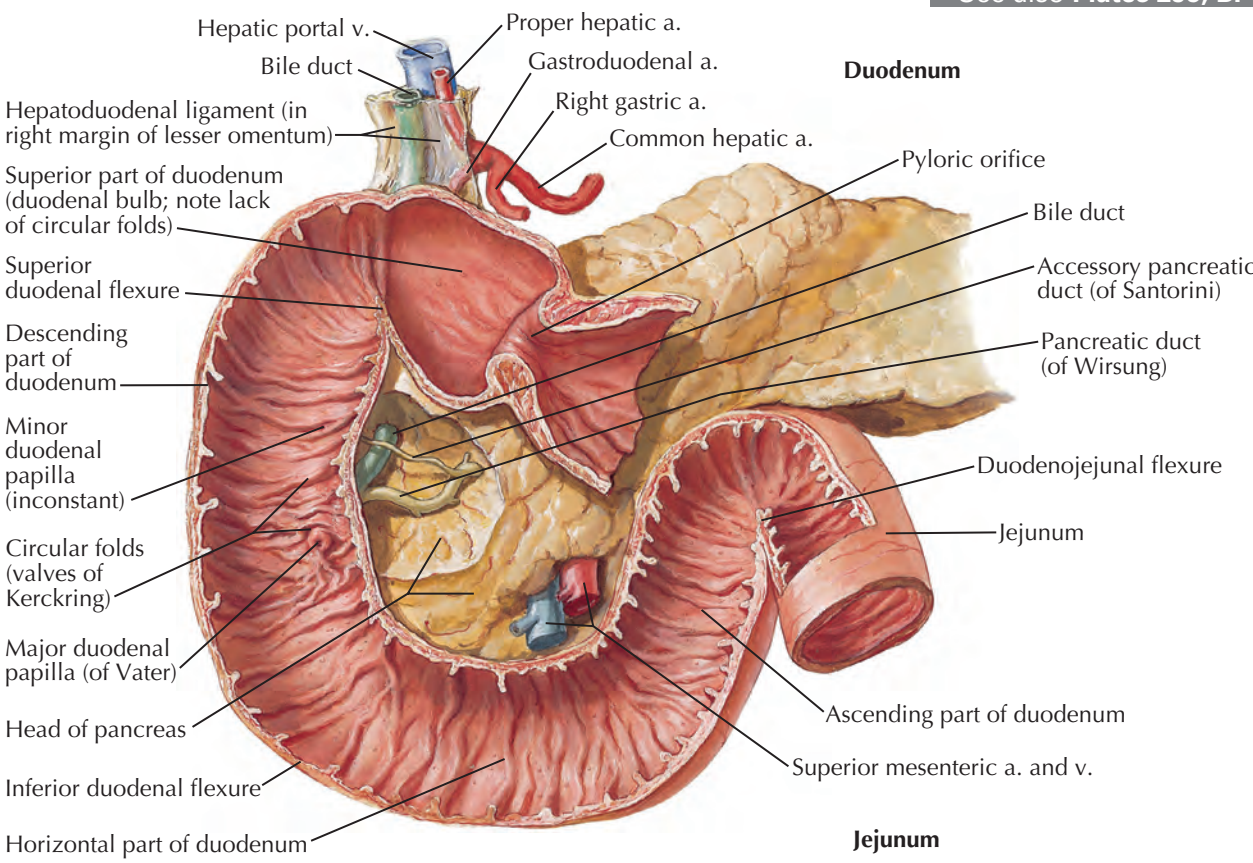
See also **Plate 293**

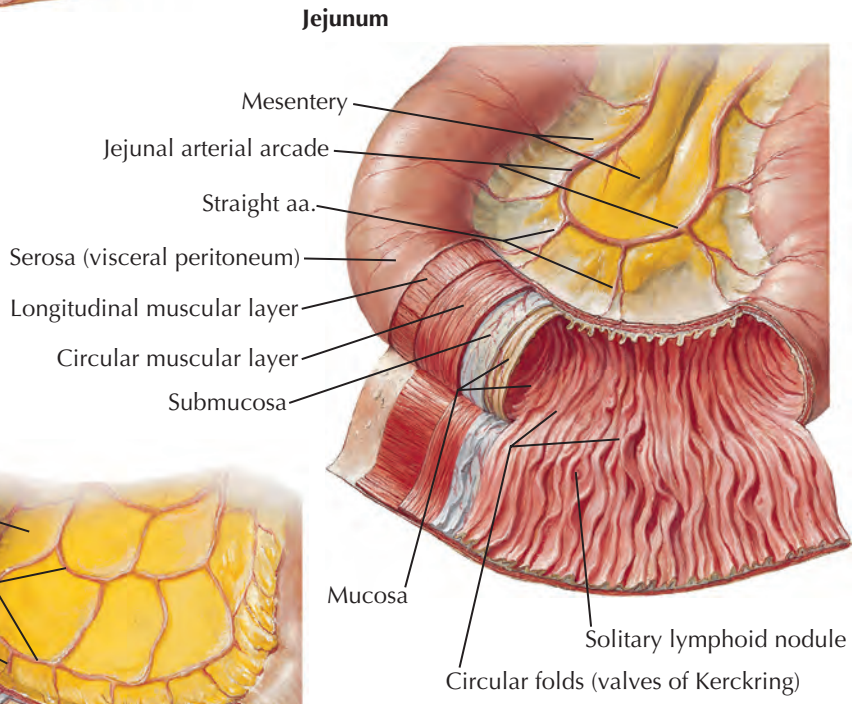


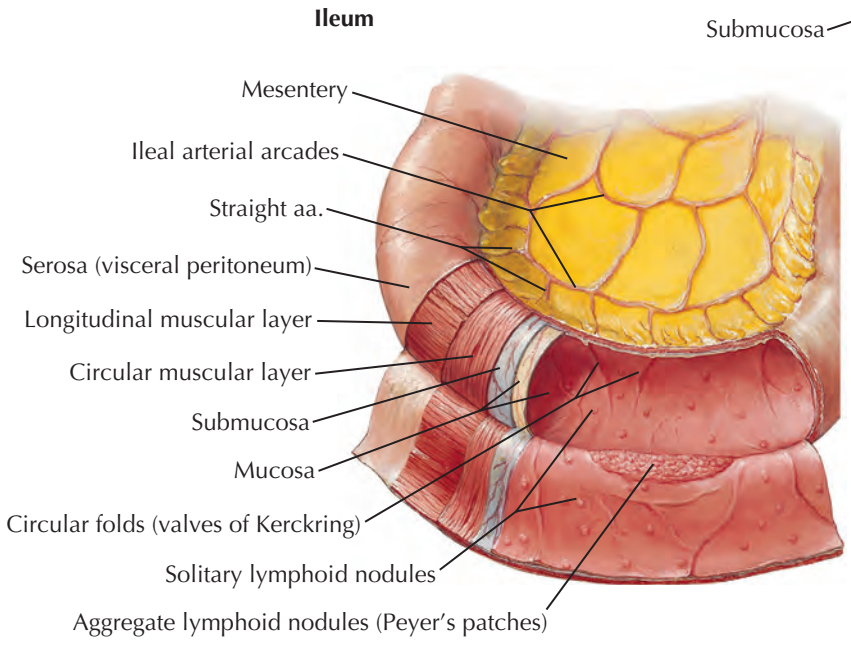
Gray-scale ultrasound image of right kidney, sagittal view



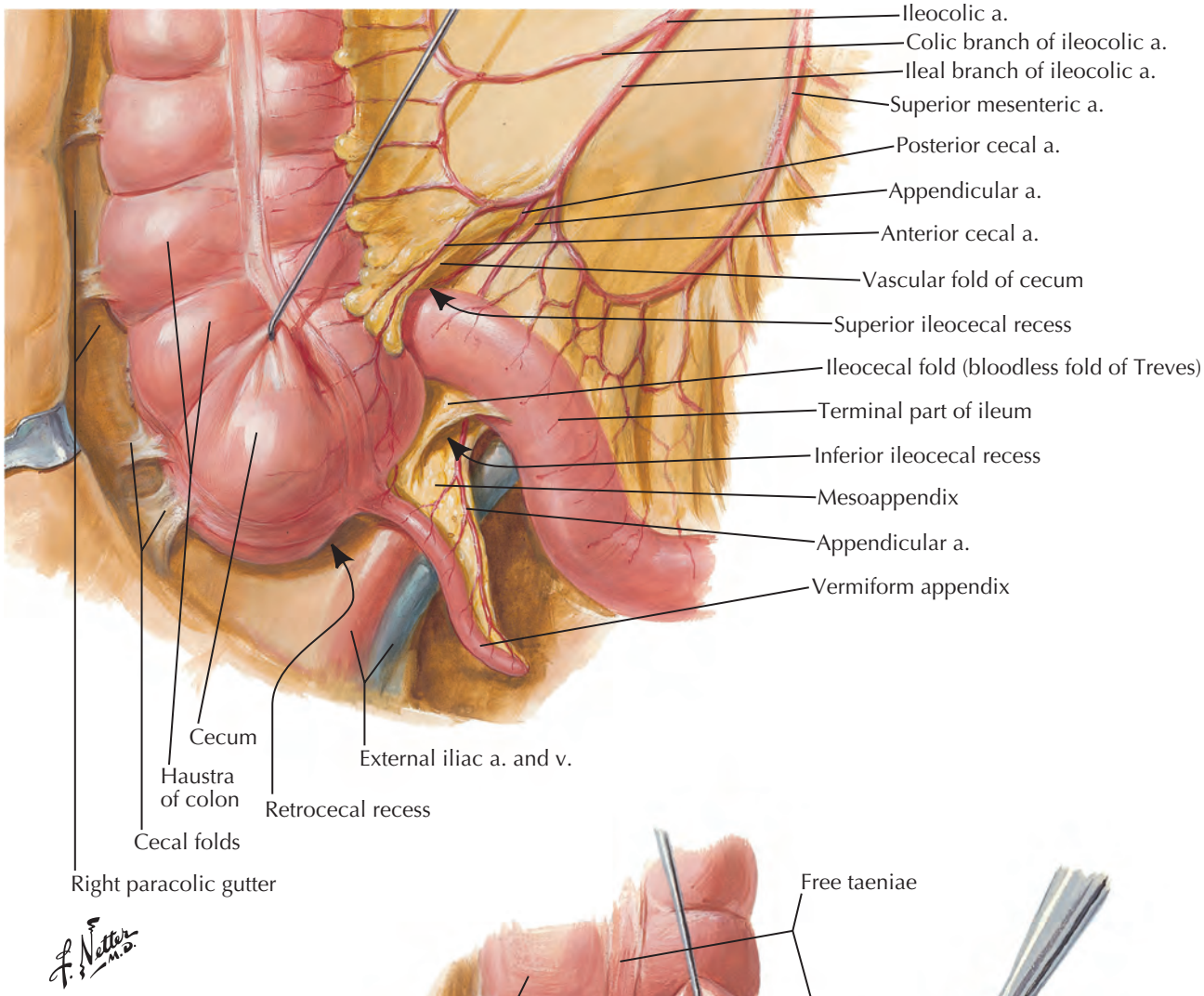
See also **Plates 295, BP 56, BP 62**

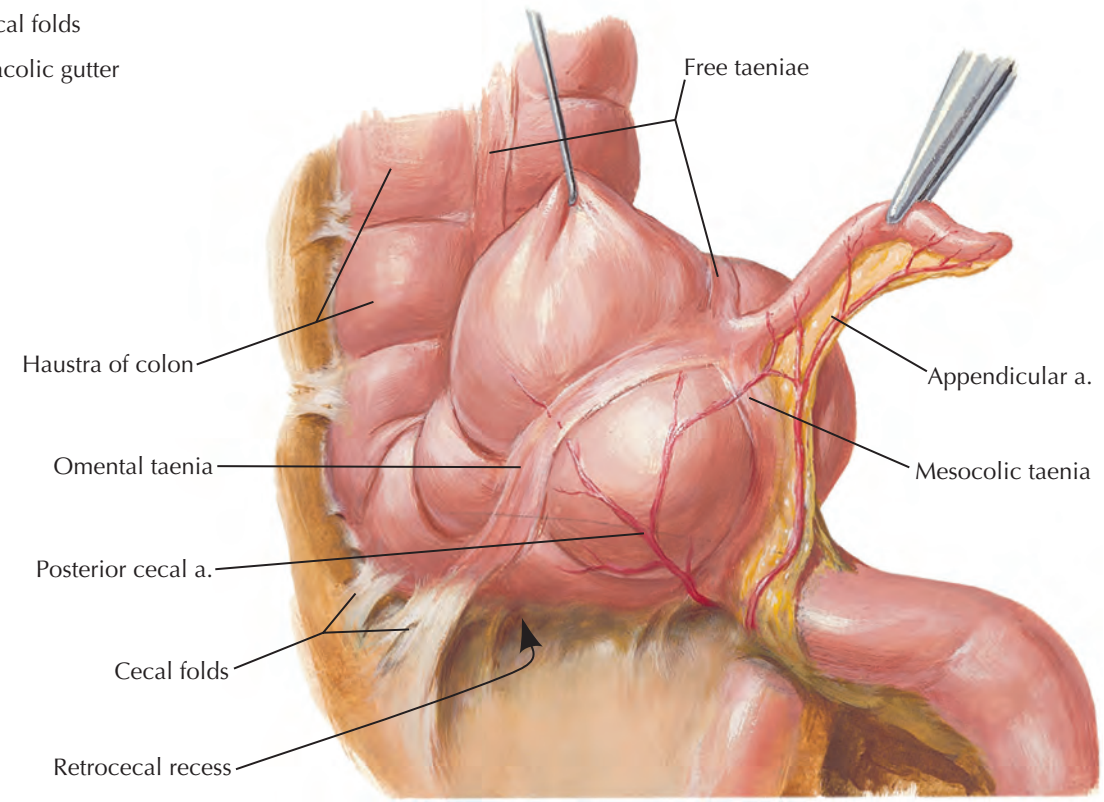


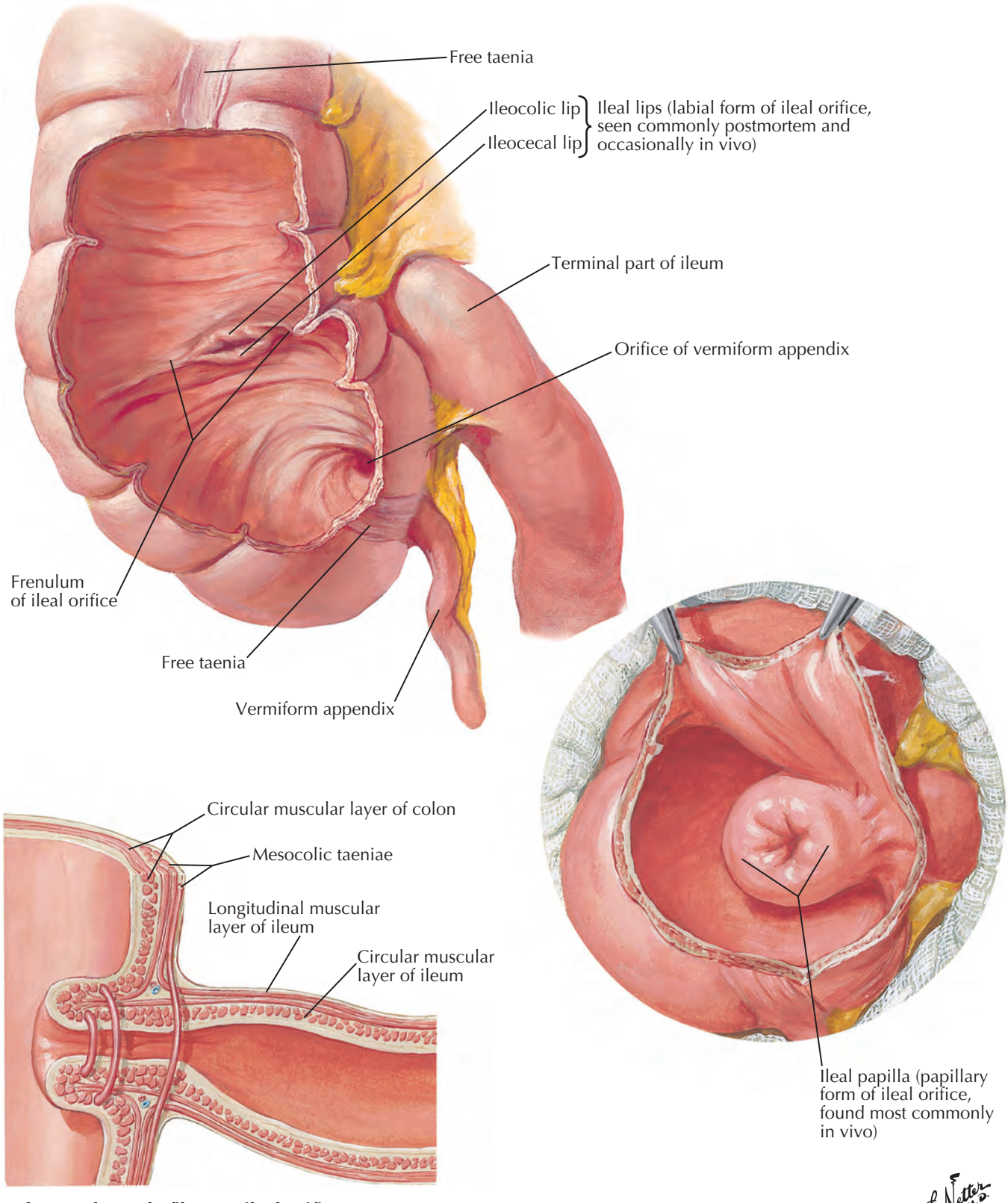




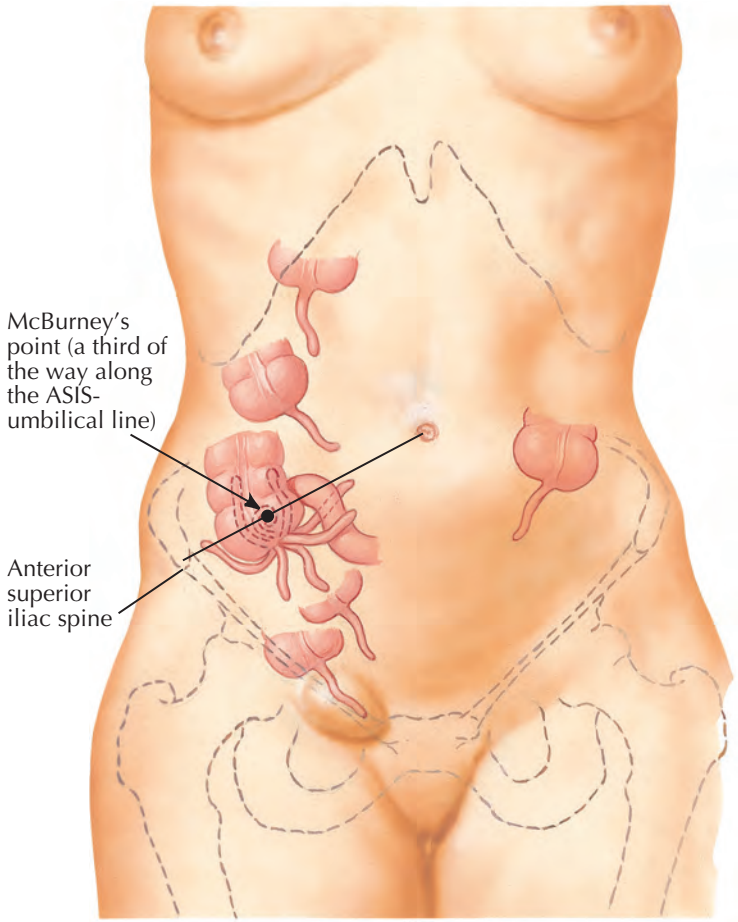
See also **Plates 313, 314, BP 61**



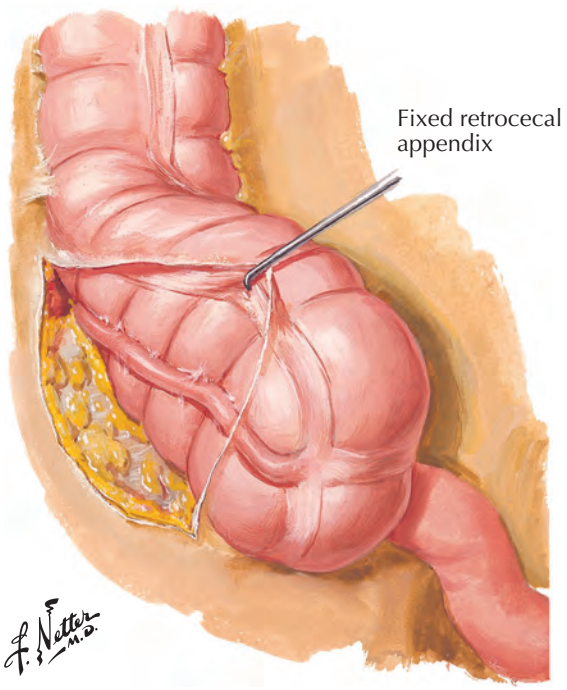




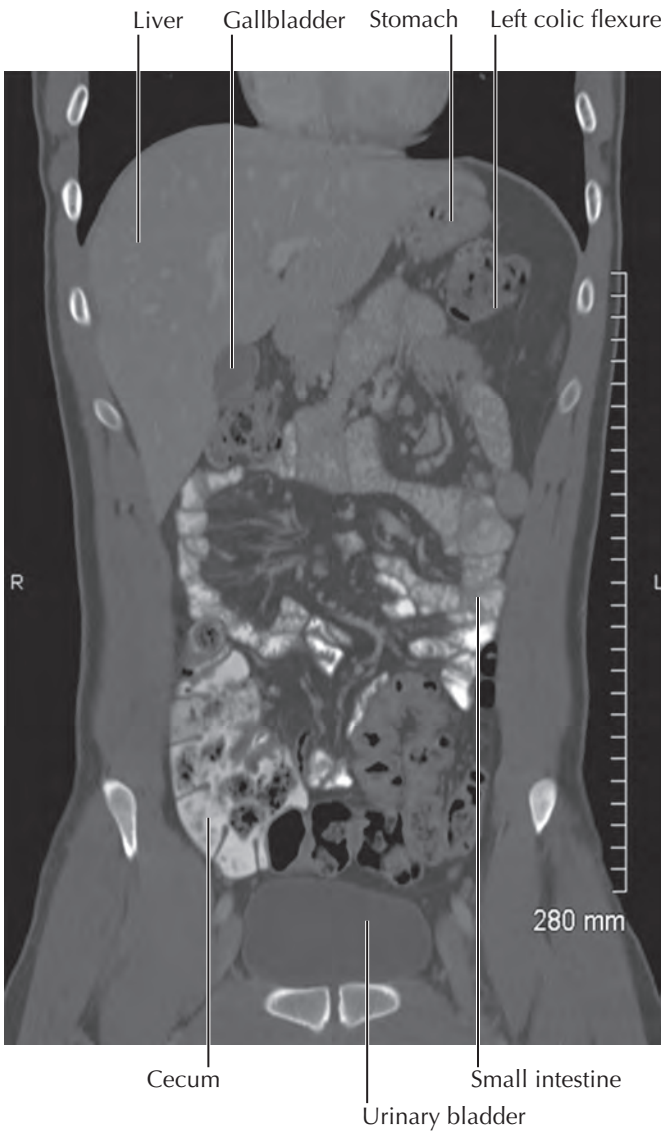
Schema of muscle fibers at ileal orifice



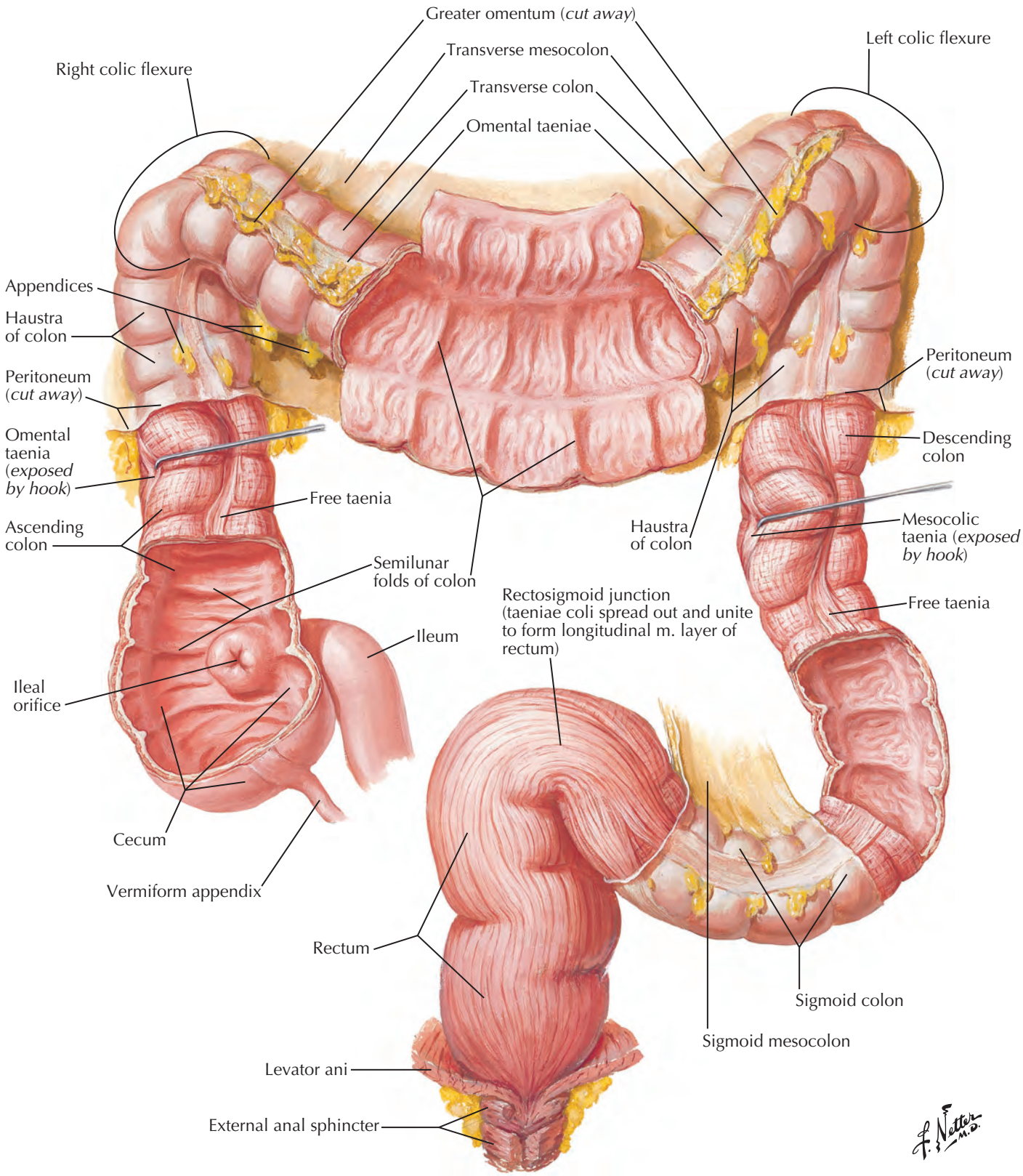
Variations in position of vermiform appendix



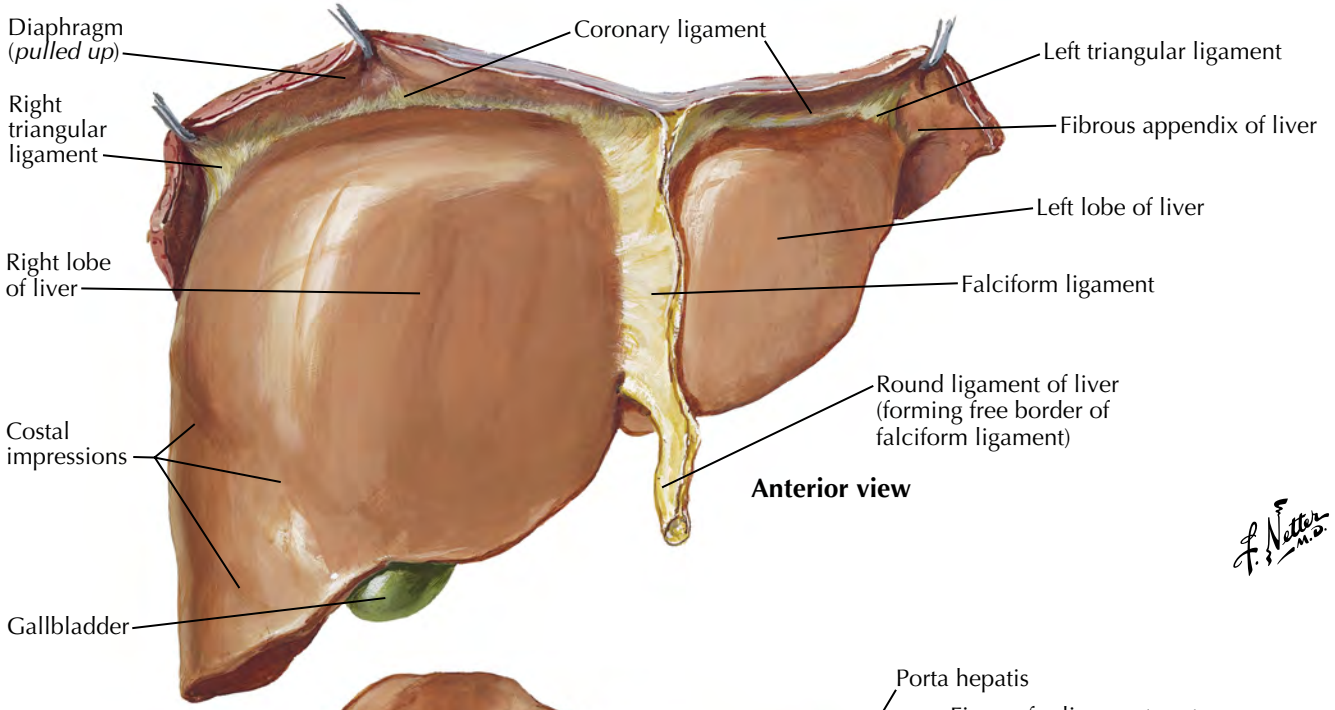
Coronal CT image with oral and intravenous contrast



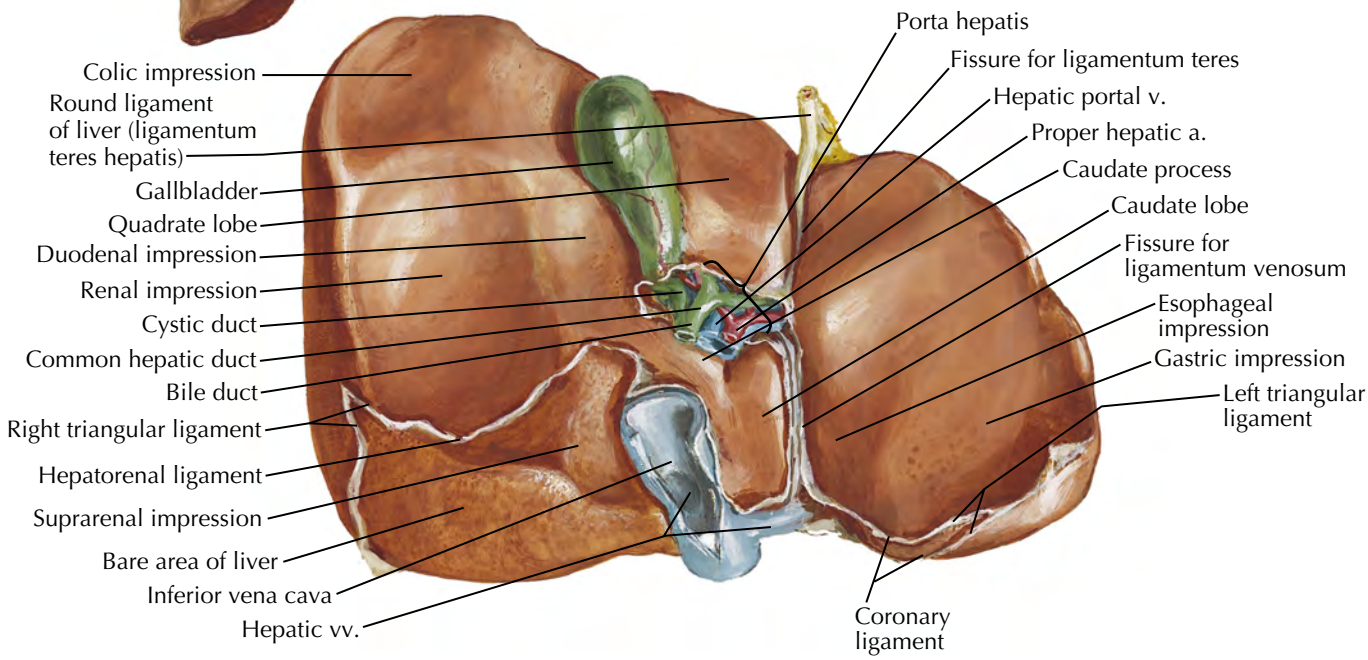
See also **Plates 314, BP 60**



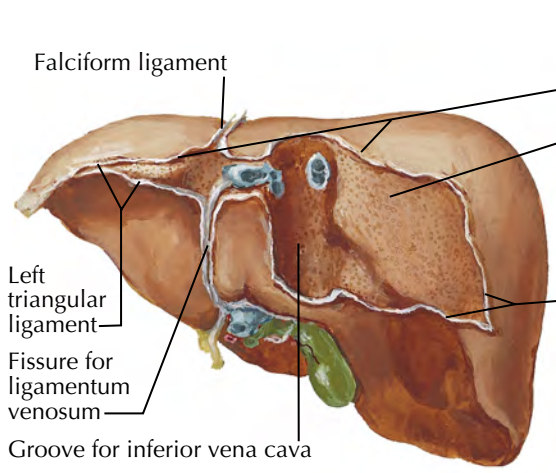
See also **Plates 293, BP 59**



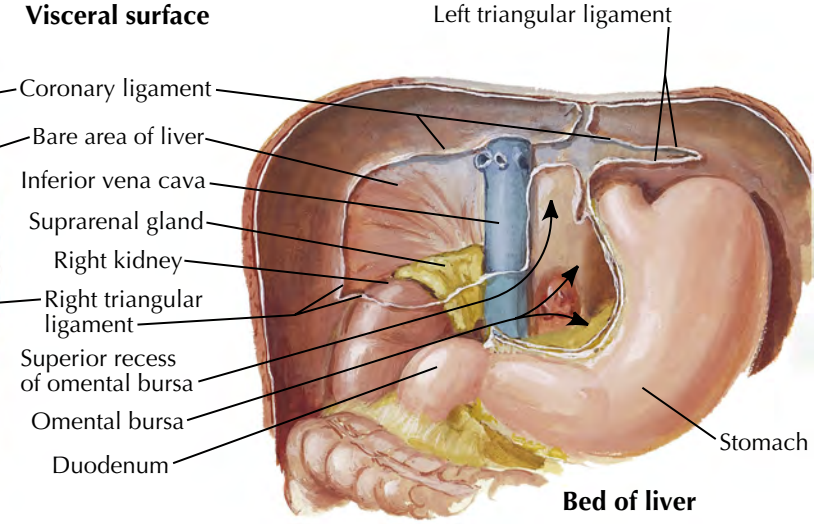
Anterior view



Visceral surface

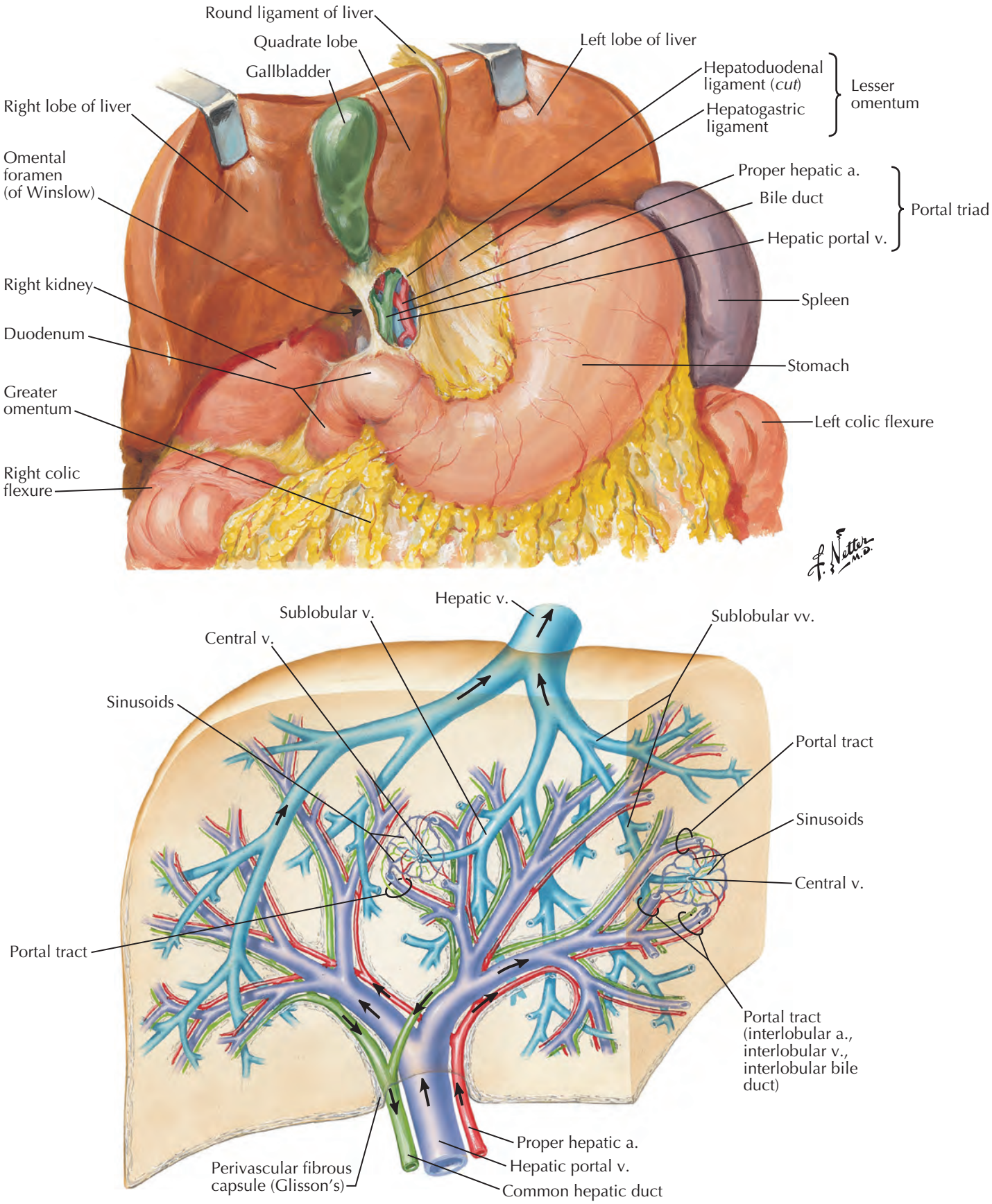


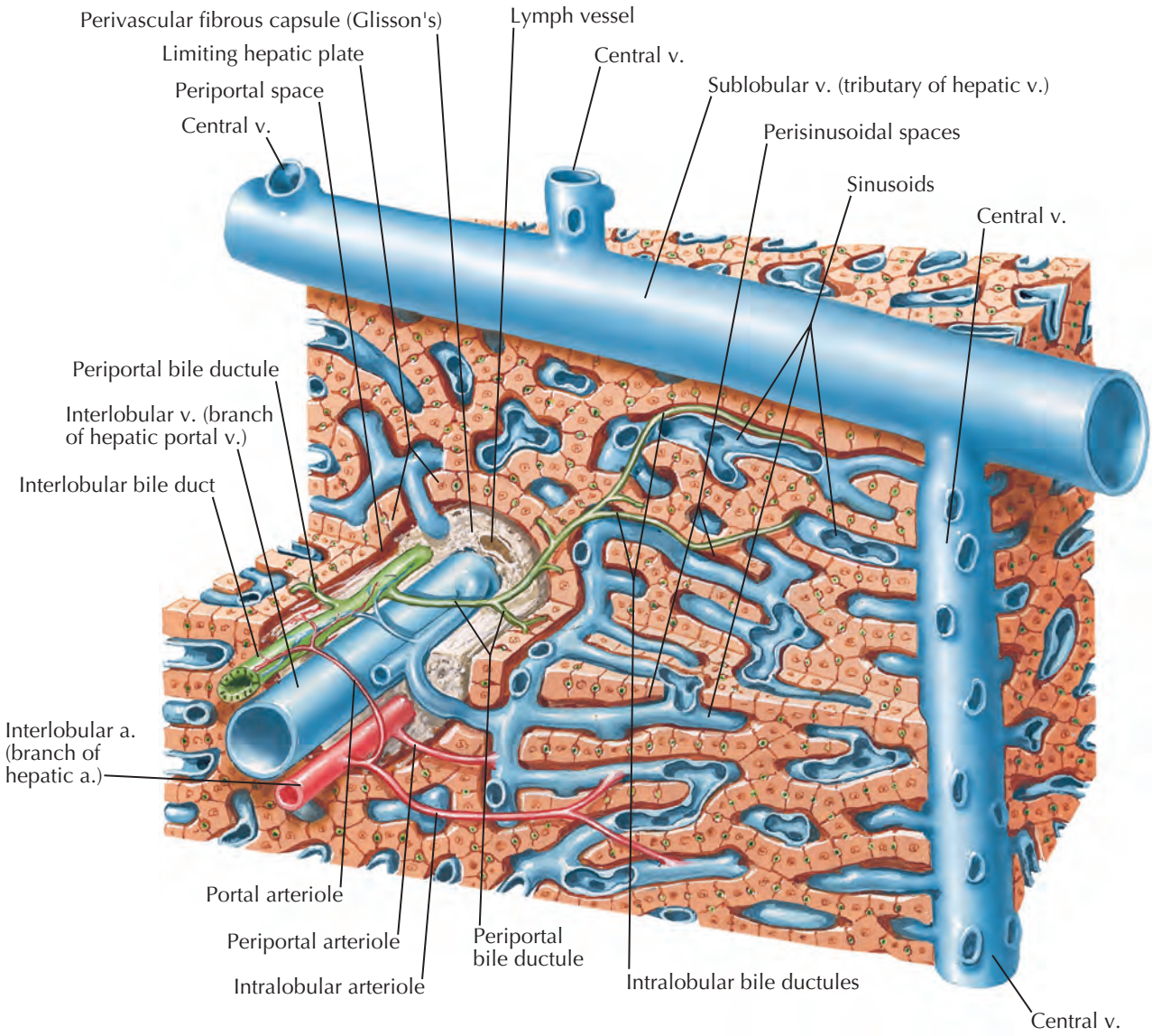
Posterior view

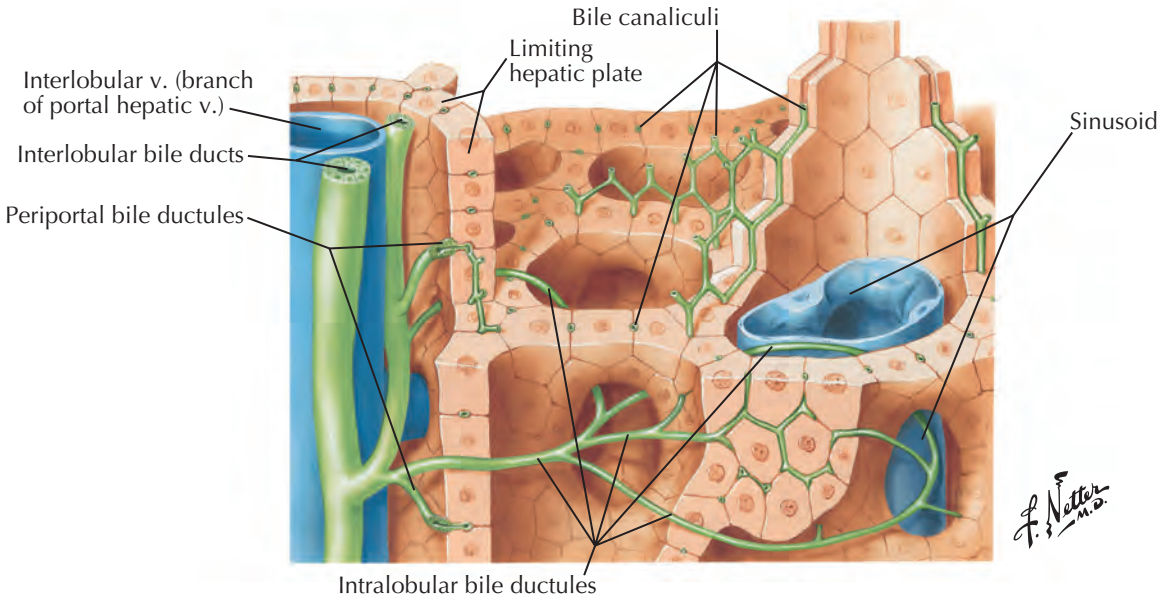


Bed of liver

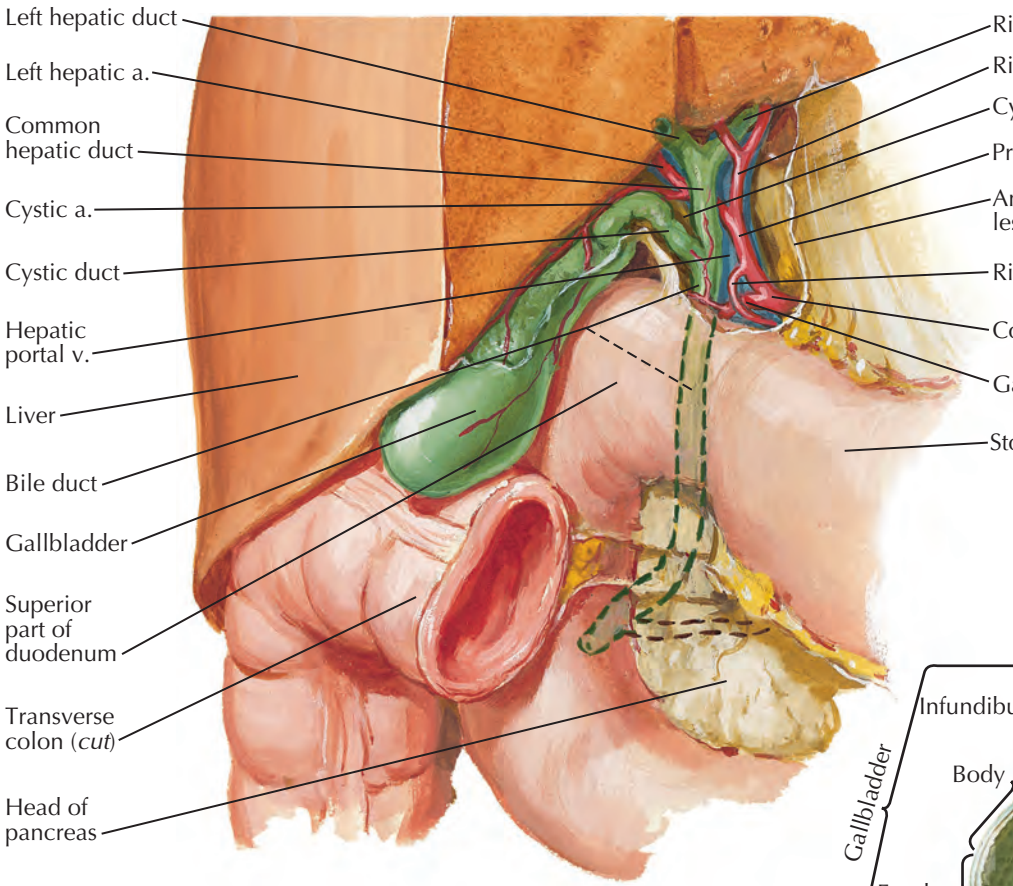
See also **Plates 292, BP 58**

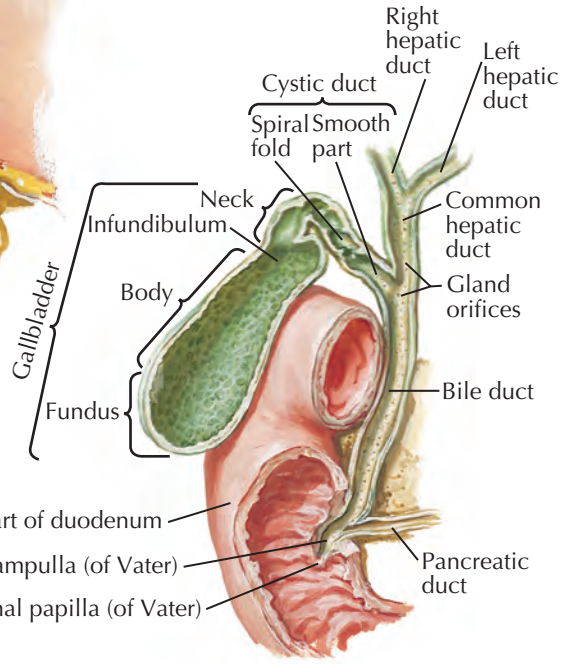


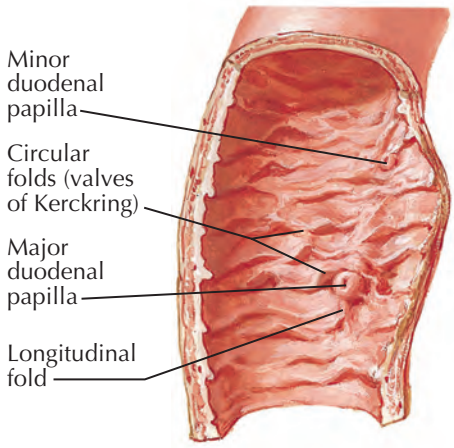

Perivascular fibrous capsule (Glisson's)
Limiting hepatic plate
Periportal space
Central v.
Lymph vessel
Central v.
Sublobular v. (tributary of hepatic v.)
Perisinusoidal spaces
Sinusoids
Central v.
Periportal bile ductule
Interlobular v. (branch of hepatic portal v.)
Interlobular bile duct
Interlobular a. (branch of hepatic a.)
Portal arteriole
Periportal arteriole
Intralobular arteriole
Periportal bile ductule
Intralobular bile ductules
Central v.


Bile canaliculi
Limiting hepatic plate
Interlobular v. (branch of portal hepatic v.)
Interlobular bile ducts
Periportal bile ductules
Sinusoid
Intralobular bile ductules

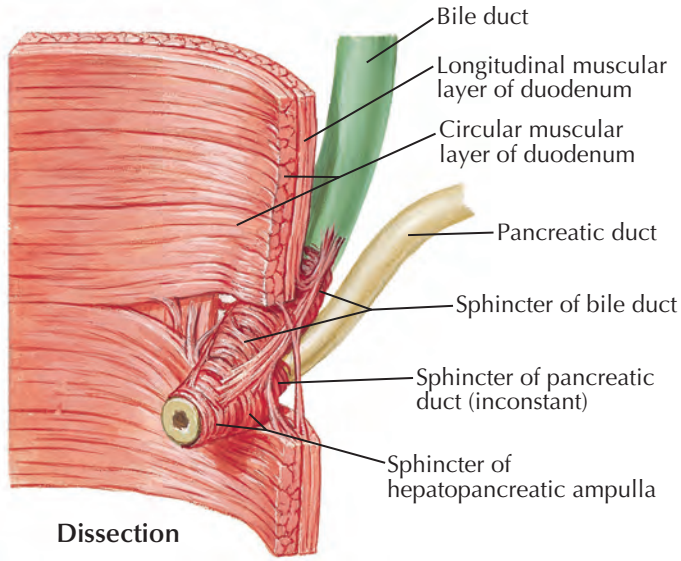
See also **Plates BP 57, BP 62, BP 63**





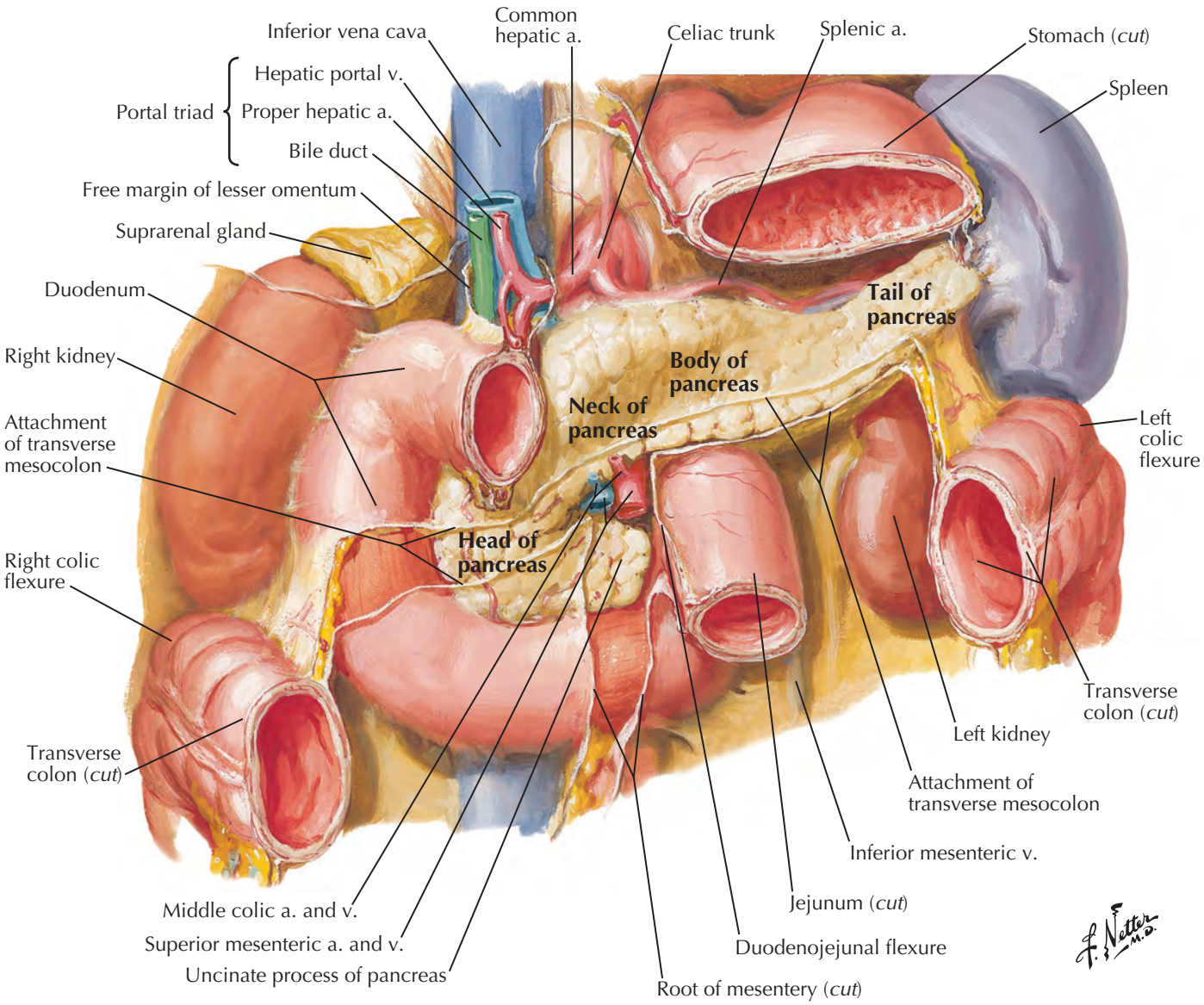


Interior of descending part of duodenum

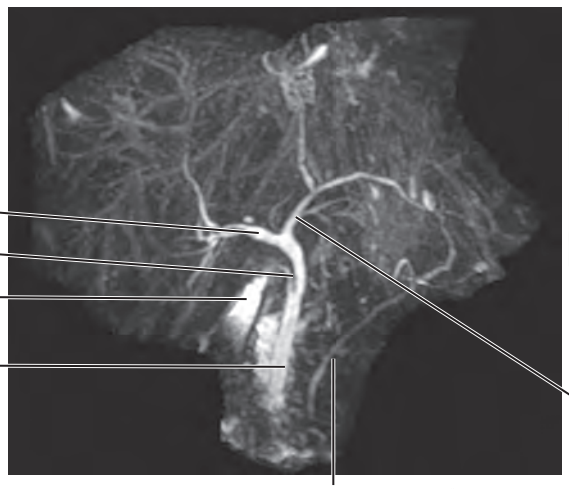


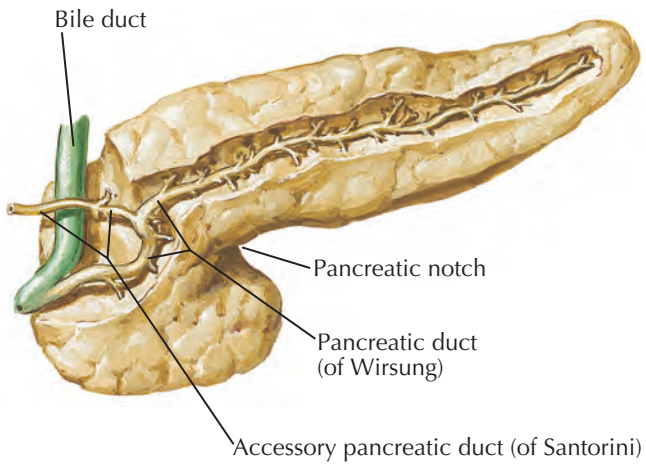
Dissection

See also **Plates BP 62, BP 63**

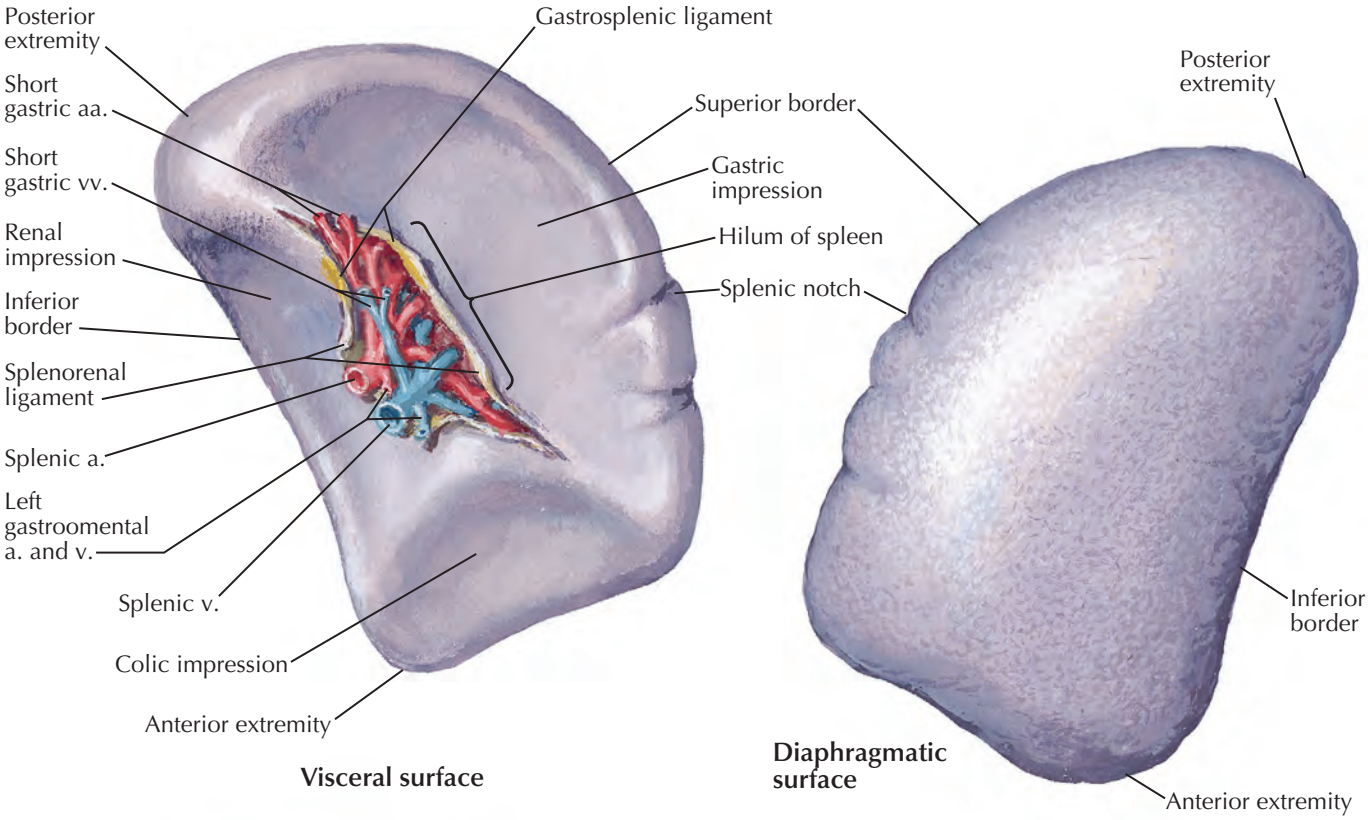


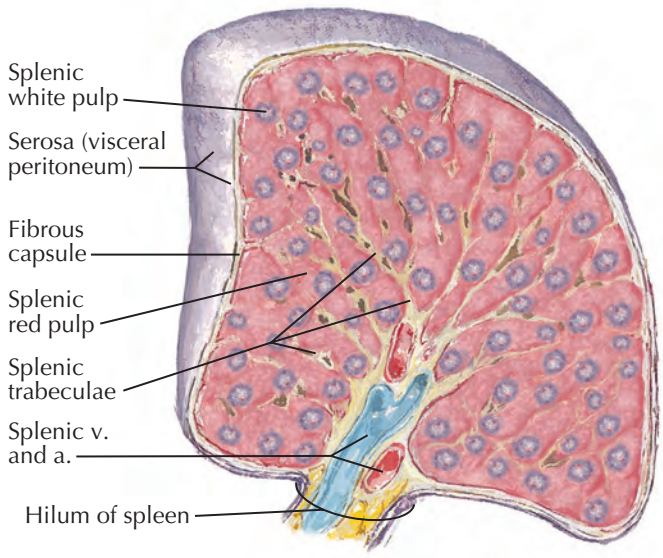
Magnetic resonance cholangiopancreatography (MRCP)

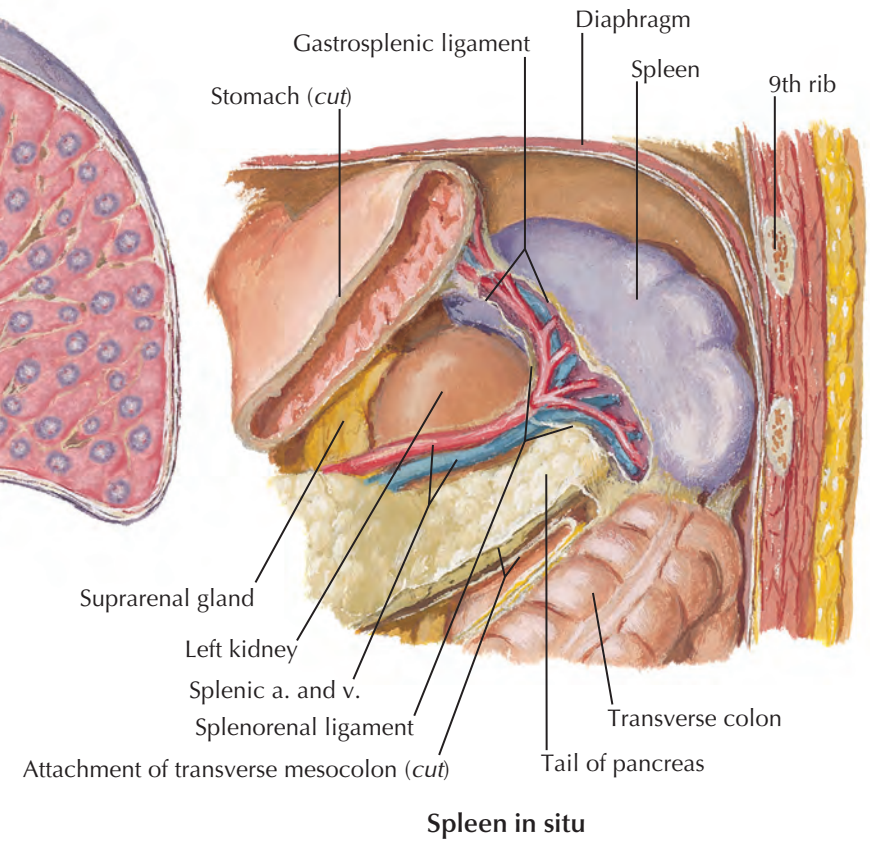




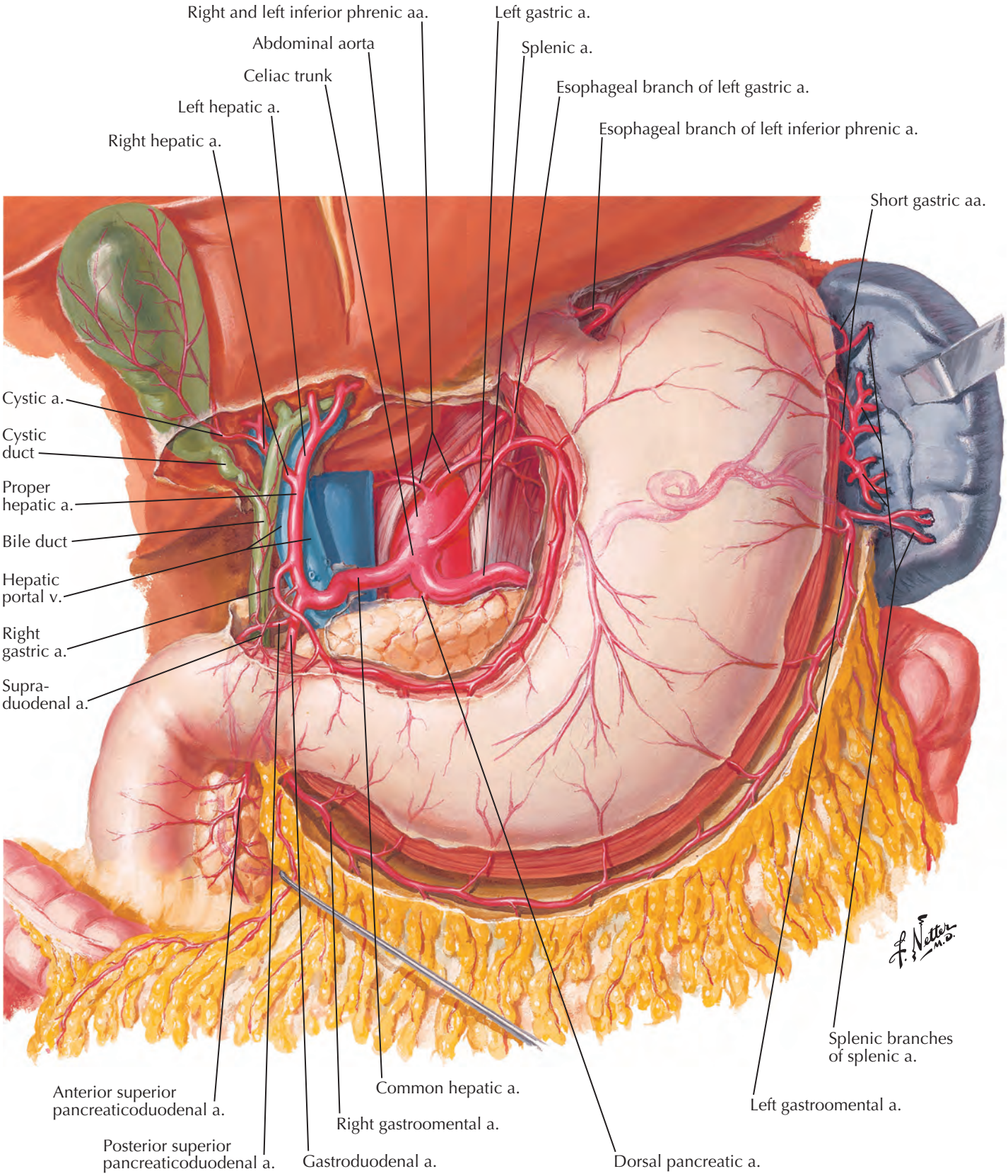
See also **Plate 291**

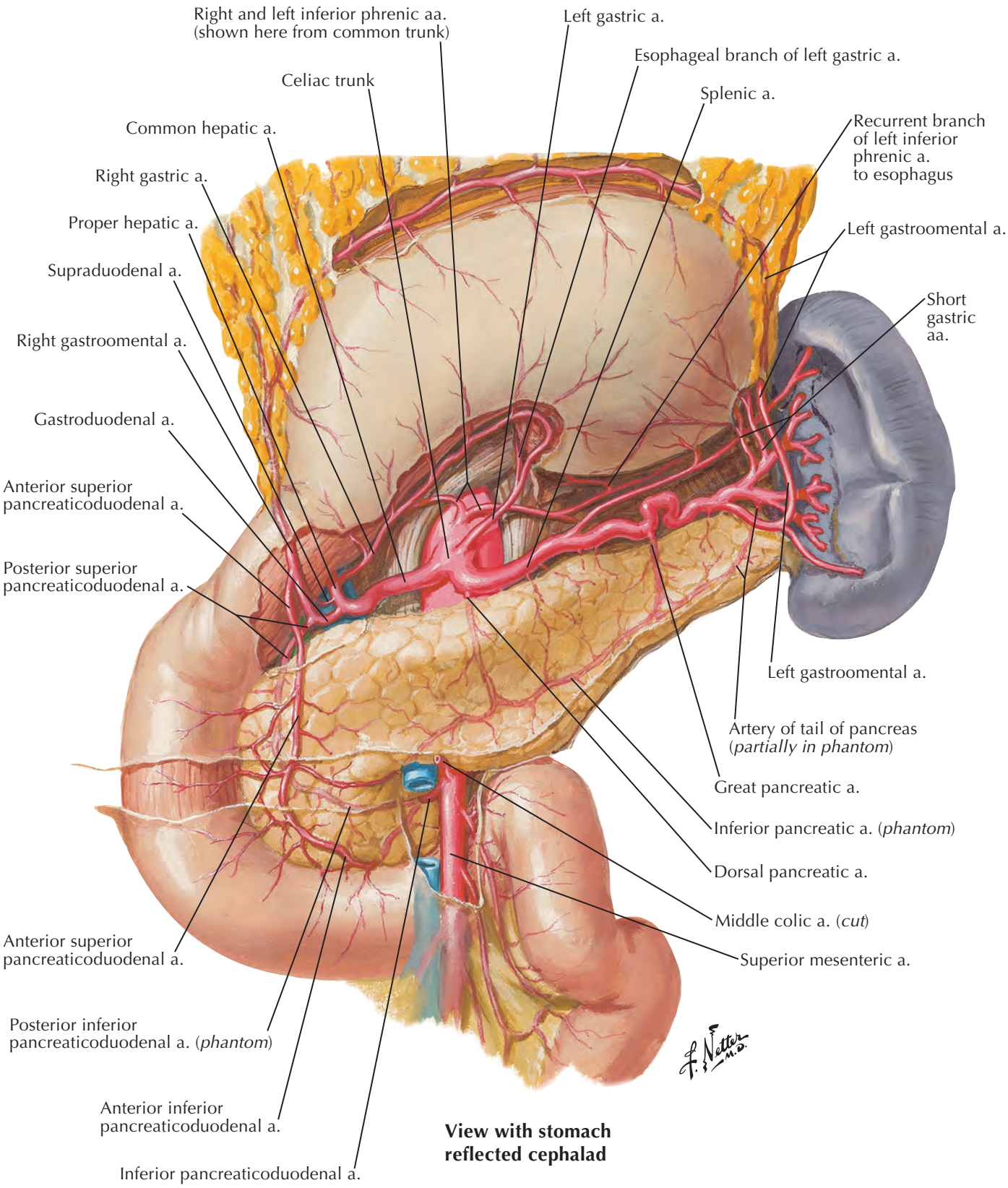






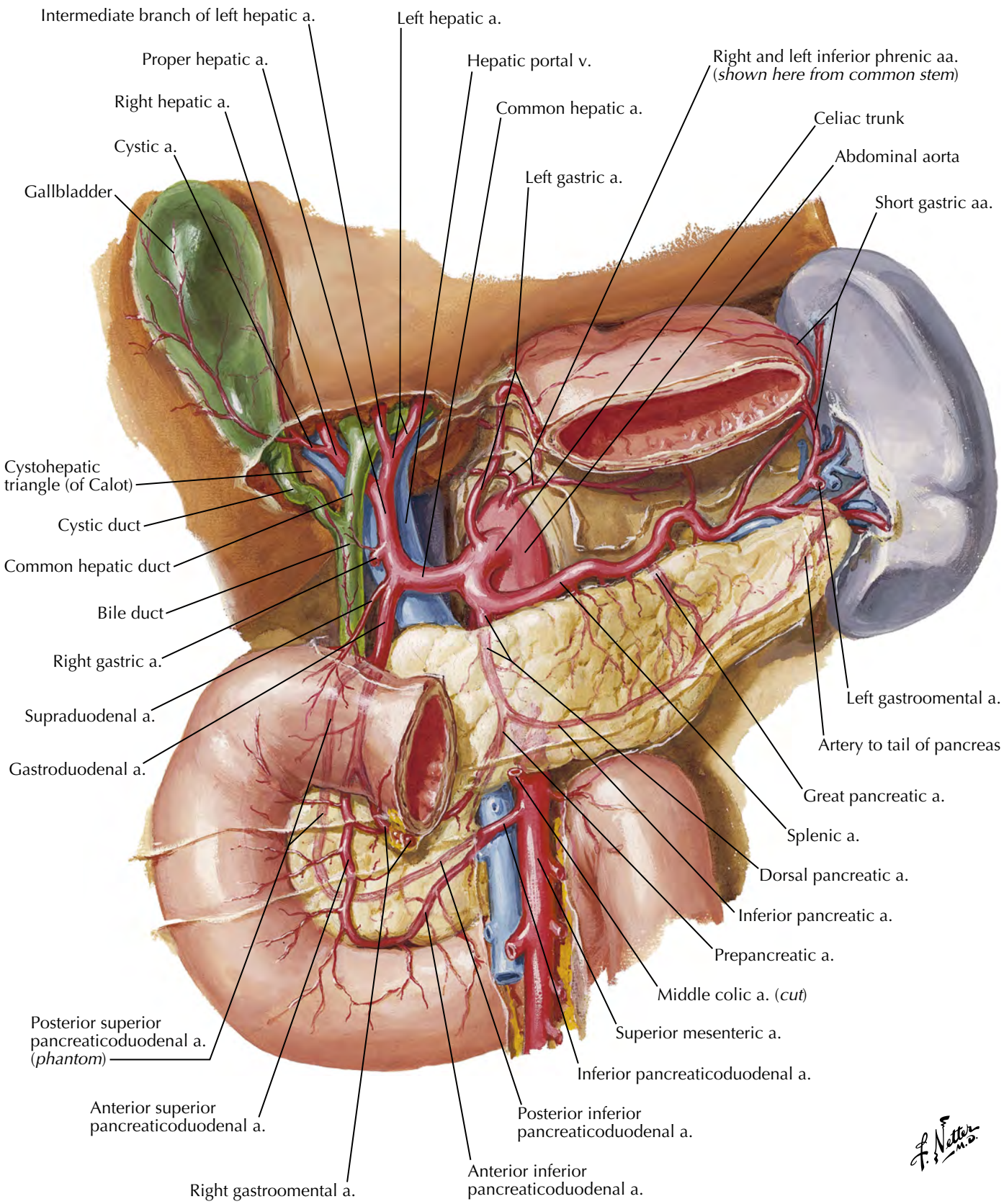
See also **Plates BP 64, BP 65, BP 67**





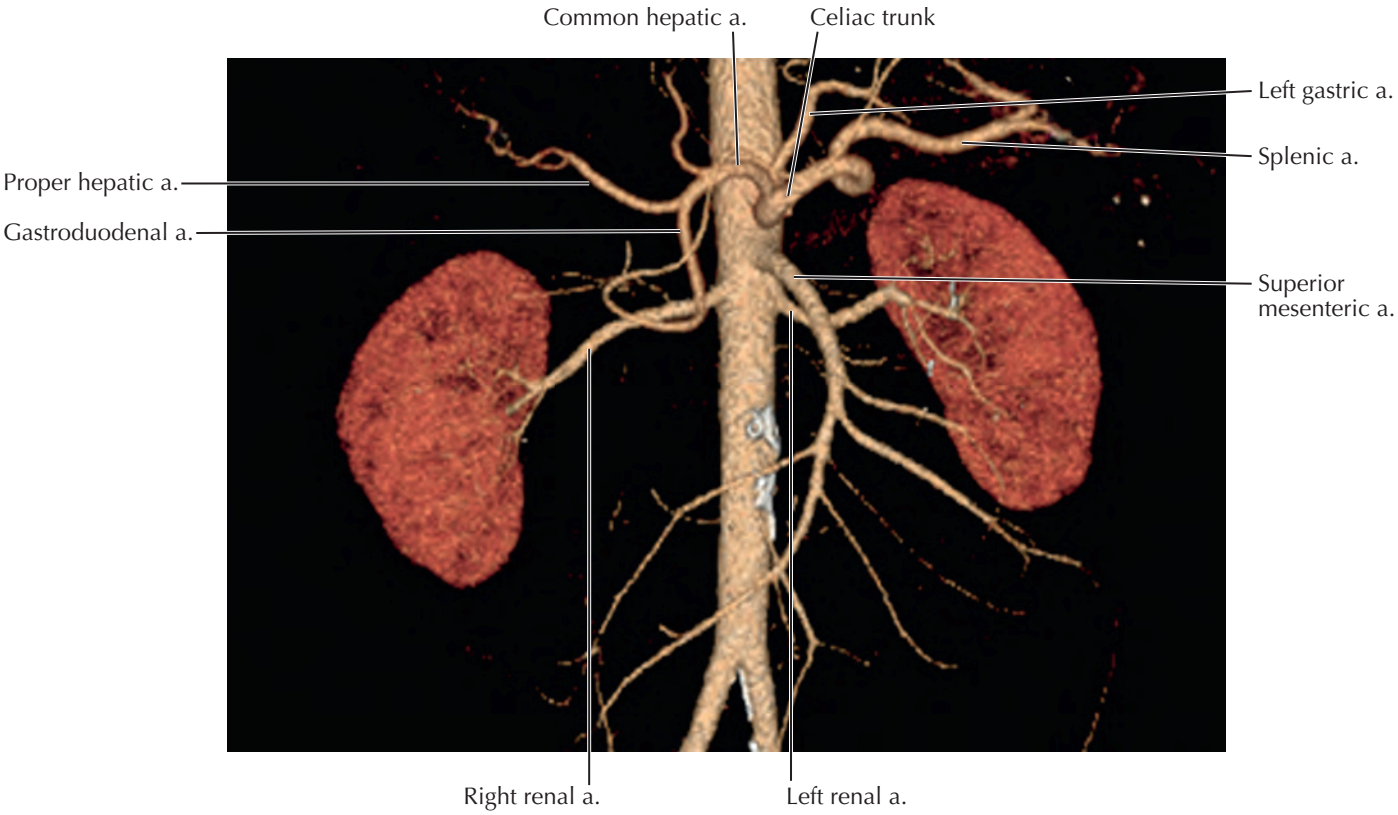
View with stomach reflected cephalad

See also **Plates BP 64, BP 65, BP 67**

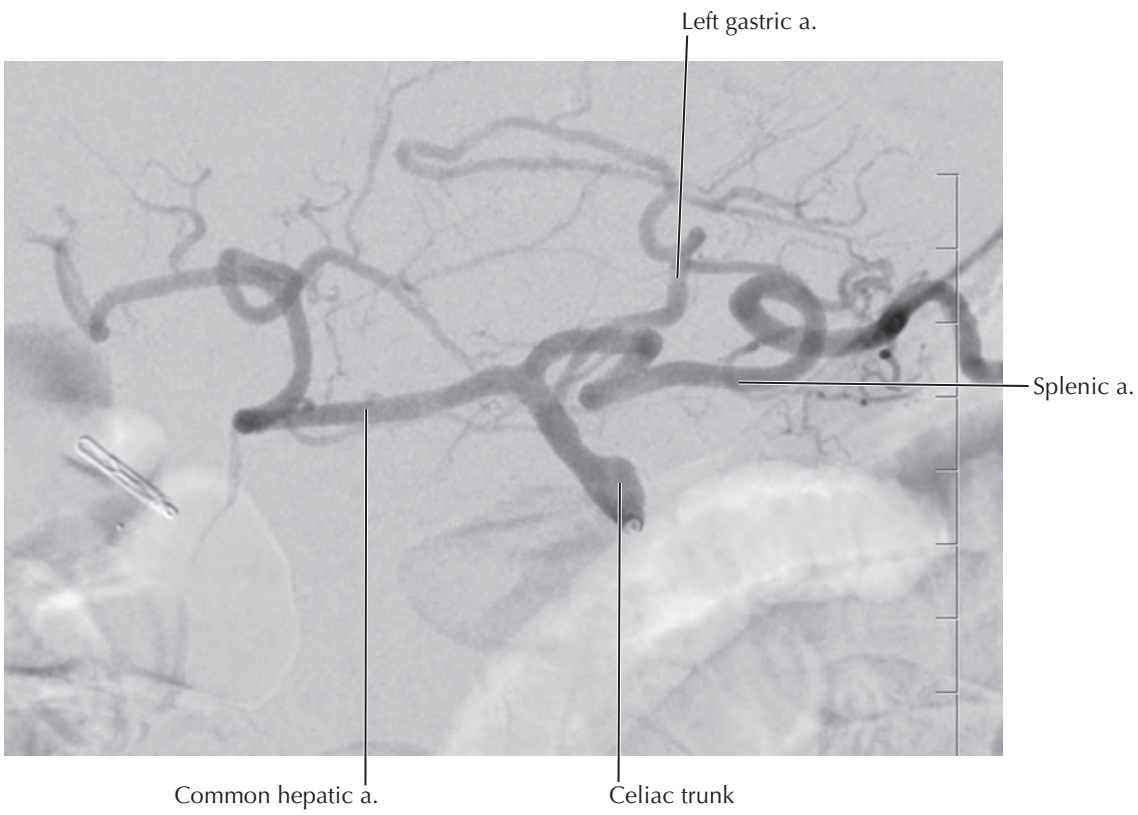


See also **Plates 308, 310**

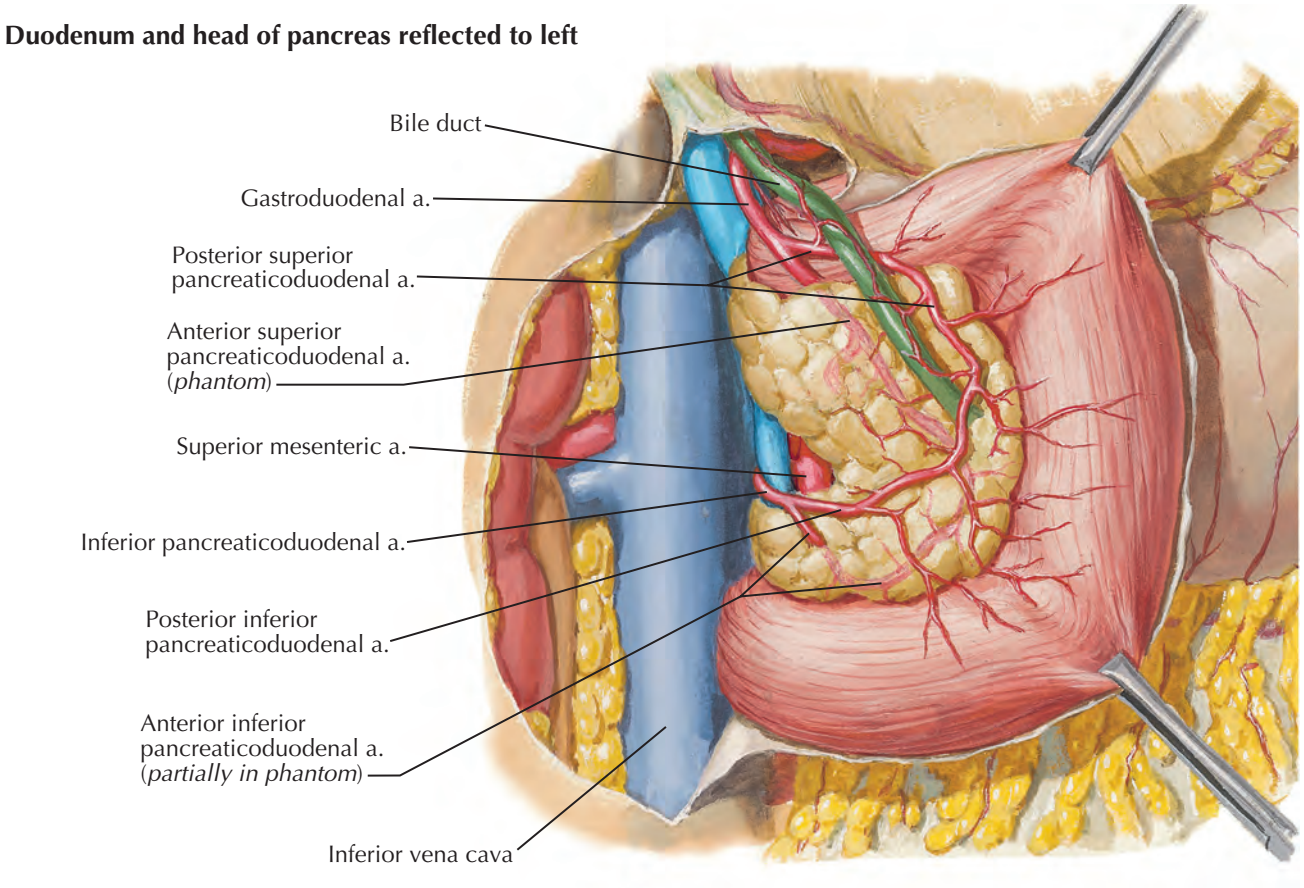
3D volume-rendered CT image with intravenous contrast enhancement

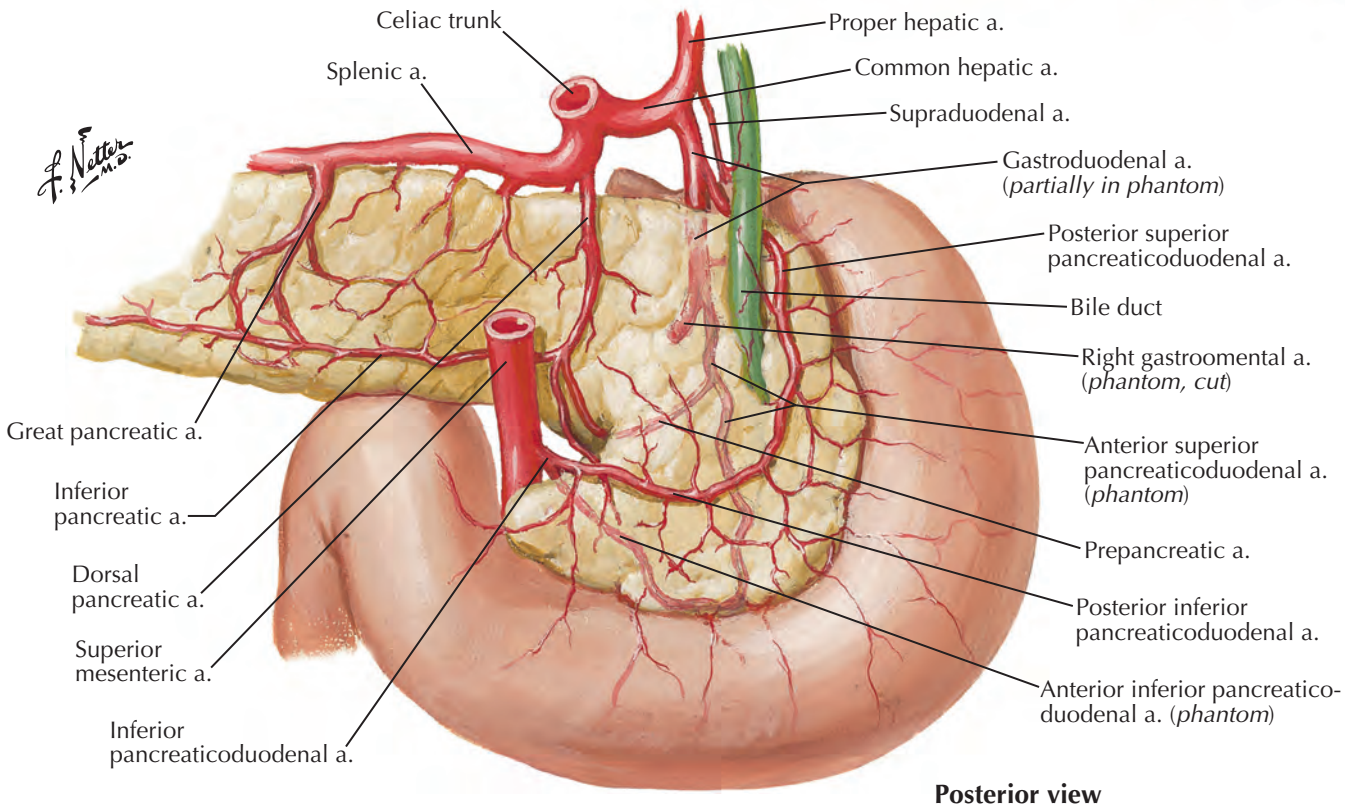


Selective digital subtraction angiogram, celiac trunk

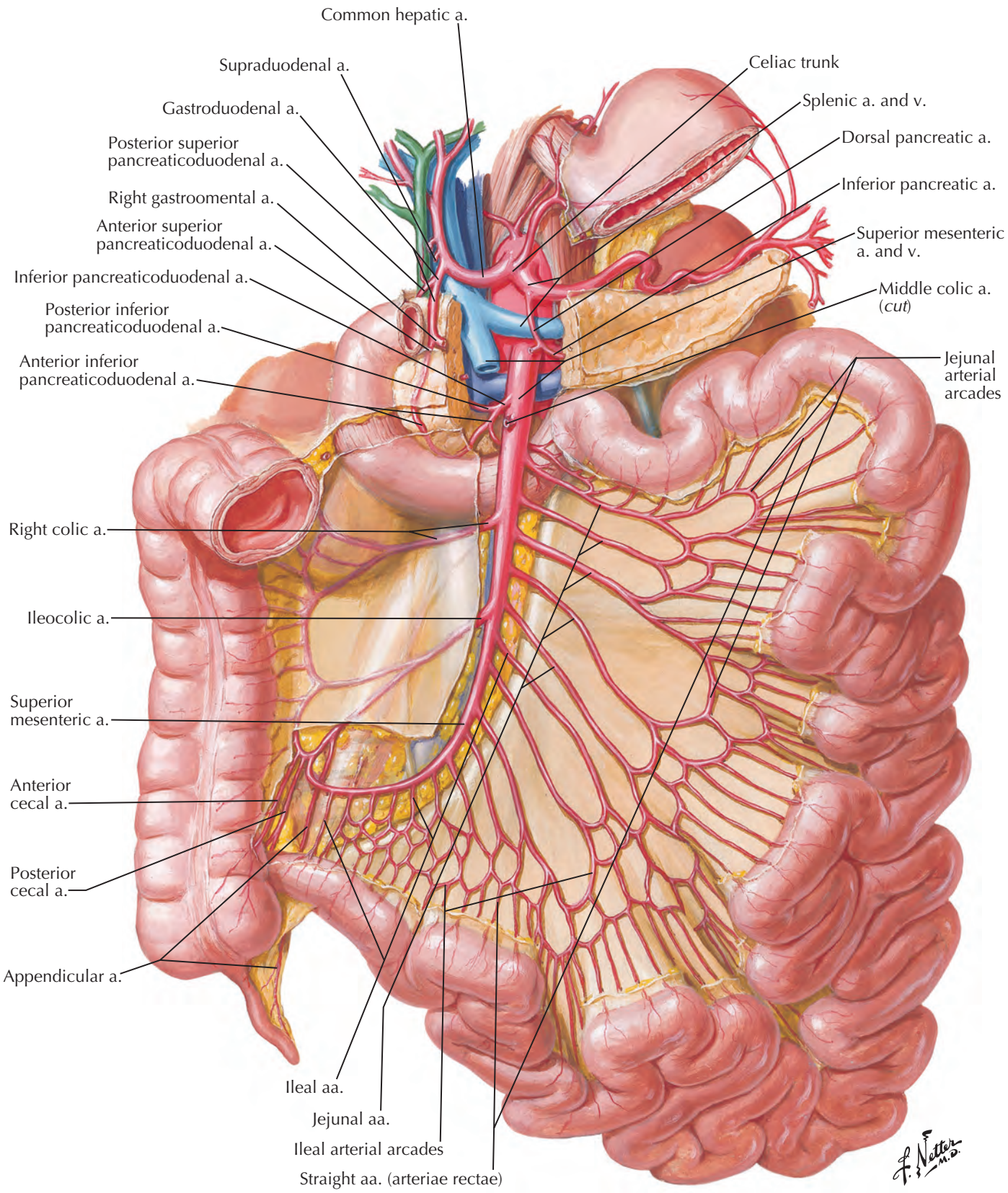


Duodenum and head of pancreas reflected to left

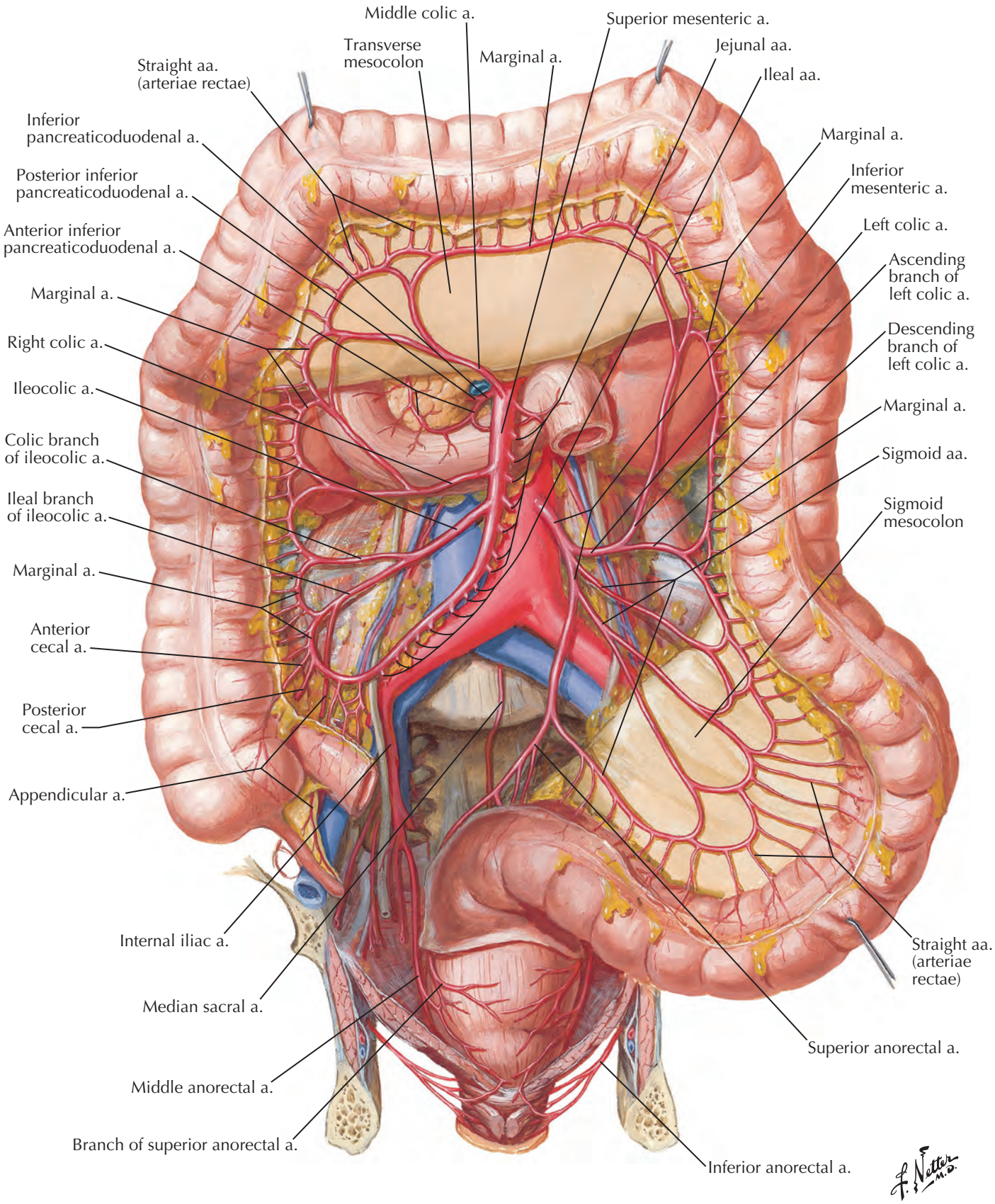




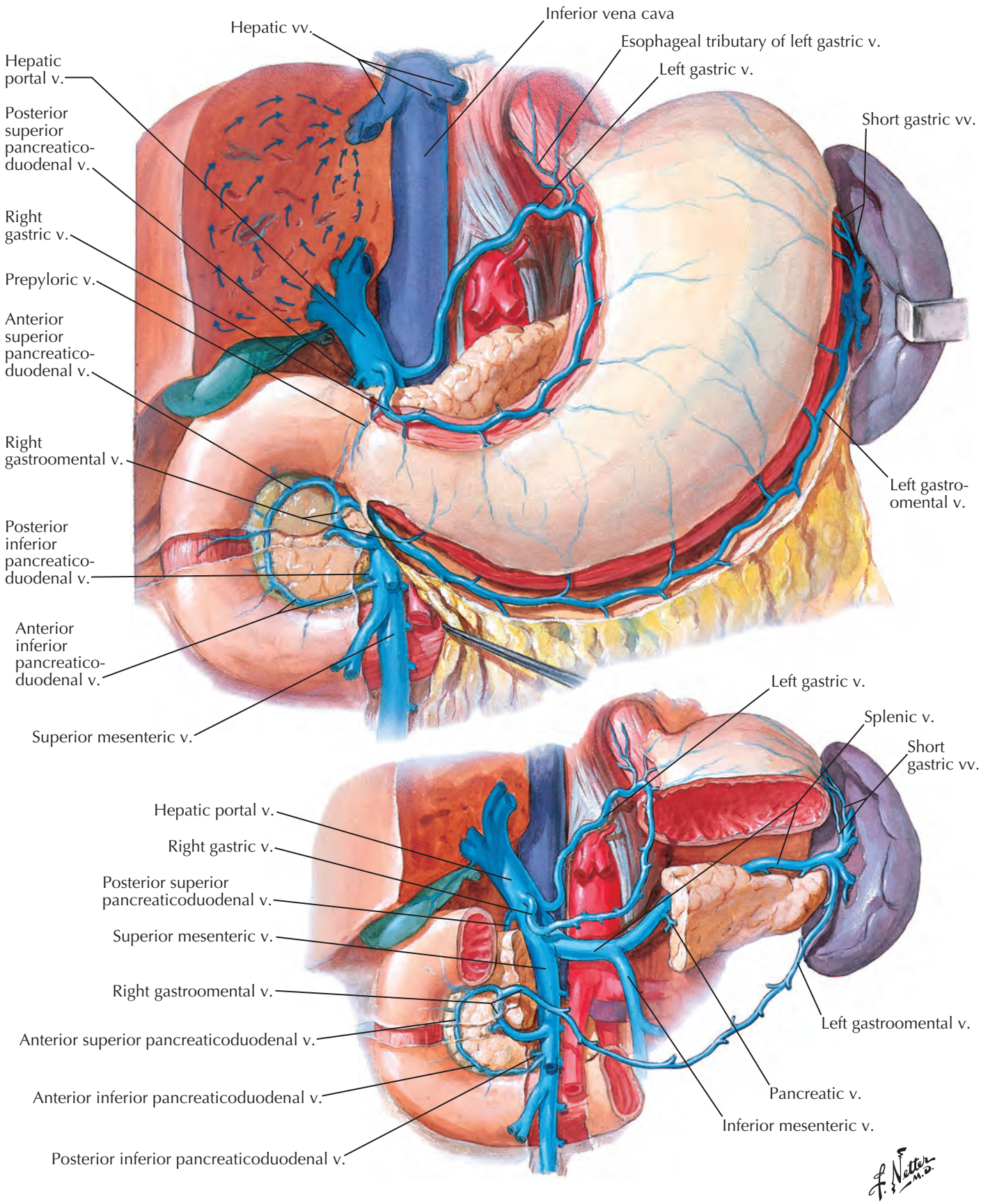
Posterior view


Common hepatic a.
Supraduodenal a.
Gastroduodenal a.
Posterior superior pancreaticoduodenal a.
Right gastroomental a.
Anterior superior pancreaticoduodenal a.
Inferior pancreaticoduodenal a.
Posterior inferior pancreaticoduodenal a.
Anterior inferior pancreaticoduodenal a.
Celiac trunk
Splenic a. and v.
Dorsal pancreatic a.
Inferior pancreatic a.
Superior mesenteric a. and v.
Middle colic a. (cut)
Jejunal arterial arcades
Right colic a.
Ileocolic a.
Superior mesenteric a.
Anterior cecal a.
Posterior cecal a.
Appendicular a.
Ileal aa.
Jejunal aa.
Ileal arterial arcades
Straight aa. (arteriae rectae)

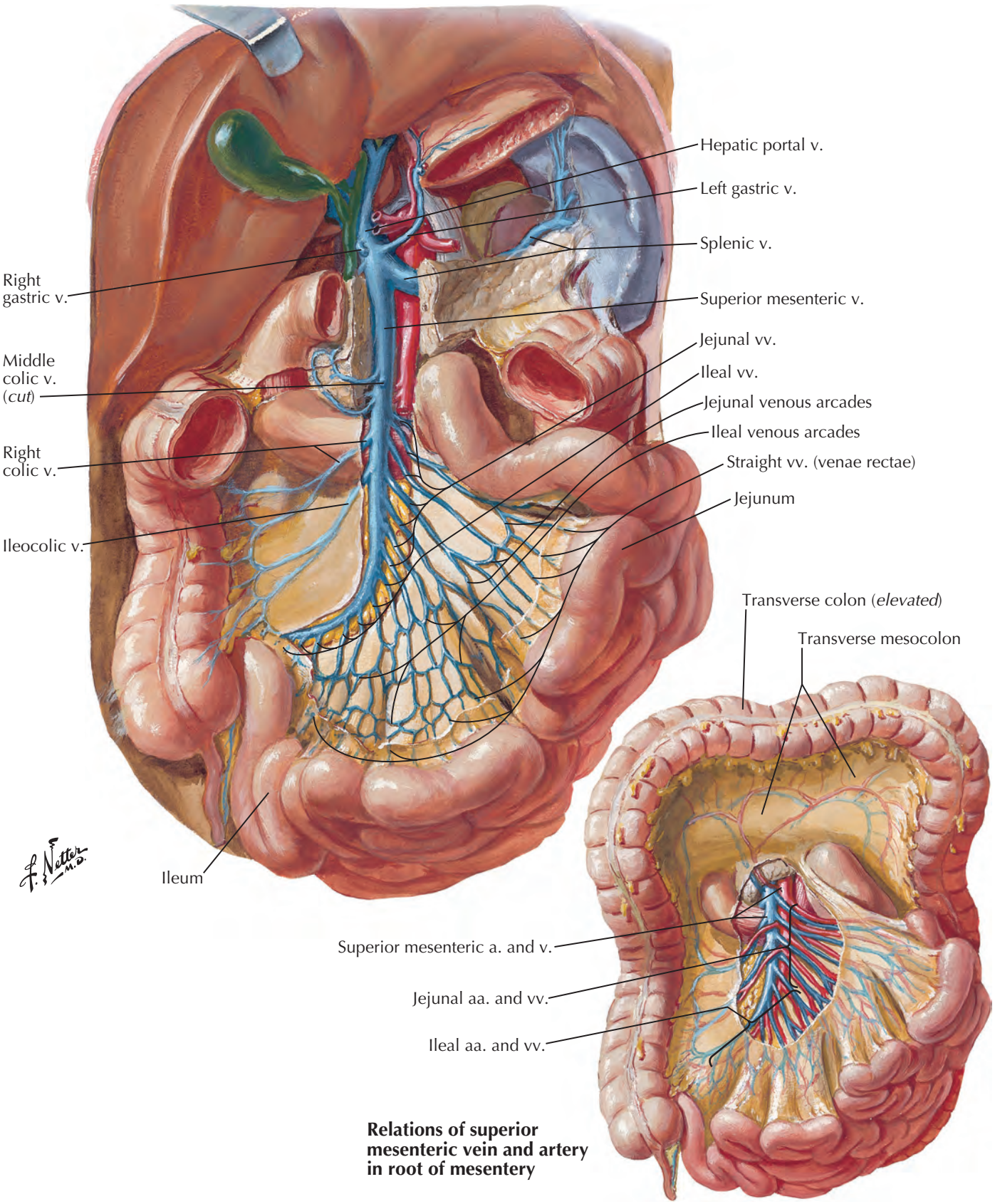
See also **Plates 400, BP 61, BP 68, BP 69**



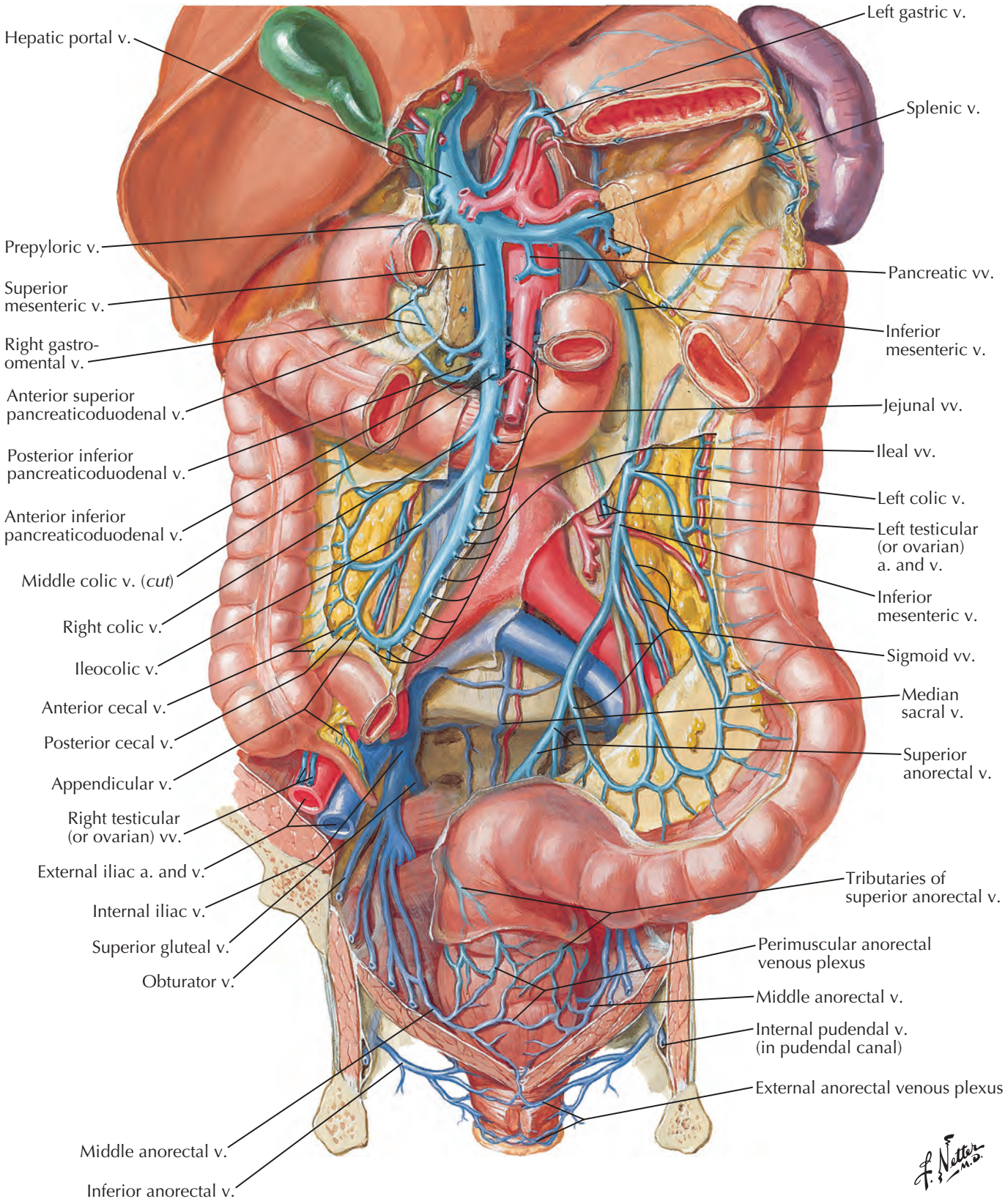
See also **Plates BP 66, BP 74, BP 75, BP 78**

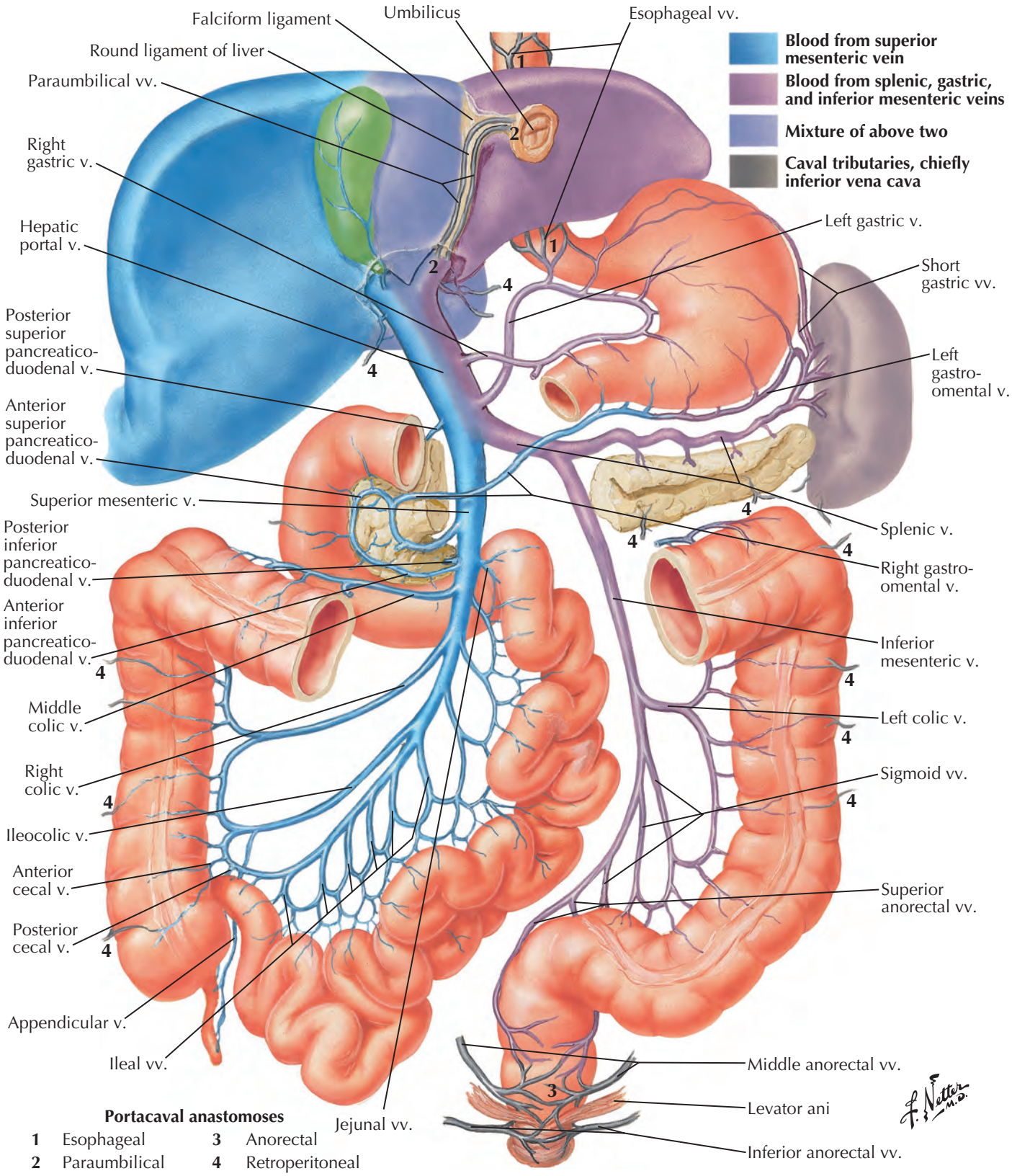


See also **Plate BP 76**



Relations of superior mesenteric vein and artery in root of mesentery

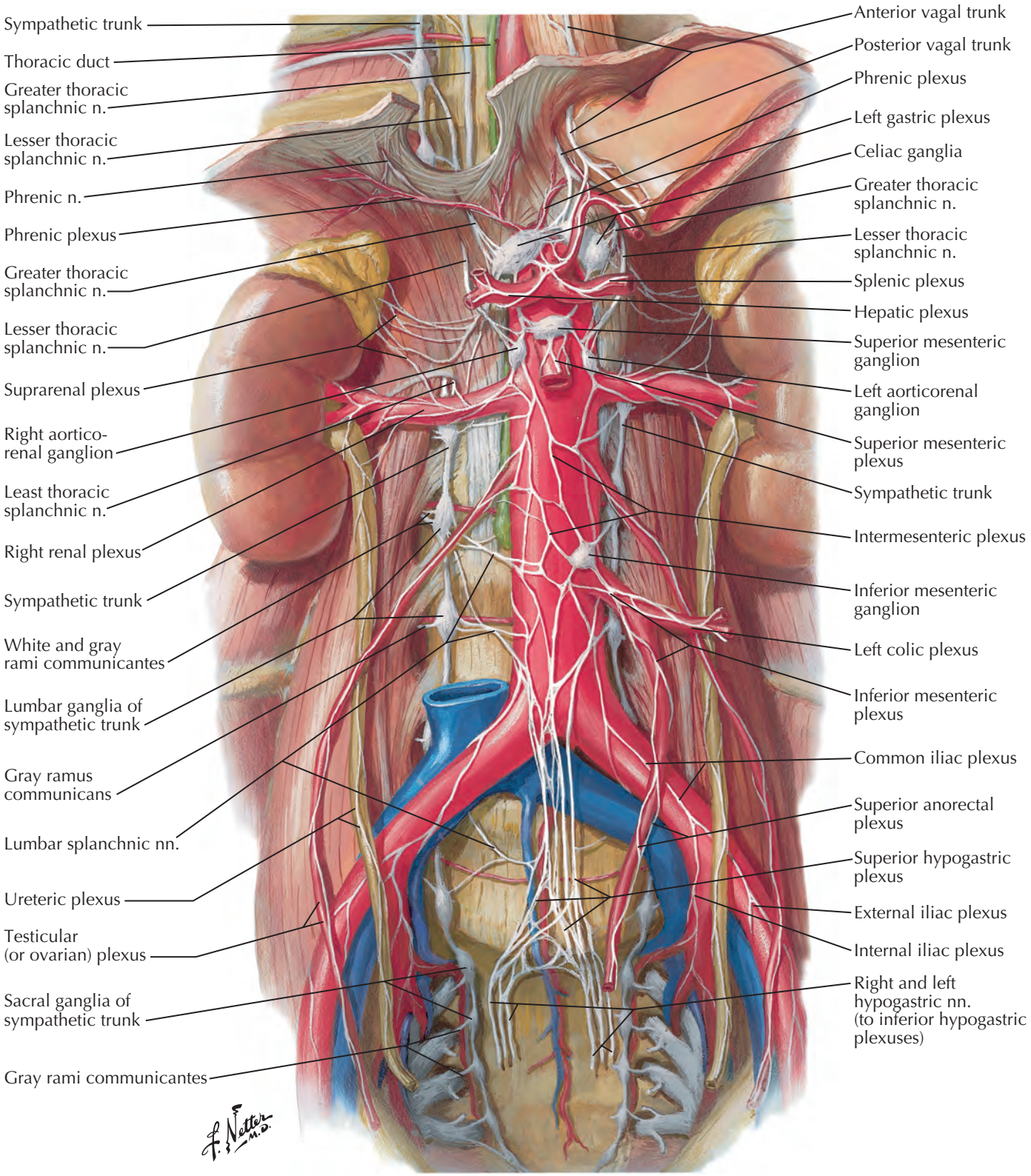

Hepatic portal v.
Left gastric v.
Splenic v.
Prepyloric v.
Superior mesenteric v.
Right gastro-omental v.
Anterior superior pancreaticoduodenal v.
Posterior inferior pancreaticoduodenal v.
Anterior inferior pancreaticoduodenal v.
Middle colic v. (*cut*)
Right colic v.
Ileocolic v.
Anterior cecal v.
Posterior cecal v.
Appendicular v.
Right testicular (or ovarian) vv.
External iliac a. and v.
Internal iliac v.
Superior gluteal v.
Obturator v.
Middle anorectal v.
Inferior anorectal v.
Pancreatic vv.
Inferior mesenteric v.
Jejunal vv.
Ileal vv.
Left colic v.
Left testicular (or ovarian) a. and v.
Inferior mesenteric v.
Sigmoid vv.
Median sacral v.
Superior anorectal v.
Tributaries of superior anorectal v.
Perimuscular anorectal venous plexus
Middle anorectal v.
Internal pudendal v. (in pudendal canal)
External anorectal venous plexus



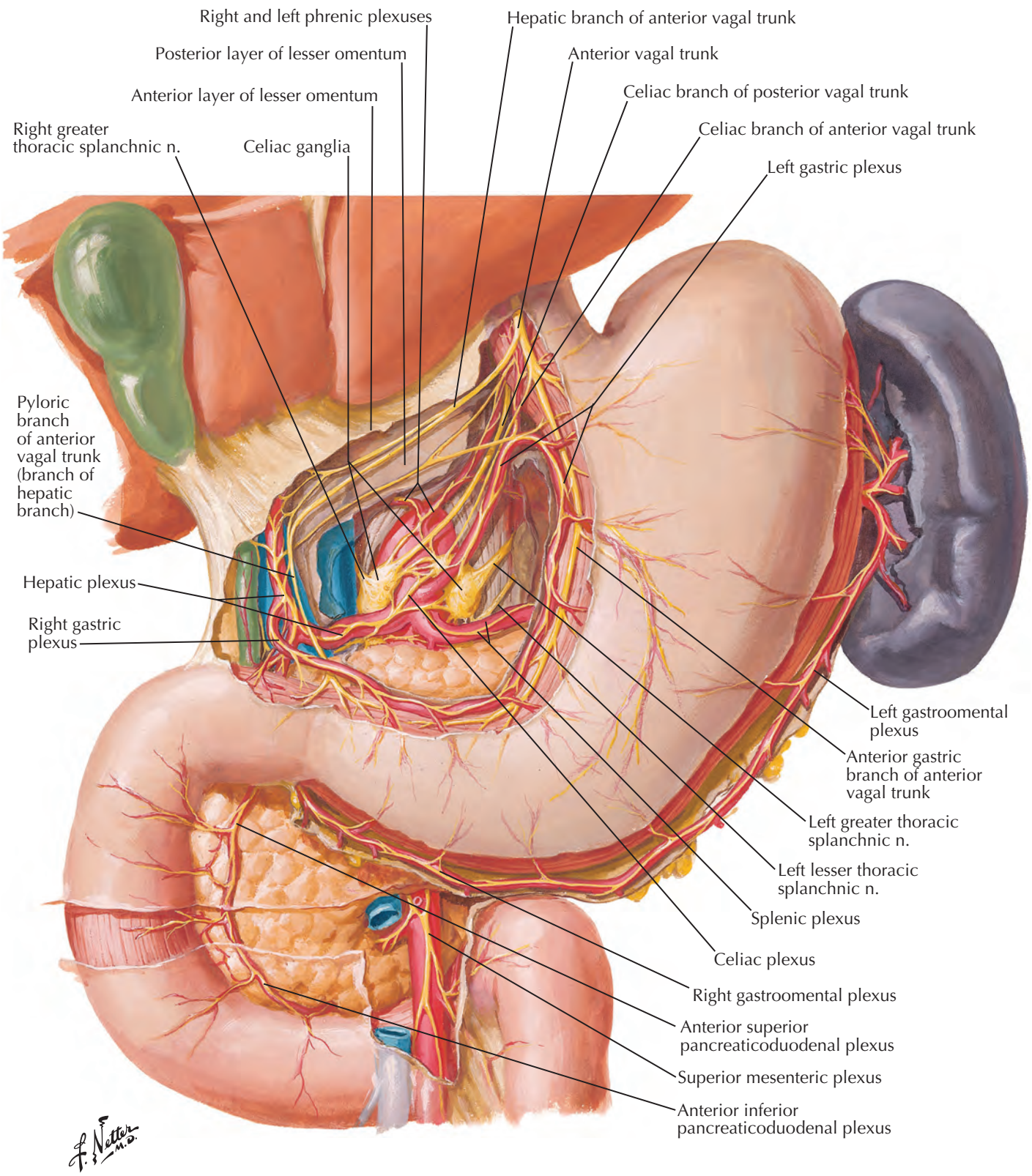
Portacaval anastomoses

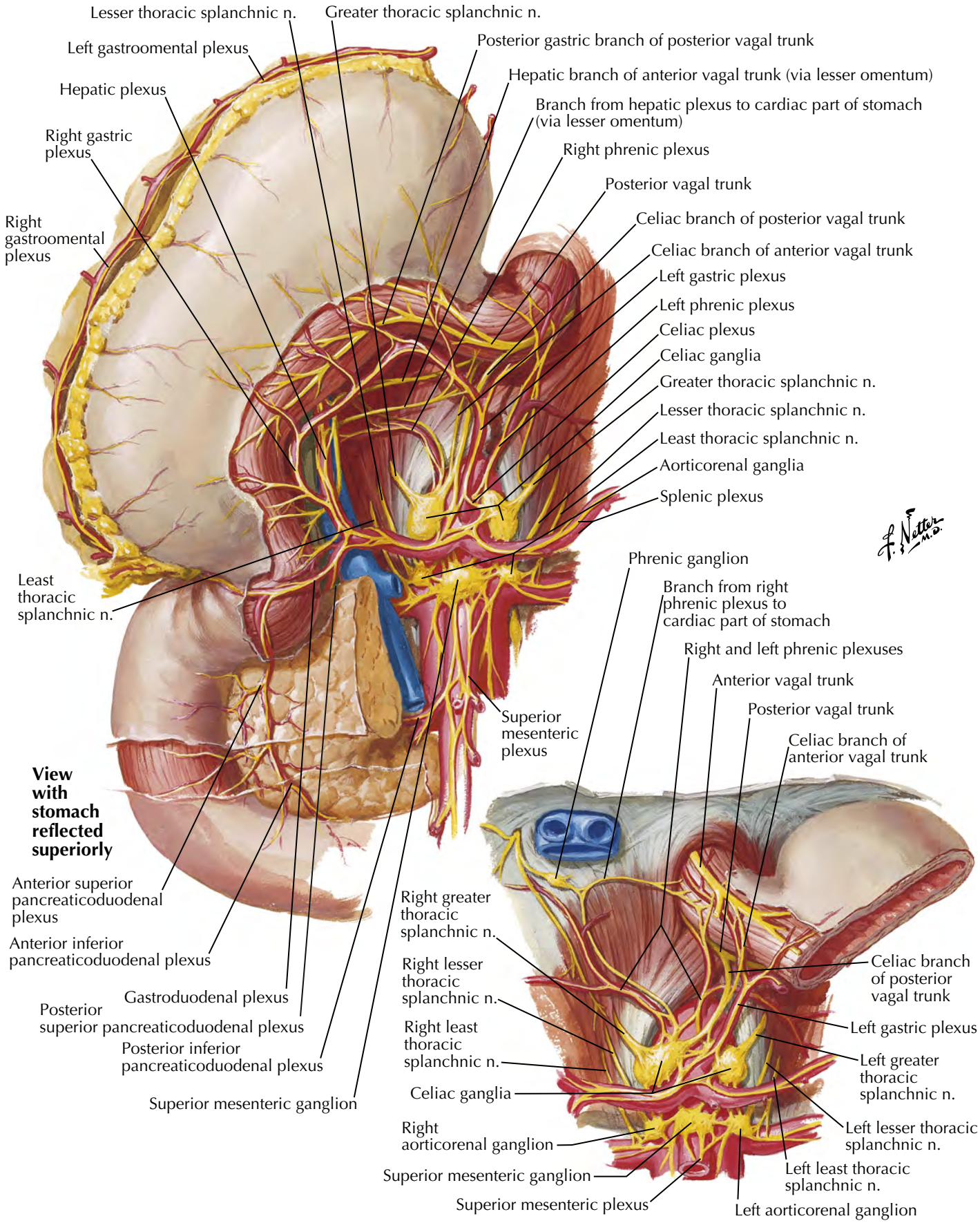
1	Esophageal	**3**	Anorectal
2	Paraumbilical	**4**	Retroperitoneal

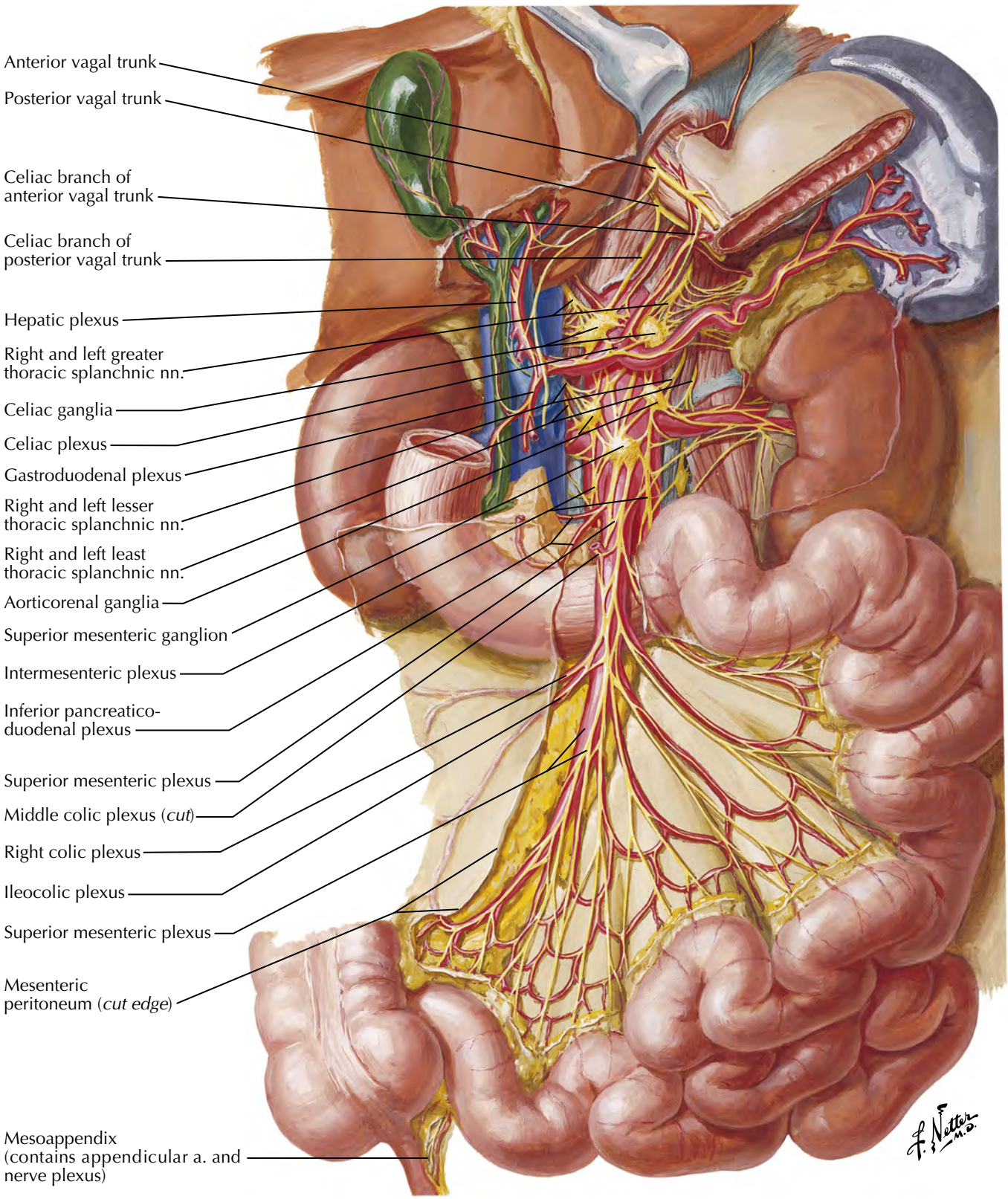
See also **Plate 323**



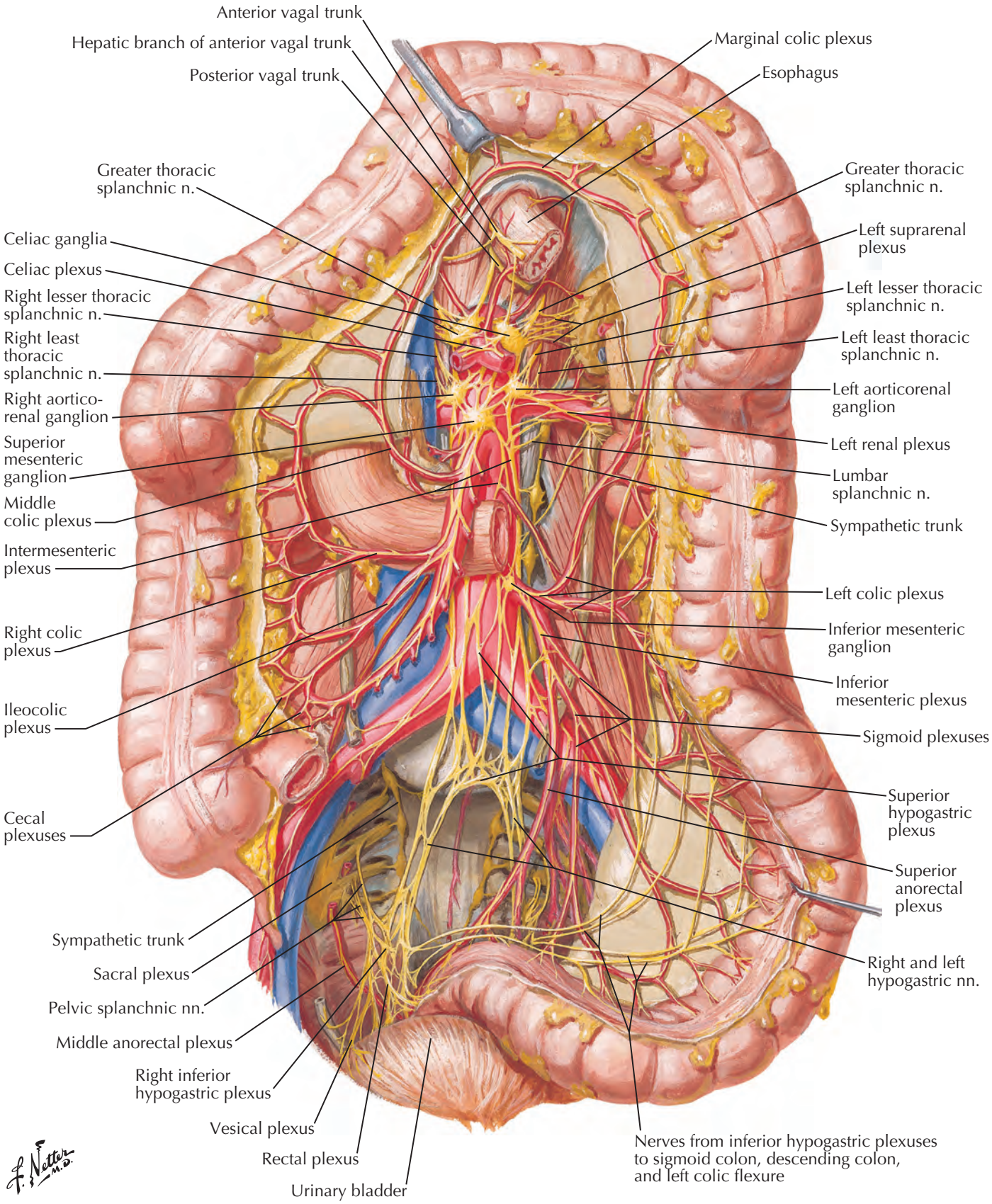
See also **Plate 261**



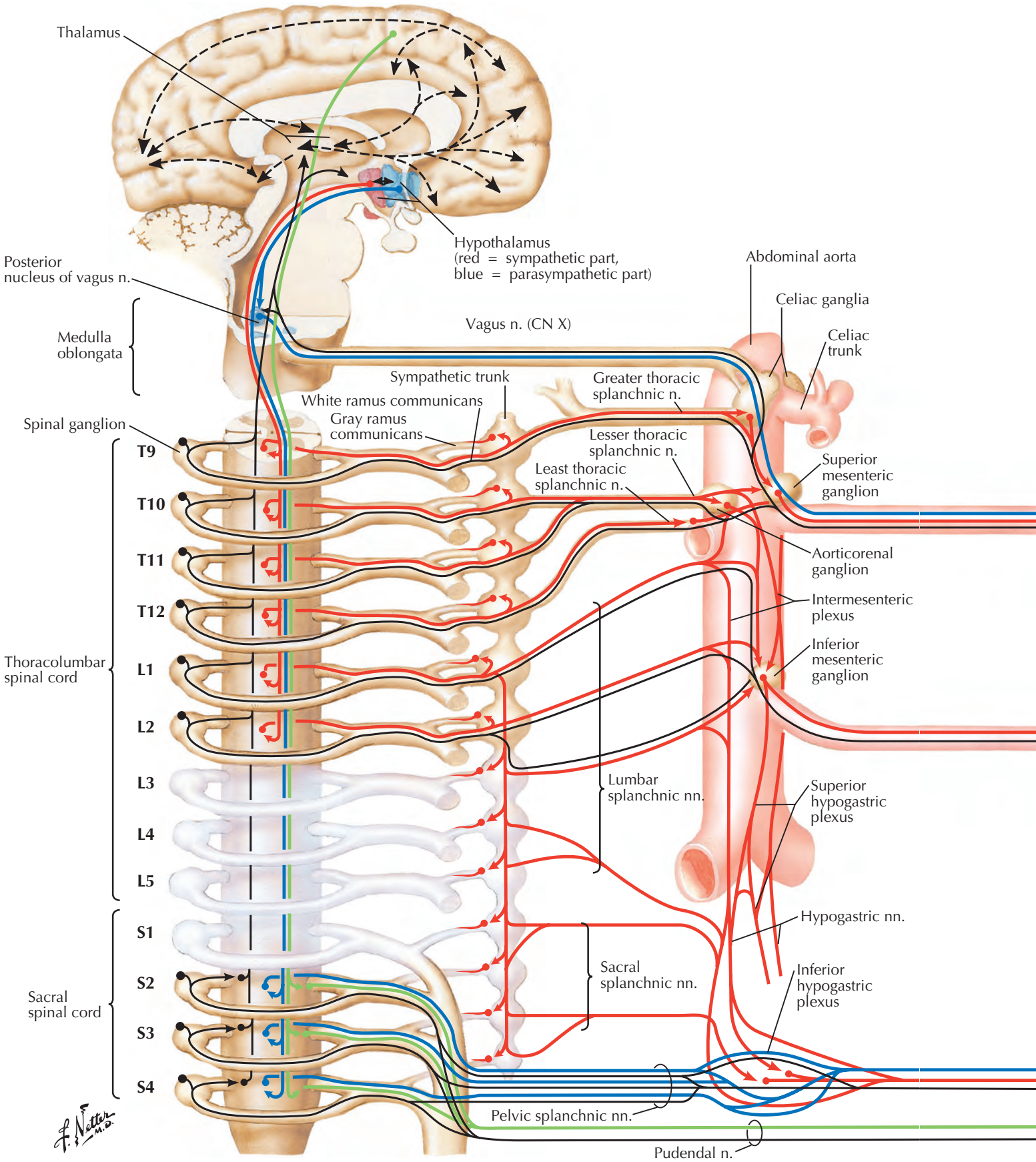

Lesser thoracic splanchnic n.
Greater thoracic splanchnic n.
Left gastroomental plexus
Posterior gastric branch of posterior vagal trunk
Hepatic plexus
Hepatic branch of anterior vagal trunk (via lesser omentum)
Branch from hepatic plexus to cardiac part of stomach (via lesser omentum)
Right gastric plexus
Right phrenic plexus
Posterior vagal trunk
Right gastroomental plexus
Celiac branch of posterior vagal trunk
Celiac branch of anterior vagal trunk
Left gastric plexus
Left phrenic plexus
Celiac plexus
Celiac ganglia
Greater thoracic splanchnic n.
Lesser thoracic splanchnic n.
Least thoracic splanchnic n.
Aorticorenal ganglia
Splenic plexus
Least thoracic splanchnic n.
Phrenic ganglion
Branch from right phrenic plexus to cardiac part of stomach
Right and left phrenic plexuses
Anterior vagal trunk
Posterior vagal trunk
Celiac branch of anterior vagal trunk
Superior mesenteric plexus
View with stomach reflected superiorly
Anterior superior pancreaticoduodenal plexus
Anterior inferior pancreaticoduodenal plexus
Gastroduodenal plexus
Posterior superior pancreaticoduodenal plexus
Posterior inferior pancreaticoduodenal plexus
Superior mesenteric ganglion
Right greater thoracic splanchnic n.
Right lesser thoracic splanchnic n.
Right least thoracic splanchnic n.
Celiac ganglia
Right aorticorenal ganglion
Superior mesenteric ganglion
Superior mesenteric plexus
Celiac branch of posterior vagal trunk
Left gastric plexus
Left greater thoracic splanchnic n.
Left lesser thoracic splanchnic n.
Left least thoracic splanchnic n.
Left aorticorenal ganglion

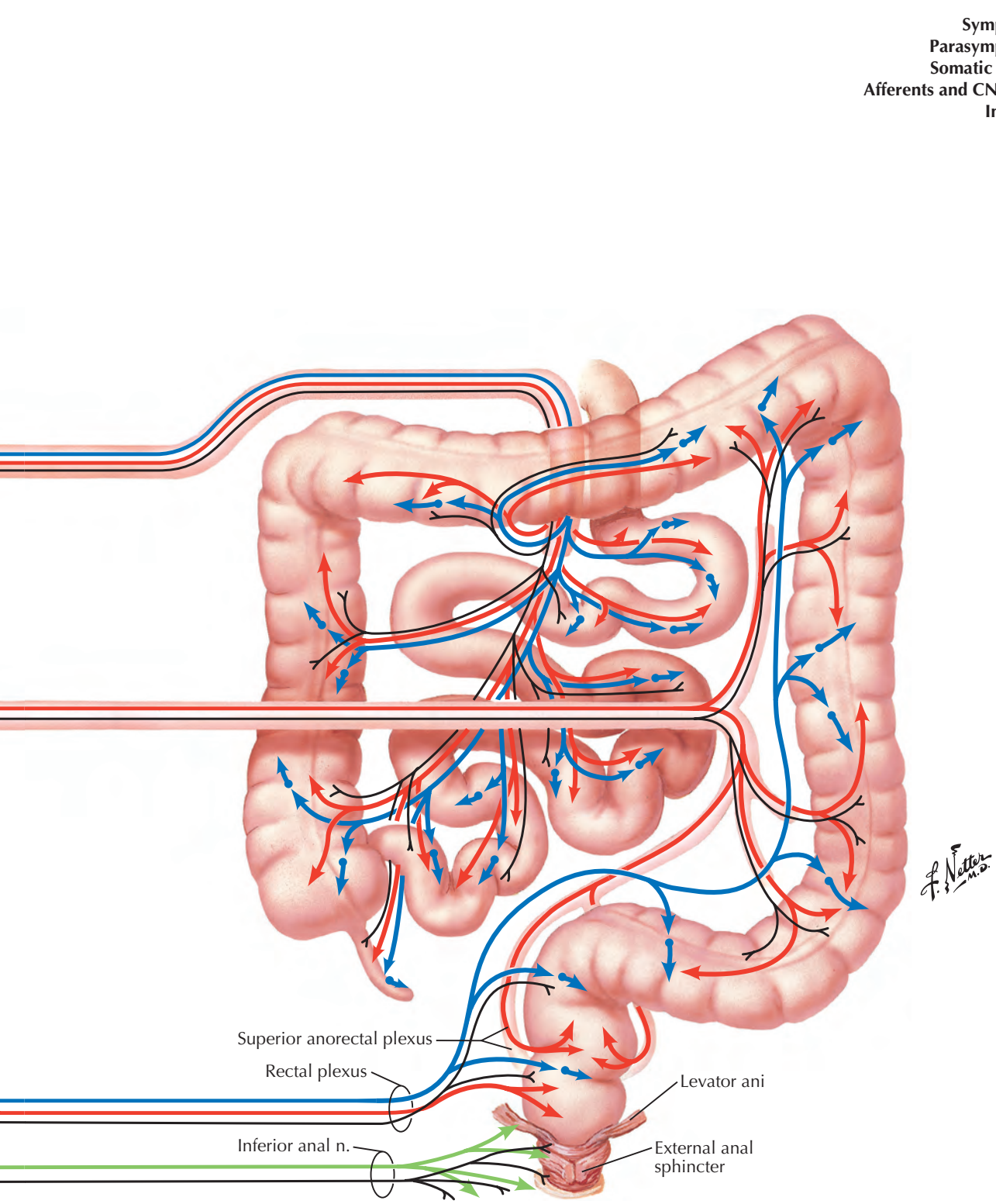

Anterior vagal trunk
Posterior vagal trunk
Celiac branch of anterior vagal trunk
Celiac branch of posterior vagal trunk
Hepatic plexus
Right and left greater thoracic splanchnic nn.
Celiac ganglia
Celiac plexus
Gastroduodenal plexus
Right and left lesser thoracic splanchnic nn.
Right and left least thoracic splanchnic nn.
Aorticorenal ganglia
Superior mesenteric ganglion
Intermesenteric plexus
Inferior pancreatico-duodenal plexus
Superior mesenteric plexus
Middle colic plexus (*cut*)
Right colic plexus
Ileocolic plexus
Superior mesenteric plexus
Mesenteric peritoneum (*cut edge*)
Mesoappendix (contains appendicular a. and nerve plexus)

See also **Plates 412, 413, 414**

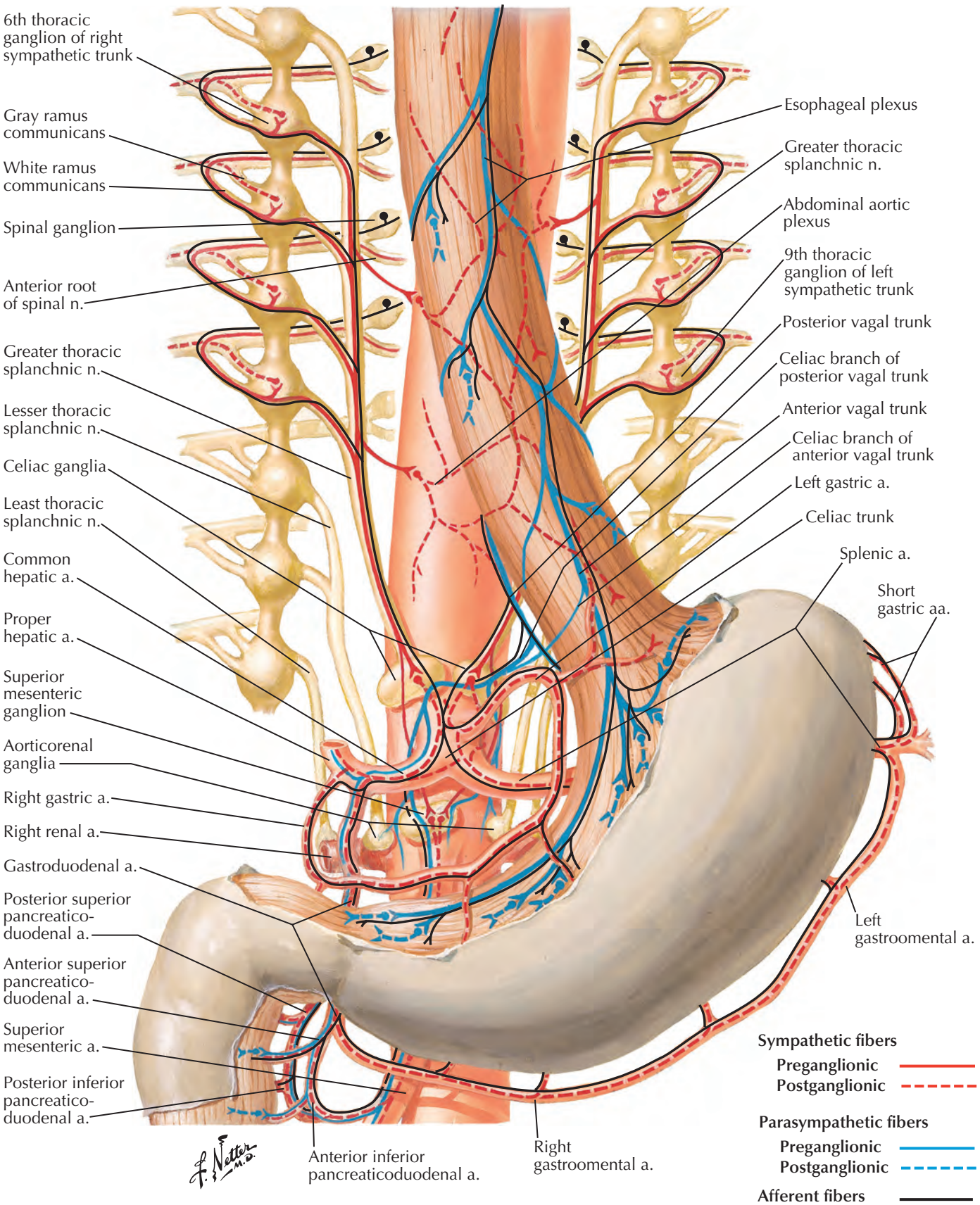


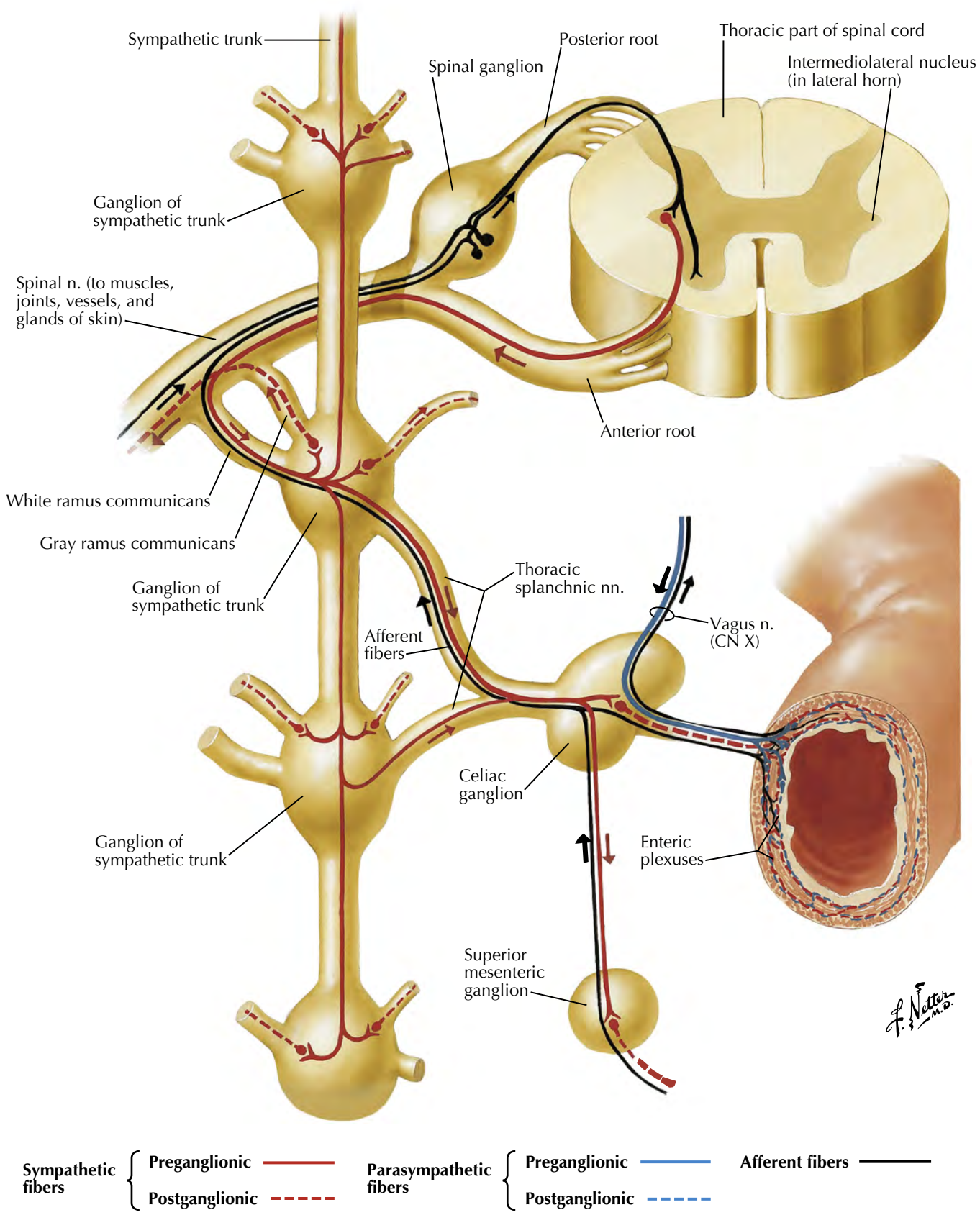
See also **Plates 6, 7**



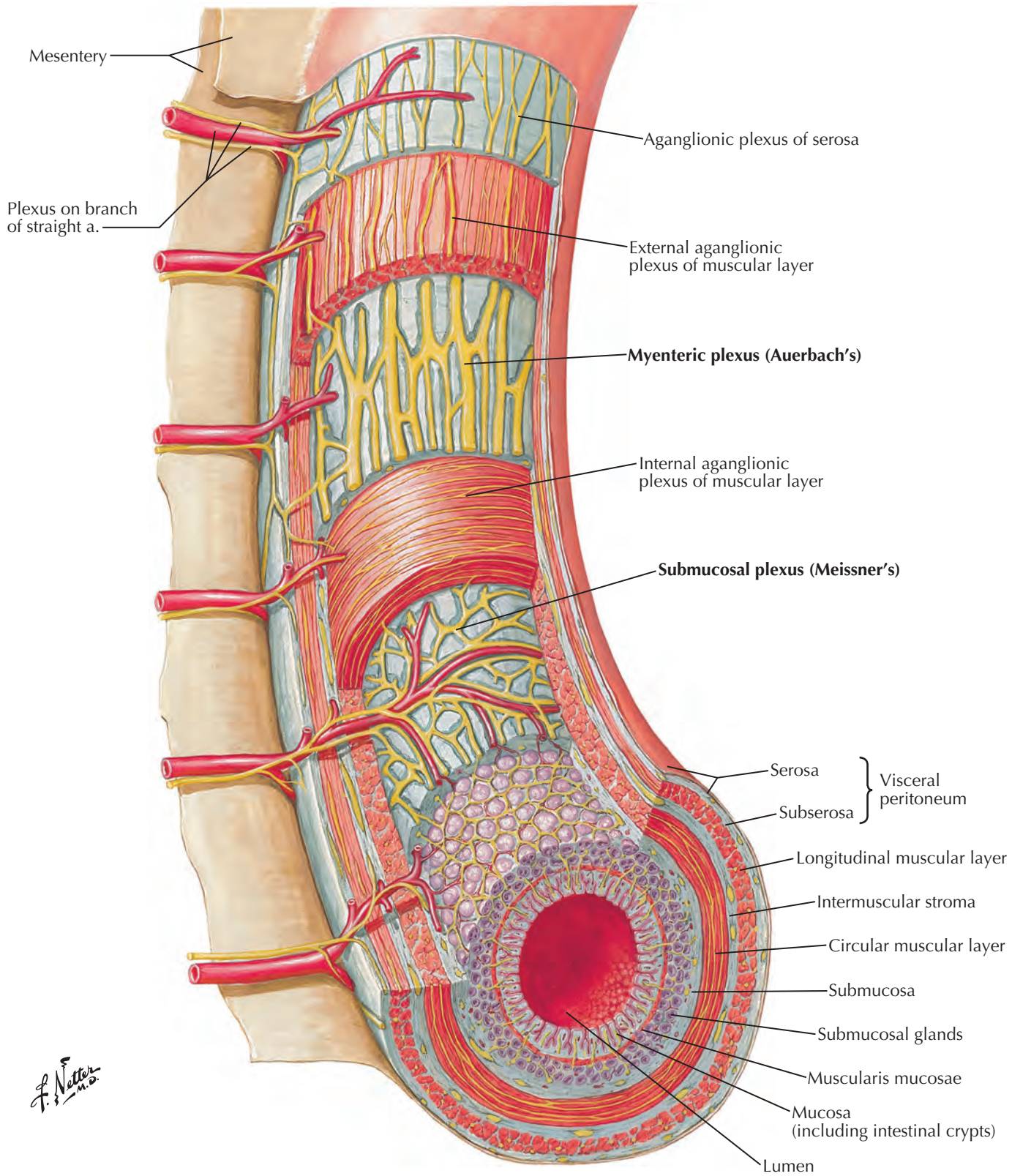

Sympathetic fibers
Parasympathetic fibers
Somatic efferent fibers
Afferents and CNS connections
Indefinite paths
Superior anorectal plexus
Rectal plexus
Inferior anal n.
Levator ani
External anal sphincter
F. Netter M.D.

See also **Plates 6, 7**

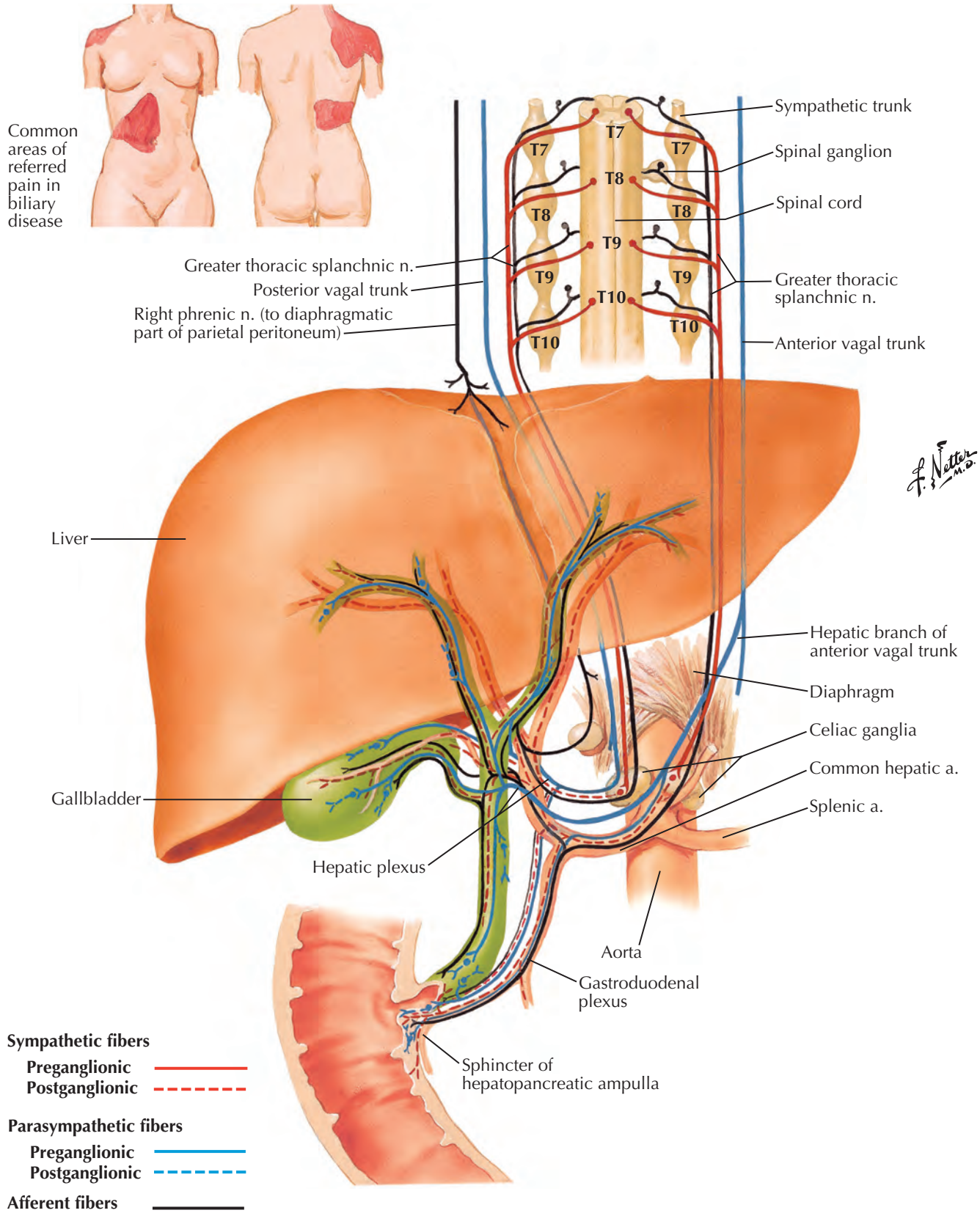



Sympathetic trunk
Posterior root
Spinal ganglion
Thoracic part of spinal cord
Intermediolateral nucleus (in lateral horn)
Ganglion of sympathetic trunk
Spinal n. (to muscles, joints, vessels, and glands of skin)
Anterior root
White ramus communicans
Gray ramus communicans
Ganglion of sympathetic trunk
Thoracic splanchnic nn.
Vagus n. (CN X)
Afferent fibers
Celiac ganglion
Ganglion of sympathetic trunk
Enteric plexuses
Superior mesenteric ganglion
F. Netter M.D.
Sympathetic fibers
Preganglionic
Postganglionic
Parasympathetic fibers
Preganglionic
Postganglionic
Afferent fibers

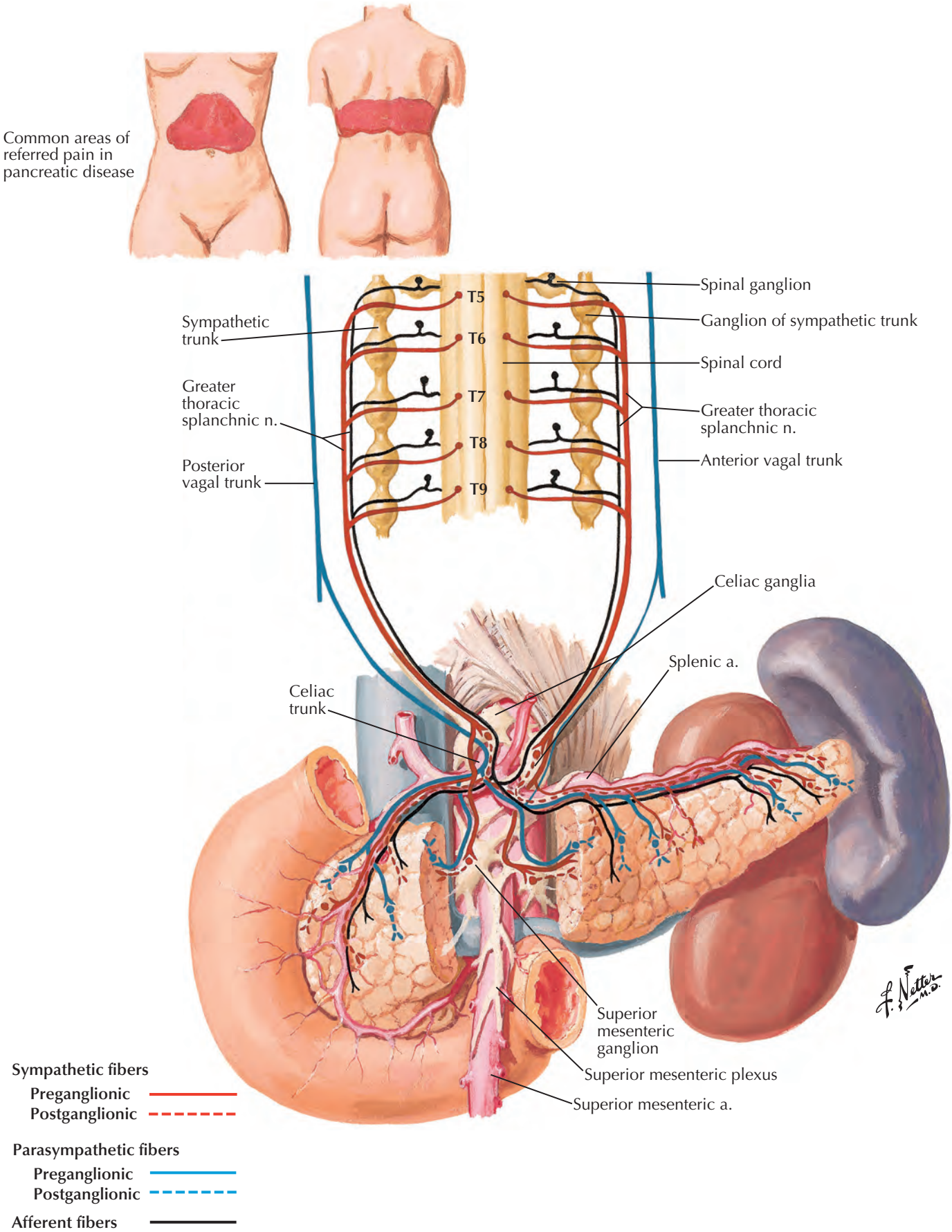
See also **Plate BP 48**

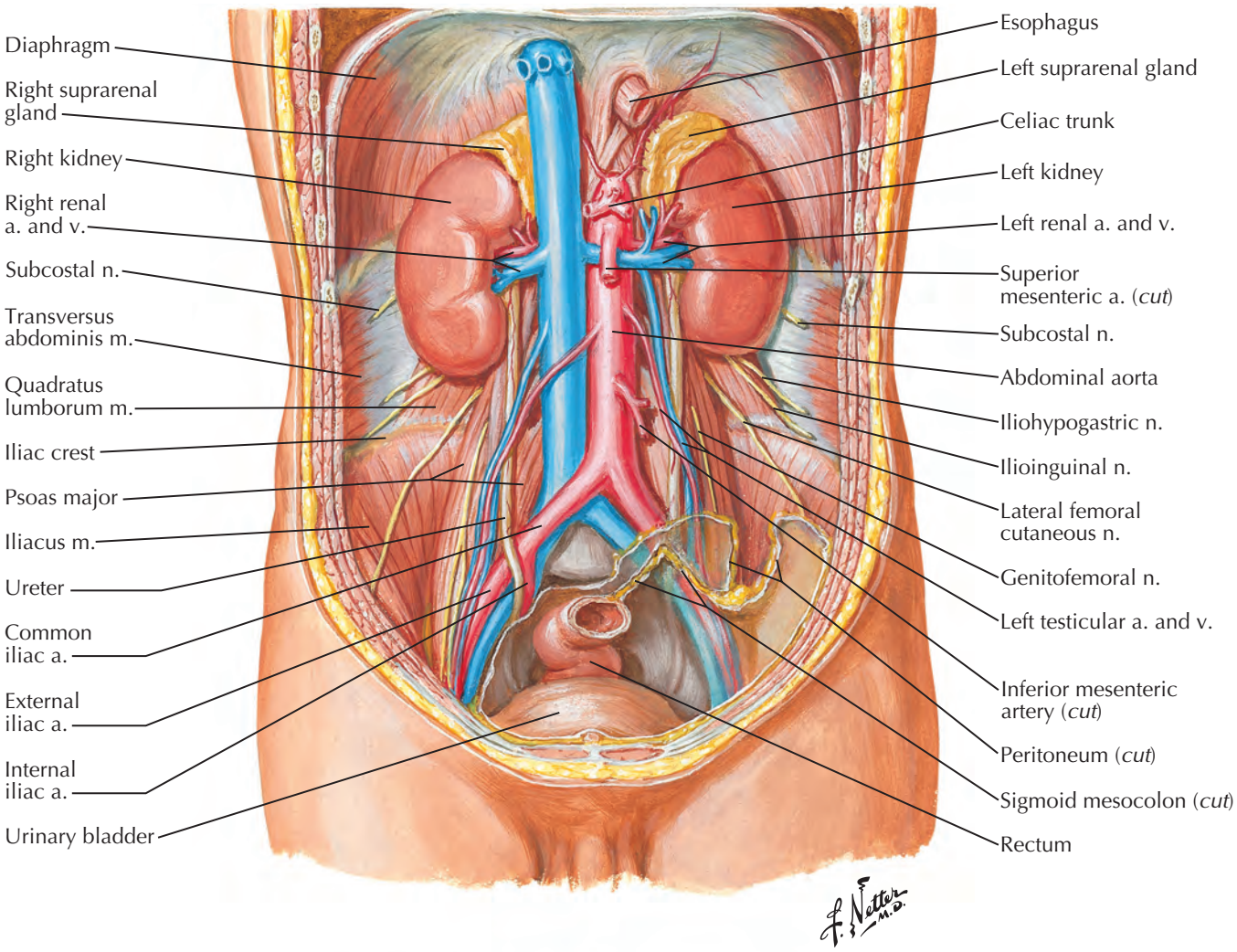


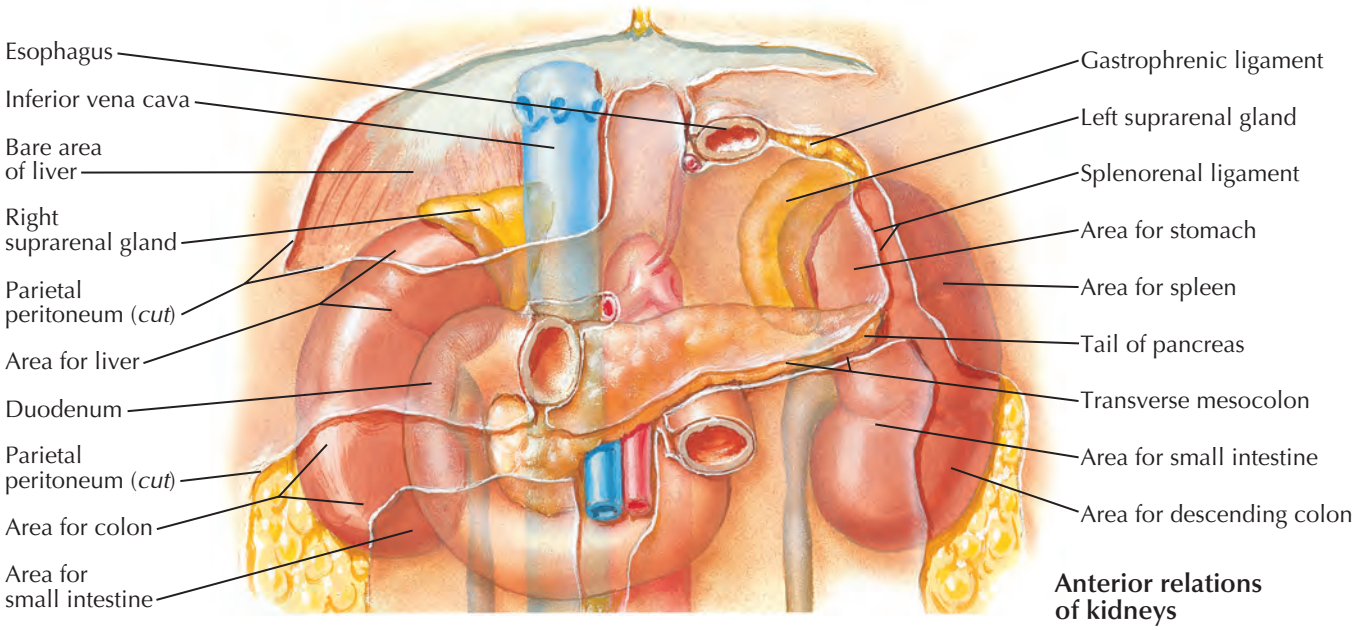
Note: Intestinal wall is shown much thicker than in actuality.


Common areas of referred pain in biliary disease
Sympathetic trunk
Spinal ganglion
Spinal cord
Greater thoracic splanchnic n.
Posterior vagal trunk
Right phrenic n. (to diaphragmatic part of parietal peritoneum)
Greater thoracic splanchnic n.
Anterior vagal trunk
T7
T8
T9
T10
Liver
Hepatic branch of anterior vagal trunk
Diaphragm
Celiac ganglia
Common hepatic a.
Splenic a.
Gallbladder
Hepatic plexus
Aorta
Gastroduodenal plexus
Sphincter of hepatopancreatic ampulla
Sympathetic fibers
Preganglionic
Postganglionic
Parasympathetic fibers
Preganglionic
Postganglionic
Afferent fibers

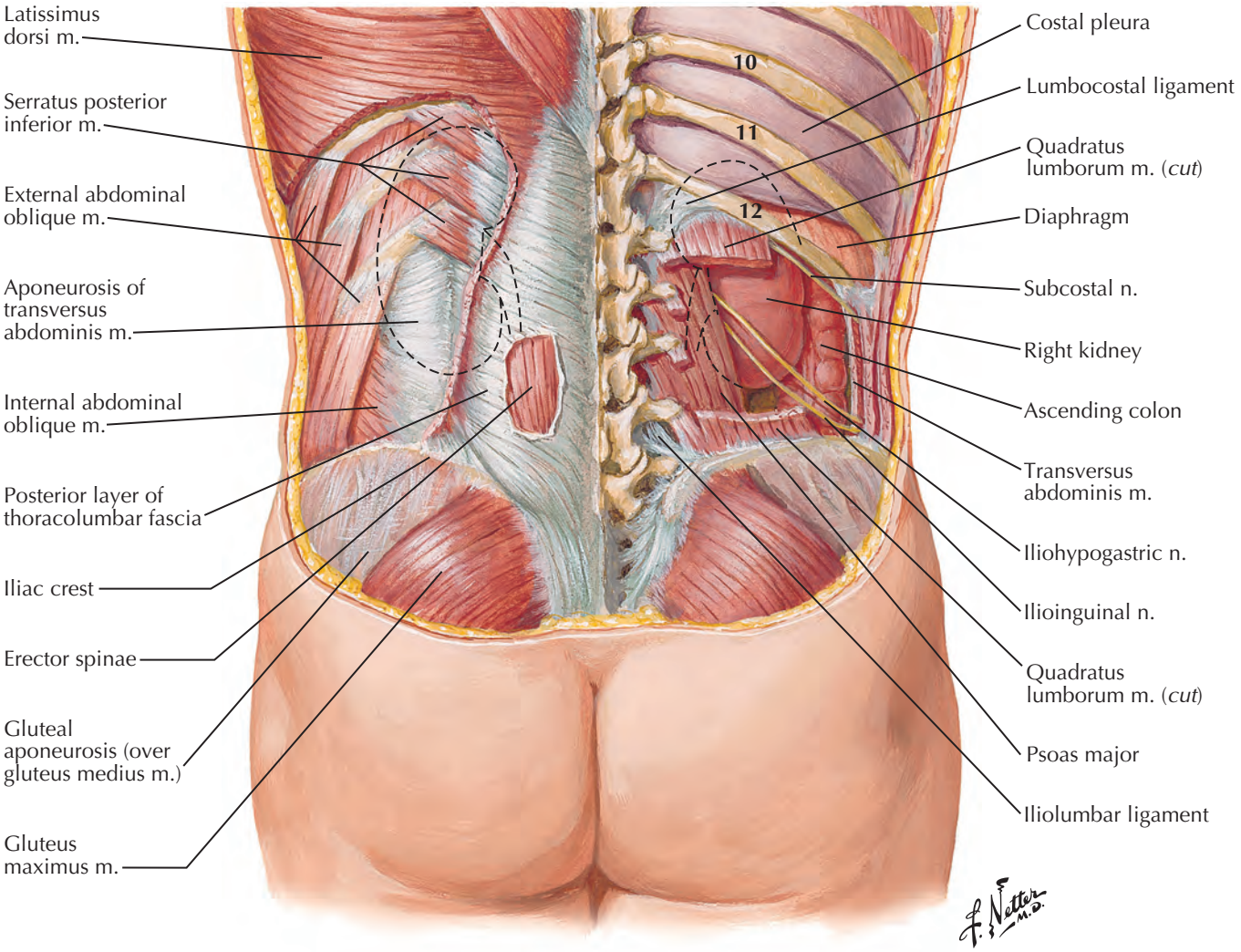
See also **Plates 6, 7**

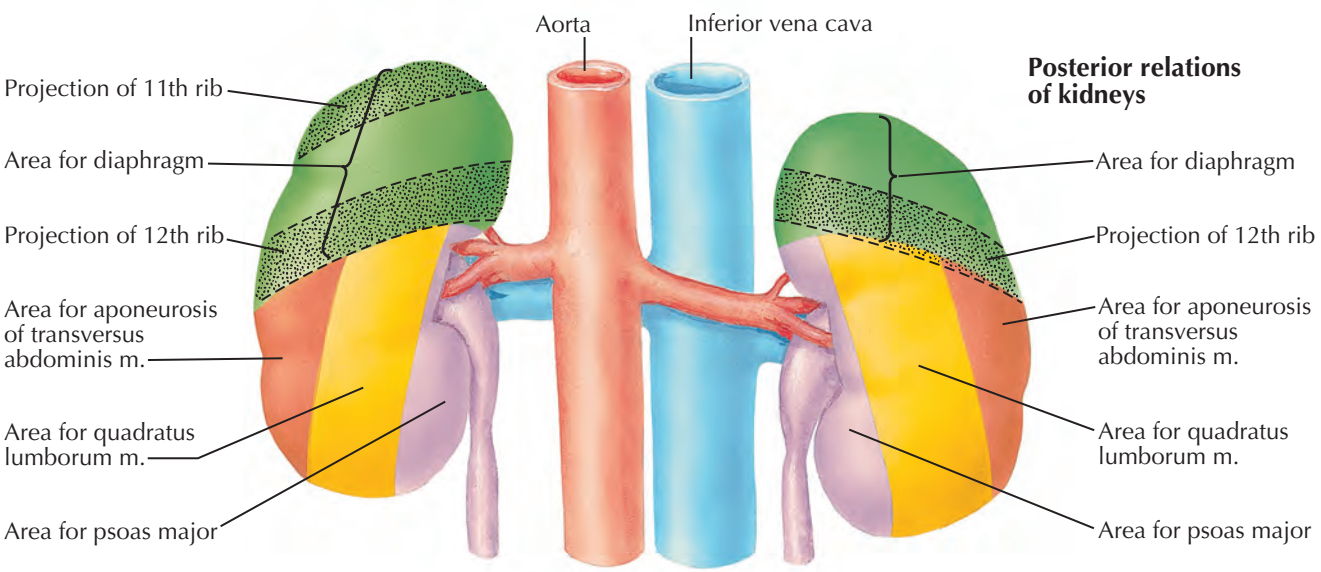




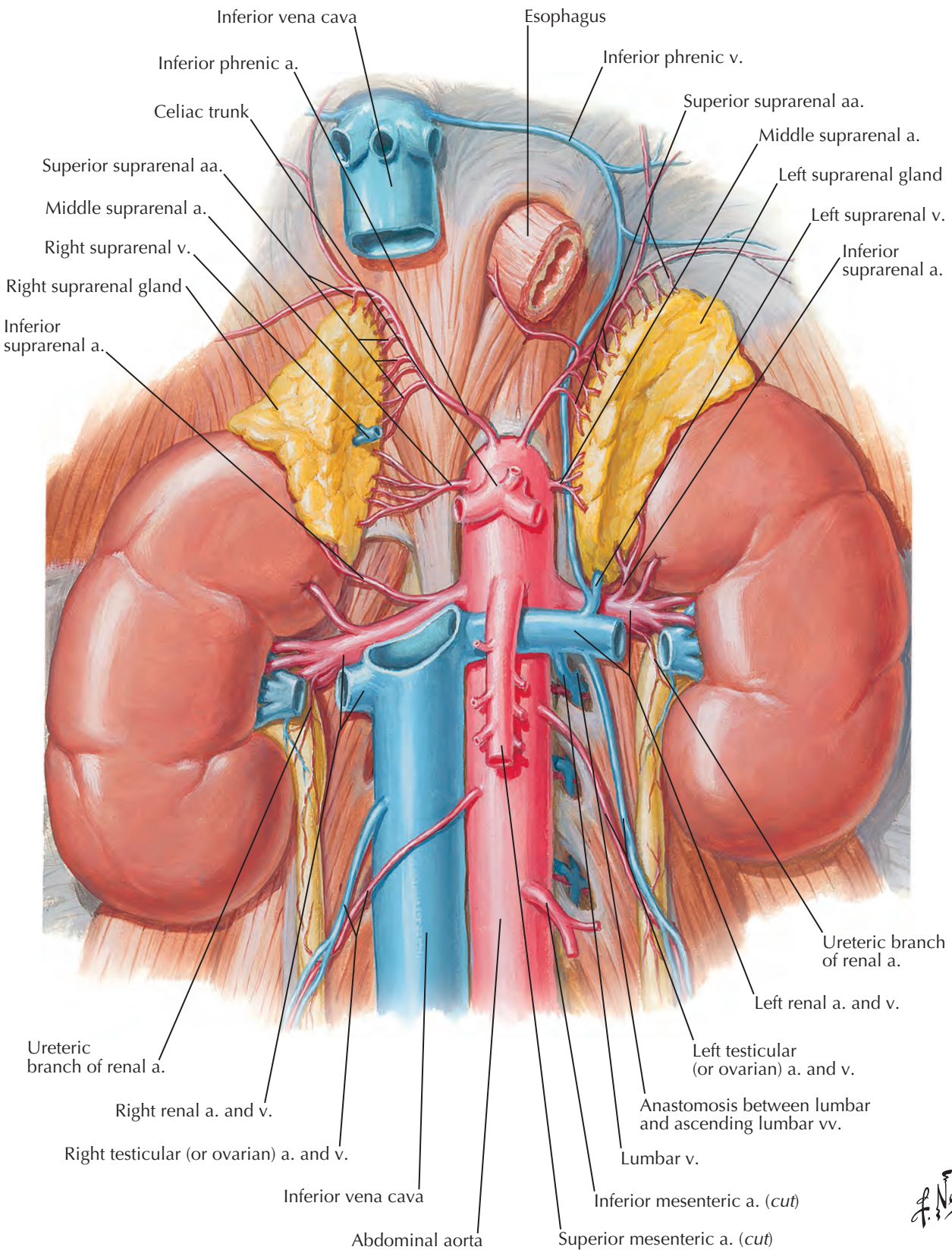


Anterior relations of kidneys

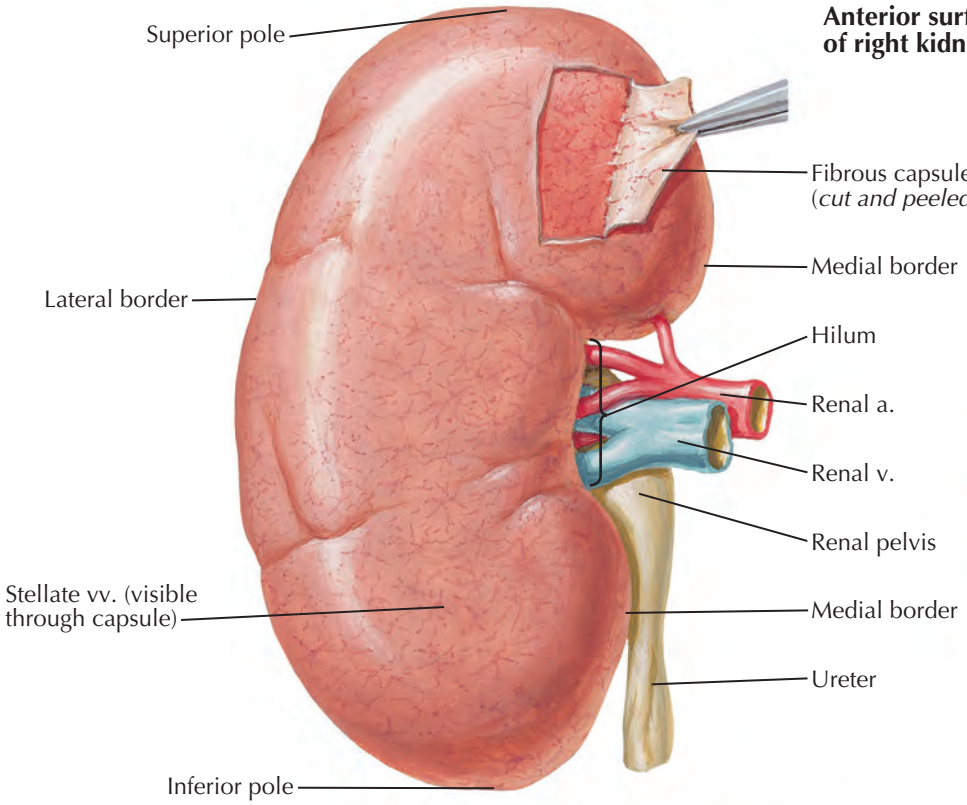

Latissimus dorsi m.
Serratus posterior inferior m.
External abdominal oblique m.
Aponeurosis of transversus abdominis m.
Internal abdominal oblique m.
Posterior layer of thoracolumbar fascia
Iliac crest
Erector spinae
Gluteal aponeurosis (over gluteus medius m.)
Gluteus maximus m.
10
11
12
Costal pleura
Lumbocostal ligament
Quadratus lumborum m. (cut)
Diaphragm
Subcostal n.
Right kidney
Ascending colon
Transversus abdominis m.
Iliohypogastric n.
Ilioinguinal n.
Quadratus lumborum m. (cut)
Psoas major
Iliolumbar ligament


Aorta
Inferior vena cava
Projection of 11th rib
Area for diaphragm
Projection of 12th rib
Area for aponeurosis of transversus abdominis m.
Area for quadratus lumborum m.
Area for psoas major
Posterior relations of kidneys
Area for diaphragm
Projection of 12th rib
Area for aponeurosis of transversus abdominis m.
Area for quadratus lumborum m.
Area for psoas major

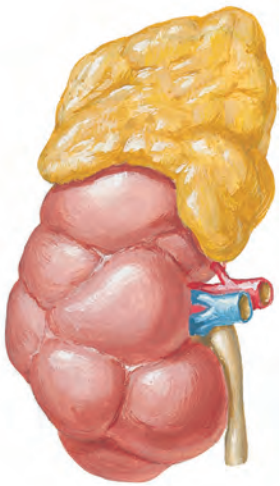
See also **Plates 342, BP 70**



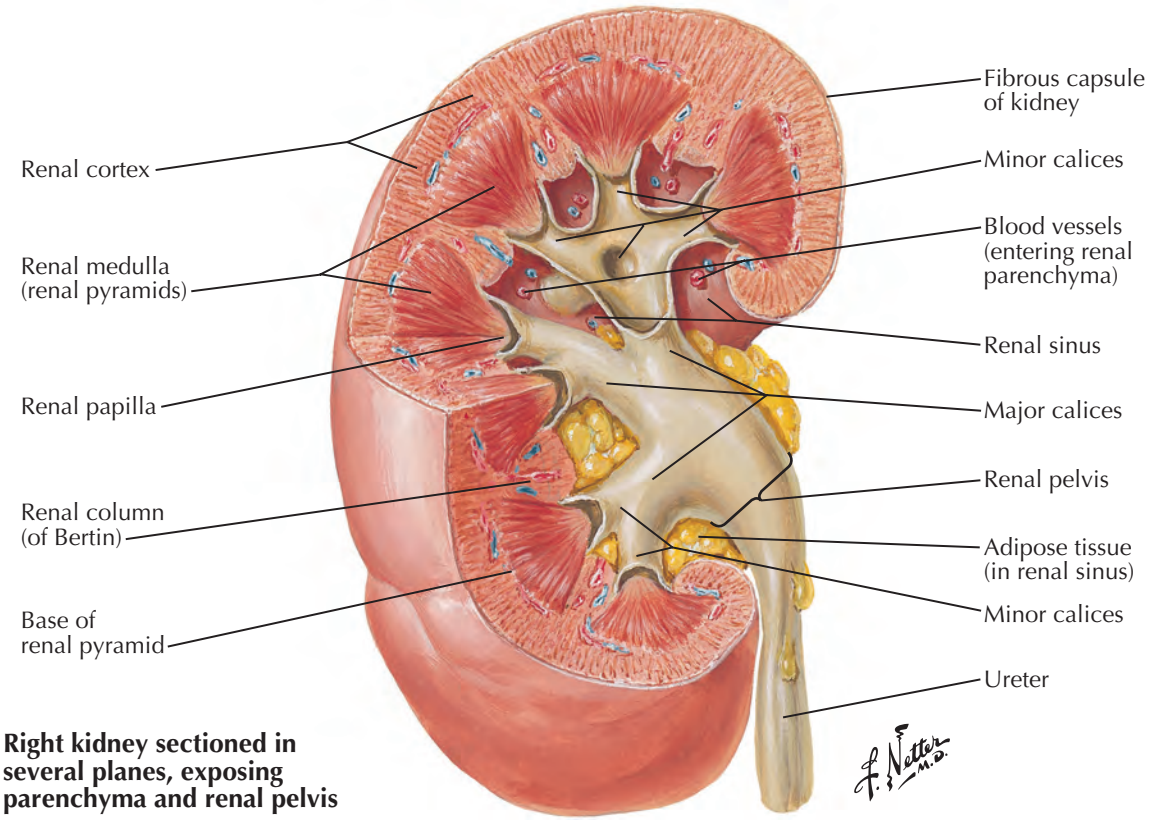
See also **Plates 71, 72**



Anterior surface of right kidney

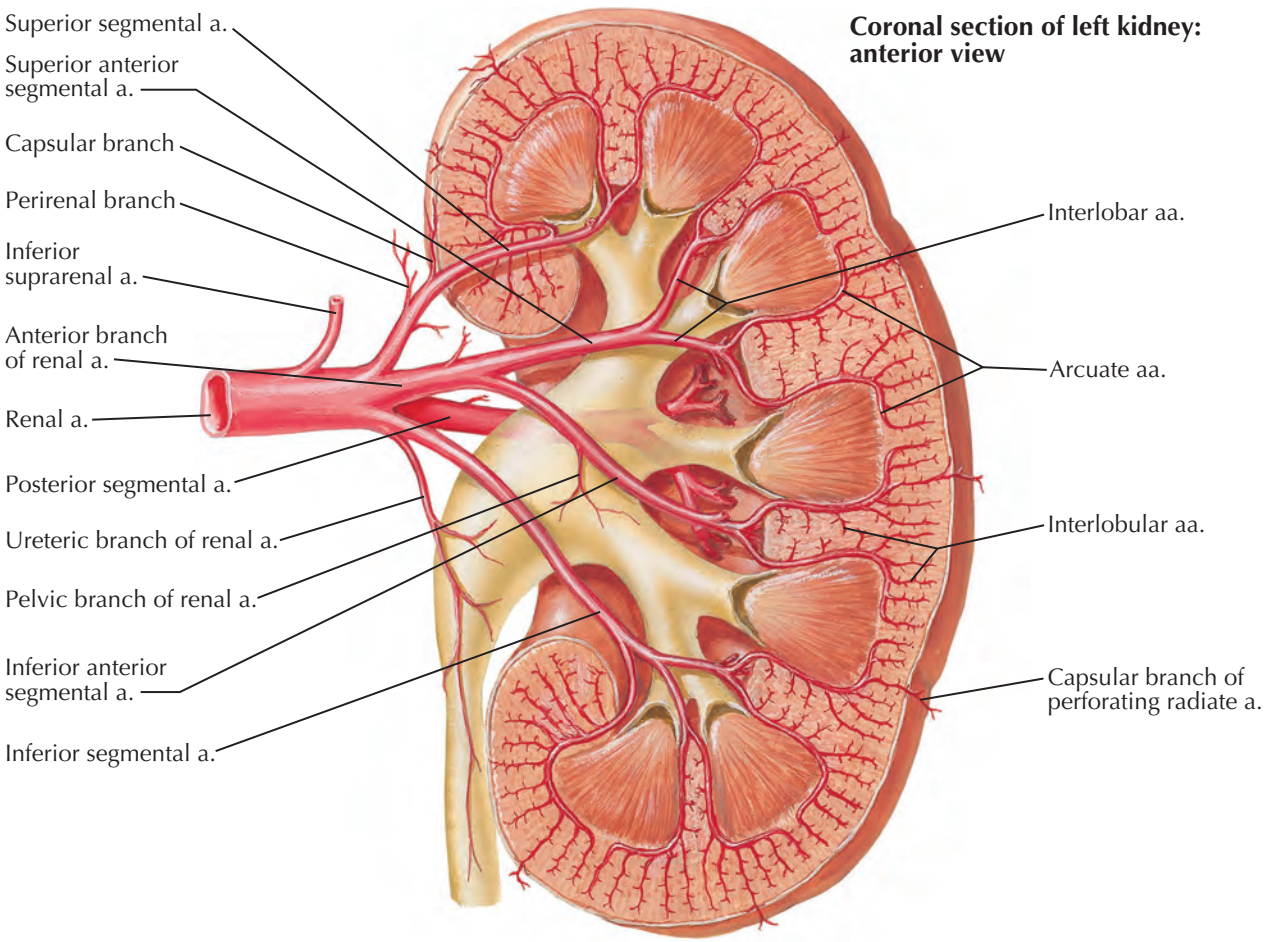


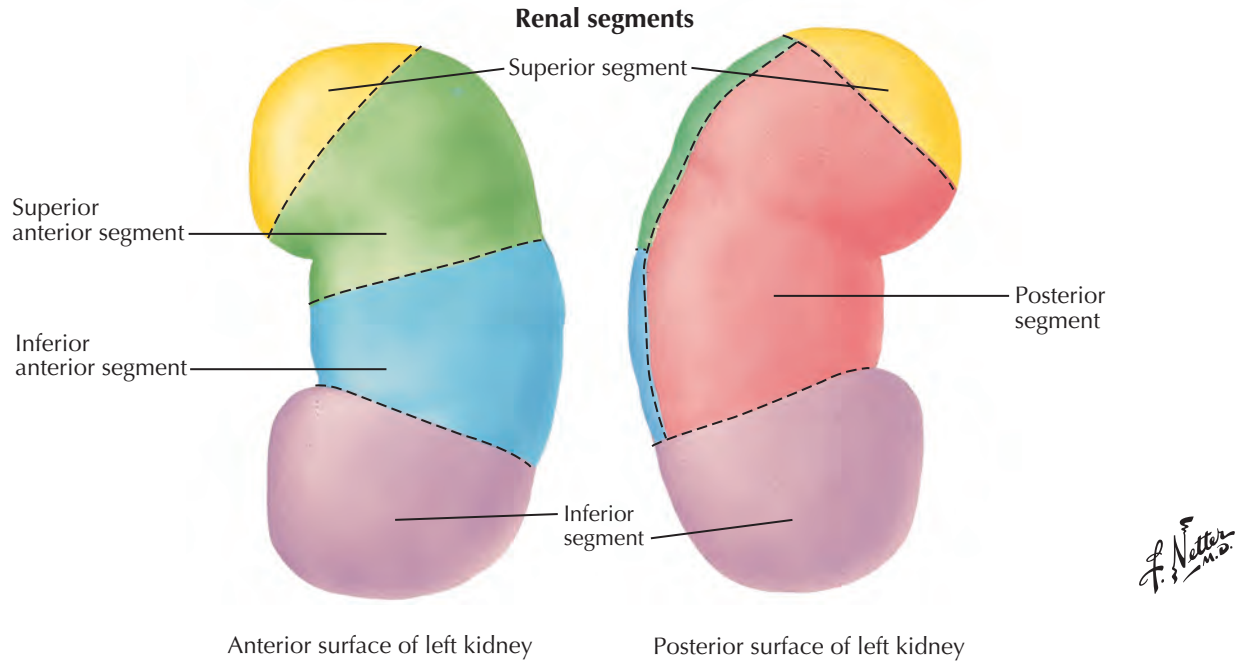
Suprarenal gland and lobulated kidney of infant



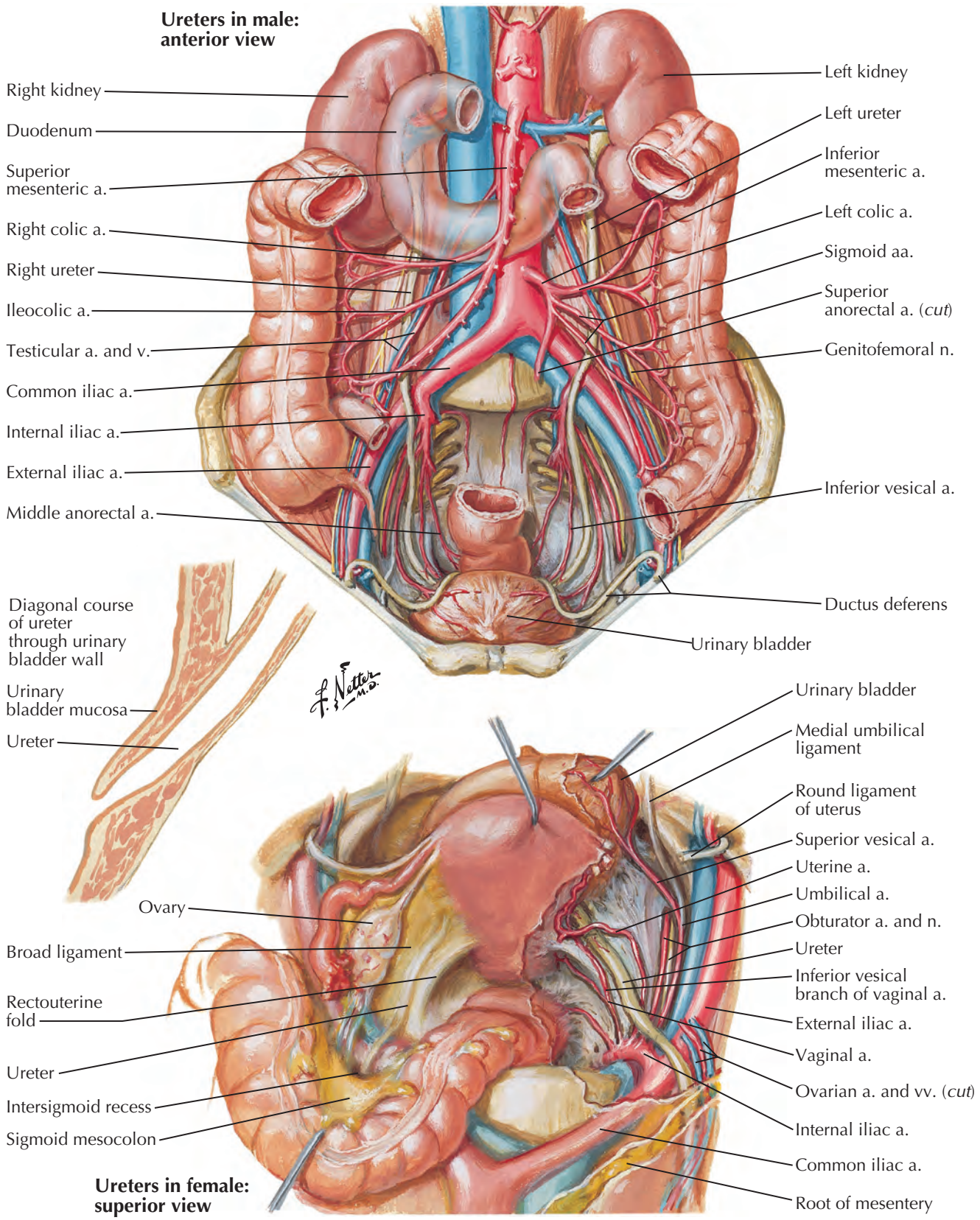
Right kidney sectioned in several planes, exposing parenchyma and renal pelvis

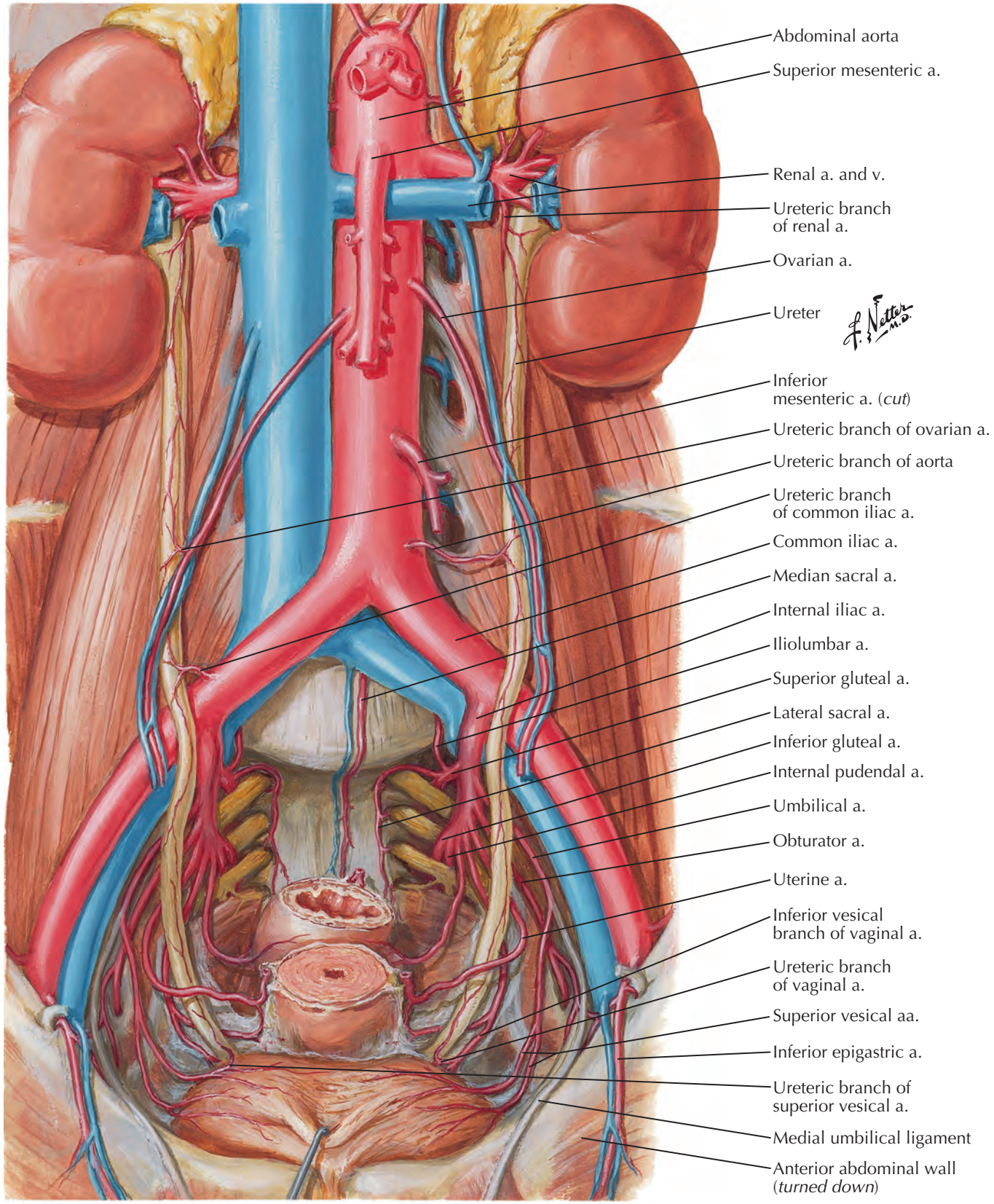
See also **Plate BP 73**

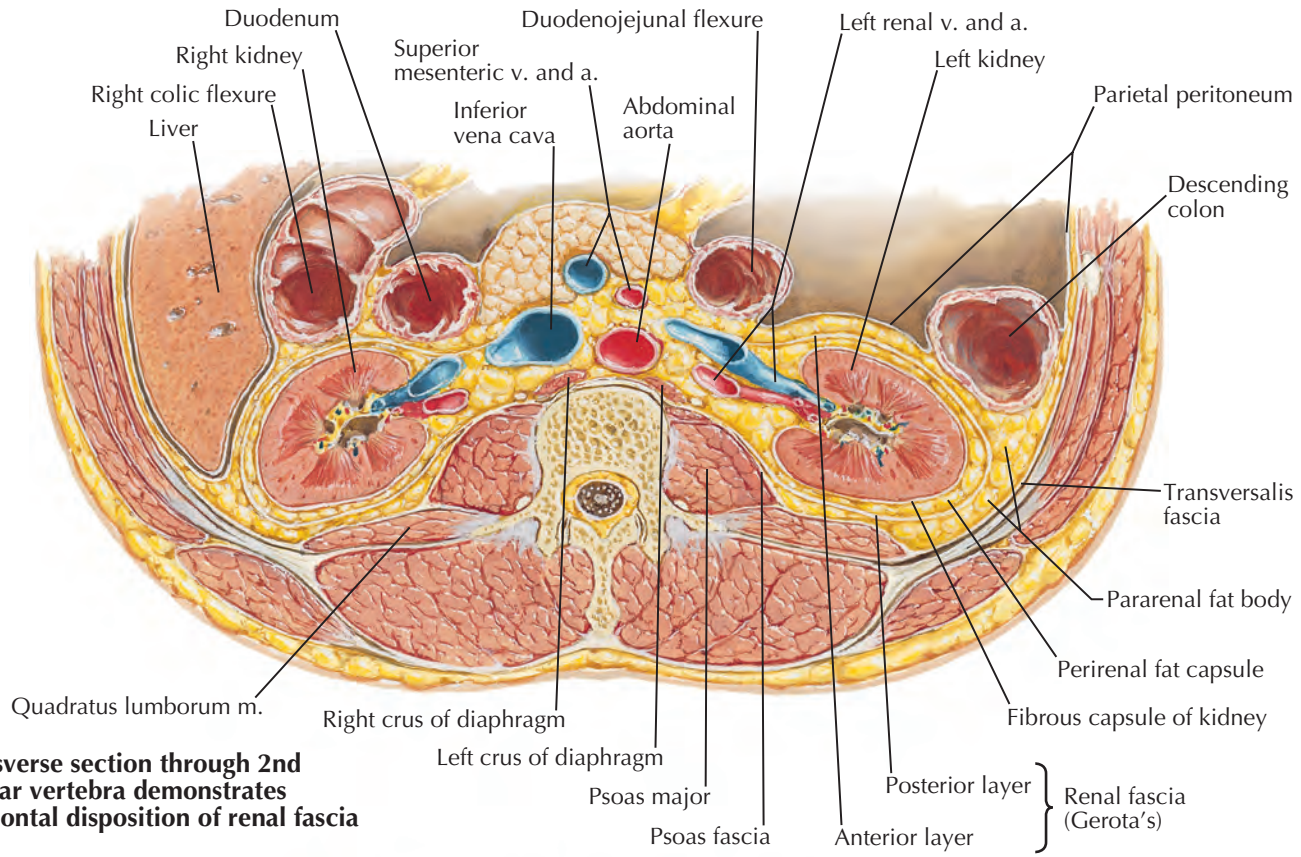




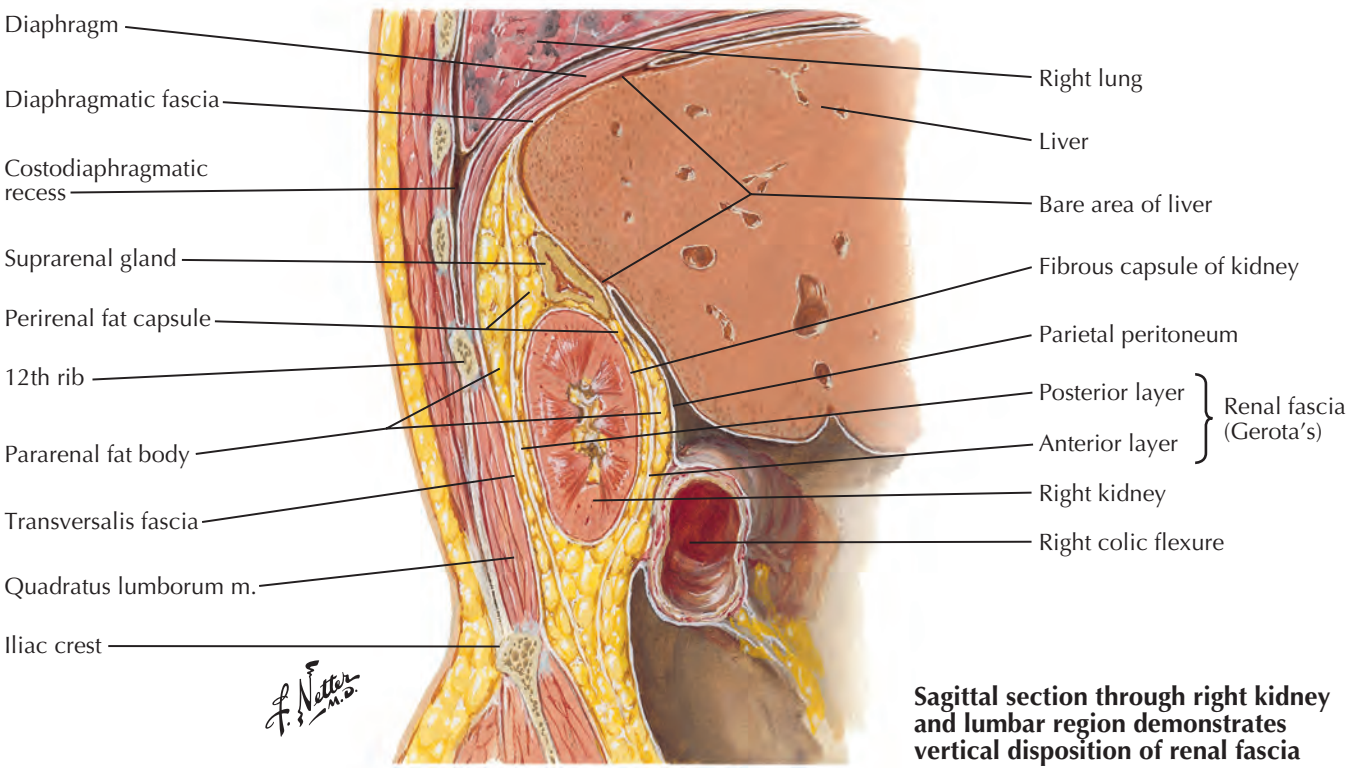
See also **Plates 363, 365, 367**




Abdominal aorta
Superior mesenteric a.
Renal a. and v.
Ureteric branch of renal a.
Ovarian a.
Ureter
Inferior mesenteric a. (*cut*)
Ureteric branch of ovarian a.
Ureteric branch of aorta
Ureteric branch of common iliac a.
Common iliac a.
Median sacral a.
Internal iliac a.
Iliolumbar a.
Superior gluteal a.
Lateral sacral a.
Inferior gluteal a.
Internal pudendal a.
Umbilical a.
Obturator a.
Uterine a.
Inferior vesical branch of vaginal a.
Ureteric branch of vaginal a.
Superior vesical aa.
Inferior epigastric a.
Ureteric branch of superior vesical a.
Medial umbilical ligament
Anterior abdominal wall (*turned down*)

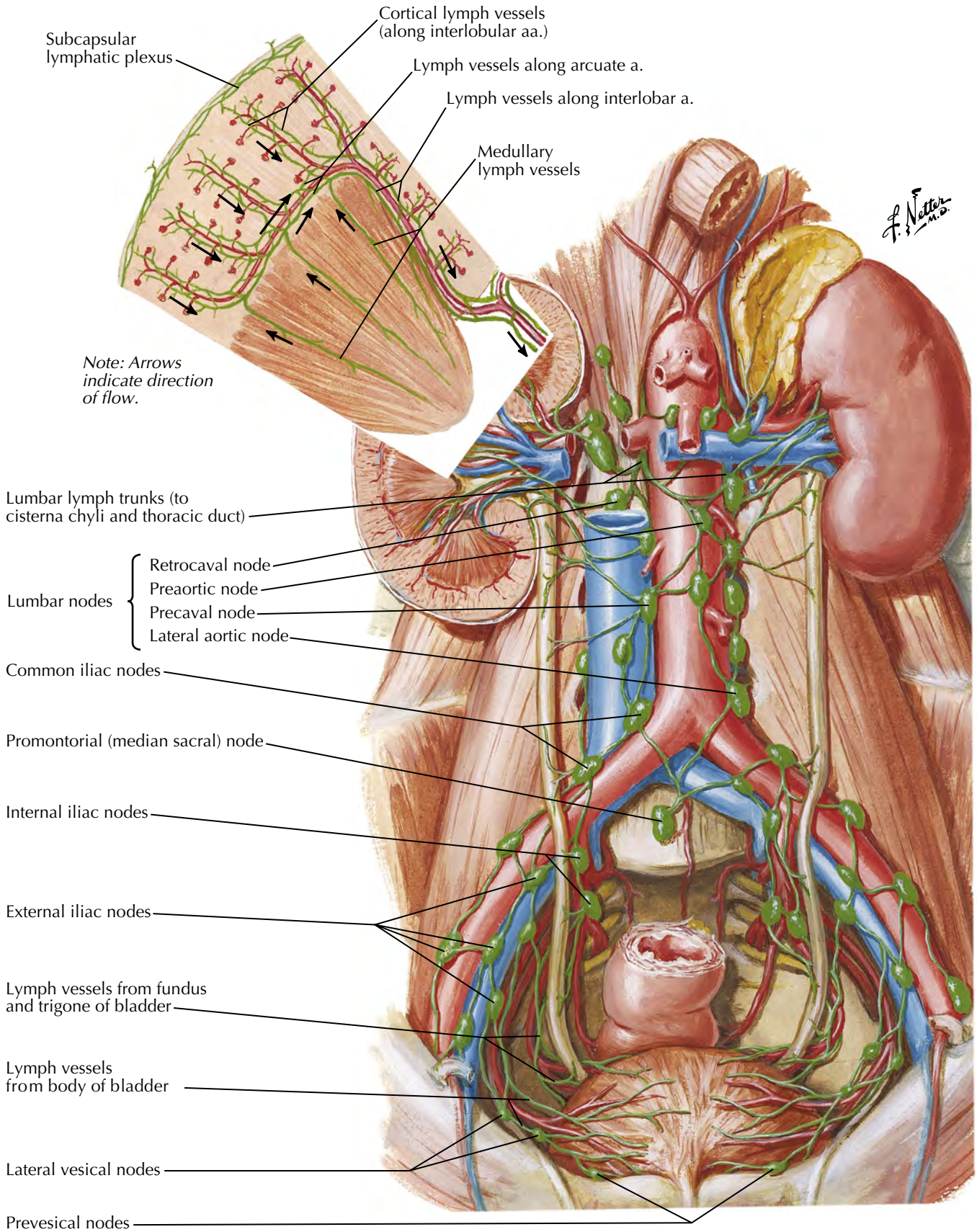


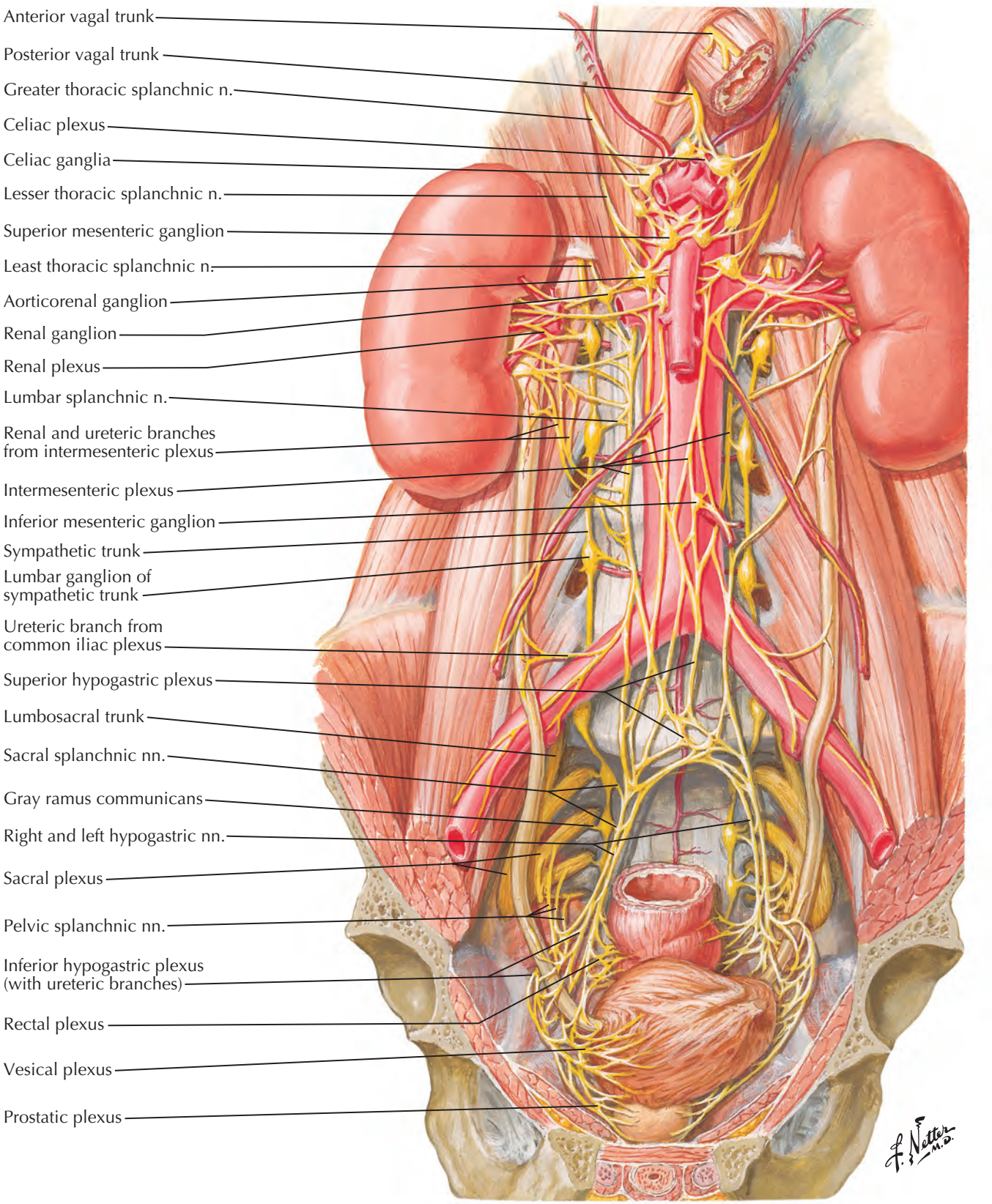
Transverse section through 2nd lumbar vertebra demonstrates horizontal disposition of renal fascia



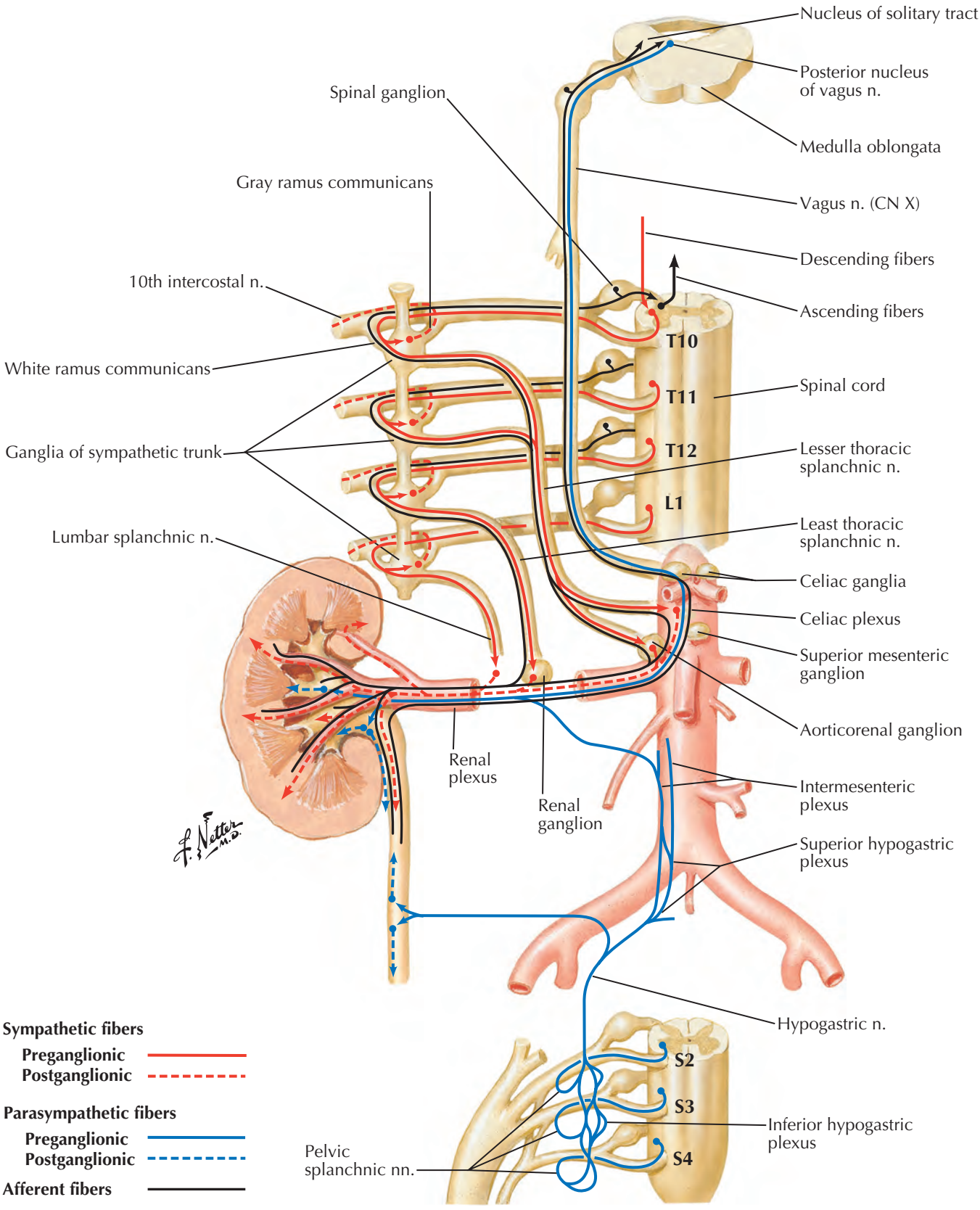
Sagittal section through right kidney and lumbar region demonstrates vertical disposition of renal fascia

See also **Plates 408, 410**

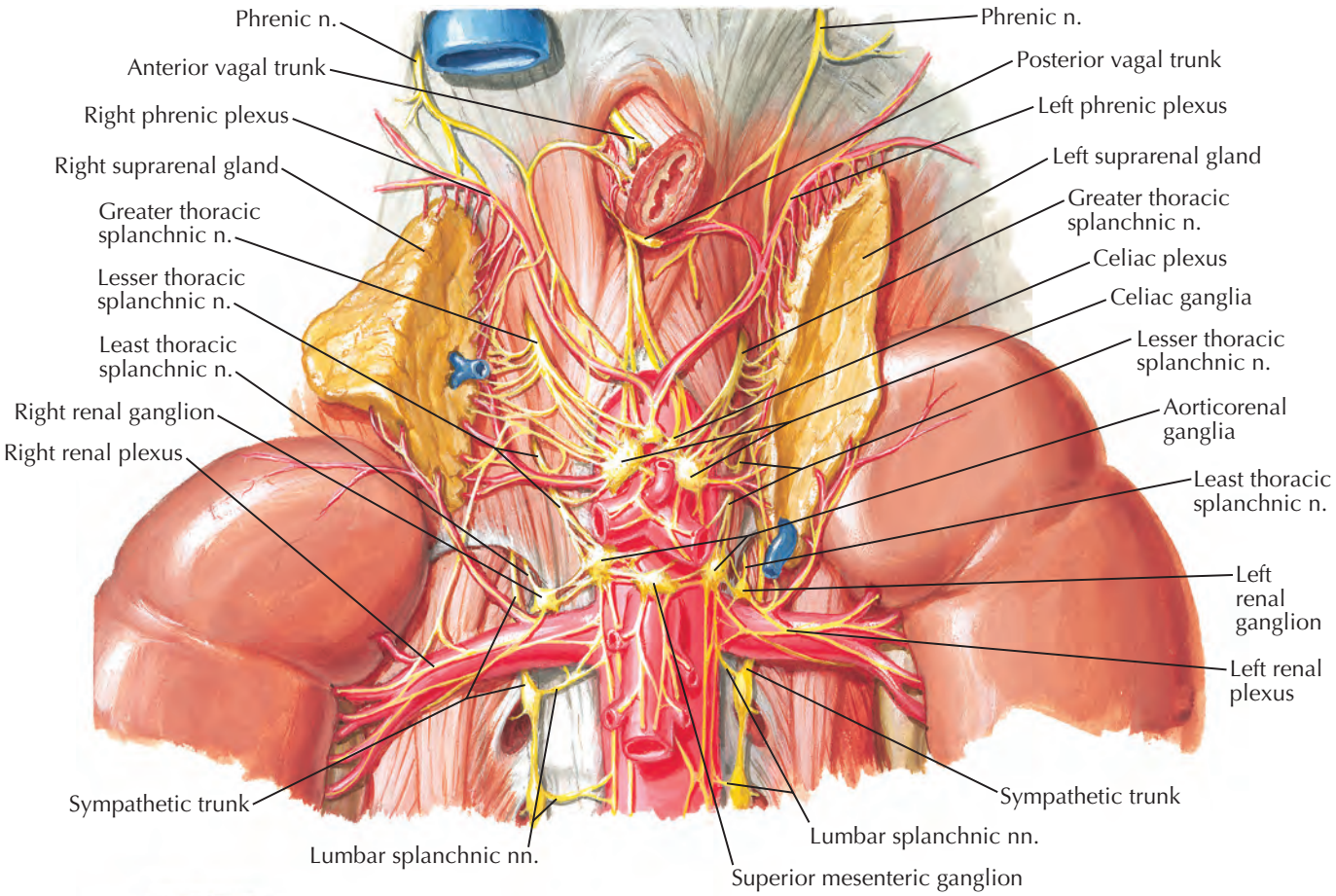


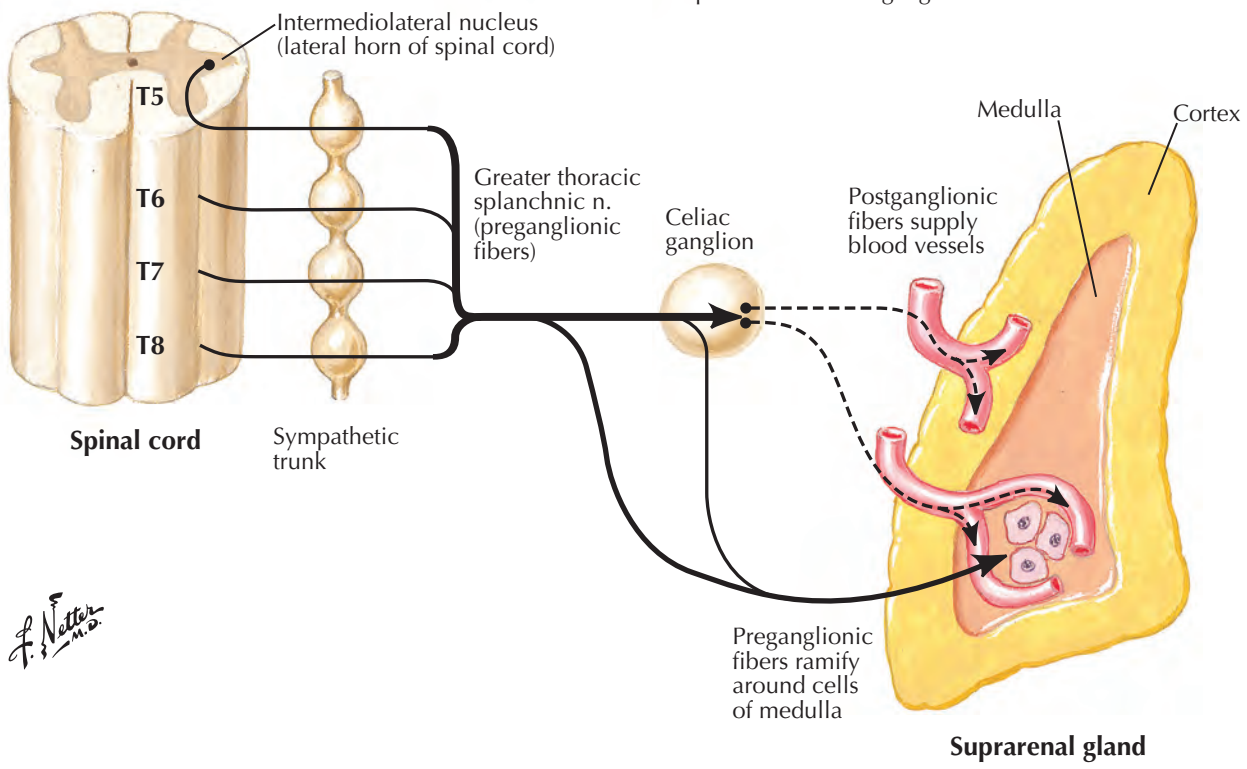

Anterior vagal trunk
Posterior vagal trunk
Greater thoracic splanchnic n.
Celiac plexus
Celiac ganglia
Lesser thoracic splanchnic n.
Superior mesenteric ganglion
Least thoracic splanchnic n.
Aorticorenal ganglion
Renal ganglion
Renal plexus
Lumbar splanchnic n.
Renal and ureteric branches from intermesenteric plexus
Intermesenteric plexus
Inferior mesenteric ganglion
Sympathetic trunk
Lumbar ganglion of sympathetic trunk
Ureteric branch from common iliac plexus
Superior hypogastric plexus
Lumbosacral trunk
Sacral splanchnic nn.
Gray ramus communicans
Right and left hypogastric nn.
Sacral plexus
Pelvic splanchnic nn.
Inferior hypogastric plexus (with ureteric branches)
Rectal plexus
Vesical plexus
Prostatic plexus

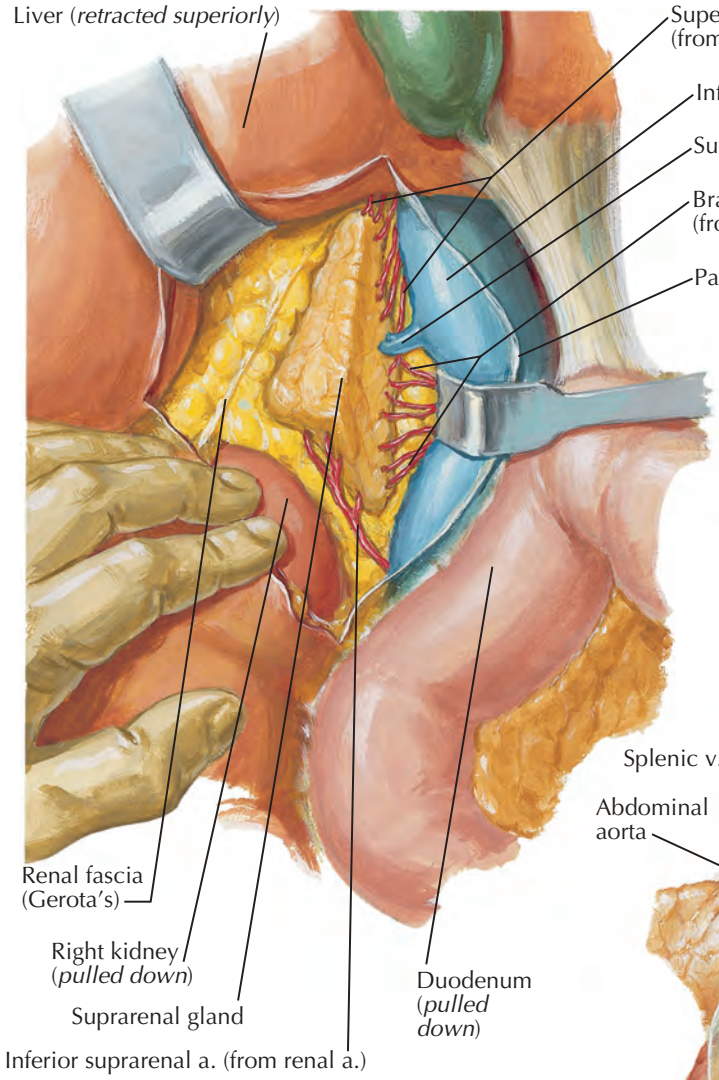
See also **Plates 6, 7, 419**



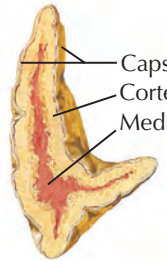
See also **Plates 6, 7, 342**



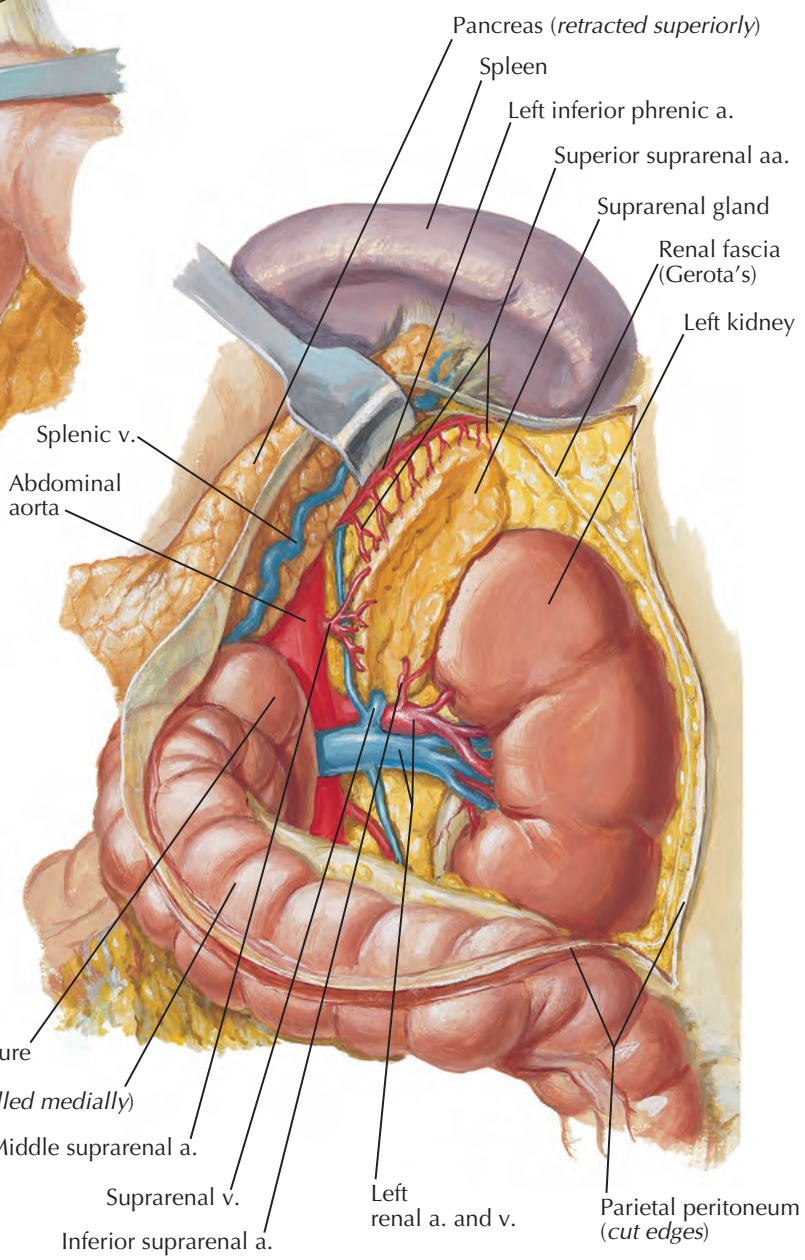




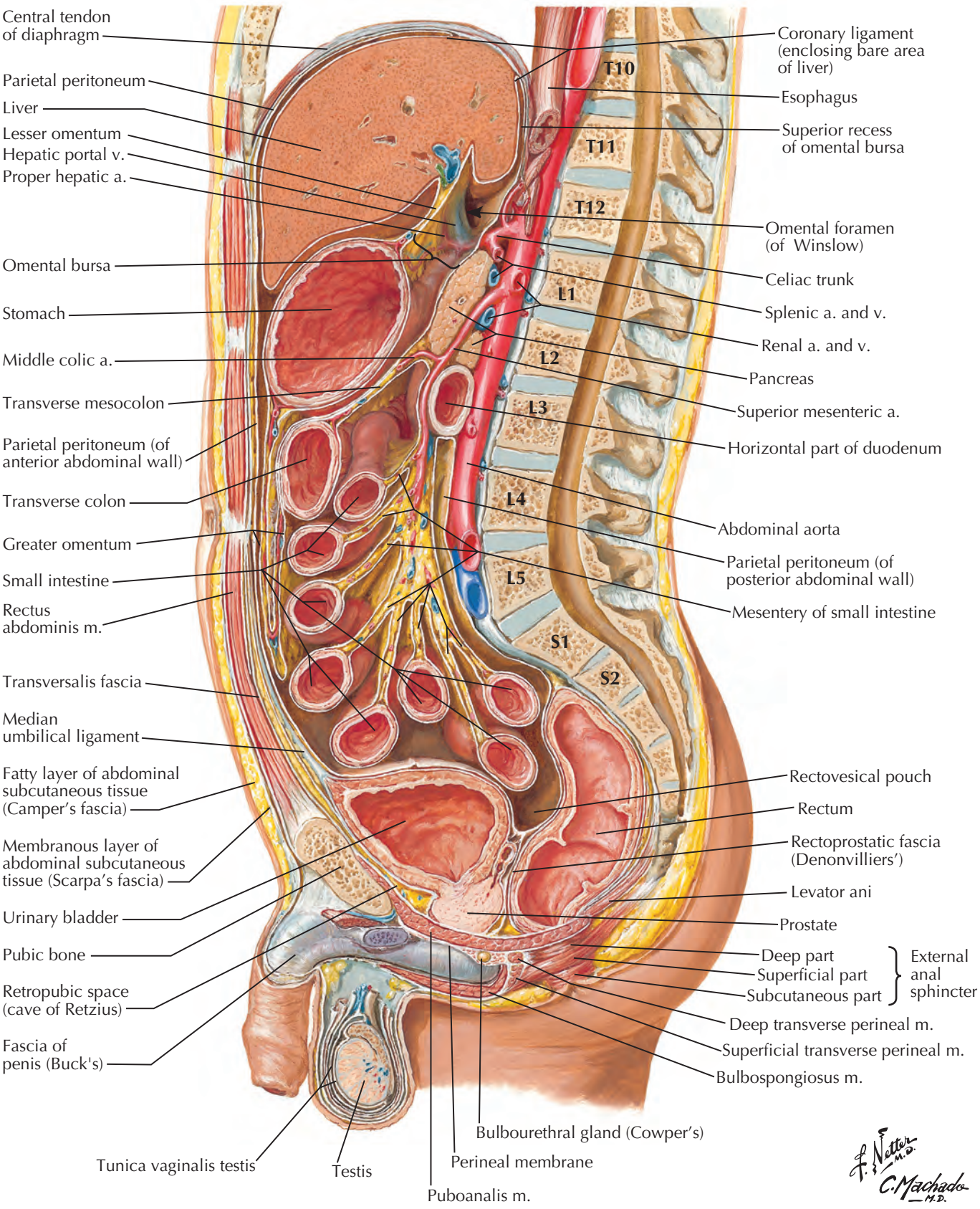
Abdominal exposure of right suprarenal gland

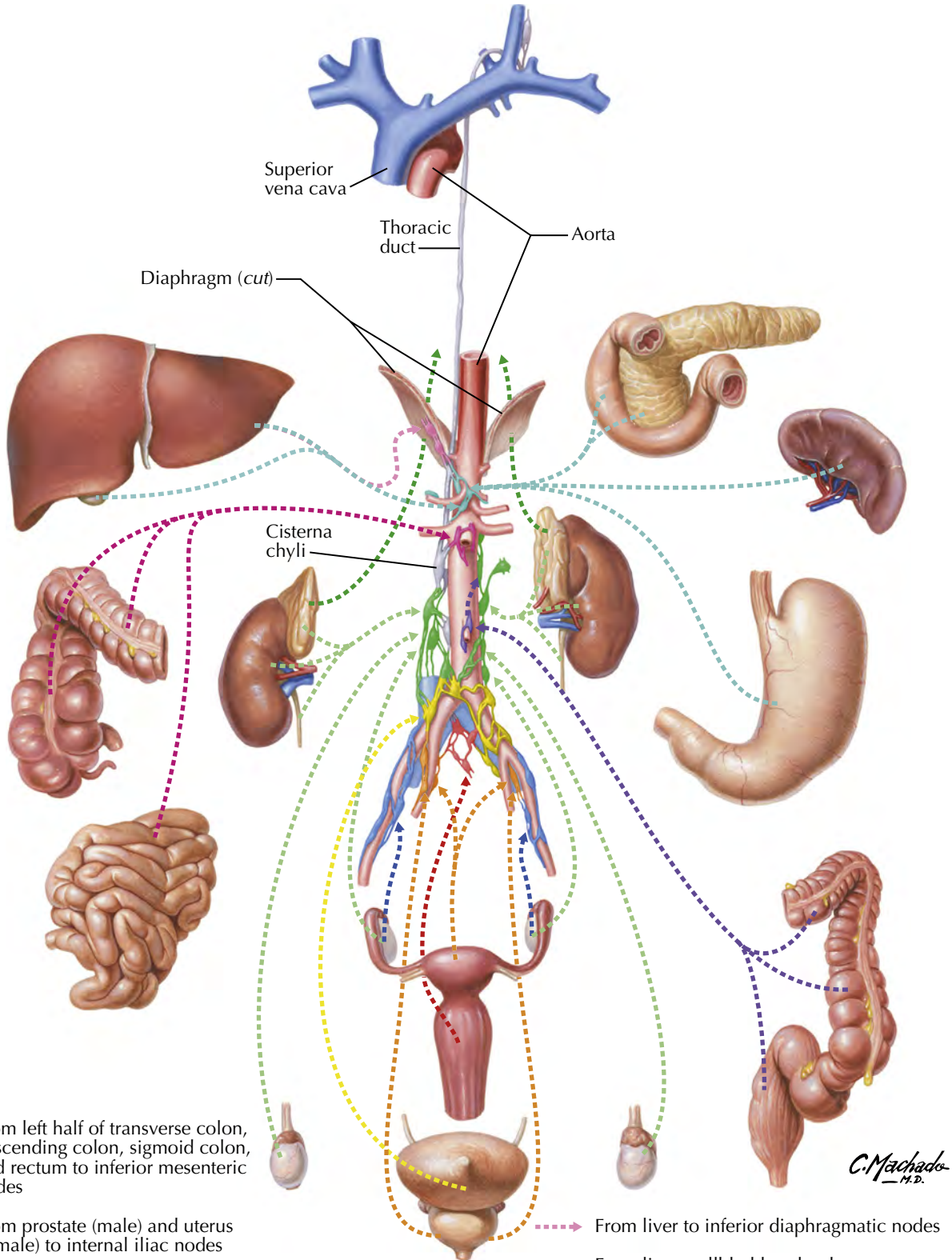


Cross section through suprarenal gland



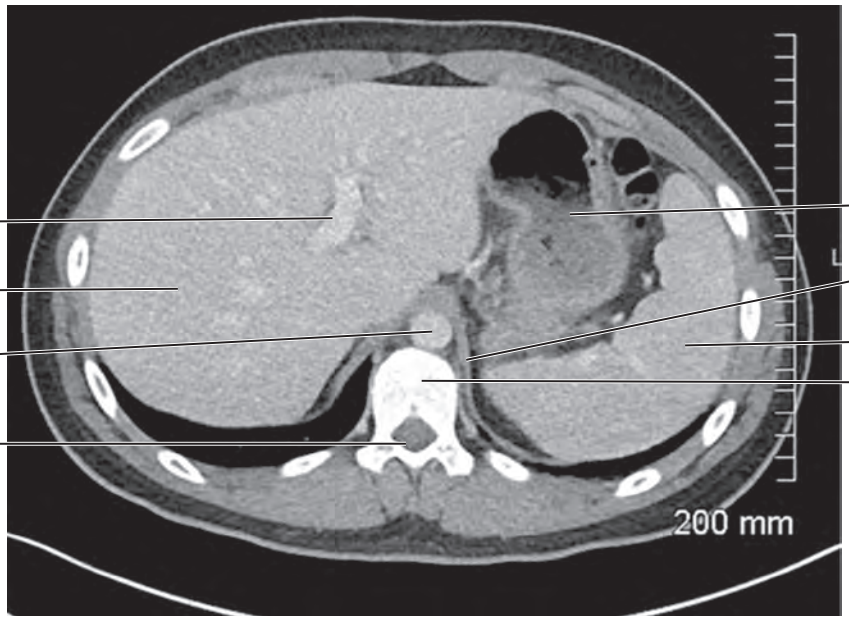
Abdominal exposure of left suprarenal gland


Central tendon of diaphragm
Parietal peritoneum
Liver
Lesser omentum
Hepatic portal v.
Proper hepatic a.
Omental bursa
Stomach
Middle colic a.
Transverse mesocolon
Parietal peritoneum (of anterior abdominal wall)
Transverse colon
Greater omentum
Small intestine
Rectus abdominis m.
Transversalis fascia
Median umbilical ligament
Fatty layer of abdominal subcutaneous tissue (Camper's fascia)
Membranous layer of abdominal subcutaneous tissue (Scarpa's fascia)
Urinary bladder
Pubic bone
Retropubic space (cave of Retzius)
Fascia of penis (Buck's)
Tunica vaginalis testis
Testis
Puboanalis m.
Perineal membrane
Bulbourethral gland (Cowper's)
Bulbospongiosus m.
Superficial transverse perineal m.
Deep transverse perineal m.
Deep part
Superficial part
Subcutaneous part
External anal sphincter
Prostate
Levator ani
Rectoprostatic fascia (Denonvilliers')
Rectum
Rectovesical pouch
Mesentery of small intestine
Parietal peritoneum (of posterior abdominal wall)
Abdominal aorta
Horizontal part of duodenum
Superior mesenteric a.
Pancreas
Renal a. and v.
Splenic a. and v.
Celiac trunk
Omental foramen (of Winslow)
Superior recess of omental bursa
Esophagus
Coronary ligament (enclosing bare area of liver)
T10
T11
T12
L1
L2
L3
L4
L5
S1
S2

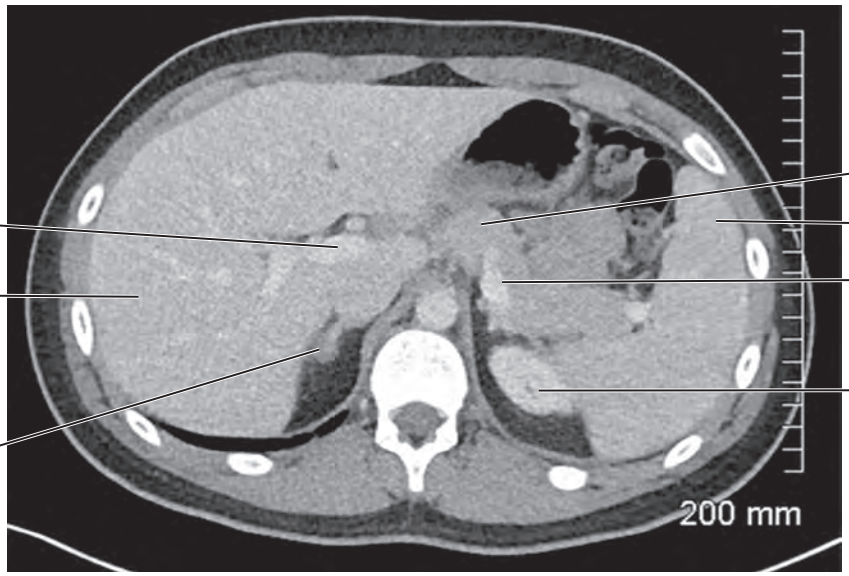


- From left half of transverse colon, descending colon, sigmoid colon, and rectum to inferior mesenteric nodes
- From prostate (male) and uterus (female) to internal iliac nodes
- From urinary bladder to common iliac nodes
- From vagina to sacral nodes
- From ovaries to external iliac nodes
- From suprarenal glands to posterior mediastinal nodes
- From liver to inferior diaphragmatic nodes
- From liver, gallbladder, duodenum, pancreas, and spleen to celiac nodes
- From jejunum, ileum, cecum, ascending colon, and right half of transverse colon to superior mesenteric nodes
- From kidneys, suprarenal glands, ureters, testes (male), and ovaries (female) to lumbar nodes

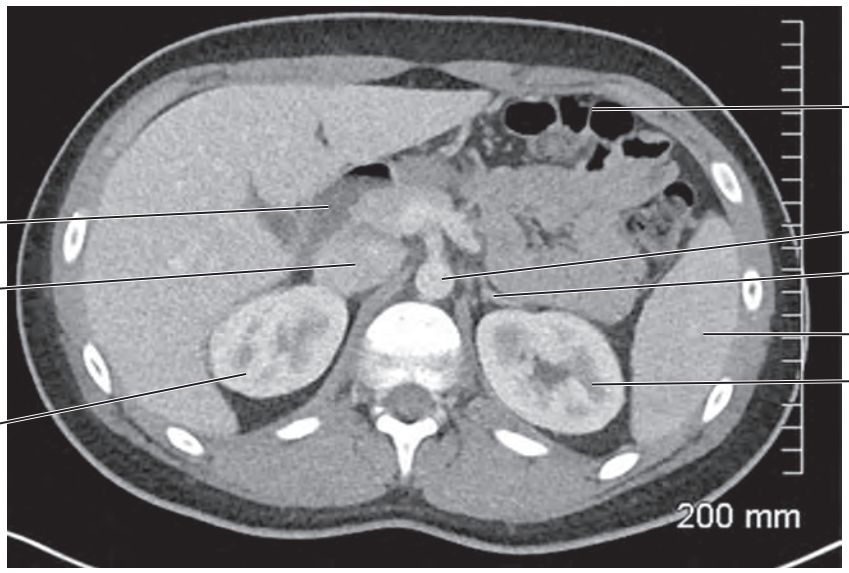
Axial CT image of abdomen with intravenous contrast enhancement



Axial CT image of upper abdomen with intravenous contrast enhancement

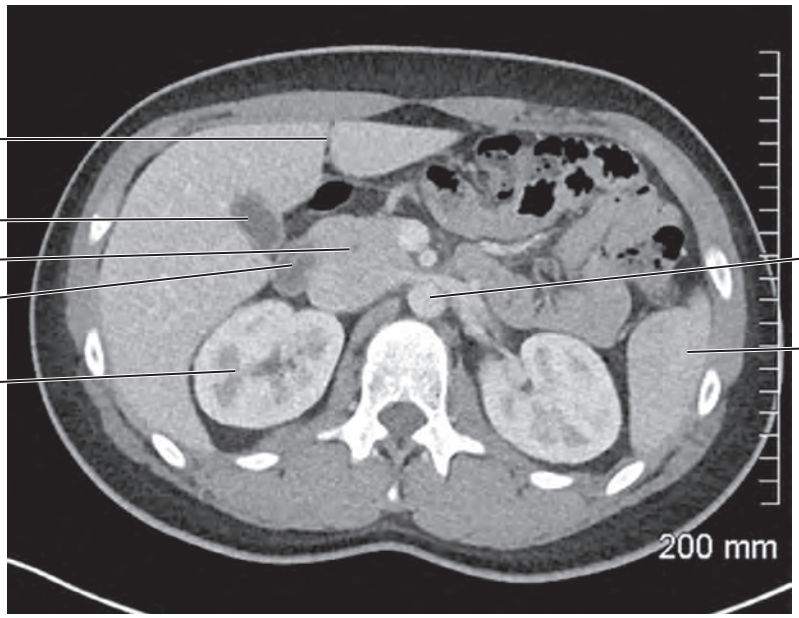


Axial CT image of midabdomen with intravenous contrast enhancement

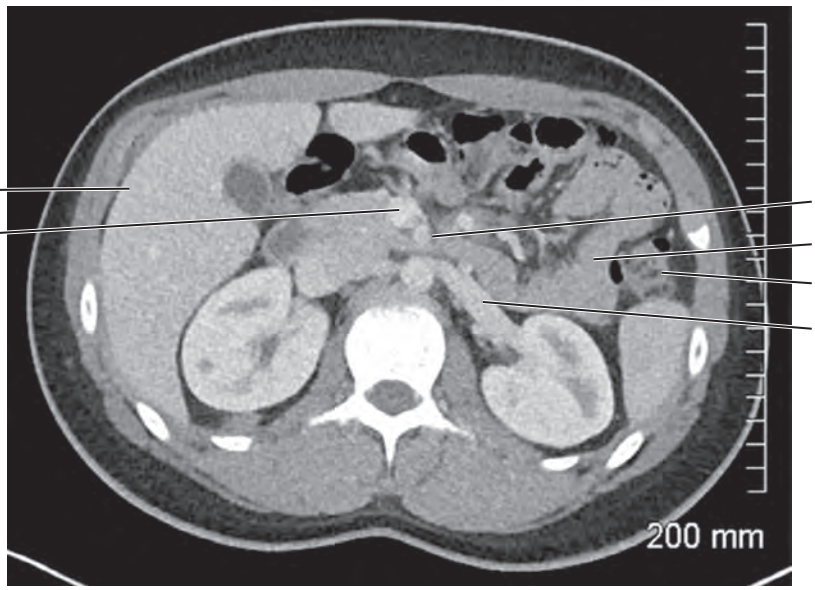


See also **Plate BP 82**

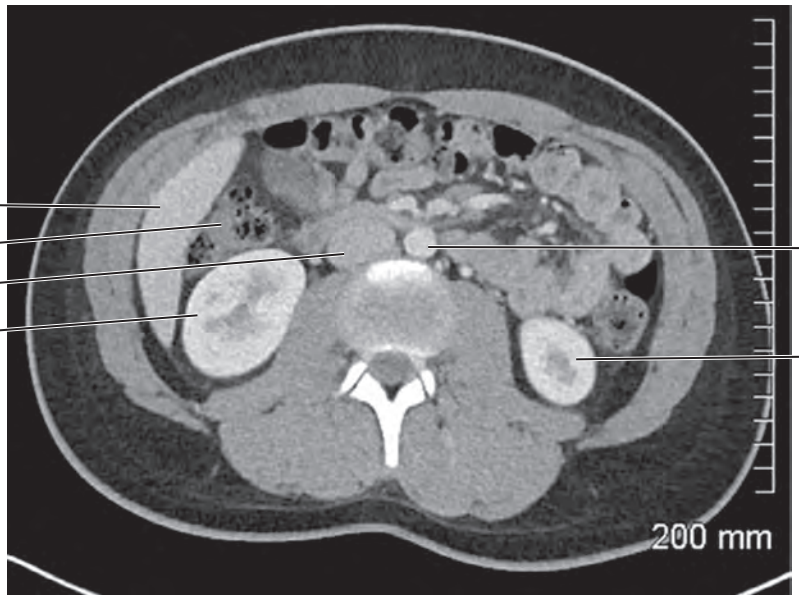
Axial CT image of midabdomen with intravenous contrast enhancement

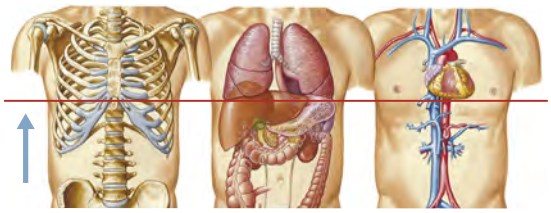


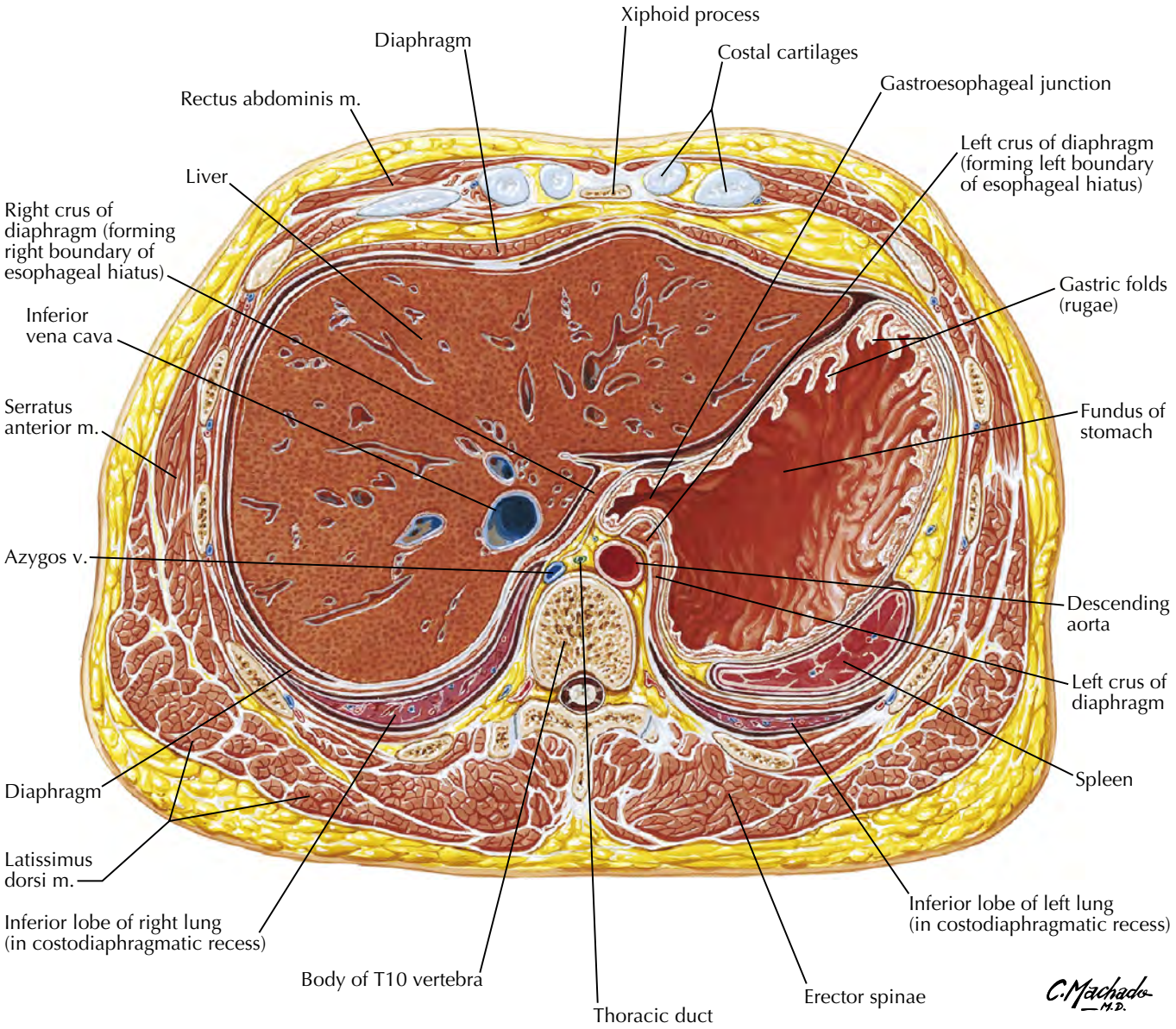
Axial CT image of abdomen with intravenous contrast enhancement



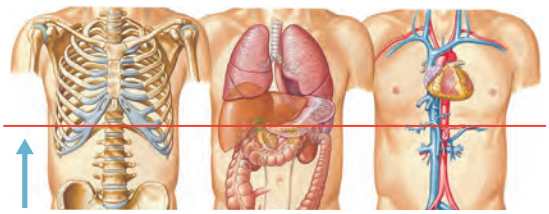
Axial CT image of abdomen with intravenous contrast enhancement

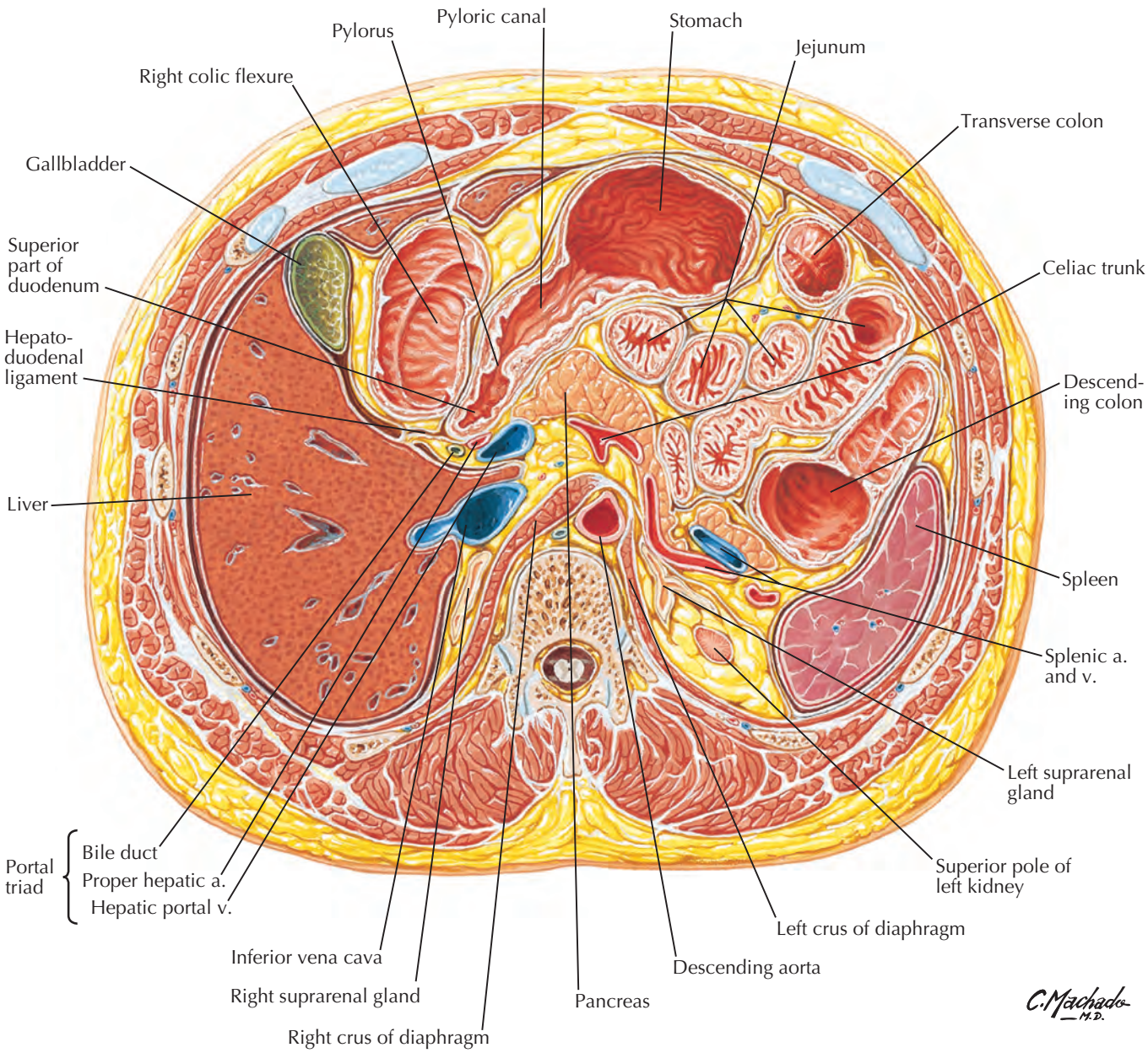




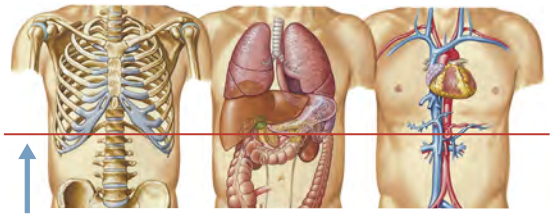

Xiphoid process
Diaphragm
Costal cartilages
Gastroesophageal junction
Rectus abdominis m.
Left crus of diaphragm (forming left boundary of esophageal hiatus)
Liver
Right crus of diaphragm (forming right boundary of esophageal hiatus)
Gastric folds (rugae)
Inferior vena cava
Serratus anterior m.
Fundus of stomach
Azygos v.
Descending aorta
Left crus of diaphragm
Spleen
Diaphragm
Latissimus dorsi m.
Inferior lobe of left lung (in costodiaphragmatic recess)
Inferior lobe of right lung (in costodiaphragmatic recess)
Body of T10 vertebra
Thoracic duct
Erector spinae
C. Machado M.D.

See also **Plate BP 79**



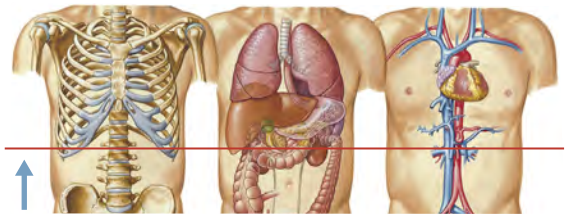


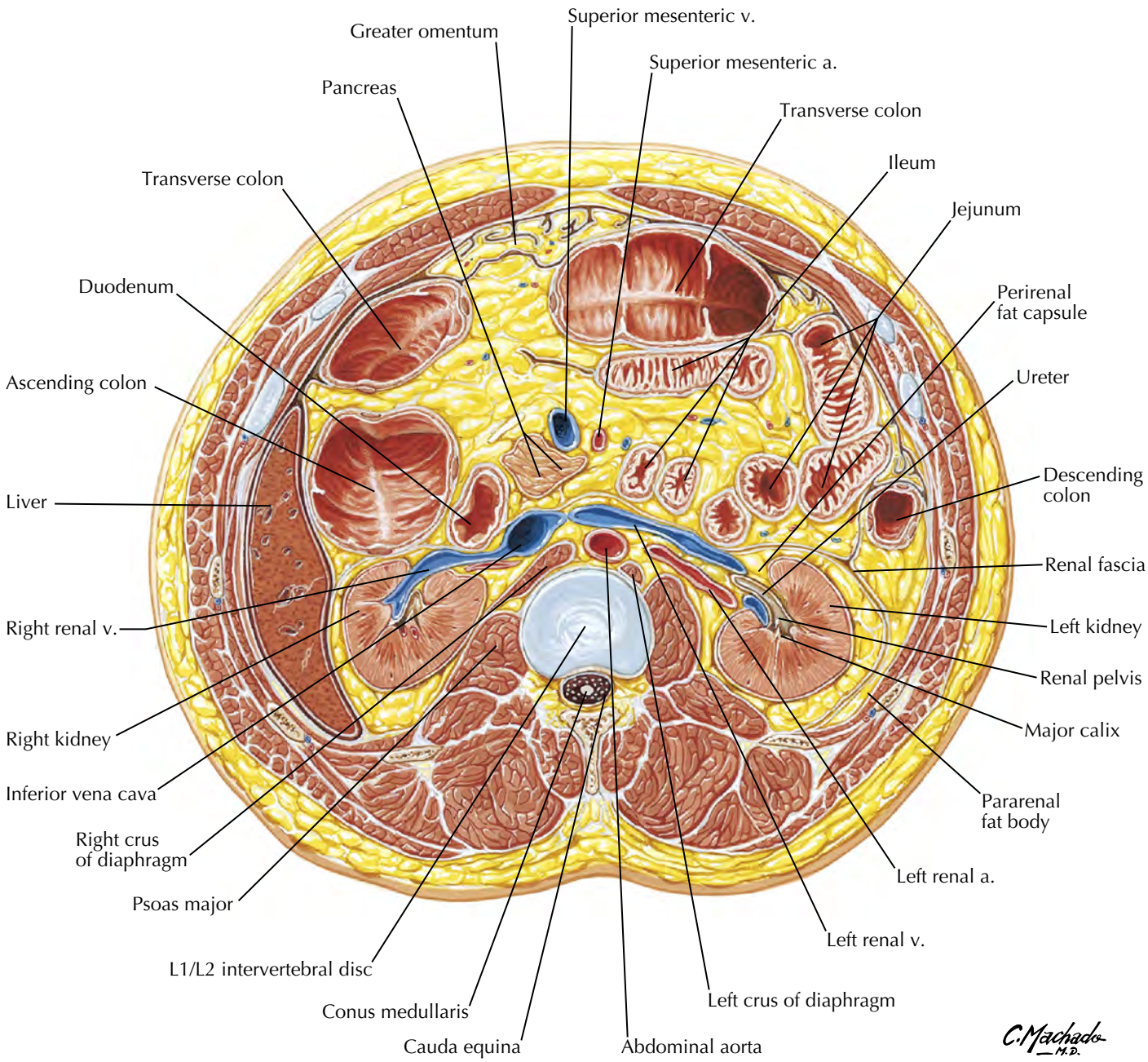
See also **Plate BP 79**

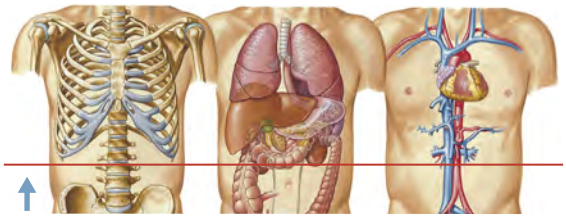


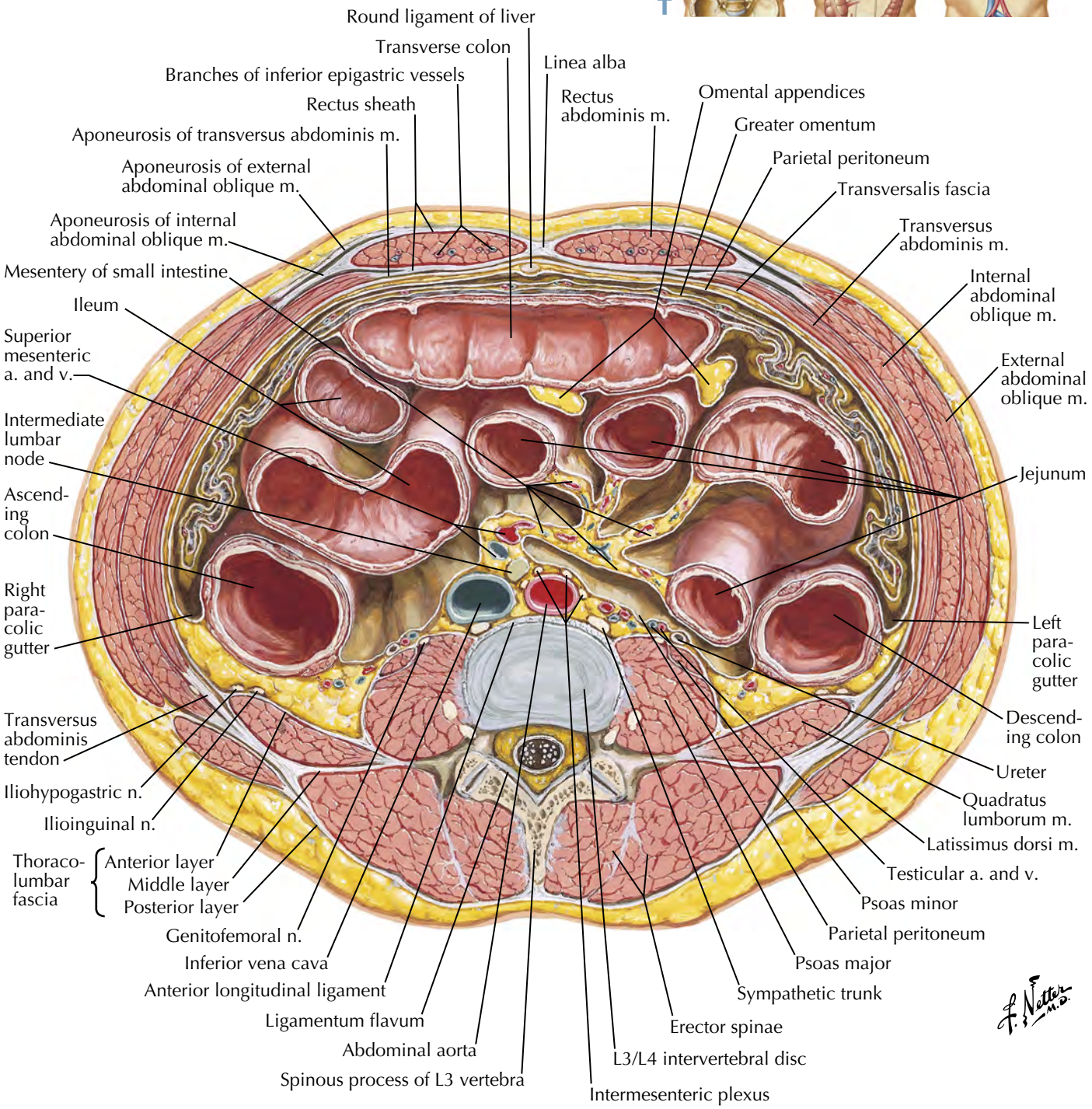
Hepatic portal v.
Celiac trunk
Splenic v.
Transverse colon
Transverse colon
Head of pancreas
Jejunum
Right colic flexure
External abdominal oblique m.
Bile duct
Descending colon
Descending part of duodenum
Left suprarenal gland
Inferior vena cava
Spleen
Right suprarenal gland
Renal cortex
Left kidney
Liver
Renal medulla
Superior pole of right kidney
Right crus of diaphragm
Left crus of diaphragm
T1/L1 intervertebral disc
Abdominal aorta

C. Machado M.D.




Greater omentum
Superior mesenteric v.
Superior mesenteric a.
Pancreas
Transverse colon
Ileum
Transverse colon
Jejunum
Duodenum
Perirenal fat capsule
Ascending colon
Ureter
Liver
Descending colon
Renal fascia
Right renal v.
Left kidney
Renal pelvis
Right kidney
Major calix
Inferior vena cava
Pararenal fat body
Right crus of diaphragm
Left renal a.
Psoas major
Left renal v.
L1/L2 intervertebral disc
Left crus of diaphragm
Conus medullaris
Cauda equina
Abdominal aorta
C. Machado M.D.




Round ligament of liver
Transverse colon
Linea alba
Branches of inferior epigastric vessels
Rectus sheath
Rectus abdominis m.
Omental appendices
Greater omentum
Aponeurosis of transversus abdominis m.
Parietal peritoneum
Aponeurosis of external abdominal oblique m.
Transversalis fascia
Aponeurosis of internal abdominal oblique m.
Transversus abdominis m.
Mesentery of small intestine
Internal abdominal oblique m.
Ileum
Superior mesenteric a. and v.
External abdominal oblique m.
Intermediate lumbar node
Jejunum
Ascending colon
Right paracolic gutter
Left paracolic gutter
Descending colon
Transversus abdominis tendon
Ureter
Iliohypogastric n.
Quadratus lumborum m.
Ilioinguinal n.
Latissimus dorsi m.
Thoracolumbar fascia
Anterior layer
Middle layer
Posterior layer
Testicular a. and v.
Psoas minor
Genitofemoral n.
Parietal peritoneum
Inferior vena cava
Psoas major
Anterior longitudinal ligament
Sympathetic trunk
Ligamentum flavum
Erector spinae
Abdominal aorta
L3/L4 intervertebral disc
Spinous process of L3 vertebra
Intermesenteric plexus

ANATOMICAL STRUCTURE	CLINICAL COMMENT	PLATE NUMBERS
Nervous System and Sense Organs		
Ilioinguinal and genitofemoral nerves	Mediate cremasteric reflex; femoral branch of genitofemoral nerve provides cutaneous innervation to skin over femoral triangle	287
Intercostal, subcostal, and iliohypogastric nerves	Convey well-localized pain sensations from abdominal wall and parietal peritoneum; pain in dermatomal distribution indicates problem with spinal nerves (e.g., herpes zoster infection)	278
Celiac ganglion	Some patients with medically intractable pain from chronic pancreatitis or advanced pancreatic malignancy undergo celiac ganglion block; located typically at upper or lower L1 vertebral level	320, 329
Thoracic and lumbar splanchnic nerves (sympathetic)	Convey pain sensations from abdominal viscera that are often referred to other sites; quadrant in which pain is located and site of radiation provide clues to source of pain	324, 325
Iliohypogastric nerve	Nephrectomy through quadratus lumborum muscle can damage iliohypogastric nerve, with resultant anesthesia superior to the pubic symphysis	331
Skeletal System		
Xiphoid process and pubic symphysis	Palpable landmarks used to locate transpyloric plane (of Addison; L1 plane), located halfway between these structures; plane may contain pylorus of stomach, horizontal portion of duodenum, head and neck of pancreas, superior mesenteric artery, and hilum of spleen	267
Anterior superior iliac spine (ASIS)	Palpable landmark used to locate McBurney's point; tenderness over McBurney's point is indication of appendicitis	268, 300
Muscular System		
Linea alba	Site used for abdominal wall incisions because this location provides access to many organs during exploratory surgery and is unlikely to have significant vessels crossing it	267, 272
Inguinal ligament	Surface landmark from ASIS to pubic tubercle that marks division between abdomen and lower limb; formed from external abdominal oblique aponeurosis	267, 271
Inguinal (Hesselbach's) triangle	Important region on interior surface of anterior abdominal wall, bounded by inferior epigastric vessels, inguinal ligament, and rectus abdominis muscle, through which abdominal contents may herniate to produce direct inguinal hernias	274, 280
Deep inguinal ring	Slit-like opening in transversalis fascia just above midpoint of inguinal ligament and lateral to inferior epigastric artery, through which abdominal contents may herniate to produce indirect inguinal hernias	280, 281
Superficial inguinal ring	Triangular opening in external abdominal oblique aponeurosis superior and lateral to pubic tubercle and medial to inferior epigastric artery, through which abdominal contents may herniate to produce indirect inguinal hernias	270, 280, 281
Femoral ring	Superior opening of femoral canal bounded by medial part of inguinal ligament, femoral vein, and lacunar ligament; abdominal contents may herniate through femoral ring into upper femoral triangle situated inferolateral to pubic tubercle, producing femoral hernia	282
Esophageal hiatus	Widening of opening through diaphragm allows stomach to protrude into mediastinum, which can increase incidence of gastroesophageal reflux disease (GERD)	287, 289
Rectus abdominis muscle	Separation (abdominal diastasis) commonly caused from multiple pregnancies, abdominal surgeries, and excessive weight gain; bleeding of inferior epigastric artery may cause blood to accumulate in rectus abdominis muscle (rectus sheath hematoma), which may be mistaken for acute abdominal pathologies, such as appendicitis	271
Cardiovascular System		
Paraumbilical veins	May become dilated in patients with portal hypertension and in late-term pregnancy	277, 318

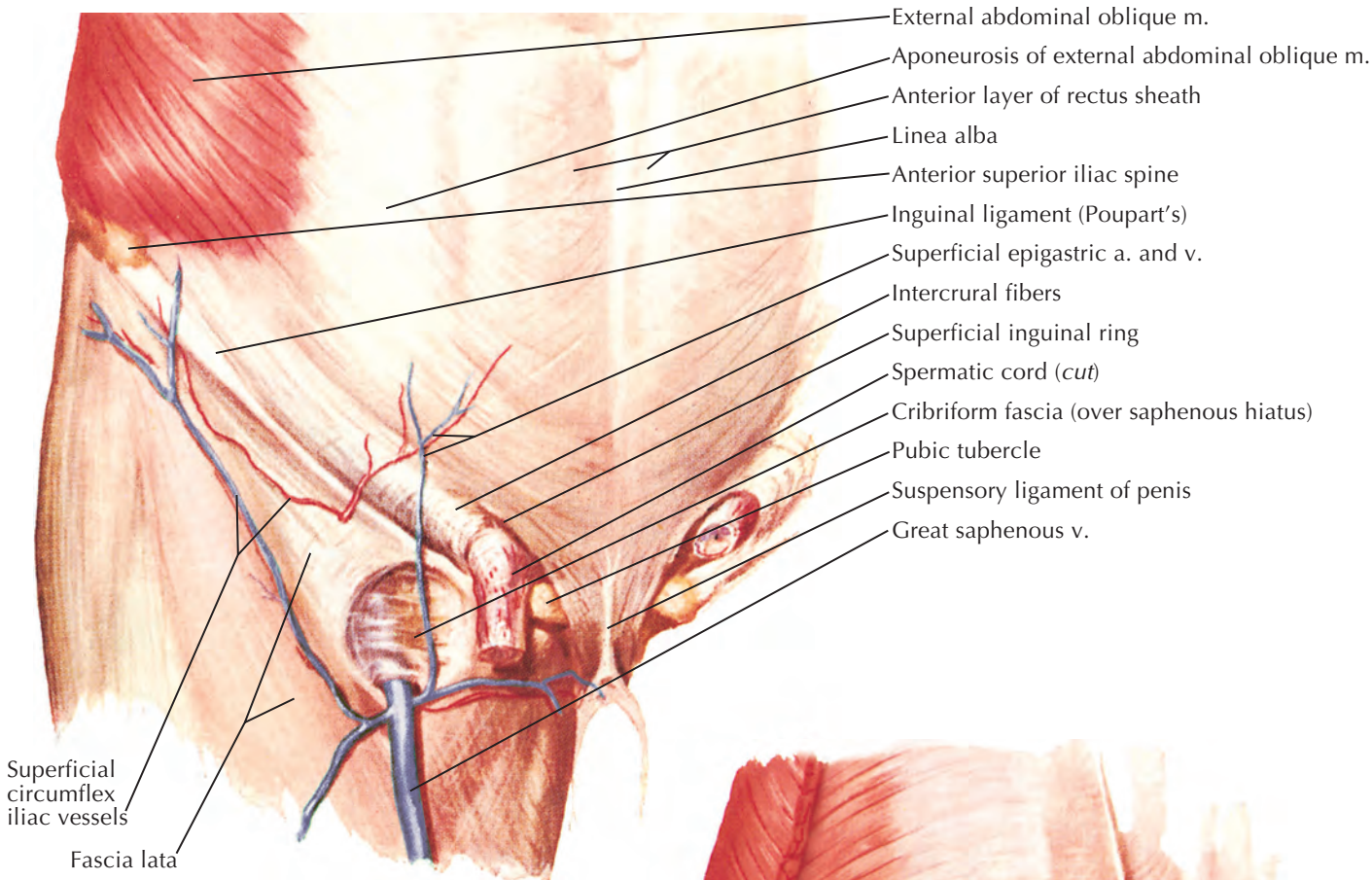
ANATOMICAL STRUCTURE	CLINICAL COMMENT	PLATE NUMBERS
Cardiovascular System—Continued		
Cystic artery	Ligated during cholecystectomy; can have multiple origins; found classically in cystohepatic triangle (of Calot)	310
Superior mesenteric artery	May compress horizontal (third) part of duodenum in thin patient or patient who has recently lost a large amount of weight; can shear or tear in sudden deceleration injuries	310, 313
Intestinal arteries	Areas without significant collateral circulation between major vessels (watershed areas) are at risk for ischemia, which can occur secondary to atherosclerosis or thromboembolism of mesenteric arteries	313, 314
Marginal artery anastomosis	Marginal artery connects right, middle, and left colic arteries, providing important anastomosis for collateral circulation	314
Esophageal veins	May become dilated in portal hypertension, resulting in esophageal varices; variceal hemorrhage can be life-threatening and often requires emergent endoscopic intervention	315, 318
Hepatic portal vein	Increased resistance to blood flow through liver (e.g., due to cirrhosis) may produce portal hypertension and dilation of tributaries of hepatic portal vein; blood may return to heart at sites of portosystemic anastomosis	317, 318
Superior anorectal (rectal) vein	Anastomoses with systemic middle and inferior anorectal veins may become dilated in portal hypertension	317, 318
Abdominal aorta	Common site for aneurysm in abdomen, especially inferior to renal arteries; assessed routinely with ultrasound to exclude aneurysms	336
Renal artery	Stenosis may occur secondary to atherosclerosis or fibromuscular dysplasia, resulting in difficult-to-control hypertension; can be affected in abdominal aortic aneurysms	334, 336
Lymph Vessels and Lymphoid Organs		
Spleen	May be ruptured by fracture of ribs 10 to 12; enlargement (splenomegaly) may occur in cirrhosis, viral infections, and hematologic malignancies; if palpable, the spleen is enlarged	291, 307
Digestive System		
Liver	Palpable inferior to right costal margin; hepatomegaly may occur in conditions such as hepatitis, heart failure, and infiltrative diseases; shrunken, nodular appearance of liver on imaging indicates cirrhosis; common site of metastasis	269, 288, 294
Gastroesophageal junction	Transient relaxations or decreased tone of lower esophageal sphincter can cause gastroesophageal reflux disease (GERD), a common cause of epigastric pain; common site of esophageal cancer	257, 295, 347
Stomach and duodenum	Primary sites of peptic ulcers; nonsteroidal anti-inflammatory drug (NSAID) overuse and/or *Helicobacter pylori* infection may cause ulceration	292, 294, 295
Pylorus	Infantile hypertrophic pyloric stenosis causes postprandial projectile vomiting among newborns	295
Major duodenal papilla (of Vater)	Catheterized and injected with contrast during endoscopic retrograde cholangiopancreatography (ERCP), a common diagnostic procedure; sphincter of hepatopancreatic ampulla (sphincter of Oddi) dysfunction may obstruct biliary flow through major duodenal papilla, resulting in right upper quadrant pain	297, 305
Vermiform appendix	Prone to inflammation and rupture (appendicitis); may have retrocecal position, in which case appendicitis causes inflammation of adjacent psoas fascia and atypical location of pain	298, 300
Colon	Common site of diverticula and malignancies; colonoscopy is performed to screen for colon cancer	301

ANATOMICAL STRUCTURE	CLINICAL COMMENT	PLATE NUMBERS
Gallbladder	May become inflamed (cholecystitis) and cause pain secondary to gallstones blocking cystic duct	302, 305, 308, 328
Bile duct	Gallstones may become impacted in bile duct (choledocholithiasis), resulting in hepatitis and jaundice; some cases may be complicated by pancreatitis and/or infection of obstructed biliary ducts (cholangitis); small stones can be problematic, whereas large stones usually remain in gallbladder and are more typically asymptomatic; ERCP is performed to locate and relieve obstruction	302, 303, 305
Umbilicus	Remnant of umbilical cord insertion into fetal umbilical vessels; landmark for locating trans-umbilical plane, which is used to divide abdomen into quadrants; marks position of T10 dermatome; used to locate McBurney's point; common site for hernias in abdominal wall	267, 269
Pancreas	Lies primarily retroperitoneal and deep to stomach; thus, inflamed pancreas may be compressed by stomach and cause intense pain referred to the back; inflamed pancreas, most often caused by biliary obstruction or alcohol abuse, may cause severe life-threatening complications; cancer of head/neck of pancreas can compress biliary tree	292, 306, 329
Urinary System		
Kidney	Right kidney is lower or more inferior than left kidney due to position inferior to liver; renal arteries are generally located at L2 vertebral level and may be involved in abdominal aortic aneurysms; renal calculi (kidney stones) cause significant pain when impacted in ureter	333
Renal pelvis	May become dilated secondary to ureteral or urinary bladder outlet obstruction, a condition known as hydronephrosis, which is readily visualized using ultrasound	333
Endocrine System		
Suprarenal gland	Produces hormones in its cortex (e.g., cortisol, aldosterone) and medulla (e.g., epinephrine, norepinephrine); small masses are frequently incidentally discovered on axial abdominal imaging; need for further workup depends in part on size	330

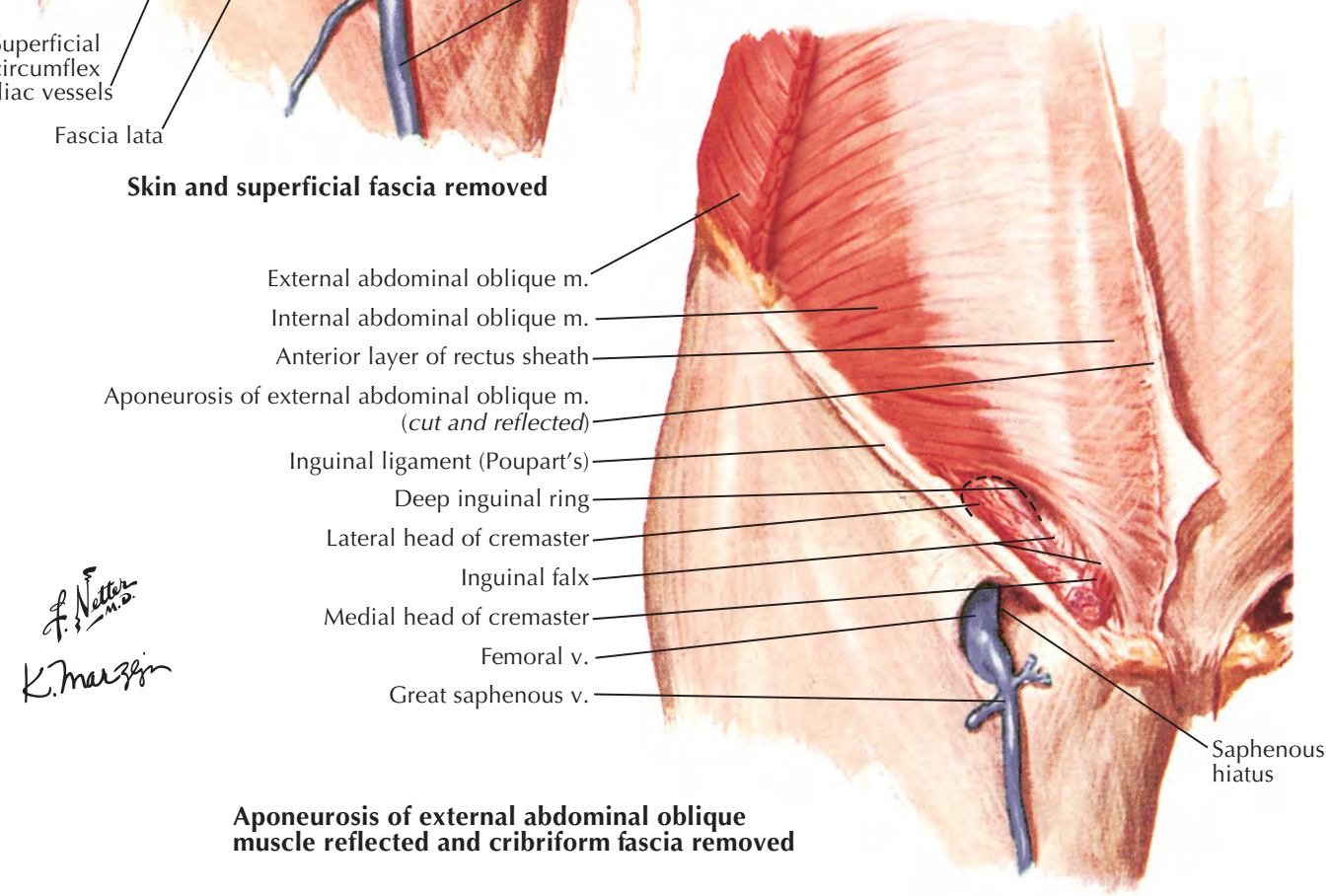
*Selections were based largely on clinical data and commonly discussed clinical correlations in macroscopic ("gross") anatomy courses.

MUSCLE	MUSCLE GROUP	ORIGIN ATTACHMENT	INSERTION ATTACHMENT	INNERVATION	BLOOD SUPPLY	MAIN ACTIONS
External abdominal oblique m.	Anterior abdominal wall	External surfaces of ribs 5–12	Linea alba, pubic tubercle, anterior half of iliac crest	Anterior rami of T7–T12 spinal nerves	Superior and inferior epigastric, and lumbar arteries	Compresses and supports abdominal viscera, flexes and rotates trunk
Internal abdominal oblique m.	Anterior abdominal wall	Thoracolumbar fascia, anterior two-thirds of iliac crest	Inferior borders of ribs 10–12, linea alba (via rectus sheath), pubic crest and pecten pubis (via conjoint tendon)	Anterior rami of T7–L1 spinal nerves	Superior and inferior epigastric, deep circumflex iliac, and lumbar arteries	Compresses and supports abdominal viscera, flexes and rotates trunk
Pyramidalis m.	Anterior abdominal wall	Body of pubis and pubic symphysis (anterior to rectus abdominis)	Linea alba (inferior to umbilicus)	Anterior ramus of T12 spinal nerve via subcostal or iliohypogastric nerves	Inferior epigastric artery	Tenses linea alba
Quadratus lumborum m.	Posterior abdominal wall	Medial half of inferior border of 12th rib, tips of transverse processes of L1–L4 vertebrae	Internal lip of iliac crest, iliolumbar ligament	Anterior rami of T12–L1 spinal nerves	Iliolumbar artery	Extends and laterally flexes vertebral column, fixes 12th rib during inspiration
Rectus abdominis m.	Anterior abdominal wall	Pubic crest, pubic symphysis	Costal cartilages 5–7, xiphoid process	Anterior rami of T7–T12 spinal nerves	Superior and inferior epigastric arteries	Flexes trunk, compresses abdominal viscera
Transversus abdominis m.	Anterior abdominal wall	Internal surfaces of costal cartilages 7–12, thoracolumbar fascia, iliac crest	Linea alba (via rectus sheath), pubic crest and pecten pubis (via conjoint tendon)	Anterior rami of T7–L1 spinal nerves	Deep circumflex iliac, inferior epigastric, and lumbar arteries	Compresses and supports abdominal viscera

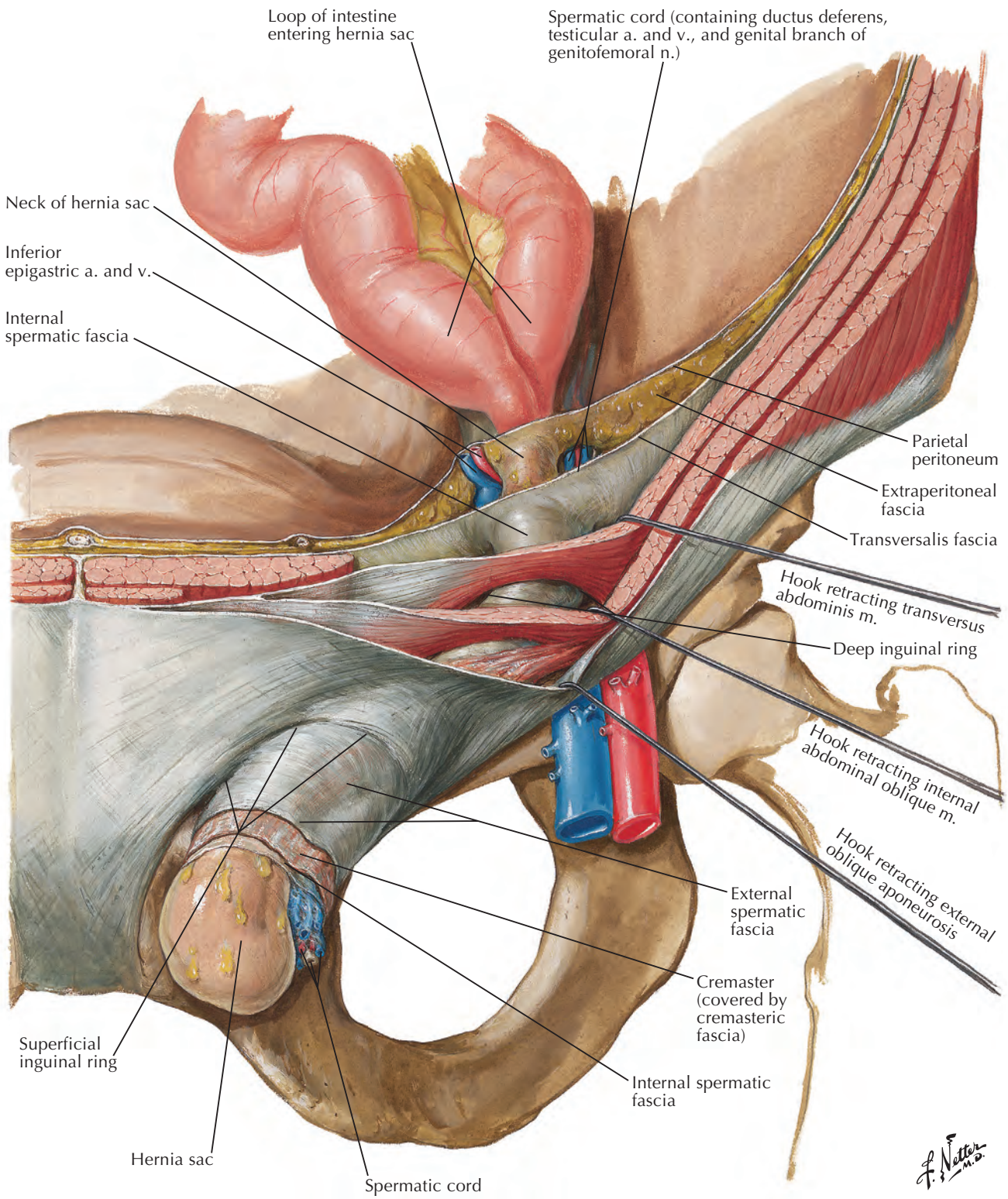
Variations in spinal nerve contributions to the innervation of muscles, their arterial supply, their attachments, and their actions are common themes in human anatomy. Therefore, expect differences between texts and realize that anatomical variation is normal.



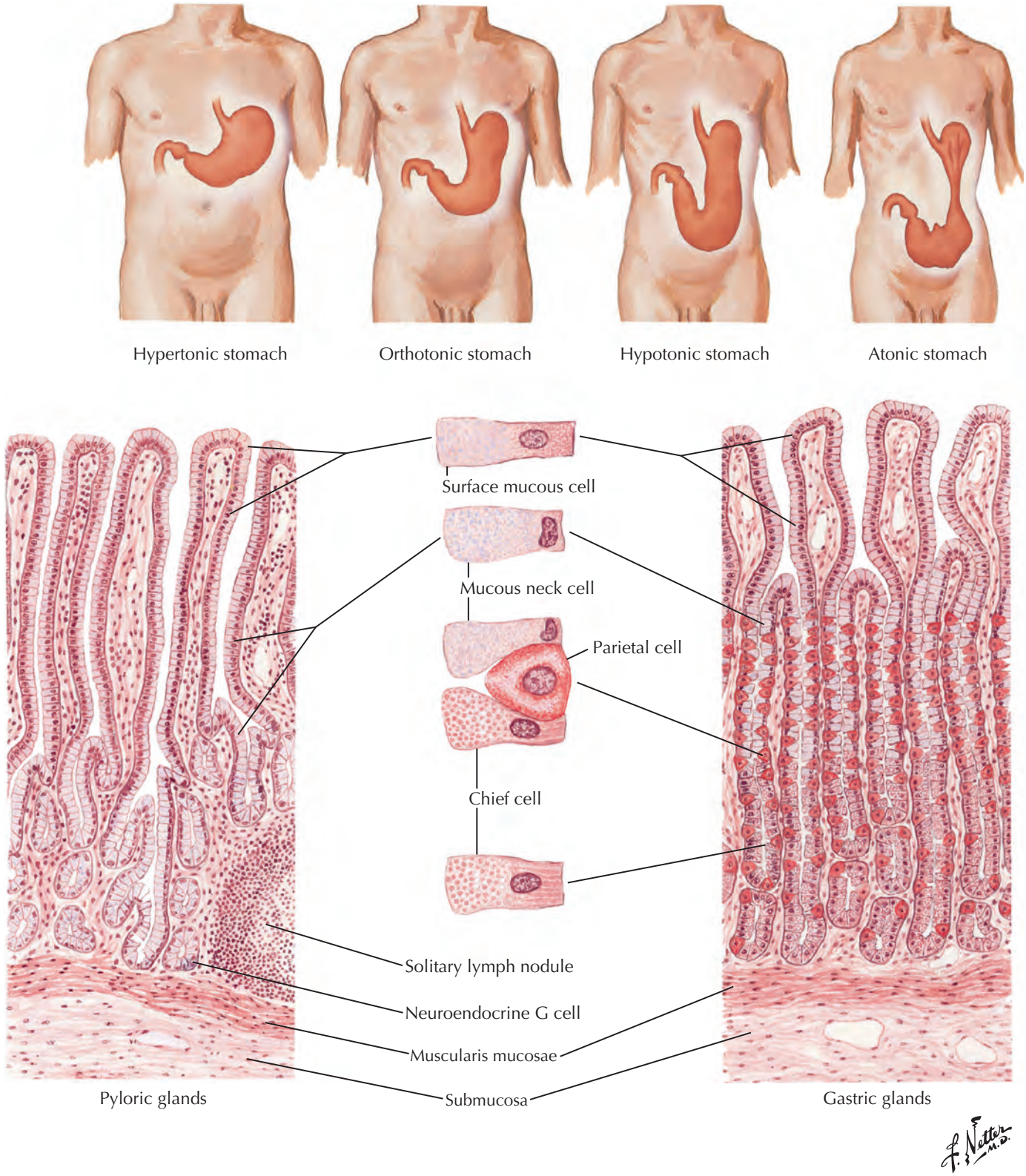
Skin and superficial fascia removed

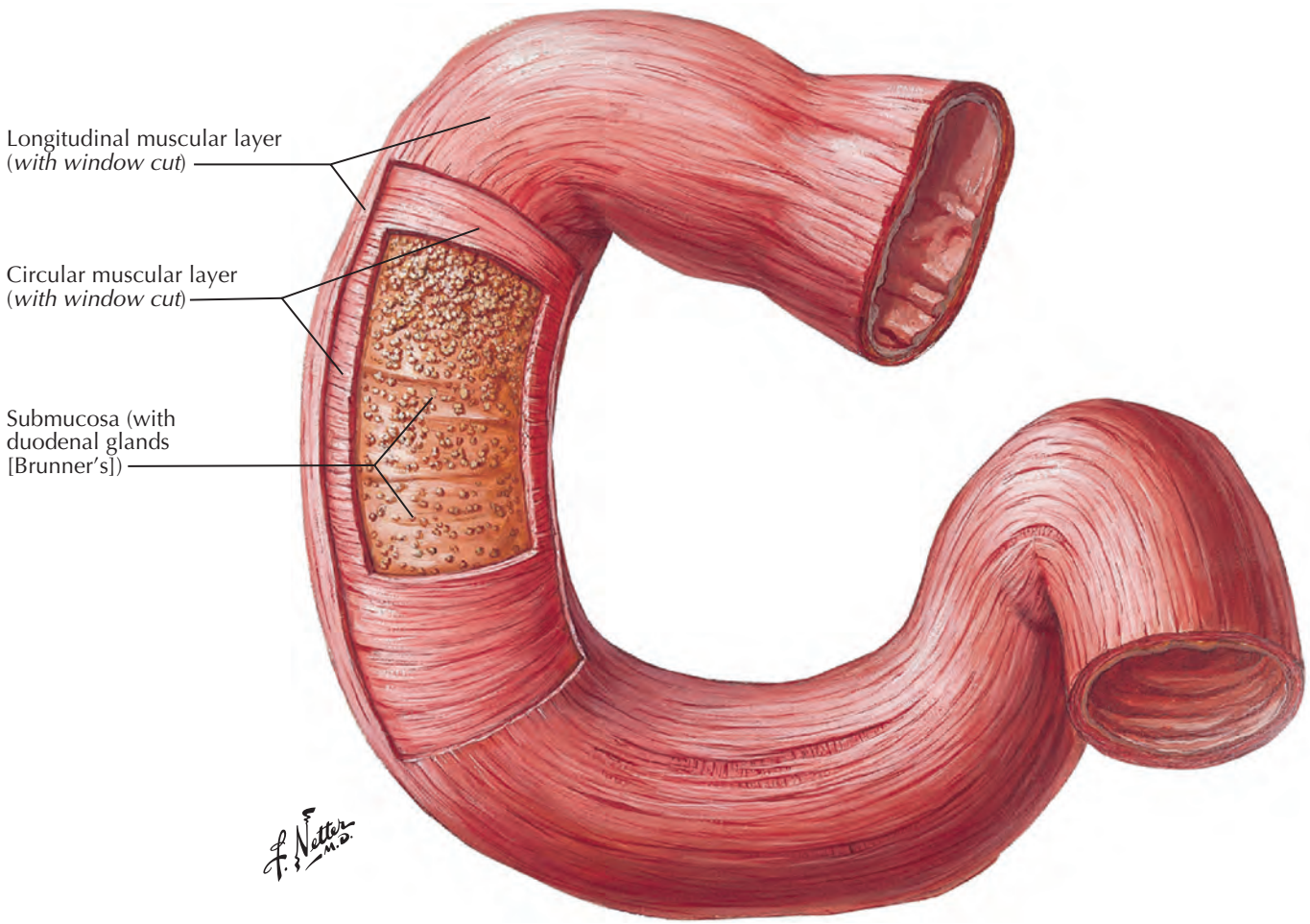


Aponeurosis of external abdominal oblique muscle reflected and cribriform fascia removed


Loop of intestine entering hernia sac
Spermatic cord (containing ductus deferens, testicular a. and v., and genital branch of genitofemoral n.)
Neck of hernia sac
Inferior epigastric a. and v.
Internal spermatic fascia
Parietal peritoneum
Extraperitoneal fascia
Transversalis fascia
Hook retracting transversus abdominis m.
Deep inguinal ring
Hook retracting internal abdominal oblique m.
Hook retracting external oblique aponeurosis
External spermatic fascia
Cremaster (covered by cremasteric fascia)
Internal spermatic fascia
Superficial inguinal ring
Hernia sac
Spermatic cord

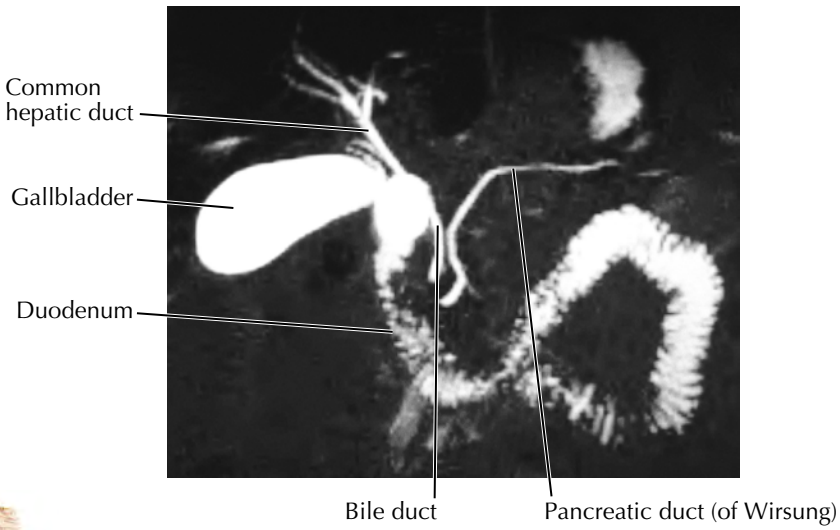
Variations in position and contour of stomach in relation to body habitus

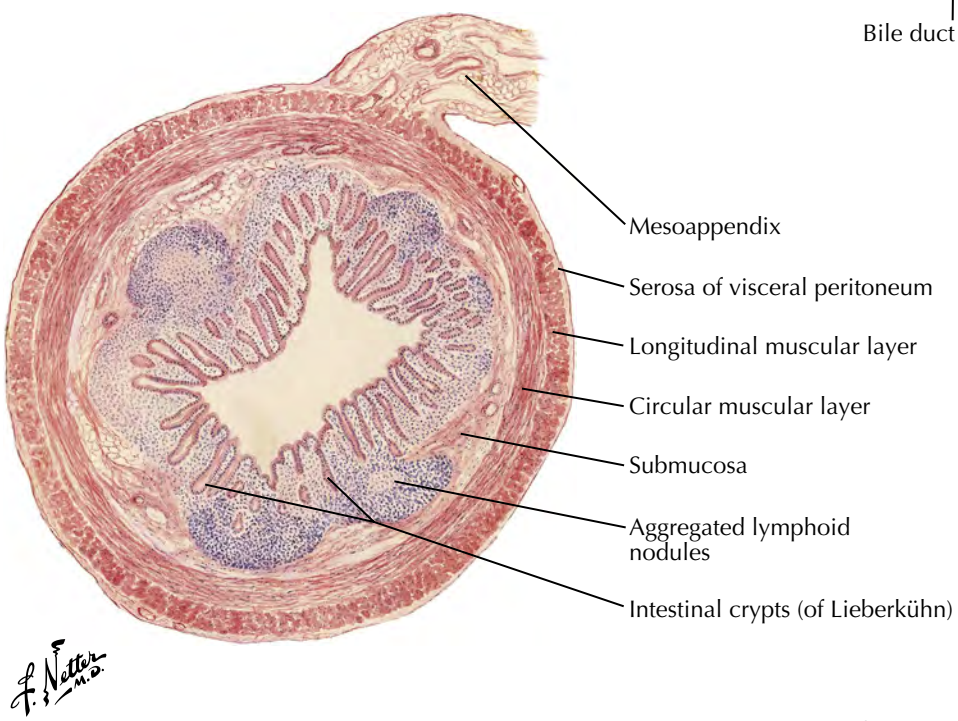



Longitudinal muscular layer
(*with window cut*)
Circular muscular layer
(*with window cut*)
Submucosa (with
duodenal glands
[Brunner's])

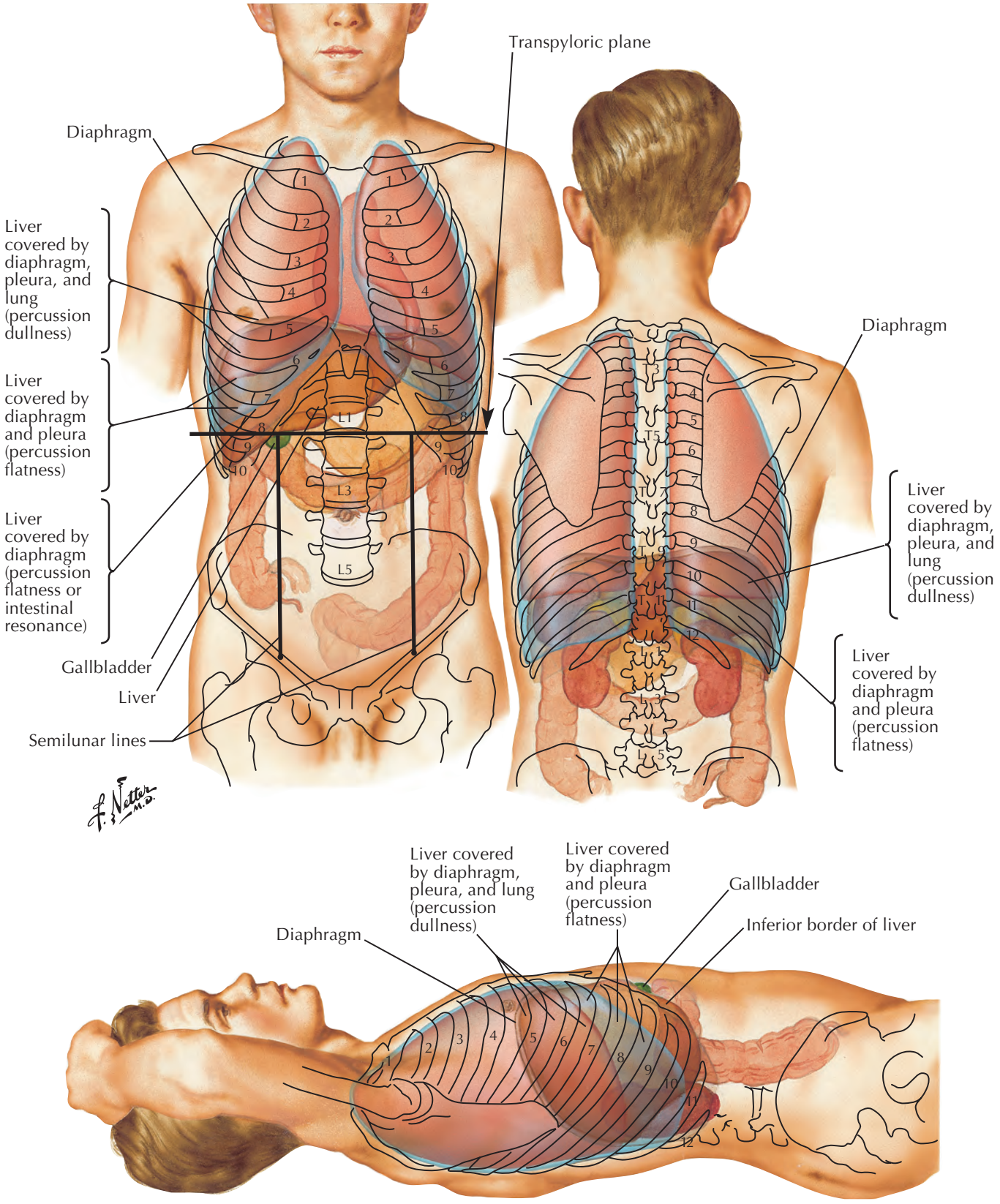
Coronal CT image with contrast

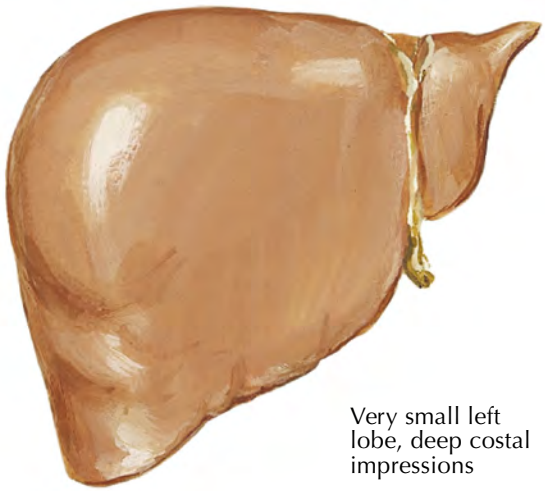
Magnetic resonance cholangiopancreatography (MRCP)



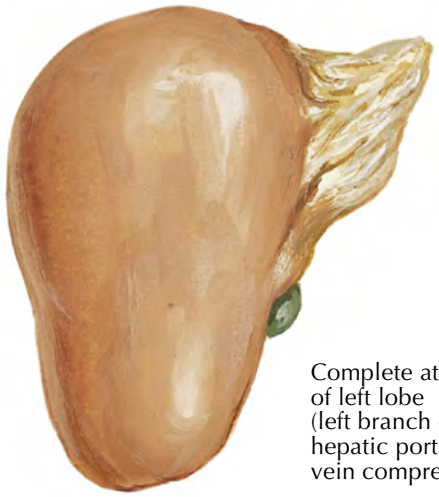


Ramification of nerve fibers around fine branch of hepatic artery

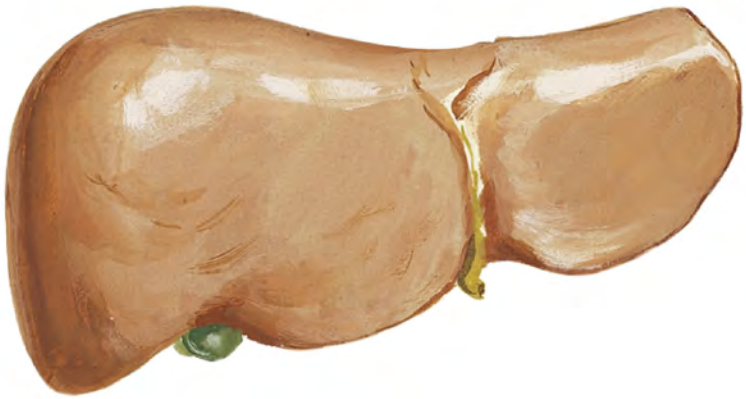

Transpyloric plane
Diaphragm
Liver covered by diaphragm, pleura, and lung (percussion dullness)
Liver covered by diaphragm and pleura (percussion flatness)
Liver covered by diaphragm (percussion flatness or intestinal resonance)
Gallbladder
Liver
Semilunar lines
Diaphragm
Liver covered by diaphragm, pleura, and lung (percussion dullness)
Liver covered by diaphragm and pleura (percussion flatness)
Liver covered by diaphragm, pleura, and lung (percussion dullness)
Liver covered by diaphragm and pleura (percussion flatness)
Gallbladder
Inferior border of liver



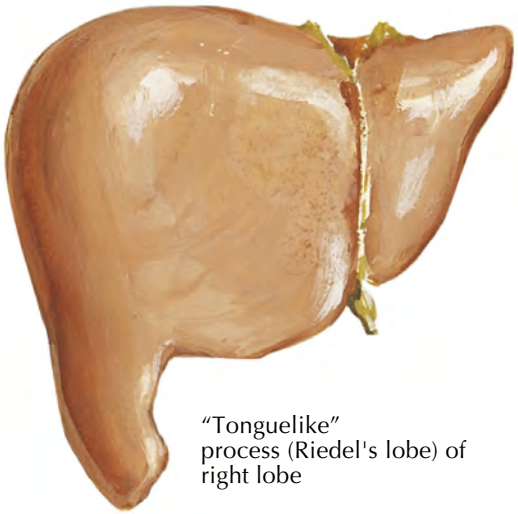
Very small left lobe, deep costal impressions



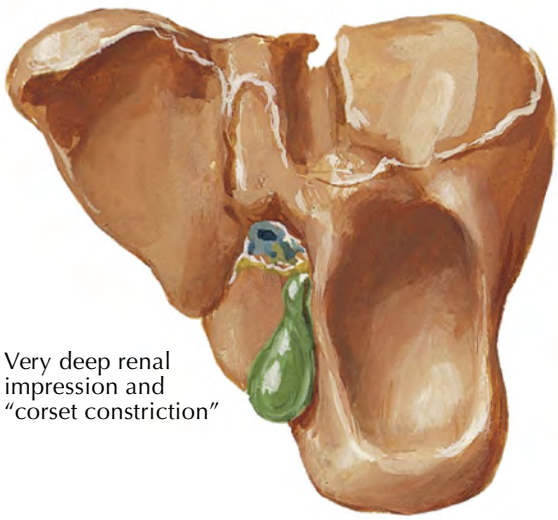
Complete atrophy of left lobe (left branch of hepatic portal vein compression)



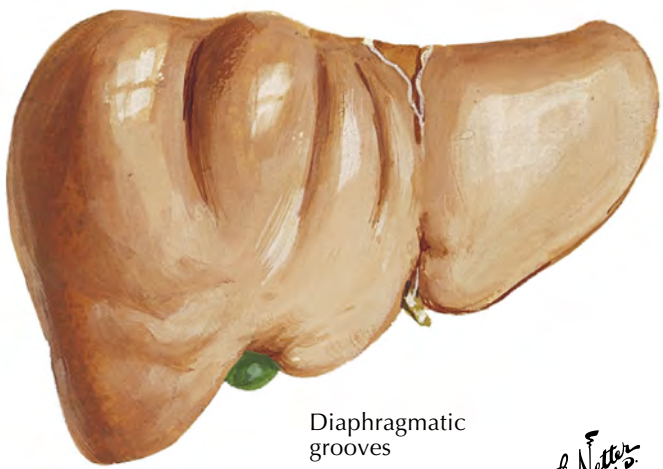
Transverse, "saddlelike" liver, relatively large left lobe



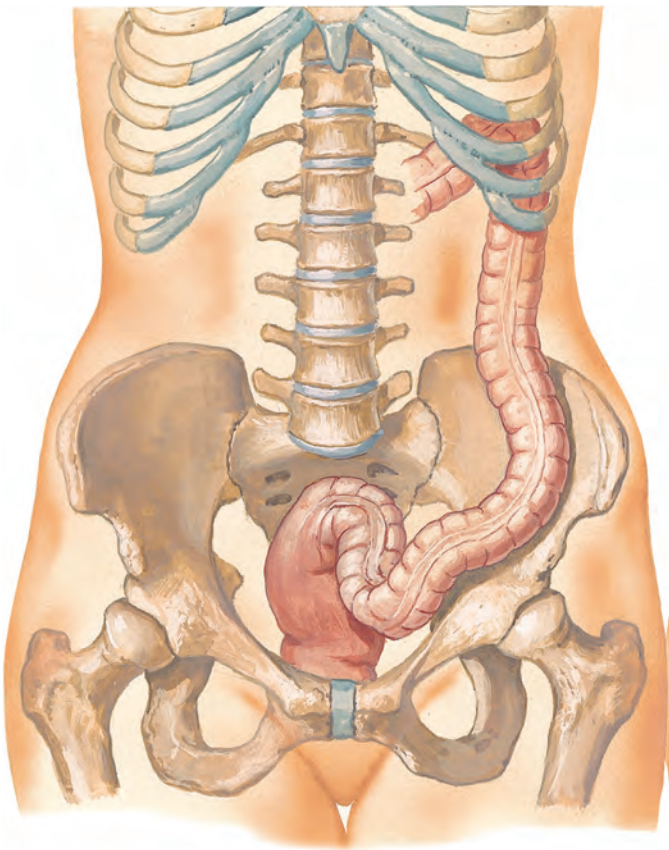
"Tonguelike" process (Riedel's lobe) of right lobe



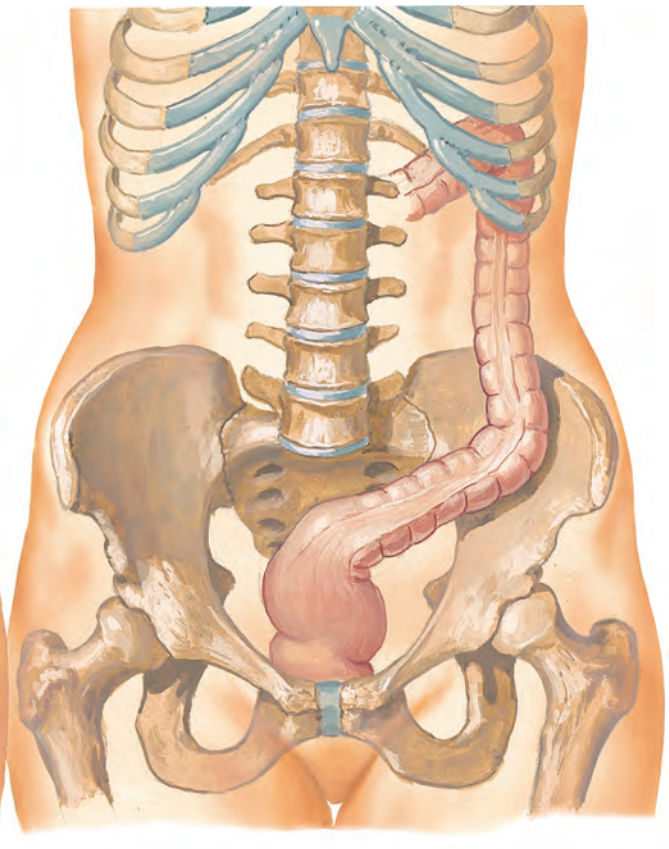
Very deep renal impression and "corset constriction"



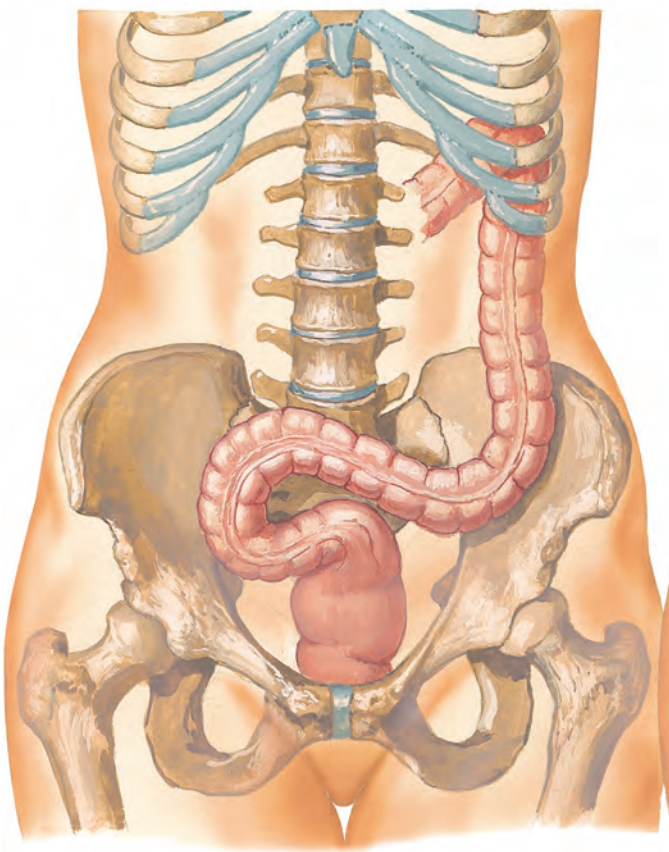
Diaphragmatic grooves



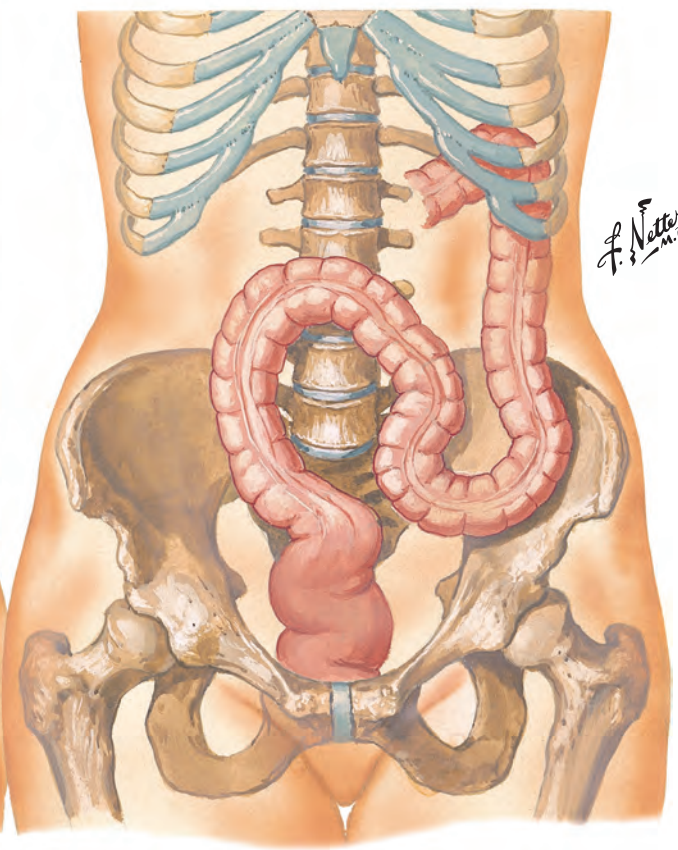
Typical



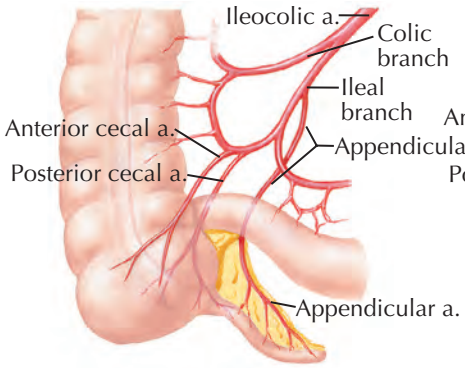
Short, straight, obliquely entering pelvis



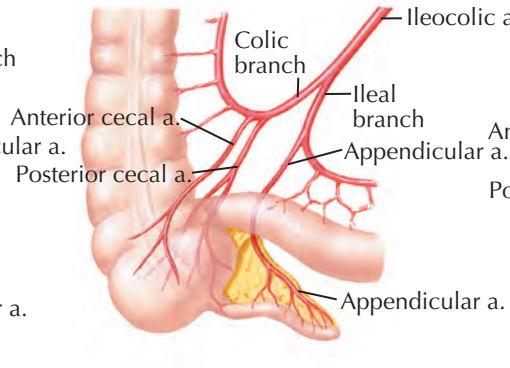
Looping to right side



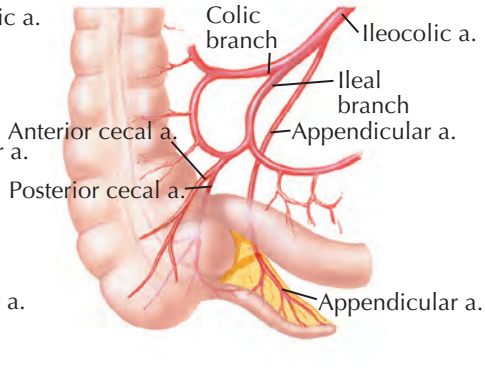
Ascending high into abdomen



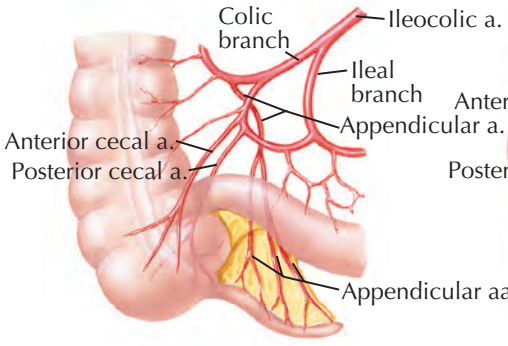
Anterior cecal and posterior cecal arteries originate from arcade between colic and ileal branches of ileocolic artery and appendicular artery from ileal branch



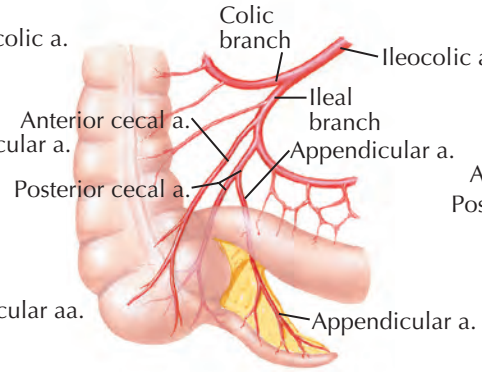
Anterior cecal and posterior cecal arteries originate from colic branch; appendicular artery from ileal branch of ileocolic artery



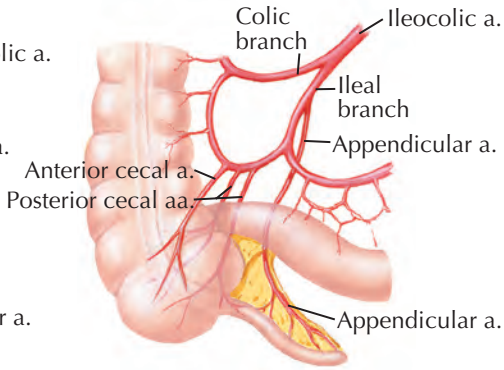
Anterior cecal and posterior cecal arteries have common origin from arcade; appendicular artery from ileocolic artery



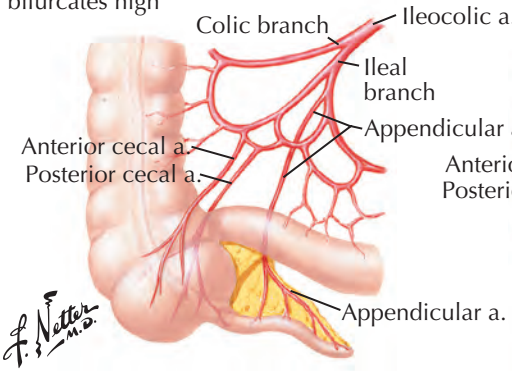
Anterior cecal and posterior cecal arteries originate from arcade between colic and ileal branches of ileocolic artery; appendicular artery from colic branch bifurcates high



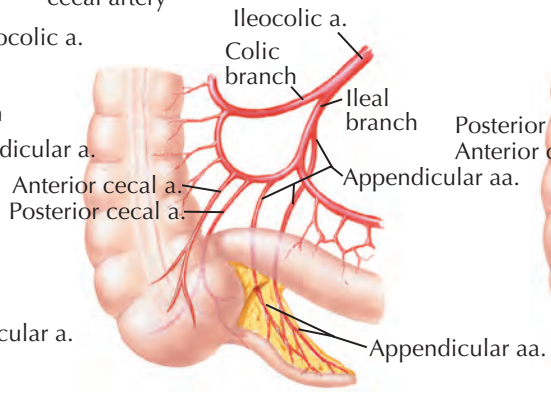
Anterior cecal and posterior cecal arteries originate from ileal branch of ileocolic artery; appendicular artery from posterior cecal artery



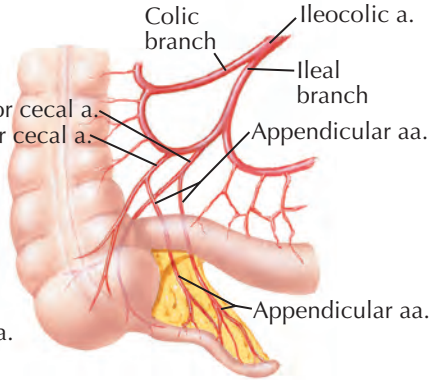
Anterior cecal and two posterior cecal arteries originate from arcade; appendicular artery from ileal branch of ileocolic artery



Multiple arcades between ileal branch and colic branch of ileocolic artery. Anterior cecal and posterior cecal arteries originate from these arcades; appendicular artery from ileal branch

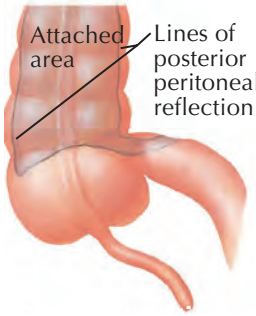


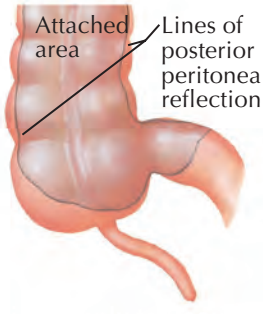
Anterior cecal and posterior cecal arteries originate from arcade between colic and ileal branches of ileocolic artery; two appendicular arteries, one deriving from arcade and the other from ileal branch, are present

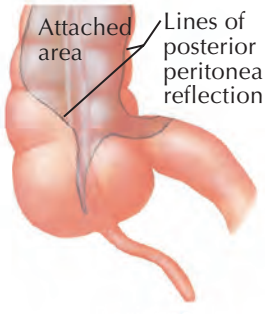


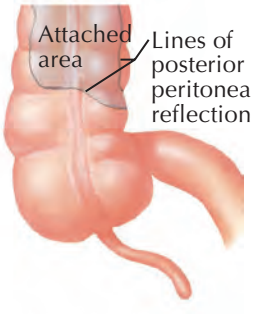
Anterior cecal and posterior cecal arteries originate from arcade; two appendicular arteries, one deriving from anterior cecal artery and the other from posterior cecal artery, are present

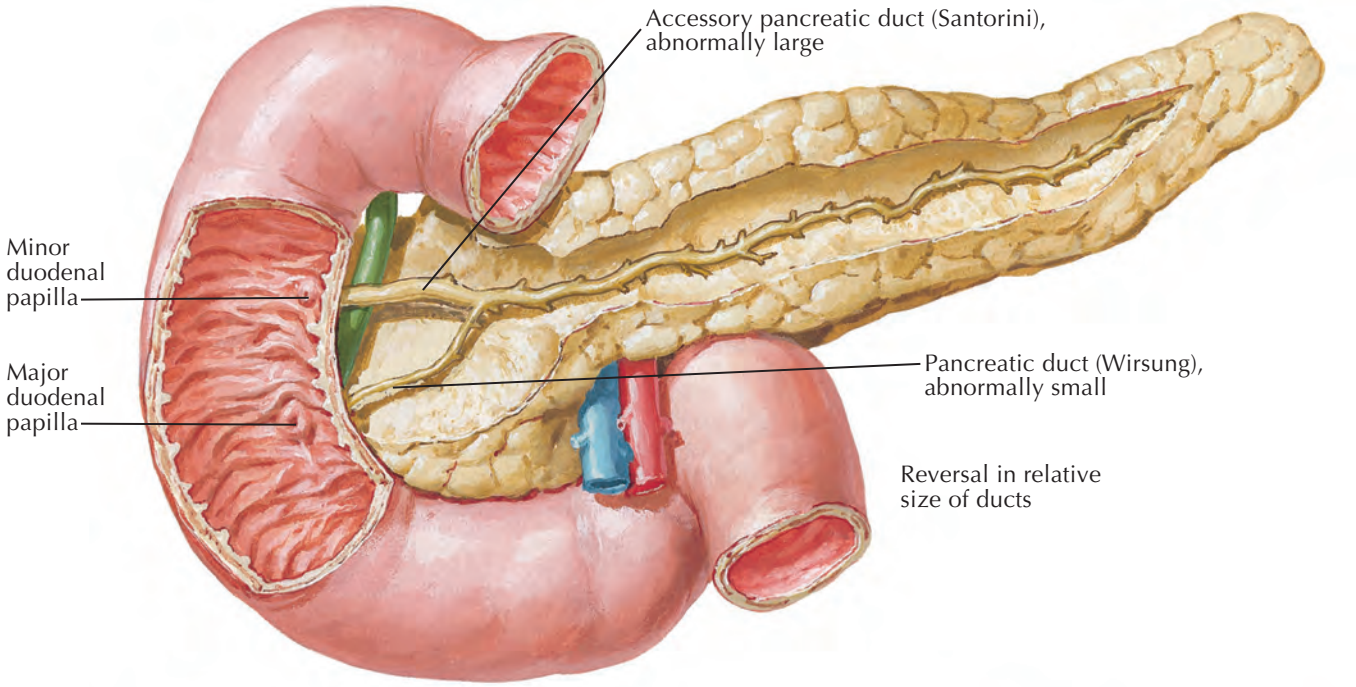
Some variations in posterior peritoneal attachment of cecum

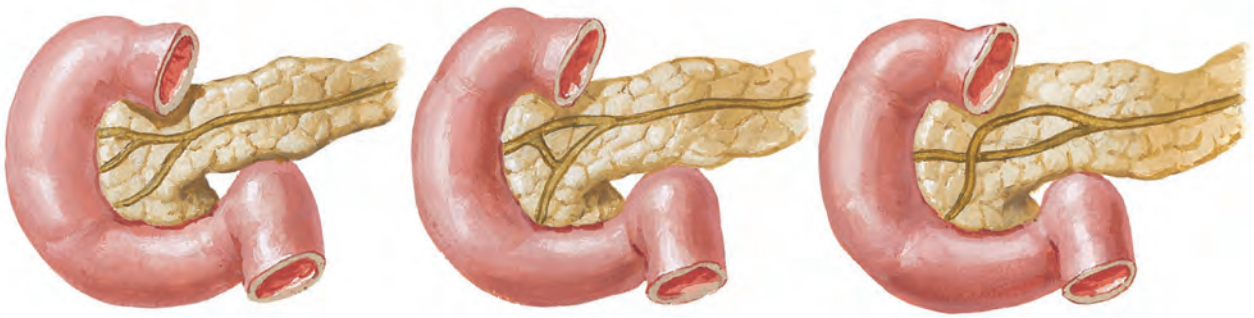


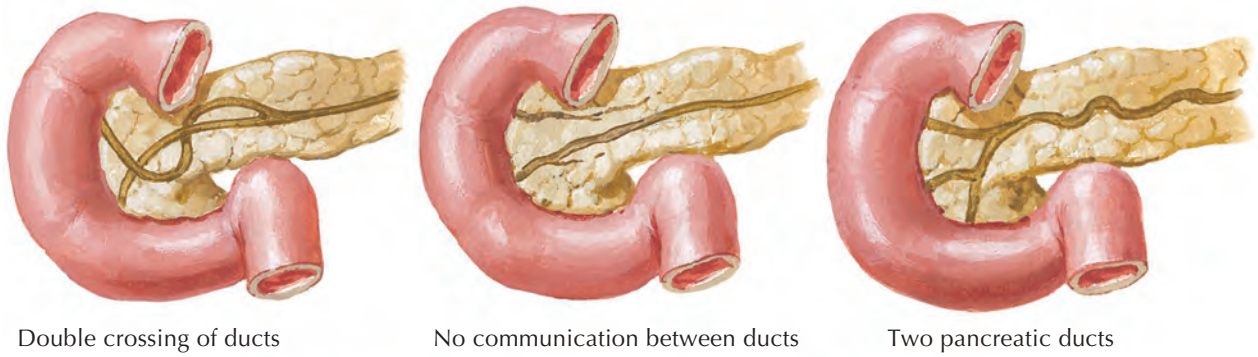


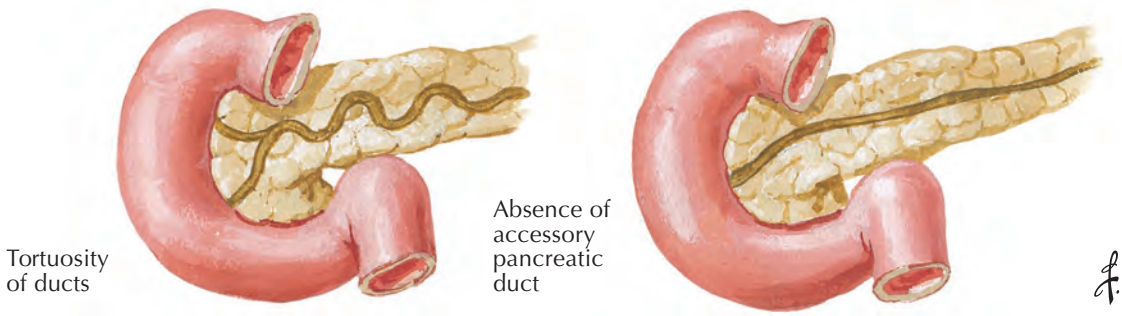




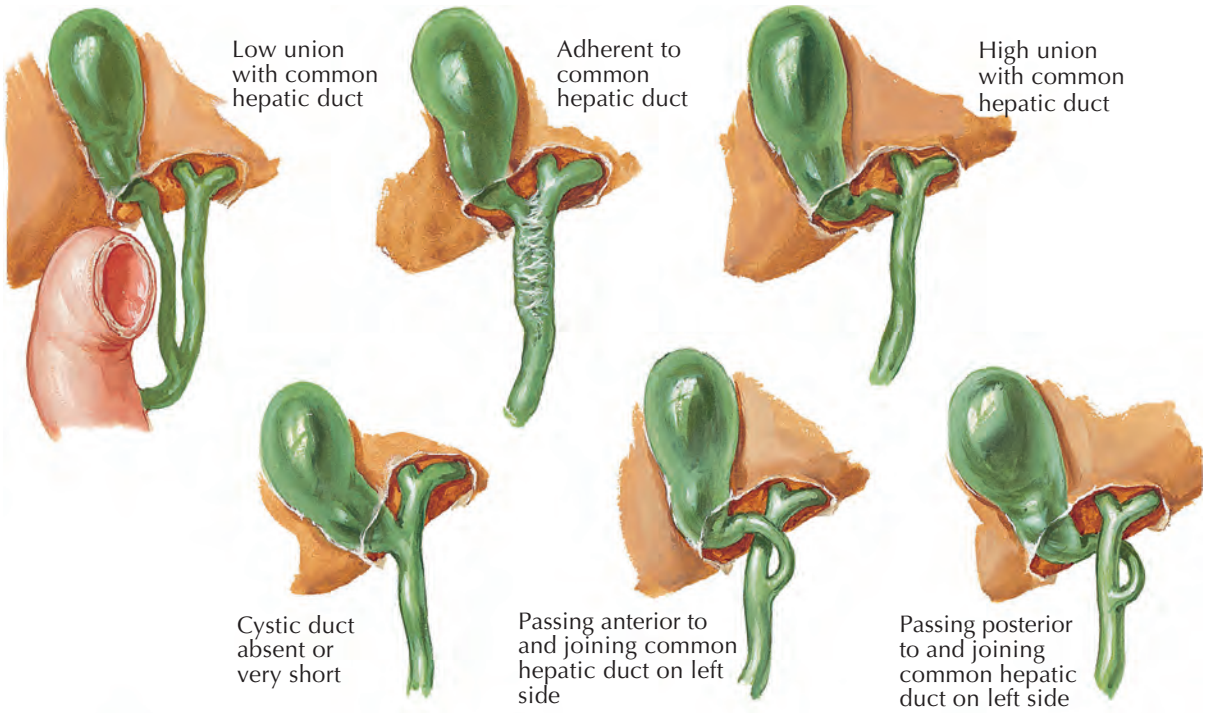

Accessory pancreatic duct (Santorini), abnormally large
Minor duodenal papilla
Major duodenal papilla
Pancreatic duct (Wirsung), abnormally small
Reversal in relative size of ducts


Two accessory pancreatic ducts
Anastomosis between ducts
Crossing of ducts

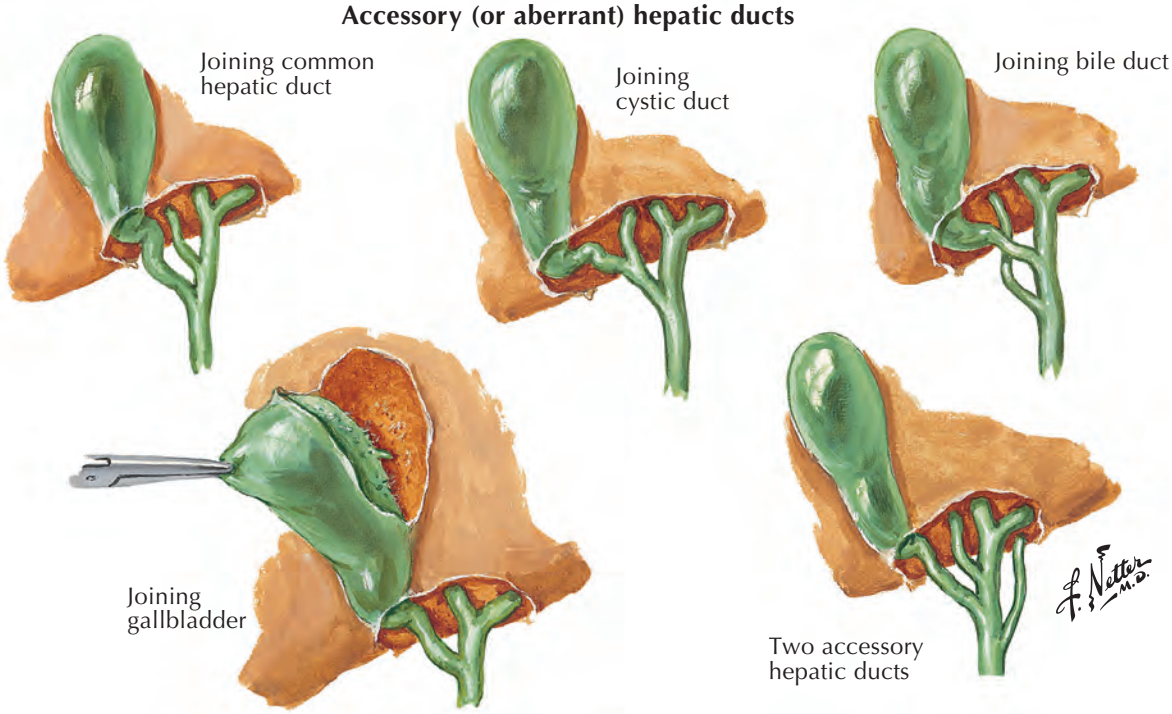

Double crossing of ducts
No communication between ducts
Two pancreatic ducts


Tortuosity of ducts
Absence of accessory pancreatic duct

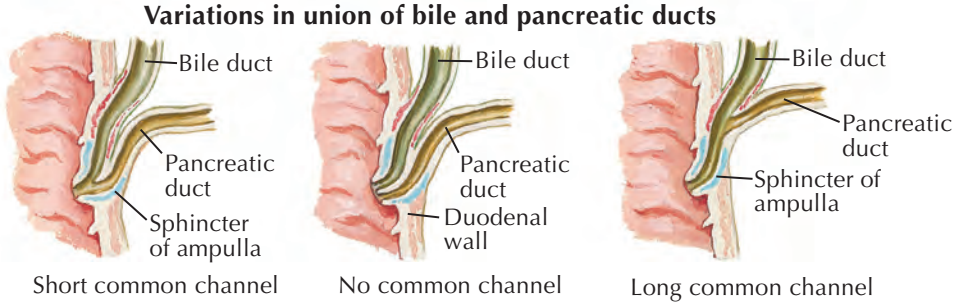
Variations in cystic duct

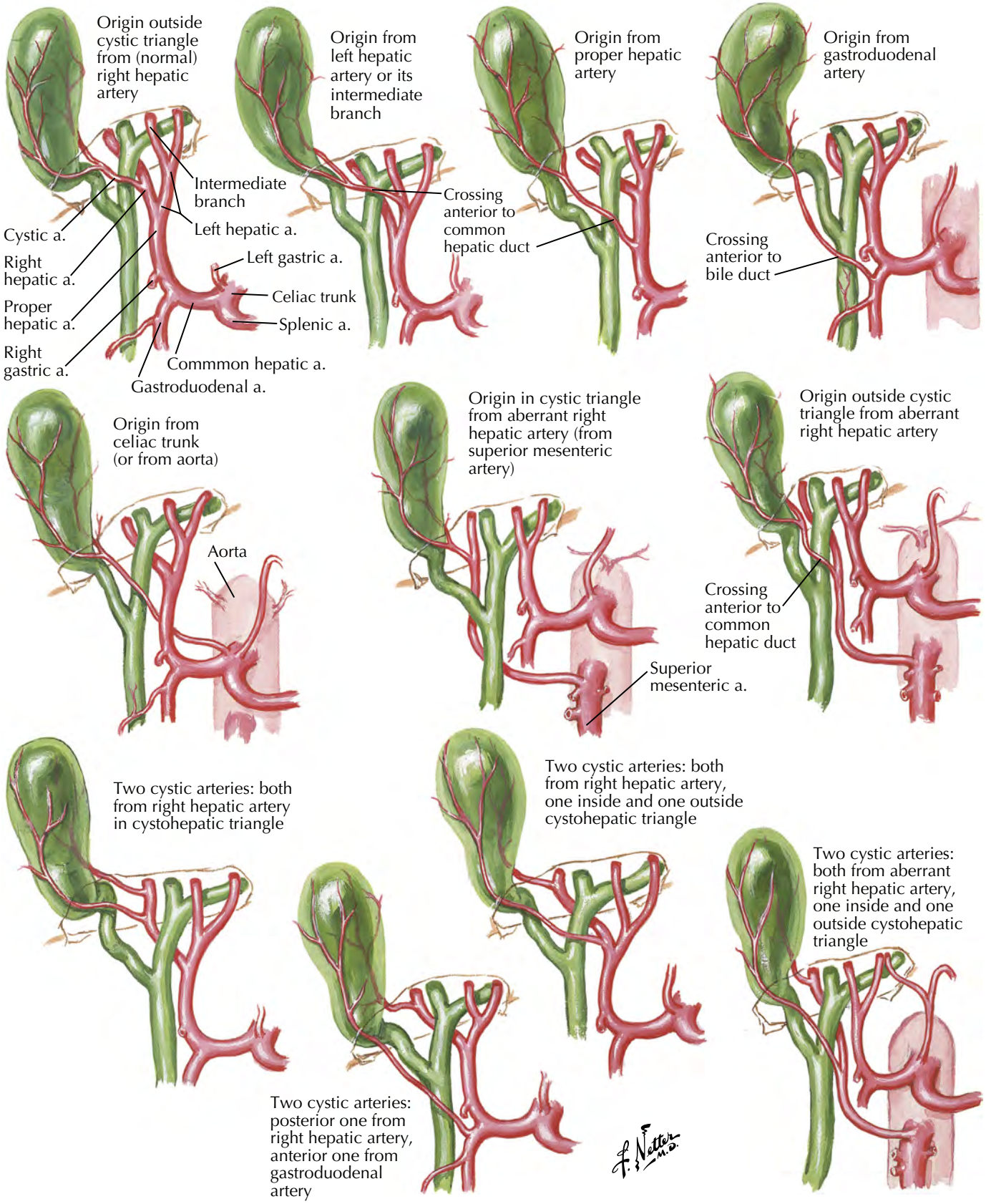


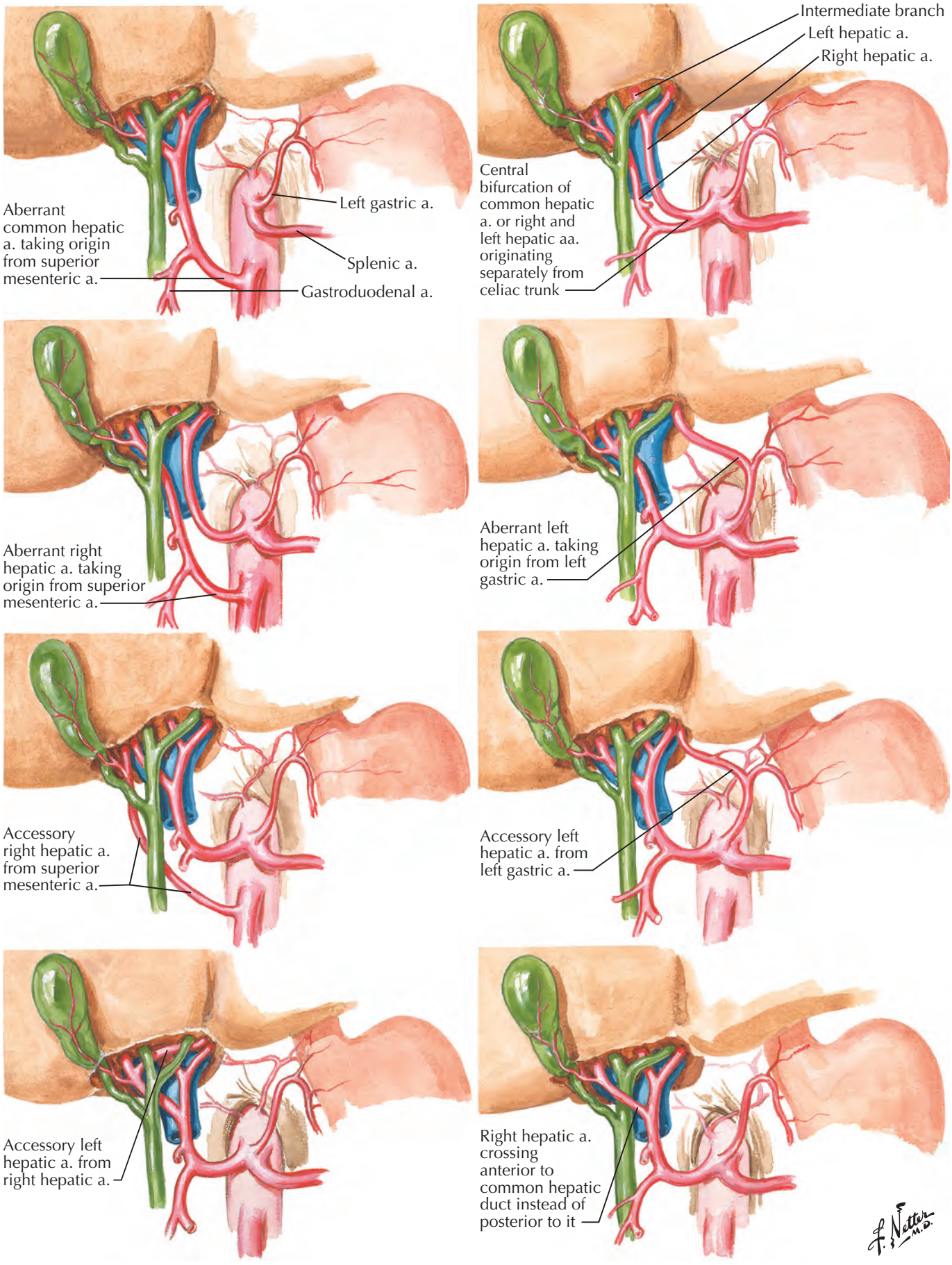
Accessory (or aberrant) hepatic ducts



Variations in union of bile and pancreatic ducts




Origin outside cystic triangle from (normal) right hepatic artery
Intermediate branch
Left hepatic a.
Cystic a.
Right hepatic a.
Proper hepatic a.
Right gastric a.
Left gastric a.
Celiac trunk
Splenic a.
Commmon hepatic a.
Gastroduodenal a.
Origin from left hepatic artery or its intermediate branch
Crossing anterior to common hepatic duct
Origin from proper hepatic artery
Origin from gastroduodenal artery
Crossing anterior to bile duct
Origin from celiac trunk (or from aorta)
Aorta
Origin in cystic triangle from aberrant right hepatic artery (from superior mesenteric artery)
Superior mesenteric a.
Origin outside cystic triangle from aberrant right hepatic artery
Crossing anterior to common hepatic duct
Two cystic arteries: both from right hepatic artery in cystohepatic triangle
Two cystic arteries: both from right hepatic artery, one inside and one outside cystohepatic triangle
Two cystic arteries: posterior one from right hepatic artery, anterior one from gastroduodenal artery
Two cystic arteries: both from aberrant right hepatic artery, one inside and one outside cystohepatic triangle


Aberrant common hepatic a. taking origin from superior mesenteric a.
Left gastric a.
Splenic a.
Gastroduodenal a.
Intermediate branch
Left hepatic a.
Right hepatic a.
Central bifurcation of common hepatic a. or right and left hepatic aa. originating separately from celiac trunk
Aberrant right hepatic a. taking origin from superior mesenteric a.
Aberrant left hepatic a. taking origin from left gastric a.
Accessory right hepatic a. from superior mesenteric a.
Accessory left hepatic a. from left gastric a.
Accessory left hepatic a. from right hepatic a.
Right hepatic a. crossing anterior to common hepatic duct instead of posterior to it
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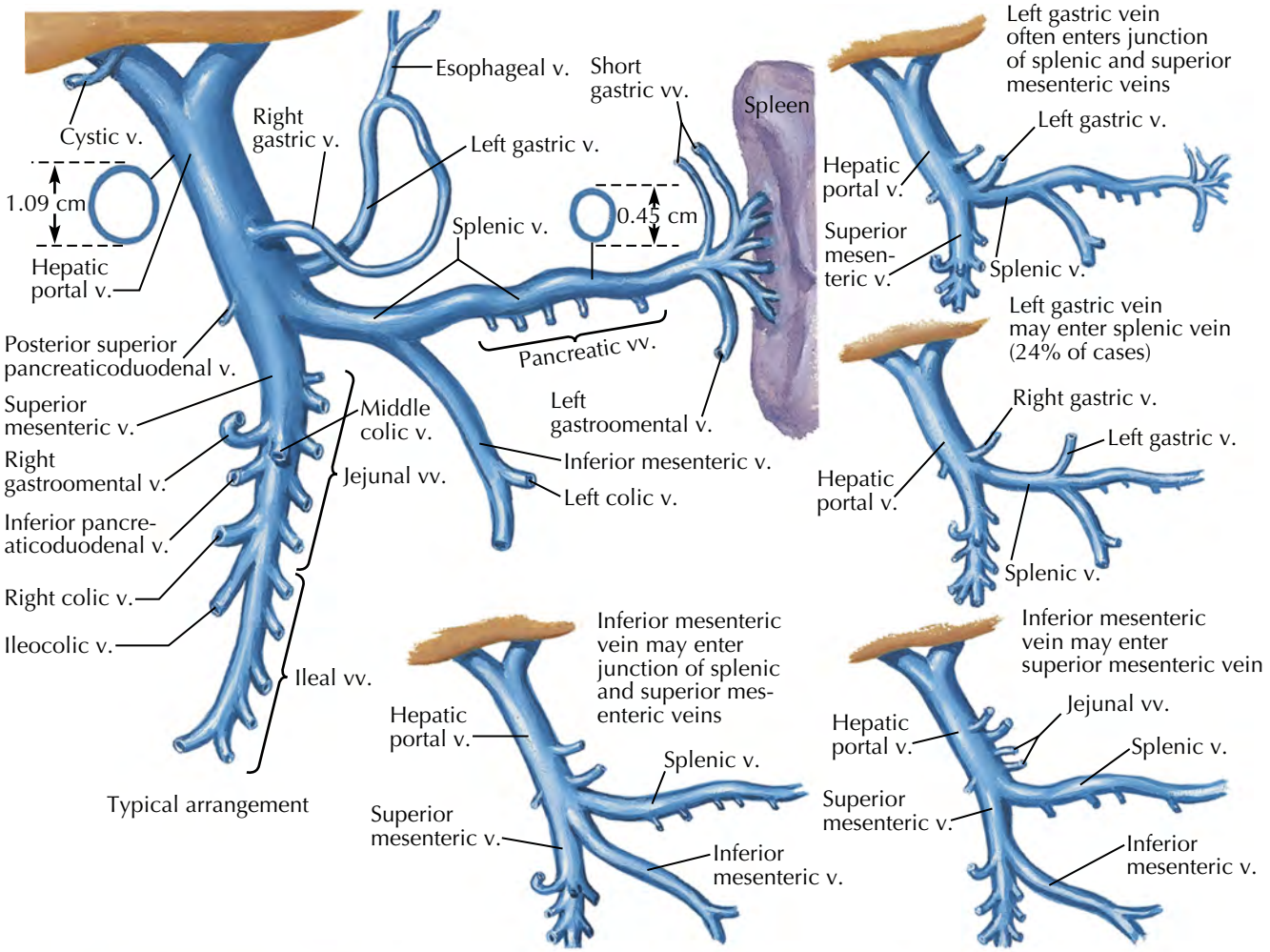
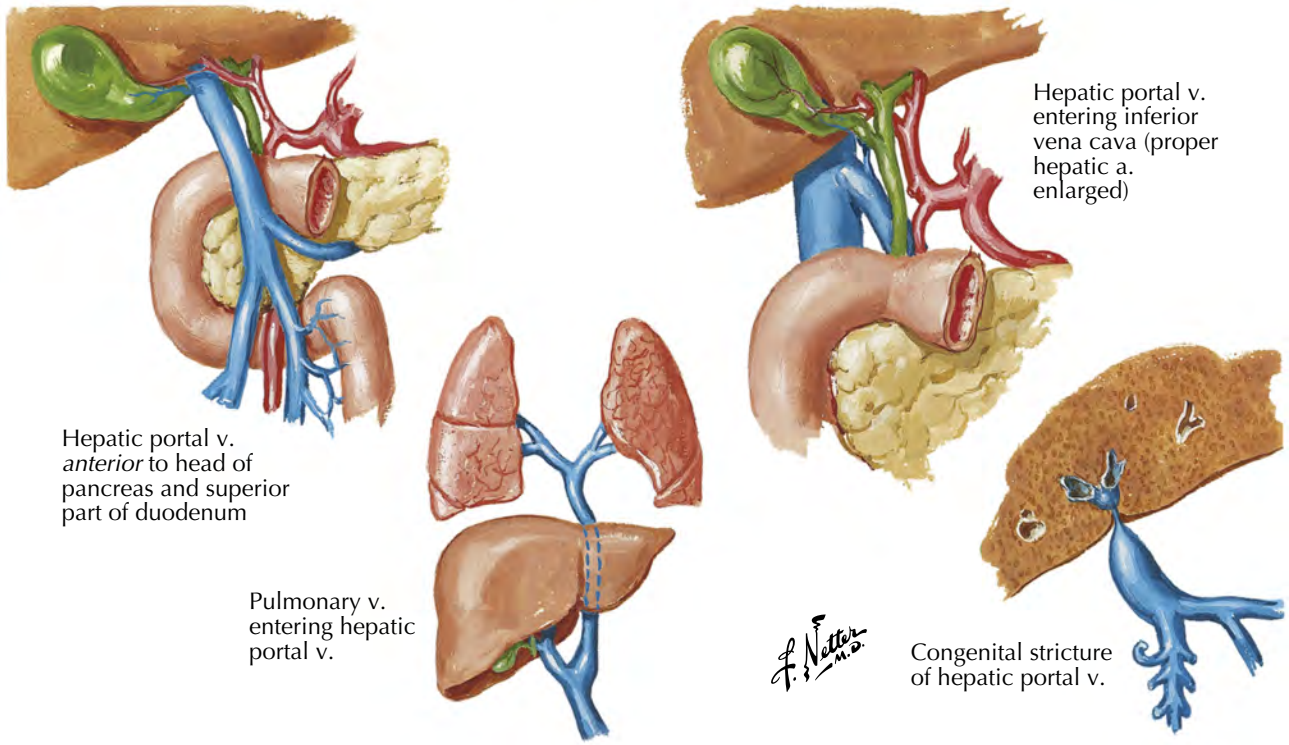
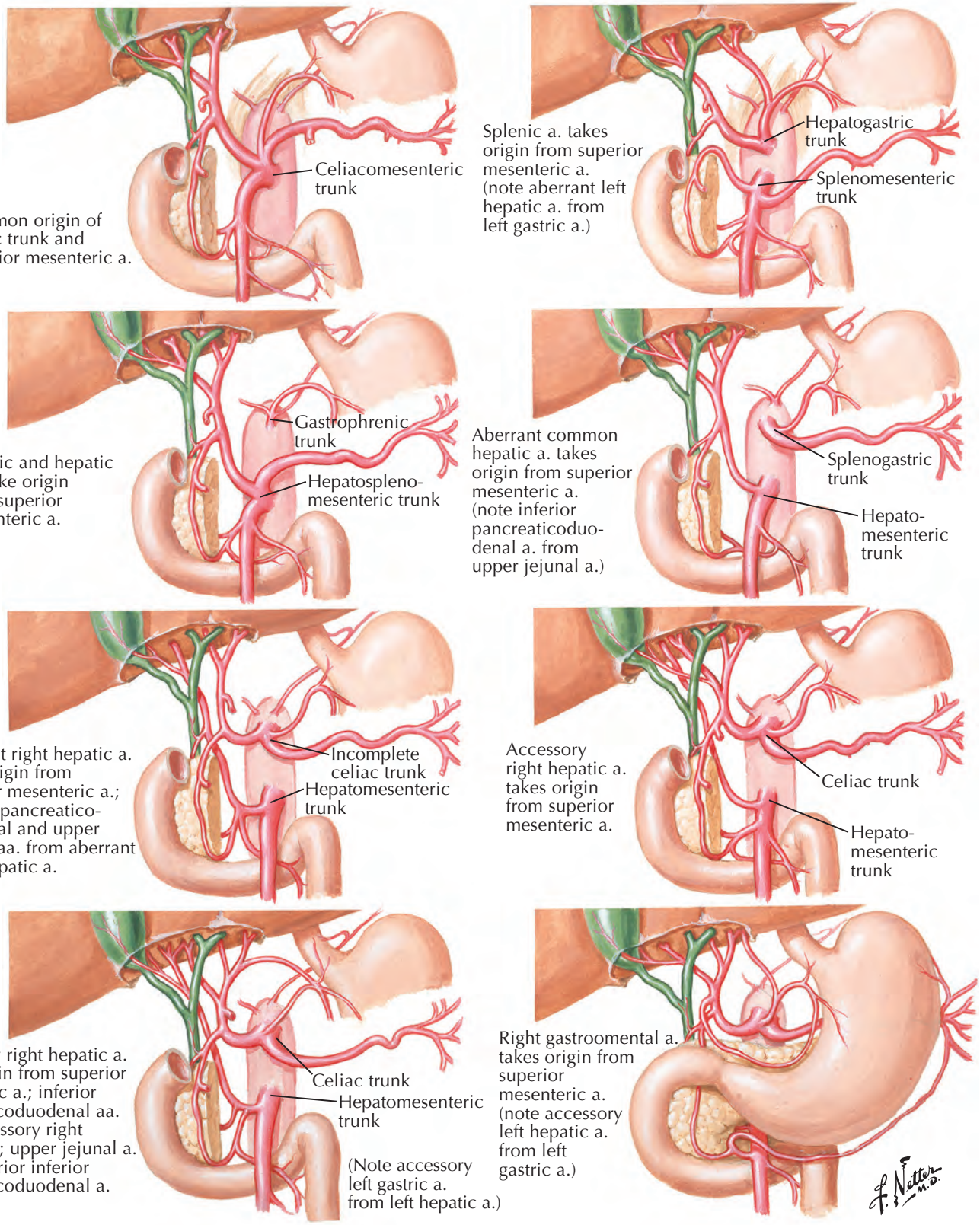
Variations



Anomalies




Common origin of celiac trunk and superior mesenteric a.
Celiacomesenteric trunk
Splenic a. takes origin from superior mesenteric a. (note aberrant left hepatic a. from left gastric a.)
Hepatogastric trunk
Splenomesenteric trunk
Splenic and hepatic aa. take origin from superior mesenteric a.
Gastrophrenic trunk
Hepatospleno-mesenteric trunk
Aberrant common hepatic a. takes origin from superior mesenteric a. (note inferior pancreaticoduo-denal a. from upper jejunal a.)
Splenogastric trunk
Hepato-mesenteric trunk
Aberrant right hepatic a. takes origin from superior mesenteric a.; inferior pancreatico-duodenal and upper jejunal aa. from aberrant right hepatic a.
Incomplete celiac trunk
Hepatomesenteric trunk
Accessory right hepatic a. takes origin from superior mesenteric a.
Celiac trunk
Hepato-mesenteric trunk
Accessory right hepatic a. takes origin from superior mesenteric a.; inferior pancreaticoduodenal aa. from accessory right hepatic a.; upper jejunal a. from anterior inferior pancreaticoduodenal a.
Celiac trunk
Hepatomesenteric trunk
(Note accessory left gastric a. from left hepatic a.)
Right gastroomental a. takes origin from superior mesenteric a. (note accessory left hepatic a. from left gastric a.)
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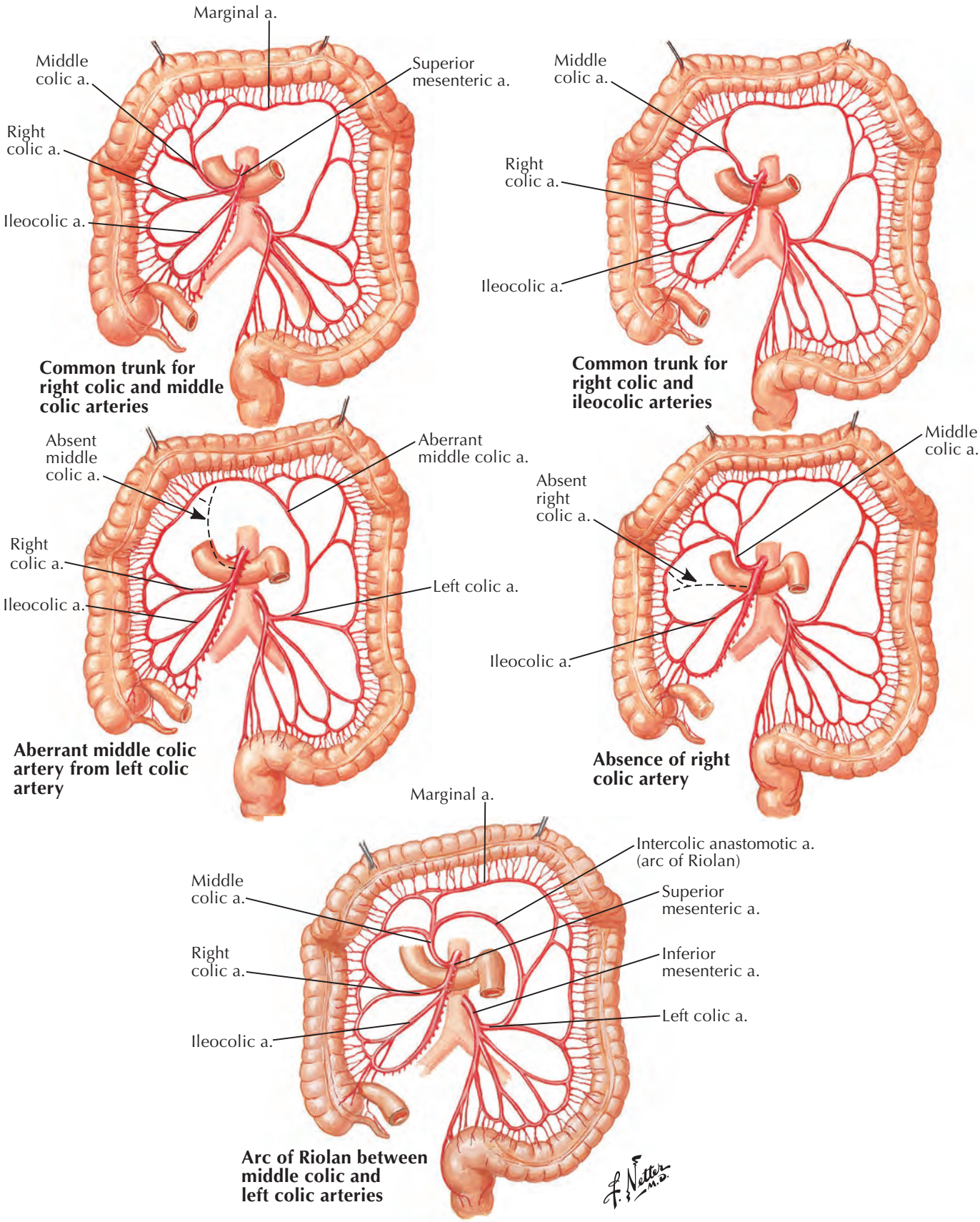
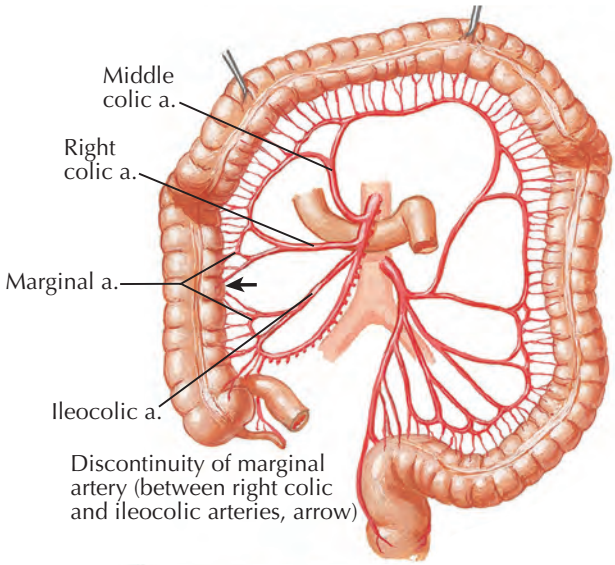
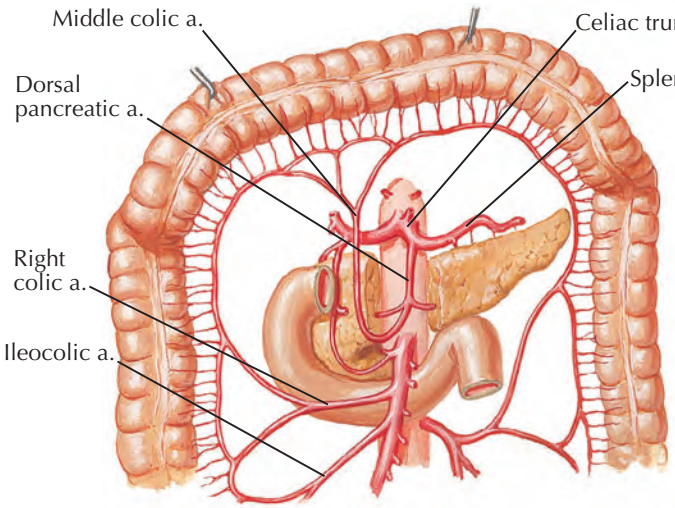
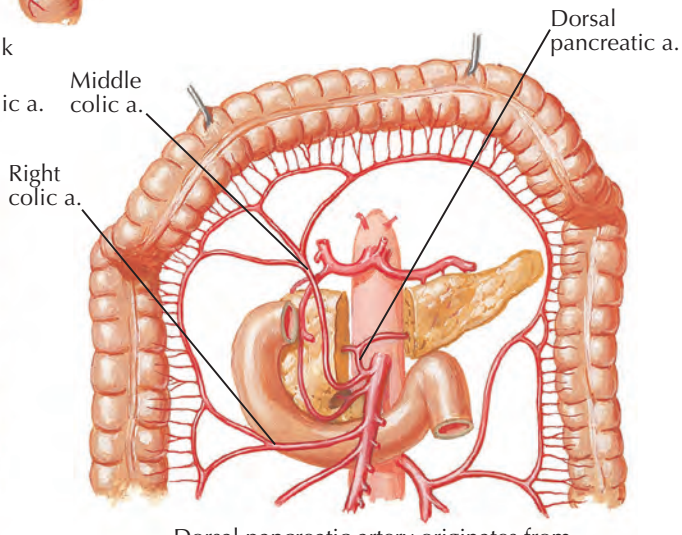

Marginal a.
Middle colic a.
Superior mesenteric a.
Right colic a.
Ileocolic a.
Common trunk for right colic and middle colic arteries
Middle colic a.
Right colic a.
Ileocolic a.
Common trunk for right colic and ileocolic arteries
Absent middle colic a.
Aberrant middle colic a.
Right colic a.
Left colic a.
Ileocolic a.
Aberrant middle colic artery from left colic artery
Middle colic a.
Absent right colic a.
Ileocolic a.
Absence of right colic artery
Marginal a.
Intercolic anastomotic a. (arc of Riolan)
Middle colic a.
Superior mesenteric a.
Right colic a.
Inferior mesenteric a.
Left colic a.
Ileocolic a.
Arc of Riolan between middle colic and left colic arteries

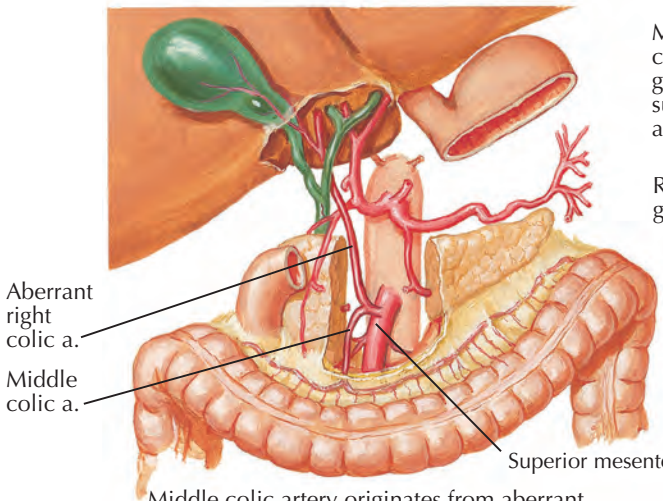




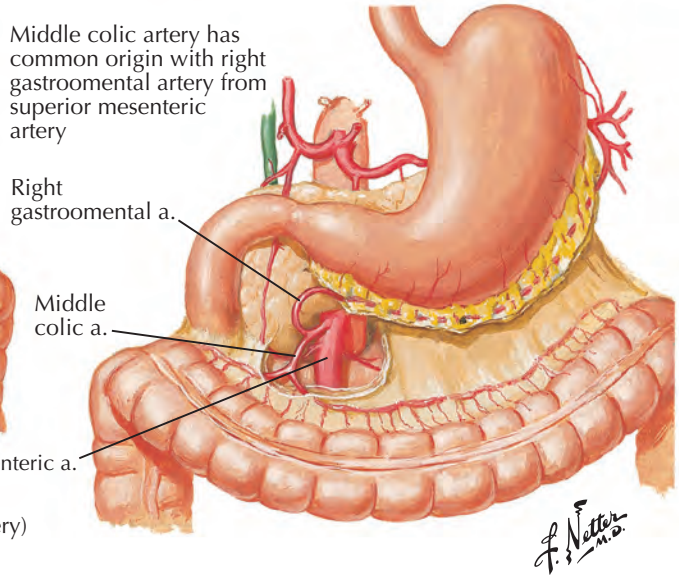
Middle colic artery originates from celiac trunk via dorsal pancreatic artery

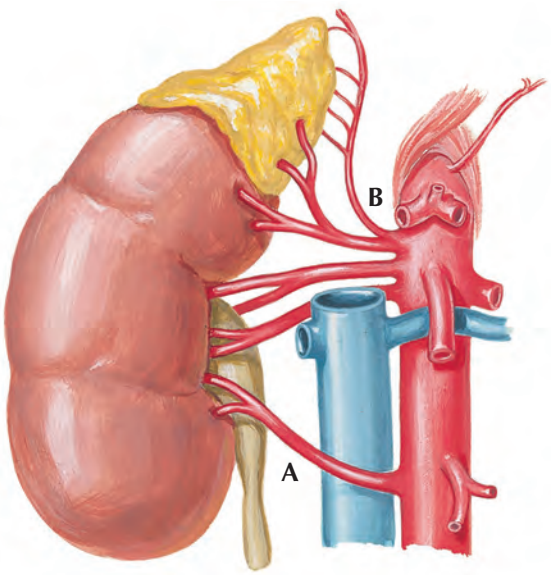


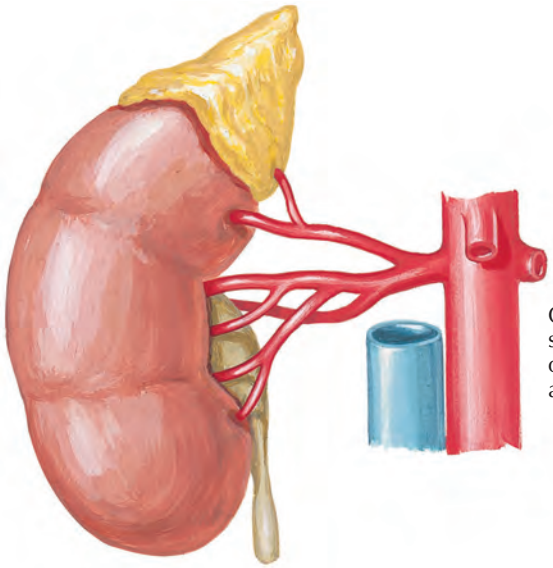
Dorsal pancreatic artery originates from middle colic artery



Middle colic artery originates from aberrant right hepatic artery (from superior mesenteric artery)



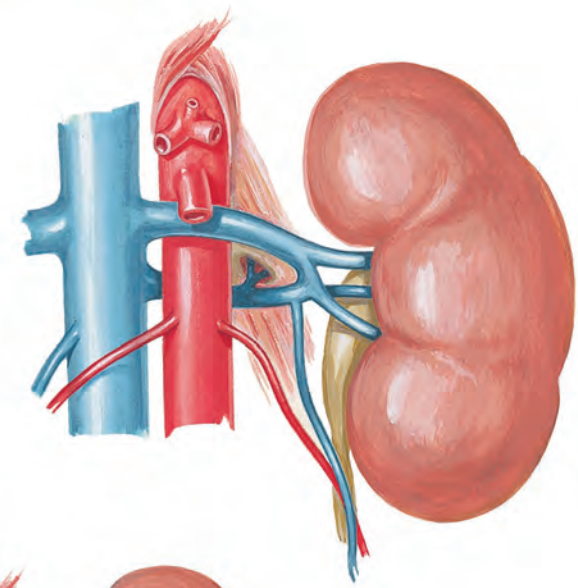




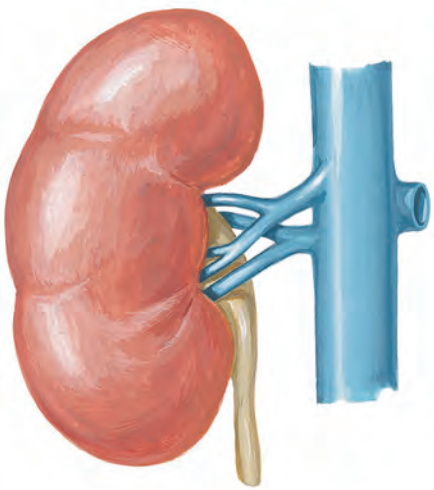
Central subdivision of renal artery

A Low accessory right renal artery may pass anterior to inferior vena cava instead of posterior to it

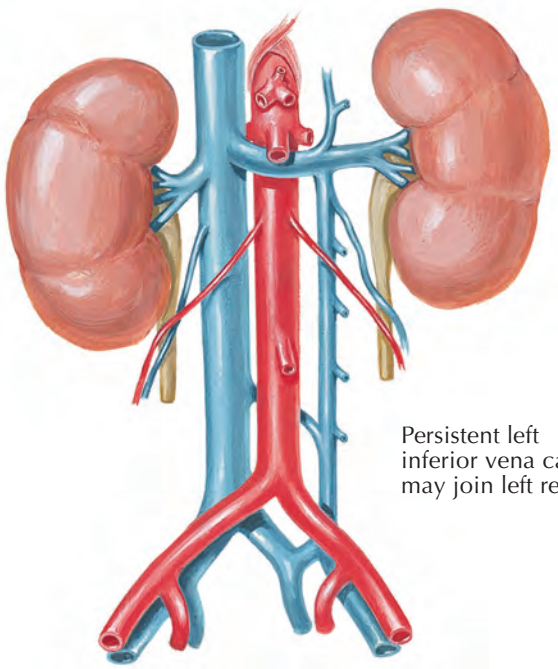
B Inferior phrenic artery and all suprarenal arteries may arise from an accessory renal artery



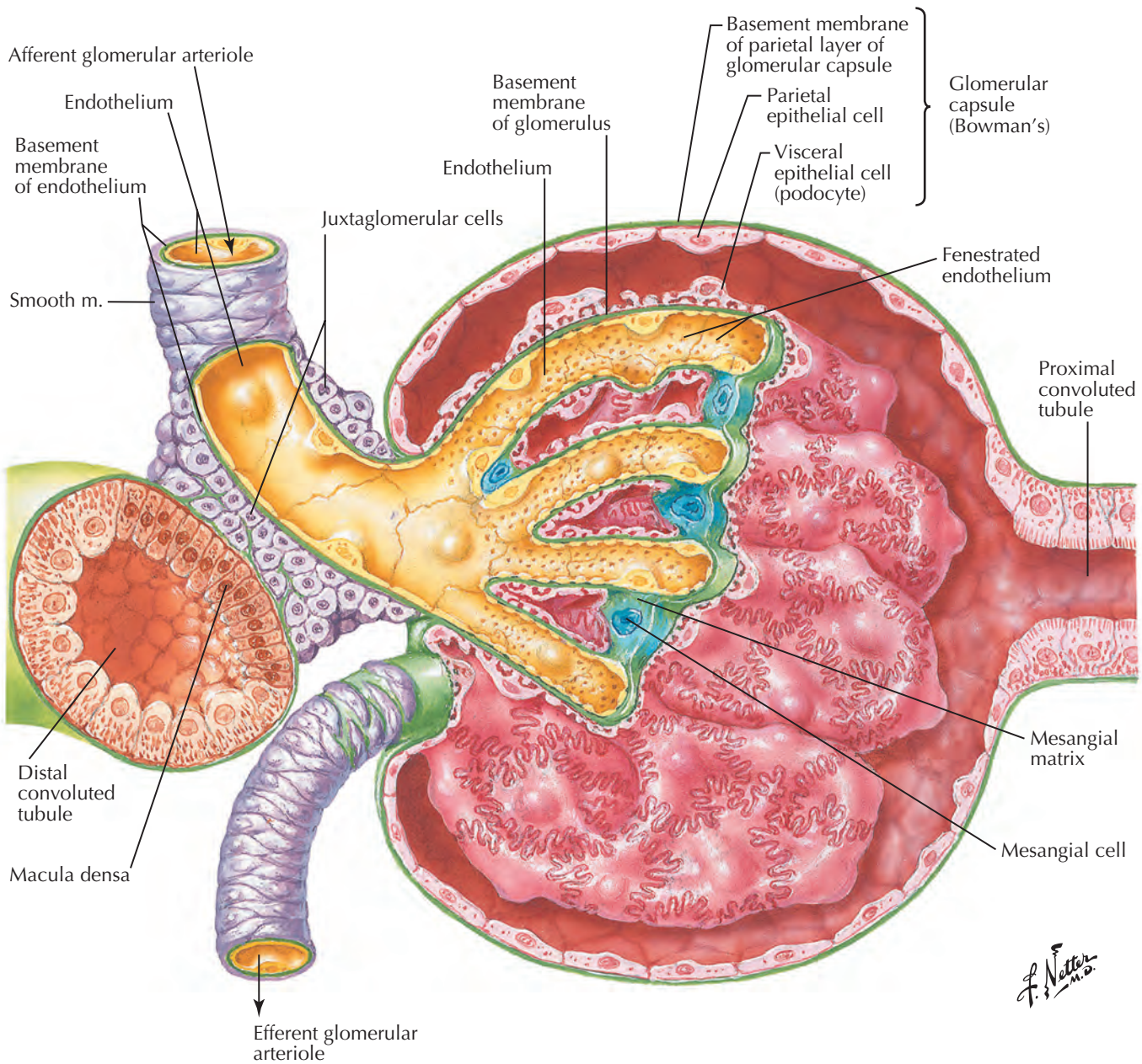
Two left renal veins may form ring around abdominal aorta

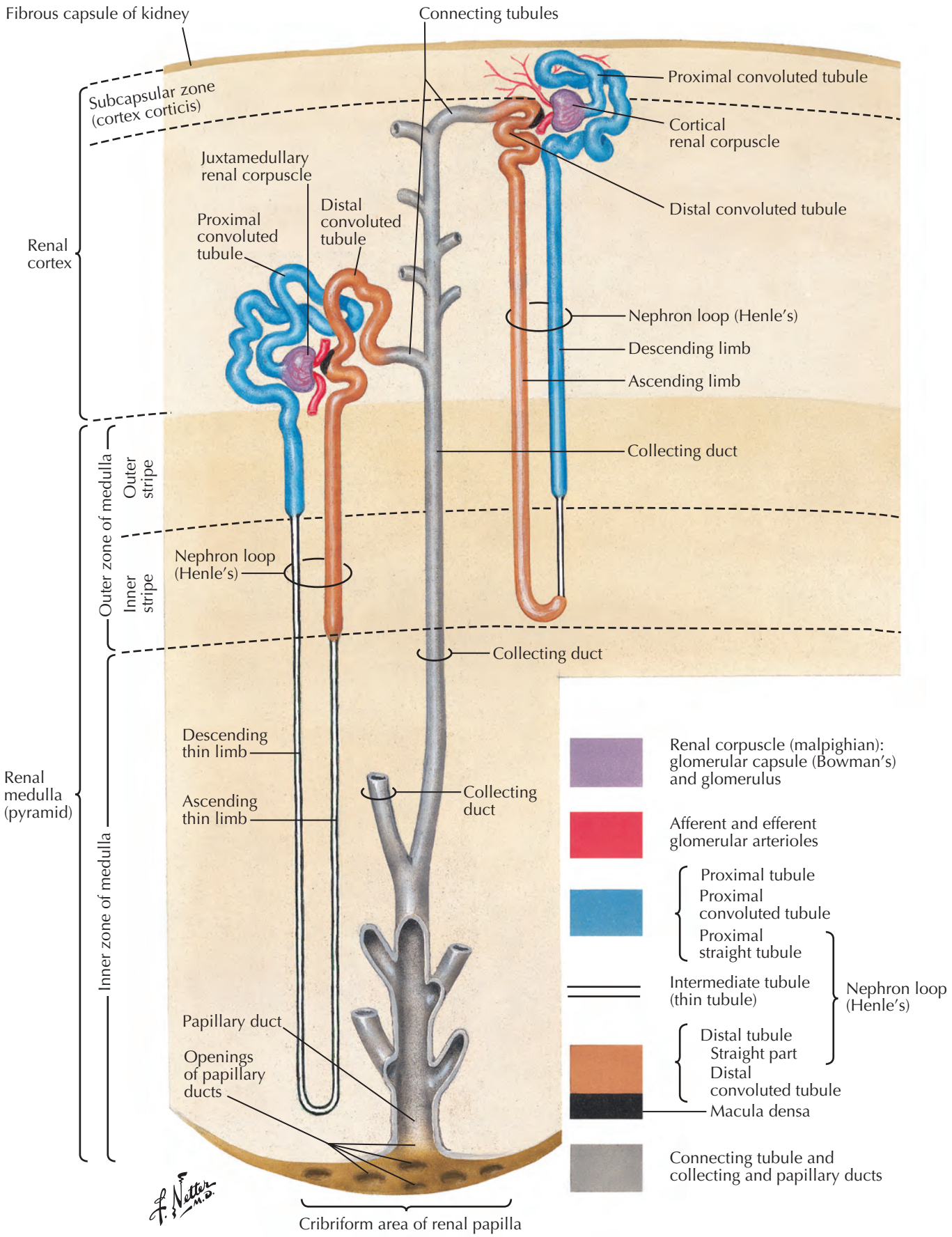


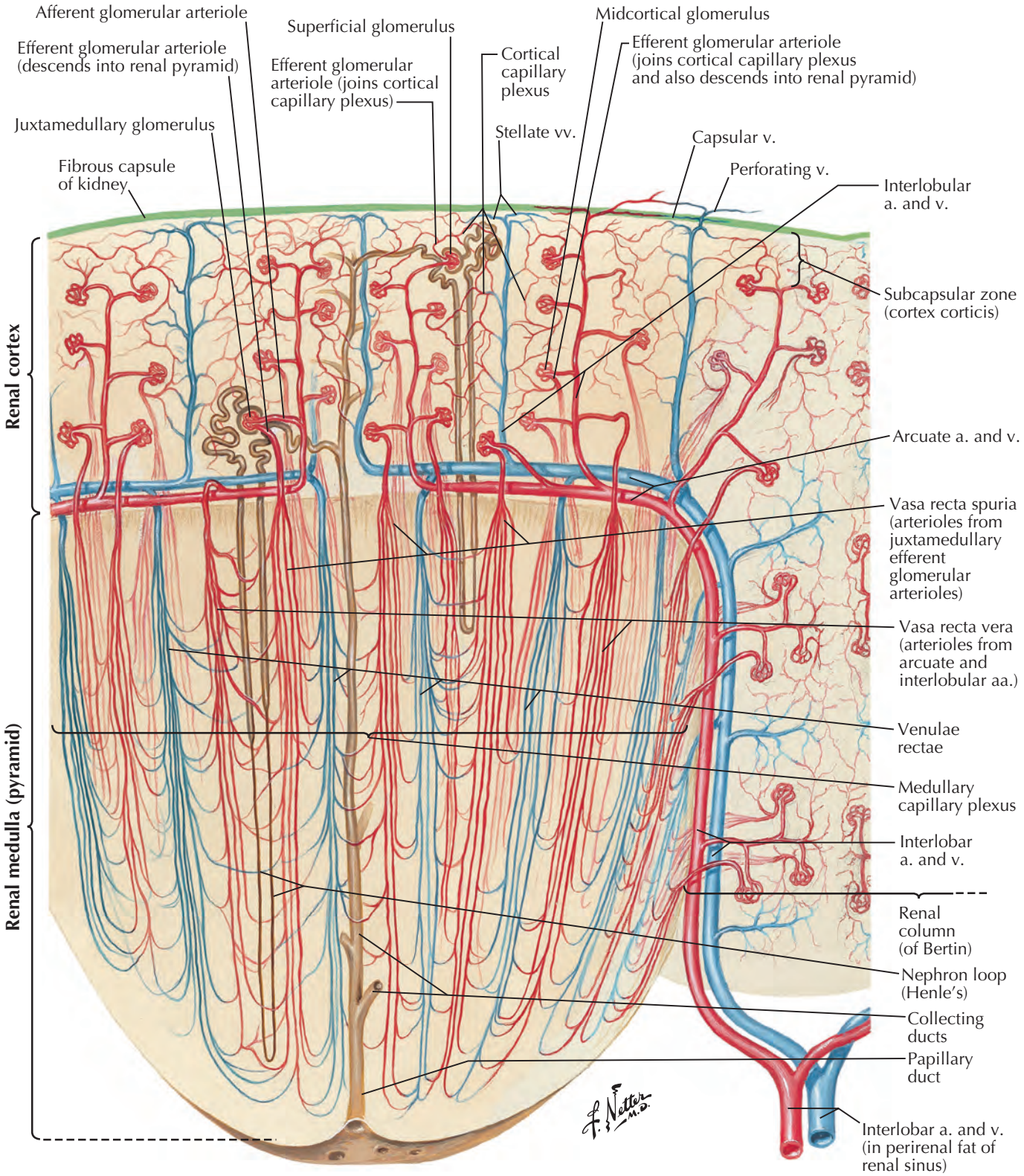
Multiple renal veins



Persistent left inferior vena cava may join left renal vein


Afferent glomerular arteriole
Endothelium
Basement membrane of endothelium
Smooth m.
Juxtaglomerular cells
Basement membrane of glomerulus
Endothelium
Basement membrane of parietal layer of glomerular capsule
Parietal epithelial cell
Visceral epithelial cell (podocyte)
Glomerular capsule (Bowman's)
Fenestrated endothelium
Proximal convoluted tubule
Mesangial matrix
Mesangial cell
Distal convoluted tubule
Macula densa
Efferent glomerular arteriole


Fibrous capsule of kidney
Connecting tubules
Subcapsular zone (cortex corticis)
Proximal convoluted tubule
Cortical renal corpuscle
Juxtamedullary renal corpuscle
Distal convoluted tubule
Proximal convoluted tubule
Distal convoluted tubule
Renal cortex
Nephron loop (Henle's)
Descending limb
Ascending limb
Collecting duct
Outer zone of medulla
Outer stripe
Inner stripe
Nephron loop (Henle's)
Collecting duct
Descending thin limb
Collecting duct
Renal medulla (pyramid)
Ascending thin limb
Inner zone of medulla
Papillary duct
Openings of papillary ducts
Cribriform area of renal papilla
Renal corpuscle (malpighian): glomerular capsule (Bowman's) and glomerulus
Afferent and efferent glomerular arterioles
Proximal tubule
Proximal convoluted tubule
Proximal straight tubule
Nephron loop (Henle's)
Intermediate tubule (thin tubule)
Distal tubule
Straight part
Distal convoluted tubule
Macula densa
Connecting tubule and collecting and papillary ducts


Afferent glomerular arteriole
Efferent glomerular arteriole (descends into renal pyramid)
Juxtamedullary glomerulus
Fibrous capsule of kidney
Superficial glomerulus
Efferent glomerular arteriole (joins cortical capillary plexus)
Cortical capillary plexus
Stellate vv.
Midcortical glomerulus
Efferent glomerular arteriole (joins cortical capillary plexus and also descends into renal pyramid)
Capsular v.
Perforating v.
Interlobular a. and v.
Subcapsular zone (cortex corticis)
Arcuate a. and v.
Vasa recta spuria (arterioles from juxtamedullary efferent glomerular arterioles)
Vasa recta vera (arterioles from arcuate and interlobular aa.)
Venulae rectae
Medullary capillary plexus
Interlobar a. and v.
Renal column (of Bertin)
Nephron loop (Henle's)
Collecting ducts
Papillary duct
Interlobar a. and v. (in perirenal fat of renal sinus)
Renal cortex
Renal medulla (pyramid)
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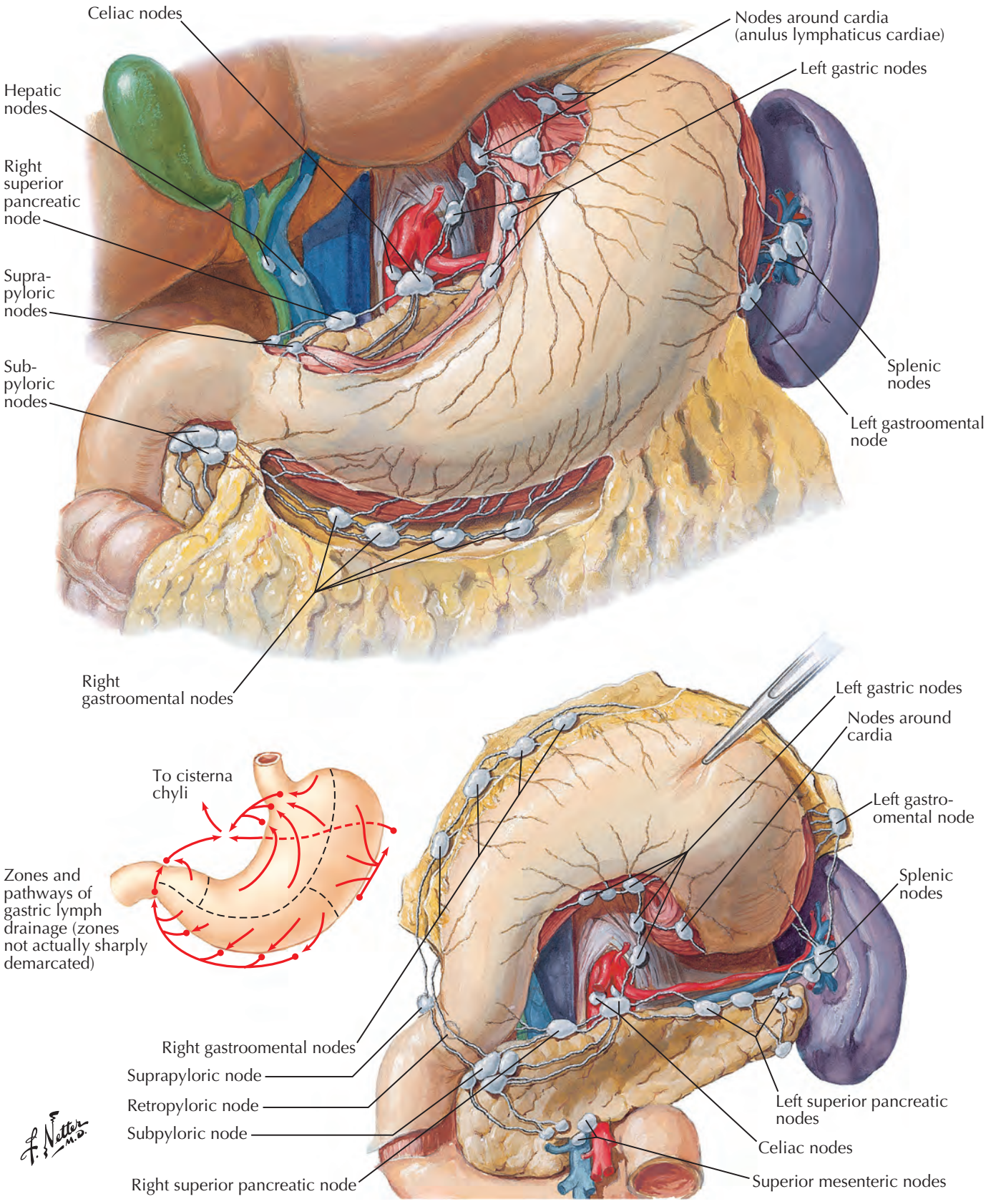
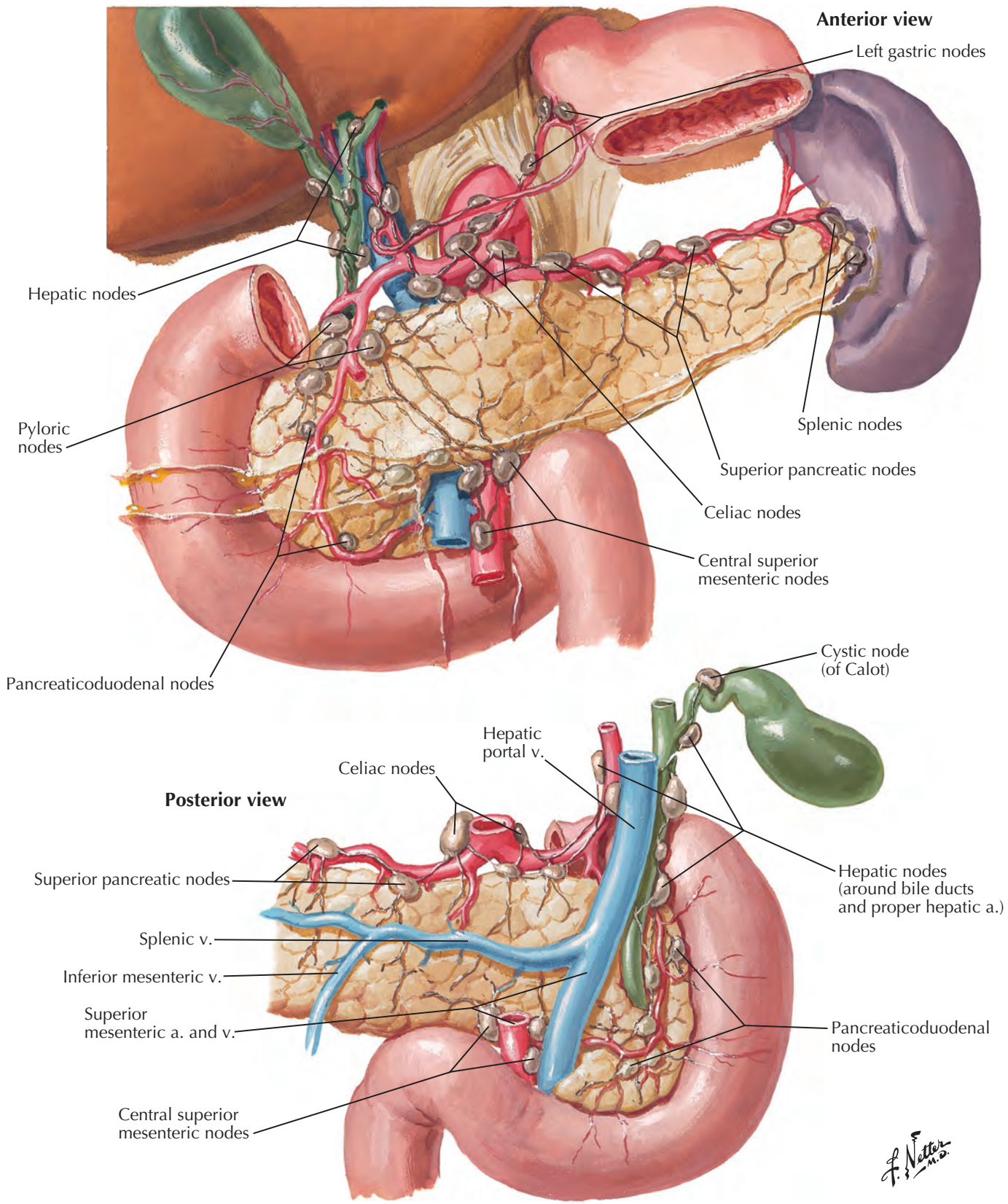
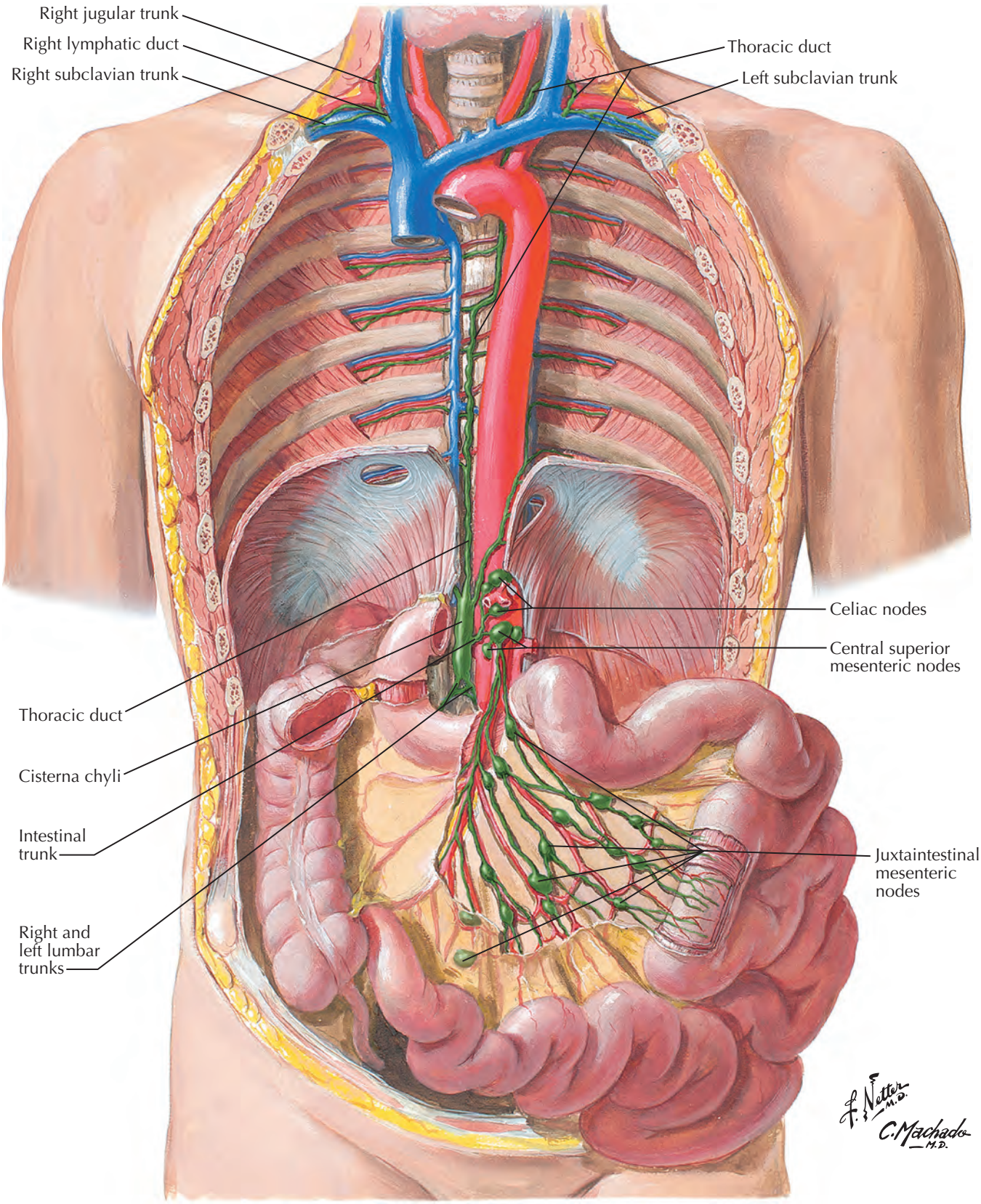

Celiac nodes
Nodes around cardia (anulus lymphaticus cardiae)
Left gastric nodes
Hepatic nodes
Right superior pancreatic node
Supra-pyloric nodes
Sub-pyloric nodes
Splenic nodes
Left gastroomental node
Right gastroomental nodes
To cisterna chyli
Zones and pathways of gastric lymph drainage (zones not actually sharply demarcated)
Left gastric nodes
Nodes around cardia
Left gastro-omental node
Splenic nodes
Right gastroomental nodes
Suprapyloric node
Retropyloric node
Subpyloric node
Right superior pancreatic node
Left superior pancreatic nodes
Celiac nodes
Superior mesenteric nodes


Anterior view
Left gastric nodes
Hepatic nodes
Pyloric nodes
Splenic nodes
Superior pancreatic nodes
Celiac nodes
Central superior mesenteric nodes
Pancreaticoduodenal nodes
Cystic node (of Calot)
Hepatic portal v.
Celiac nodes
Posterior view
Superior pancreatic nodes
Splenic v.
Inferior mesenteric v.
Superior mesenteric a. and v.
Central superior mesenteric nodes
Hepatic nodes (around bile ducts and proper hepatic a.)
Pancreaticoduodenal nodes


Right jugular trunk
Right lymphatic duct
Right subclavian trunk
Thoracic duct
Left subclavian trunk
Celiac nodes
Central superior mesenteric nodes
Thoracic duct
Cisterna chyli
Intestinal trunk
Right and left lumbar trunks
Juxtaintestinal mesenteric nodes
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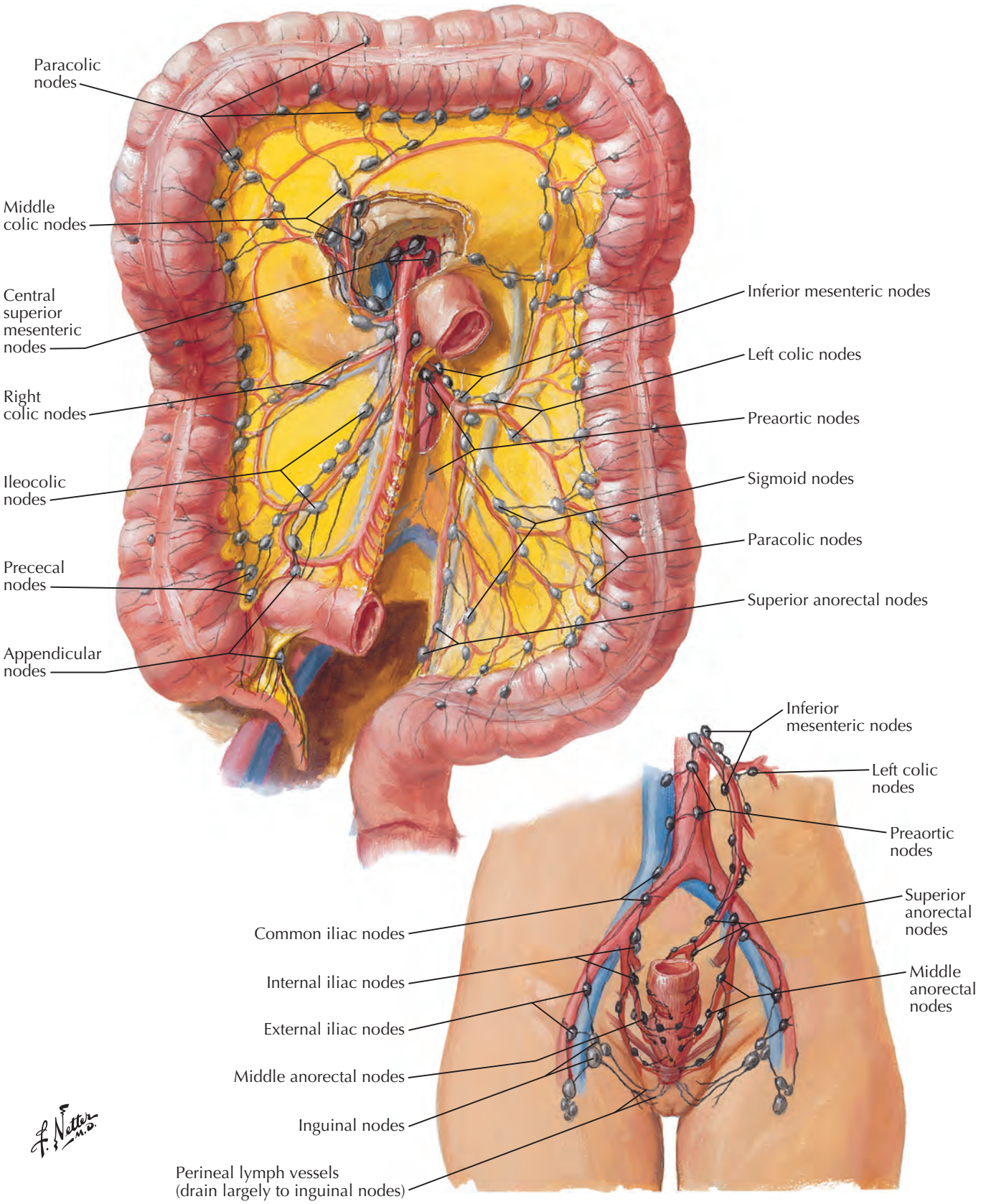
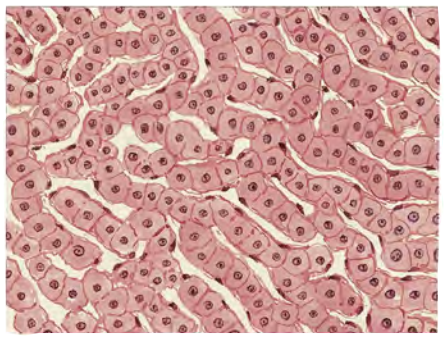
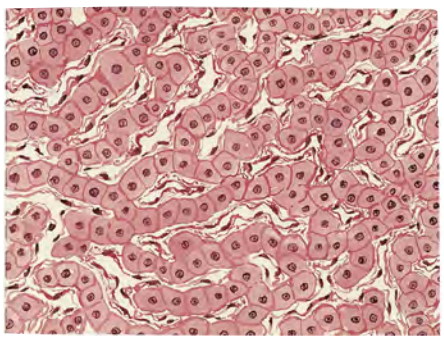
C. Machado M.D.


Paracolic nodes
Middle colic nodes
Central superior mesenteric nodes
Right colic nodes
Ileocolic nodes
Prececal nodes
Appendicular nodes
Inferior mesenteric nodes
Left colic nodes
Preaortic nodes
Sigmoid nodes
Paracolic nodes
Superior anorectal nodes
Inferior mesenteric nodes
Left colic nodes
Preaortic nodes
Superior anorectal nodes
Middle anorectal nodes
Common iliac nodes
Internal iliac nodes
External iliac nodes
Middle anorectal nodes
Inguinal nodes
Perineal lymph vessels (drain largely to inguinal nodes)

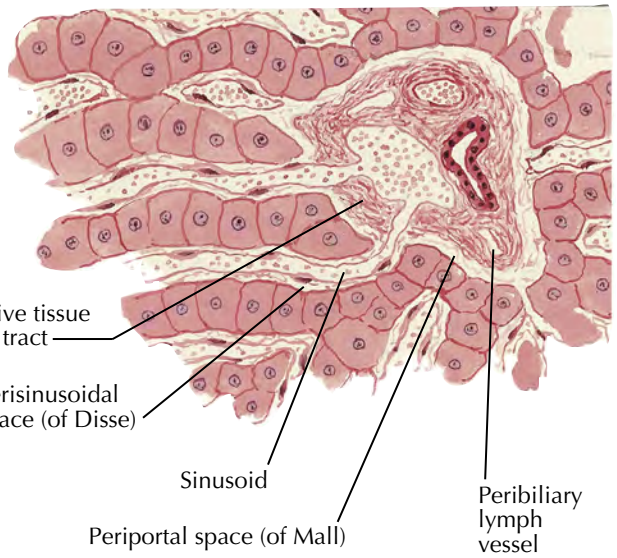


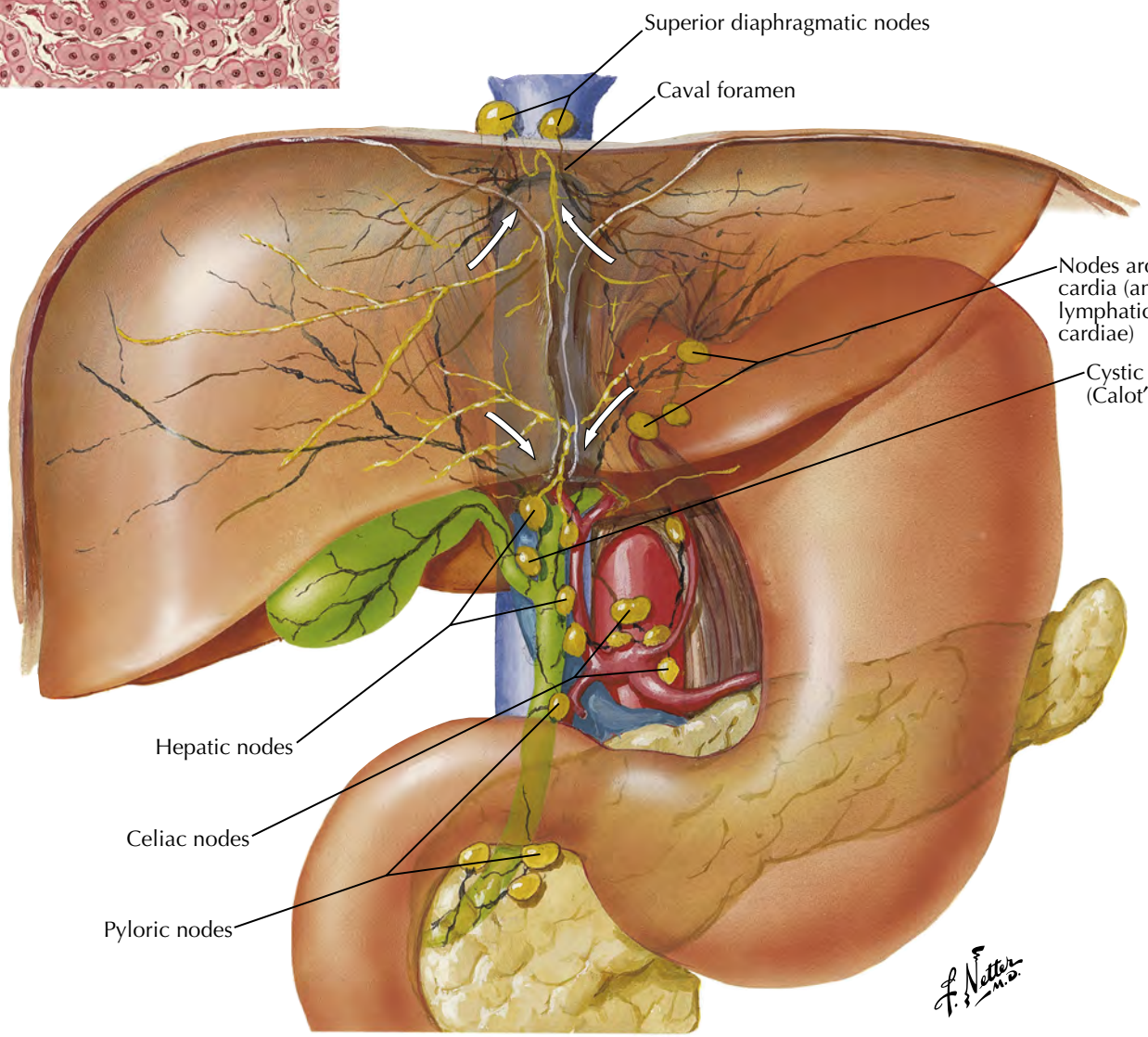


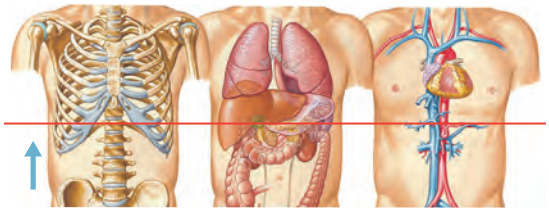
Low-power sections of liver

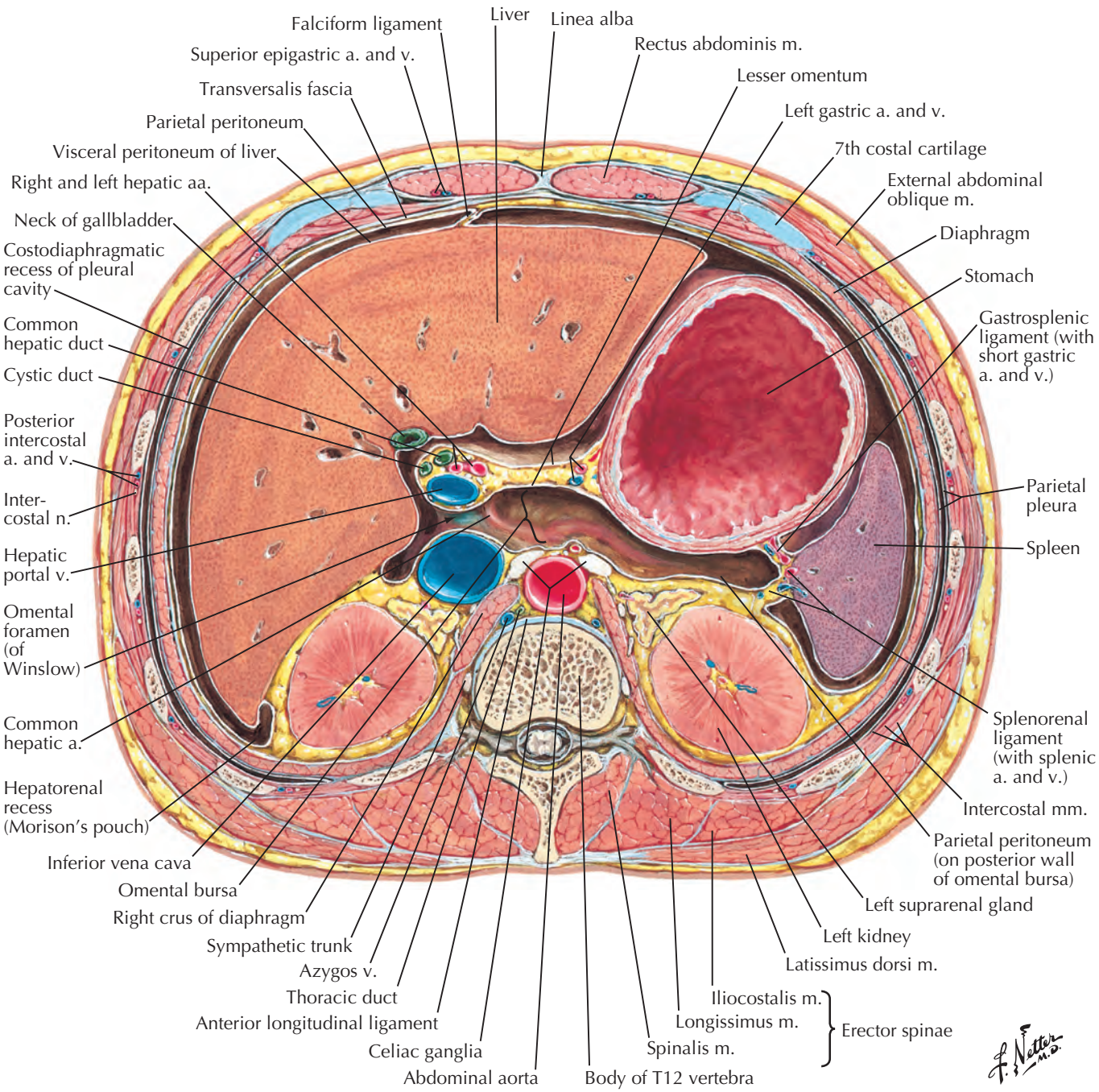
Perisinusoidal spaces (of Disse) very narrow or obliterated

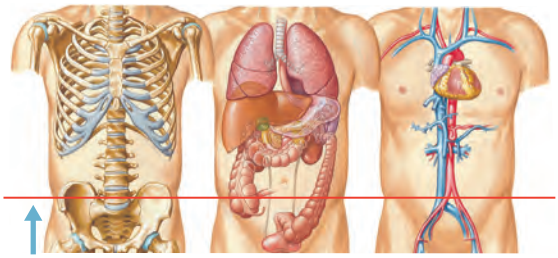
Perisinusoidal spaces (of Disse) markedly widened

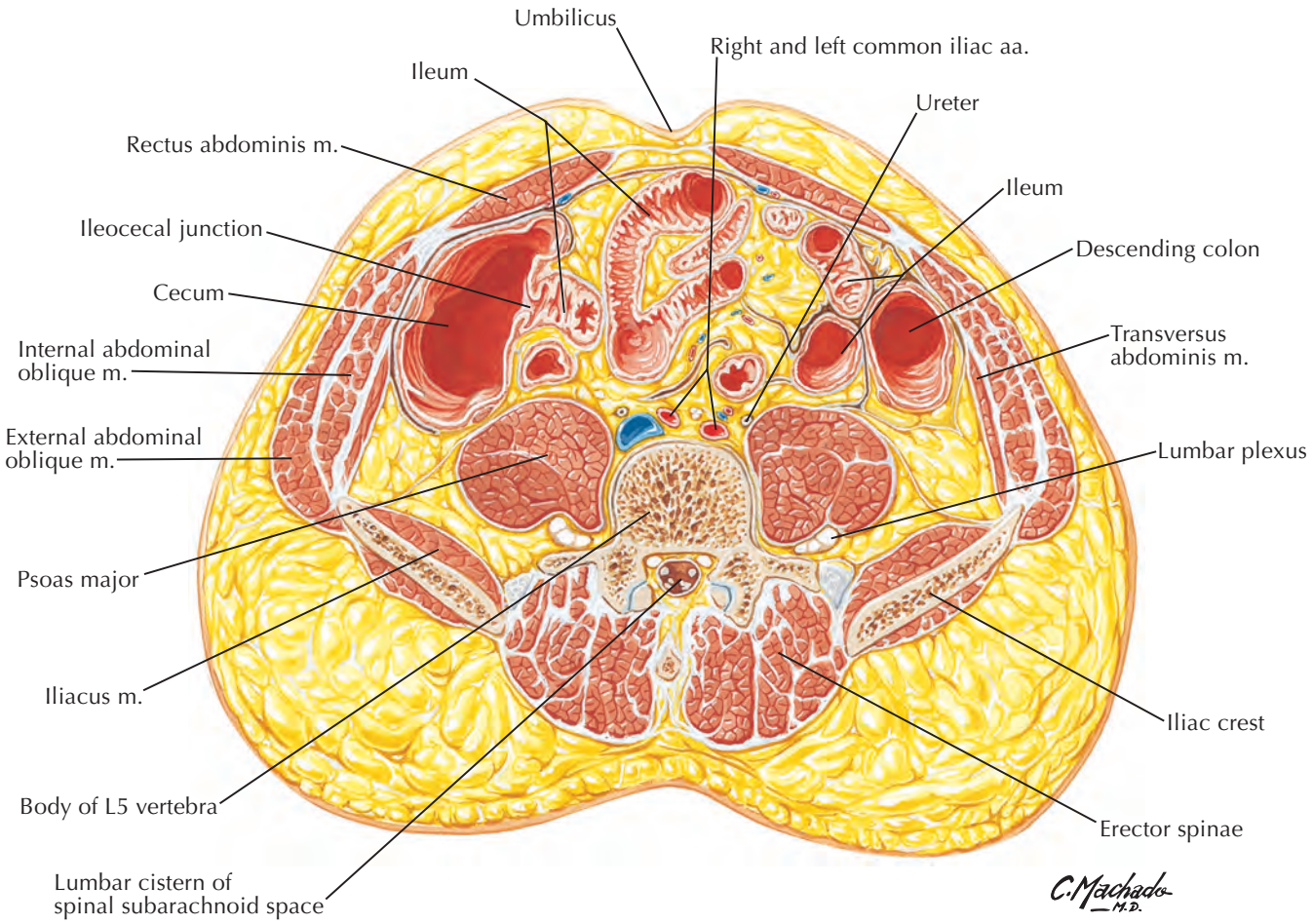


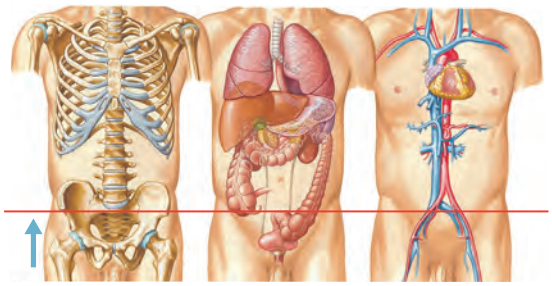


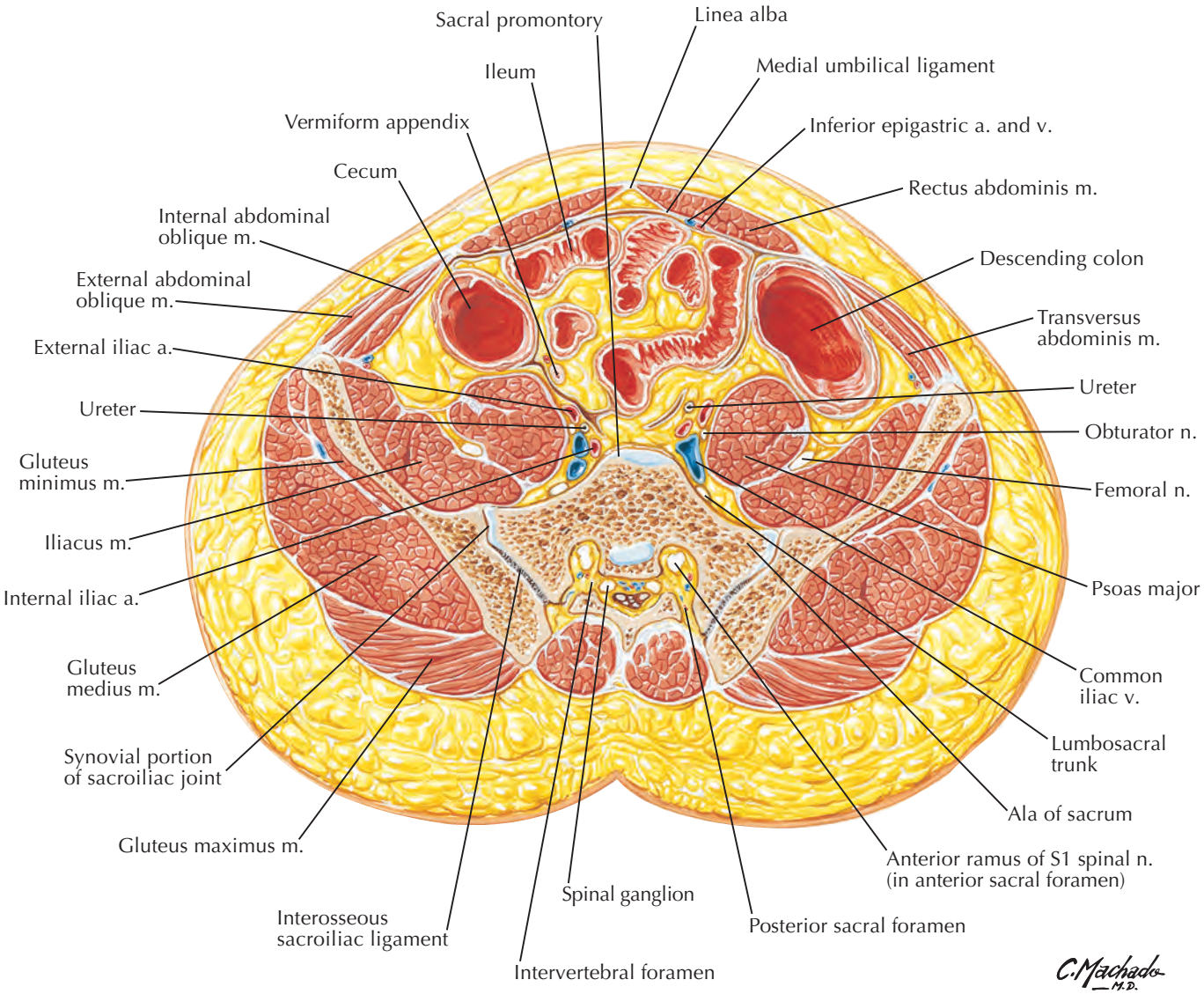



Falciform ligament
Liver
Linea alba
Superior epigastric a. and v.
Rectus abdominis m.
Transversalis fascia
Lesser omentum
Parietal peritoneum
Left gastric a. and v.
Visceral peritoneum of liver
7th costal cartilage
Right and left hepatic aa.
External abdominal oblique m.
Neck of gallbladder
Diaphragm
Costodiaphragmatic recess of pleural cavity
Stomach
Common hepatic duct
Gastrosplenic ligament (with short gastric a. and v.)
Cystic duct
Posterior intercostal a. and v.
Parietal pleura
Inter-costal n.
Spleen
Hepatic portal v.
Omental foramen (of Winslow)
Splenorenal ligament (with splenic a. and v.)
Common hepatic a.
Intercostal mm.
Hepatorenal recess (Morison's pouch)
Parietal peritoneum (on posterior wall of omental bursa)
Inferior vena cava
Left suprarenal gland
Omental bursa
Left kidney
Right crus of diaphragm
Latissimus dorsi m.
Sympathetic trunk
Azygos v.
Iliocostalis m.
Thoracic duct
Longissimus m.
Anterior longitudinal ligament
Erector spinae
Celiac ganglia
Spinalis m.
Abdominal aorta
Body of T12 vertebra

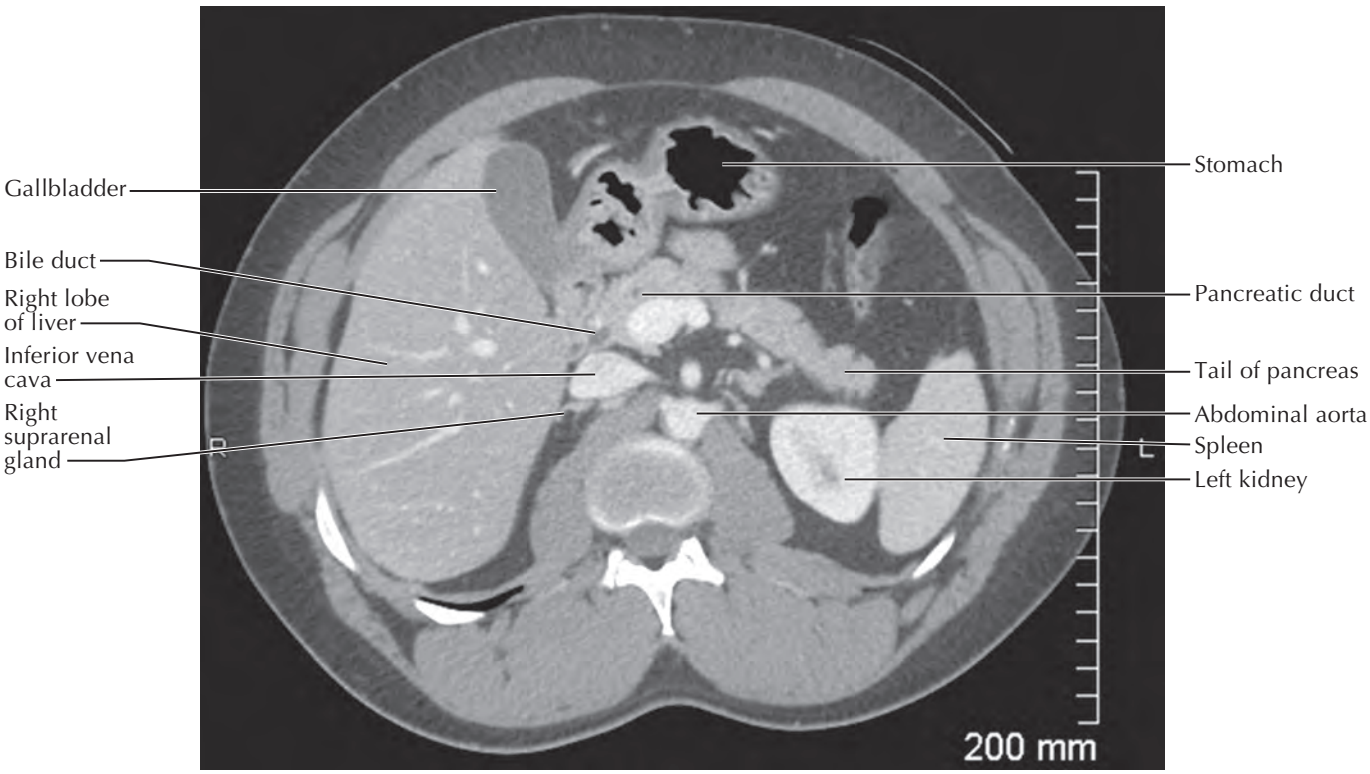


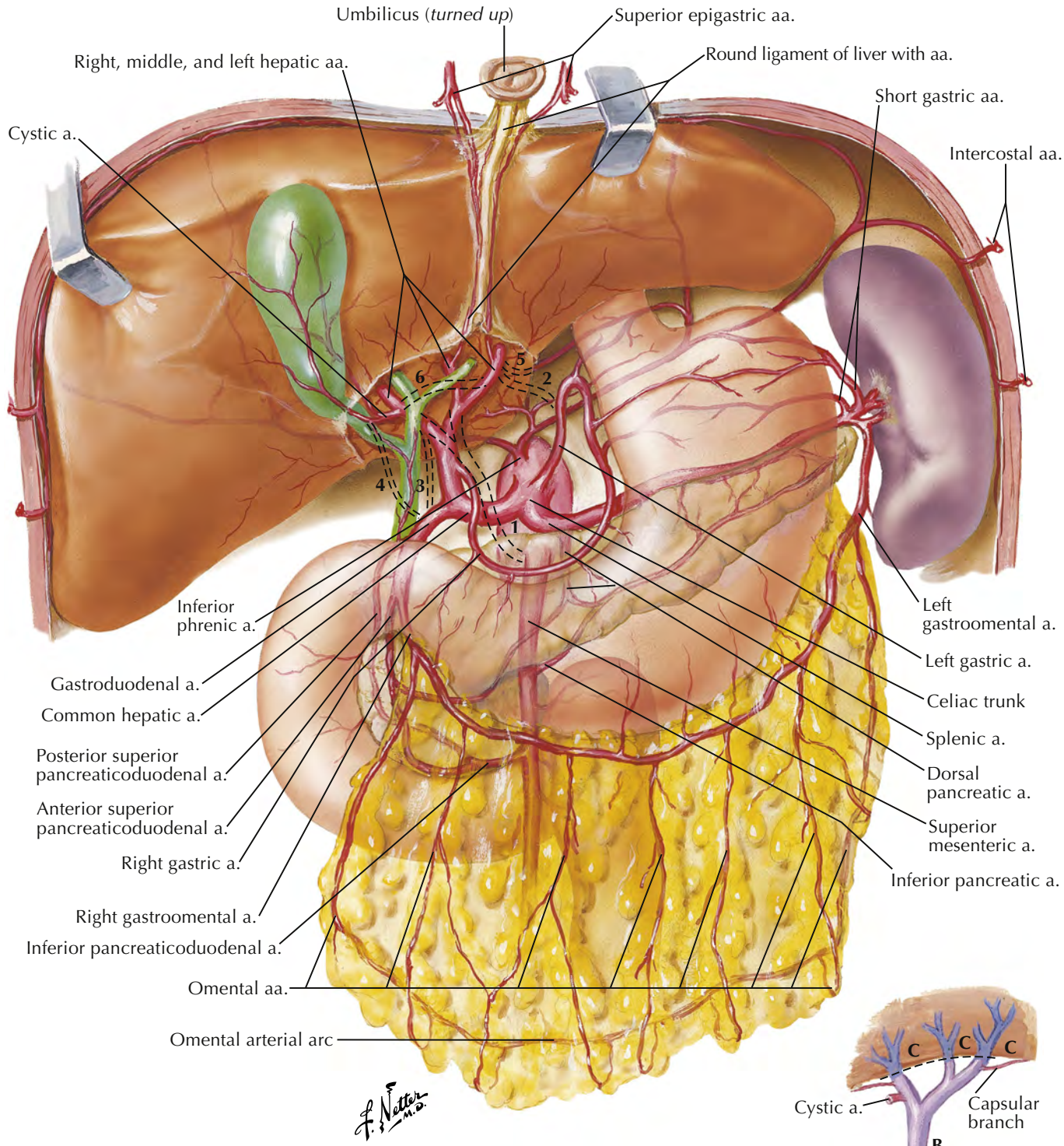

Umbilicus
Right and left common iliac aa.
Ileum
Ureter
Rectus abdominis m.
Ileum
Ileocecal junction
Descending colon
Cecum
Transversus abdominis m.
Internal abdominal oblique m.
External abdominal oblique m.
Lumbar plexus
Psoas major
Iliacus m.
Iliac crest
Body of L5 vertebra
Erector spinae
Lumbar cistern of spinal subarachnoid space
C. Machado M.D.




Sacral promontory
Linea alba
Ileum
Medial umbilical ligament
Vermiform appendix
Inferior epigastric a. and v.
Cecum
Rectus abdominis m.
Internal abdominal oblique m.
Descending colon
External abdominal oblique m.
Transversus abdominis m.
External iliac a.
Ureter
Ureter
Obturator n.
Gluteus minimus m.
Femoral n.
Iliacus m.
Psoas major
Internal iliac a.
Common iliac v.
Gluteus medius m.
Lumbosacral trunk
Synovial portion of sacroiliac joint
Ala of sacrum
Gluteus maximus m.
Anterior ramus of S1 spinal n. (in anterior sacral foramen)
Spinal ganglion
Interosseous sacroiliac ligament
Posterior sacral foramen
Intervertebral foramen
C. Machado M.D.

Axial CT image enhanced with intravenous contrast





Accessory or aberrant arteries
1. Right or common hepatic
2. Left hepatic
3. Right hepatic
4. Cystic

Arterial anastomoses (variants)
5. Inferior phrenic/left gastric ⟷ left hepatic
6. Right hepatic ⟷ left hepatic

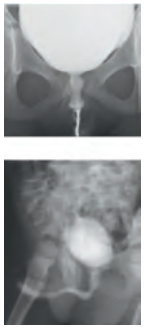
Effects of hepatic artery obstruction
- A. Zone of relative safety
- B. Zone of questionable effects
- C. Zone of inevitable infarction

PELVIS 6

Surface Anatomy	352	**Male Internal Genitalia**	391–392
Bony Pelvis	353–357	**Rectum and Anal Canal**	393–399
Pelvic Diaphragm and Viscera	358–368	**Vasculature**	400–410
Urinary Bladder	369–371	**Nerves of Perineum and Pelvic Viscera**	411–419
Female Internal Genitalia	372–376	**Cross-Sectional Anatomy**	420–421
Female Perineum and External Genitalia	377–380	**Structures with High Clinical Significance**	Tables 6.1–6.3
Male Perineum and External Genitalia	381–388	**Muscles**	Table 6.4
Homologies of Male and Female Genitalia	389–390	**Electronic Bonus Plates**	BP 84–BP 95

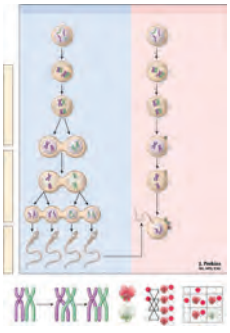
ELECTRONIC BONUS PLATES

BP 84 Fasciae of Pelvis and Perineum: Male and Female



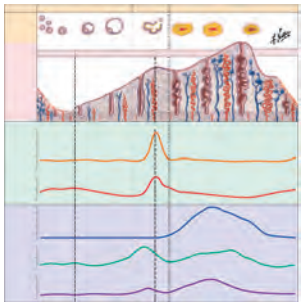
BP 85 Cystourethrograms: Male and Female

BP 86 Female Urethra



BP 87 Genetics of Reproduction

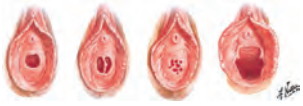
ELECTRONIC BONUS PLATES—*cont'd*



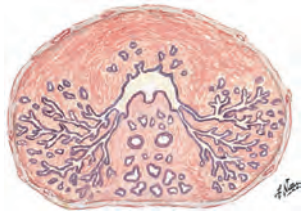
BP 88 Menstrual Cycle

BP 89 Uterine Development

BP 90 Ovary, Oocytes, and Follicles



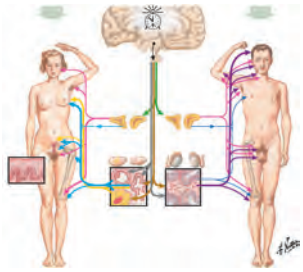
BP 91 Variations in Hymen



BP 92 Cross Section of Pelvis Through Prostate

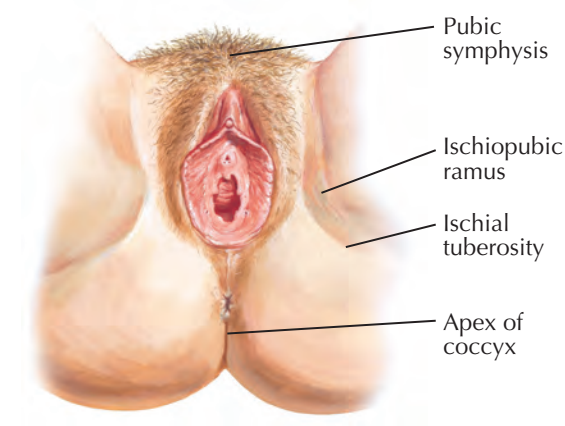
BP 93 Arteries and Veins of Pelvis: Male (Featuring Prostate)

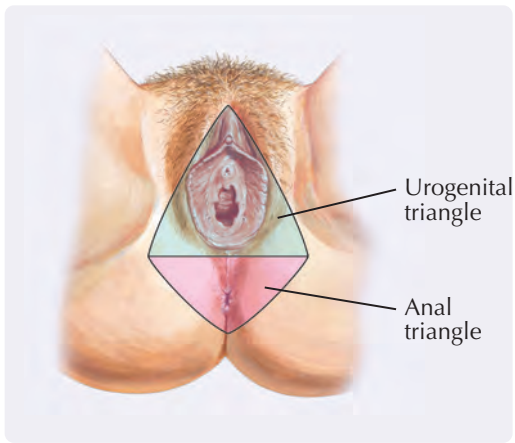
BP 94 Cross Section of Pelvis Through Vesicoprostatic Junction

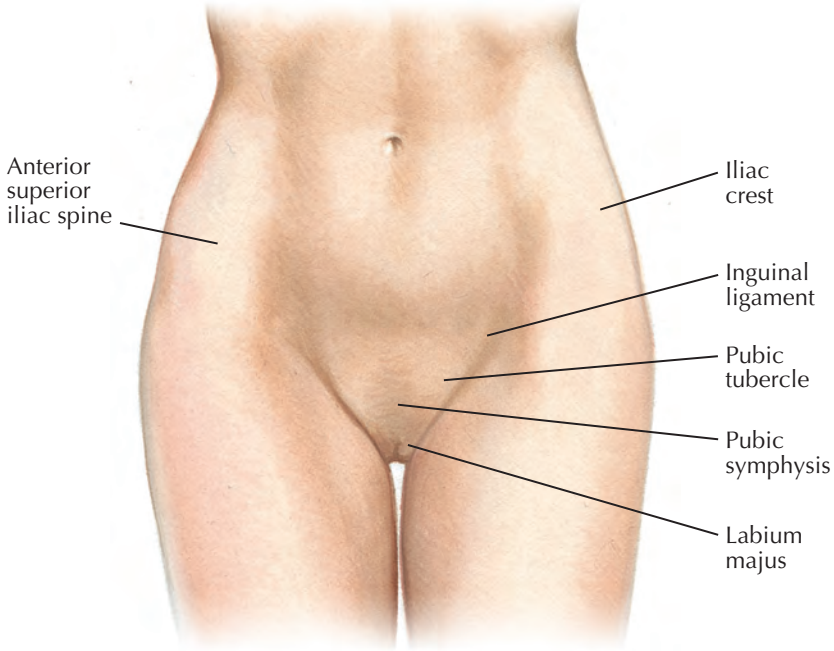


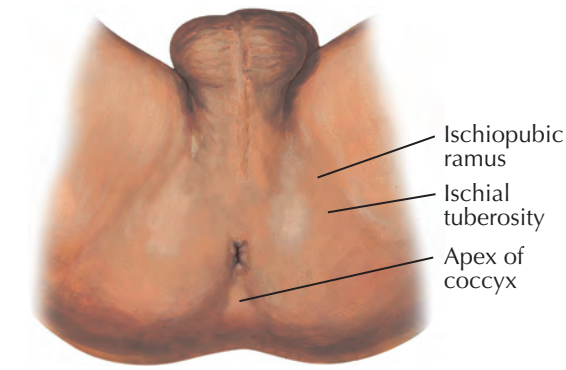
BP 95 Endocrine Glands, Hormones, and Puberty

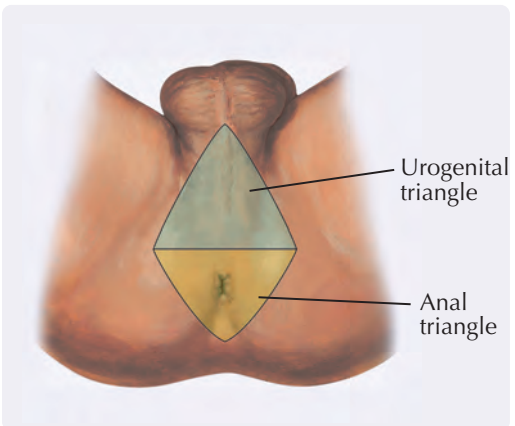
See also **Plates 188, 267**

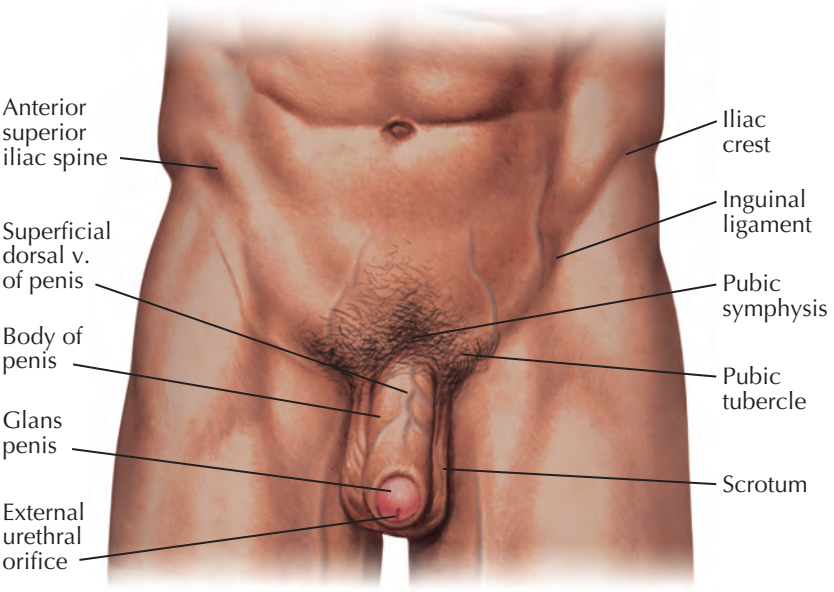












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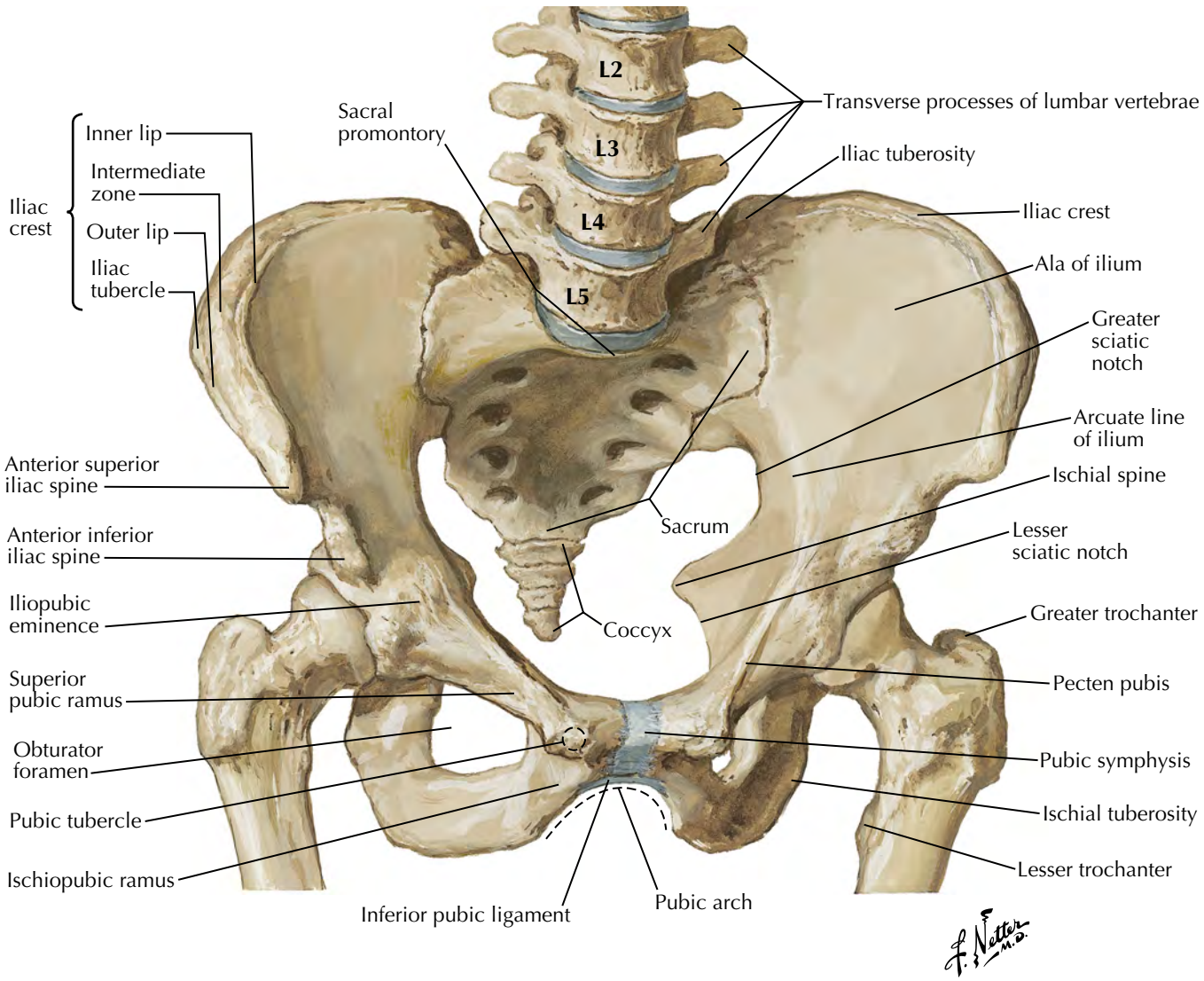
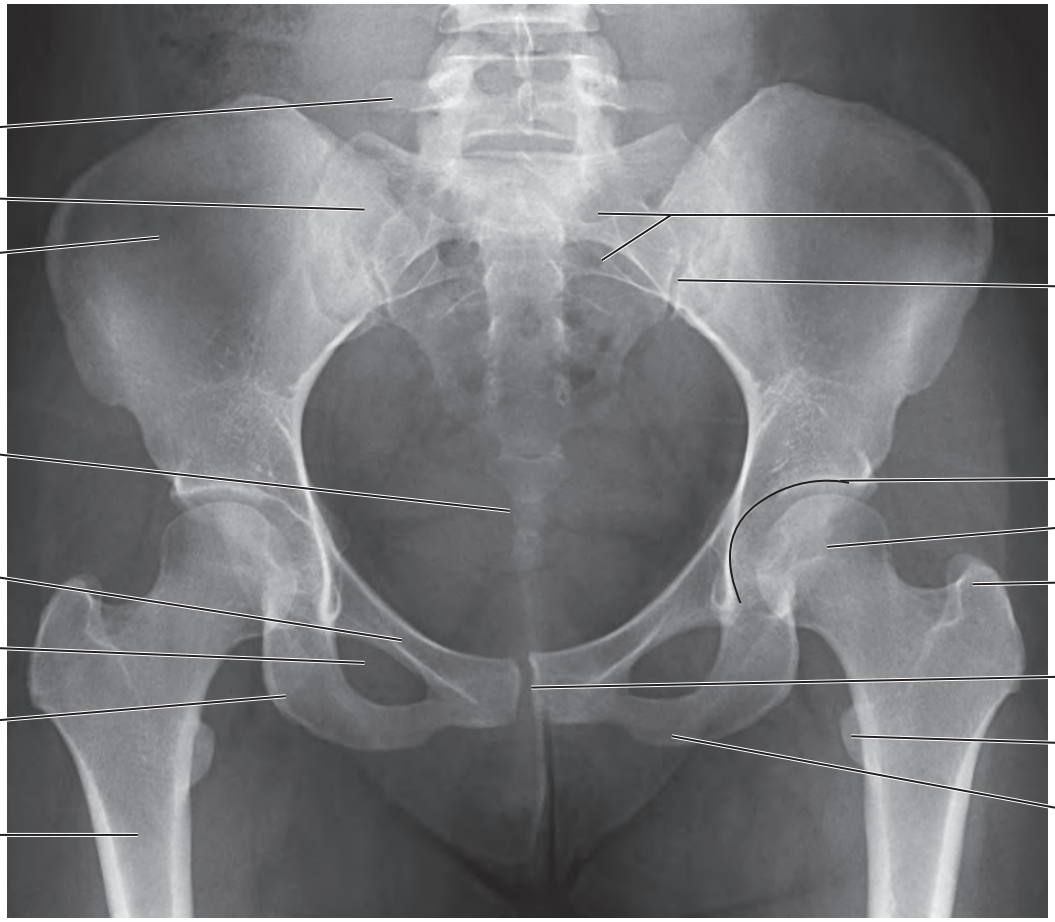
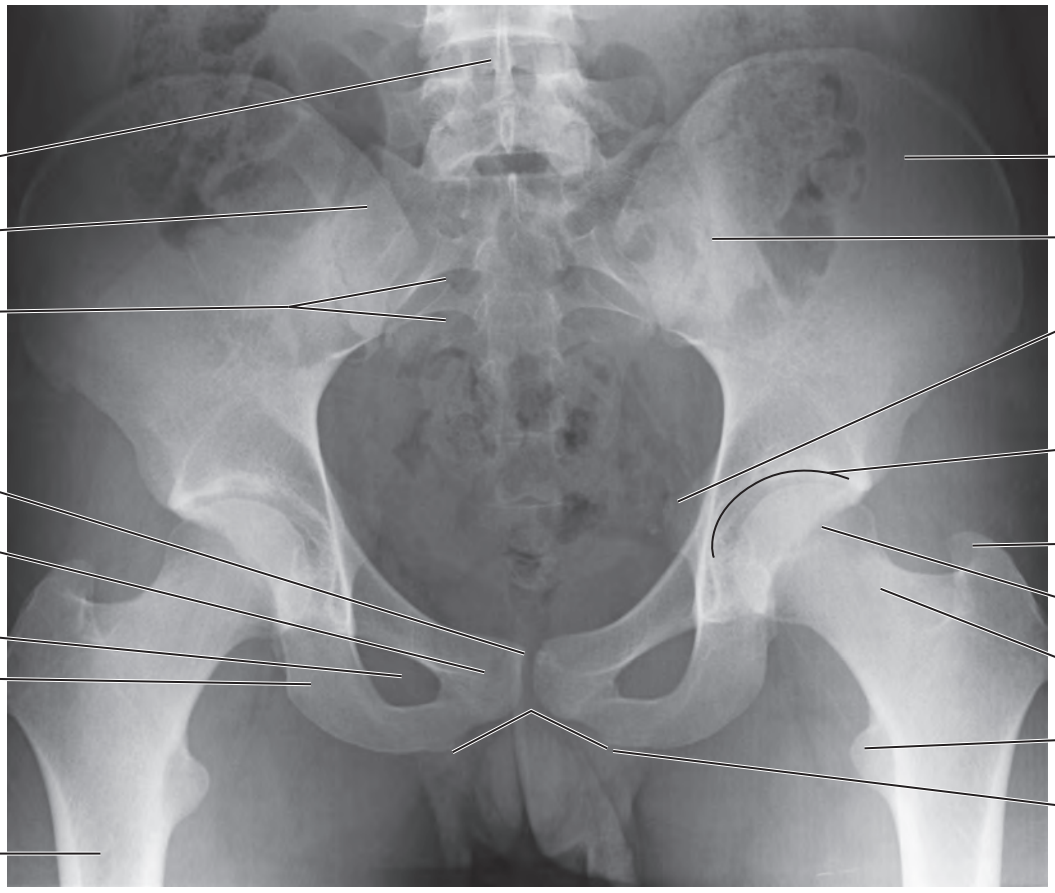

L2
L3
L4
L5
Transverse processes of lumbar vertebrae
Sacral promontory
Iliac tuberosity
Iliac crest
Ala of ilium
Greater sciatic notch
Arcuate line of ilium
Ischial spine
Lesser sciatic notch
Greater trochanter
Pecten pubis
Pubic symphysis
Ischial tuberosity
Lesser trochanter
Pubic arch
Inferior pubic ligament
Ischiopubic ramus
Pubic tubercle
Obturator foramen
Superior pubic ramus
Iliopubic eminence
Anterior inferior iliac spine
Anterior superior iliac spine
Iliac crest
Inner lip
Intermediate zone
Outer lip
Iliac tubercle
Sacrum
Coccyx

Female

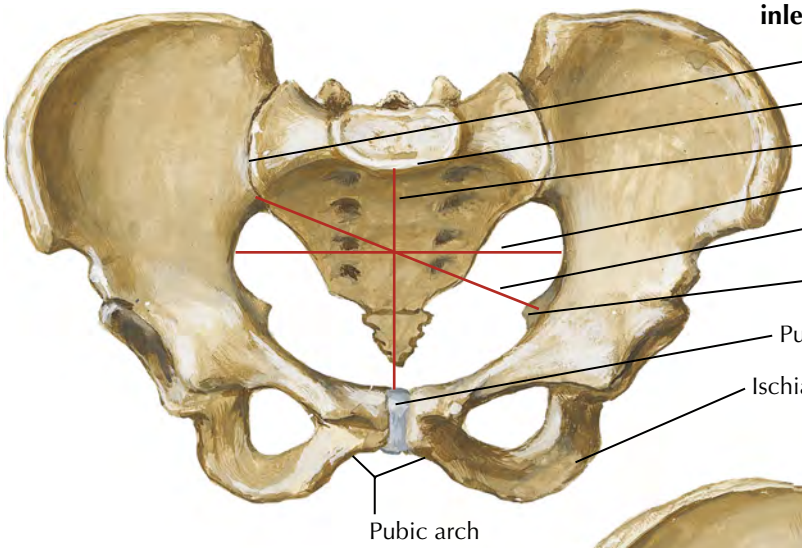

Transverse process of L5 vertebra
Ala of sacrum
Ilium
Coccyx
Superior pubic ramus
Obturator foramen
Ischial tuberosity
Body of femur
Anterior sacral foramina
Sacroiliac joint
Acetabulum
Head of femur
Greater trochanter
Pubic symphysis
Lesser trochanter
Ischiopubic ramus

Male

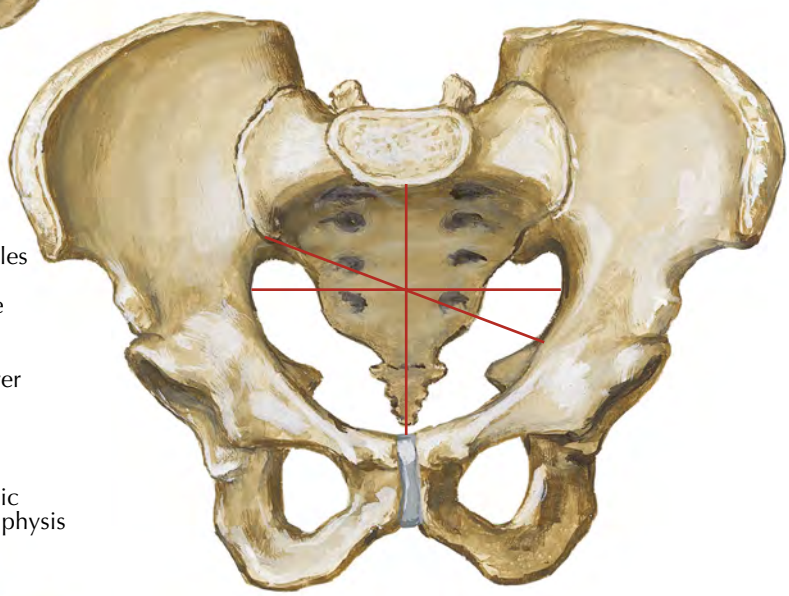

Spinous process of L4 vertebra
Ala of sacrum
Anterior sacral foramina
Pubic symphysis
Pubis
Obturator foramen
Ischium
Body of femur
Ilium
Sacroiliac joint
Ischial spine
Acetabulum
Greater trochanter
Head of femur
Neck of femur
Lesser trochanter
Subpubic angle

See also **Plate 268**

Female bony pelvis/female pelvic inlet: anterior view

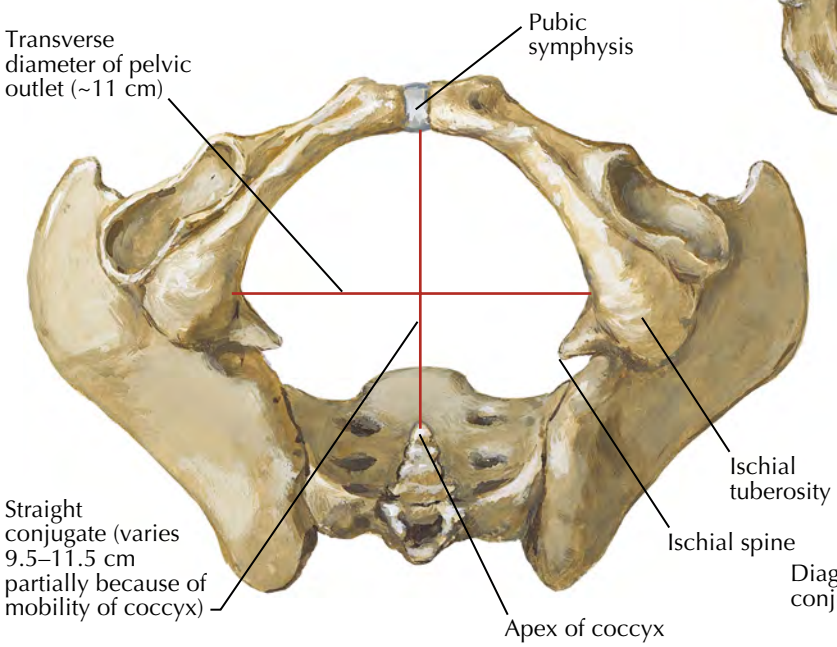


Male bony pelvis/male pelvic inlet: anterior view

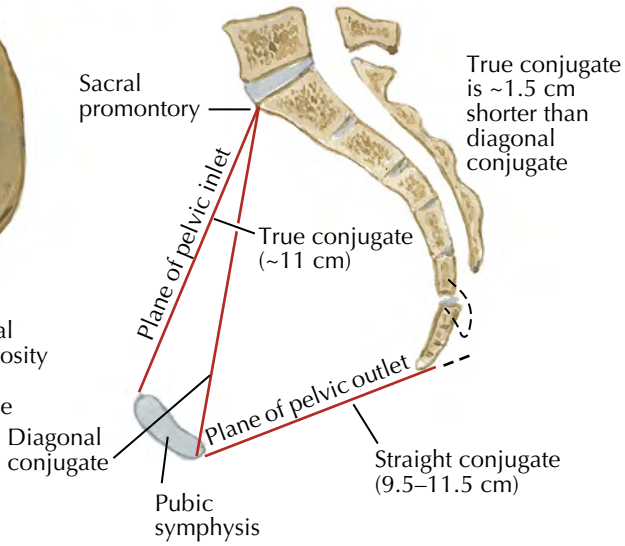


Diagonal conjugate is only diameter of pelvic inlet (superior pelvic aperture) that can be measured clinically

- All measurements slightly shorter in relation to body size than in females
- Pelvic inlet oriented more antero-posteriorly than in females, where it tends to be transversely oval
- Pubic symphysis deeper (longer)
- Pubic arch (subpubic angle) narrower
- Ischial tuberosities less far apart
- Iliac alae less flared



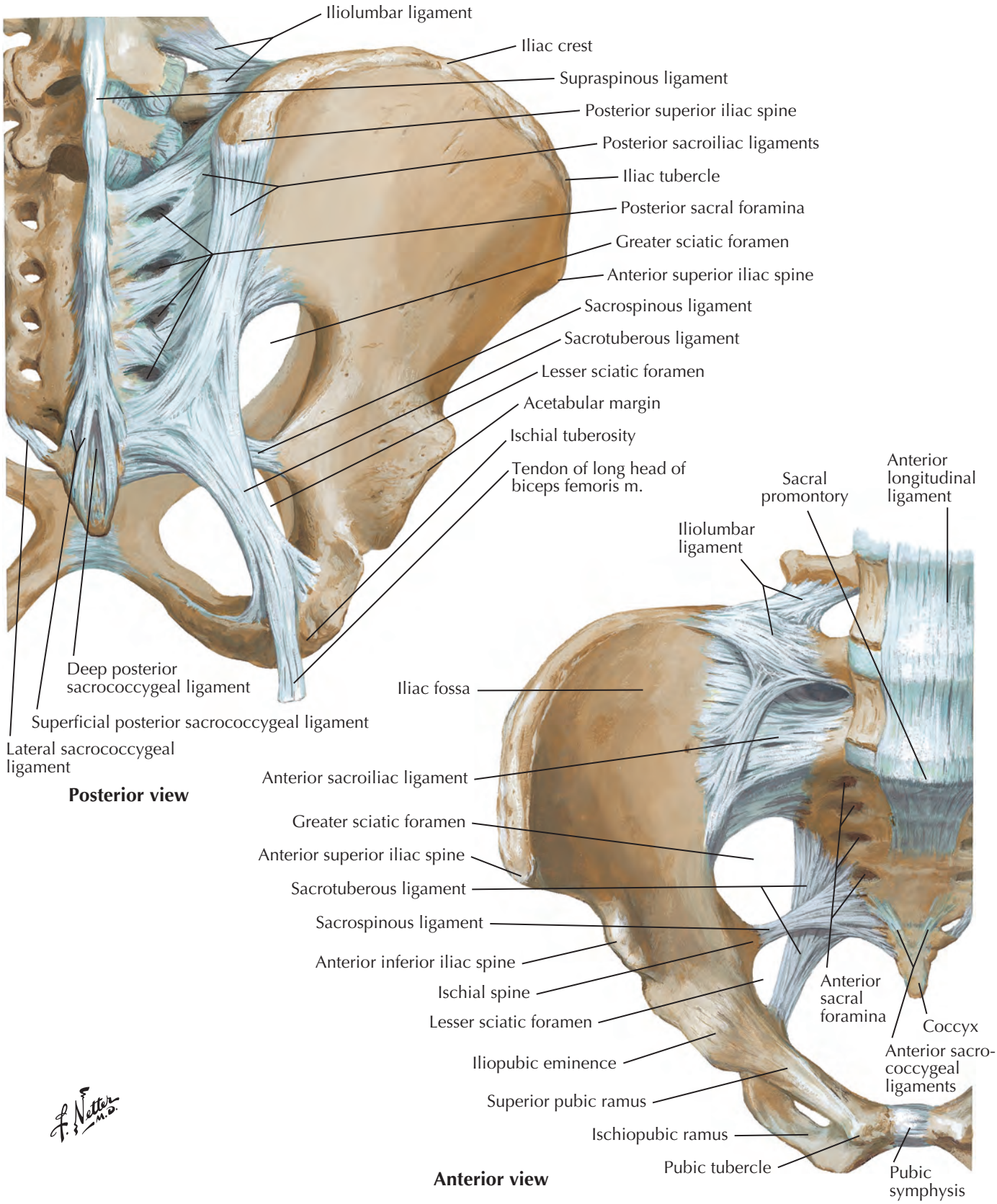
Female bony pelvis/female pelvic outlet: inferior view



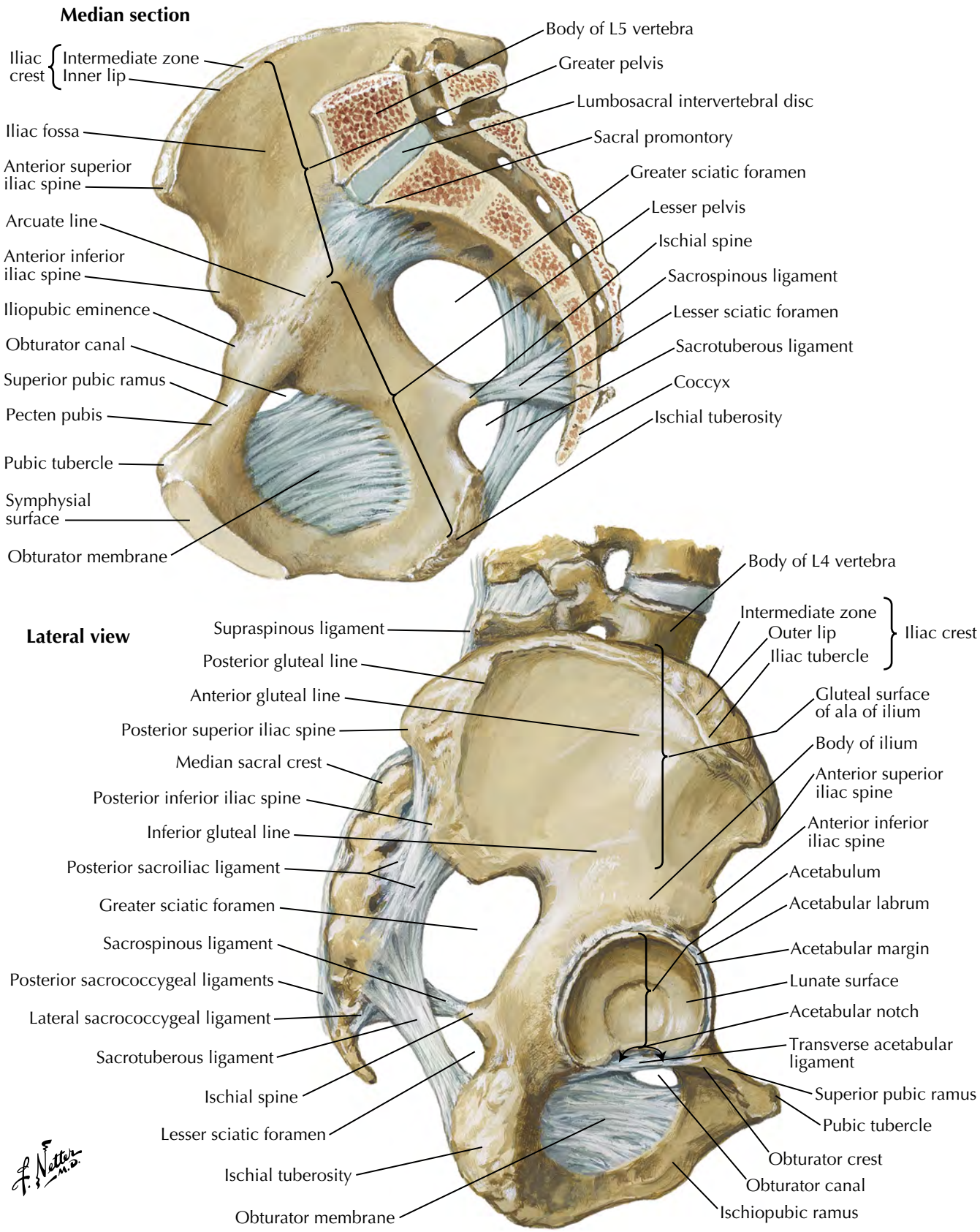
Transverse diameter is the widest distance of pelvic inlet

Female: sagittal section

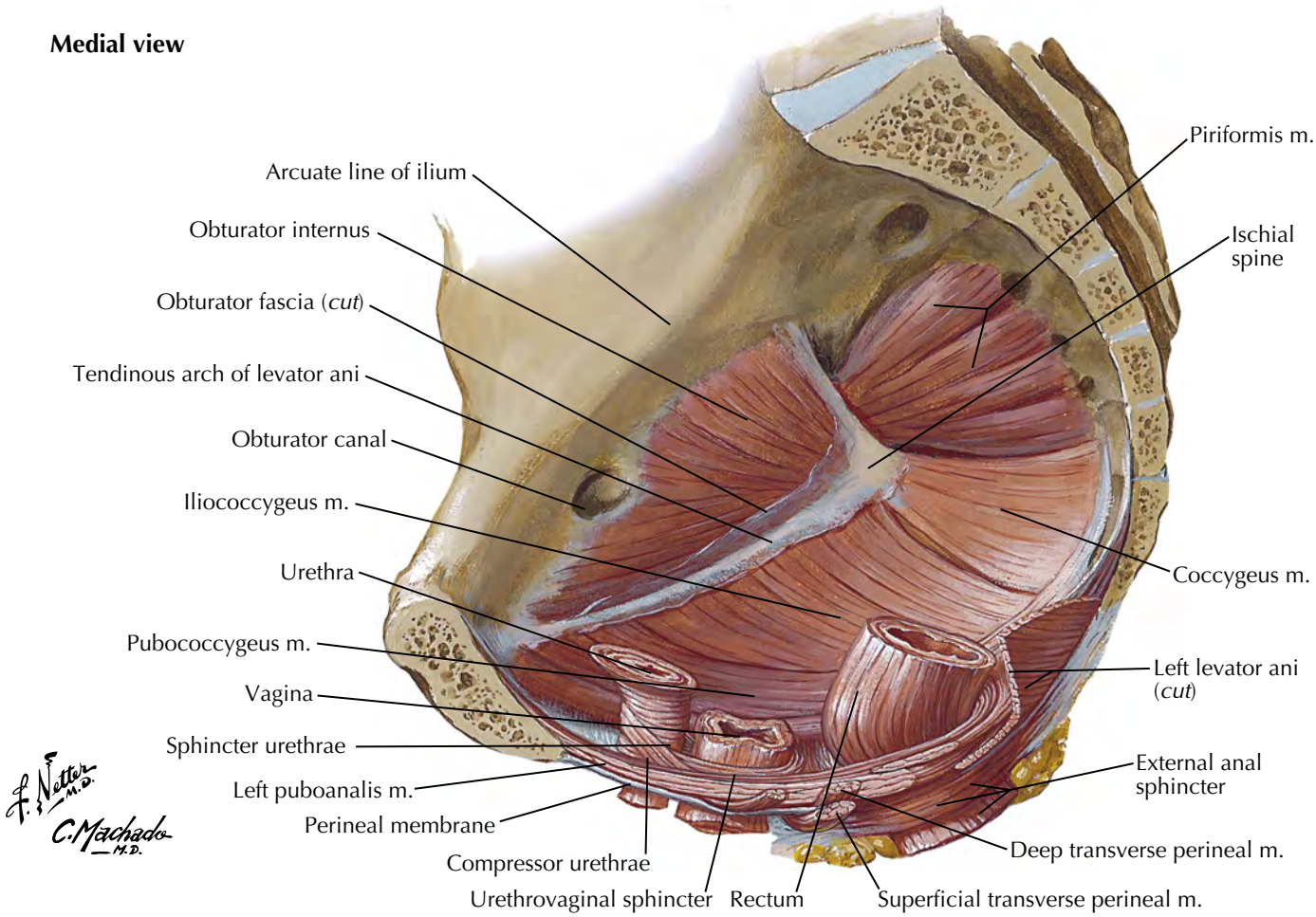
See also **Plate 184**



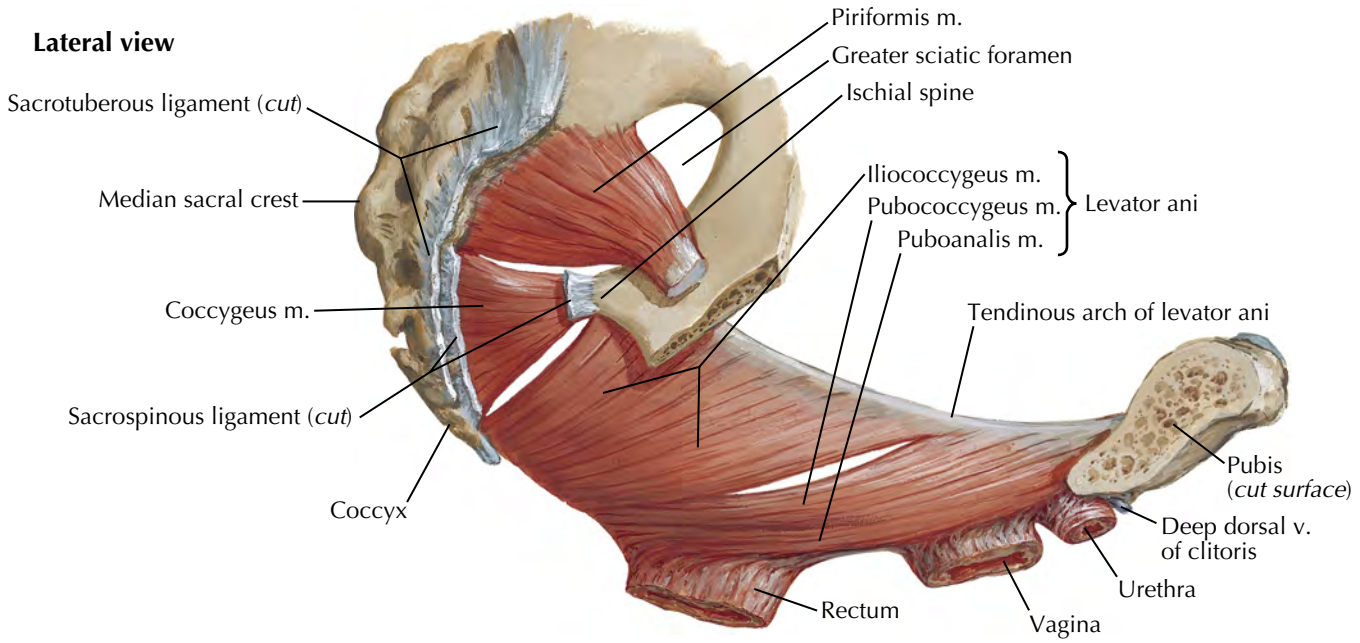
See also **Plate 184**



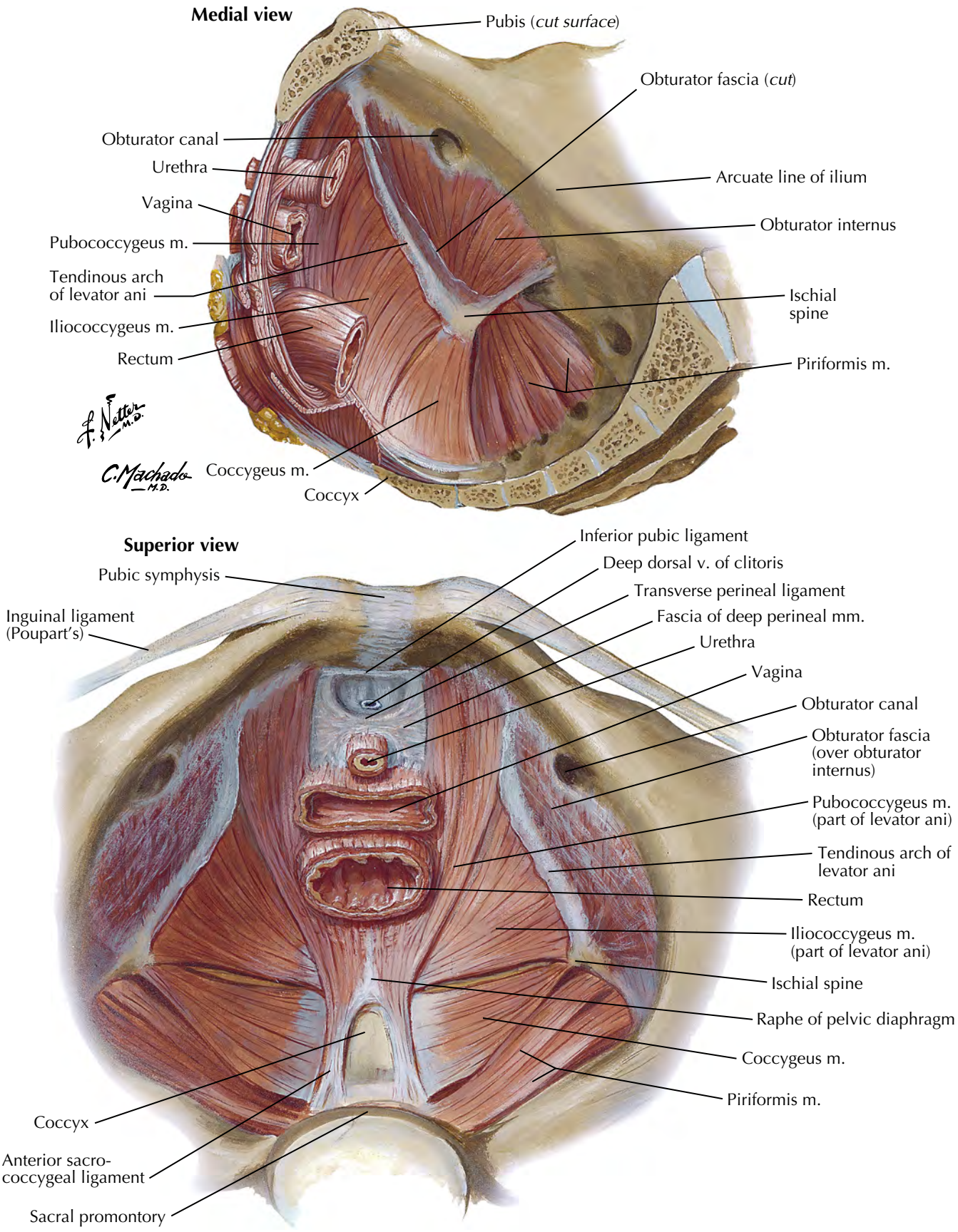
Medial view



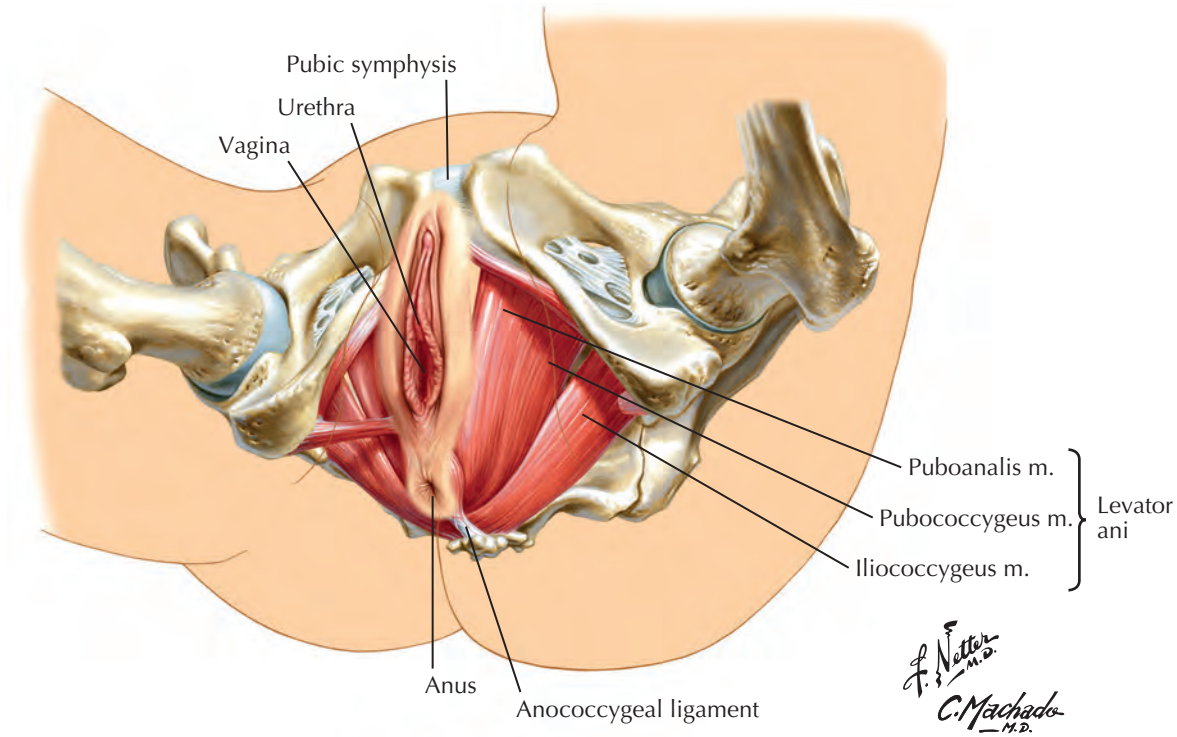
Lateral view



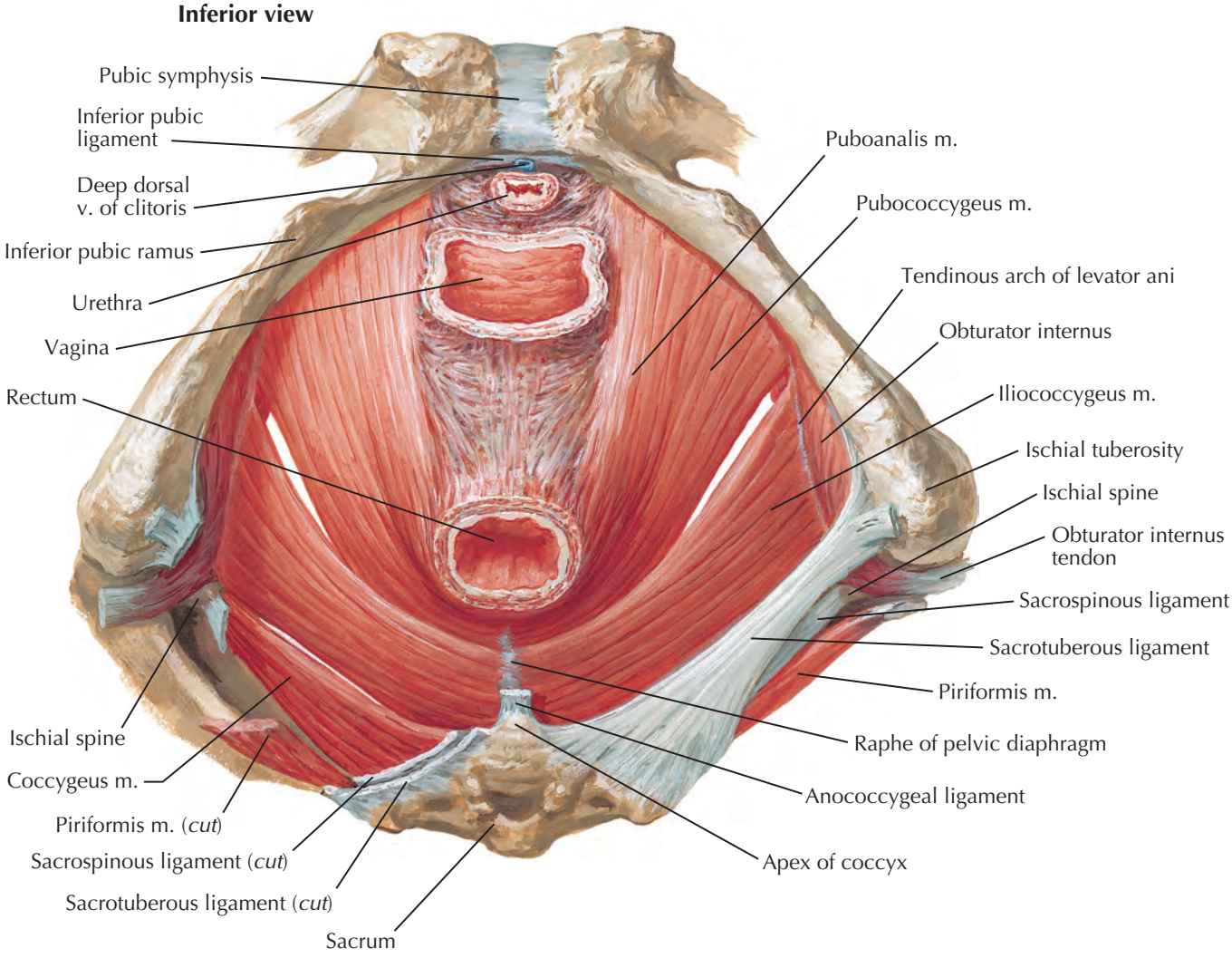
See also **Plate 379**



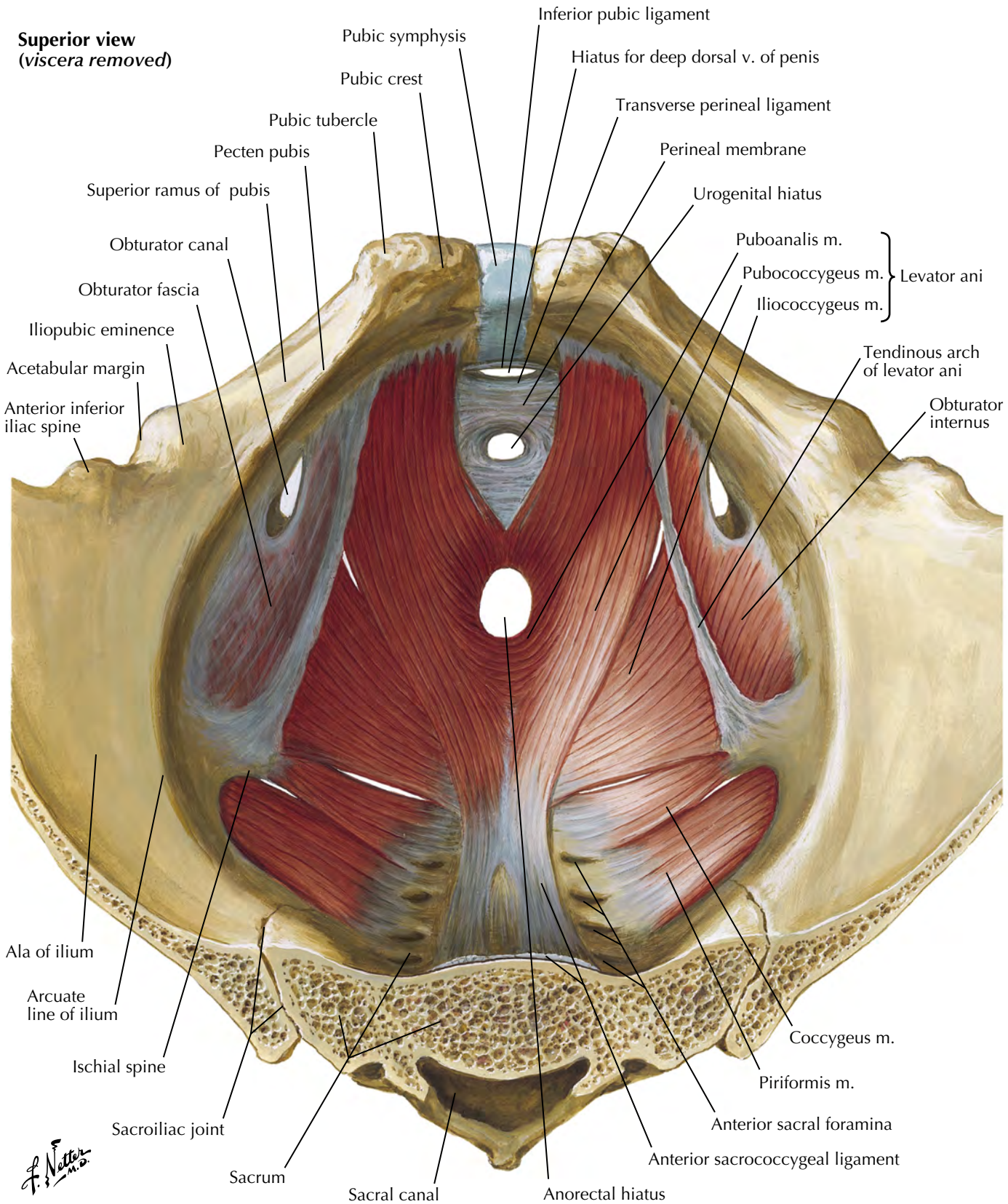
See also **Plate 380**



Inferior view

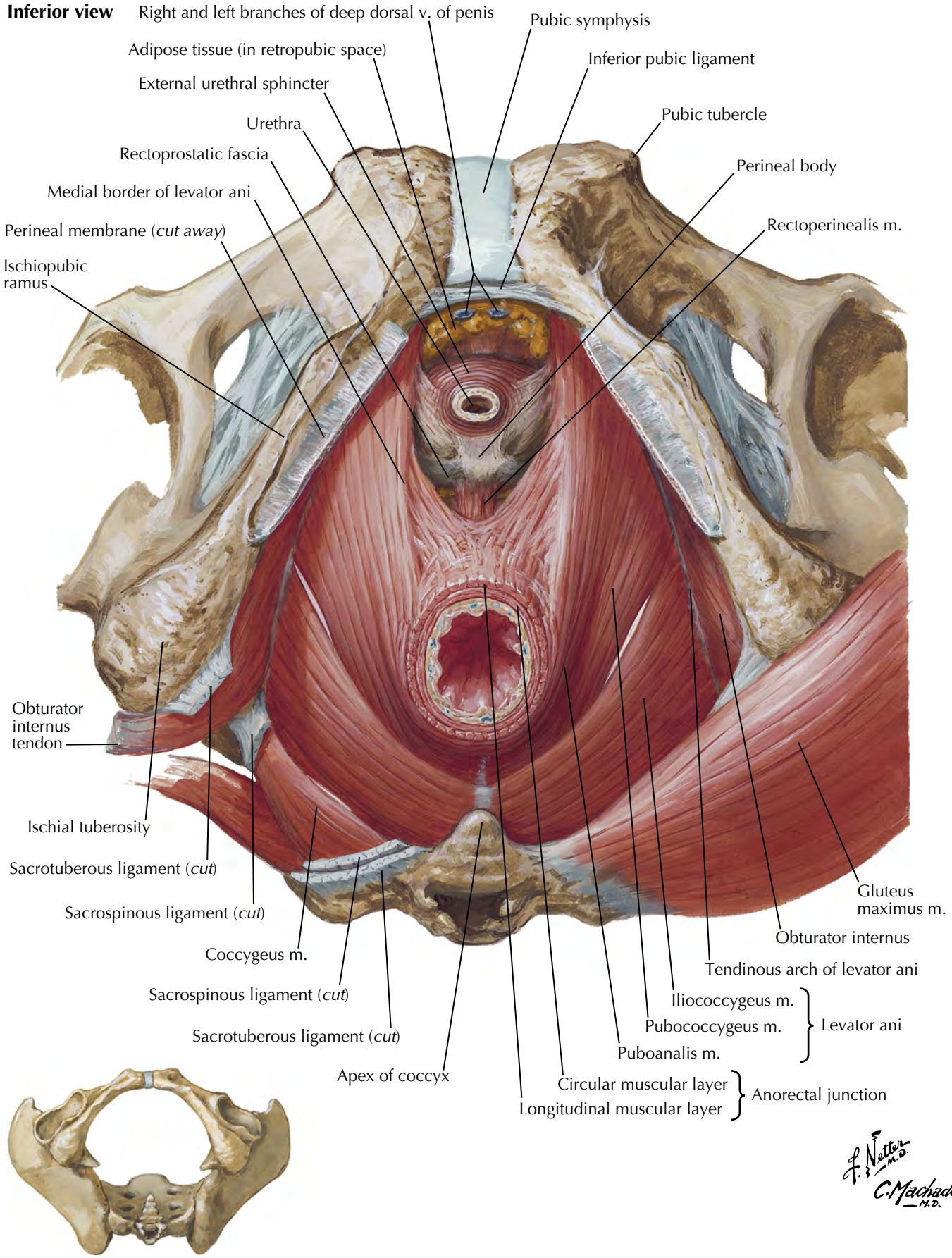


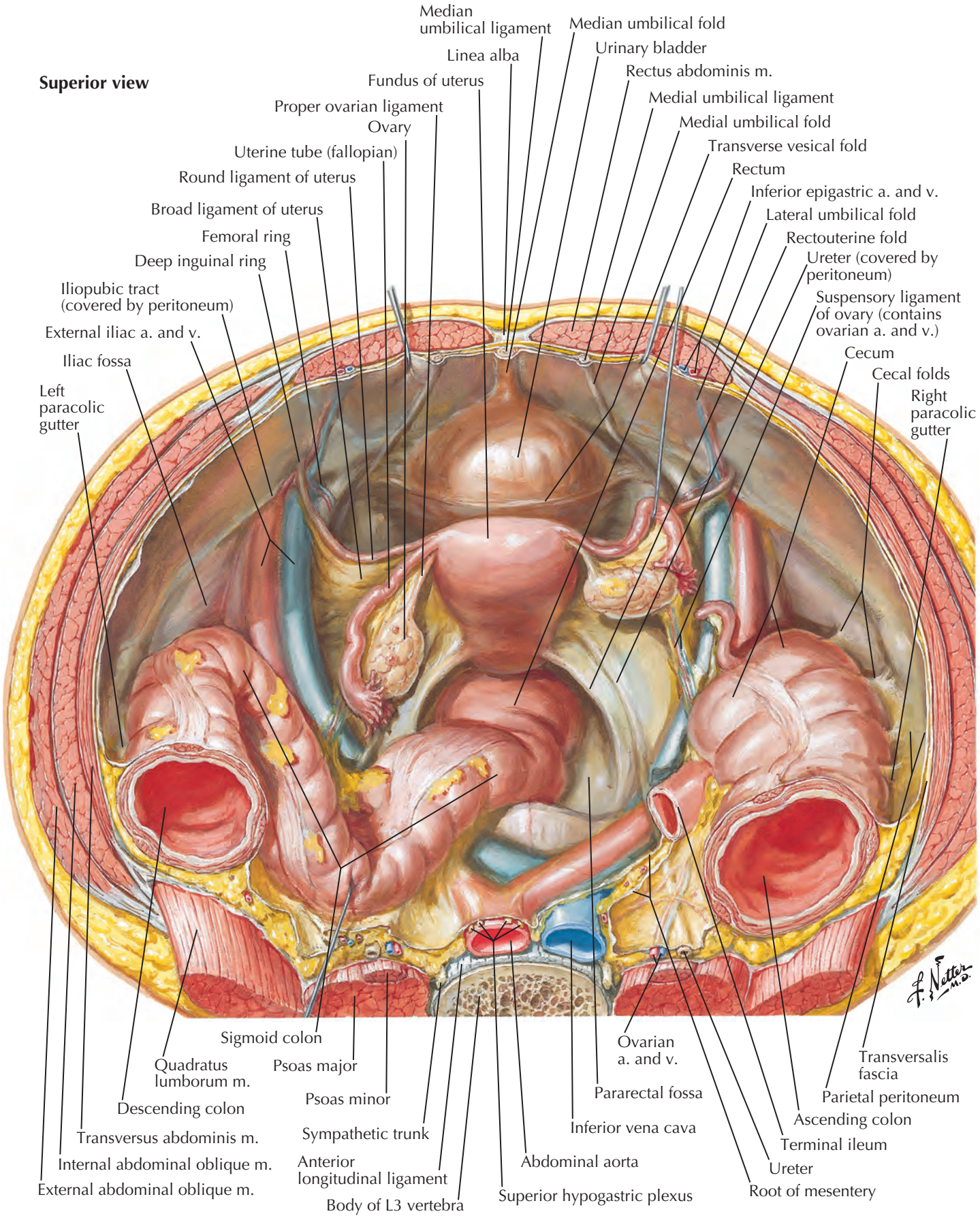
See also **Plate 362**



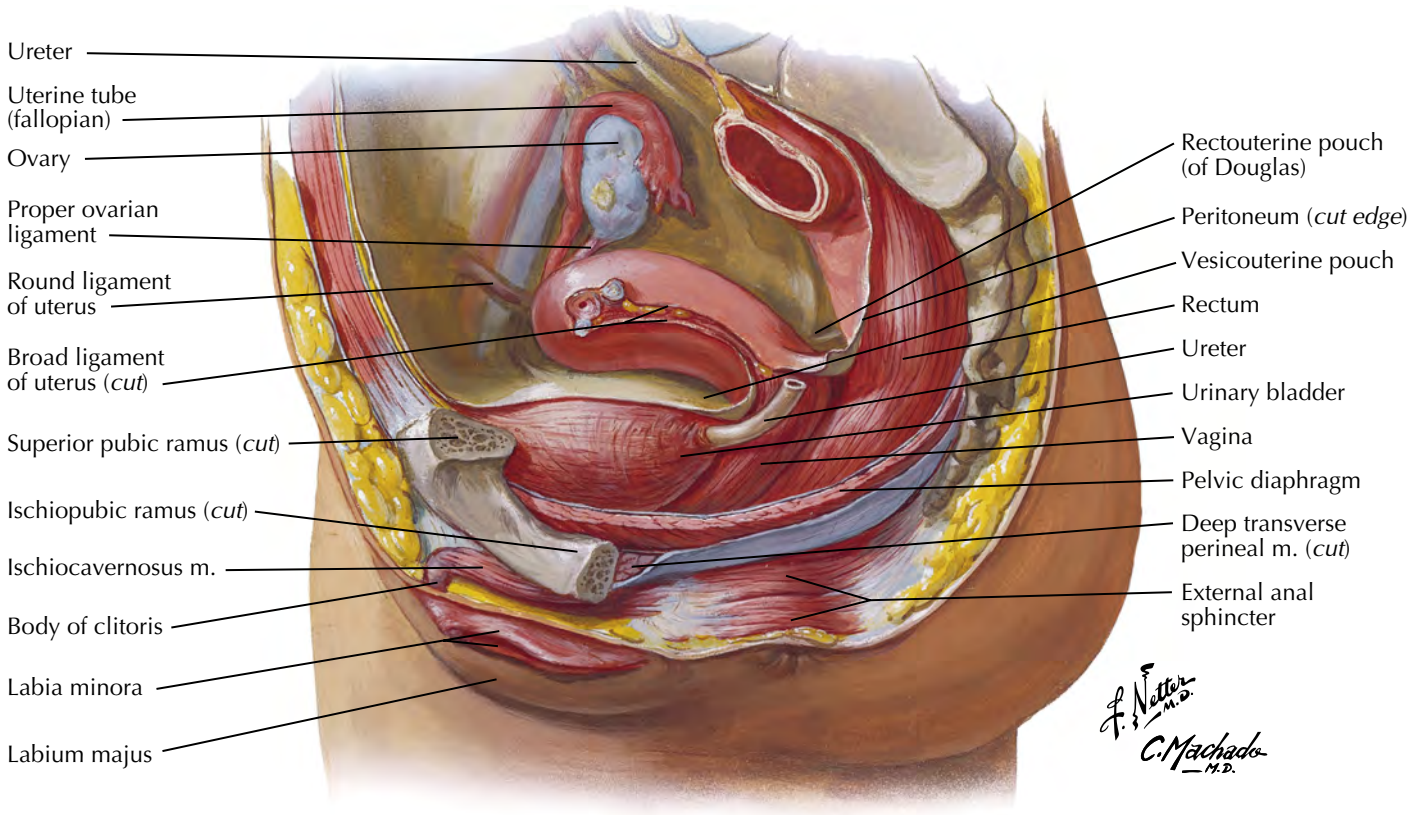
See also **Plate 384**

Inferior view

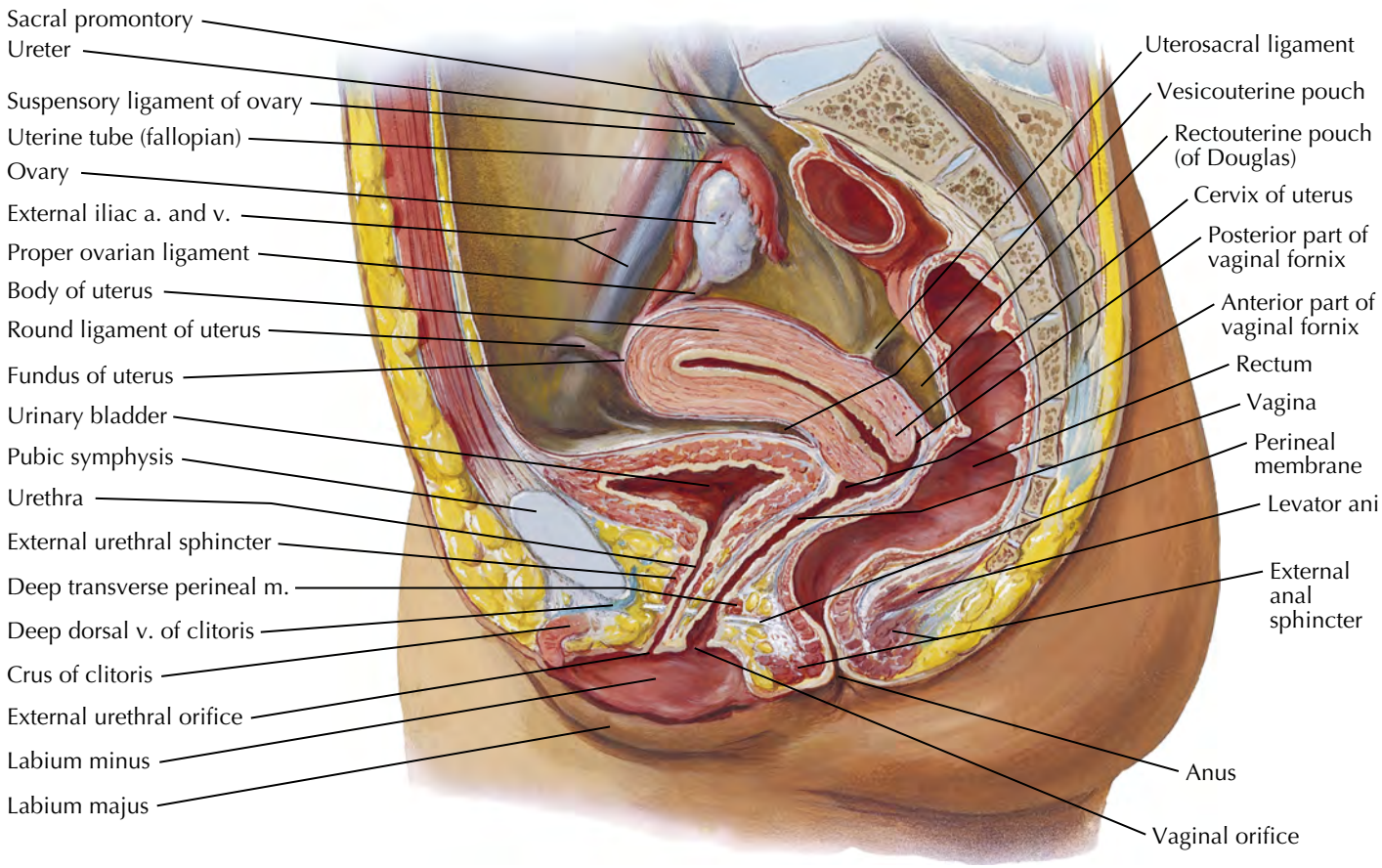



Superior view
Median umbilical ligament
Median umbilical fold
Linea alba
Urinary bladder
Rectus abdominis m.
Fundus of uterus
Medial umbilical ligament
Proper ovarian ligament
Medial umbilical fold
Ovary
Transverse vesical fold
Uterine tube (fallopian)
Rectum
Round ligament of uterus
Inferior epigastric a. and v.
Broad ligament of uterus
Lateral umbilical fold
Femoral ring
Rectouterine fold
Deep inguinal ring
Ureter (covered by peritoneum)
Iliopubic tract (covered by peritoneum)
Suspensory ligament of ovary (contains ovarian a. and v.)
External iliac a. and v.
Cecum
Iliac fossa
Cecal folds
Left paracolic gutter
Right paracolic gutter
Sigmoid colon
Ovarian a. and v.
Transversalis fascia
Quadratus lumborum m.
Psoas major
Pararectal fossa
Parietal peritoneum
Descending colon
Psoas minor
Ascending colon
Sympathetic trunk
Inferior vena cava
Terminal ileum
Transversus abdominis m.
Abdominal aorta
Ureter
Internal abdominal oblique m.
Anterior longitudinal ligament
Root of mesentery
External abdominal oblique m.
Body of L3 vertebra
Superior hypogastric plexus

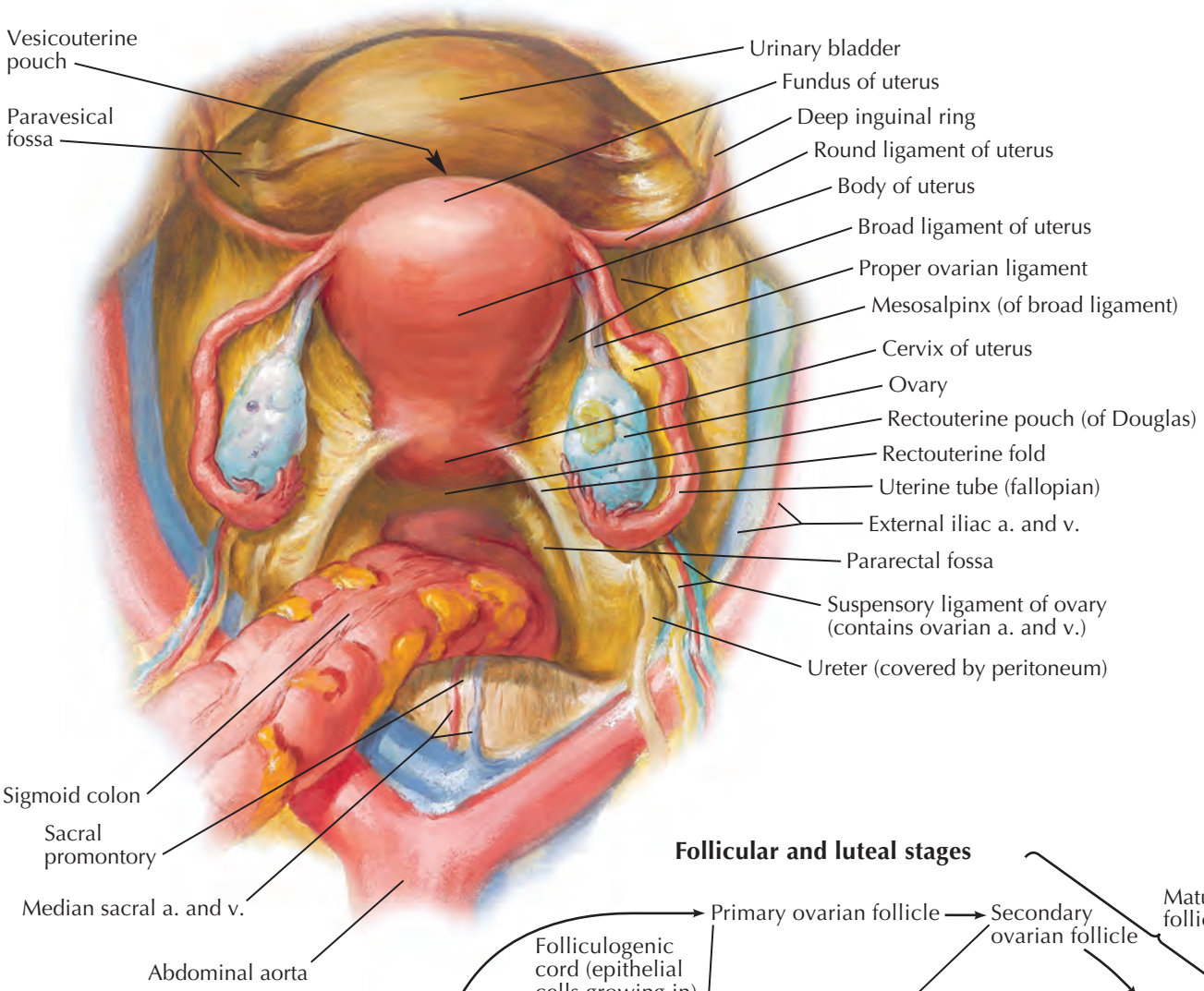
Paramedian (sagittal) dissection



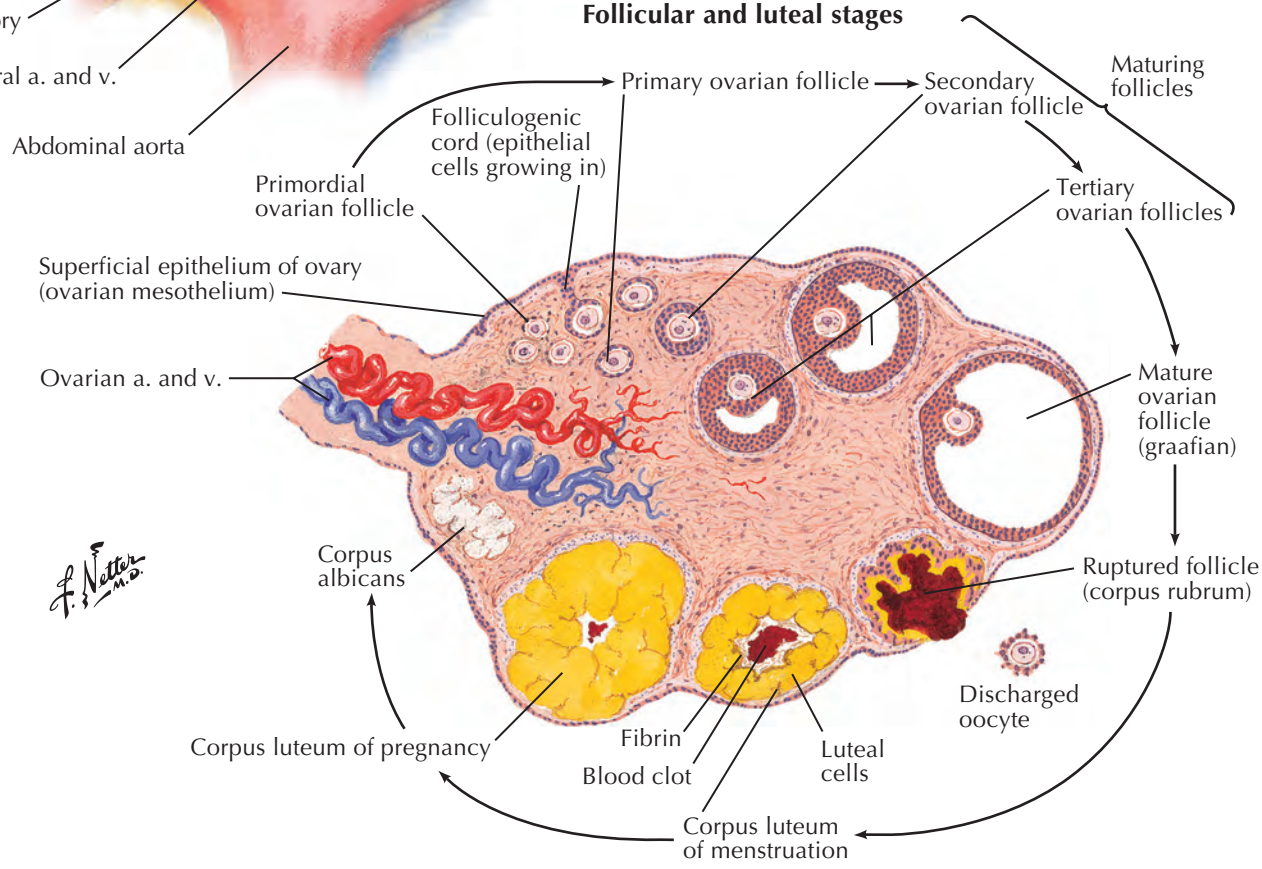
Median (sagittal) section



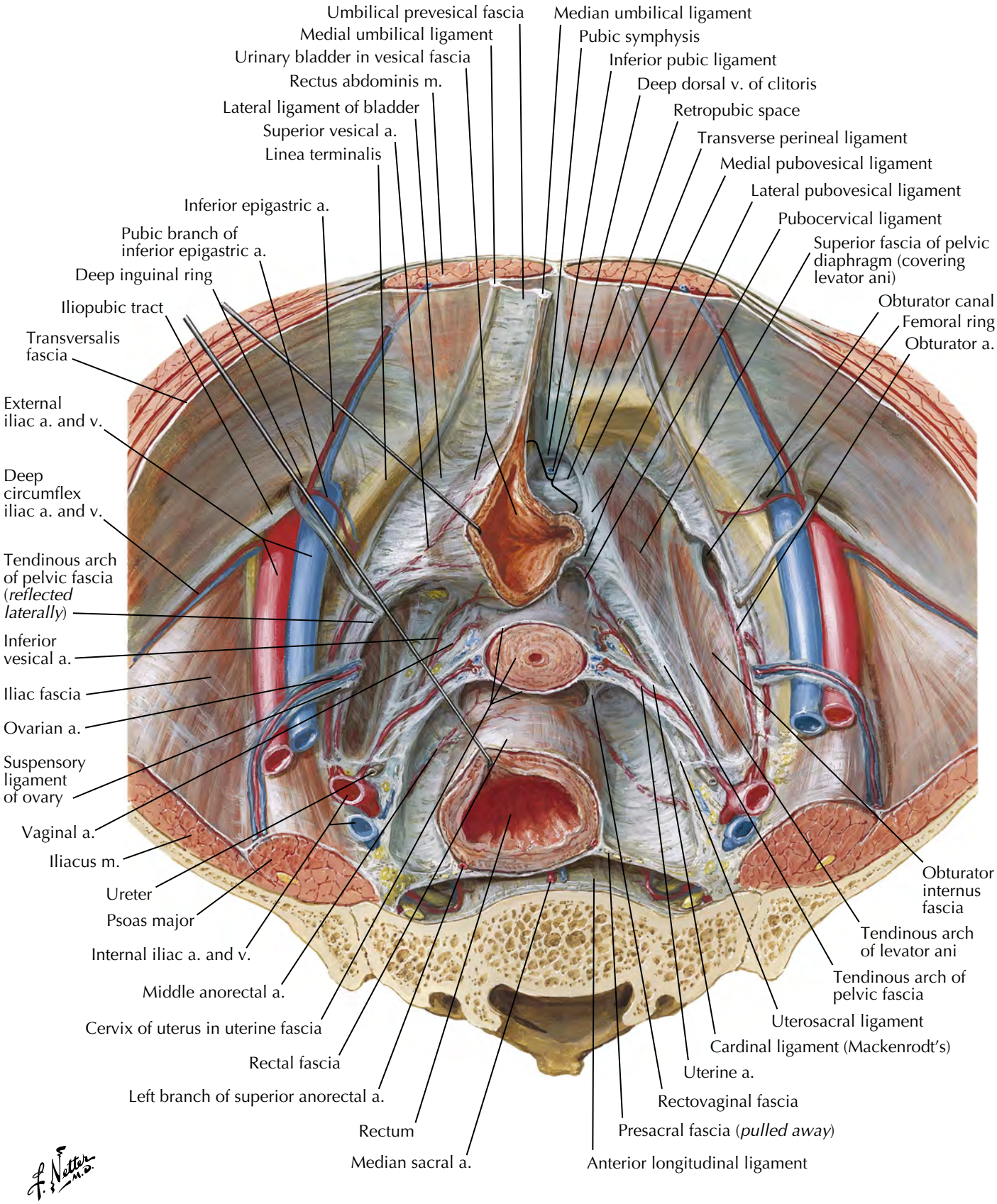
Superior view with peritoneum intact



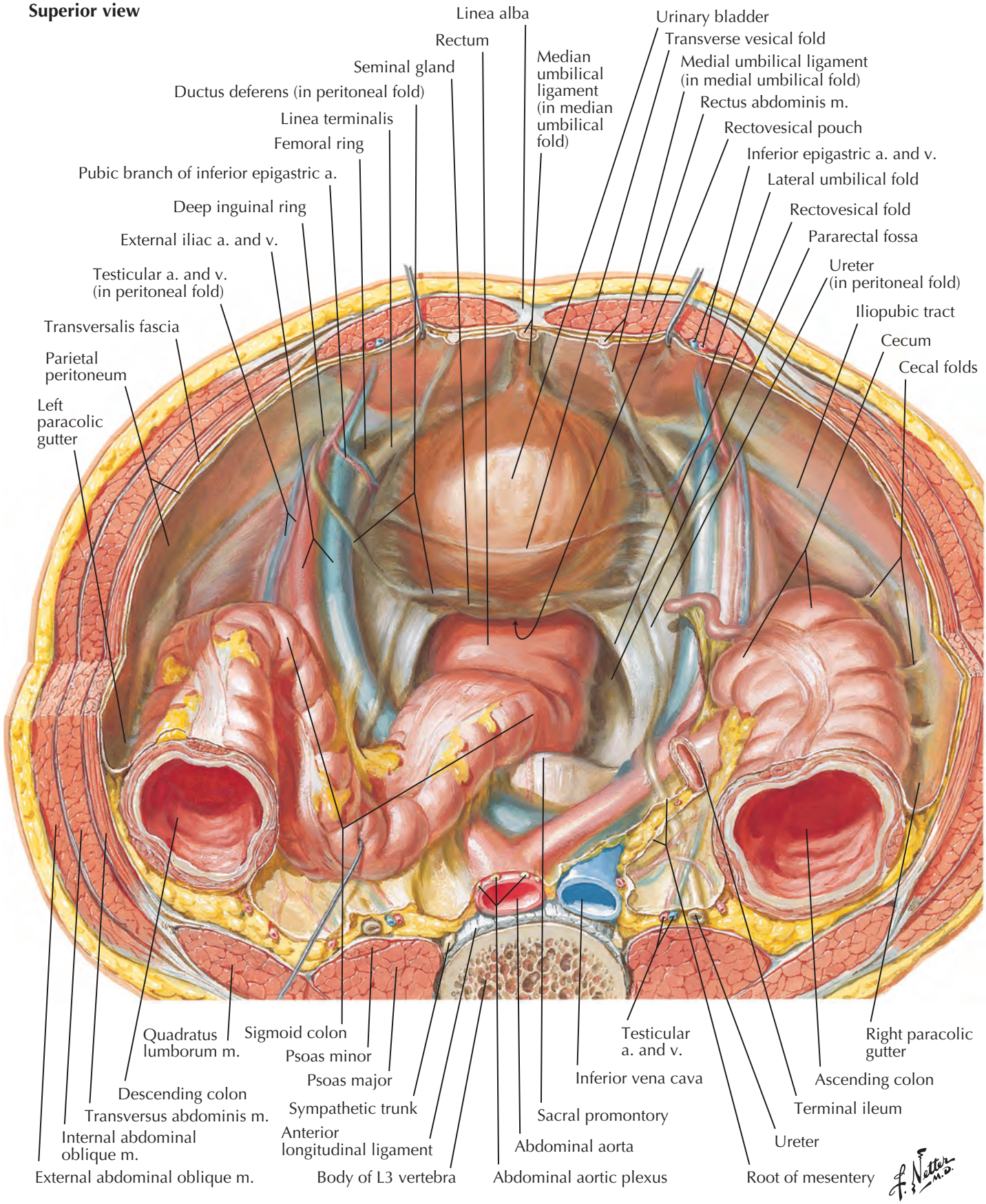
Follicular and luteal stages



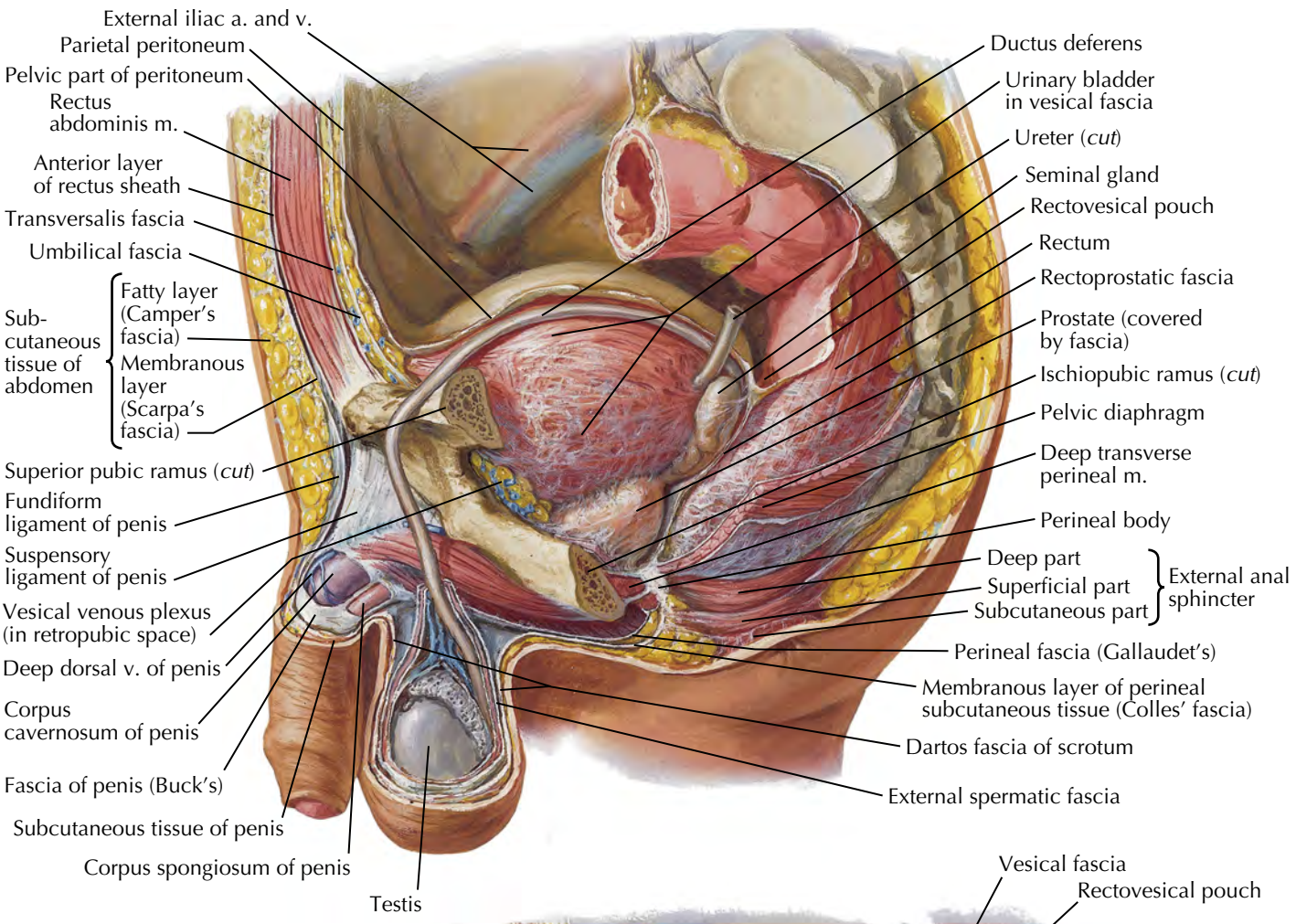
Female: superior view (peritoneum and loose connective tissue removed)



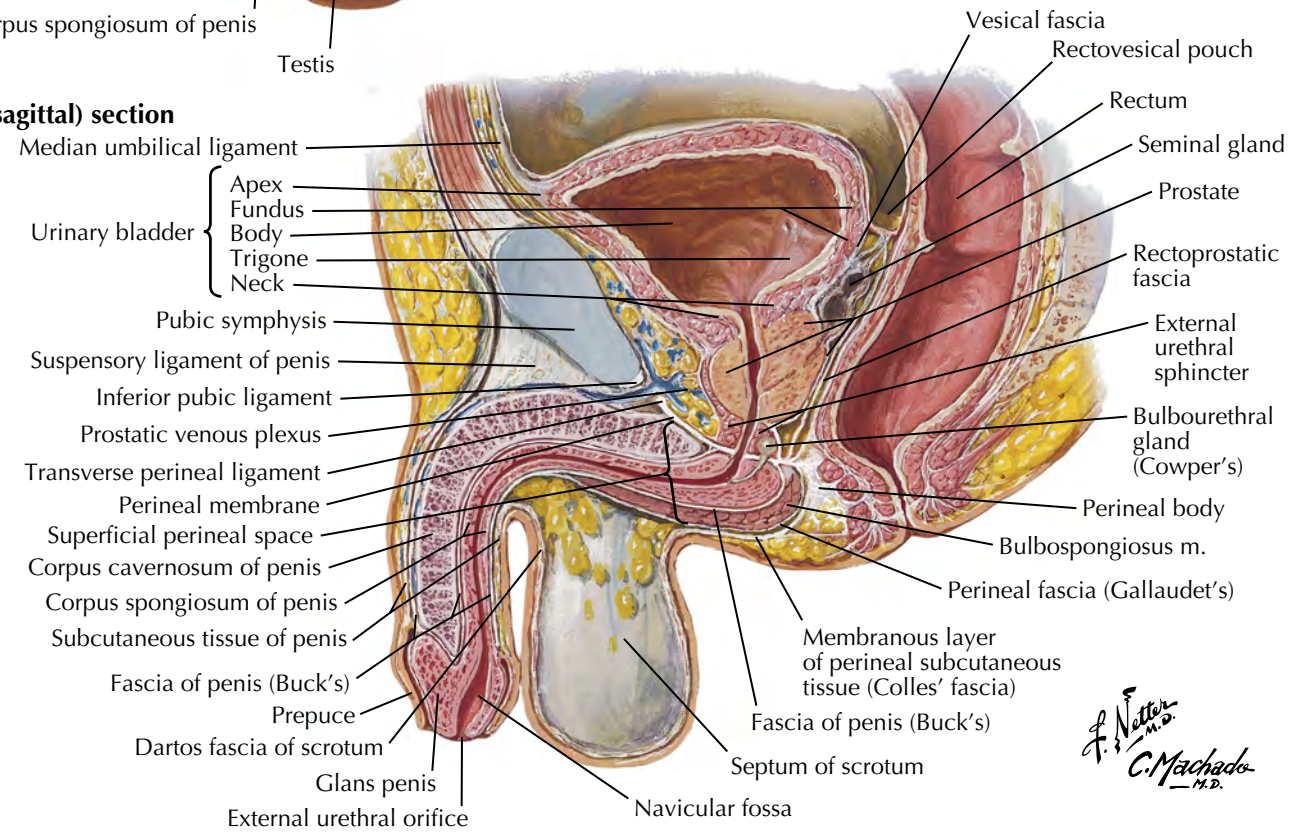
Superior view



Parasagittal view



Median (sagittal) section



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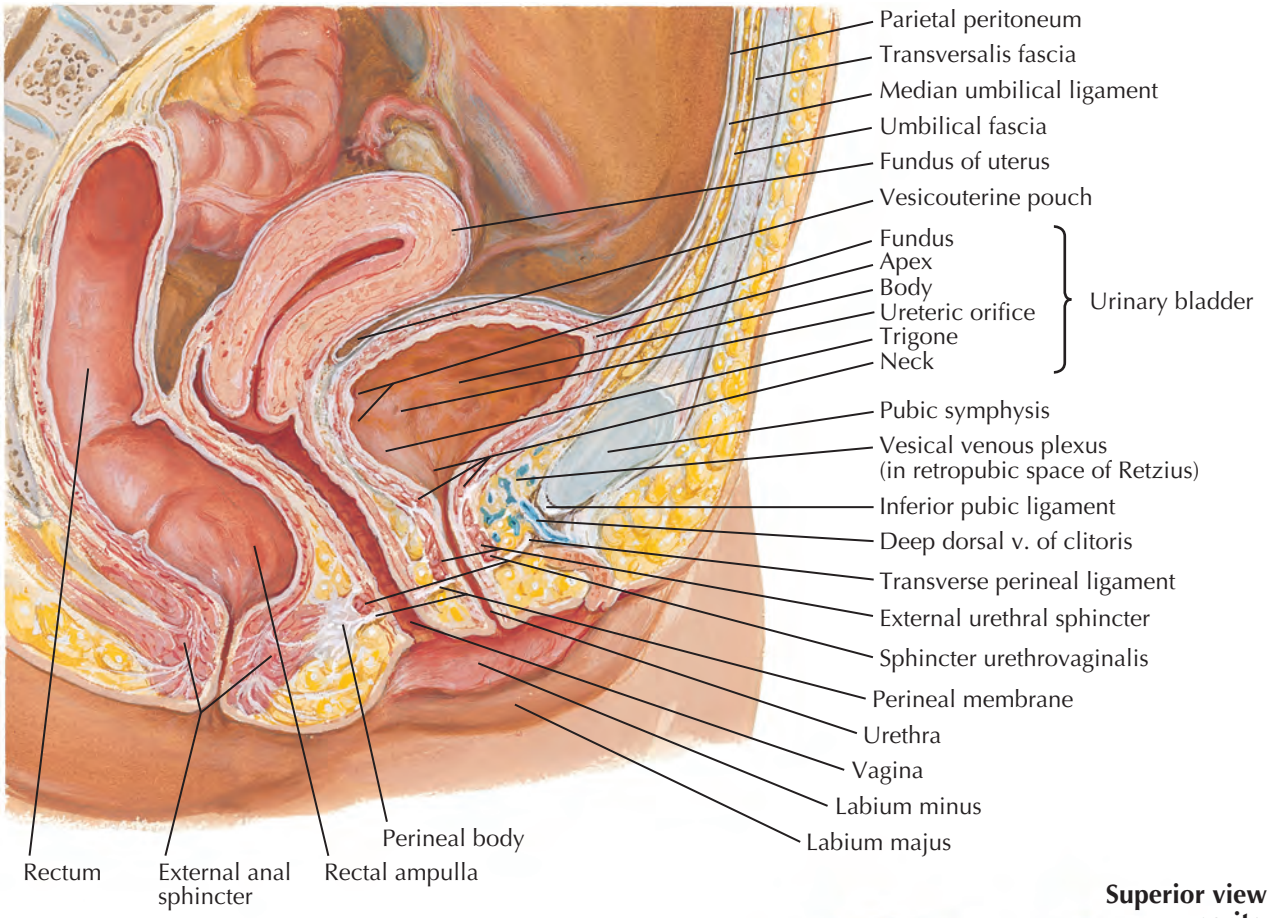
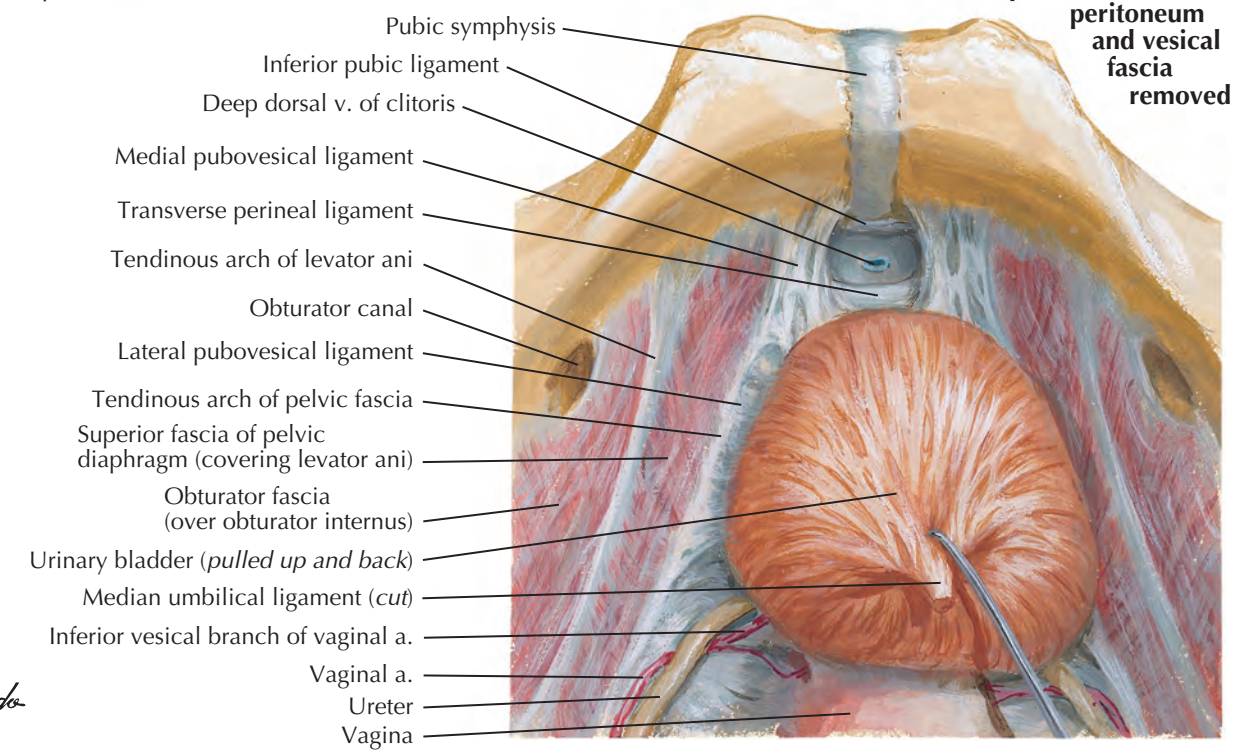
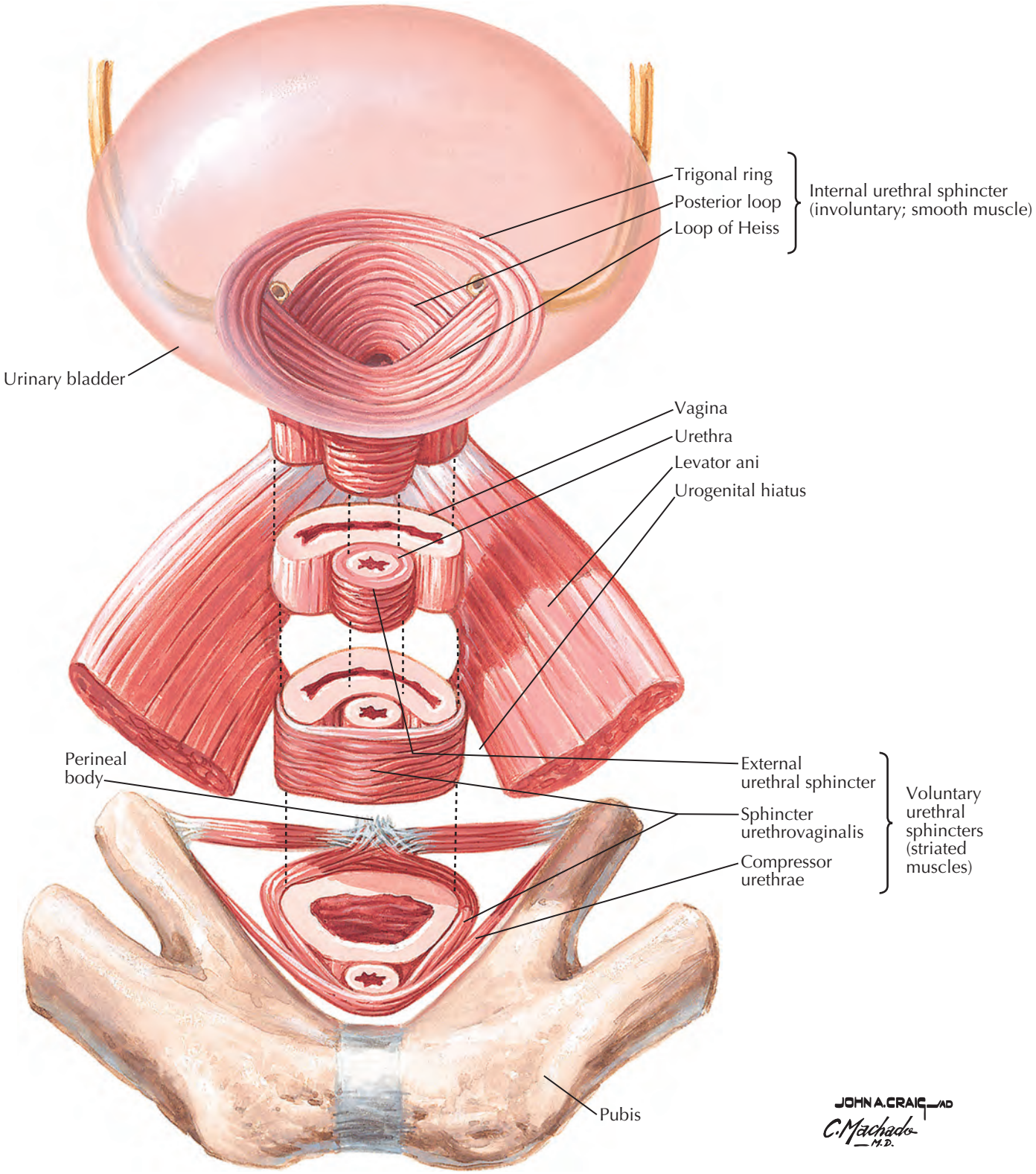
Female: median section



Superior view with peritoneum and vesical fascia removed

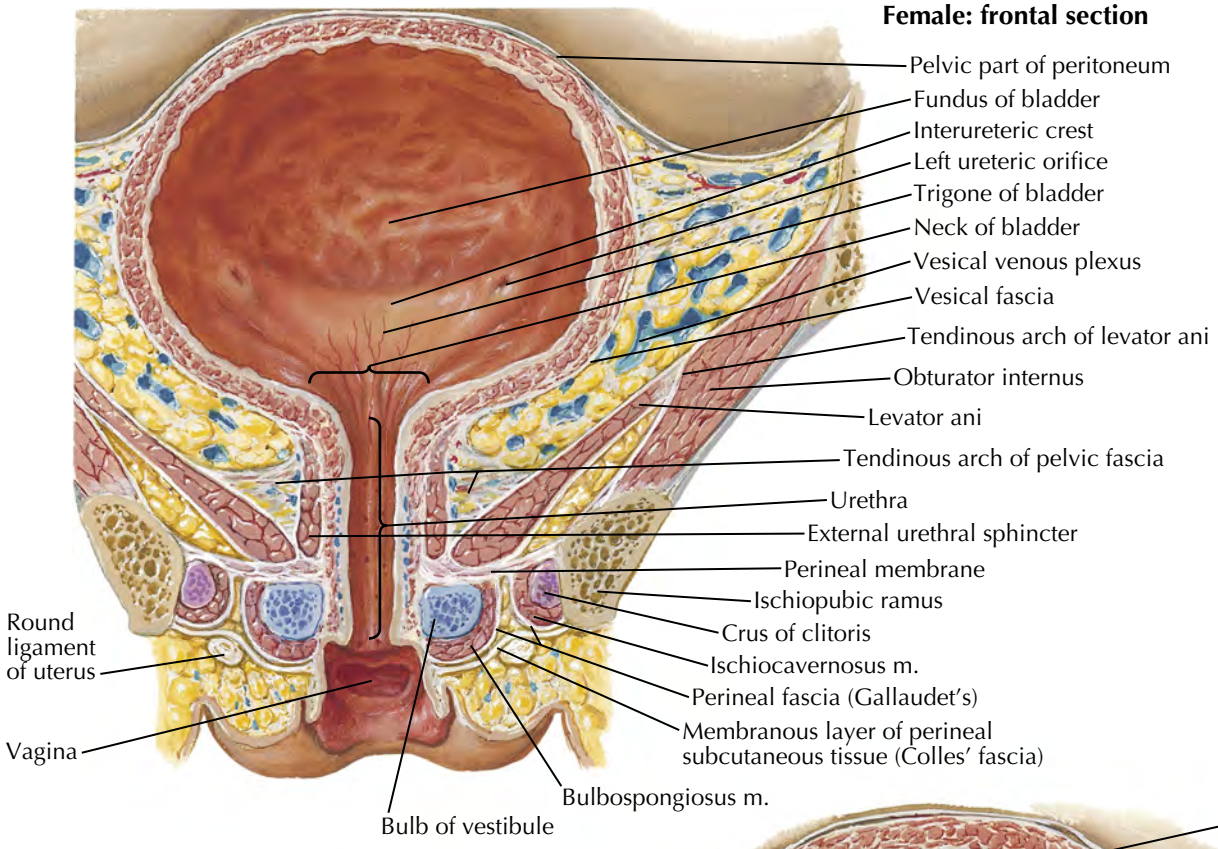


See also **Plates 371, 379**

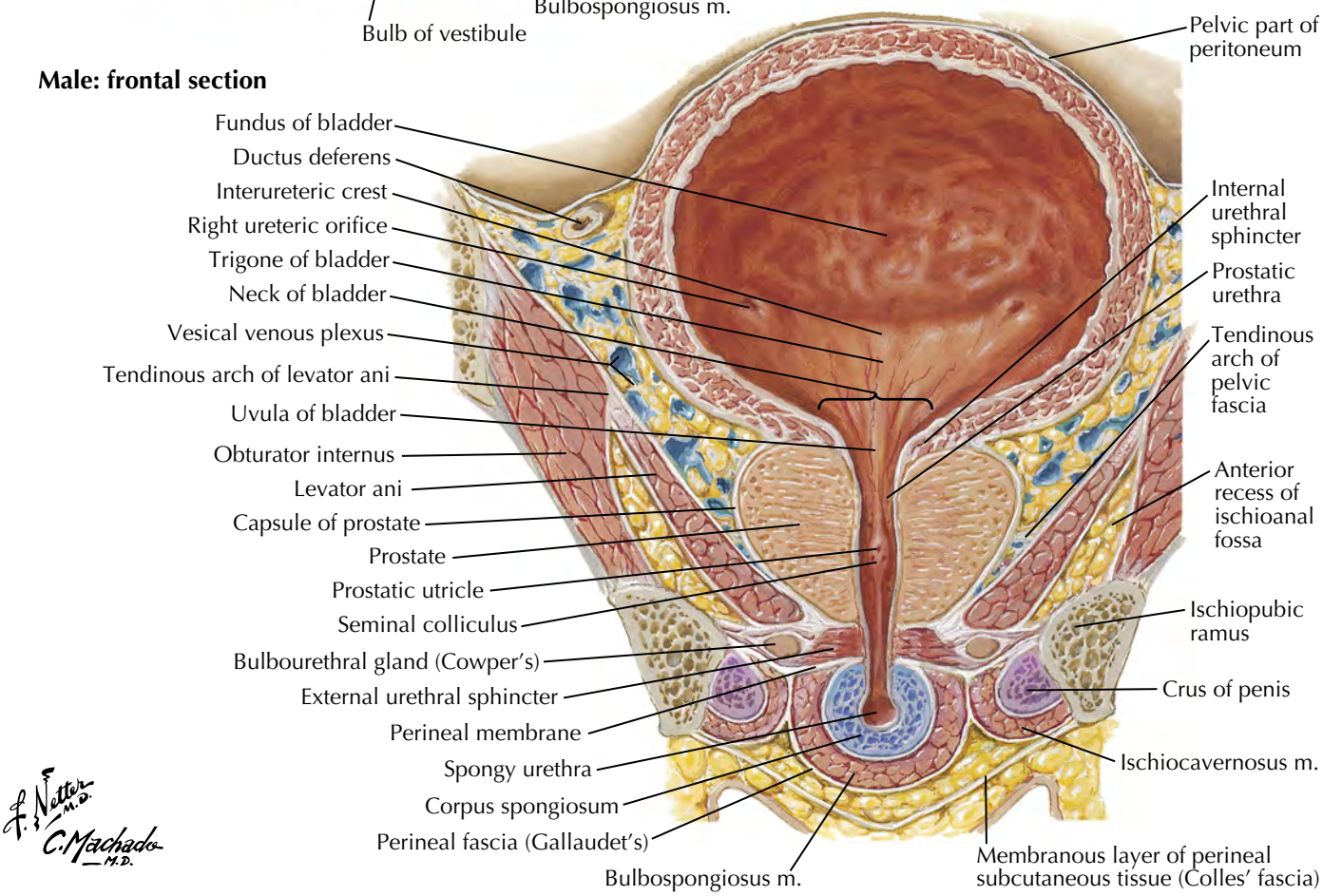


See also **Plates 364, 368, 405, BP 85, BP 86**

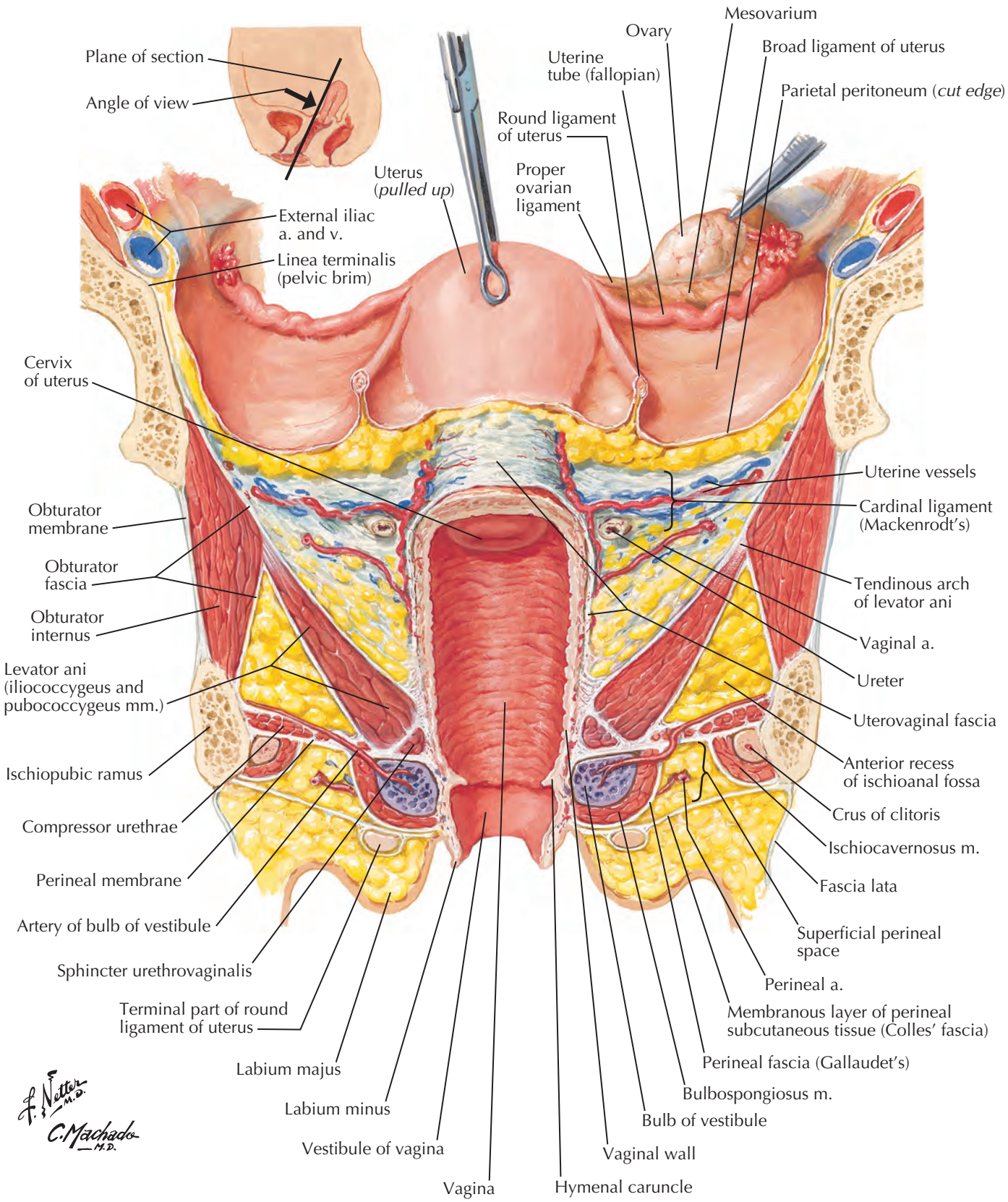
Female: frontal section



Male: frontal section

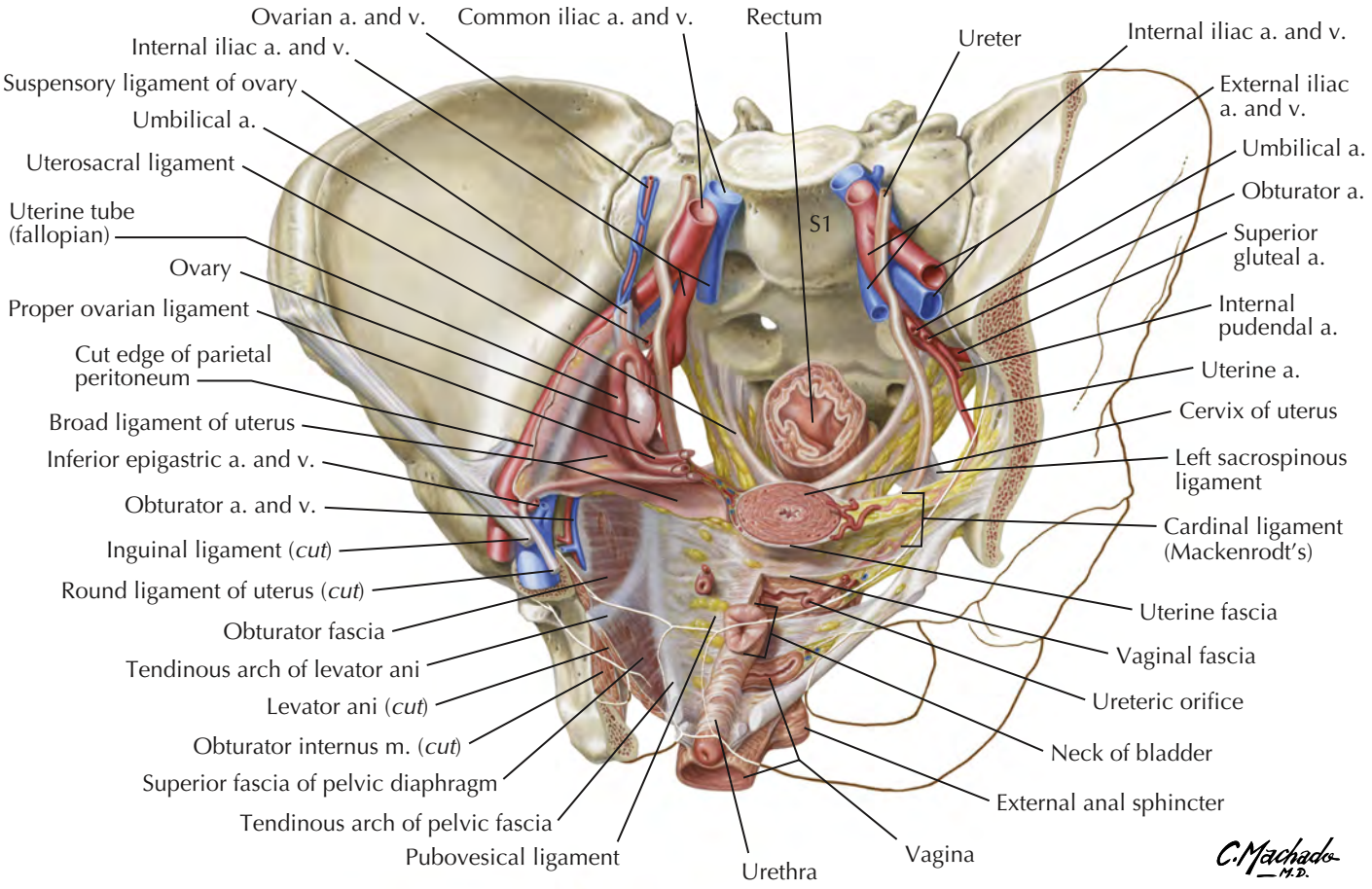


See also **Plates 406, 408, 414**

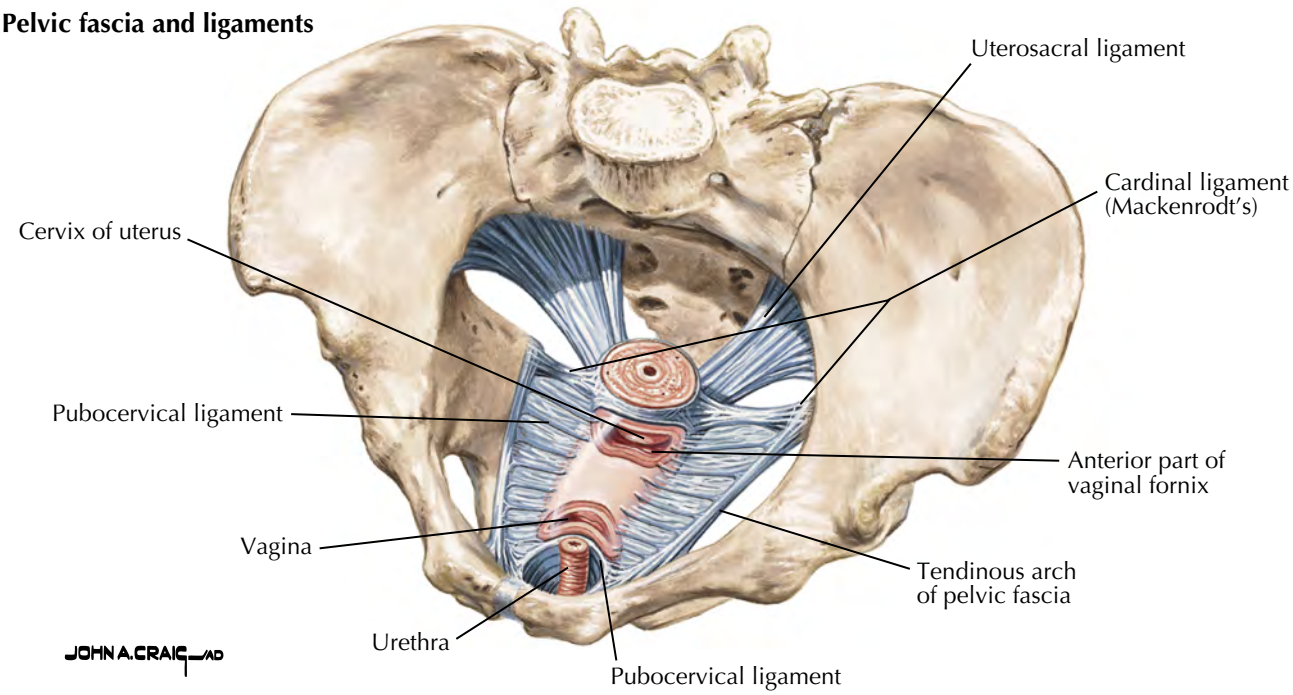


F. Netter M.D.
C. Machado M.D.

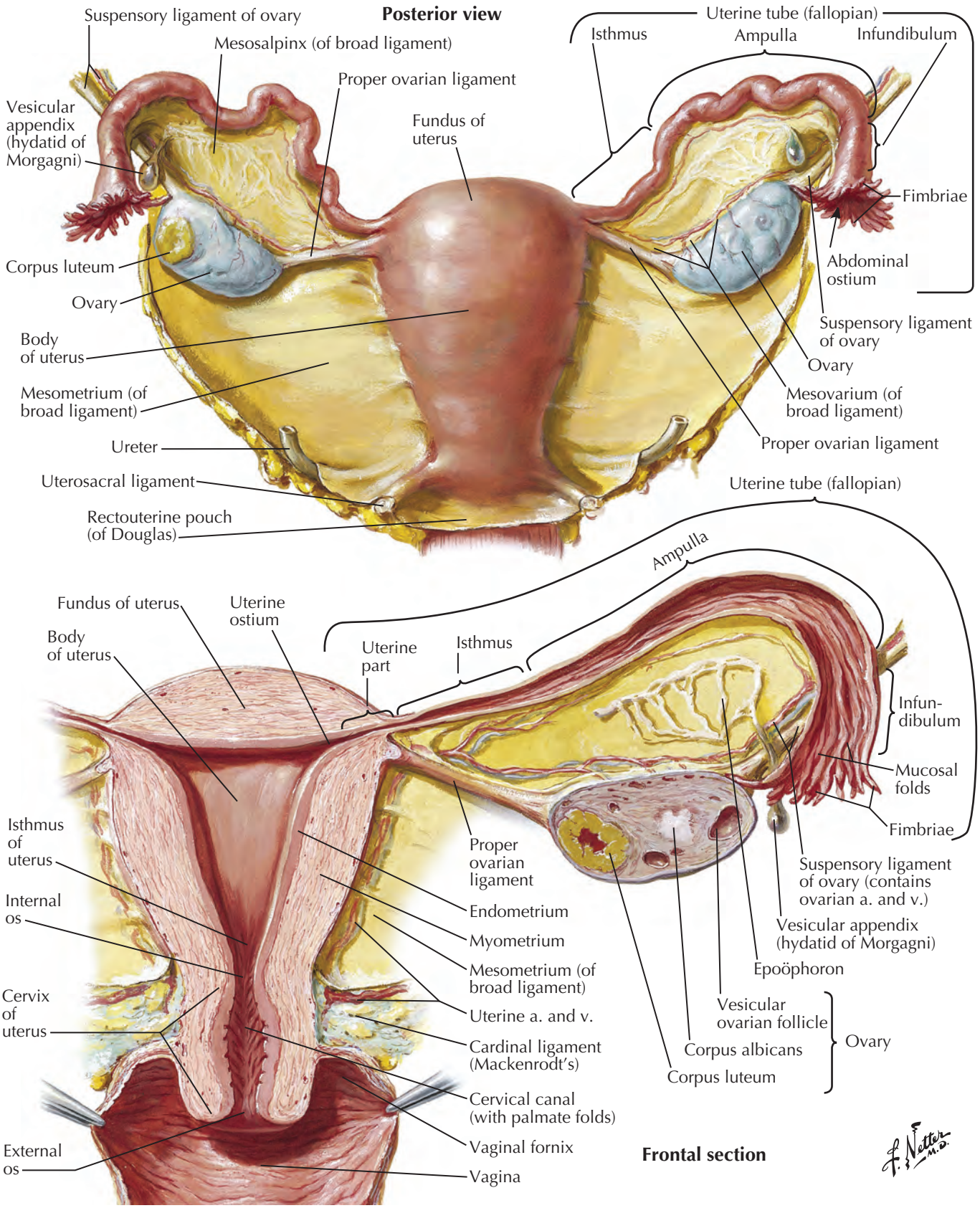
See also **Plate 366**

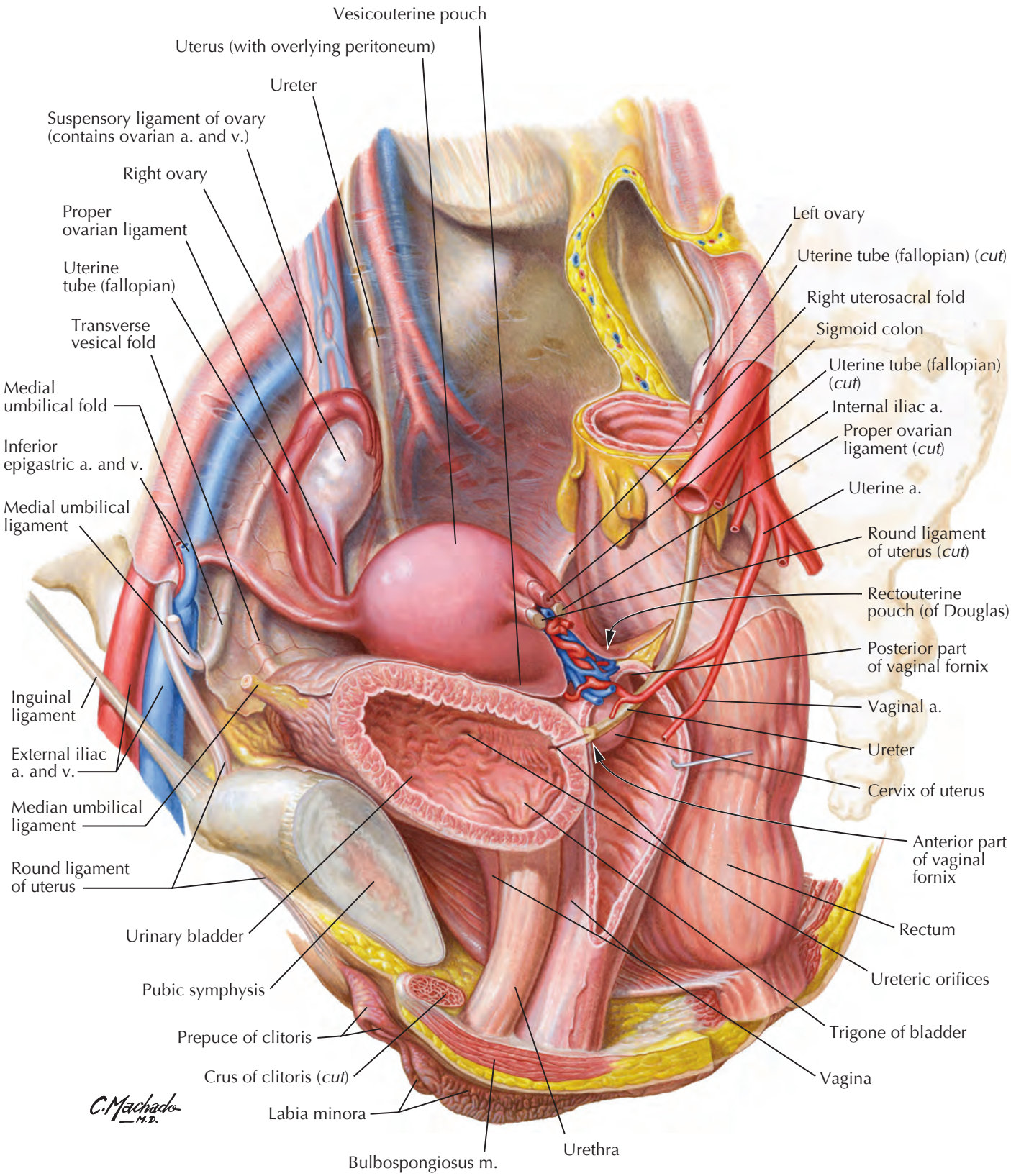


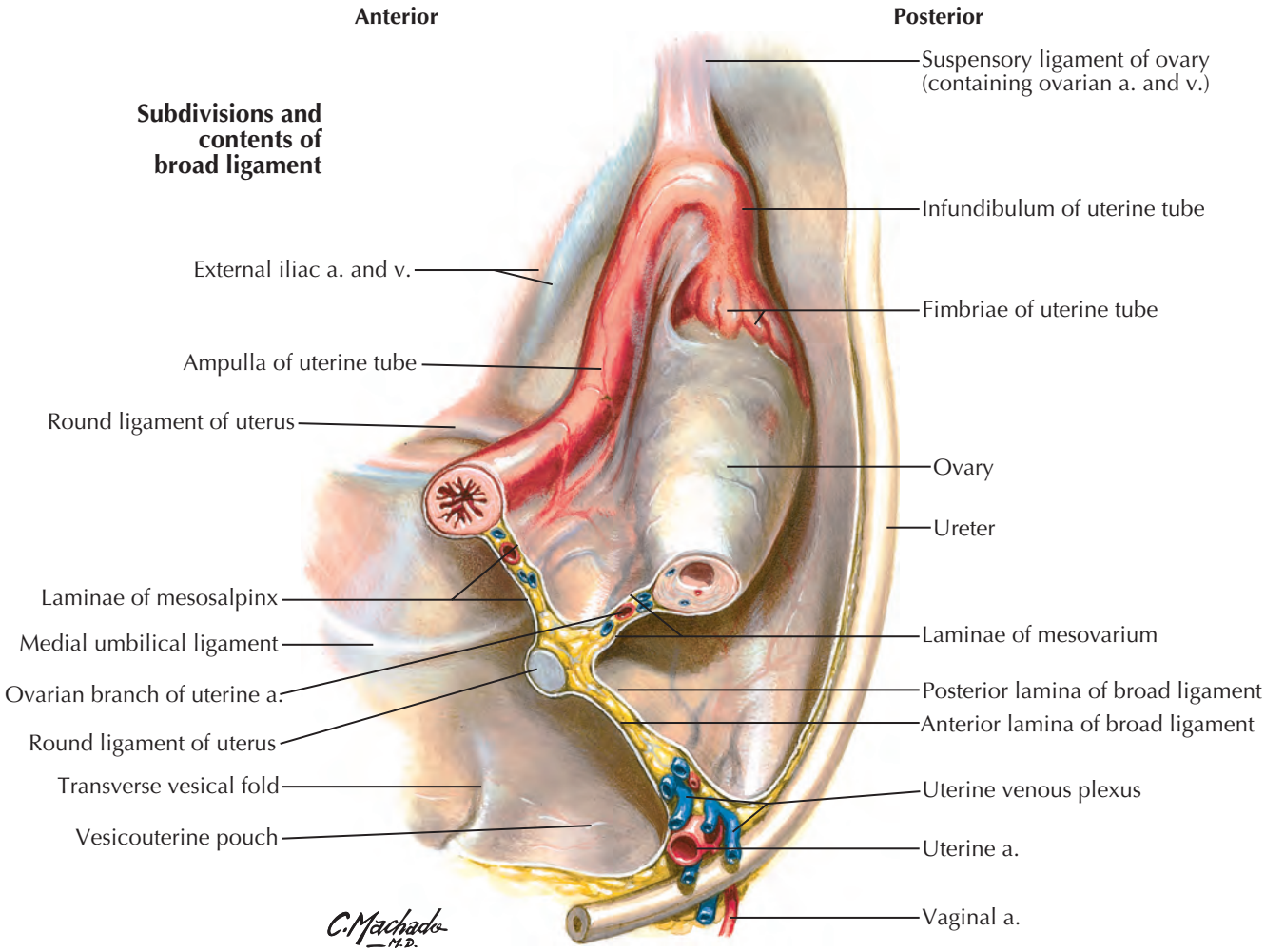
Pelvic fascia and ligaments



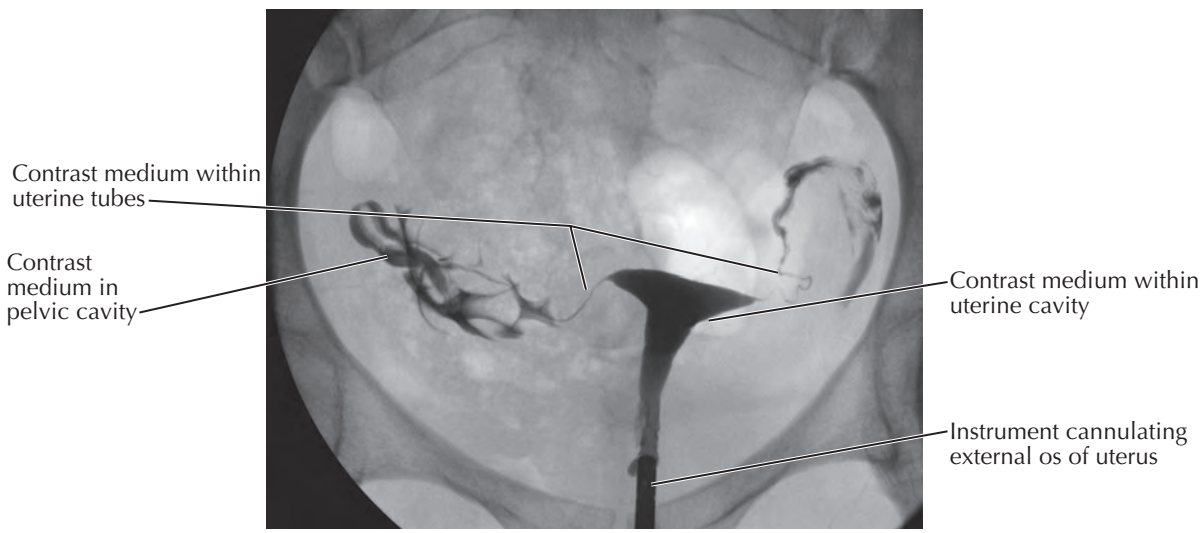
See also **Plates BP 89, BP 90**



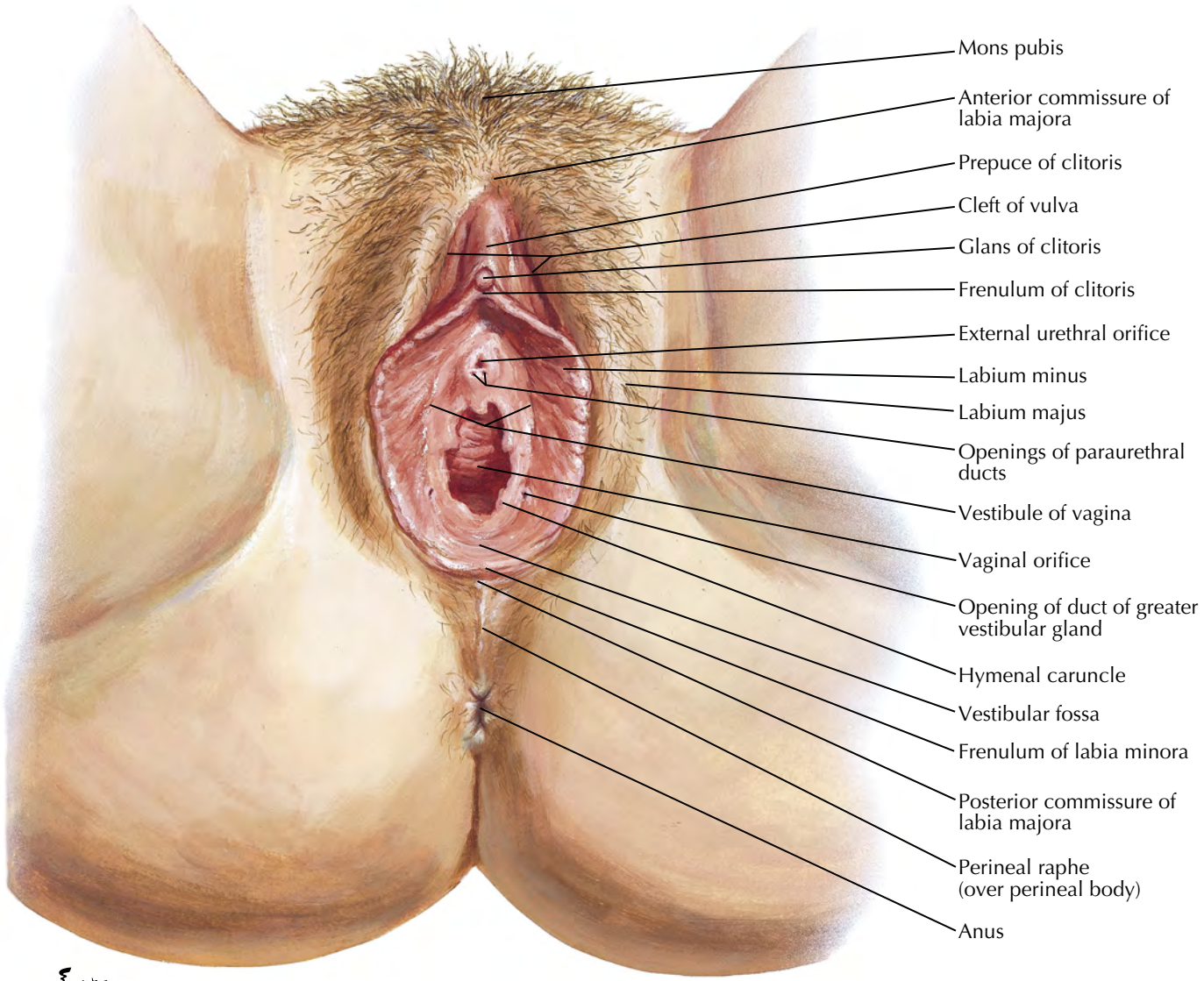

Vesicouterine pouch
Uterus (with overlying peritoneum)
Ureter
Suspensory ligament of ovary (contains ovarian a. and v.)
Right ovary
Proper ovarian ligament
Uterine tube (fallopian)
Transverse vesical fold
Medial umbilical fold
Inferior epigastric a. and v.
Medial umbilical ligament
Inguinal ligament
External iliac a. and v.
Median umbilical ligament
Round ligament of uterus
Urinary bladder
Pubic symphysis
Prepuce of clitoris
Crus of clitoris (cut)
Labia minora
Bulbospongiosus m.
Urethra
Vagina
Trigone of bladder
Ureteric orifices
Rectum
Anterior part of vaginal fornix
Cervix of uterus
Ureter
Vaginal a.
Posterior part of vaginal fornix
Rectouterine pouch (of Douglas)
Round ligament of uterus (cut)
Uterine a.
Proper ovarian ligament (cut)
Internal iliac a.
Uterine tube (fallopian) (cut)
Sigmoid colon
Right uterosacral fold
Uterine tube (fallopian) (cut)
Left ovary

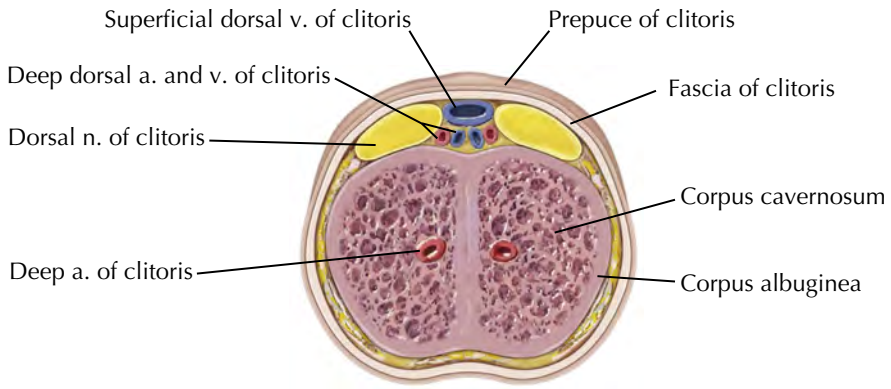


Anteroposterior fluoroscopic image obtained during hysterosalpingography



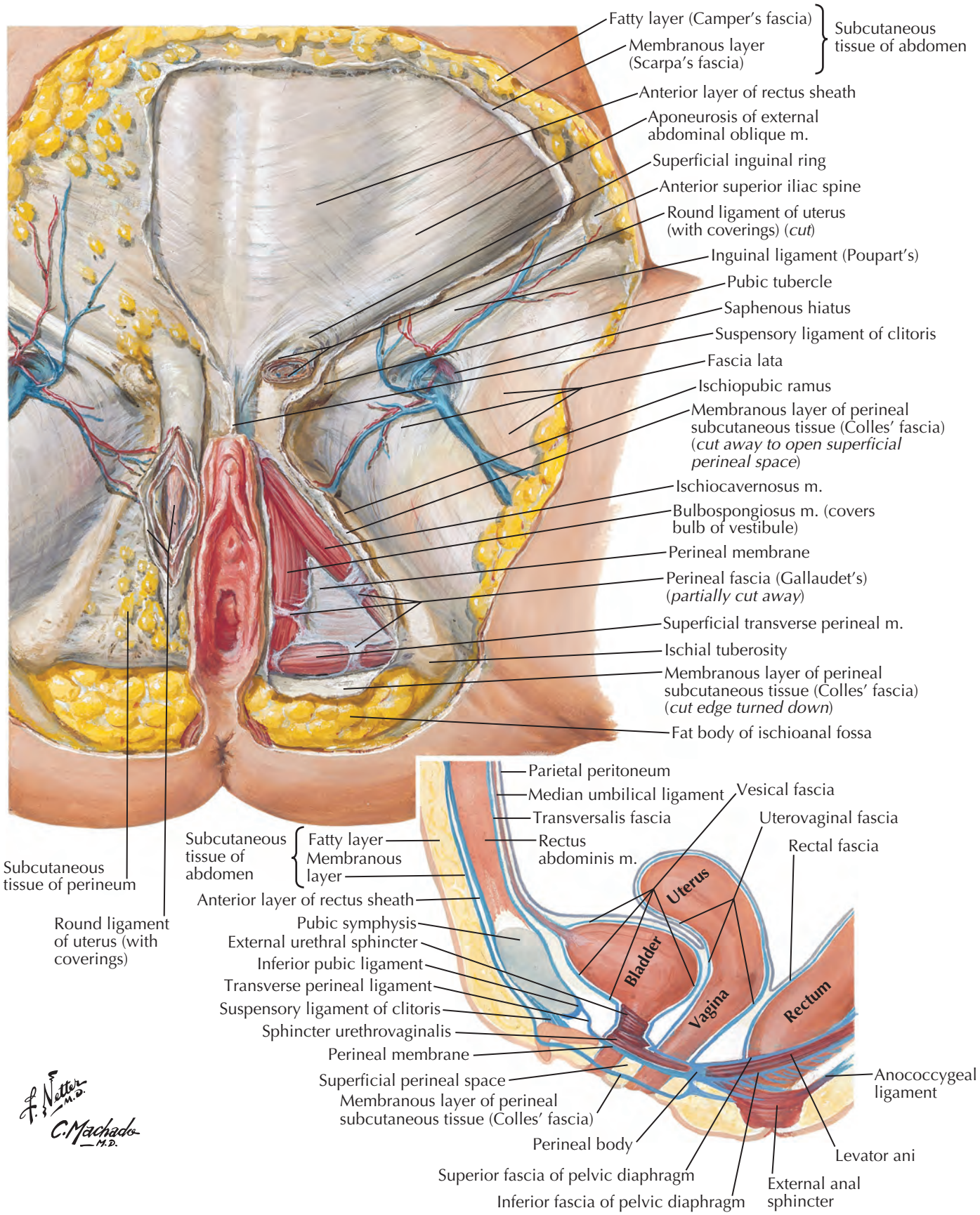
See also **Plates 406, 409, 415, BP 91**





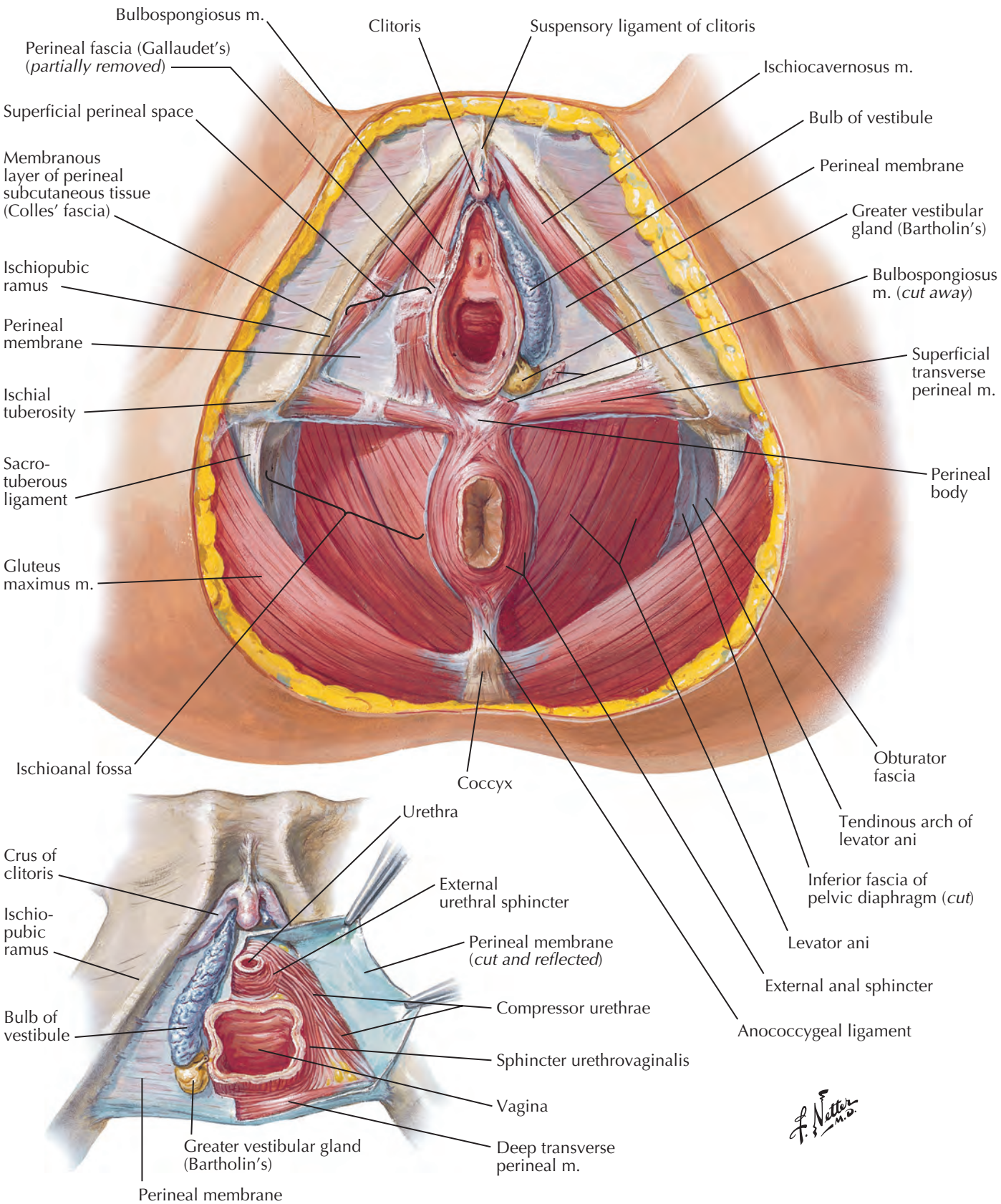
Transverse section through body of clitoris

See also **Plate BP 84**



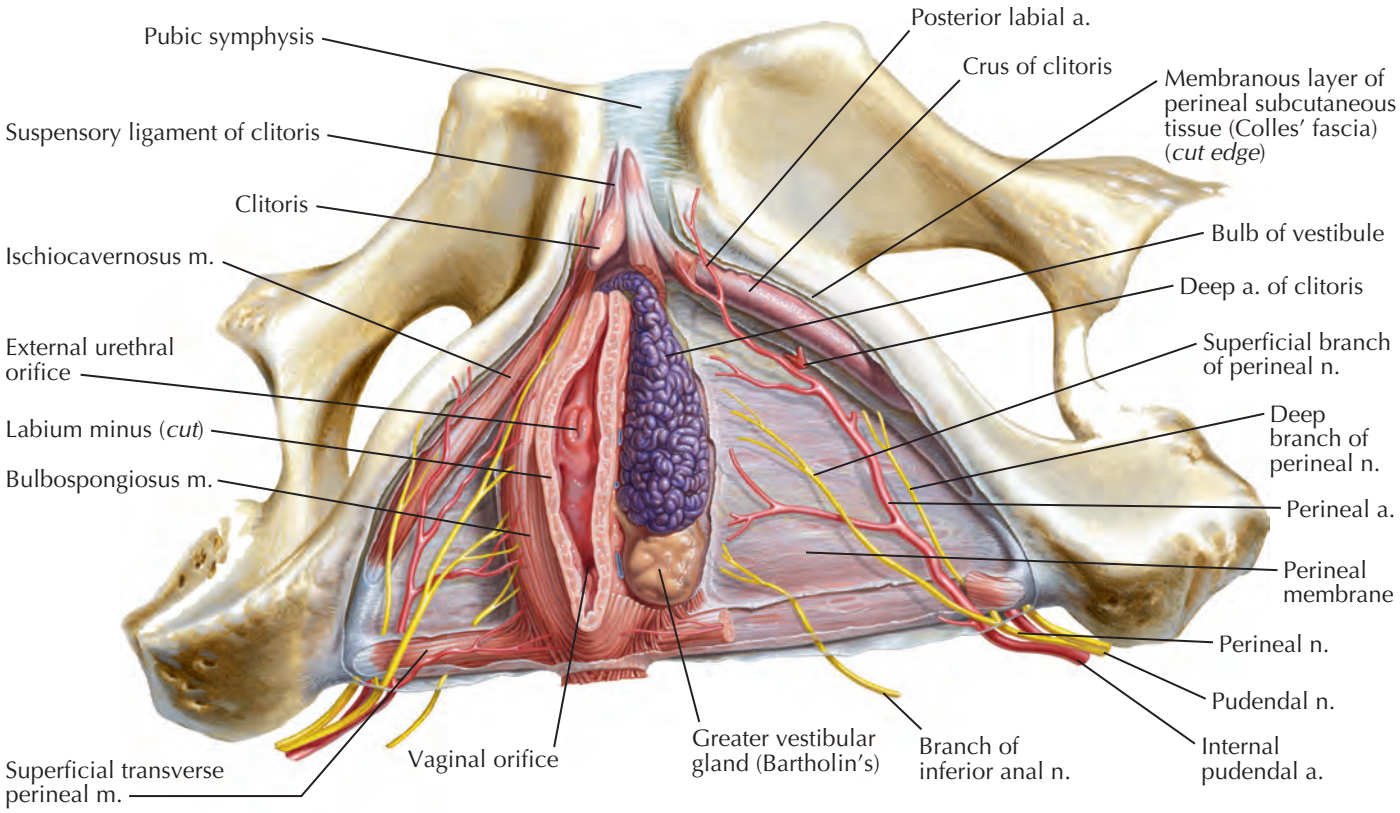
F. Netter M.D.
C. Machado M.D.

See also **Plate BP 86**

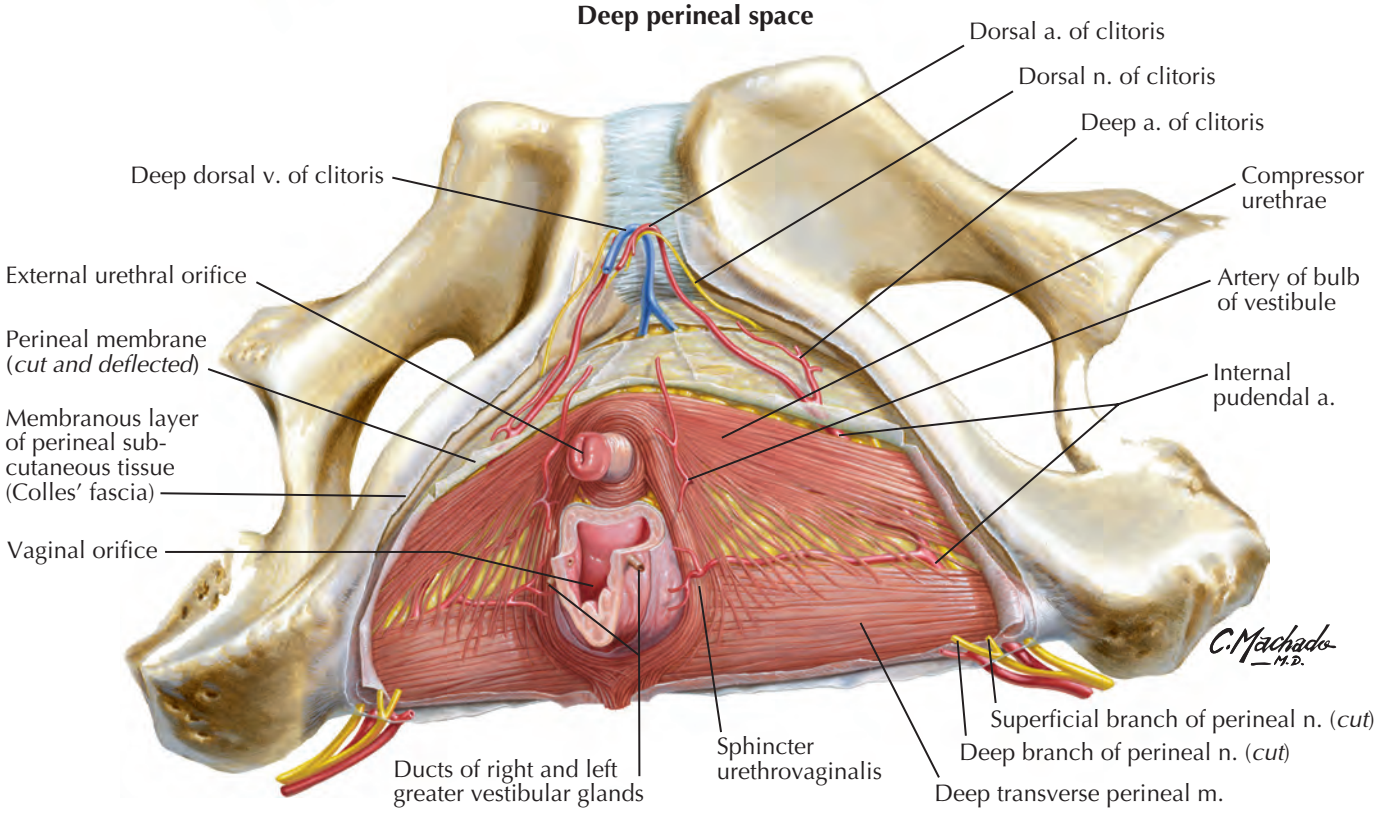


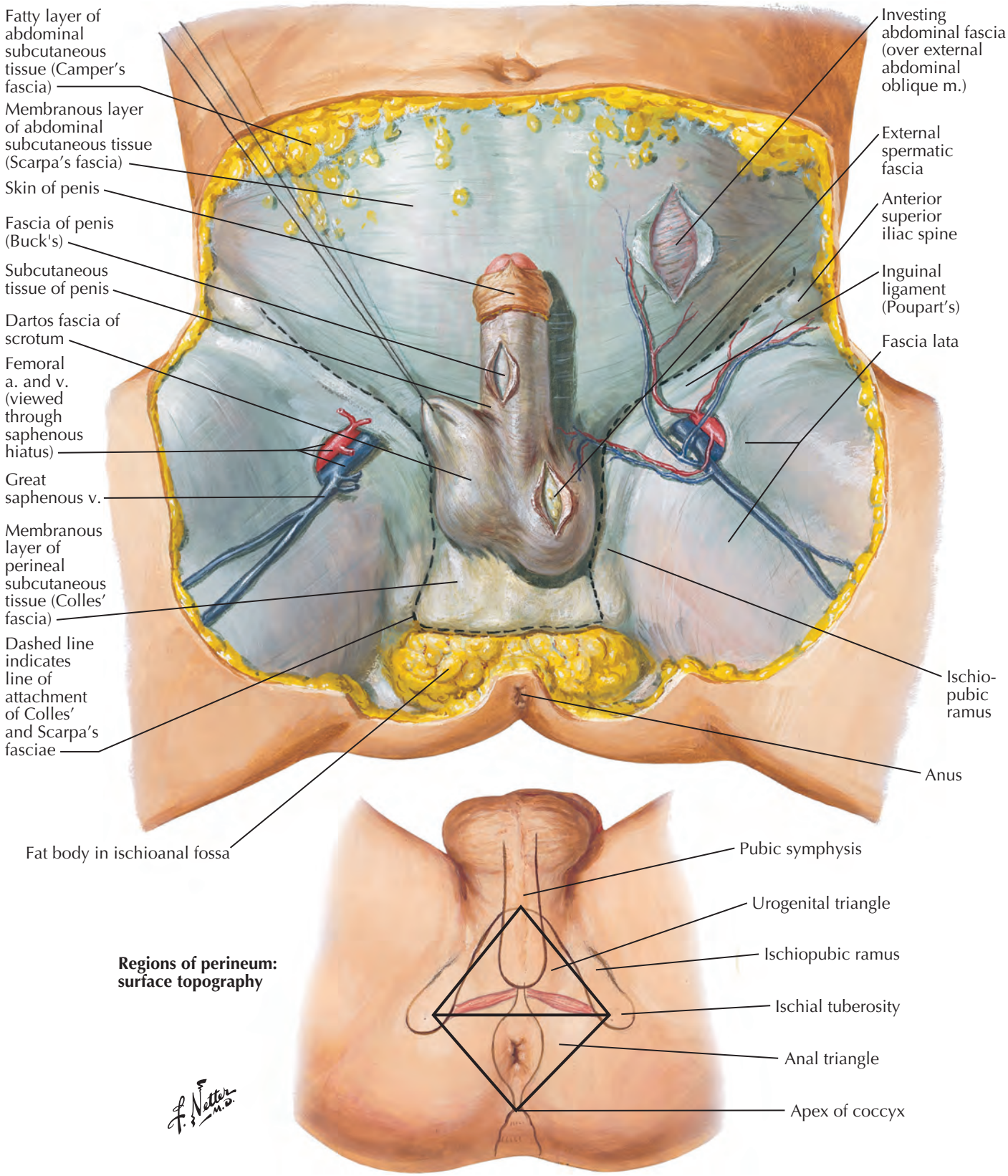
See also **Plates 406, 415, BP 86**

Superficial perineal space



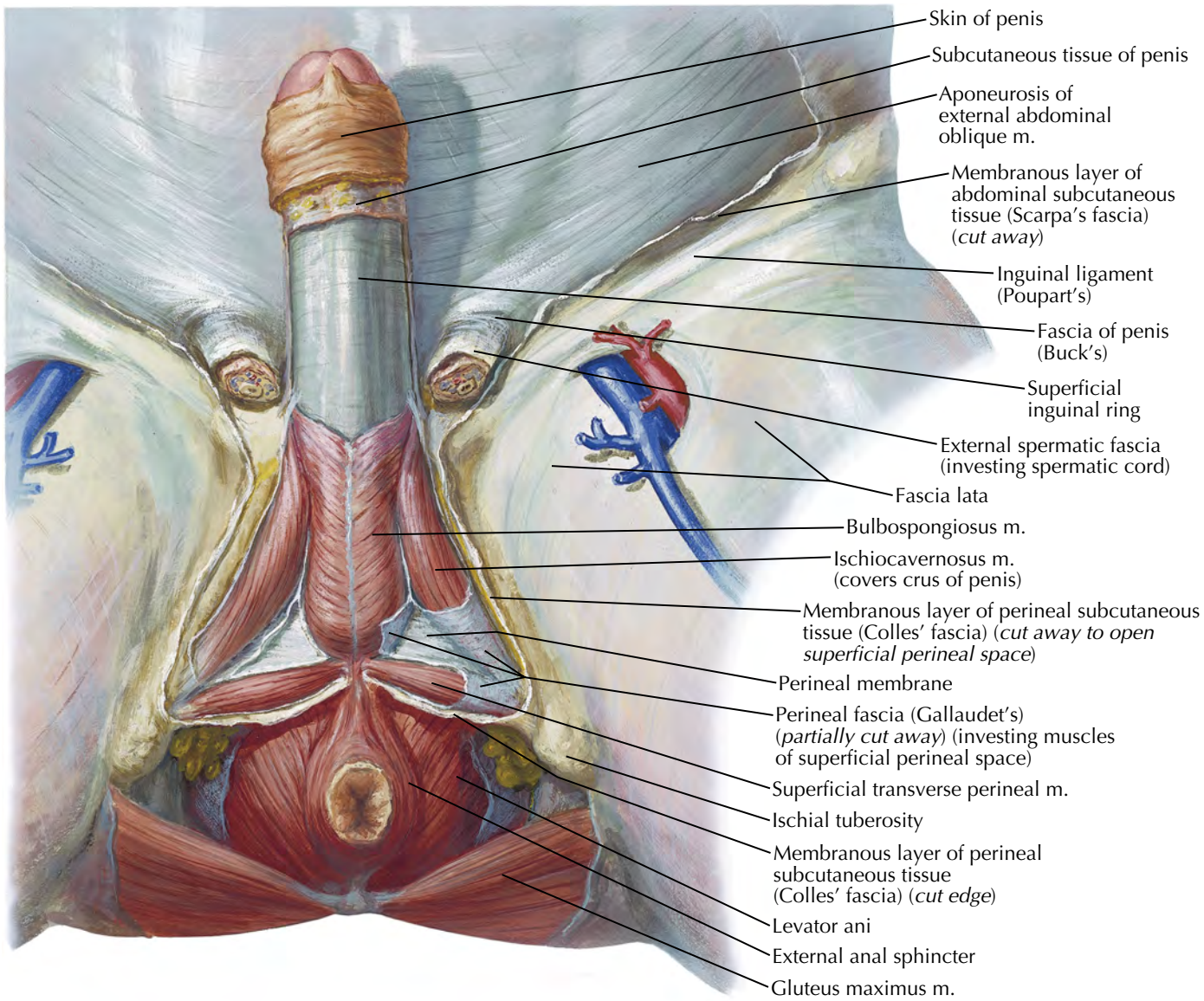
Deep perineal space

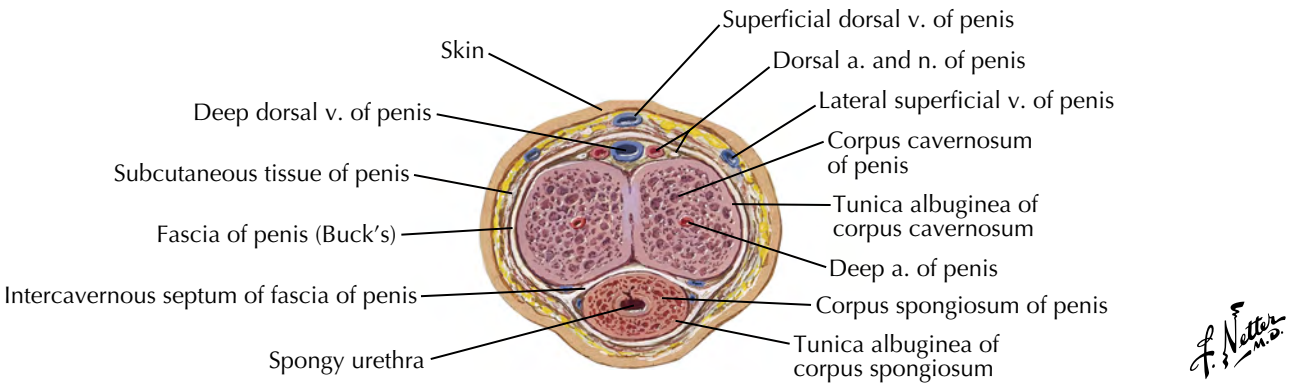




Regions of perineum: surface topography

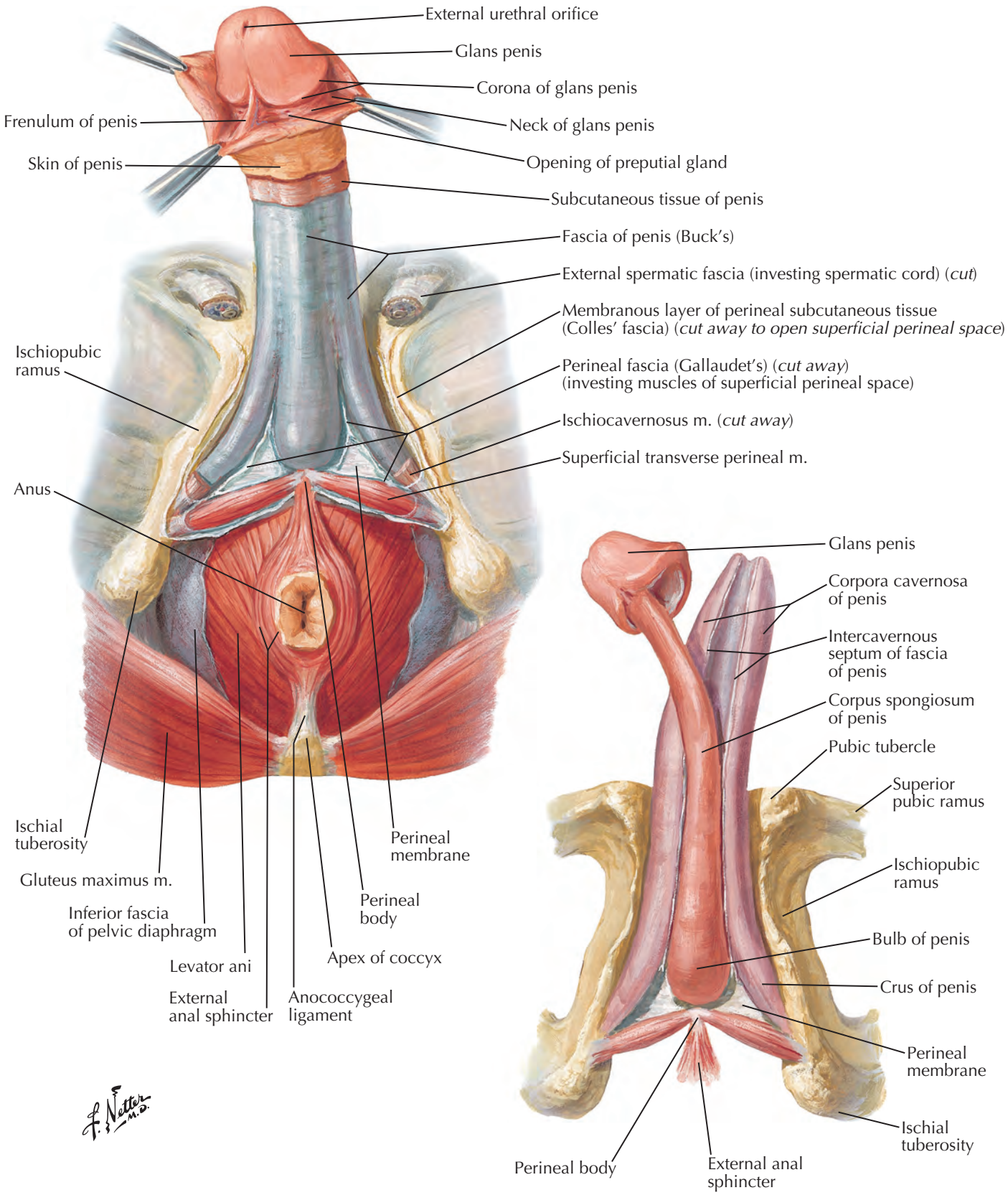
See also **Plates 391, 403, 405, 407, BP 84**

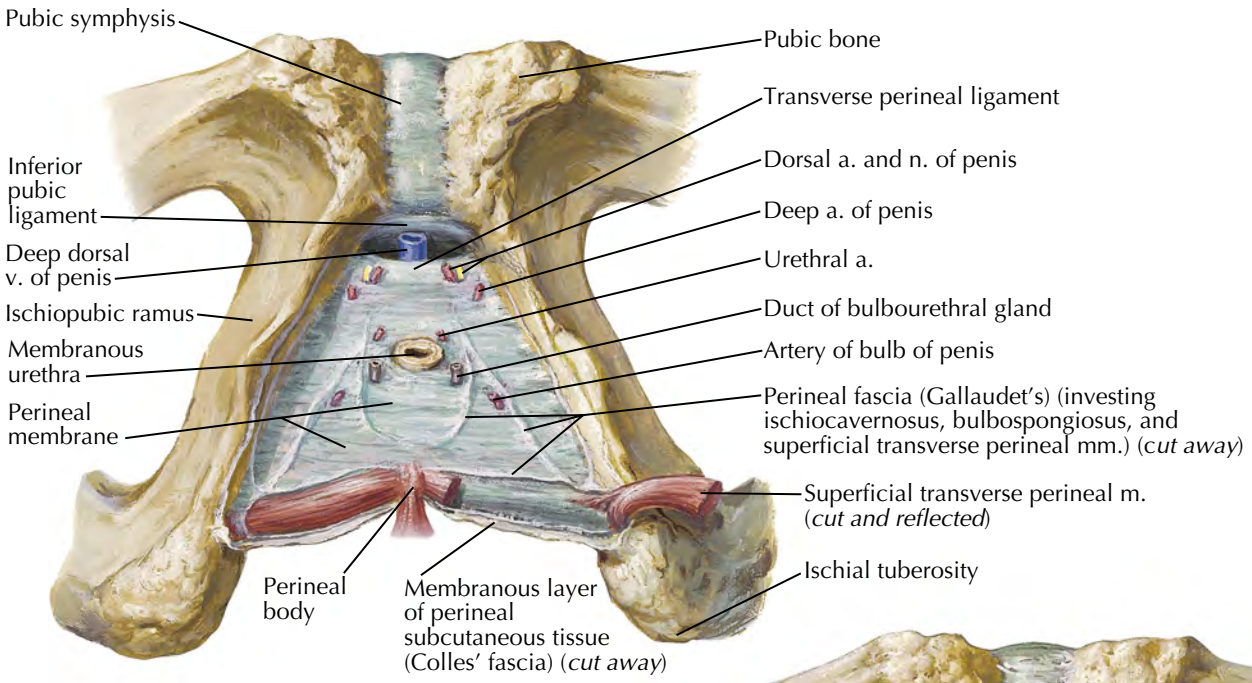




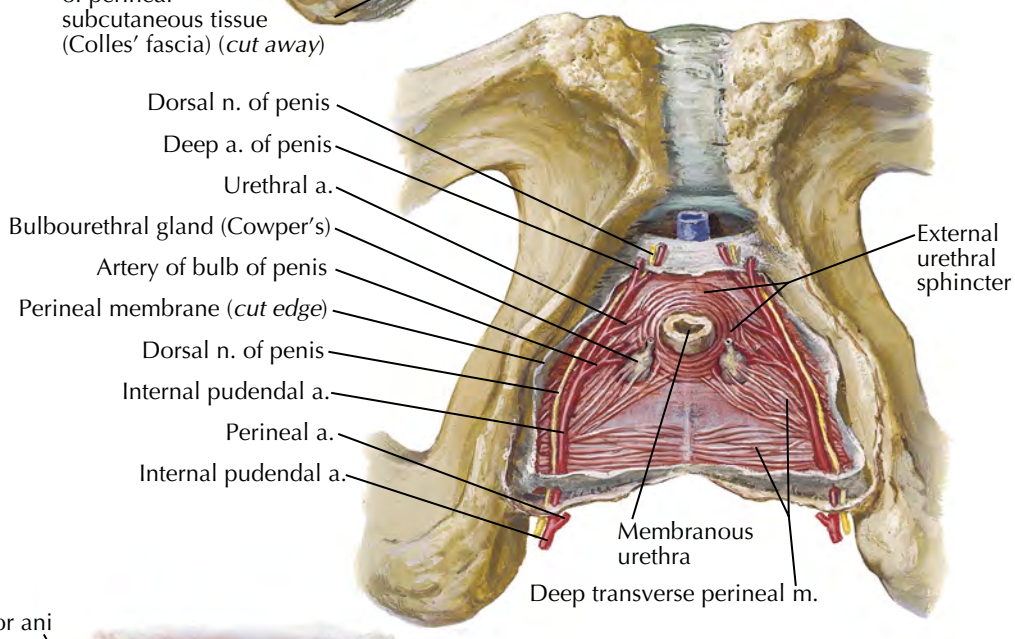
Transverse section through body of penis

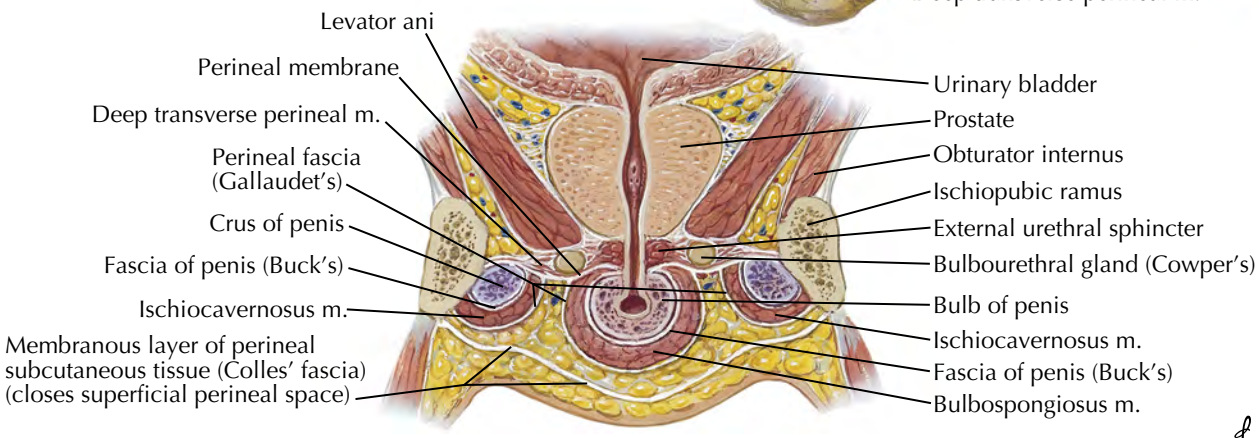
See also **Plate 391**





Inferior views

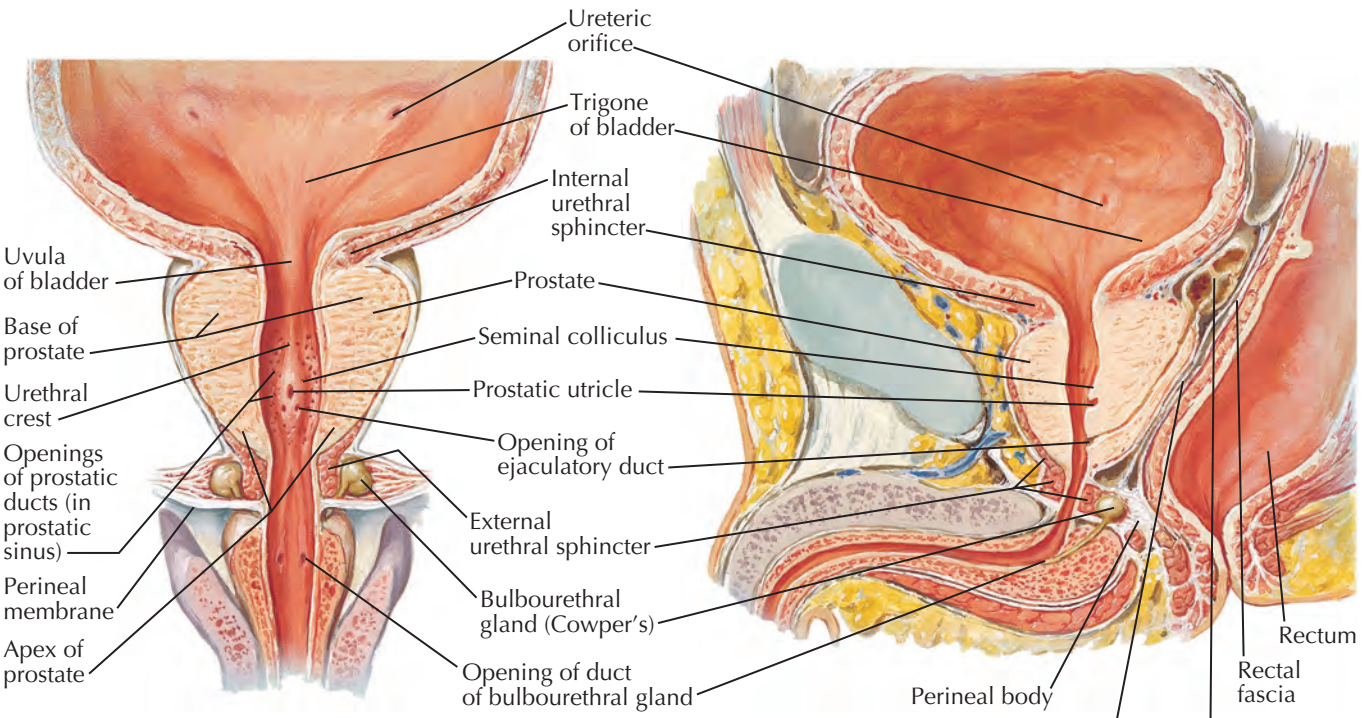




Frontal section, anterior view of perineum: schema

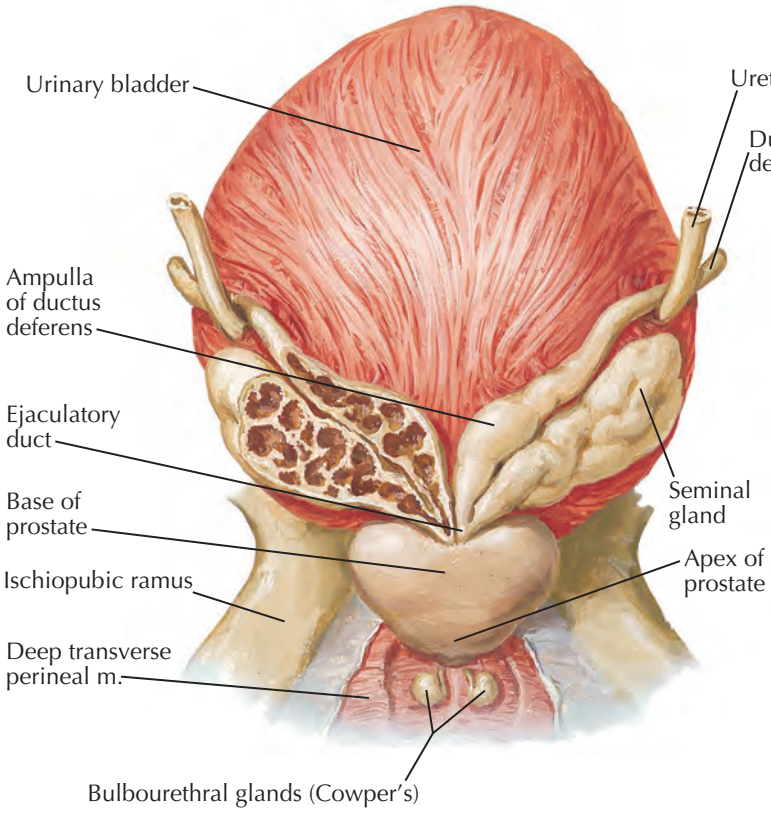
F. Netter M.D. C. Machado M.D.

See also **Plates 368, 371, 405, BP 93**

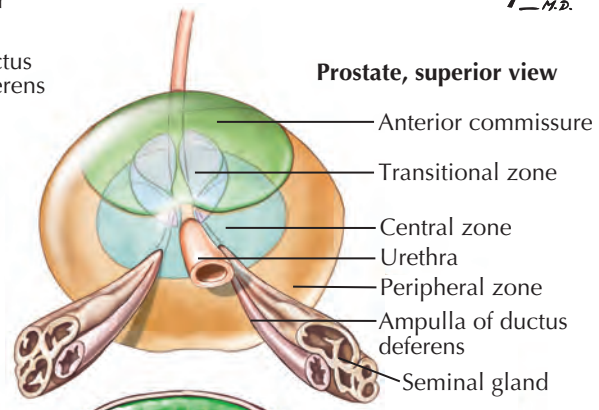


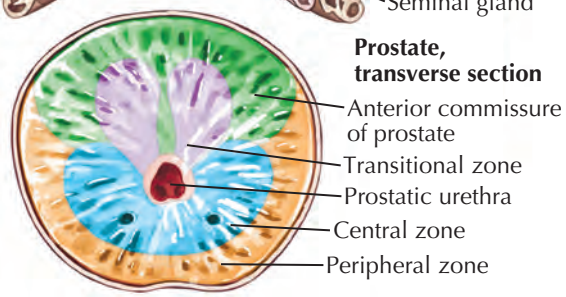
Anterior view of coronal section

Sagittal section

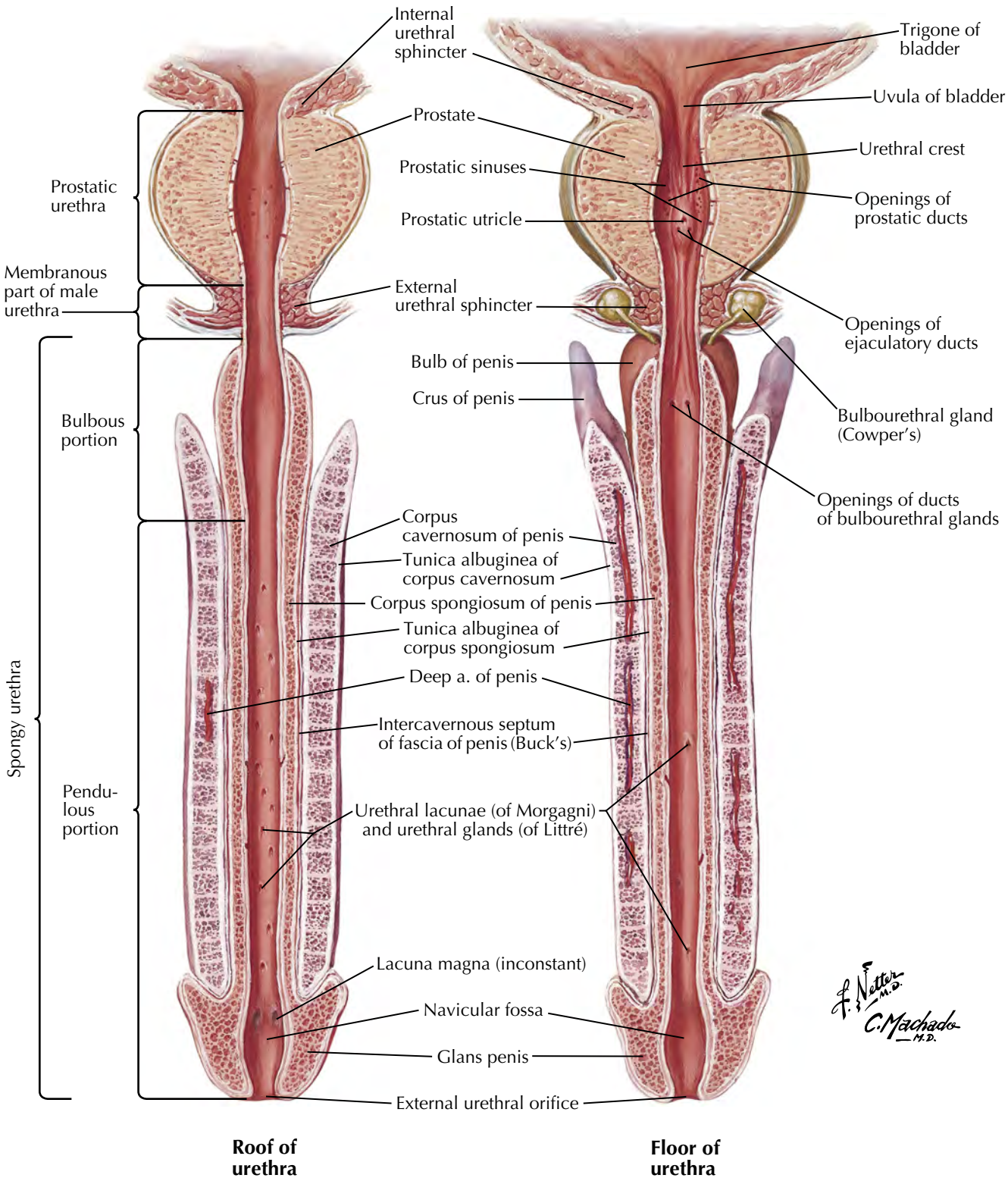


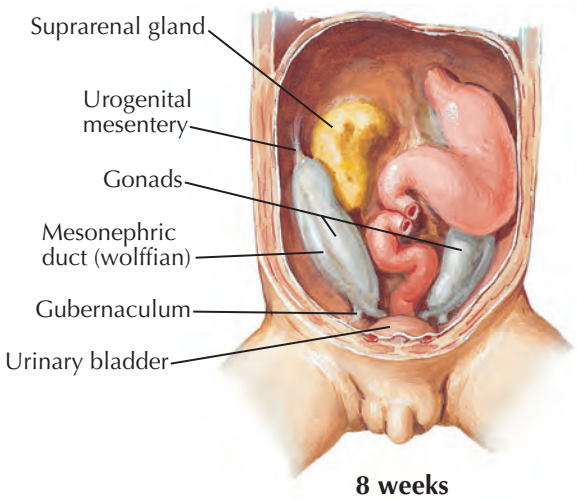
Posterior view



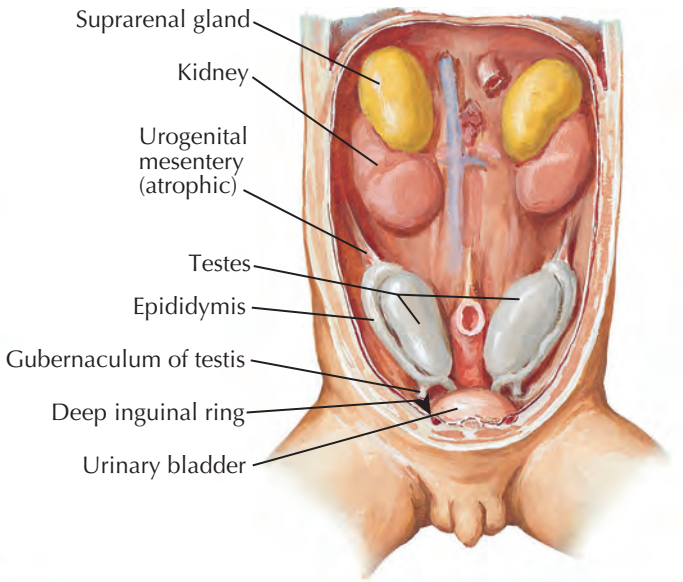


See also **Plates 391, BP 92**

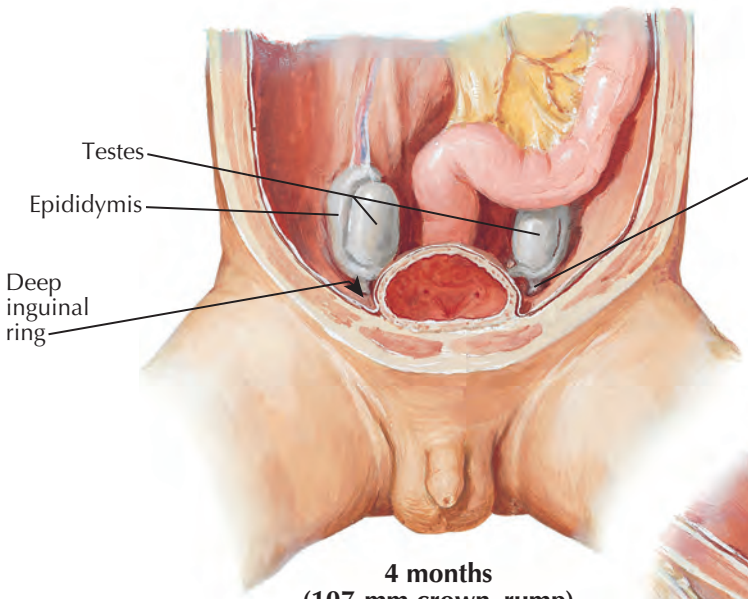




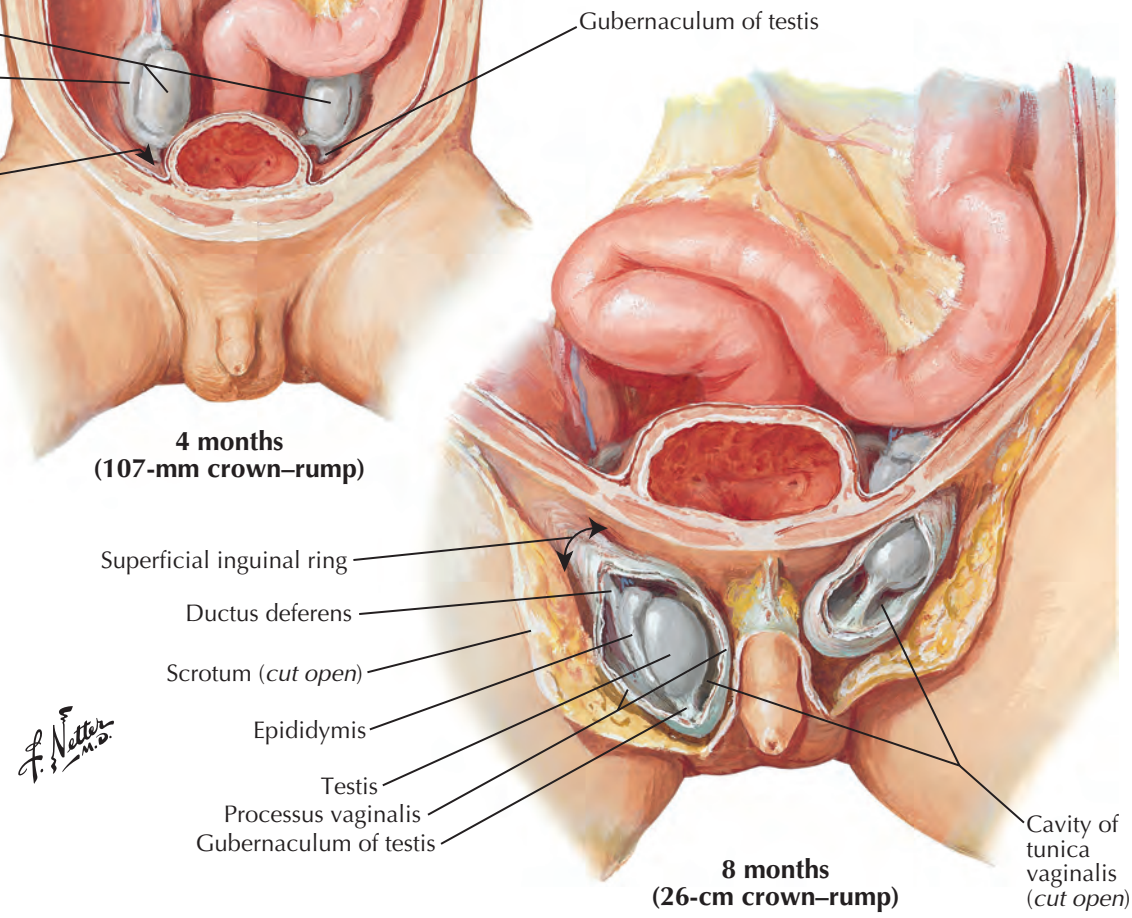
8 weeks
(22.5-mm crown–rump)



11 weeks
(43-mm crown–rump)

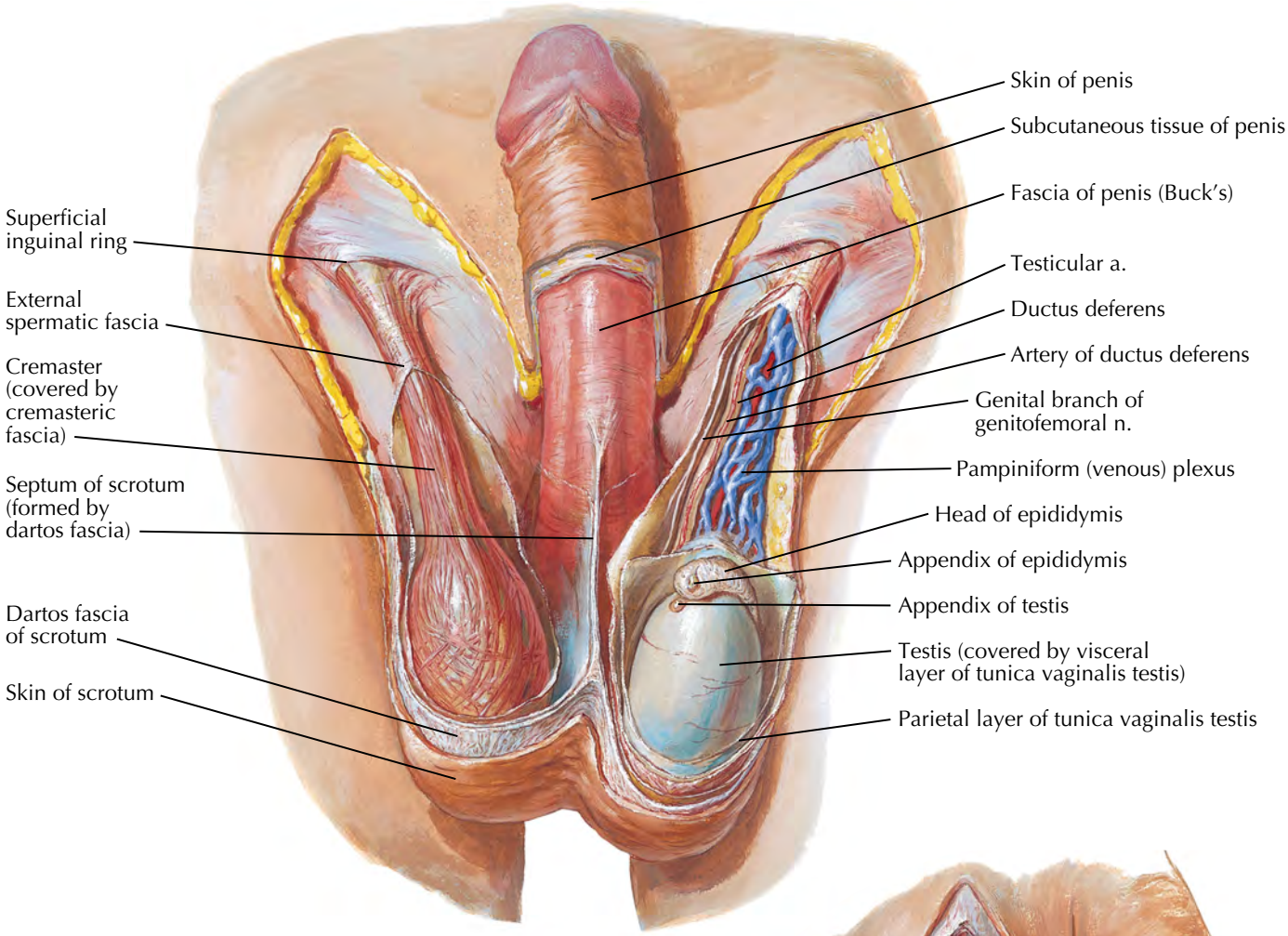


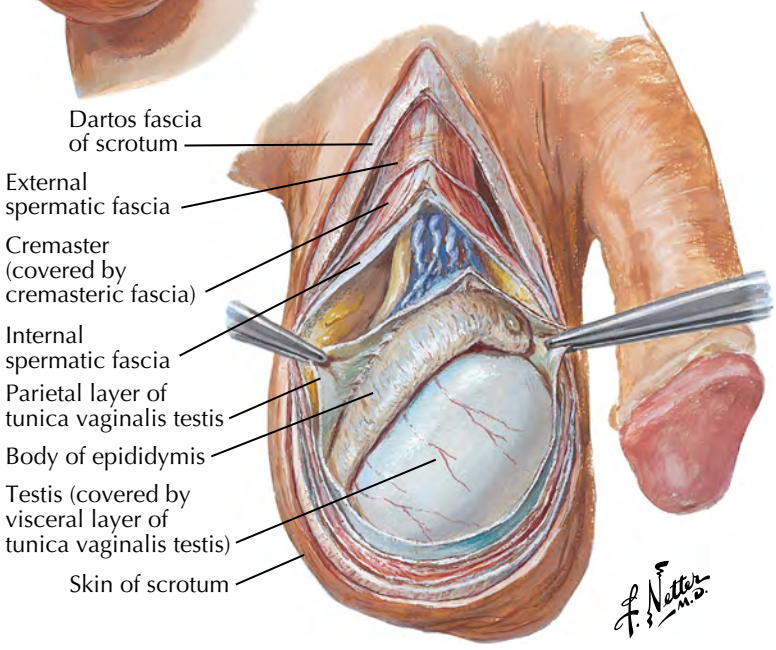
4 months
(107-mm crown–rump)



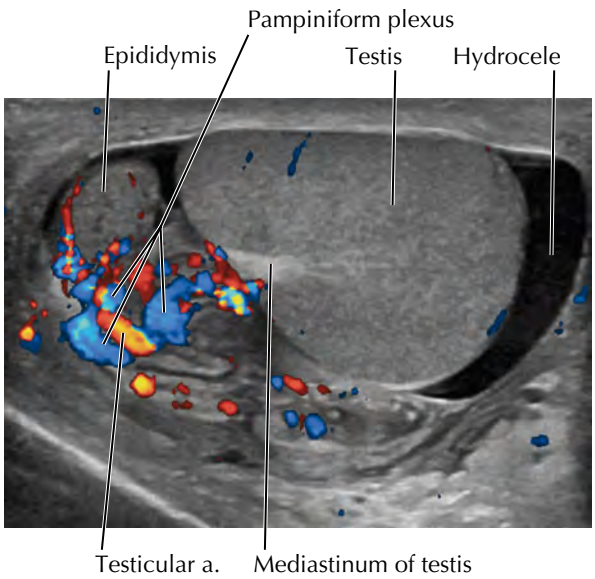
8 months
(26-cm crown–rump)

See also **Plates 343, 368**

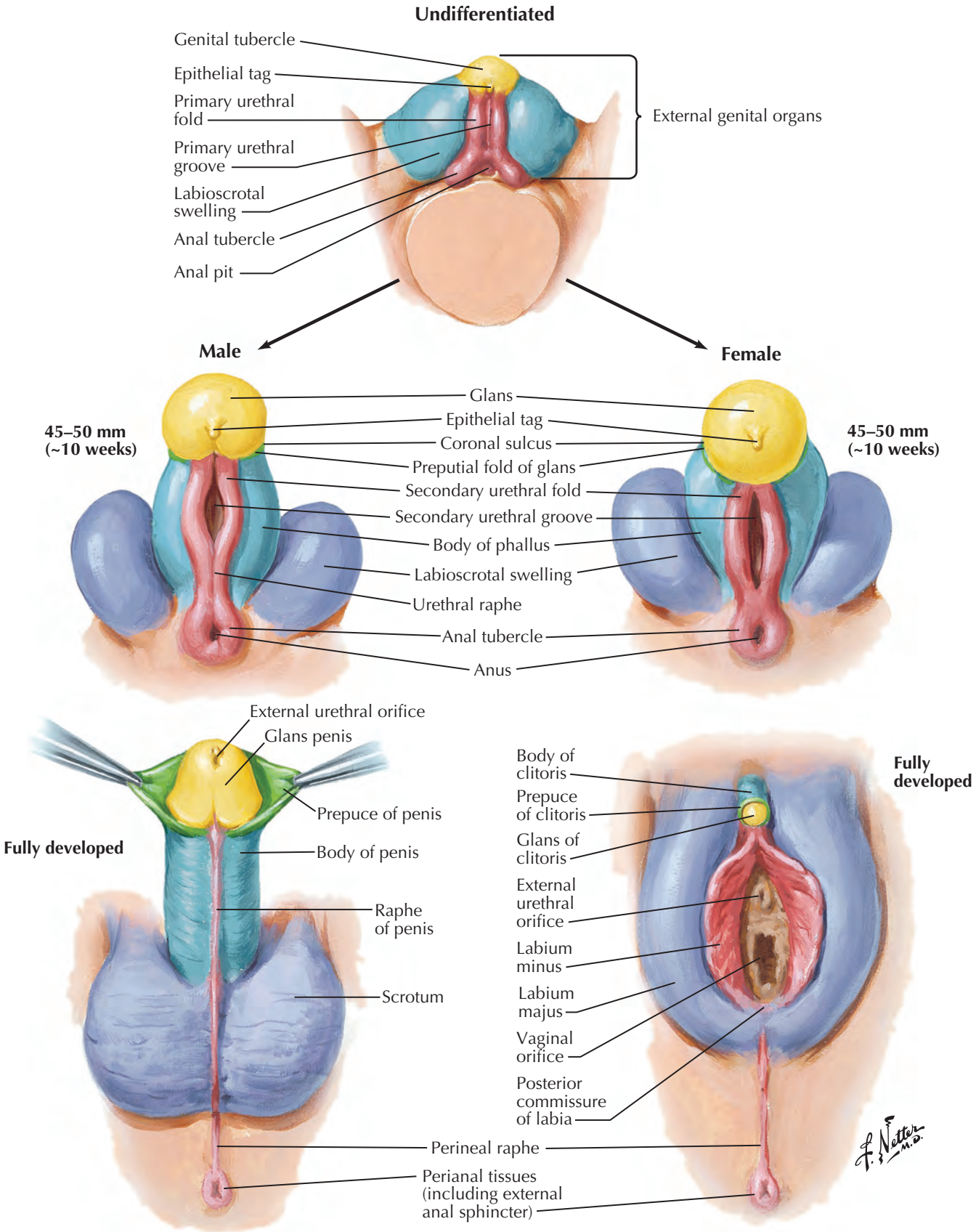


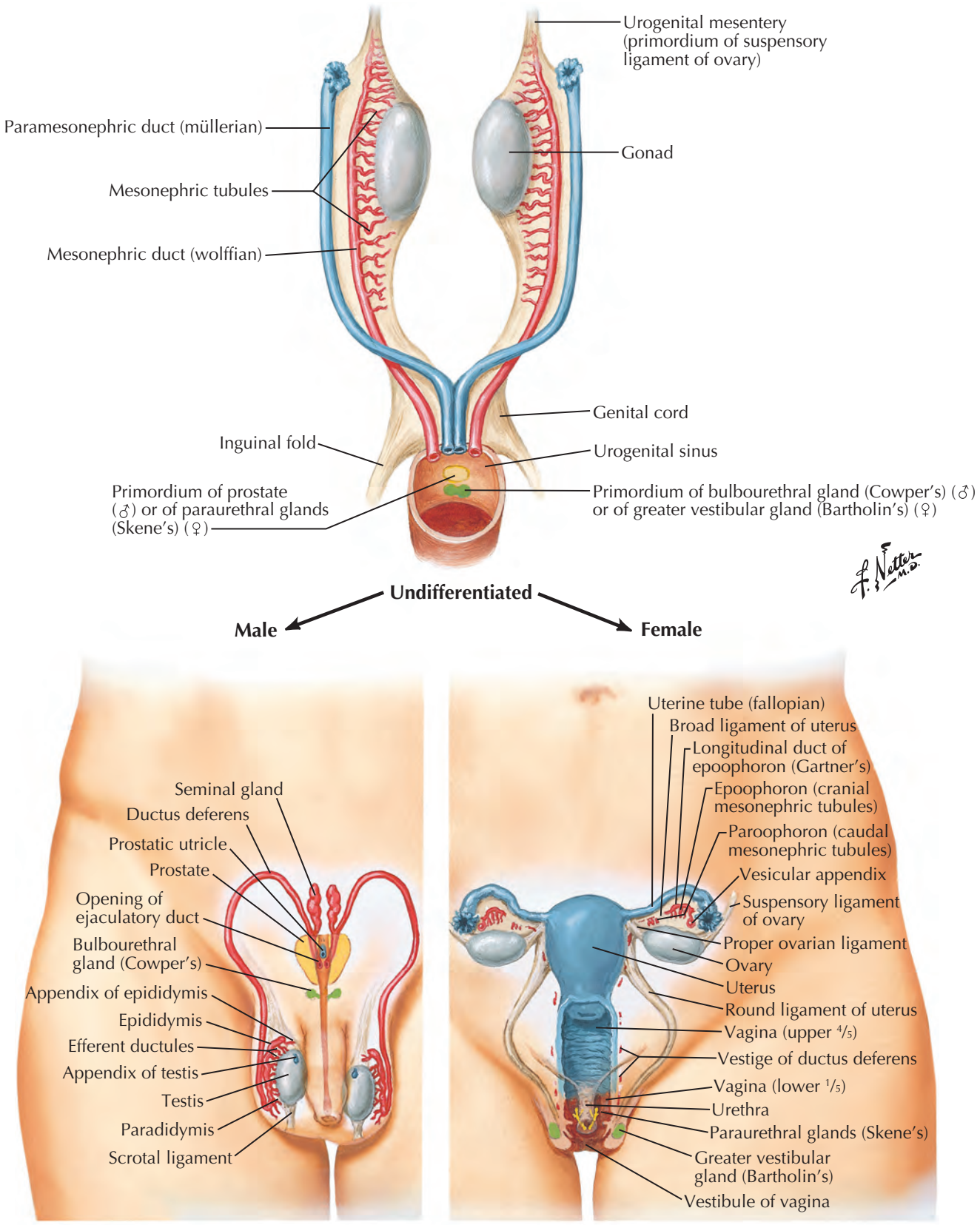


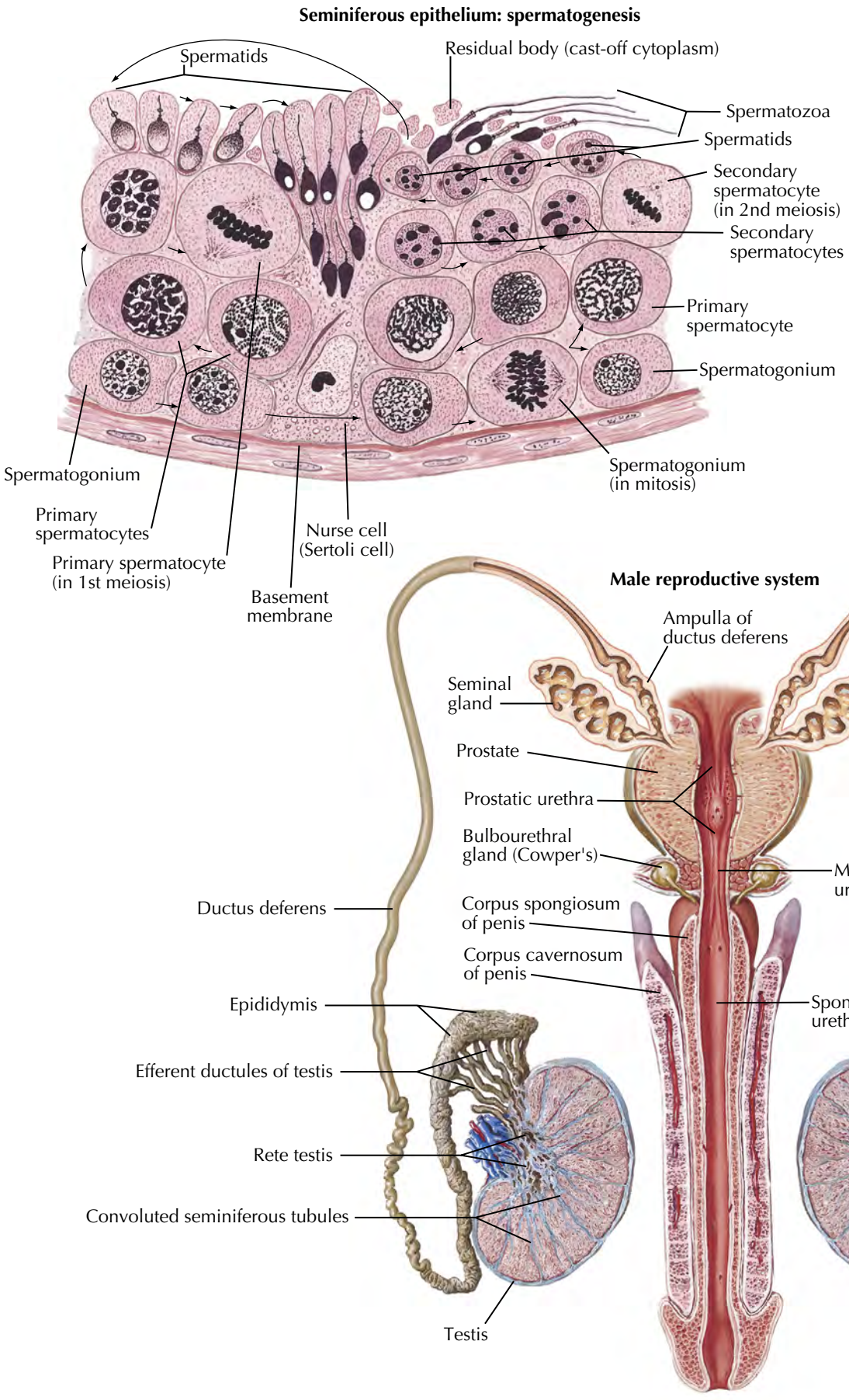
Color Doppler ultrasound: transverse view of testis

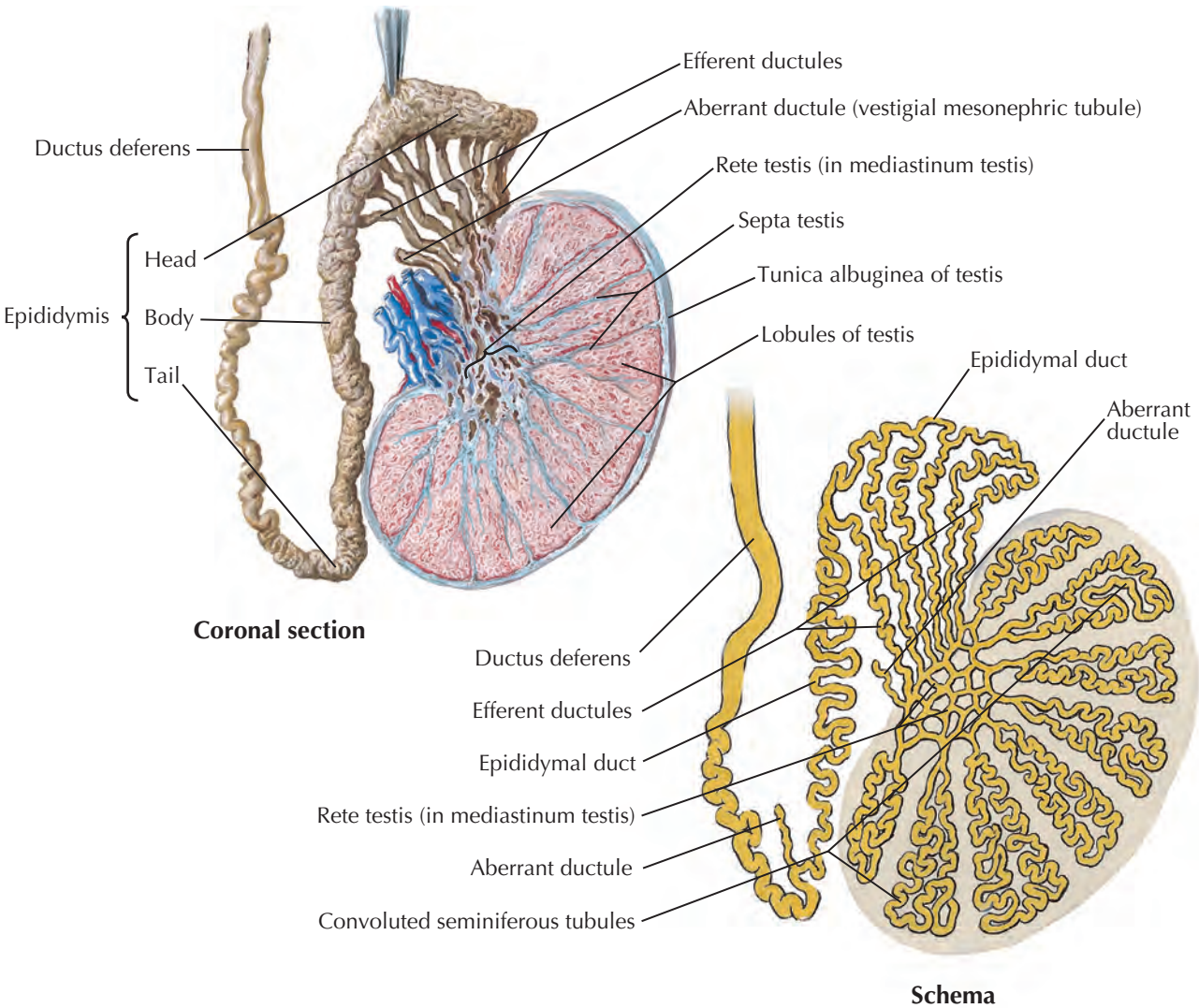


See also **Plates 377, 381**



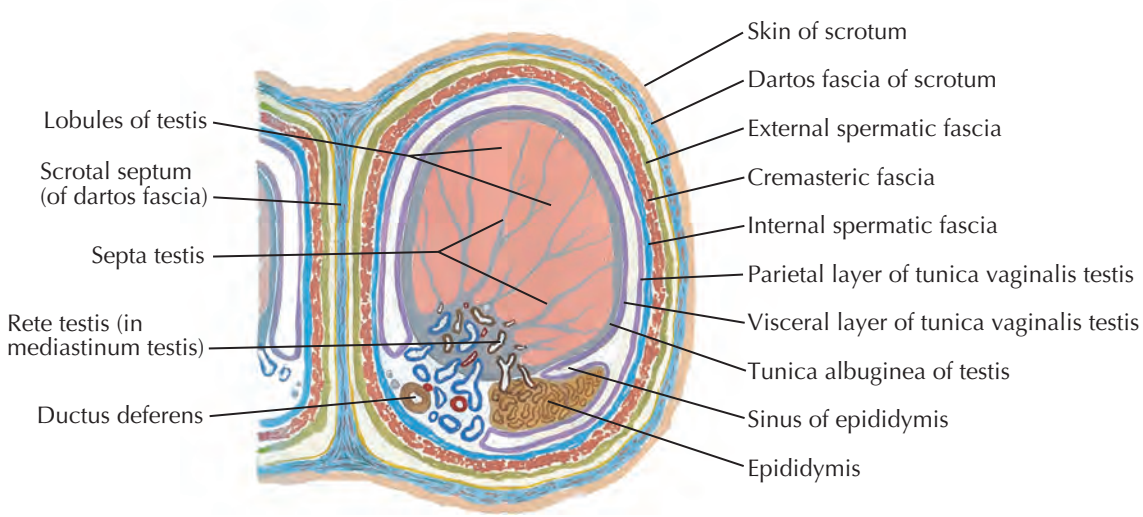

Urogenital mesentery (primordium of suspensory ligament of ovary)
Paramesonephric duct (müllerian)
Gonad
Mesonephric tubules
Mesonephric duct (wolffian)
Genital cord
Inguinal fold
Urogenital sinus
Primordium of prostate (♂) or of paraurethral glands (Skene's) (♀)
Primordium of bulbourethral gland (Cowper's) (♂) or of greater vestibular gland (Bartholin's) (♀)
Undifferentiated
Male
Female
Seminal gland
Ductus deferens
Prostatic utricle
Prostate
Opening of ejaculatory duct
Bulbourethral gland (Cowper's)
Appendix of epididymis
Epididymis
Efferent ductules
Appendix of testis
Testis
Paradidymis
Scrotal ligament
Uterine tube (fallopian)
Broad ligament of uterus
Longitudinal duct of epoophoron (Gartner's)
Epoophoron (cranial mesonephric tubules)
Paroophoron (caudal mesonephric tubules)
Vesicular appendix
Suspensory ligament of ovary
Proper ovarian ligament
Ovary
Uterus
Round ligament of uterus
Vagina (upper 4/5)
Vestige of ductus deferens
Vagina (lower 1/5)
Urethra
Paraurethral glands (Skene's)
Greater vestibular gland (Bartholin's)
Vestibule of vagina


Seminiferous epithelium: spermatogenesis
Spermatids
Residual body (cast-off cytoplasm)
Spermatozoa
Spermatids
Secondary spermatocyte (in 2nd meiosis)
Secondary spermatocytes
Primary spermatocyte
Spermatogonium
Spermatogonium (in mitosis)
Spermatogonium
Primary spermatocytes
Primary spermatocyte (in 1st meiosis)
Nurse cell (Sertoli cell)
Basement membrane
Male reproductive system
Ampulla of ductus deferens
Seminal gland
Prostate
Prostatic urethra
Bulbourethral gland (Cowper's)
Membranous urethra
Ductus deferens
Corpus spongiosum of penis
Corpus cavernosum of penis
Epididymis
Spongy urethra
Efferent ductules of testis
Rete testis
Convoluted seminiferous tubules
Testis

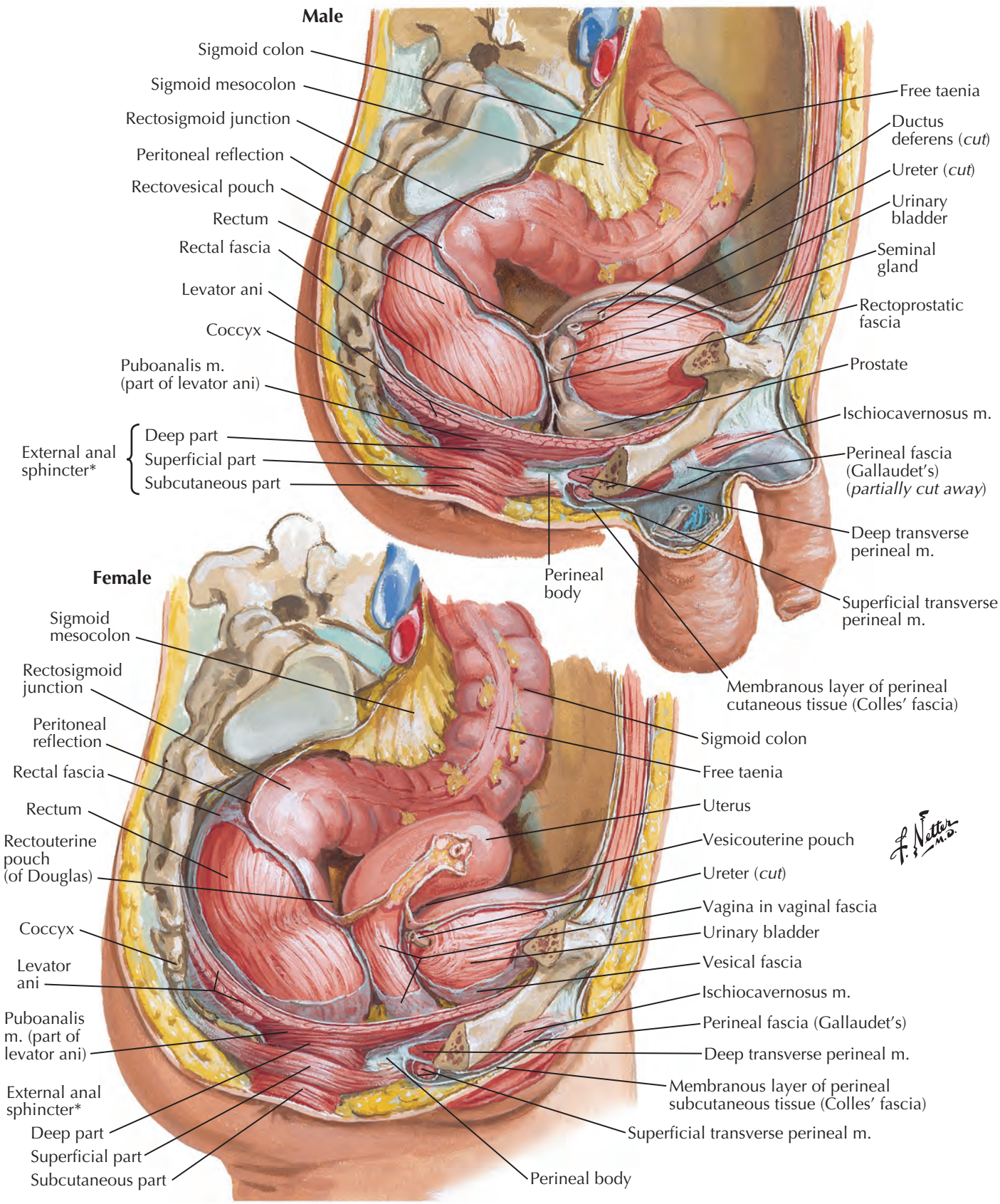


Coronal section

Schema

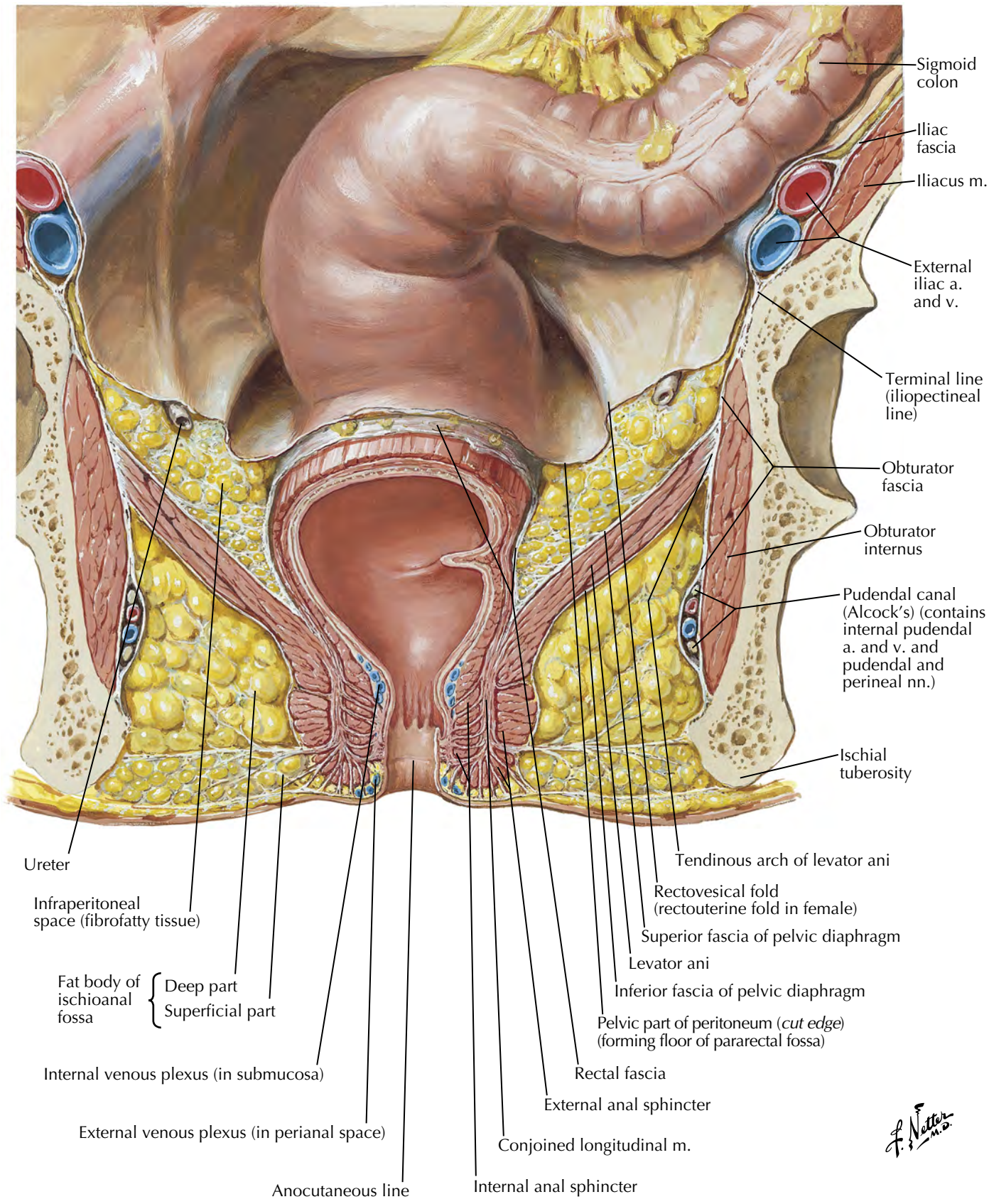


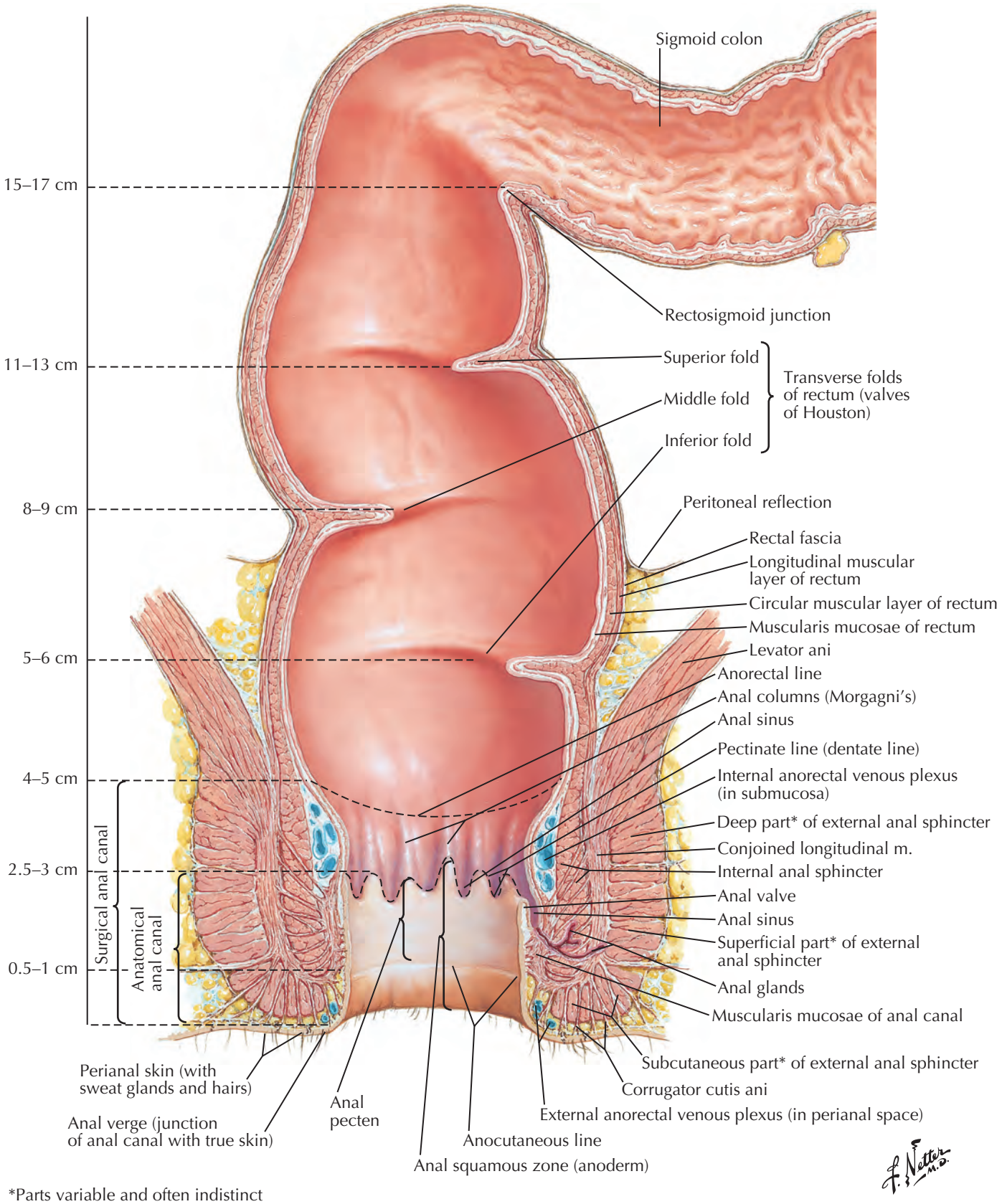
Horizontal section through scrotum and testis



*Parts variable and often indistinct

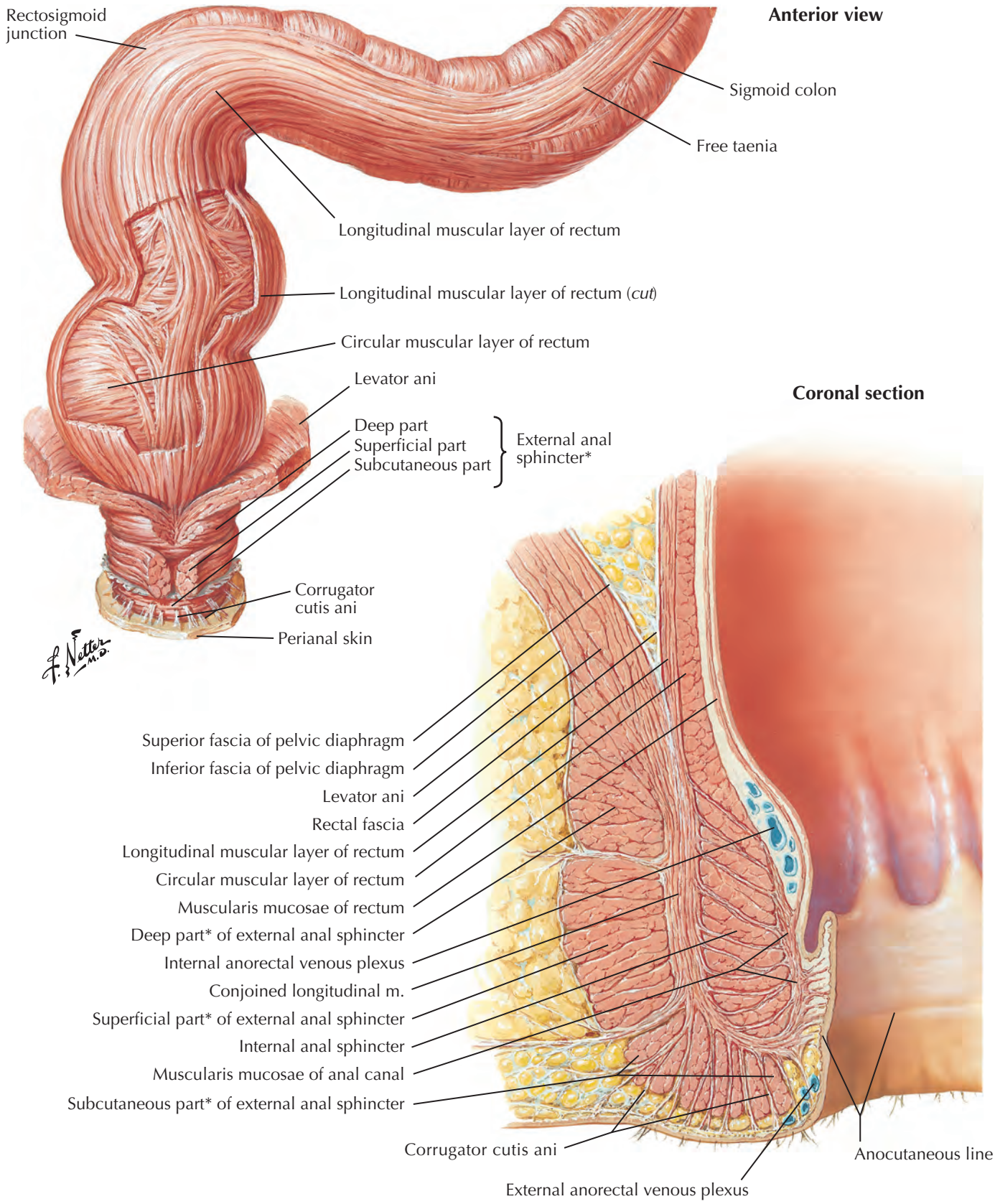
See also **Plate 412**





*Parts variable and often indistinct

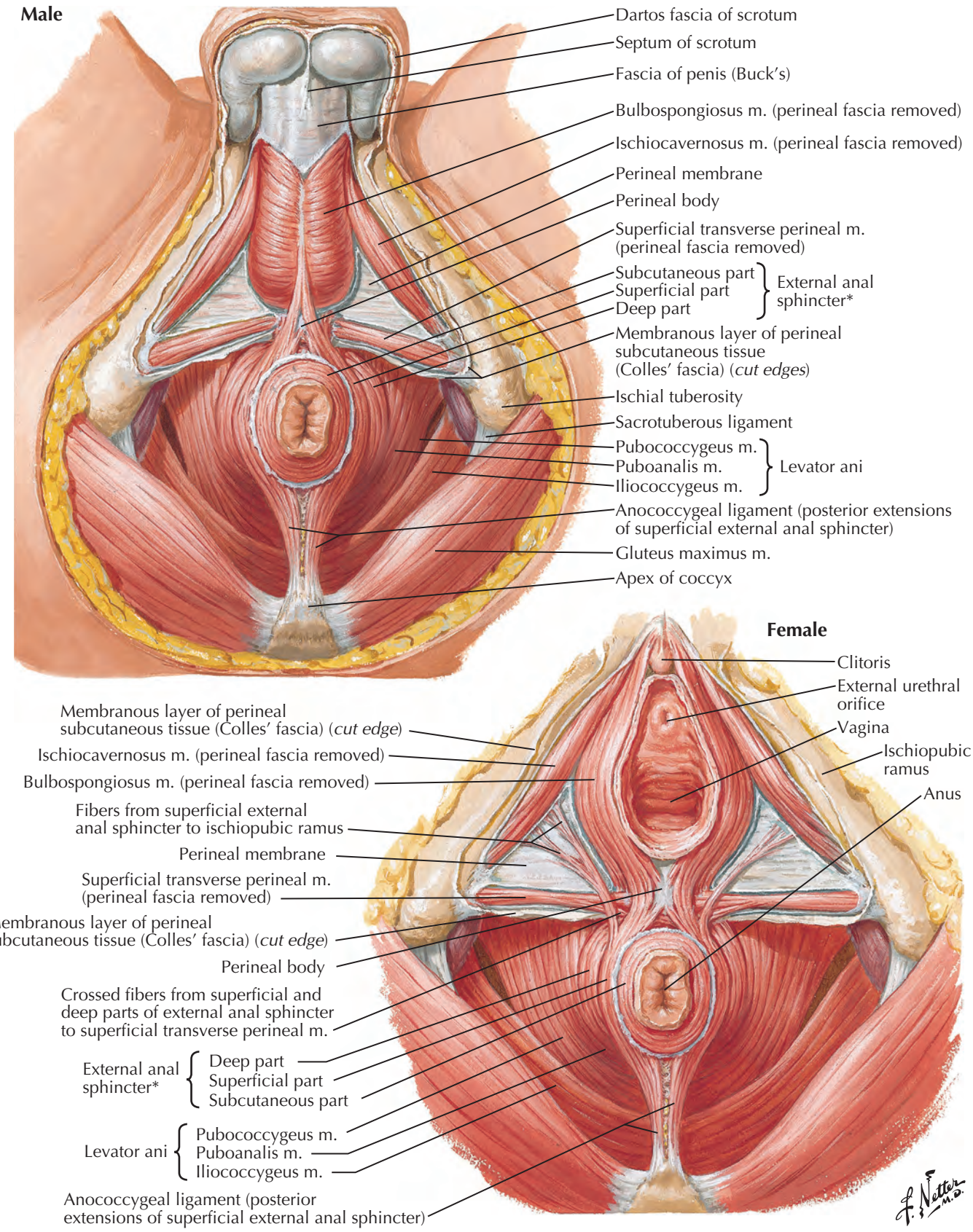
See also **Plates 400, 401**



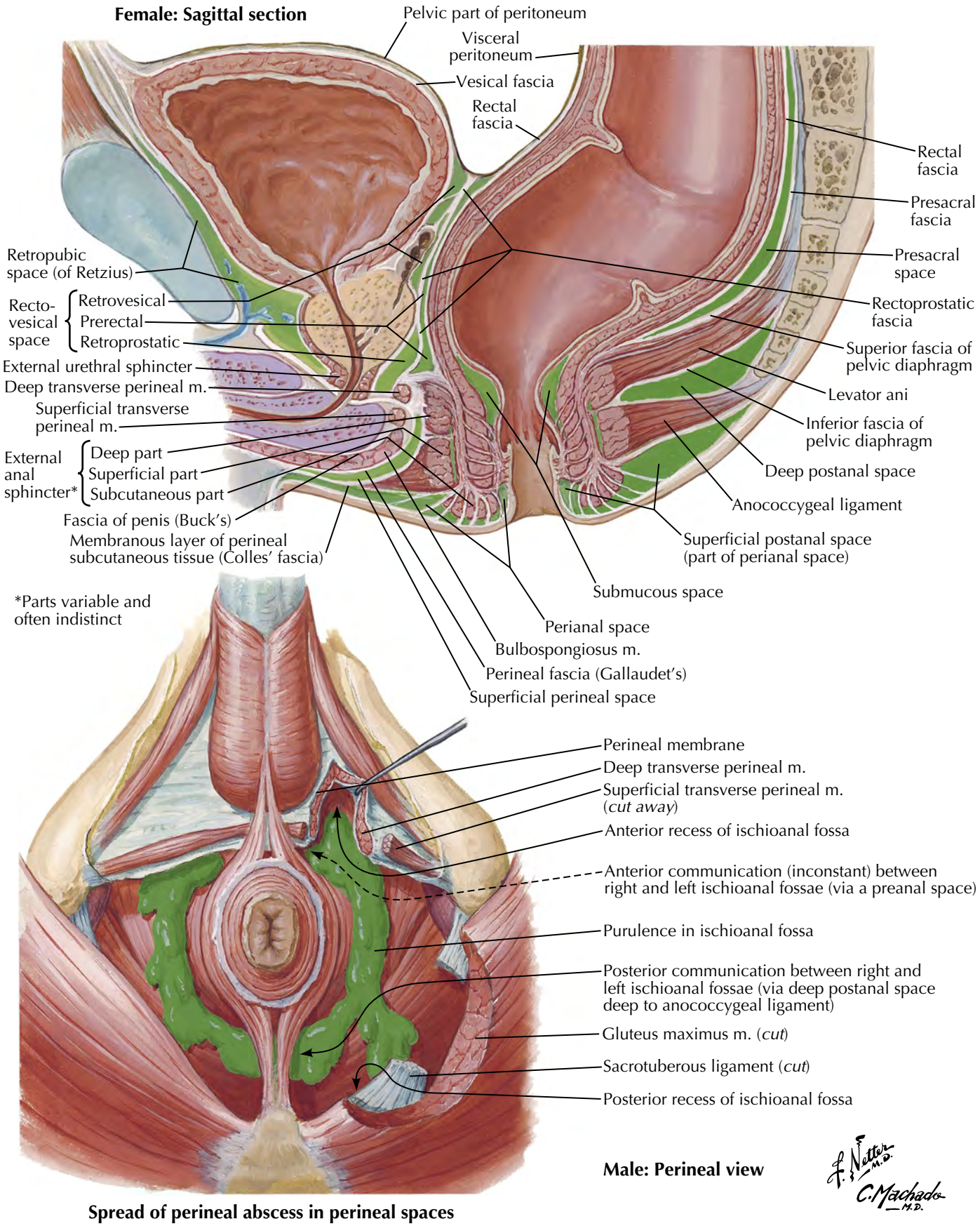
*Parts variable and often indistinct

External Anal Sphincter: Perineal Views

See also **Plates 379, 384**

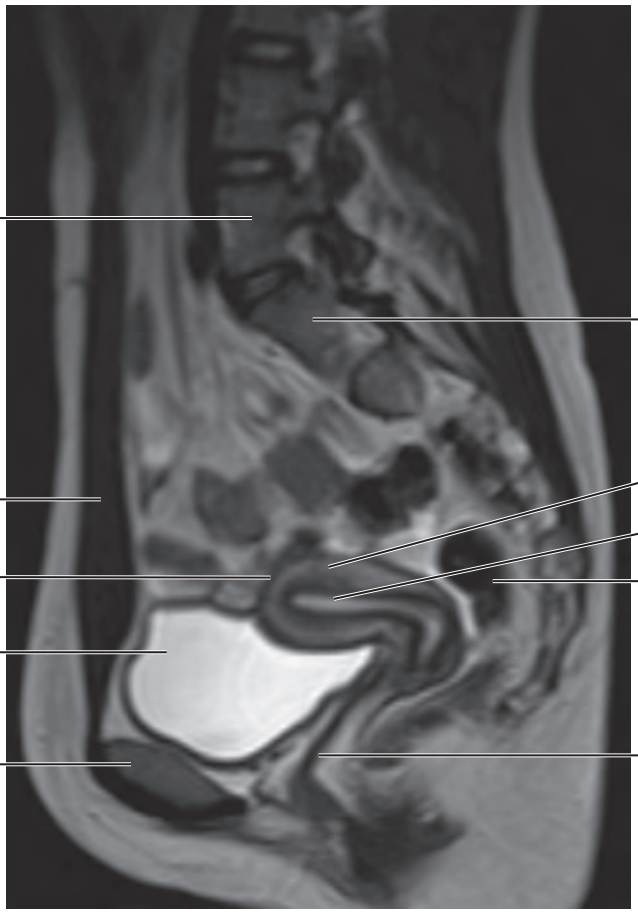


*Parts variable and often indistinct

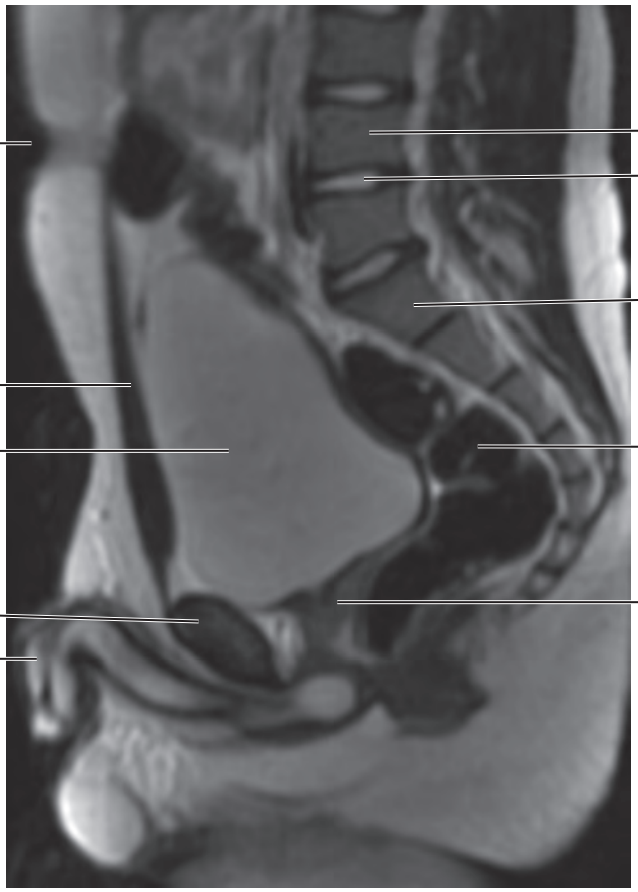


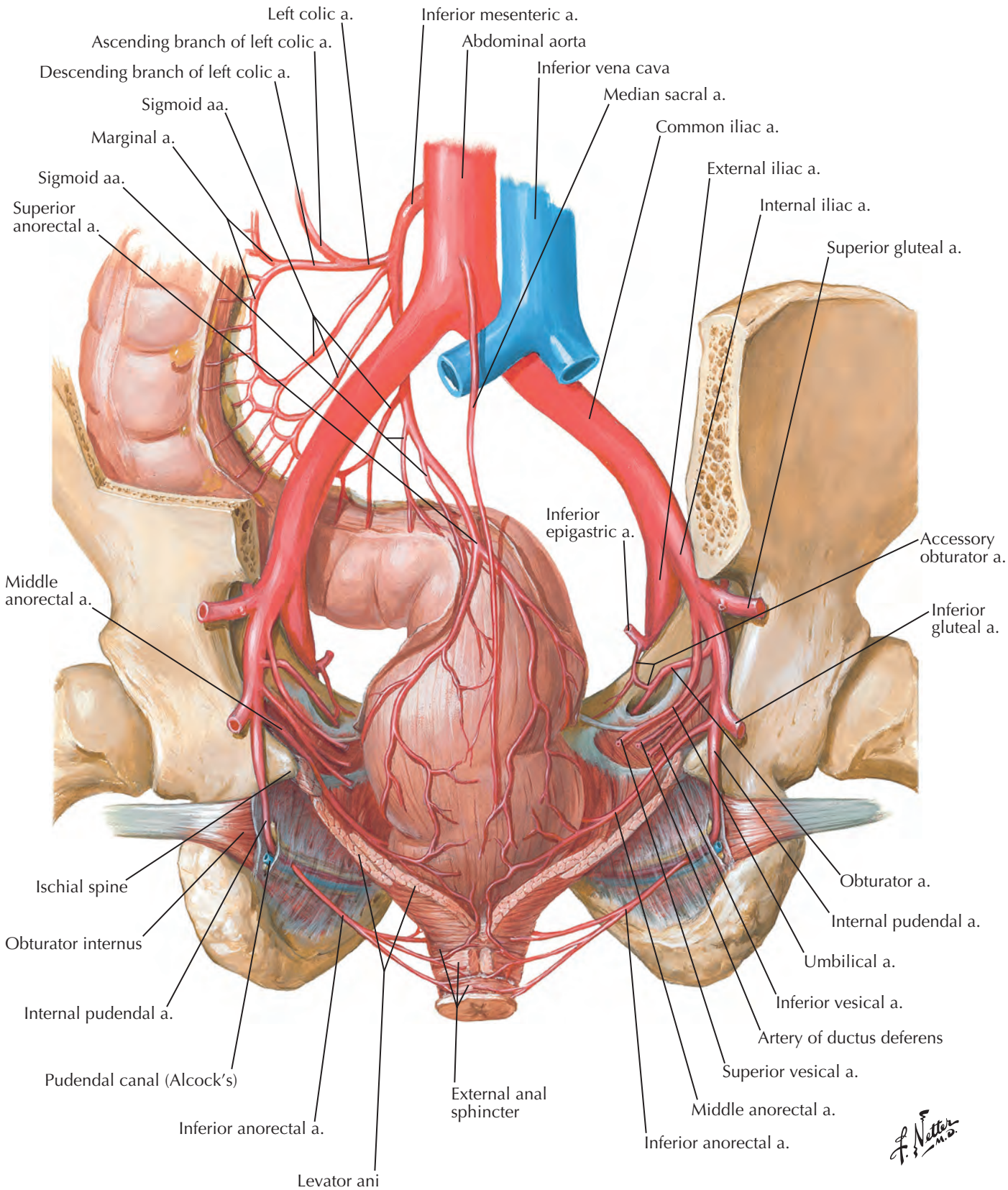
Spread of perineal abscess in perineal spaces

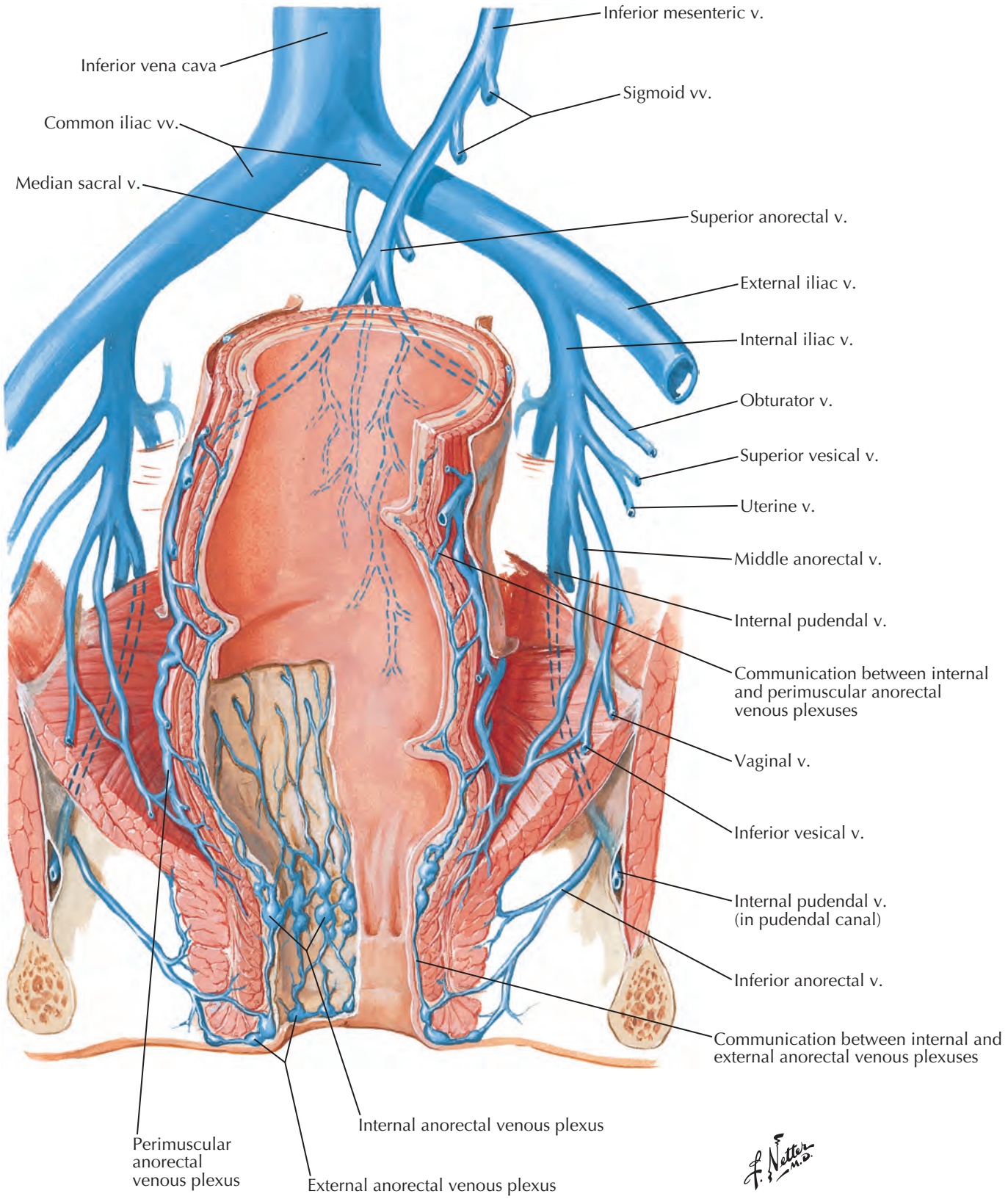
MRI of female pelvis (without intravenous contrast medium)

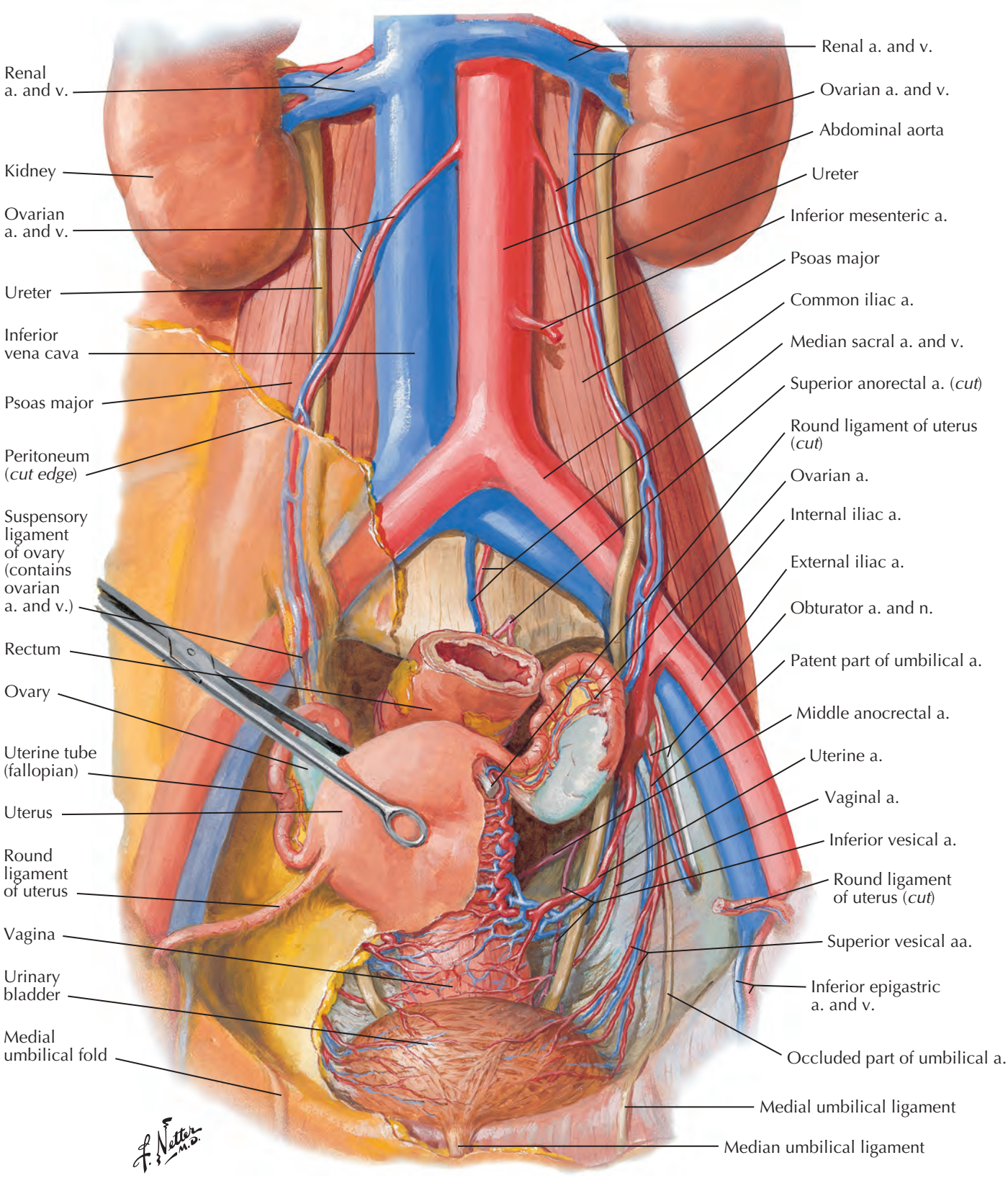


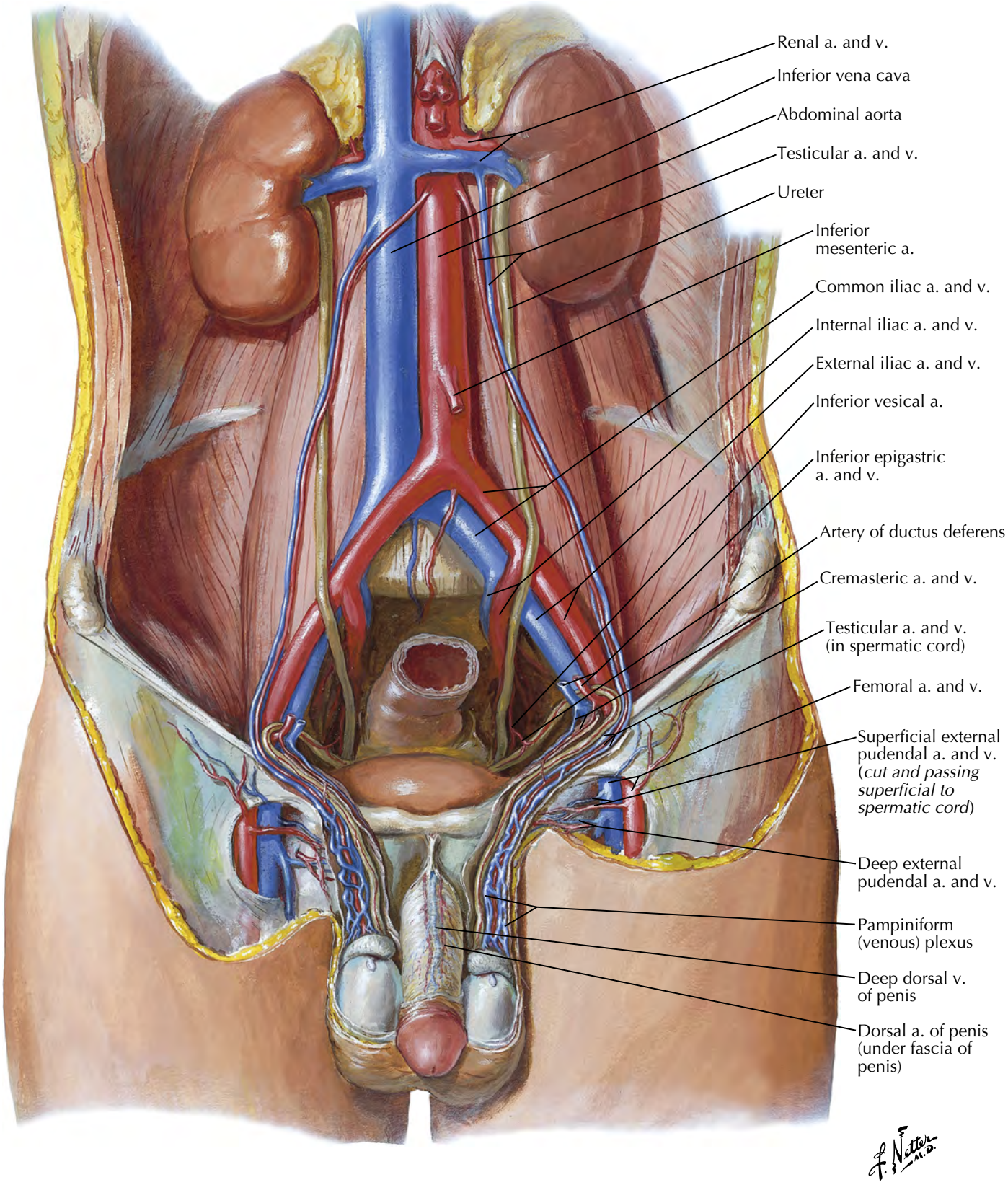
MRI of male pelvis (without intravenous contrast medium)

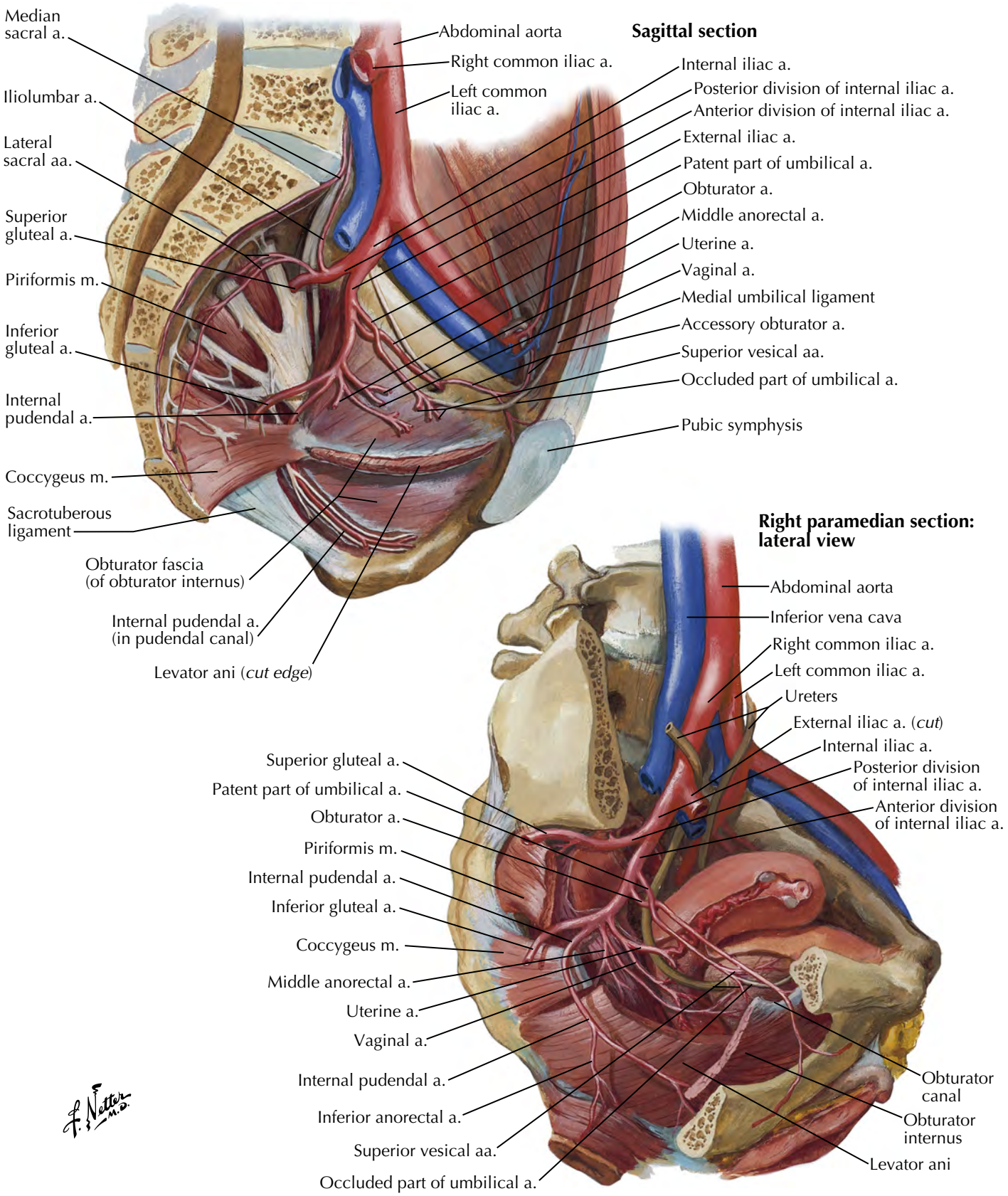



Left colic a.
Inferior mesenteric a.
Ascending branch of left colic a.
Abdominal aorta
Descending branch of left colic a.
Inferior vena cava
Sigmoid aa.
Median sacral a.
Marginal a.
Common iliac a.
Sigmoid aa.
External iliac a.
Superior anorectal a.
Internal iliac a.
Superior gluteal a.
Inferior epigastric a.
Accessory obturator a.
Middle anorectal a.
Inferior gluteal a.
Ischial spine
Obturator a.
Internal pudendal a.
Obturator internus
Umbilical a.
Inferior vesical a.
Internal pudendal a.
Artery of ductus deferens
Superior vesical a.
Pudendal canal (Alcock's)
External anal sphincter
Middle anorectal a.
Inferior anorectal a.
Inferior anorectal a.
Levator ani

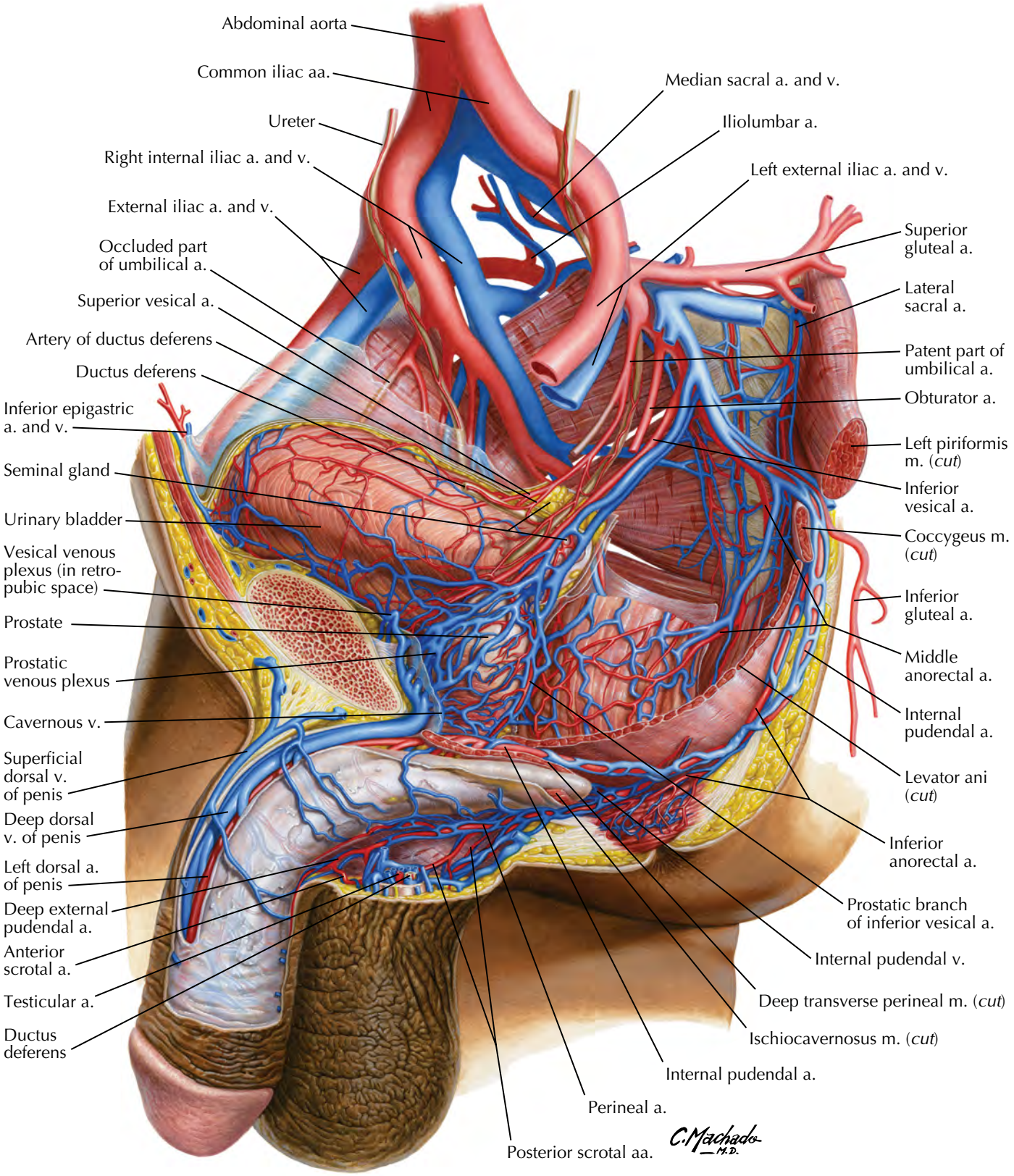

Inferior mesenteric v.
Inferior vena cava
Sigmoid vv.
Common iliac vv.
Median sacral v.
Superior anorectal v.
External iliac v.
Internal iliac v.
Obturator v.
Superior vesical v.
Uterine v.
Middle anorectal v.
Internal pudendal v.
Communication between internal and perimuscular anorectal venous plexuses
Vaginal v.
Inferior vesical v.
Internal pudendal v. (in pudendal canal)
Inferior anorectal v.
Communication between internal and external anorectal venous plexuses
Internal anorectal venous plexus
Perimuscular anorectal venous plexus
External anorectal venous plexus

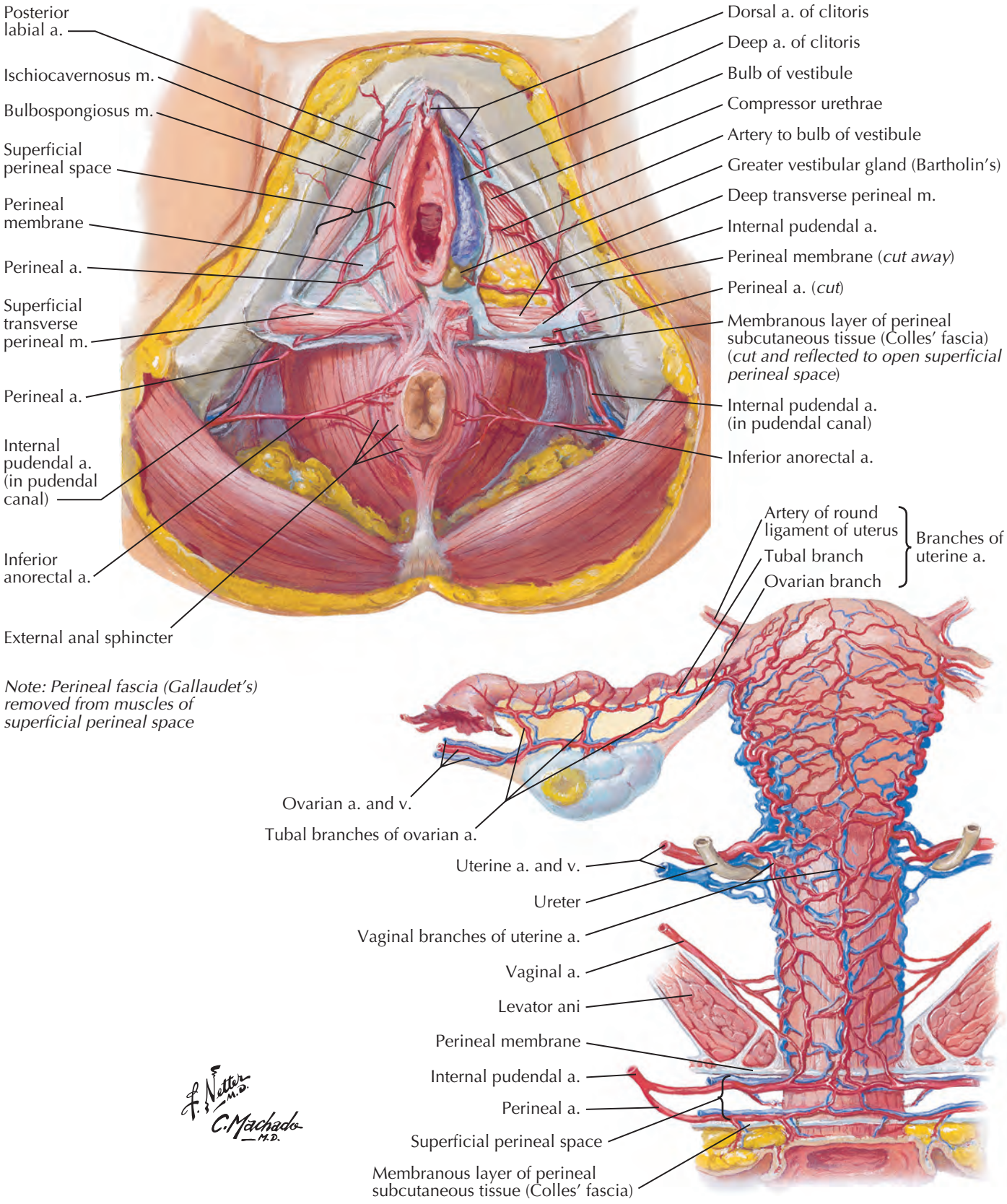

Renal a. and v.
Ovarian a. and v.
Abdominal aorta
Ureter
Inferior mesenteric a.
Psoas major
Common iliac a.
Median sacral a. and v.
Superior anorectal a. (*cut*)
Round ligament of uterus (*cut*)
Ovarian a.
Internal iliac a.
External iliac a.
Obturator a. and n.
Patent part of umbilical a.
Middle anorectal a.
Uterine a.
Vaginal a.
Inferior vesical a.
Round ligament of uterus (*cut*)
Superior vesical aa.
Inferior epigastric a. and v.
Occluded part of umbilical a.
Medial umbilical ligament
Median umbilical ligament
Renal a. and v.
Kidney
Ovarian a. and v.
Ureter
Inferior vena cava
Psoas major
Peritoneum (*cut edge*)
Suspensory ligament of ovary (contains ovarian a. and v.)
Rectum
Ovary
Uterine tube (fallopian)
Uterus
Round ligament of uterus
Vagina
Urinary bladder
Medial umbilical fold


Renal a. and v.
Inferior vena cava
Abdominal aorta
Testicular a. and v.
Ureter
Inferior mesenteric a.
Common iliac a. and v.
Internal iliac a. and v.
External iliac a. and v.
Inferior vesical a.
Inferior epigastric a. and v.
Artery of ductus deferens
Cremasteric a. and v.
Testicular a. and v. (in spermatic cord)
Femoral a. and v.
Superficial external pudendal a. and v. (*cut and passing superficial to spermatic cord*)
Deep external pudendal a. and v.
Pampiniform (venous) plexus
Deep dorsal v. of penis
Dorsal a. of penis (under fascia of penis)


Median sacral a.
Iliolumbar a.
Lateral sacral aa.
Superior gluteal a.
Piriformis m.
Inferior gluteal a.
Internal pudendal a.
Coccygeus m.
Sacrotuberous ligament
Obturator fascia (of obturator internus)
Internal pudendal a. (in pudendal canal)
Levator ani (*cut edge*)
Abdominal aorta
Right common iliac a.
Left common iliac a.
Sagittal section
Internal iliac a.
Posterior division of internal iliac a.
Anterior division of internal iliac a.
External iliac a.
Patent part of umbilical a.
Obturator a.
Middle anorectal a.
Uterine a.
Vaginal a.
Medial umbilical ligament
Accessory obturator a.
Superior vesical aa.
Occluded part of umbilical a.
Pubic symphysis
Right paramedian section: lateral view
Abdominal aorta
Inferior vena cava
Right common iliac a.
Left common iliac a.
Ureters
External iliac a. (*cut*)
Internal iliac a.
Posterior division of internal iliac a.
Anterior division of internal iliac a.
Superior gluteal a.
Patent part of umbilical a.
Obturator a.
Piriformis m.
Internal pudendal a.
Inferior gluteal a.
Coccygeus m.
Middle anorectal a.
Uterine a.
Vaginal a.
Internal pudendal a.
Inferior anorectal a.
Superior vesical aa.
Occluded part of umbilical a.
Obturator canal
Obturator internus
Levator ani

See also **Plates 93, BP 93**





Note: Perineal fascia (Gallaudet's) removed from muscles of superficial perineal space

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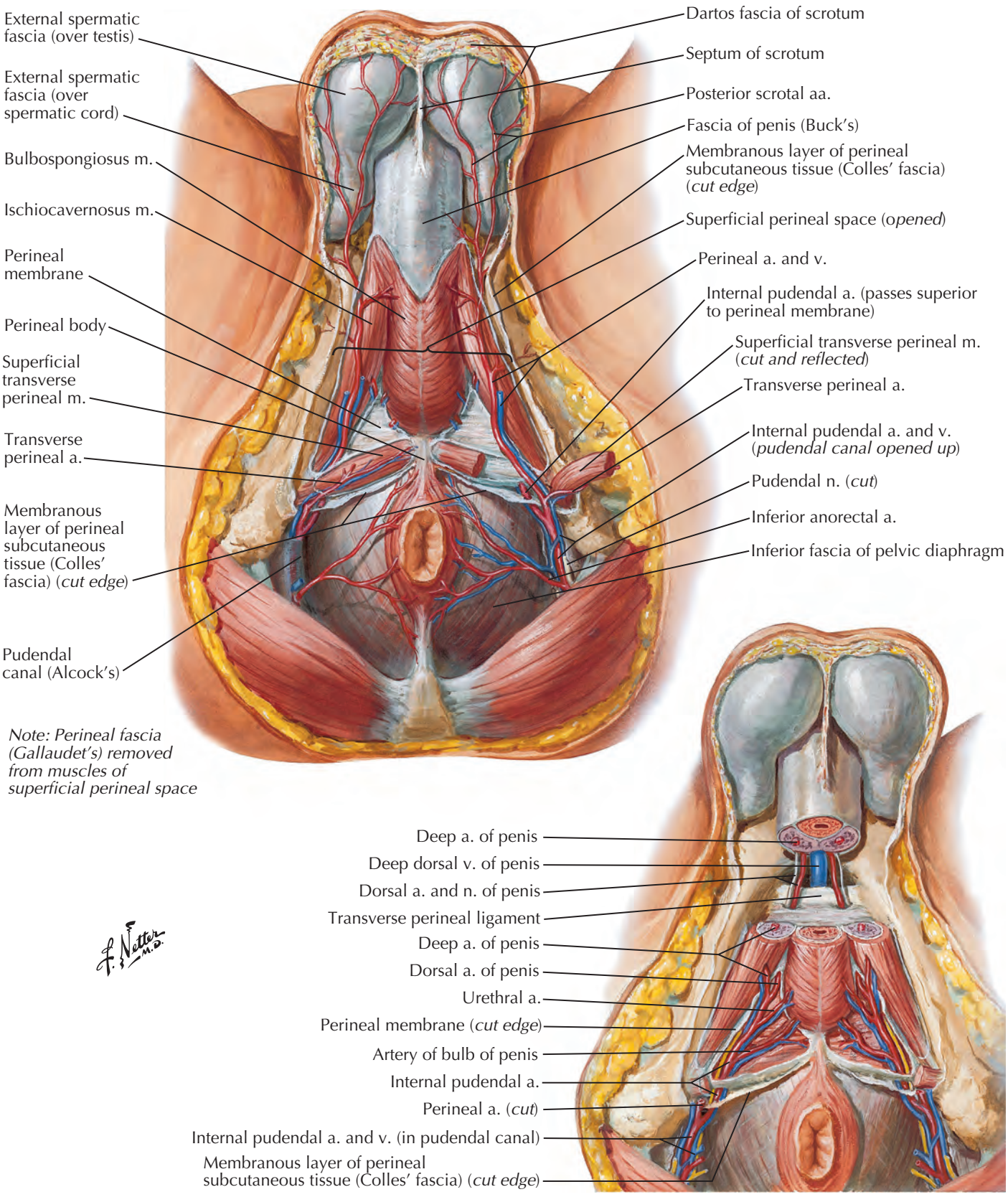
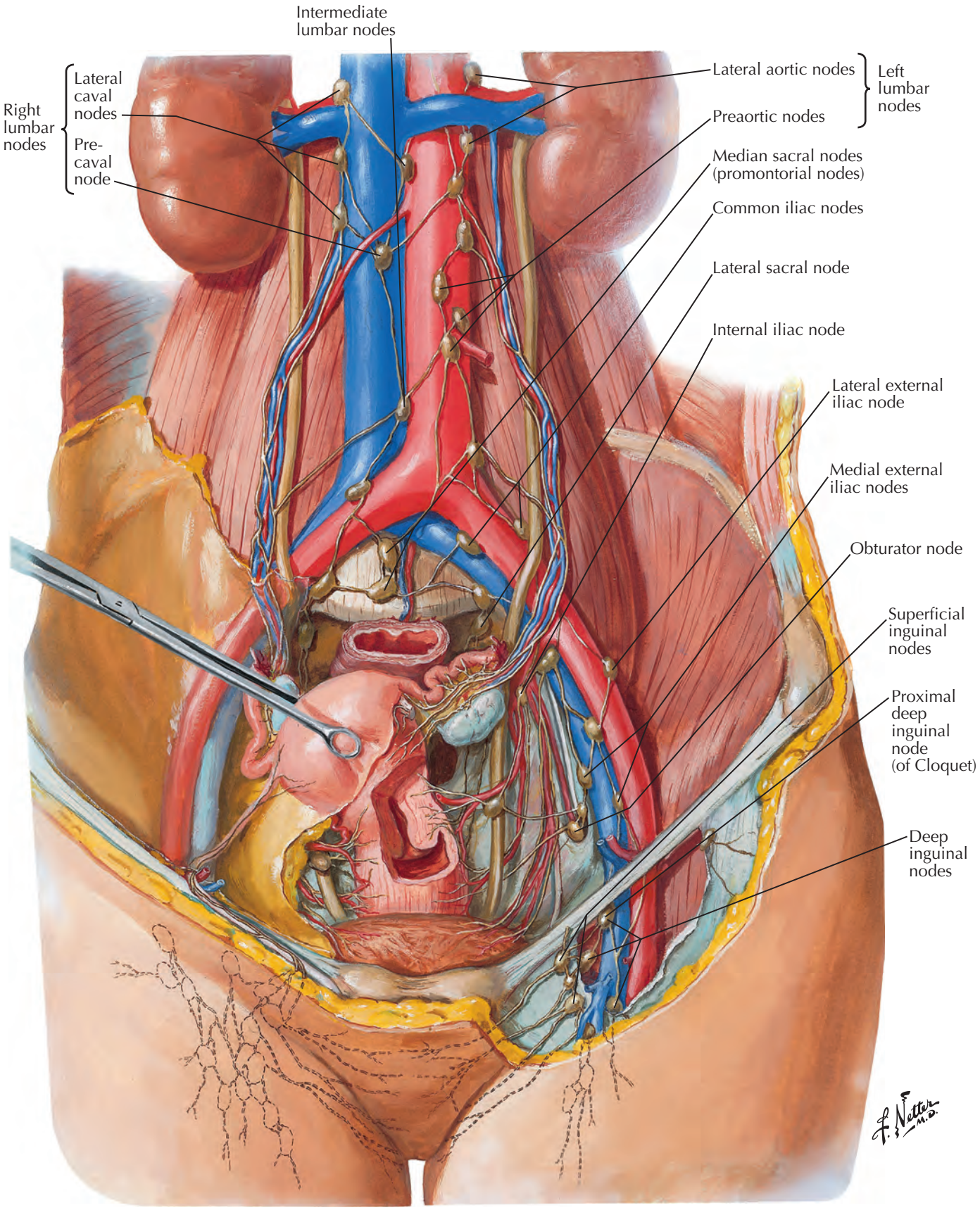
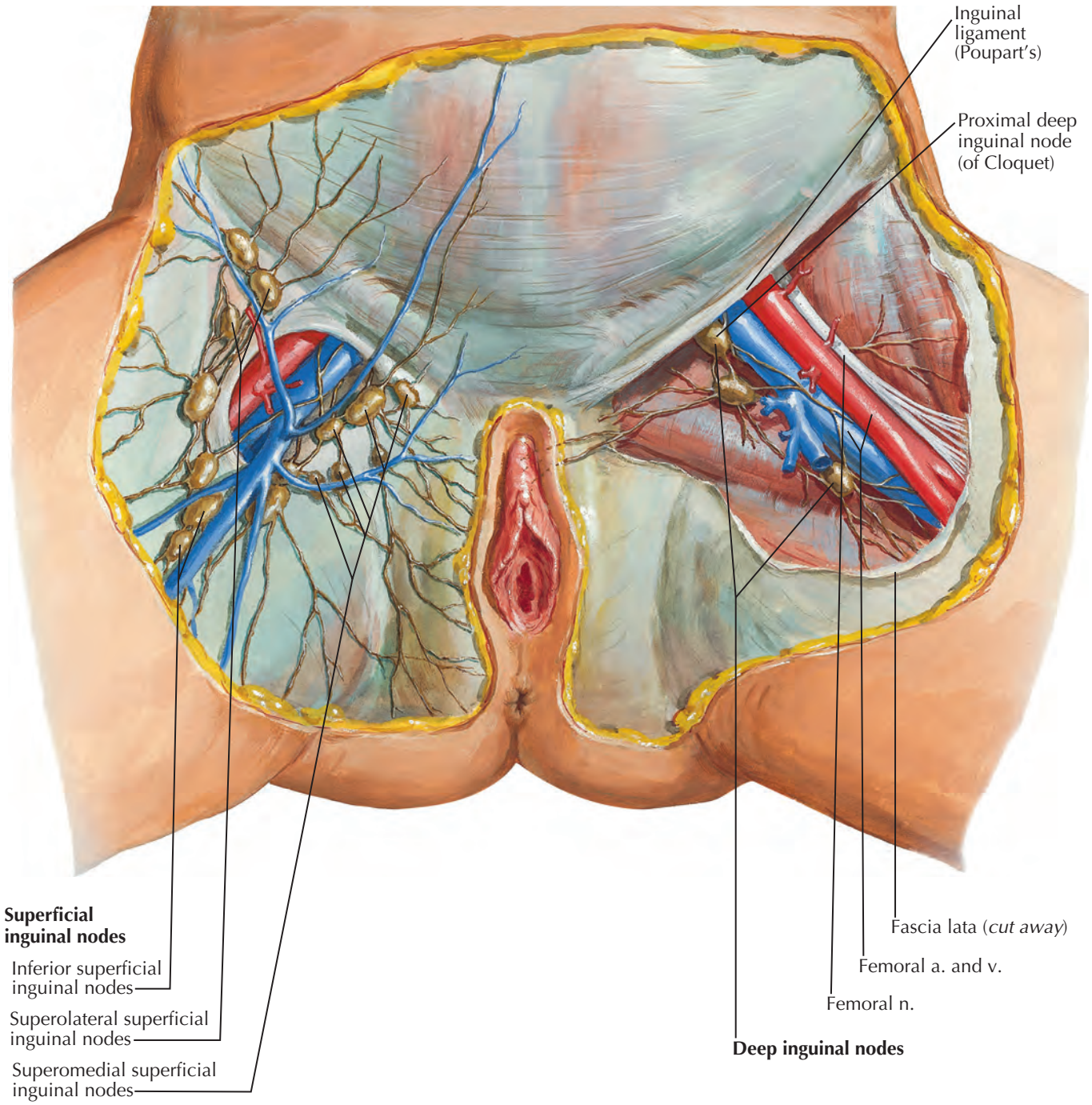
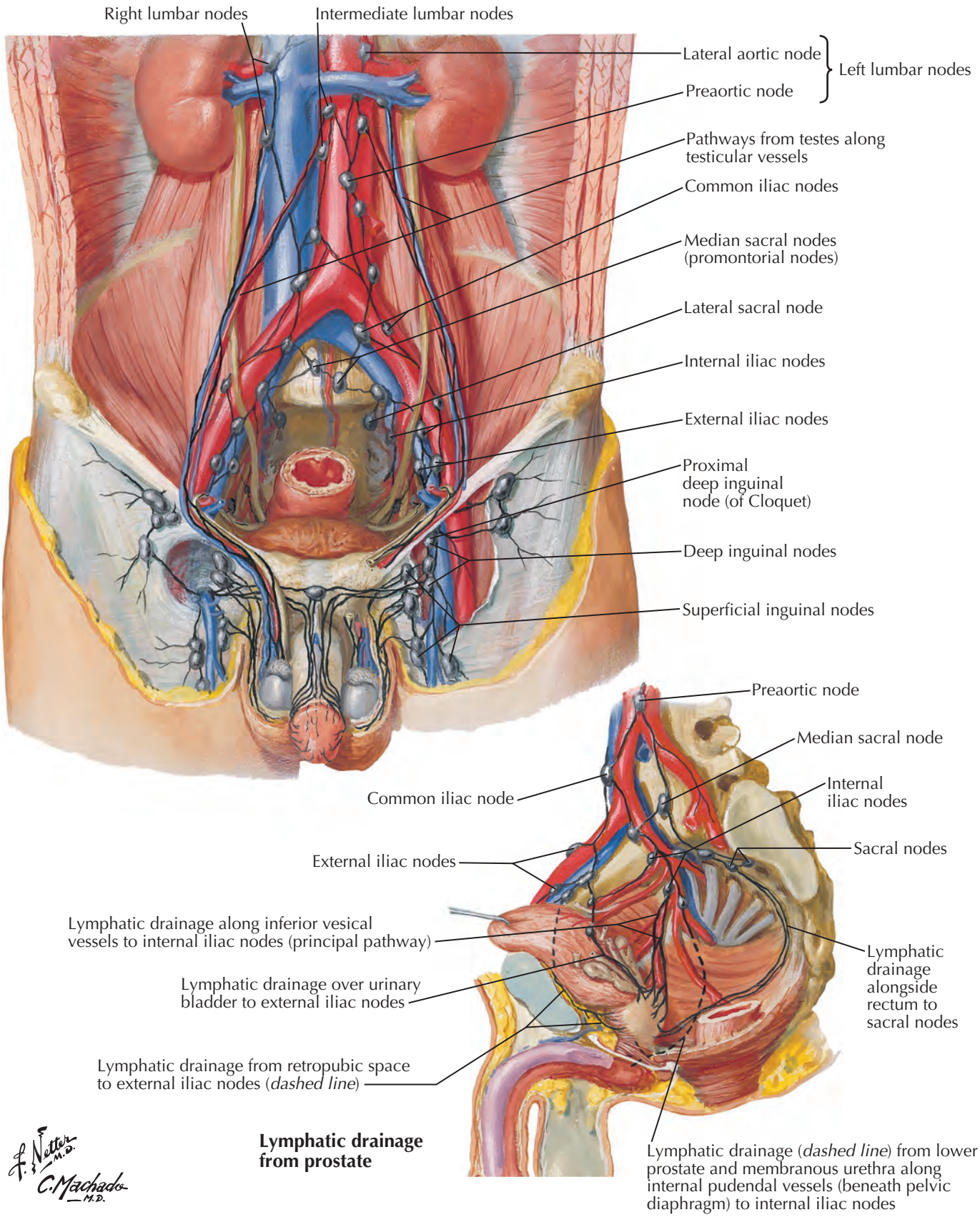
C. Machado M.D.



Note: Perineal fascia (Gallaudet's) removed from muscles of superficial perineal space


Intermediate lumbar nodes
Right lumbar nodes
Lateral caval nodes
Pre-caval node
Lateral aortic nodes
Left lumbar nodes
Preaortic nodes
Median sacral nodes (promontorial nodes)
Common iliac nodes
Lateral sacral node
Internal iliac node
Lateral external iliac node
Medial external iliac nodes
Obturator node
Superficial inguinal nodes
Proximal deep inguinal node (of Cloquet)
Deep inguinal nodes


Inguinal ligament (Poupart's)
Proximal deep inguinal node (of Cloquet)
Superficial inguinal nodes
Inferior superficial inguinal nodes
Superolateral superficial inguinal nodes
Superomedial superficial inguinal nodes
Fascia lata (*cut away*)
Femoral a. and v.
Femoral n.
Deep inguinal nodes



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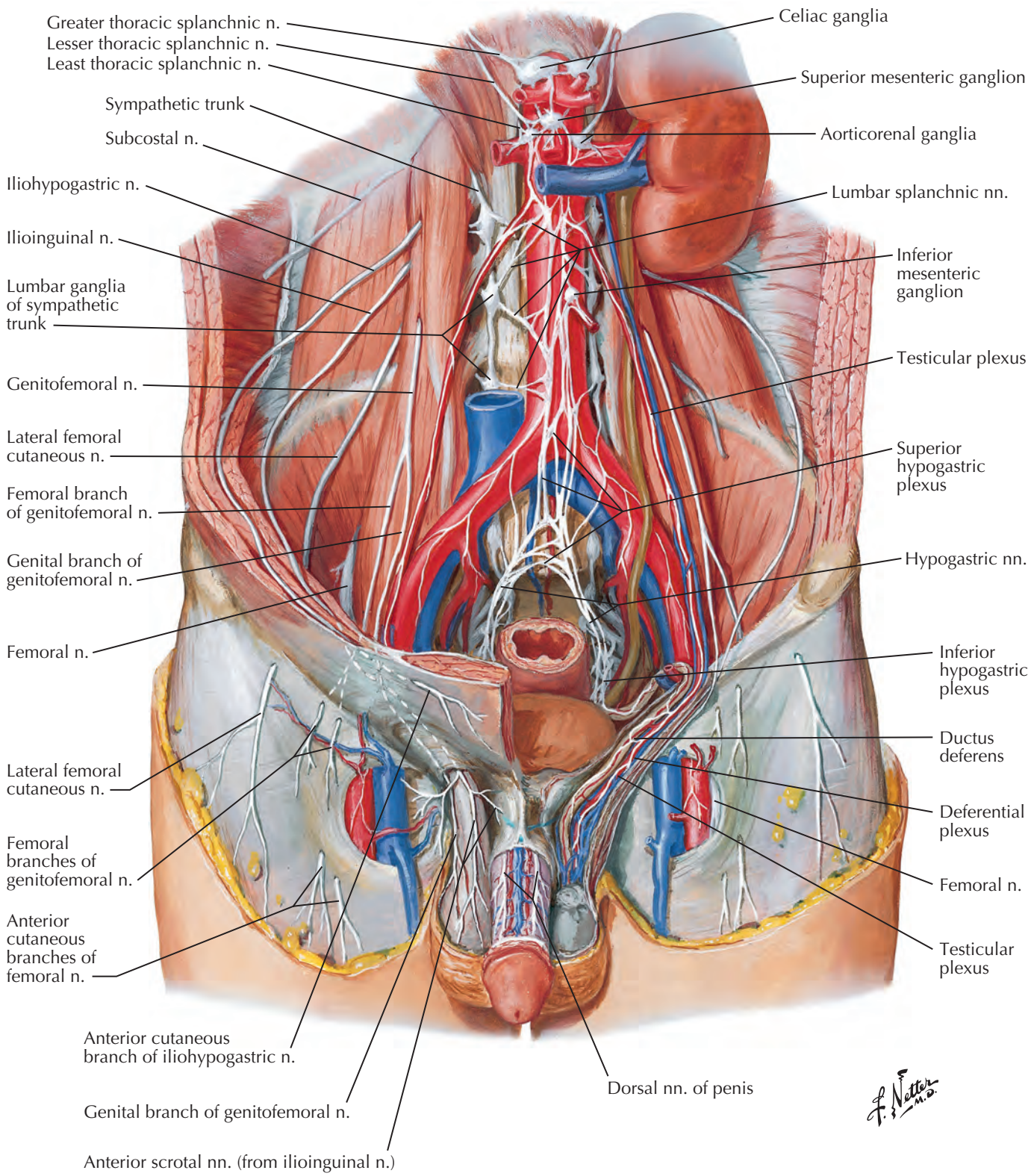
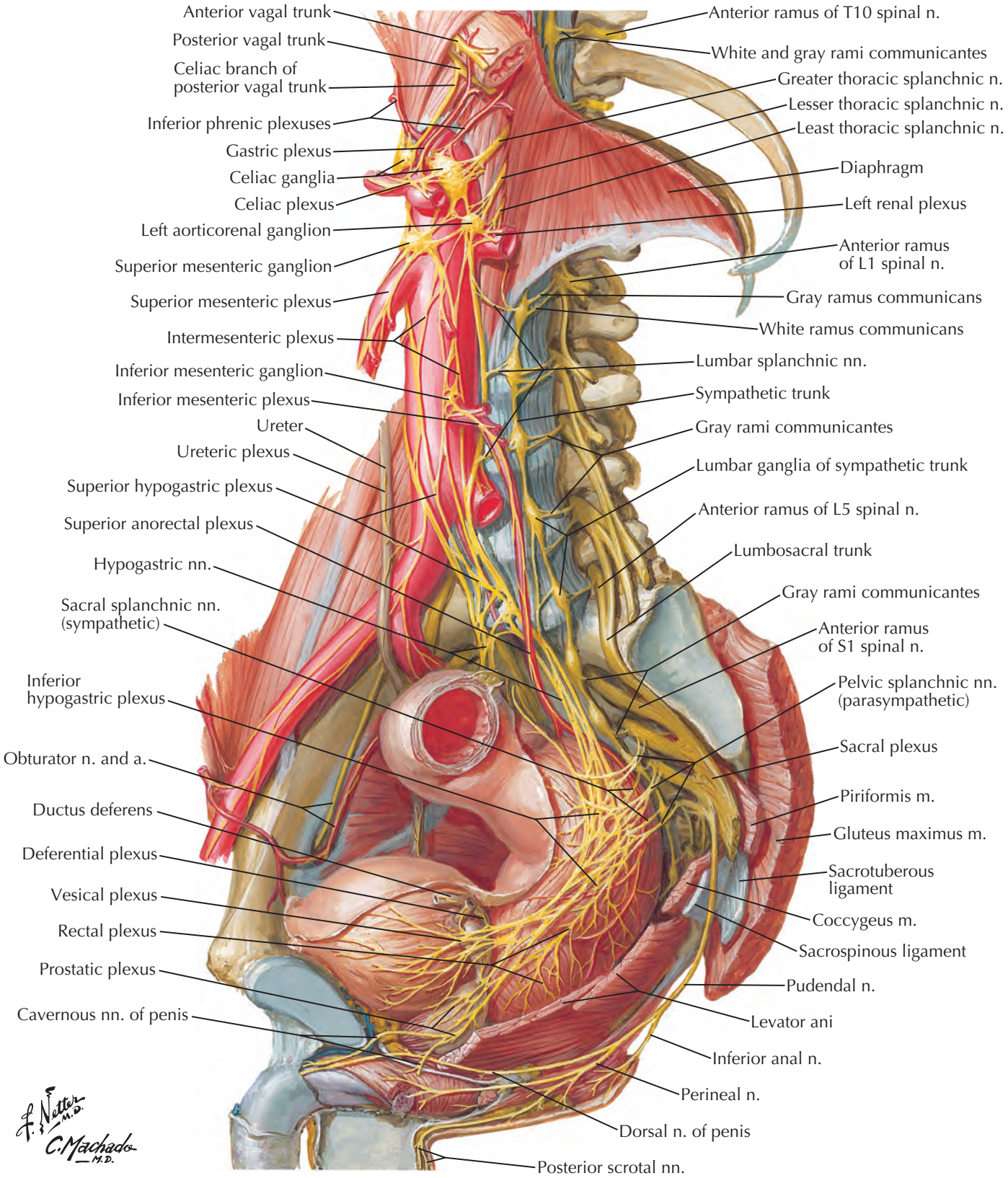
C. Machado M.D.

Lymphatic drainage from prostate

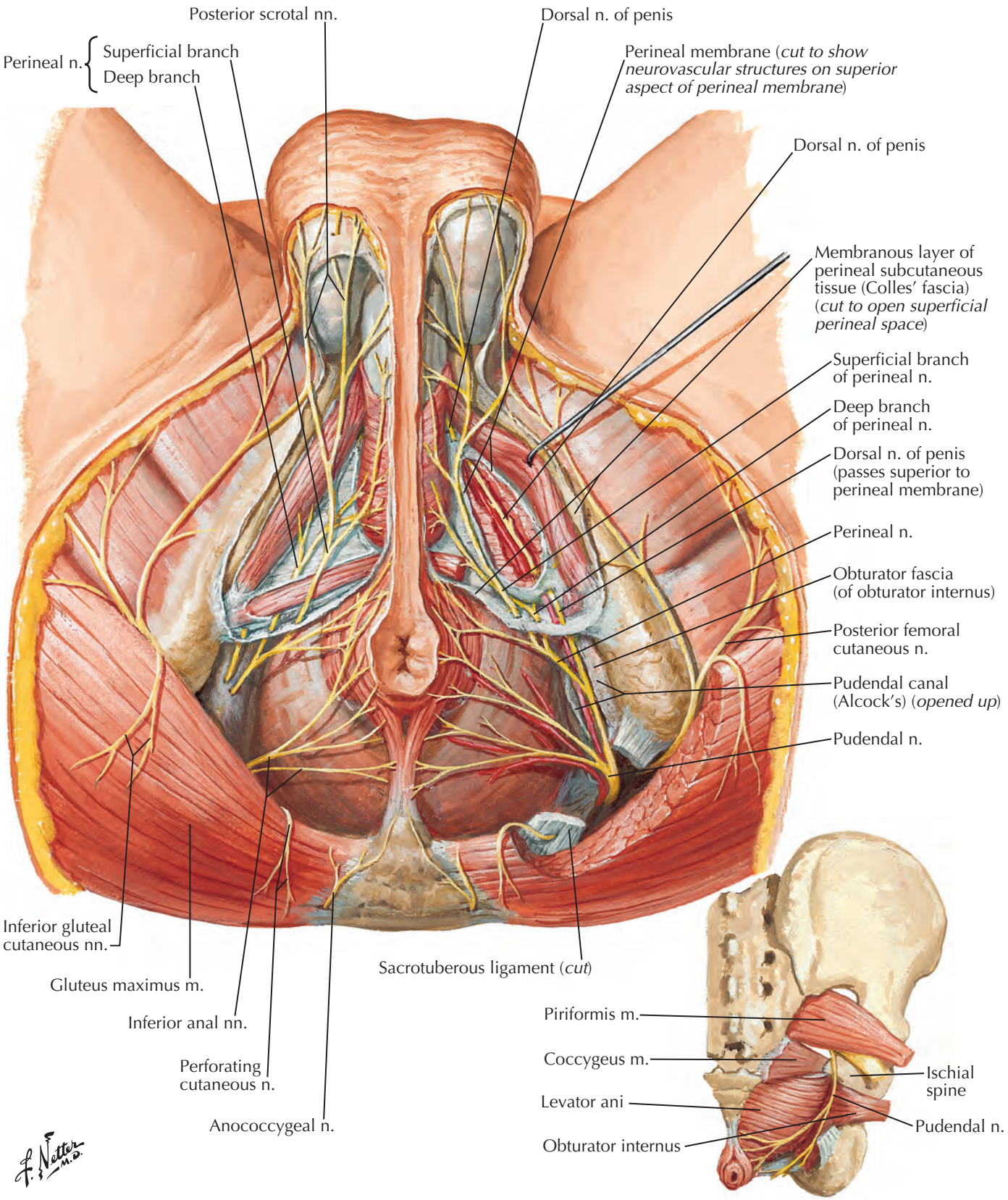
See also **Plate 319**



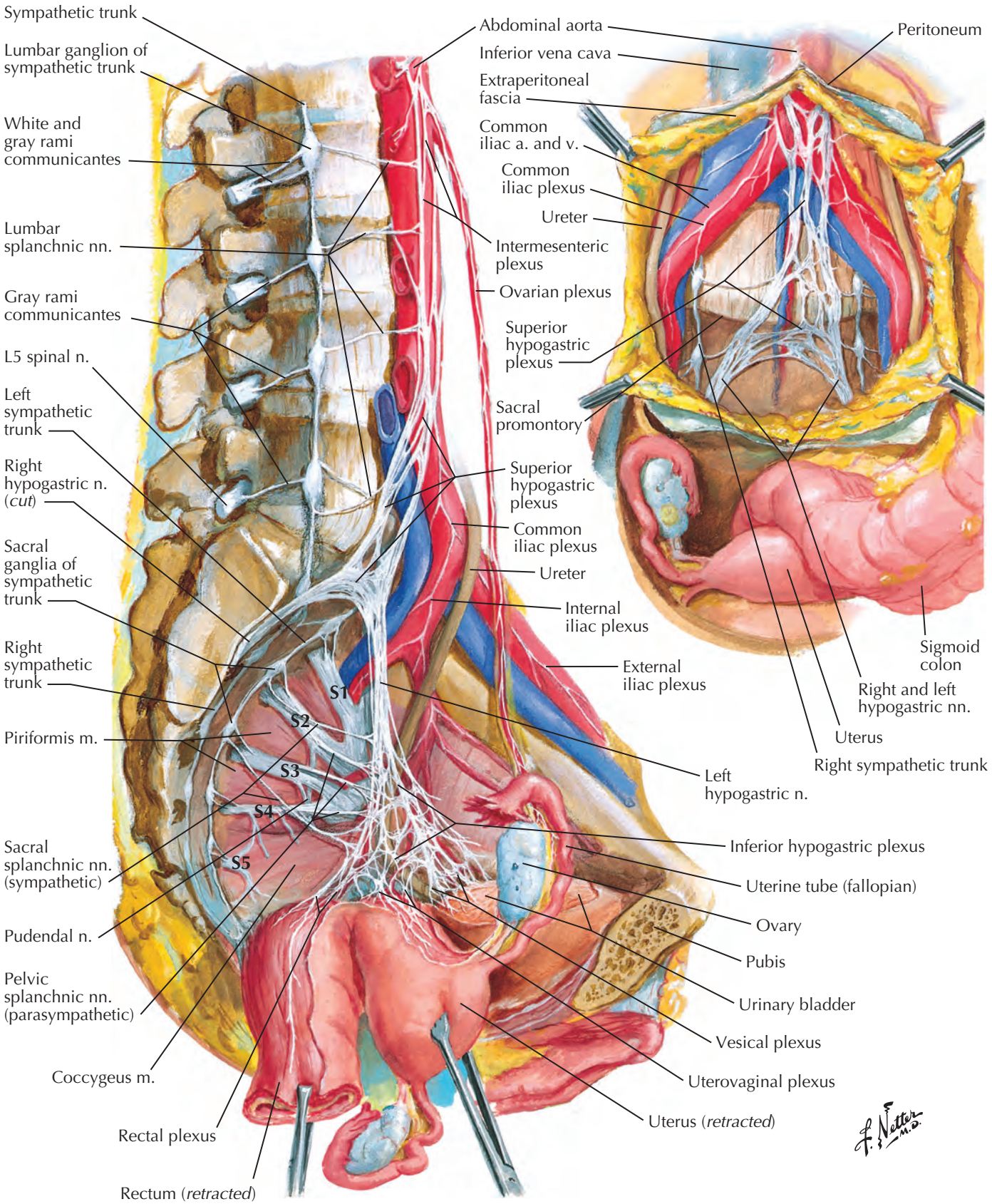
See also **Plates 319, 399**



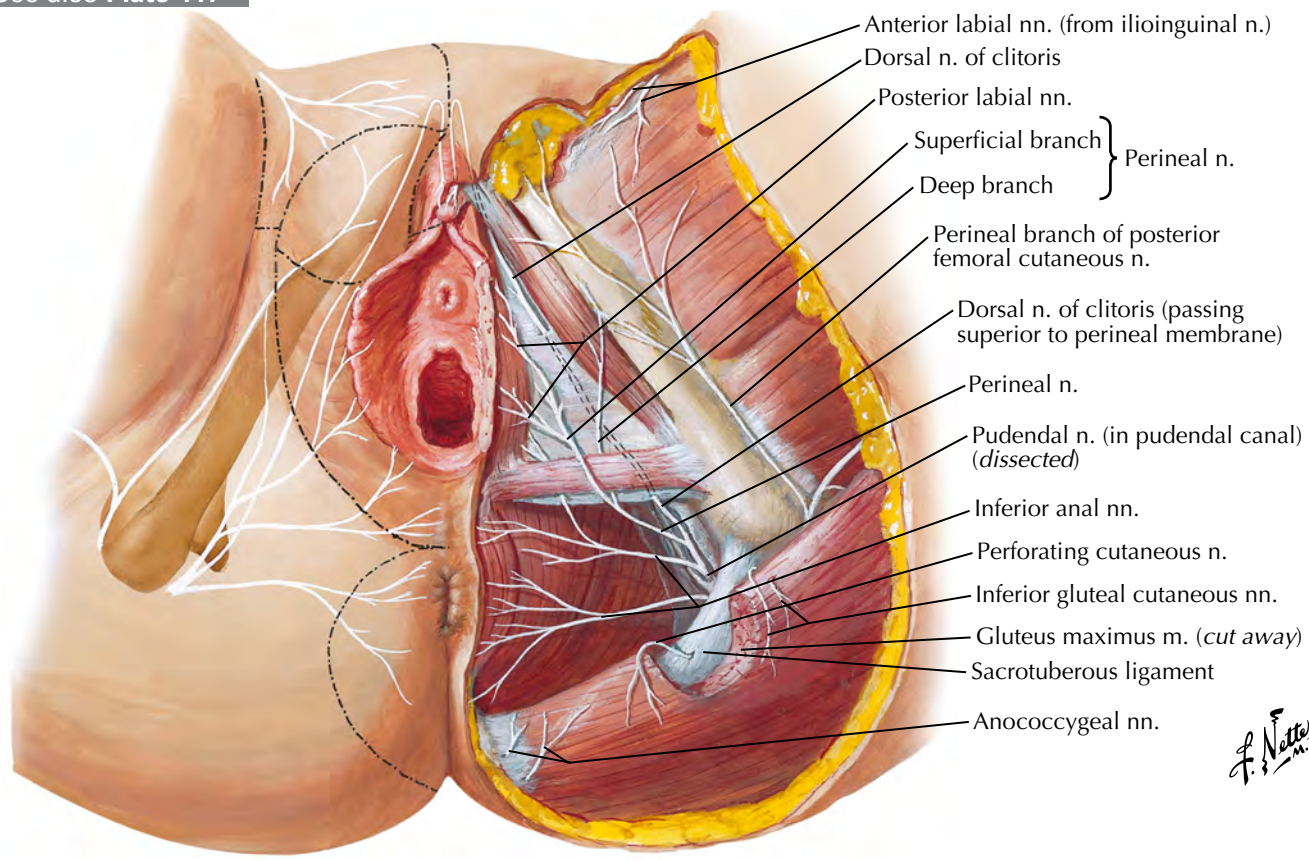
See also **Plate 418**

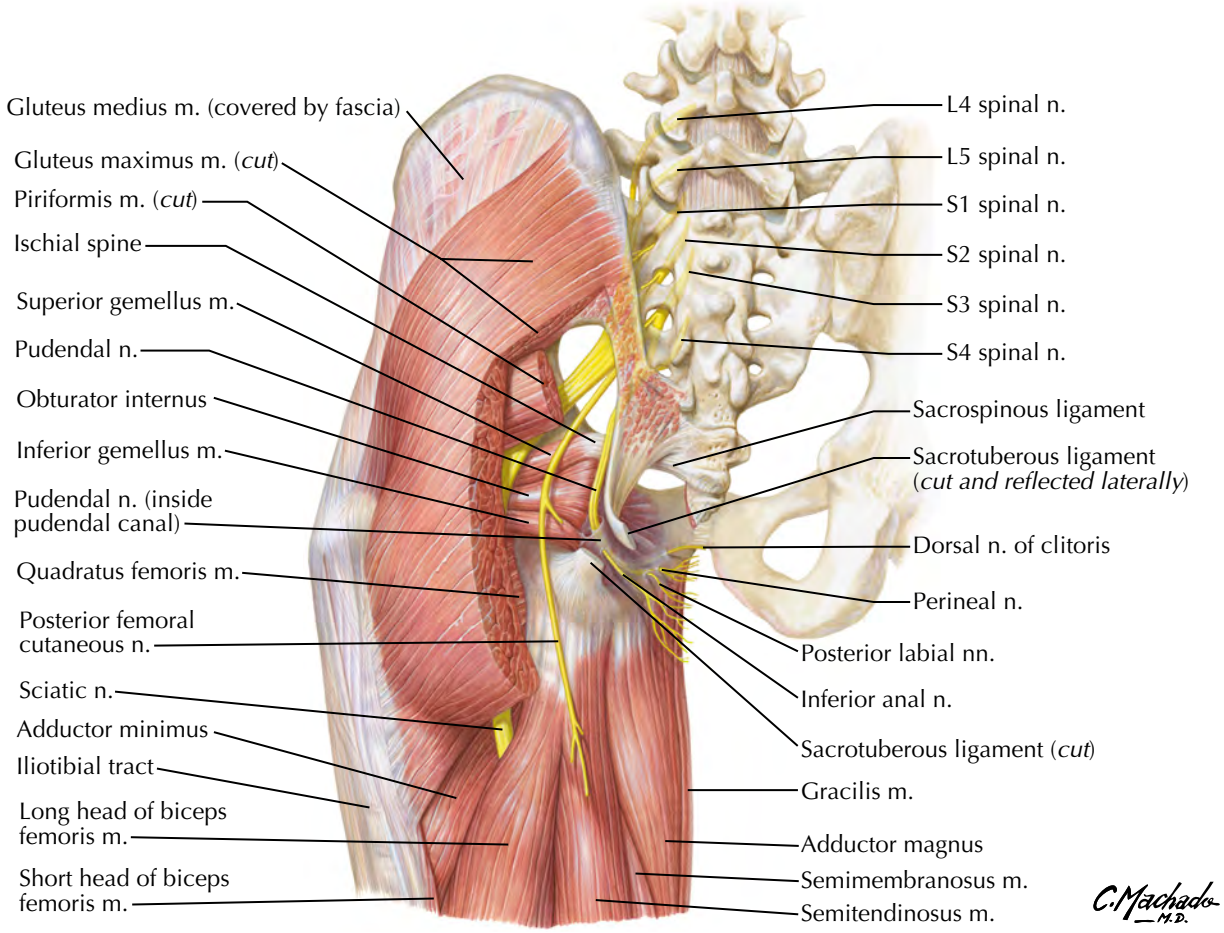


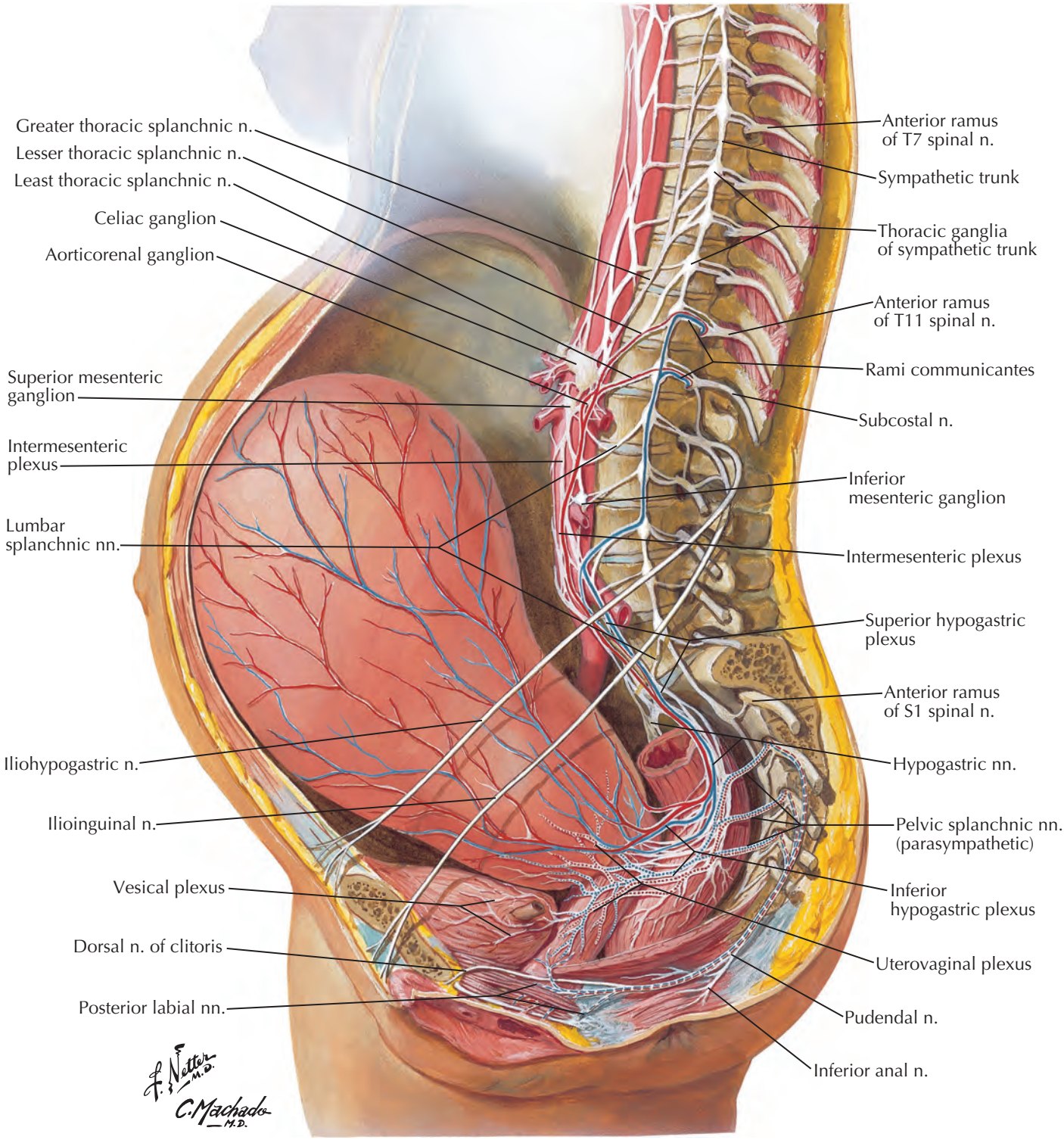
See also **Plate 319**



See also **Plate 417**







Sensory fibers from body and fundus of uterus accompany sympathetic fibers to lower thoracic part of spinal cord via hypogastric plexuses

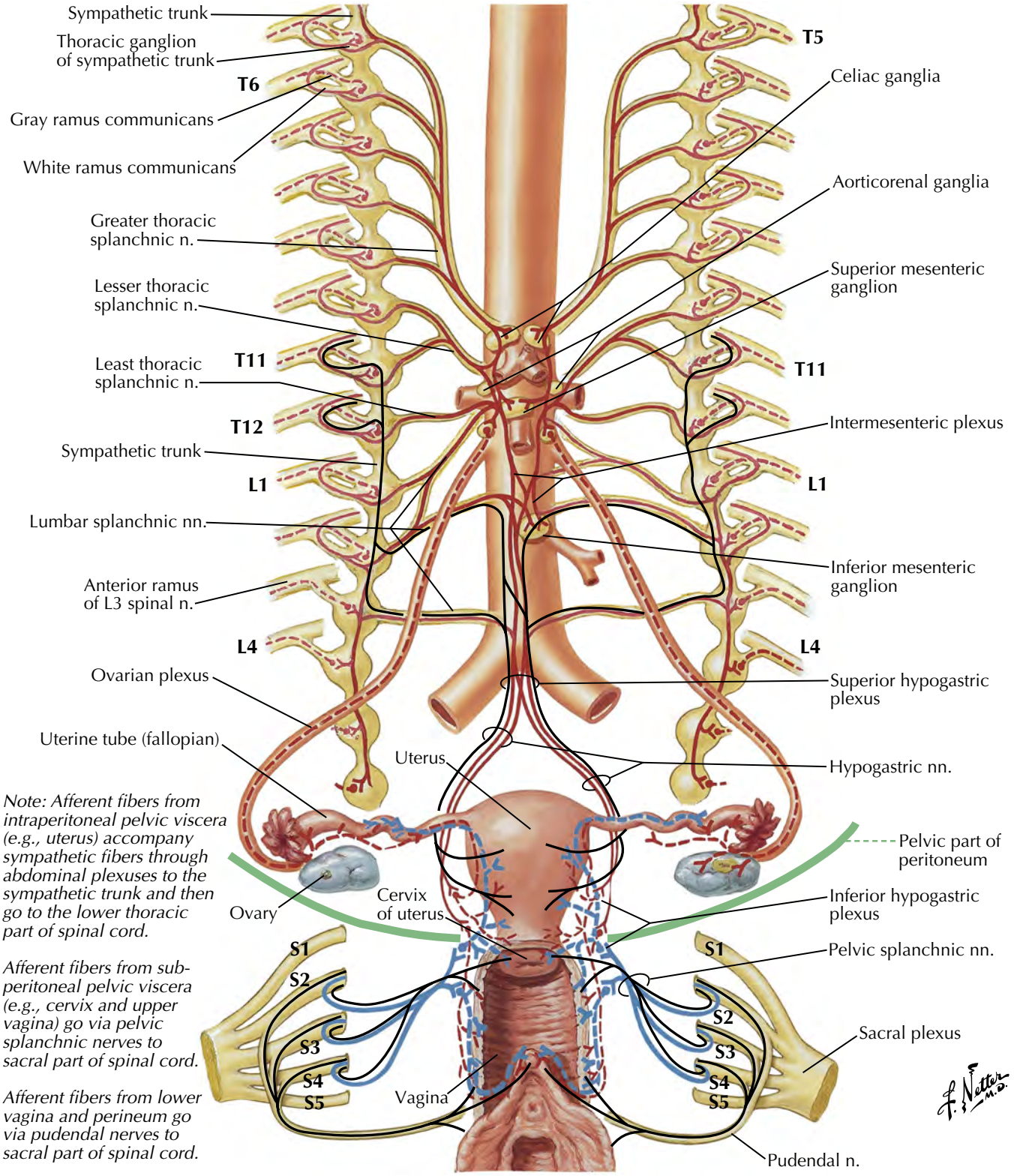
Sympathetic fibers to body and fundus of uterus

Sensory fibers from cervix and upper vagina accompany parasympathetic fibers to sacral part of spinal cord via pelvic splanchnic nerves

Parasympathetic fibers to lower uterine segment, cervix, and upper vagina

Sensory fibers from lower vagina and perineum accompany somatic motor fibers to sacral part of spinal cord via pudendal nerve

Somatic motor fibers to lower vagina and perineum via pudendal nerve



Note: Afferent fibers from intraperitoneal pelvic viscera (e.g., uterus) accompany sympathetic fibers through abdominal plexuses to the sympathetic trunk and then go to the lower thoracic part of spinal cord.

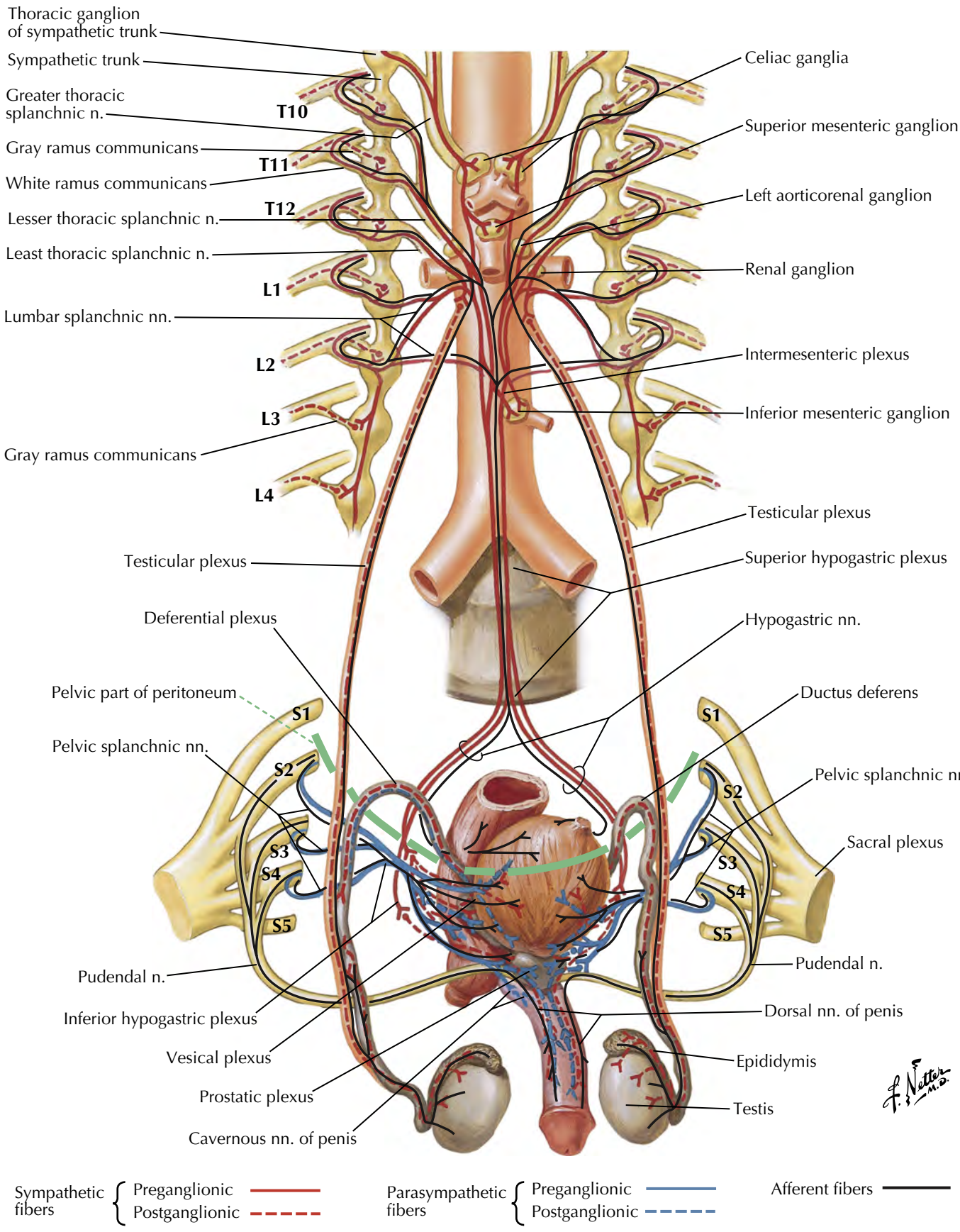
Afferent fibers from subperitoneal pelvic viscera (e.g., cervix and upper vagina) go via pelvic splanchnic nerves to sacral part of spinal cord.

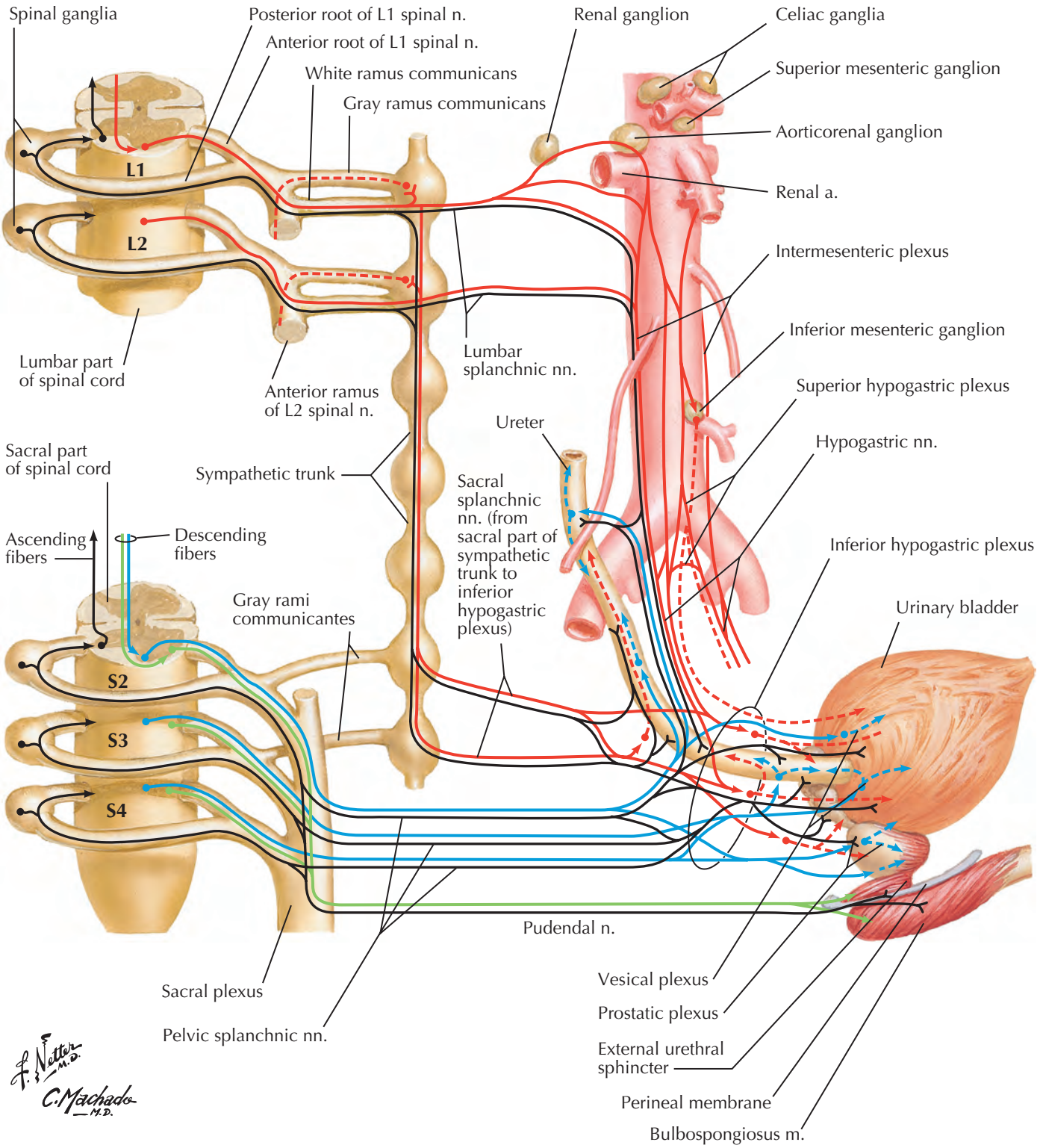
Afferent fibers from lower vagina and perineum go via pudendal nerves to sacral part of spinal cord.

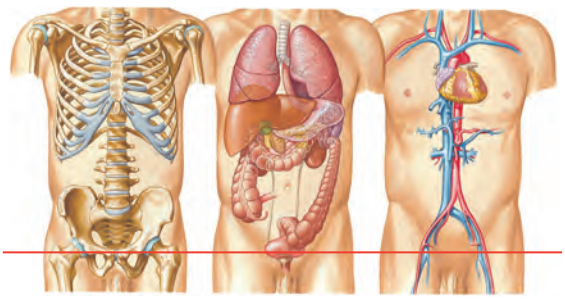
Sympathetic fibers { **Preganglionic** —— **Postganglionic** - - - -

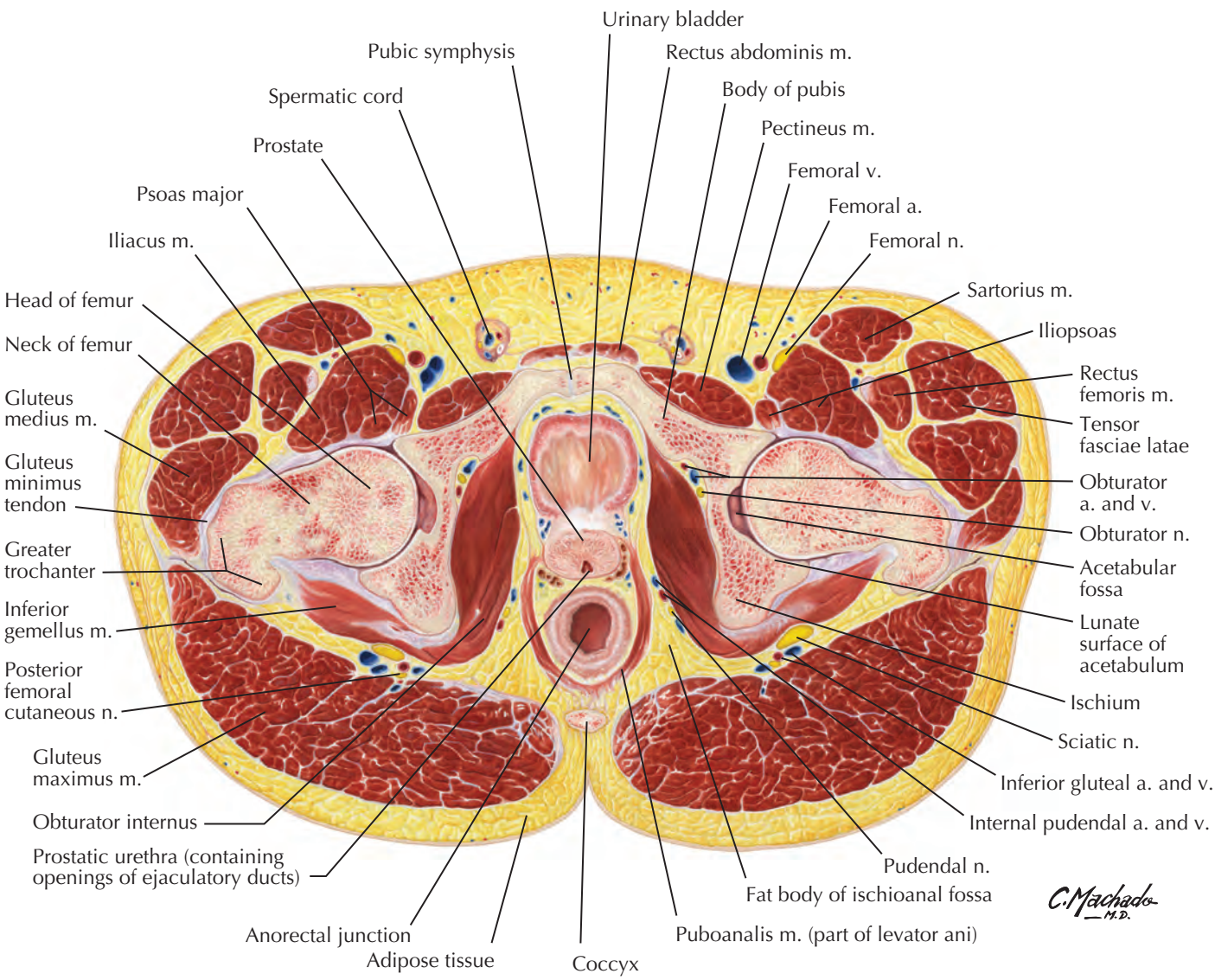
Parasympathetic fibers { **Preganglionic** —— **Postganglionic** - - - -

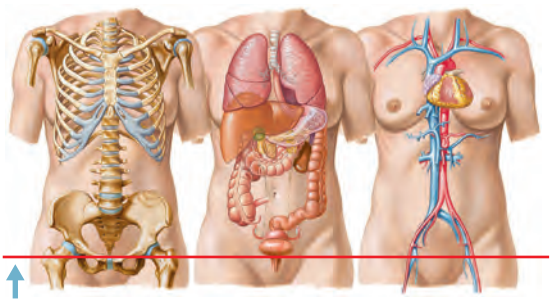
Afferent fibers ——

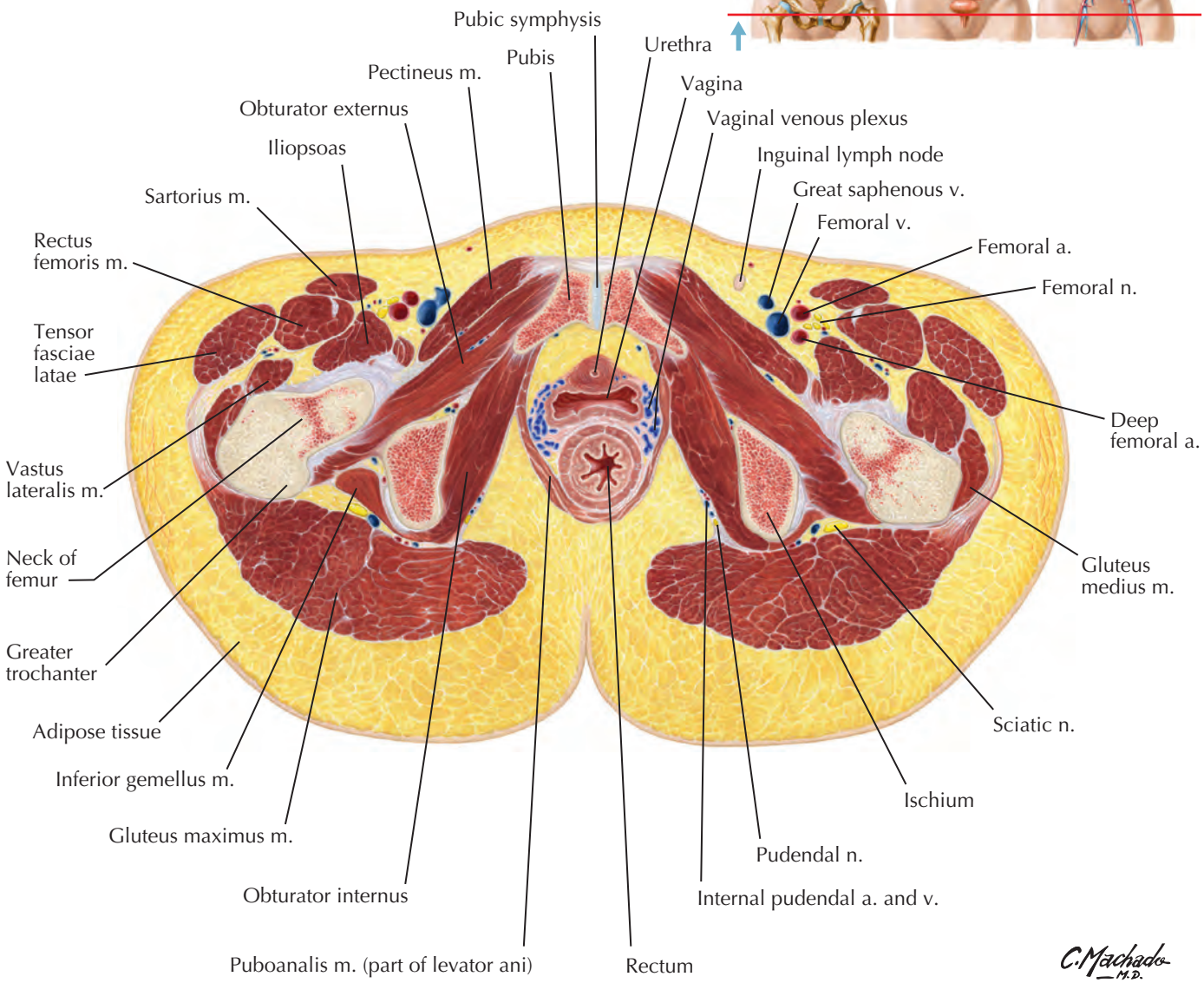

Thoracic ganglion of sympathetic trunk
Sympathetic trunk
Greater thoracic splanchnic n.
Gray ramus communicans
White ramus communicans
Lesser thoracic splanchnic n.
Least thoracic splanchnic n.
Lumbar splanchnic nn.
Gray ramus communicans
Testicular plexus
Deferential plexus
Pelvic part of peritoneum
Pelvic splanchnic nn.
Pudendal n.
Inferior hypogastric plexus
Vesical plexus
Prostatic plexus
Cavernous nn. of penis
T10
T11
T12
L1
L2
L3
L4
S1
S2
S3
S4
S5
Celiac ganglia
Superior mesenteric ganglion
Left aorticorenal ganglion
Renal ganglion
Intermesenteric plexus
Inferior mesenteric ganglion
Testicular plexus
Superior hypogastric plexus
Hypogastric nn.
Ductus deferens
Pelvic splanchnic nn.
Sacral plexus
Pudendal n.
Dorsal nn. of penis
Epididymis
Testis
F. Netter M.D.
Sympathetic fibers
Preganglionic
Postganglionic
Parasympathetic fibers
Preganglionic
Postganglionic
Afferent fibers


Spinal ganglia
Posterior root of L1 spinal n.
Anterior root of L1 spinal n.
White ramus communicans
Gray ramus communicans
Renal ganglion
Celiac ganglia
Superior mesenteric ganglion
Aorticorenal ganglion
Renal a.
L1
L2
Intermesenteric plexus
Inferior mesenteric ganglion
Lumbar part of spinal cord
Anterior ramus of L2 spinal n.
Lumbar splanchnic nn.
Superior hypogastric plexus
Ureter
Hypogastric nn.
Sacral part of spinal cord
Sympathetic trunk
Sacral splanchnic nn. (from sacral part of sympathetic trunk to inferior hypogastric plexus)
Ascending fibers
Descending fibers
Inferior hypogastric plexus
Gray rami communicantes
Urinary bladder
S2
S3
S4
Pudendal n.
Sacral plexus
Vesical plexus
Prostatic plexus
Pelvic splanchnic nn.
External urethral sphincter
Perineal membrane
Bulbospongiosus m.
F. Netter M.D.
C. Machado M.D.
Sympathetic fibers
Preganglionic
Postganglionic
Parasympathetic fibers
Preganglionic
Postganglionic
Somatic efferent fibers
Afferent fibers




Urinary bladder
Pubic symphysis
Rectus abdominis m.
Spermatic cord
Body of pubis
Pectineus m.
Prostate
Femoral v.
Psoas major
Femoral a.
Iliacus m.
Femoral n.
Head of femur
Sartorius m.
Neck of femur
Iliopsoas
Gluteus medius m.
Rectus femoris m.
Tensor fasciae latae
Gluteus minimus tendon
Obturator a. and v.
Obturator n.
Greater trochanter
Acetabular fossa
Inferior gemellus m.
Lunate surface of acetabulum
Posterior femoral cutaneous n.
Ischium
Sciatic n.
Gluteus maximus m.
Inferior gluteal a. and v.
Internal pudendal a. and v.
Obturator internus
Prostatic urethra (containing openings of ejaculatory ducts)
Pudendal n.
Fat body of ischioanal fossa
Anorectal junction
Puboanalis m. (part of levator ani)
Adipose tissue
Coccyx
C. Machado M.D.




Pubic symphysis
Urethra
Pubis
Vagina
Pectineus m.
Vaginal venous plexus
Obturator externus
Inguinal lymph node
Iliopsoas
Great saphenous v.
Sartorius m.
Femoral v.
Femoral a.
Rectus femoris m.
Femoral n.
Tensor fasciae latae
Deep femoral a.
Vastus lateralis m.
Gluteus medius m.
Neck of femur
Greater trochanter
Sciatic n.
Adipose tissue
Ischium
Inferior gemellus m.
Gluteus maximus m.
Pudendal n.
Obturator internus
Internal pudendal a. and v.
Puboanalis m. (part of levator ani)
Rectum
C. Machado M.D.

ANATOMICAL STRUCTURE	CLINICAL COMMENT	PLATE NUMBERS
Nervous System and Sense Organs		
Pudendal nerve	Pudendal block is performed to anesthetize the perineum for childbirth or minor surgical procedures in the perineum	415
Inferior anal (rectal) nerve	Anesthetized in ischioanal fossa for surgical excision of external hemorrhoids	413
Prostatic plexus and cavernous nerves	Disruption of these nerves during procedures (e.g., prostate surgery) can produce inability to achieve erection	412
Skeletal System		
Pubic symphysis	Palpable landmark used to obtain pelvic measurements (e.g., diagonal conjugate) that may be used to assess adequacy of pelvis for childbirth; during prenatal examinations, used for estimating fetal growth (symphysis–fundal height measurement); injury may result in widening on x-ray	355
Ischial spine	Palpable landmark used to estimate interspinous diameter for childbirth and to locate pudendal nerve for pudendal nerve block	355
Ischial tuberosity	Palpable landmark used to estimate width of pelvic outlet for childbirth; proximal attachment site of hamstring muscles	355
Superior pubic ramus	Often fractured by lateral compression injury of pelvis in anteroposterior plane by crush injury or falls in elderly with osteoporosis	353
Sacroiliac joint	Stiffening, sclerosis, and fusion occur in autoimmune disease known as ankylosing spondylitis; difficult diagnosis to make and known to refer pain to adjacent joints	355
Muscular System		
Pelvic diaphragm (levator ani and coccygeus muscle)	Provides support to urethrovesical angle, helping to maintain urinary continence; weakness or injury during childbirth can lead to stress urinary incontinence in women	359, 370
Pelvic extraperitoneal (endopelvic) fascia	Weakness or tearing of endopelvic fascial ligaments (e.g., pubovesical or cardinal ligaments) may result in prolapse of pelvic organs	366, 373
Perineal body	Tearing of perineal body may occur during childbirth; prophylactic incision into or lateral to perineal body, known as episiotomy, may be performed to facilitate vaginal delivery in some circumstances	379
Cardiovascular System		
Pampiniform plexus	Dilation of these veins can cause testicular varicocele, affecting testicular temperature regulation and potentially contributing to infertility; most commonly occurs on left side due to longer course of left gonadal vein and angle of drainage into renal vein	403
Uterine artery	Ligated or cauterized during hysterectomy; selective embolization of branches may be performed to treat uterine fibroids	402, 406
Deep and dorsal arteries of penis, and cavernous tissue	Blockage or loss of vascular smooth muscle function can lead to erectile dysfunction, treated with vasodilators	407
Internal iliac veins	Provide communication between prostatic venous plexus and veins draining vertebral column, which is route of spread for prostate cancer	405
Anorectal (rectal) veins	Portal hypertension may cause dilated anorectal veins if portosystemic anastomoses develop between superior anorectal veins (portal drainage) and middle and/or inferior anorectal veins (systemic drainage)	318, 401
Internal and external anorectal (rectal) venous plexuses	Enlargement may result in painful condition known as hemorrhoids	395, 401

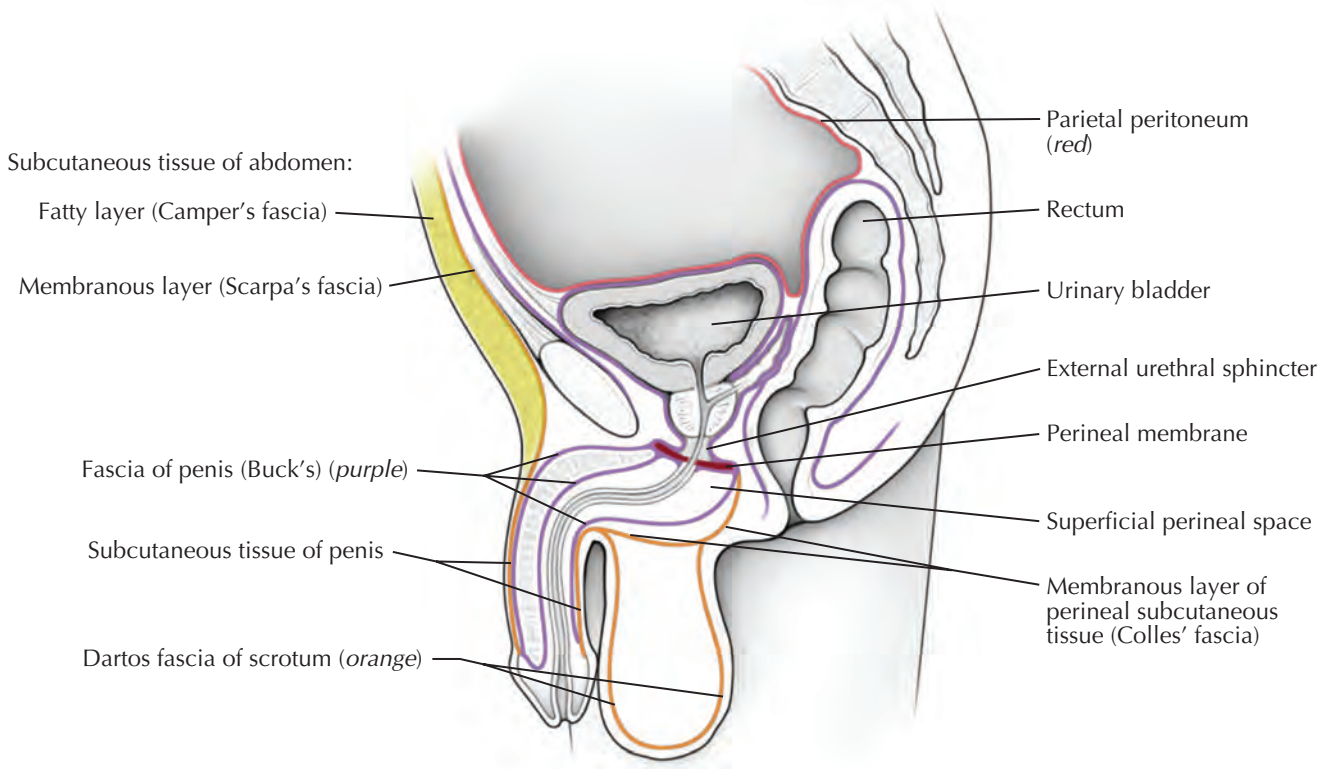
ANATOMICAL STRUCTURE	CLINICAL COMMENT	PLATE NUMBERS
Lymph Vessels and Lymphoid Organs		
Pelvic and lumbar nodes	Spread of ovarian cancer cells via venous drainage to inferior vena cava and lungs or via lymphatics	408
Lumbar and tracheobronchial nodes	Prostate cancer cells may spread via lymphatics to retroperitoneum and mediastinum	260, 410
Lumbar (e.g., lateral aortic, preaortic, lateral caval) nodes	Receive lymphatic drainage from ovary, uterine tube, and fundus of uterus in women and from testis in men; cancers in these organs may therefore spread to retroperitoneum	408, 410
Pelvic nodes	Sampling or dissection is performed to assess spread of gynecological malignancies	408
Digestive System		
Rectum and anal canal	Examined by digital rectal examination to detect internal hemorrhoids, fecal impaction, and rectal cancer	301, 393, 395
Peritoneum	Common site for metastatic spread of ovarian cancer via fluid in peritoneal cavity	363, 364
Urinary System		
Urinary bladder	Degree of filling is readily assessed with ultrasound; in patients with poor urine output, this can establish diagnosis of bladder outlet obstruction	368, 369
Ureteric orifice	Abnormal reflux of urine from urinary bladder to ureters (vesicoureteral reflux) may occur in children, contributing to recurrent urinary infections and progressive renal fibrosis	371
Ureter	Enlargement indicates obstruction of ureter or urinary bladder; impaction of renal stone in ureter causes severe pain and, in some cases, hematuria; ureter may be injured during hysterectomy because of its close relationship to uterine artery	335, 336, 402
Reproductive System		
Rectouterine pouch (of Douglas)	Region examined with ultrasound to detect presence of abdominopelvic fluid; common site of ectopic pregnancy; may be accessed via posterior vaginal fornix; normally contains small, physiologic amount of peritoneal fluid	364, 365
Uterus	Site of fetal gestation; palpated during prenatal examinations to assess fetal growth; can also contain large, sometimes painful growths known as leiomyomas (fibroids)	364, 374
Uterine tubes (fallopian)	Common site of ectopic pregnancy; inflammation (salpingitis) may occur in pelvic inflammatory disease (PID), the result of sexually transmitted infection, possibly leading to fibrosis and infertility; surgical occlusion (tubal ligation) is performed when women desire permanent contraception	363, 364, 375
Cervix of uterus	Epithelium of transformation zone of cervix is prone to dysplasia and malignancy; cells are sampled from this region during Pap smear examination and tested for infection with human papillomavirus, the leading risk factor for cervical malignancy	372, 374
Vagina	Posterior part of vaginal fornix allows access to rectouterine pouch (of Douglas)	364
Ovary	Examined with ultrasound to identify cysts, or for oocyte collection; torsion is painful condition that occurs when ovary twists on axis of suspensory ligament of ovary, occluding ovarian vessels and causing engorgement and ischemia	363, 374, 375
Testis	Torsion is painful condition that occurs when testis twists on axis of testicular vasculature, causing engorgement and ischemia	388

ANATOMICAL STRUCTURE	CLINICAL COMMENT	PLATE NUMBERS
Prostate	Prone to benign hypertrophy with aging, which results in urinary outflow obstruction; prostate cancer is second most common cancer in men	368, 385
Ductus deferens	Ligation (vasectomy) performed when men desire permanent contraception	368, 388

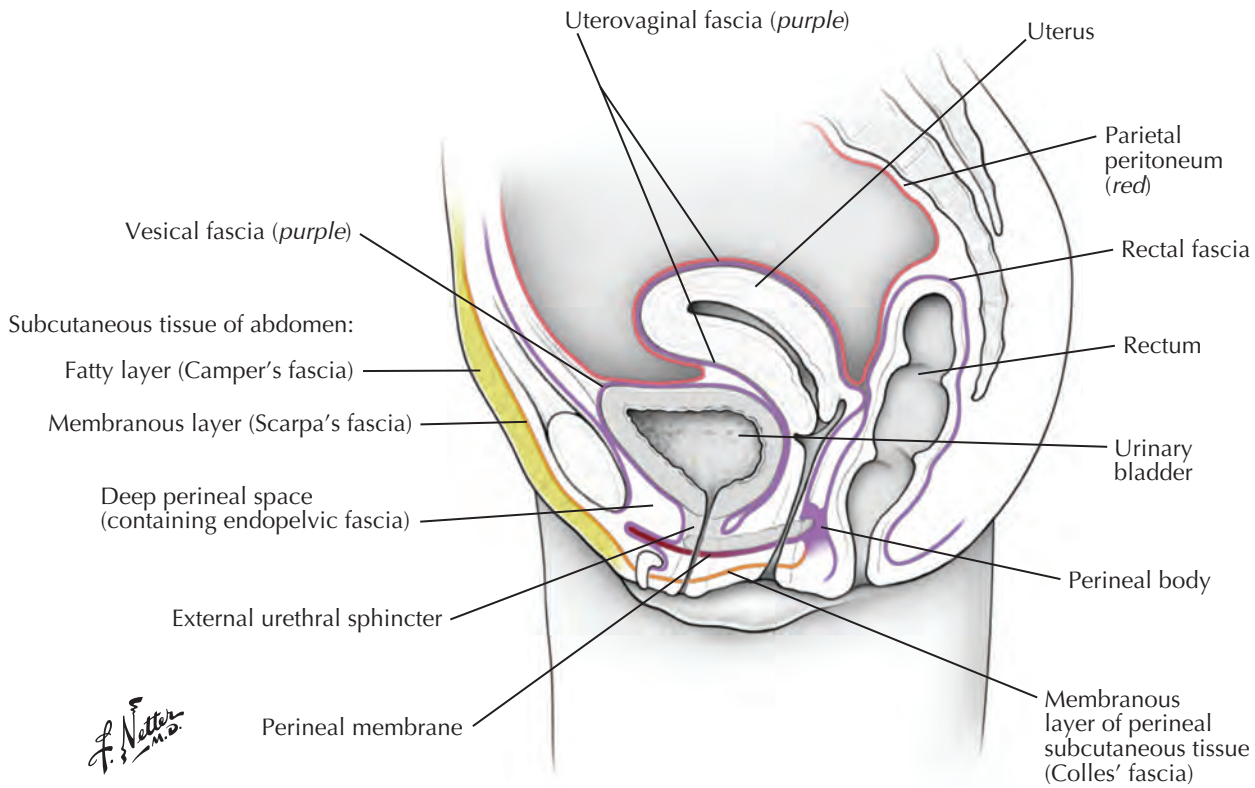
*Selections were based largely on clinical data and commonly discussed clinical correlations in macroscopic ("gross") anatomy courses.

MUSCLE	MUSCLE GROUP	ORIGIN ATTACHMENT	INSERTION ATTACHMENT	INNERVATION	BLOOD SUPPLY	MAIN ACTIONS
Bulbospongiosus m.	Perineal	*Male:* perineal body	*Male:* perineal membrane, corpus cavernosum, bulb of penis	Perineal nerve	Perineal artery	*Male:* compresses bulb of penis, forces blood into body of penis during erection, propels urine and semen through urethra
		Female: perineal body	*Female:* dorsum of clitoris, perineal membrane, bulb of vestibule, pubic arch			*Female:* constricts vaginal orifice, assists in expressing secretions of greater vestibular gland, forces blood into body of clitoris
Coccygeus m.	Pelvic diaphragm	Ischial spine	Inferior sacrum, coccyx	Nerve to coccygeus muscle	Inferior gluteal artery	Supports pelvic viscera
Compressor urethrae (female only)	Perineal	Ischiopubic ramus	Merges with contralateral partner anterior to urethra	Perineal nerve	Perineal artery	Sphincter of urethra
Cremaster	Spermatic cord	Inferior edge of internal abdominal oblique muscle, middle of inguinal ligament	Pubic tubercle, crest of pubis	Genital branch of genitofemoral nerve	Cremasteric artery	Retracts testis
Deep transverse perineal m.	Perineal	Internal surface of ramus of ischium, ischial tuberosity	Perineal body	Perineal nerve	Perineal artery	Stabilizes perineal body, supports prostate/vagina
External anal sphincter	Perineal	Anococcygeal ligament	Perineal body	Perineal and inferior anal nerves	Inferior anorectal and perineal arteries	Closes anal orifice
External urethral sphincter	Perineal	Ischiopubic ramus	*Male:* median raphe in front and behind urethra	Perineal nerve	Perineal artery	Compresses urethra at end of micturition; in female also compresses distal vagina
			Female: encloses urethra, attaches to sides of vagina			
Ischiocavernosus m.	Perineal	Inferior internal surface of ramus of ischium, ischial tuberosity	*Male:* anterior end of crus of penis or clitoris	Perineal nerve	Perineal artery	Forces blood into body of penis and clitoris during erection
			Female: anterior end of crus of clitoris			
Levator ani (iliococcygeus, pubococcygeus, and puboanalis) mm.	Pelvic diaphragm	Body of pubis, tendinous arch of levator ani (on obturator fascia), ischial spine	Perineal body, coccyx, raphe of pelvic diaphragm, walls of prostate or vagina, anorectal junction	Nerve to levator ani, perineal nerve	Inferior gluteal artery, internal pudendal artery and its branches (inferior anorectal and perineal arteries)	Supports pelvic viscera, elevates pelvic floor
Sphincter urethrovaginalis (female only)	Perineal	Perineal body	Passes anteriorly around urethra and merges with its contralateral partner	Perineal nerve	Perineal artery	Sphincter of urethra and vagina
Superficial transverse perineal m.	Perineal	Ramus of ischium, ischial tuberosity	Perineal body	Perineal nerve	Perineal artery	Stabilizes perineal body

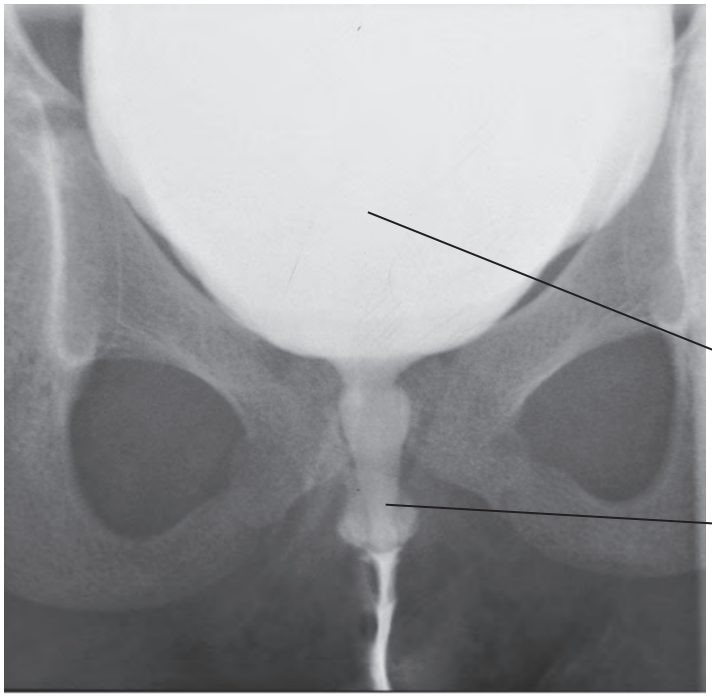
Variations in spinal nerve contributions to the innervation of muscles, their arterial supply, their attachments, and their actions are common themes in human anatomy. Therefore, expect differences between texts and realize that anatomical variation is normal.



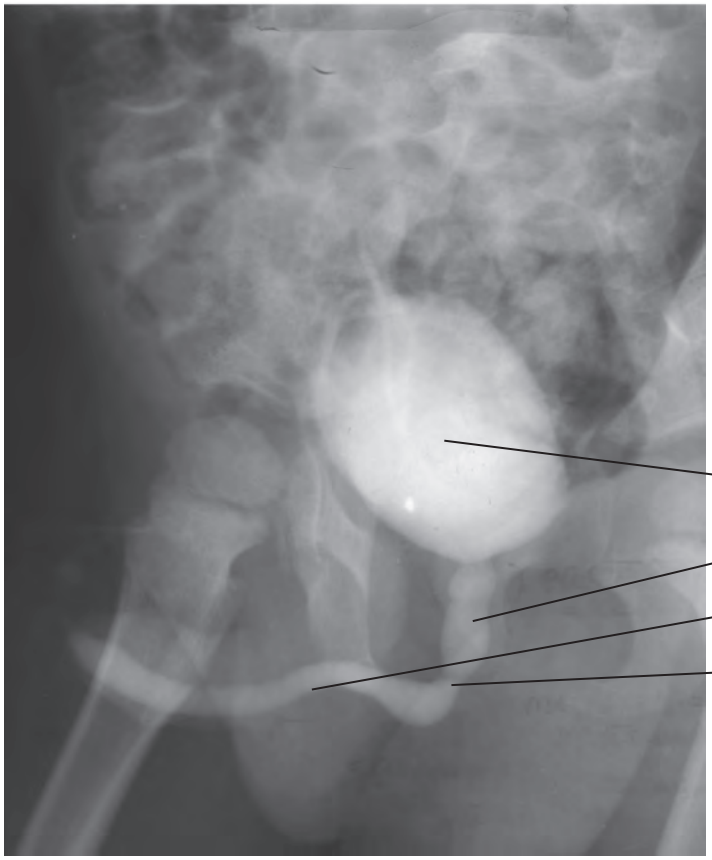
Median section of male



Median section of female

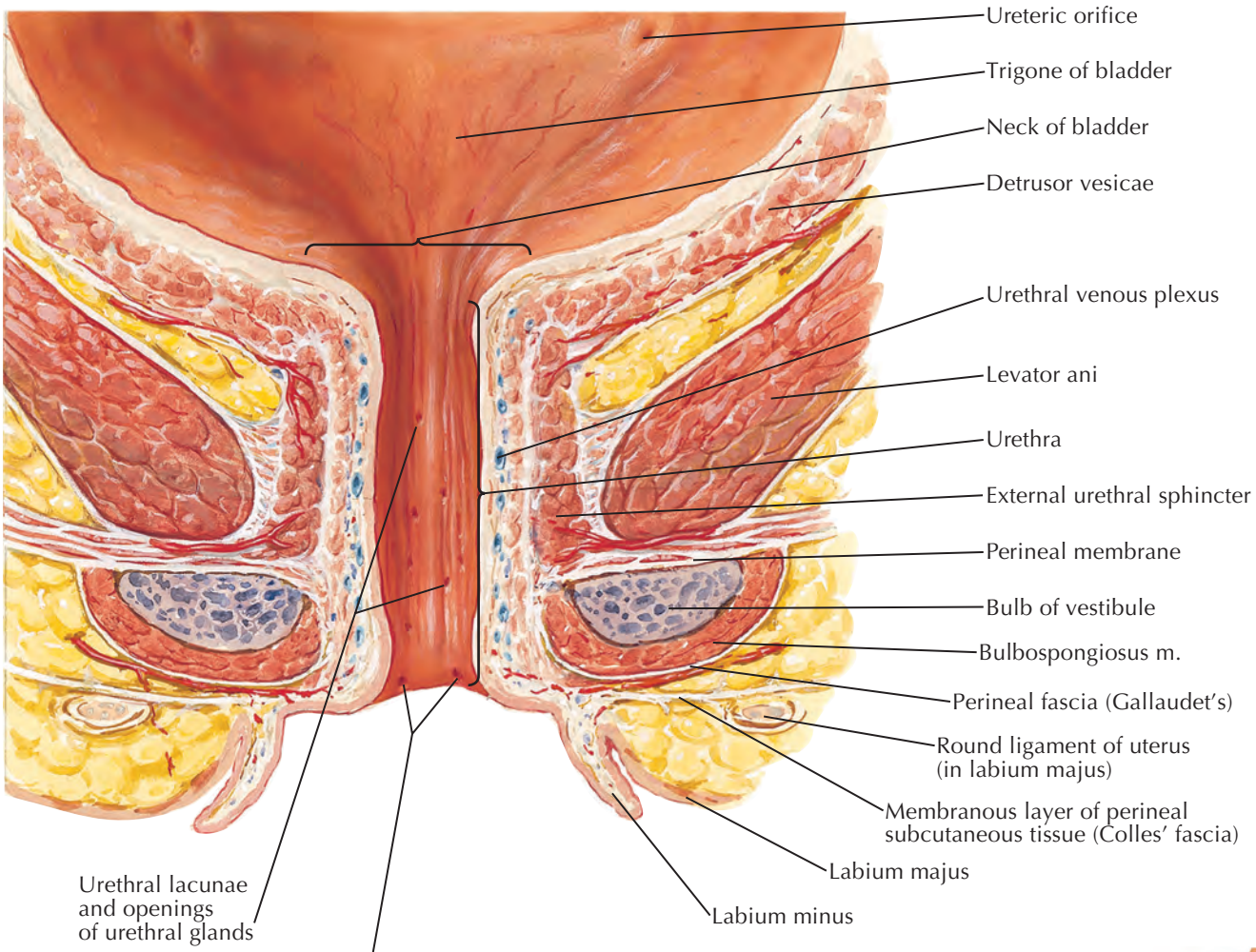


Cystourethrogram of urethra in 8-year-old girl

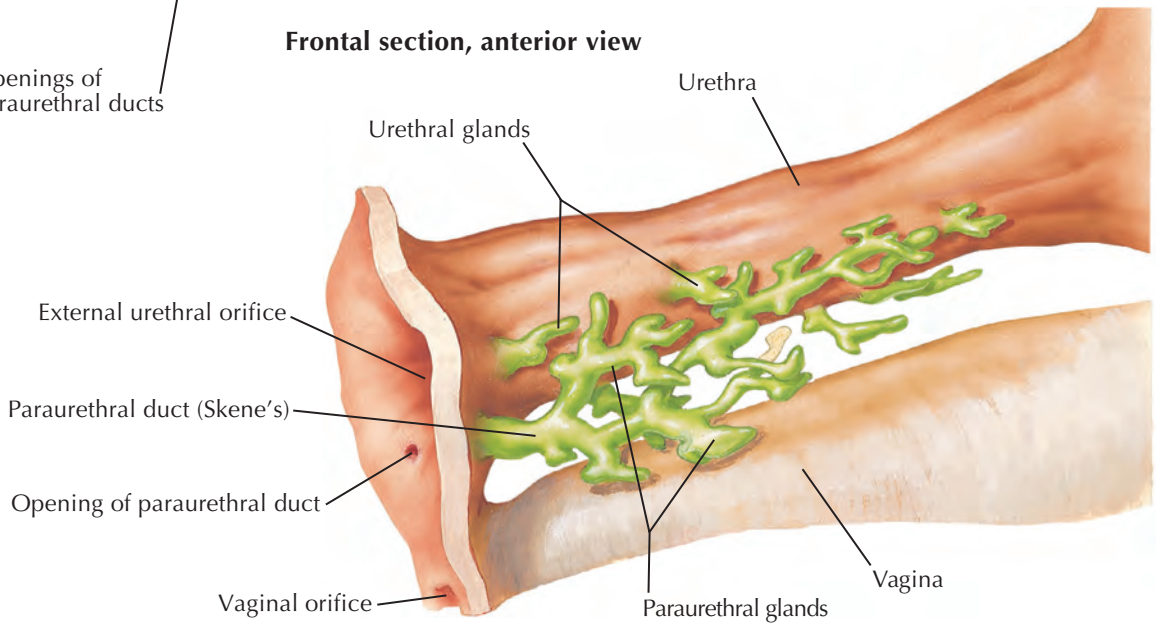


Voiding cystourethrogram in 2-year-old boy

See also **Plates 371, 379, 380**



Frontal section, anterior view



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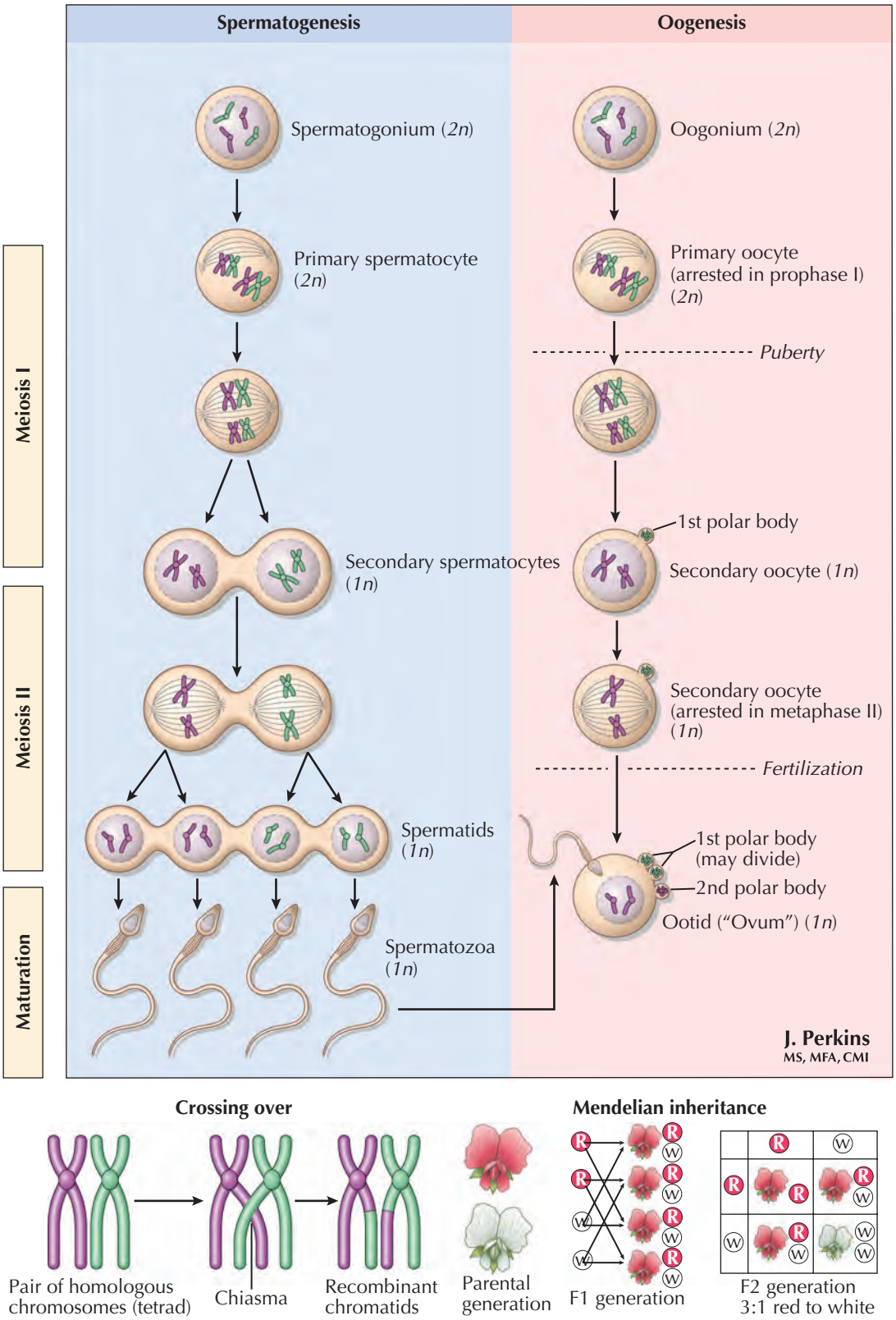
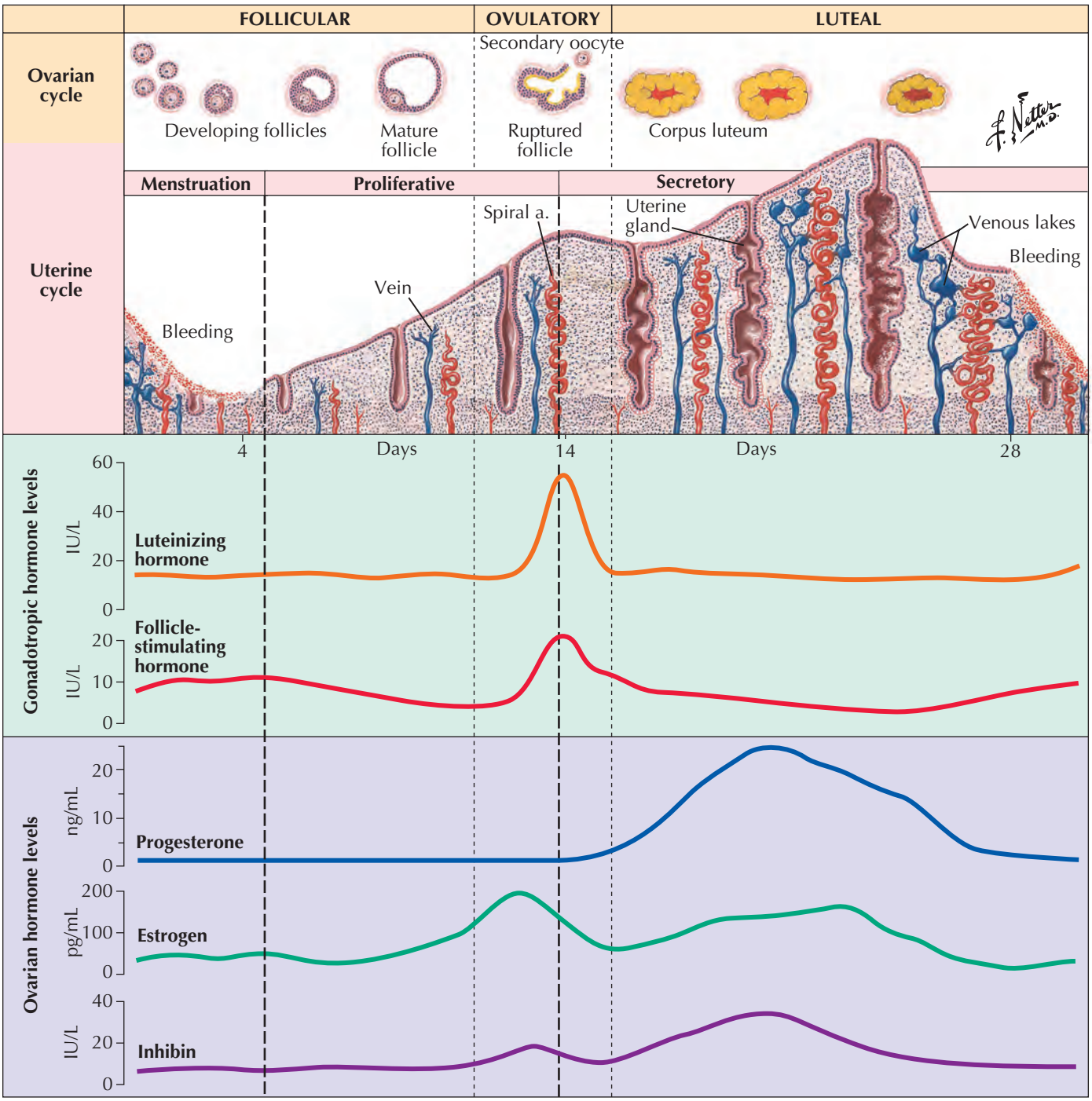
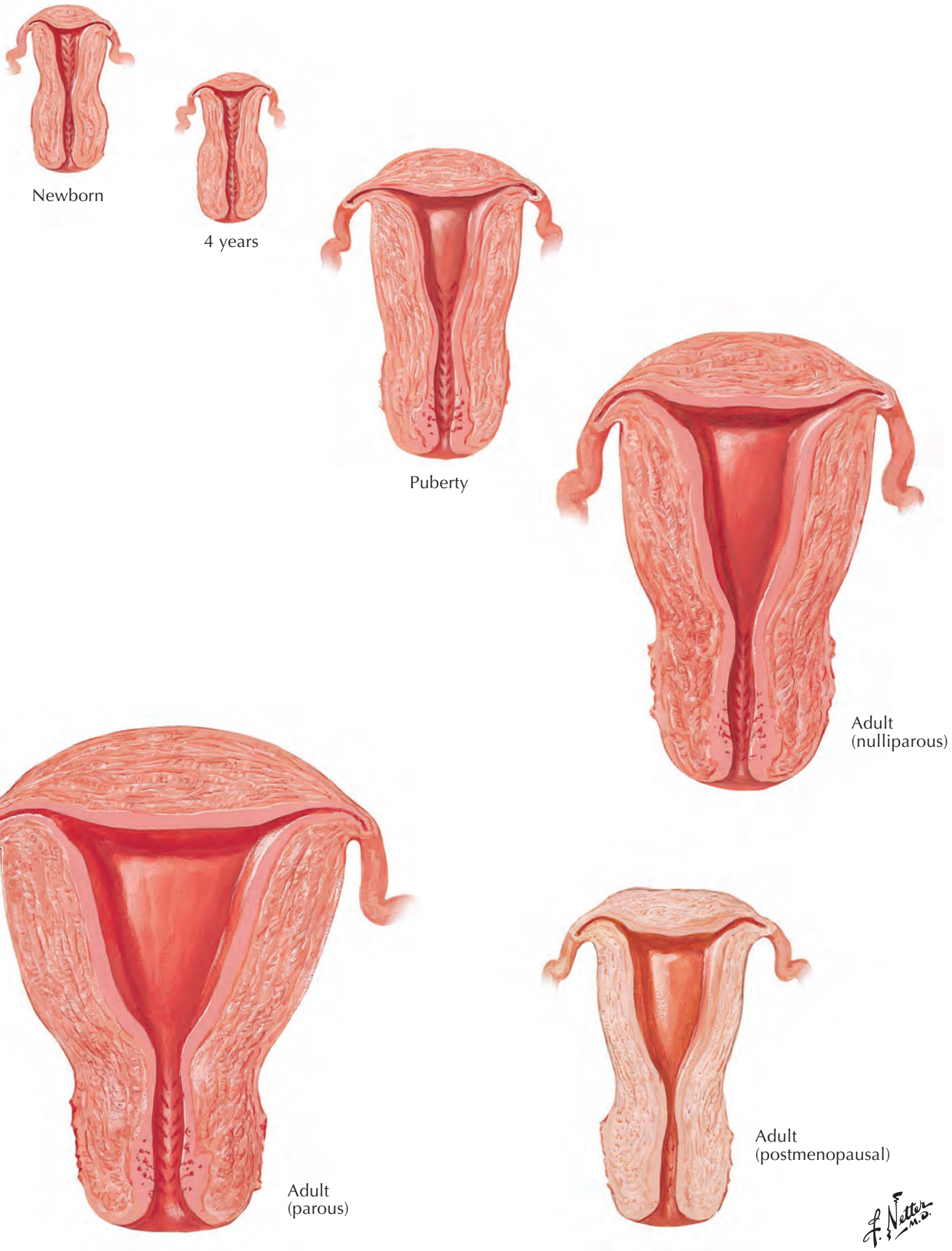
C. Machado M.D.

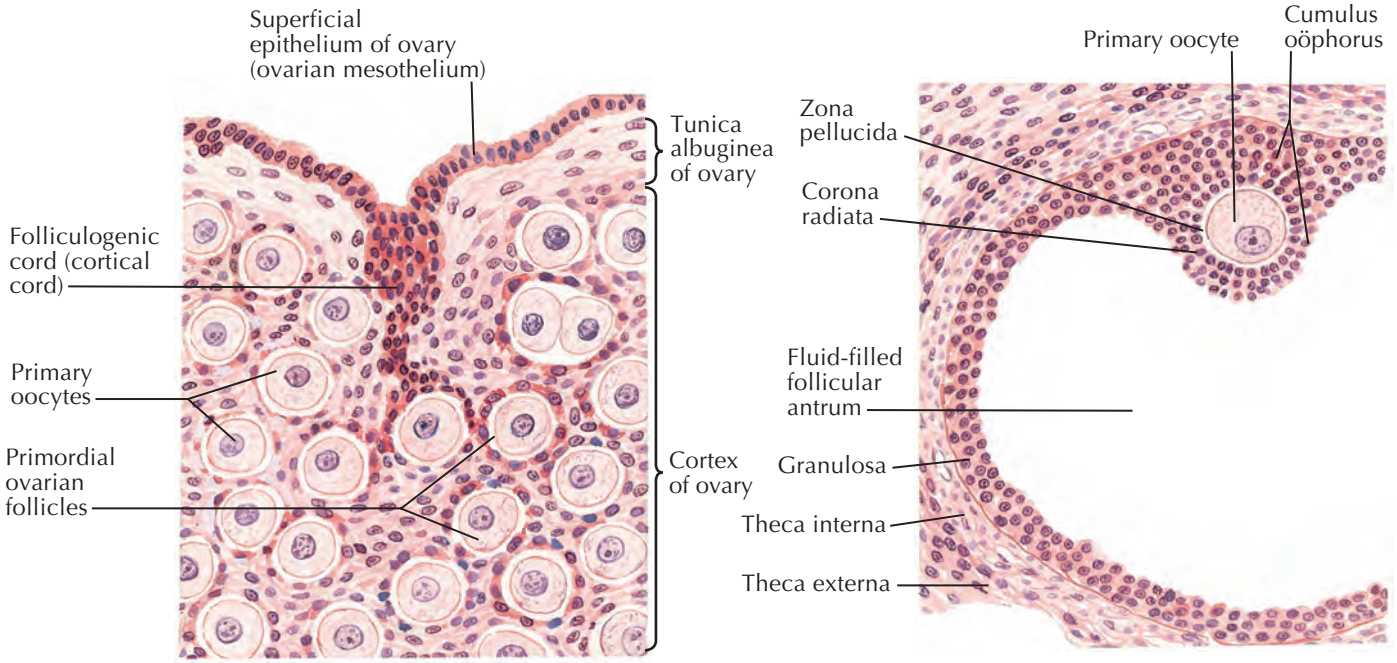
Schematic reconstruction


Spermatogenesis
Oogenesis
Meiosis I
Meiosis II
Maturation
Spermatogonium (2n)
Oogonium (2n)
Primary spermatocyte (2n)
Primary oocyte (arrested in prophase I) (2n)
Puberty
1st polar body
Secondary spermatocytes (1n)
Secondary oocyte (1n)
Secondary oocyte (arrested in metaphase II) (1n)
Fertilization
Spermatids (1n)
1st polar body (may divide)
2nd polar body
Ootid ("Ovum") (1n)
Spermatozoa (1n)
J. Perkins
MS, MFA, CMI

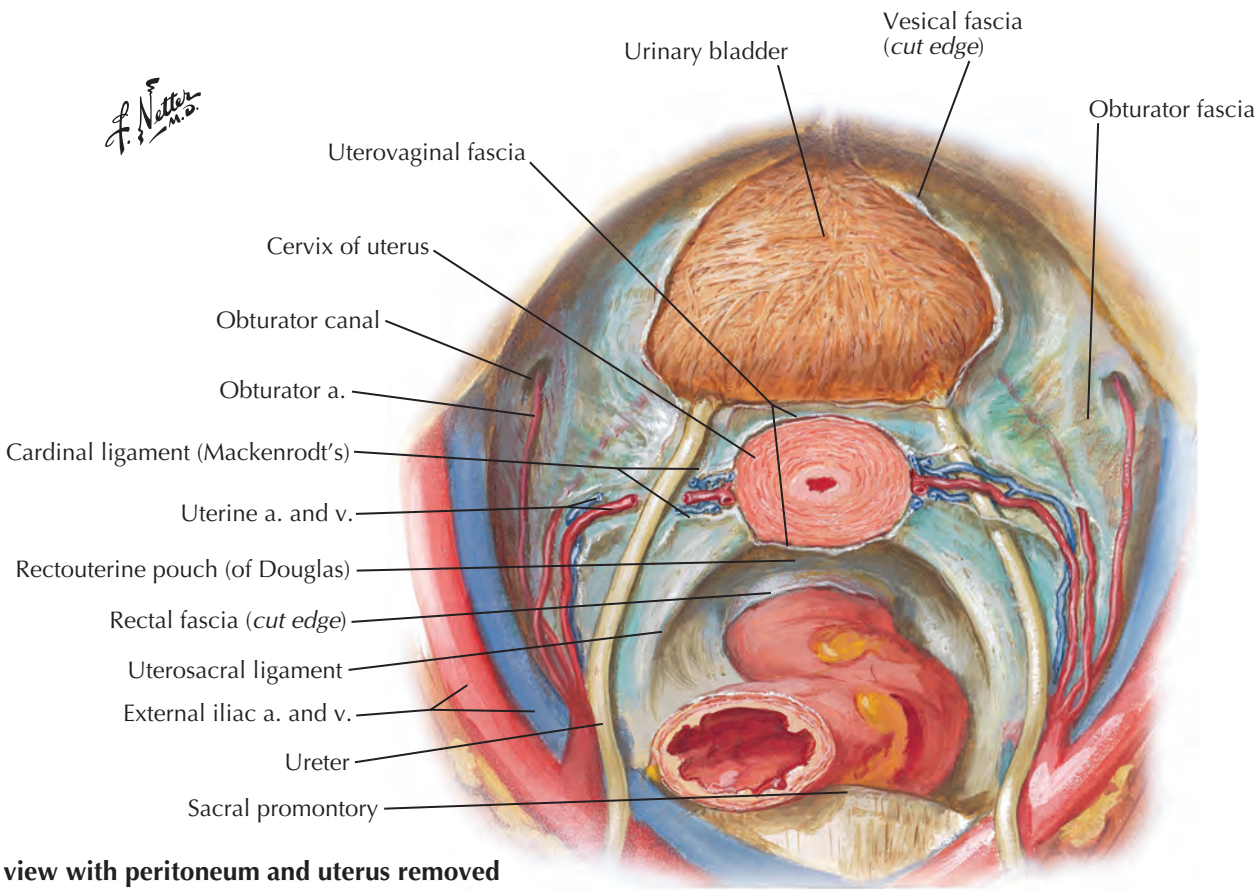
Crossing over
Pair of homologous chromosomes (tetrad)
Chiasma
Recombinant chromatids
Parental generation
Mendelian inheritance
F1 generation
F2 generation
3:1 red to white


FOLLICULAR
OVULATORY
LUTEAL
Ovarian cycle
Secondary oocyte
Developing follicles
Mature follicle
Ruptured follicle
Corpus luteum
Uterine cycle
Menstruation
Proliferative
Secretory
Spiral a.
Uterine gland
Venous lakes
Bleeding
Vein
Bleeding
4
Days
14
Days
28
Gonadotropic hormone levels
60
40
20
0
IU/L
Luteinizing hormone
20
10
0
IU/L
Follicle-stimulating hormone
Ovarian hormone levels
20
10
0
ng/mL
Progesterone
200
100
0
pg/mL
Estrogen
40
20
0
IU/L
Inhibin


Newborn
4 years
Puberty
Adult
(nulliparous)
Adult
(parous)
Adult
(postmenopausal)

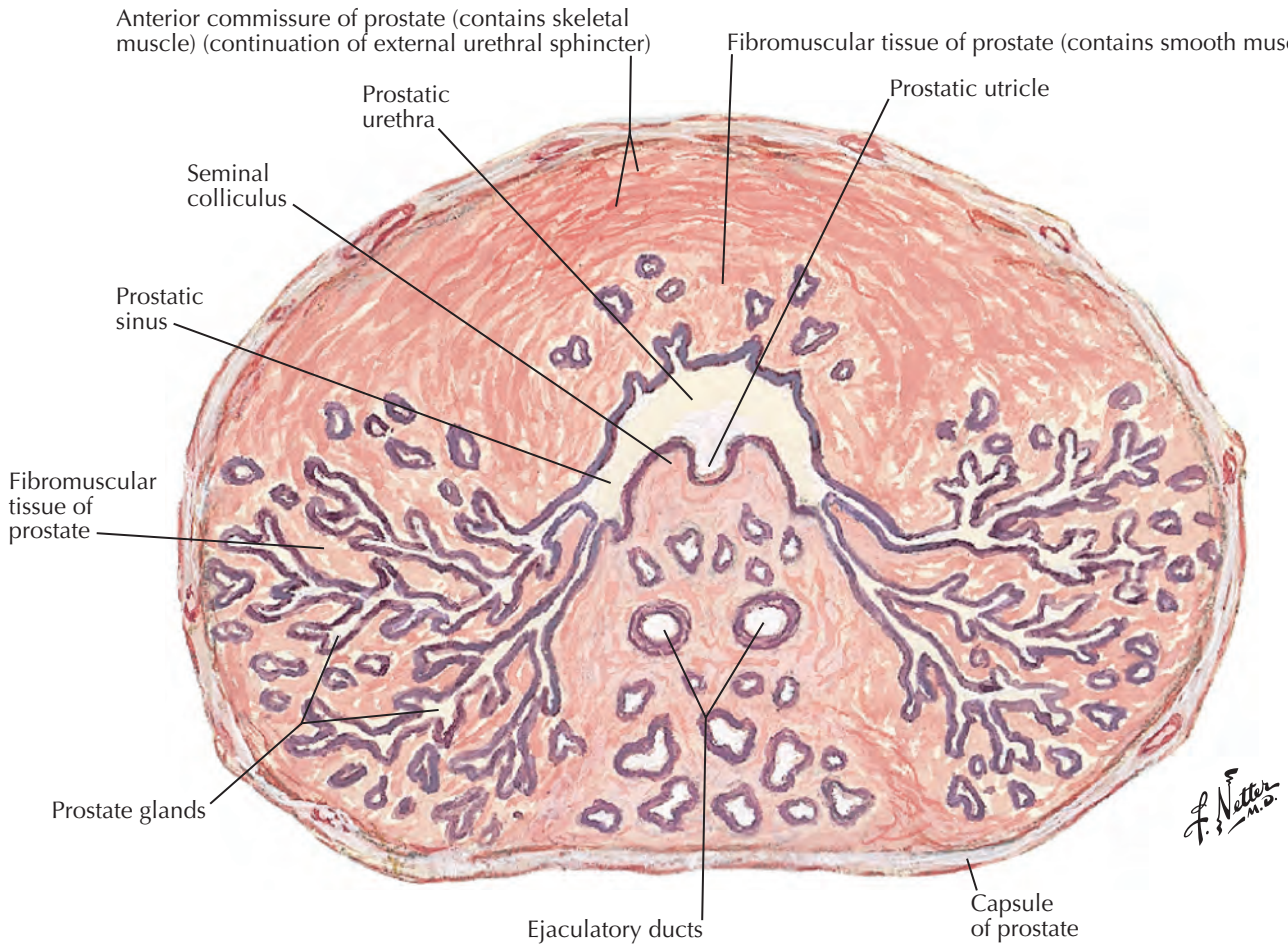


Infant ovary **Maturing follicle**

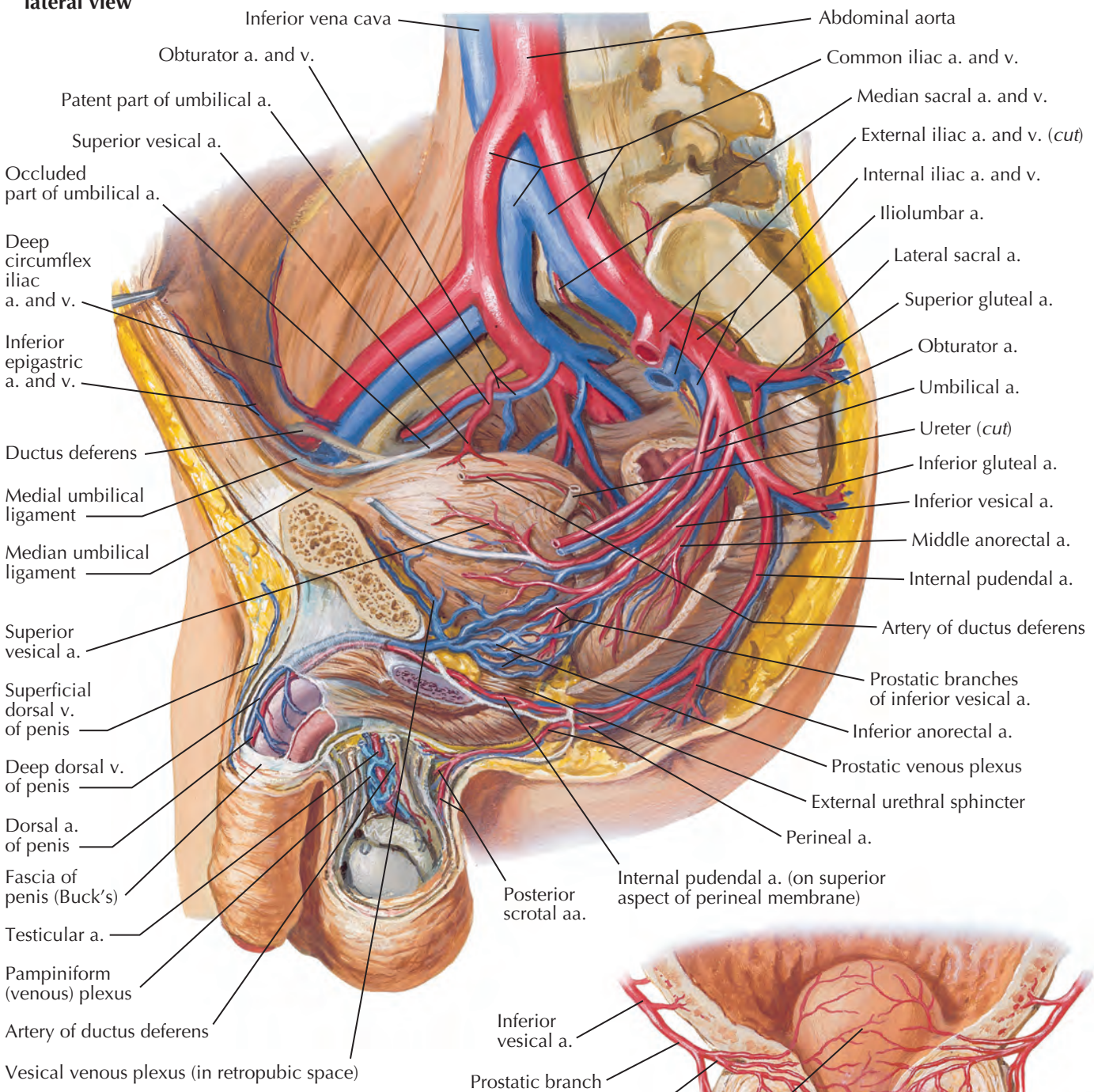


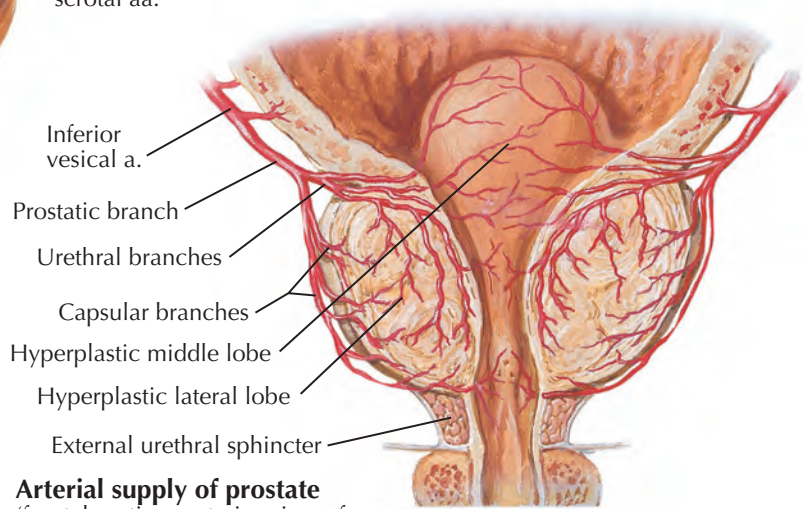
Superior view with peritoneum and uterus removed

Annular hymen | Septate hymen | Cribriform hymen | Parous introitus

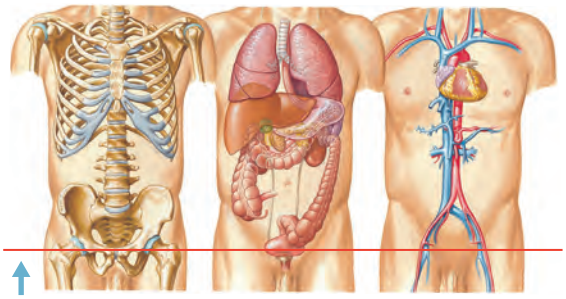

Anterior commissure of prostate (contains skeletal muscle) (continuation of external urethral sphincter)
Fibromuscular tissue of prostate (contains smooth muscle)
Prostatic urethra
Prostatic utricle
Seminal colliculus
Prostatic sinus
Fibromuscular tissue of prostate
Prostate glands
Ejaculatory ducts
Capsule of prostate
F. Netter M.D.

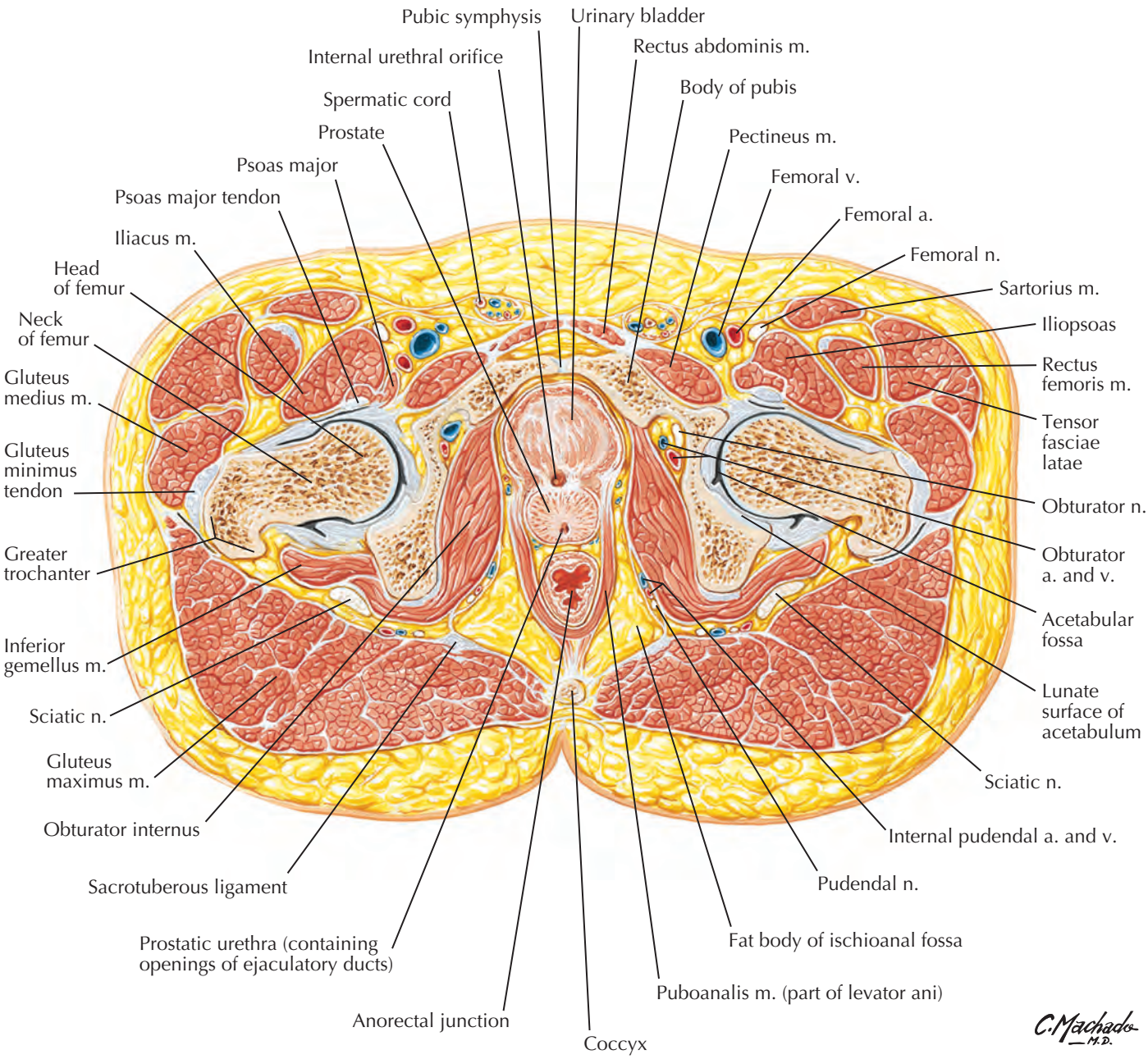
Left paramedian section: lateral view

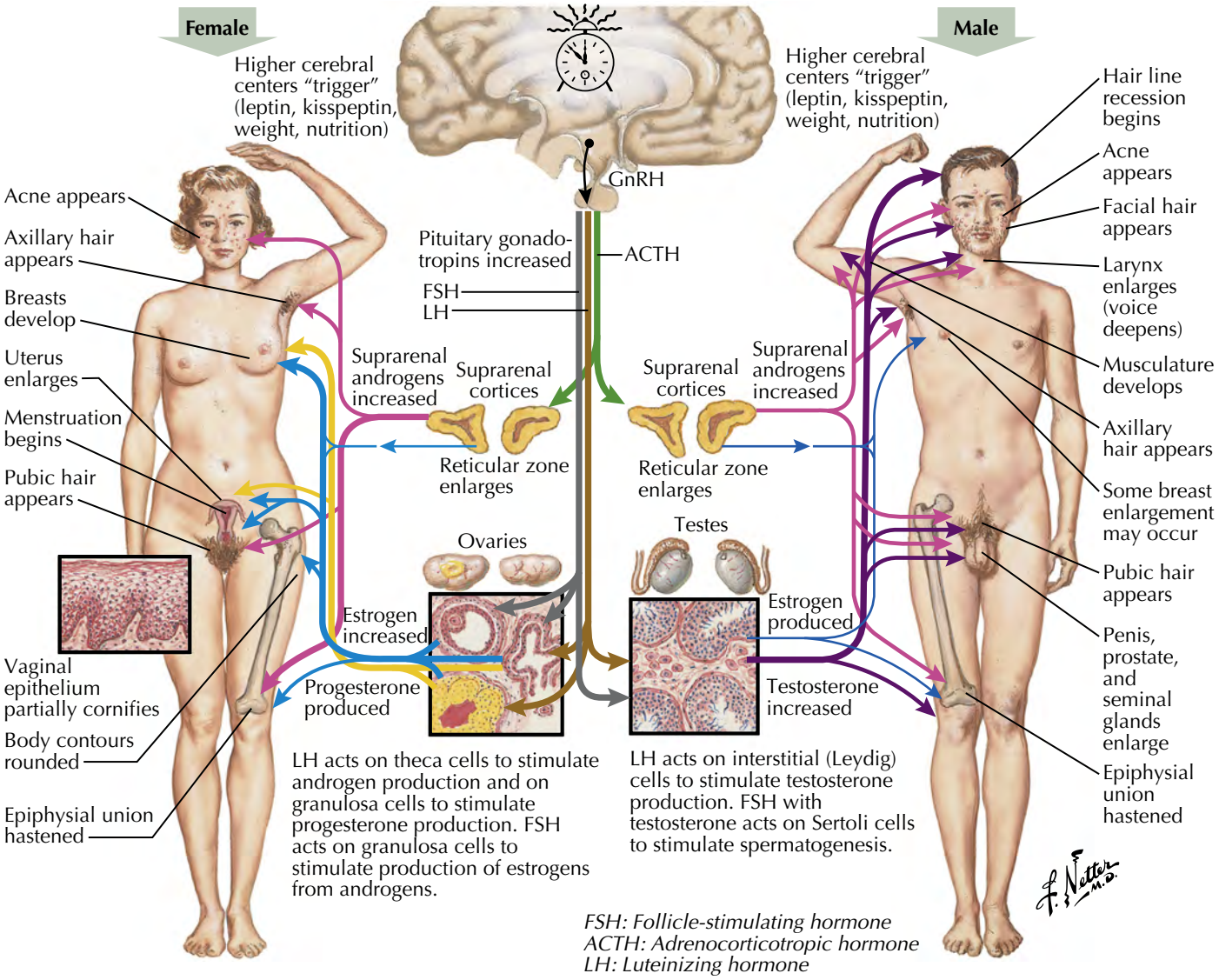




Arterial supply of prostate
(frontal section, anterior view of specimen with benign hyperplasia)




Pubic symphysis
Urinary bladder
Rectus abdominis m.
Internal urethral orifice
Body of pubis
Spermatic cord
Prostate
Pectineus m.
Psoas major
Femoral v.
Psoas major tendon
Femoral a.
Iliacus m.
Femoral n.
Head of femur
Sartorius m.
Neck of femur
Iliopsoas
Gluteus medius m.
Rectus femoris m.
Tensor fasciae latae
Gluteus minimus tendon
Obturator n.
Greater trochanter
Obturator a. and v.
Acetabular fossa
Inferior gemellus m.
Lunate surface of acetabulum
Sciatic n.
Gluteus maximus m.
Sciatic n.
Obturator internus
Internal pudendal a. and v.
Pudendal n.
Sacrotuberous ligament
Fat body of ischioanal fossa
Prostatic urethra (containing openings of ejaculatory ducts)
Puboanalis m. (part of levator ani)
Anorectal junction
Coccyx
C. Machado M.D.


Female
Male
Higher cerebral centers "trigger" (leptin, kisspeptin, weight, nutrition)
Higher cerebral centers "trigger" (leptin, kisspeptin, weight, nutrition)
GnRH
Pituitary gonado-tropins increased
ACTH
FSH
LH
Acne appears
Axillary hair appears
Breasts develop
Uterus enlarges
Menstruation begins
Pubic hair appears
Vaginal epithelium partially cornifies
Body contours rounded
Epiphysial union hastened
Suprarenal androgens increased
Suprarenal cortices
Reticular zone enlarges
Ovaries
Estrogen increased
Progesterone produced
Testes
Estrogen produced
Testosterone increased
Hair line recession begins
Acne appears
Facial hair appears
Larynx enlarges (voice deepens)
Musculature develops
Axillary hair appears
Some breast enlargement may occur
Pubic hair appears
Penis, prostate, and seminal glands enlarge
Epiphysial union hastened
LH acts on theca cells to stimulate androgen production and on granulosa cells to stimulate progesterone production. FSH acts on granulosa cells to stimulate production of estrogens from androgens.
LH acts on interstitial (Leydig) cells to stimulate testosterone production. FSH with testosterone acts on Sertoli cells to stimulate spermatogenesis.
FSH: Follicle-stimulating hormone
ACTH: Adrenocorticotropic hormone
LH: Luteinizing hormone

UPPER LIMB 7

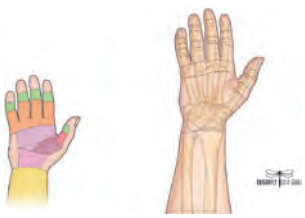
Surface Anatomy	422–426	**Regional Imaging**	490
Shoulder and Axilla	427–439	**Structures with High Clinical Significance**	Tables 7.1–7.2
Arm	440–445	**Nerves of Brachial Plexus**	Tables 7.3–7.4
Elbow and Forearm	446–461	**Muscles**	Tables 7.5–7.8
Wrist and Hand	462–481	**Electronic Bonus Plates**	BP 96–BP 102
Nerves and Vasculature	482–489		

ELECTRONIC BONUS PLATES

BP 96 Arteries of Arm and Proximal Forearm

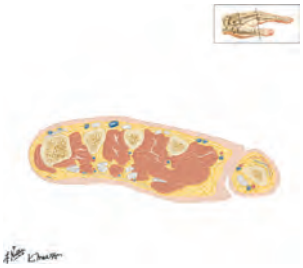
BP 97 Arteries of Forearm and Hand

BP 98 Ligaments of Wrist: Posterior and Anterior Views

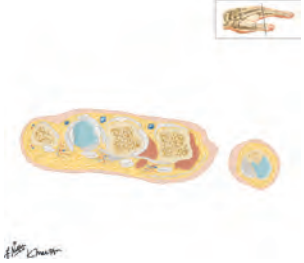


BP 99 Flexor and Extensor Zones of Hand

BP 100 Cross Sections Through Metacarpal and Distal Carpal Bones

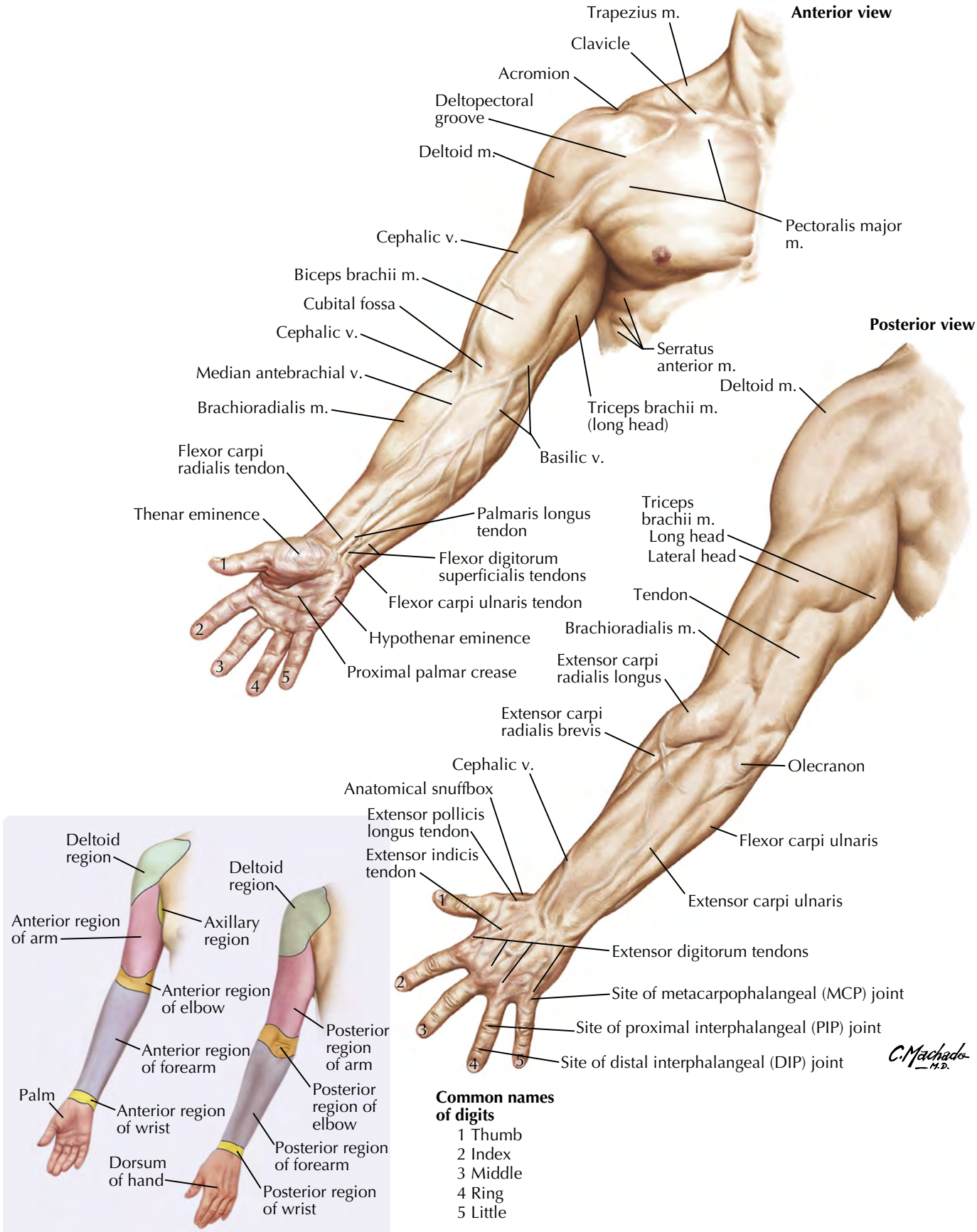


BP 101 Cross Section of Hand: Axial View



BP 102 Cross Section of Hand: Axial View (Continued)

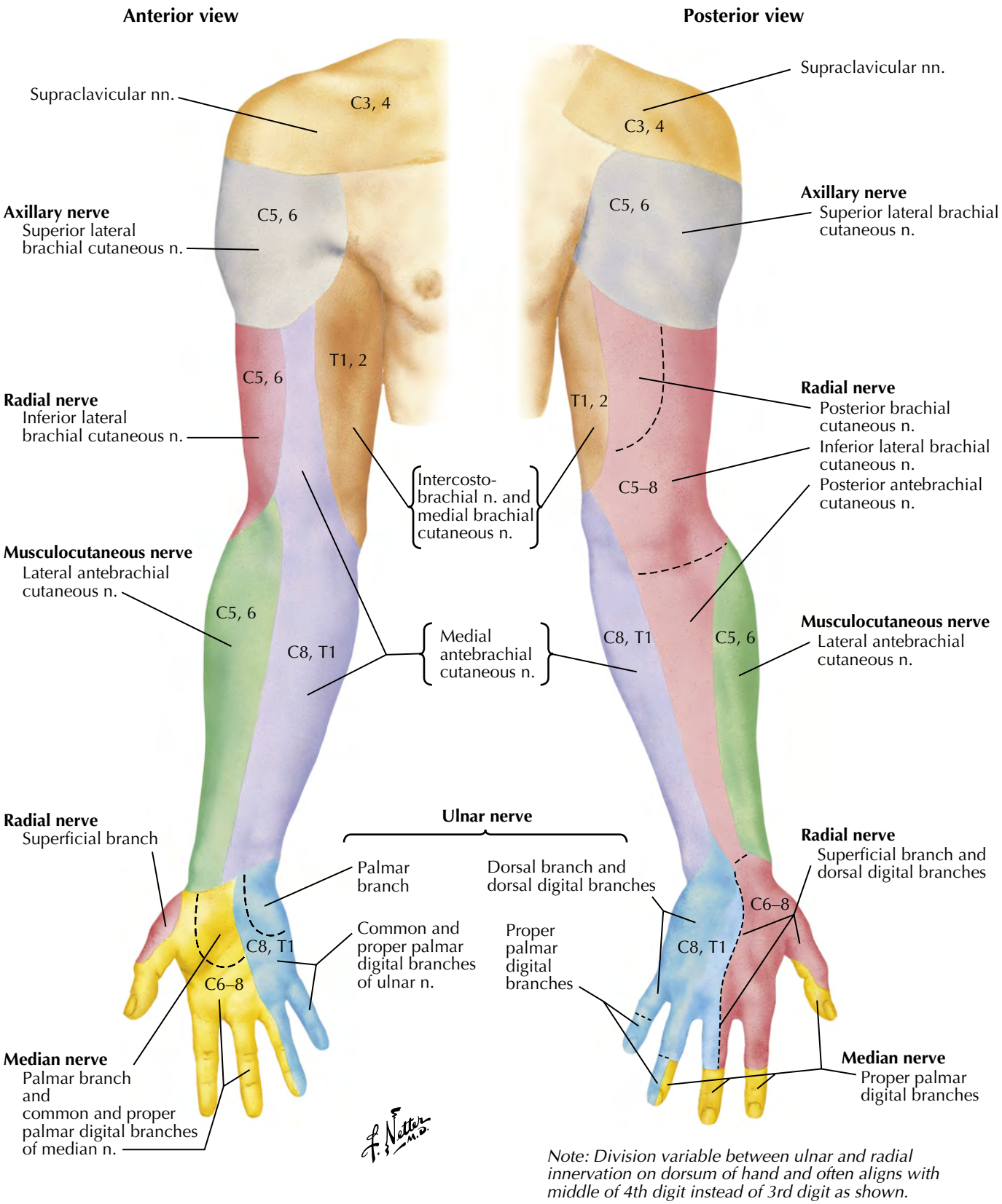
See also **Plates 5, 178, 267**



Common names of digits

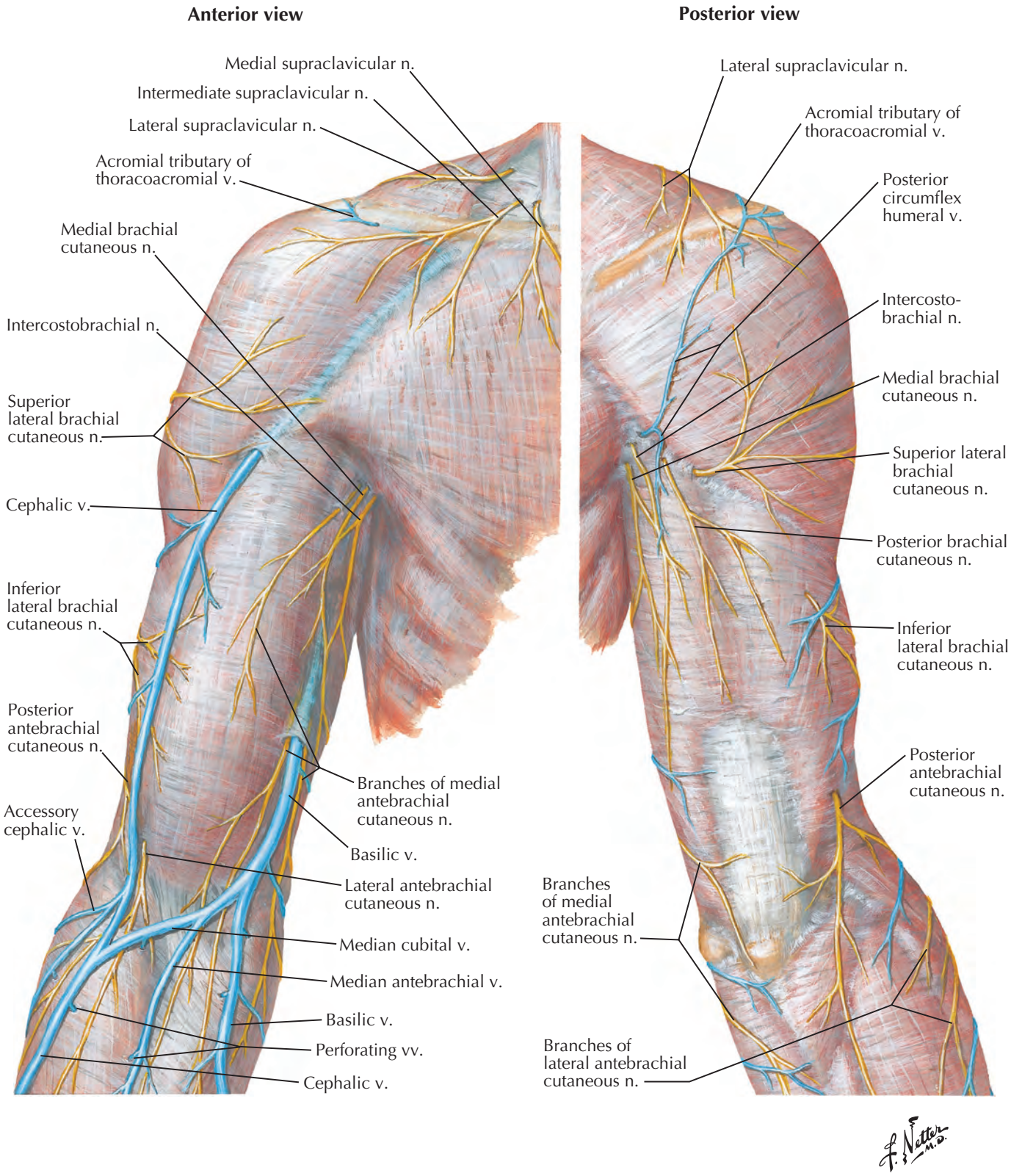
1 Thumb
2 Index
3 Middle
4 Ring
5 Little

See also **Plates 6, 482, 484**

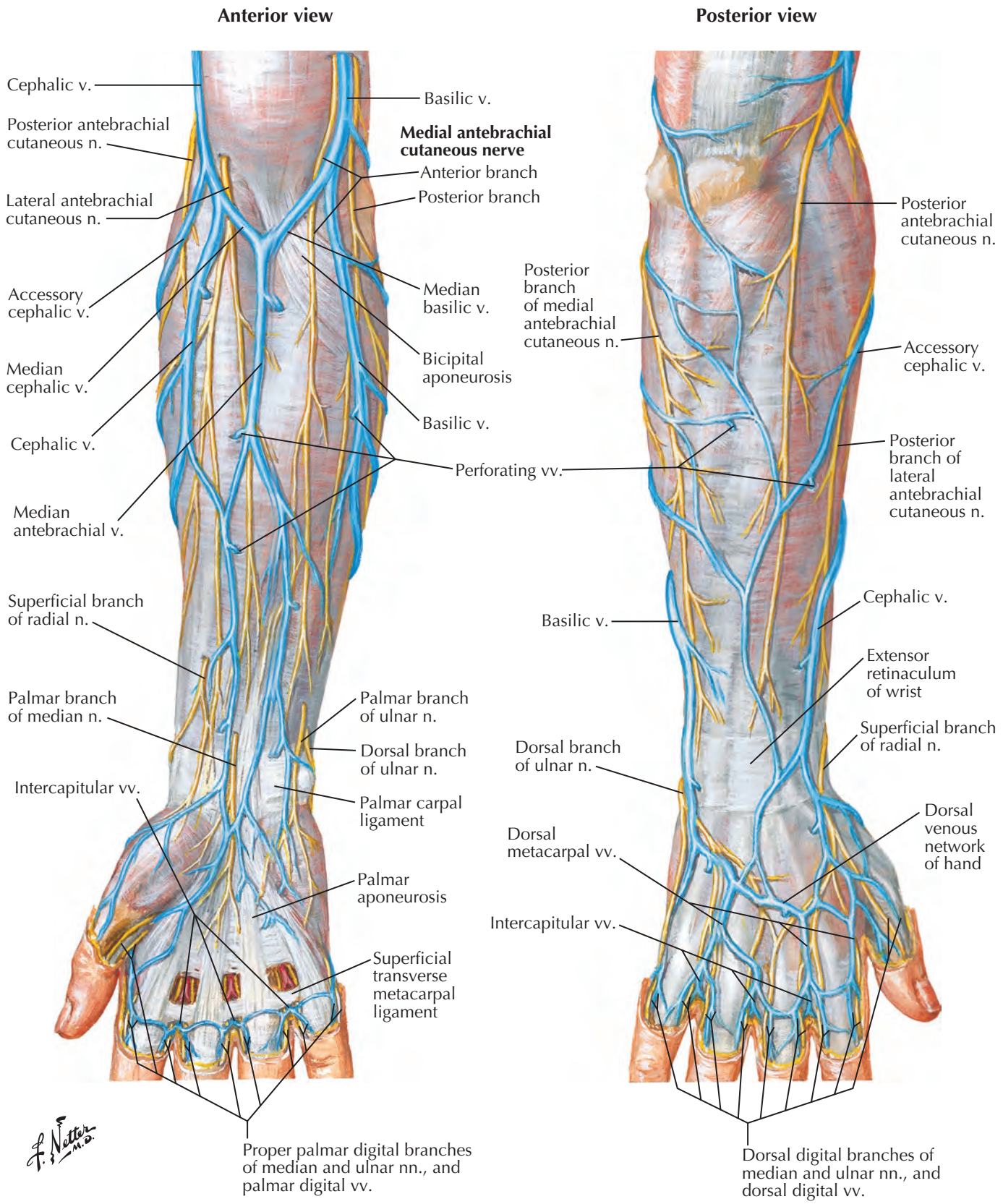


Note: Division variable between ulnar and radial innervation on dorsum of hand and often aligns with middle of 4th digit instead of 3rd digit as shown.

See also **Plates 277, 426, 444**

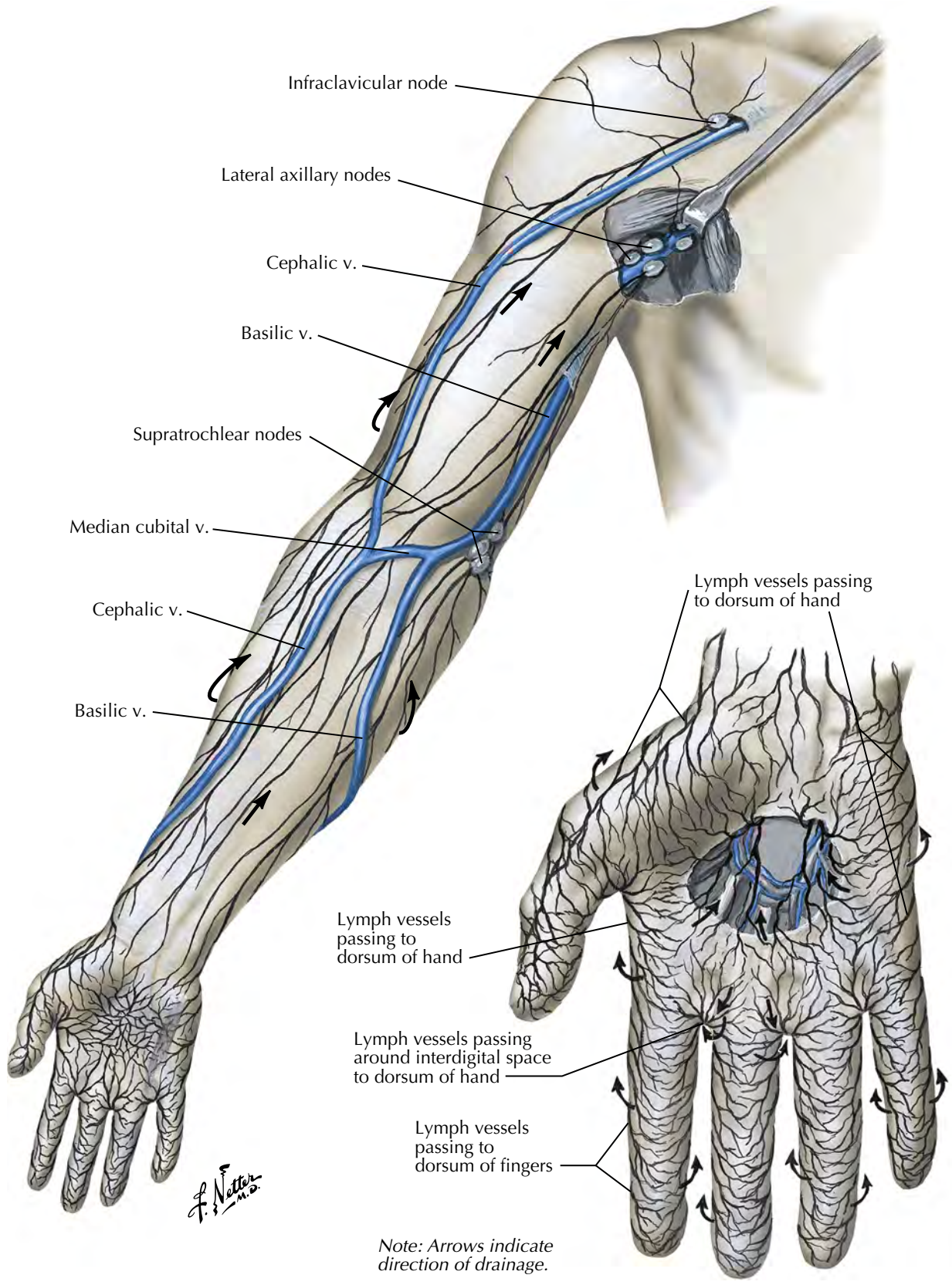


See also **Plates 423, 444, 478**



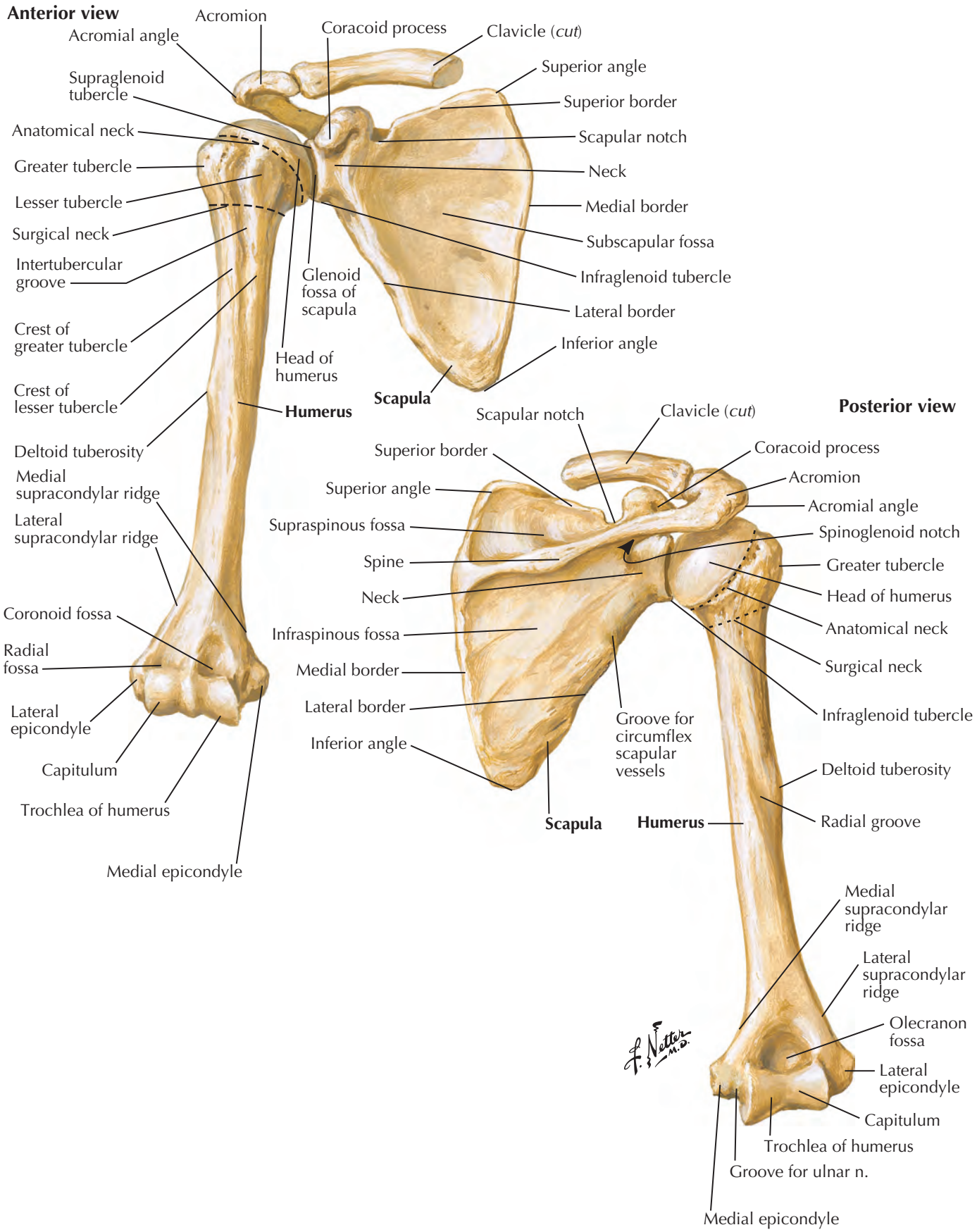
Note: In 70% of cases, a median cubital vein (a tributary to the basilic vein) replaces the median cephalic and median basilic veins (see Plate 424).

See also **Plates 208, 444, 478**

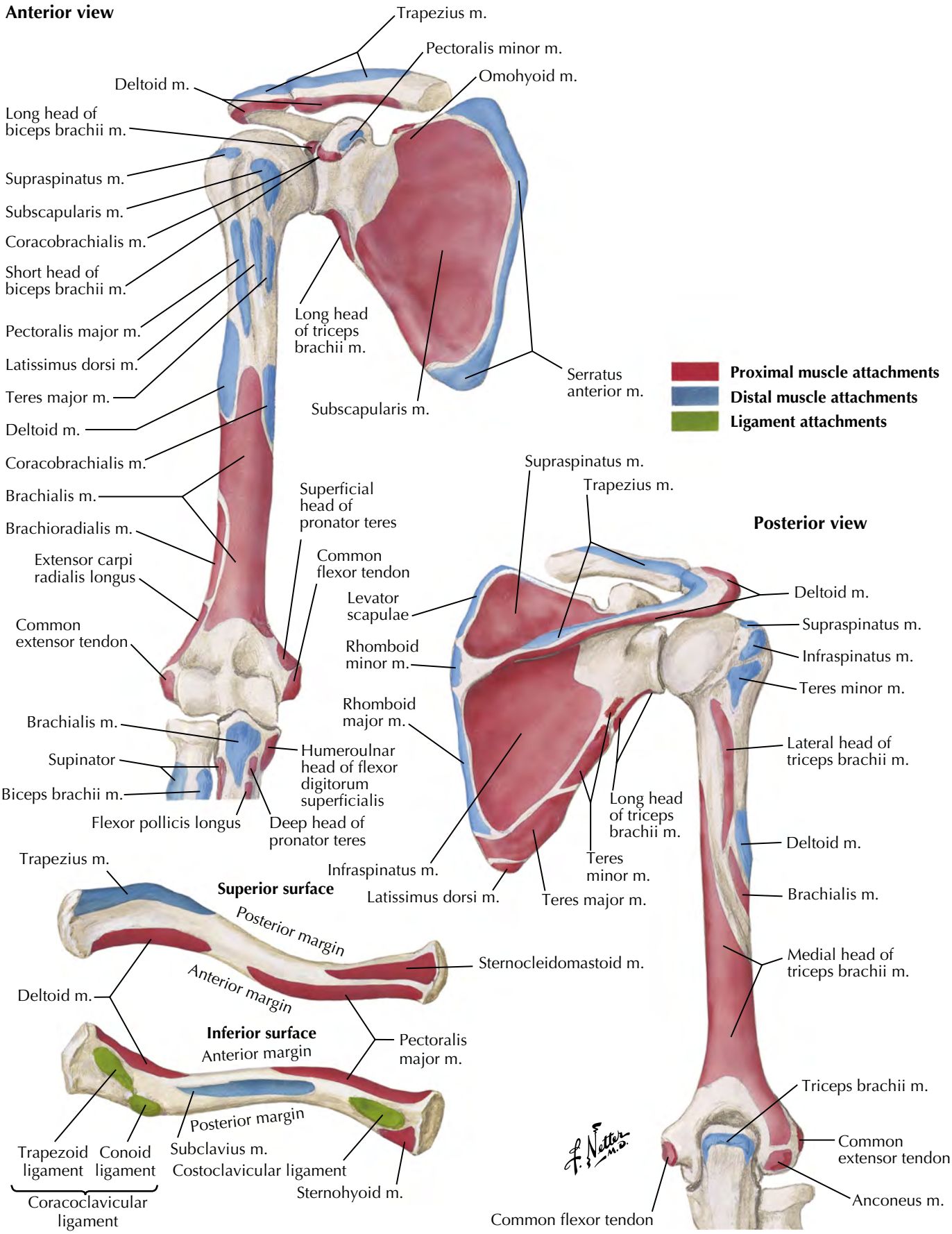


Note: Arrows indicate direction of drainage.

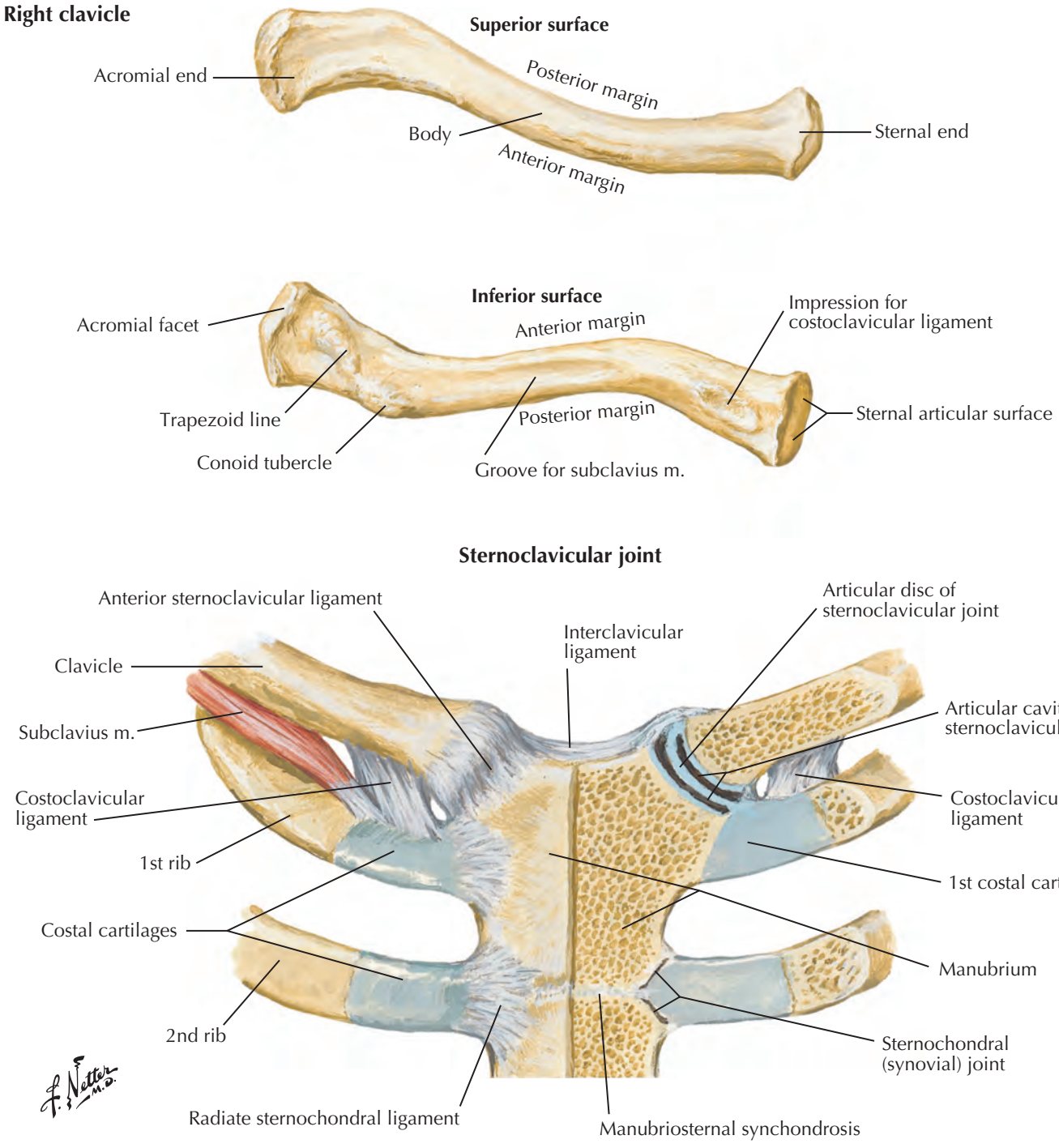
See also **Plates 203, 427, 428, 430**



See also **Plates 203, 427, 429**

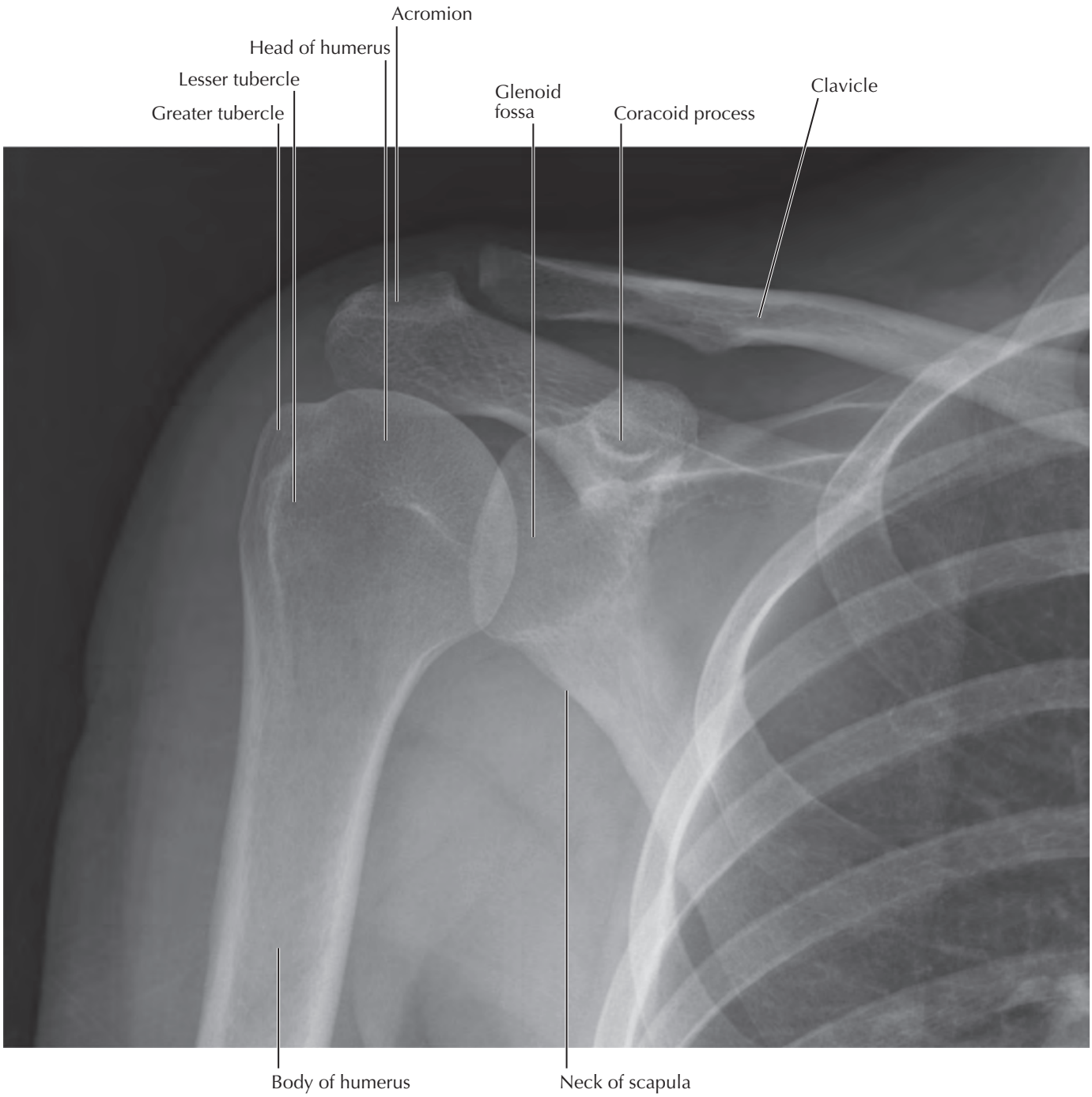


See also **Plates 203, 210, 427, 428**

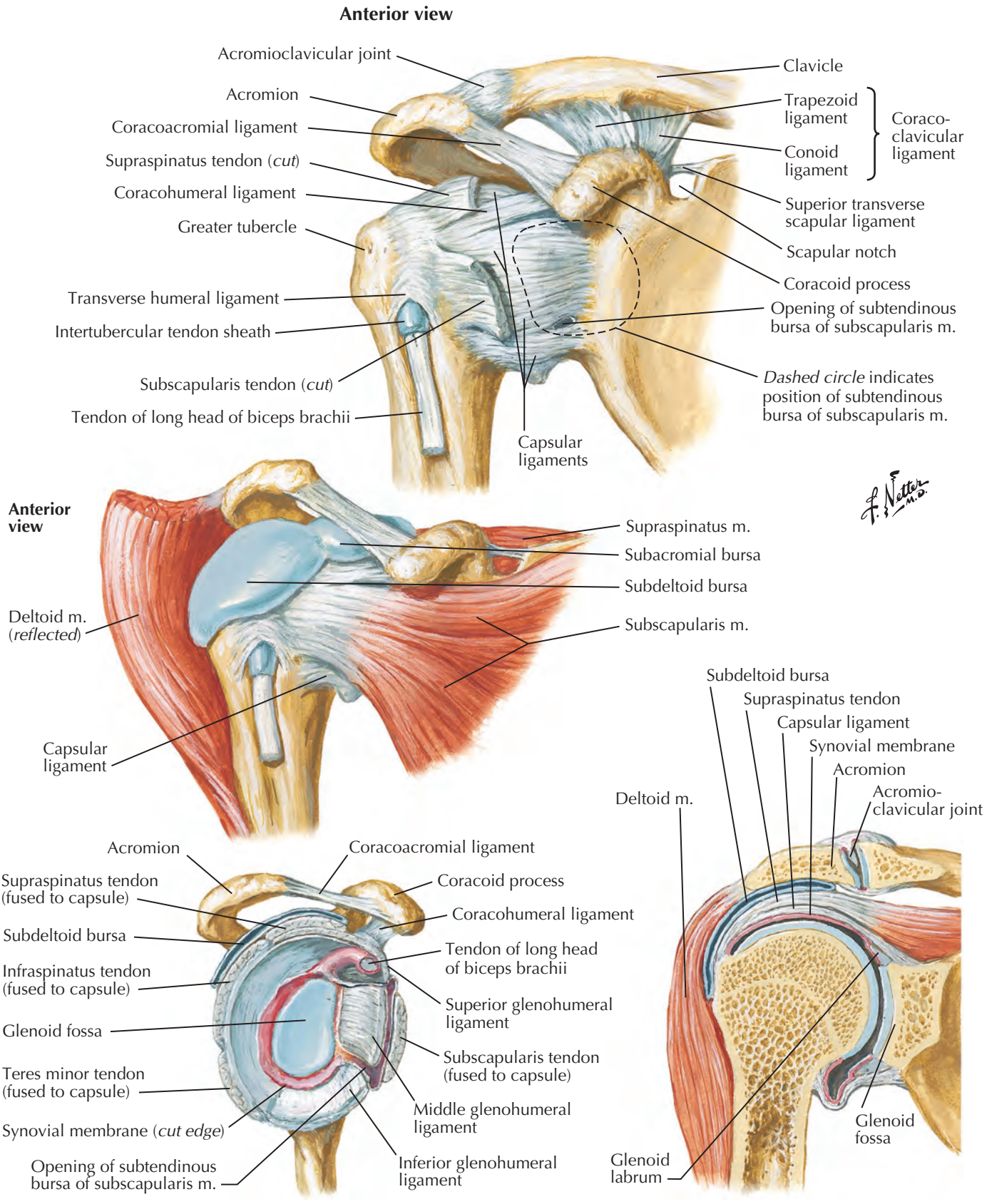


See also **Plates 427, 428, 431**

Anteroposterior radiograph of right shoulder

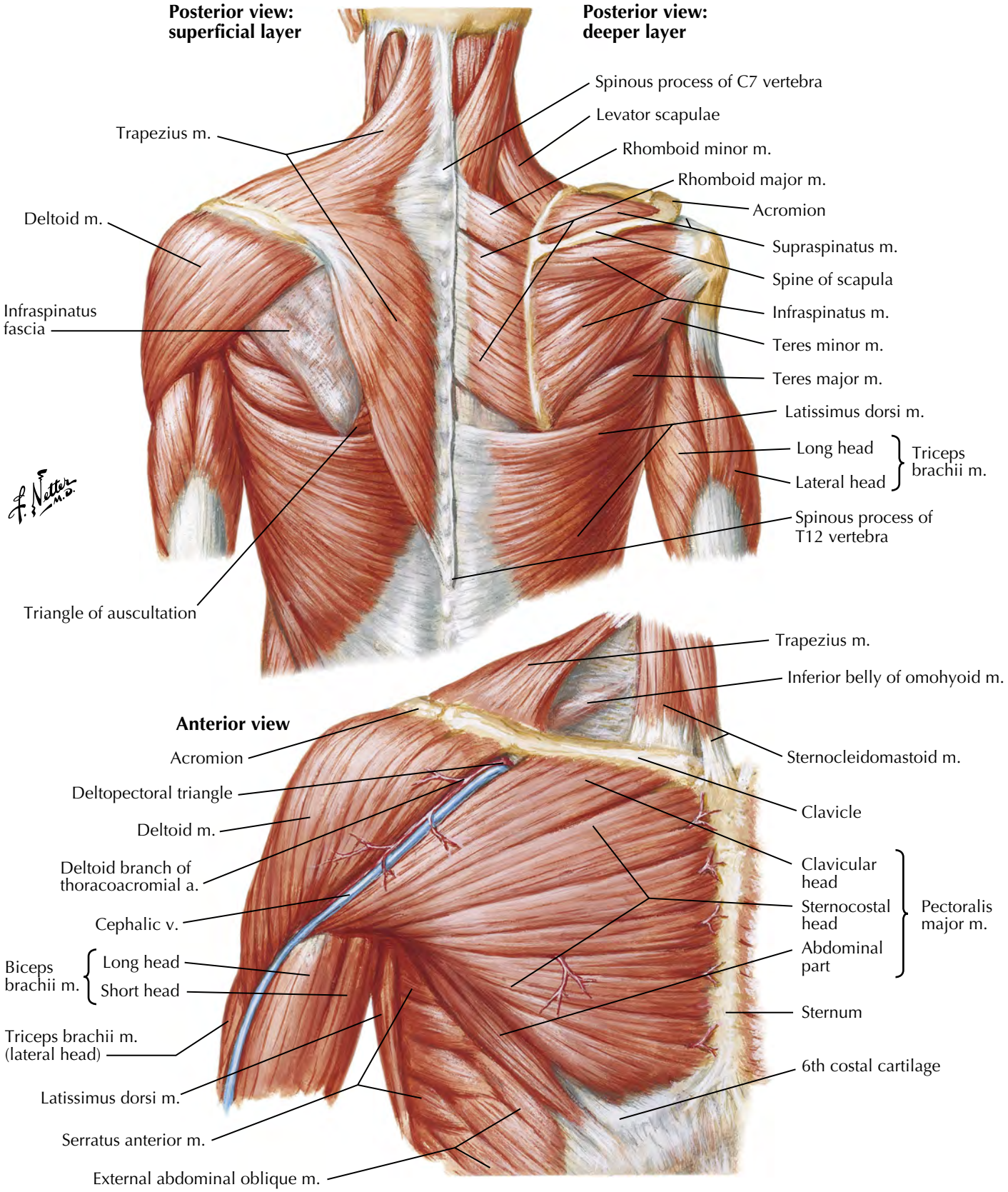


See also **Plates 434, 440, 441**

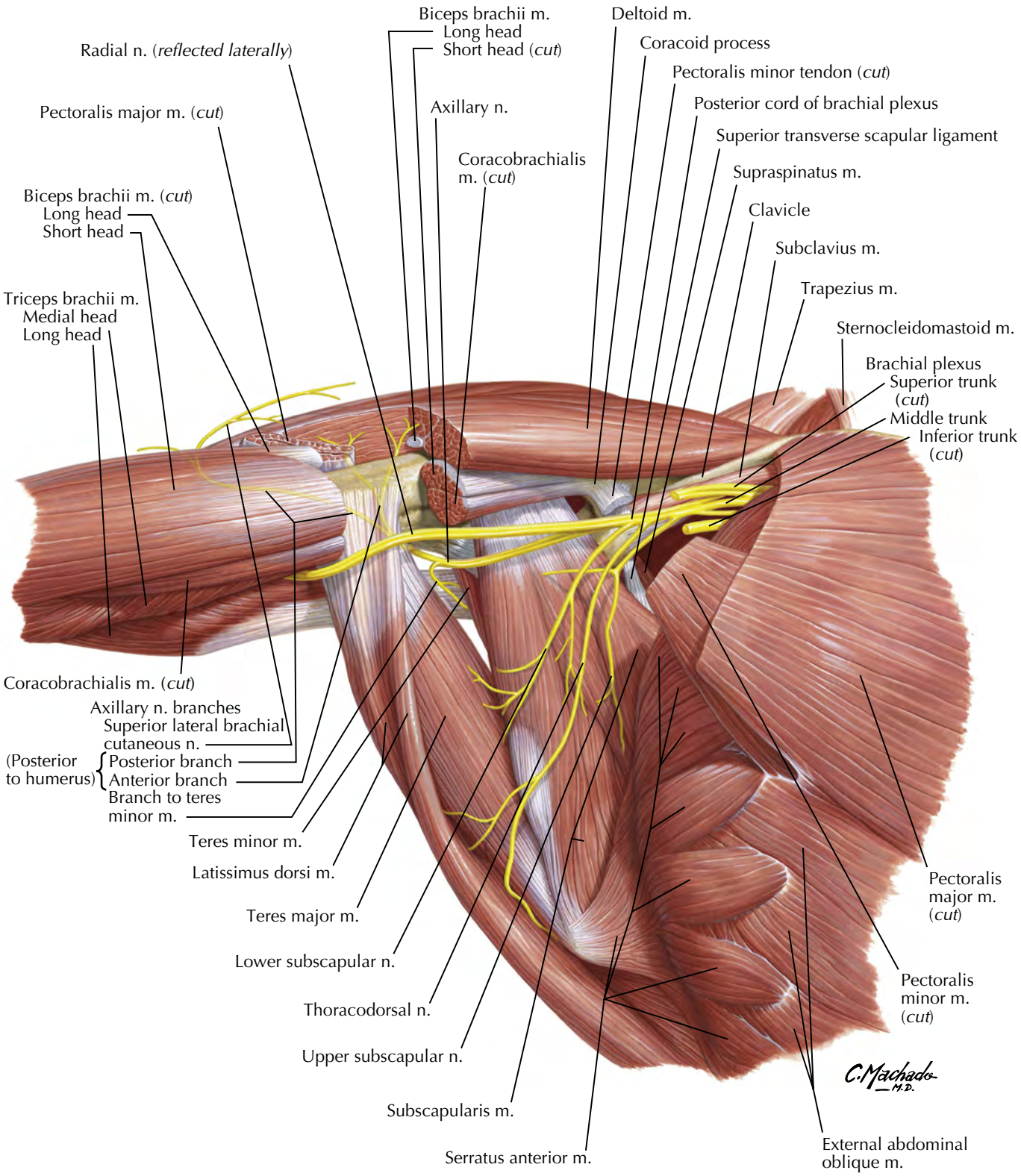


Joint opened: lateral view

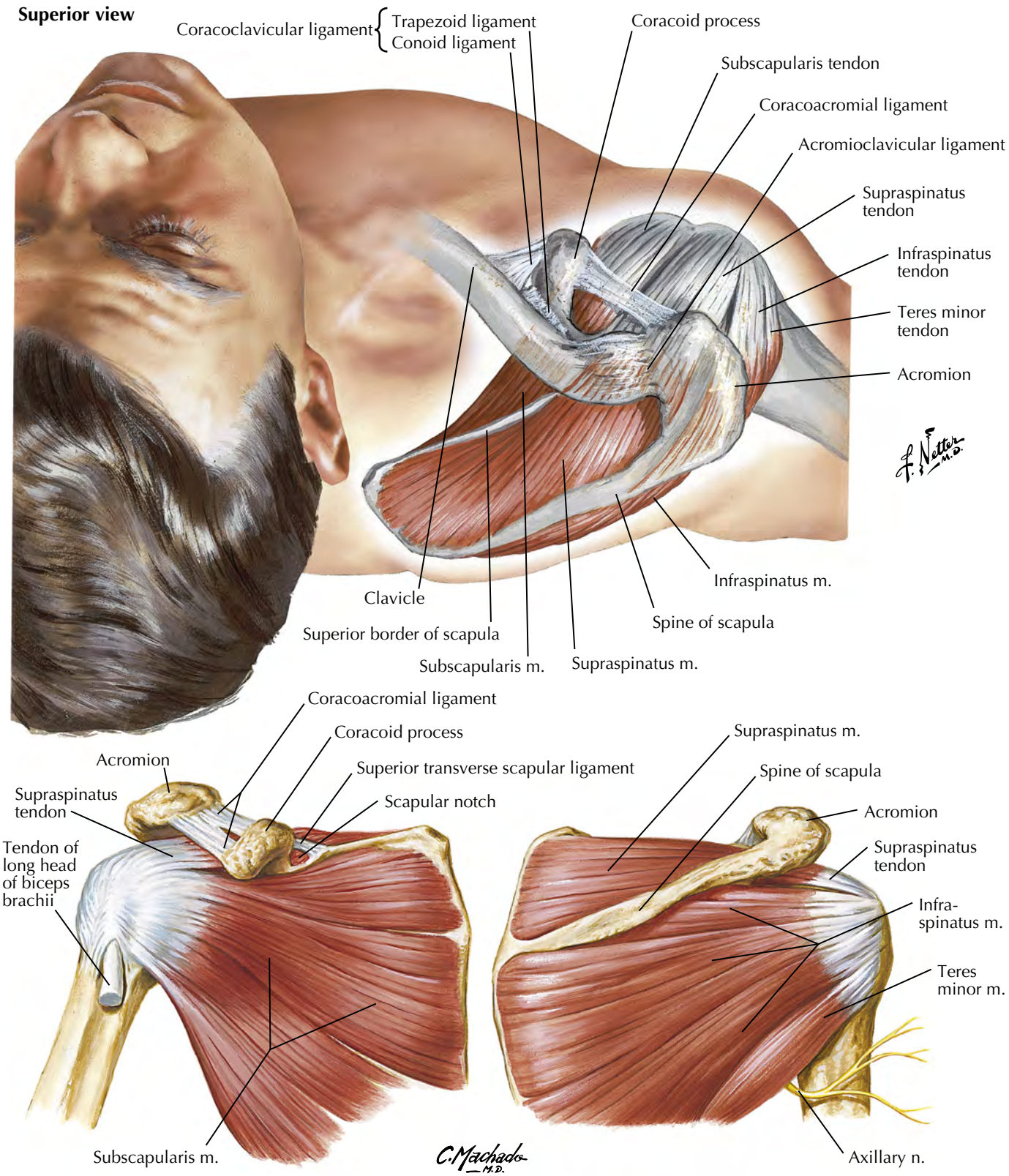
Coronal section through shoulder girdle


Posterior view: superficial layer
Posterior view: deeper layer
Spinous process of C7 vertebra
Levator scapulae
Trapezius m.
Rhomboid minor m.
Rhomboid major m.
Deltoid m.
Acromion
Supraspinatus m.
Spine of scapula
Infraspinatus fascia
Infraspinatus m.
Teres minor m.
Teres major m.
Latissimus dorsi m.
Long head
Lateral head
Triceps brachii m.
Spinous process of T12 vertebra
Triangle of auscultation
Trapezius m.
Inferior belly of omohyoid m.
Anterior view
Acromion
Sternocleidomastoid m.
Deltopectoral triangle
Clavicle
Deltoid m.
Deltoid branch of thoracoacromial a.
Clavicular head
Sternocostal head
Abdominal part
Pectoralis major m.
Cephalic v.
Biceps brachii m.
Long head
Short head
Sternum
Triceps brachii m. (lateral head)
6th costal cartilage
Latissimus dorsi m.
Serratus anterior m.
External abdominal oblique m.

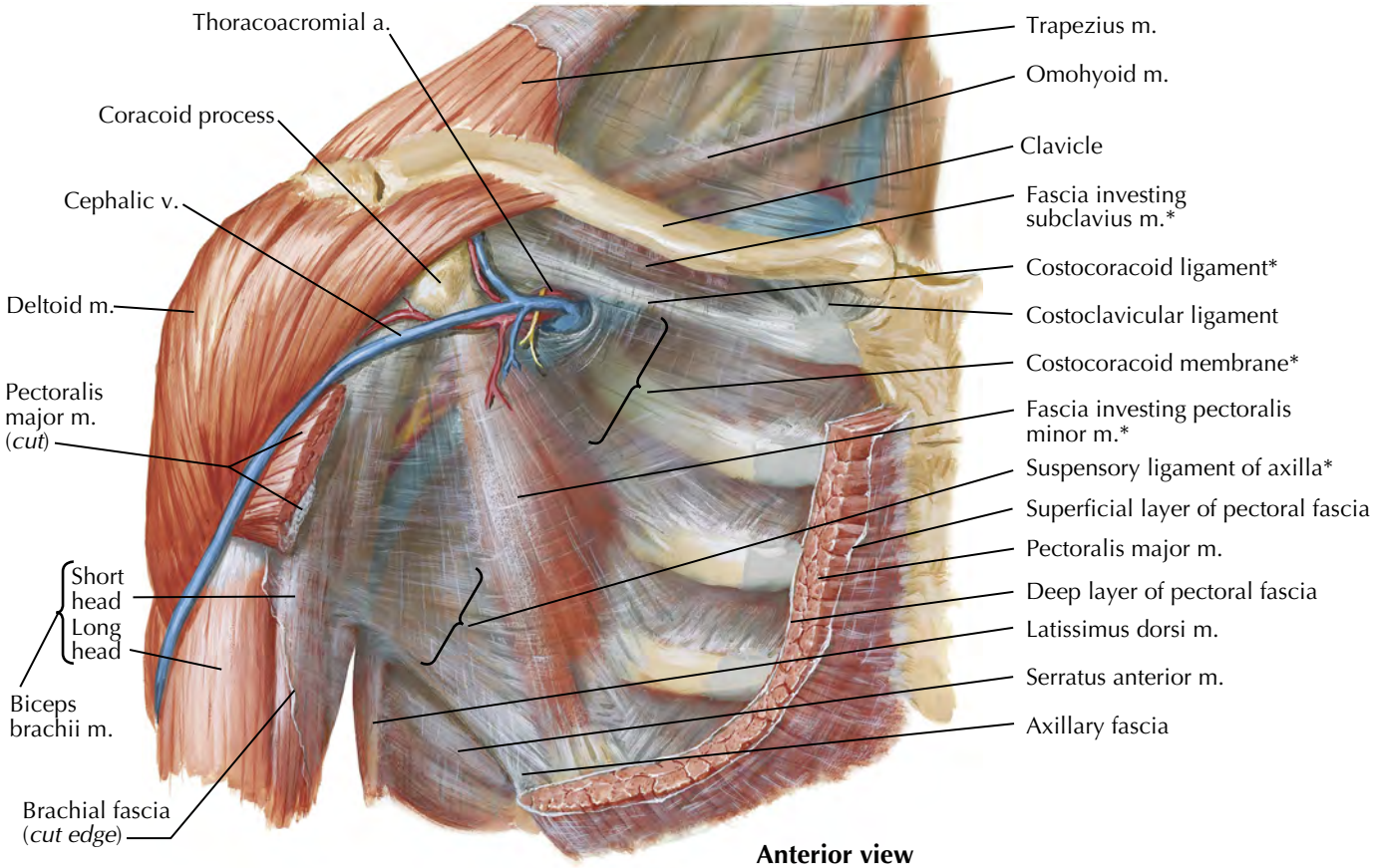
See also **Plates 438, 439**



See also **Plates 431, 440, 441**

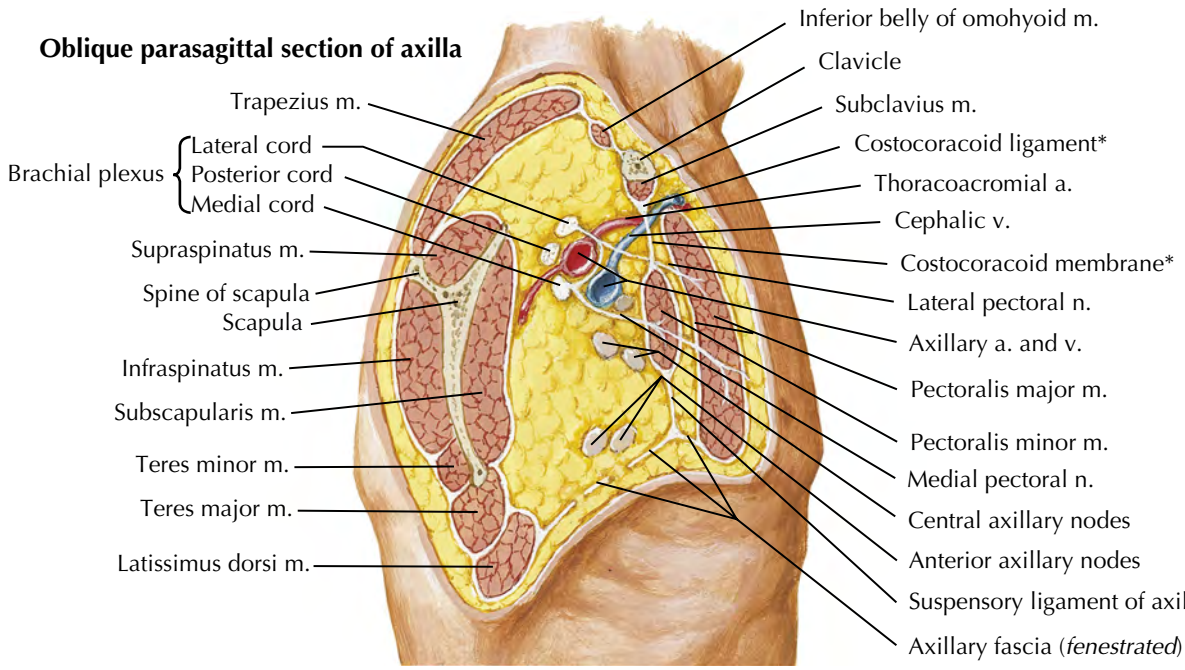


See also **Plates 207, 209**



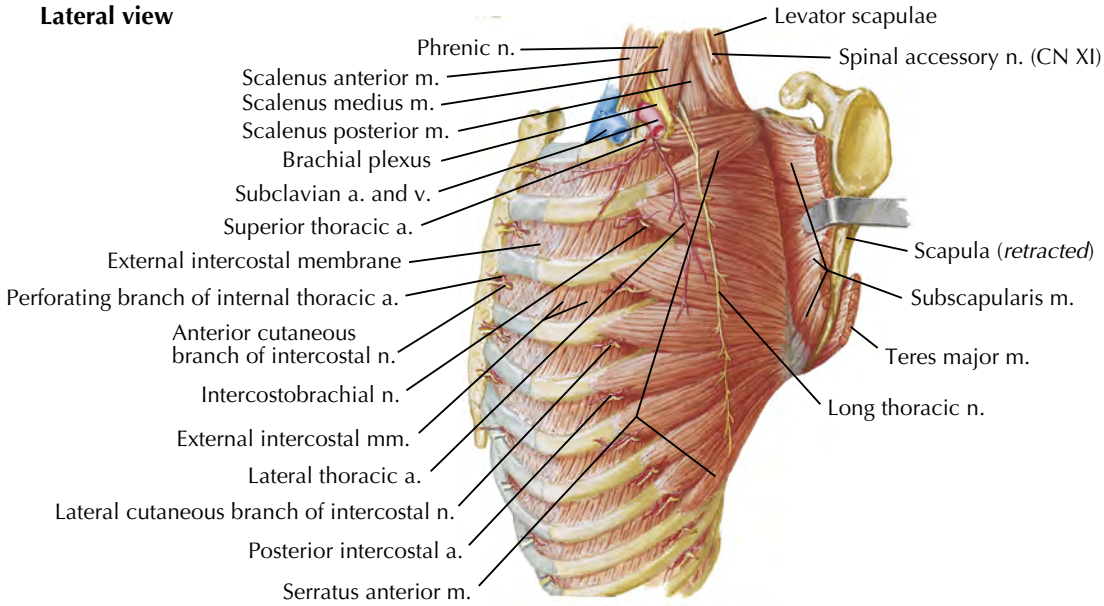
Anterior view

Oblique parasagittal section of axilla

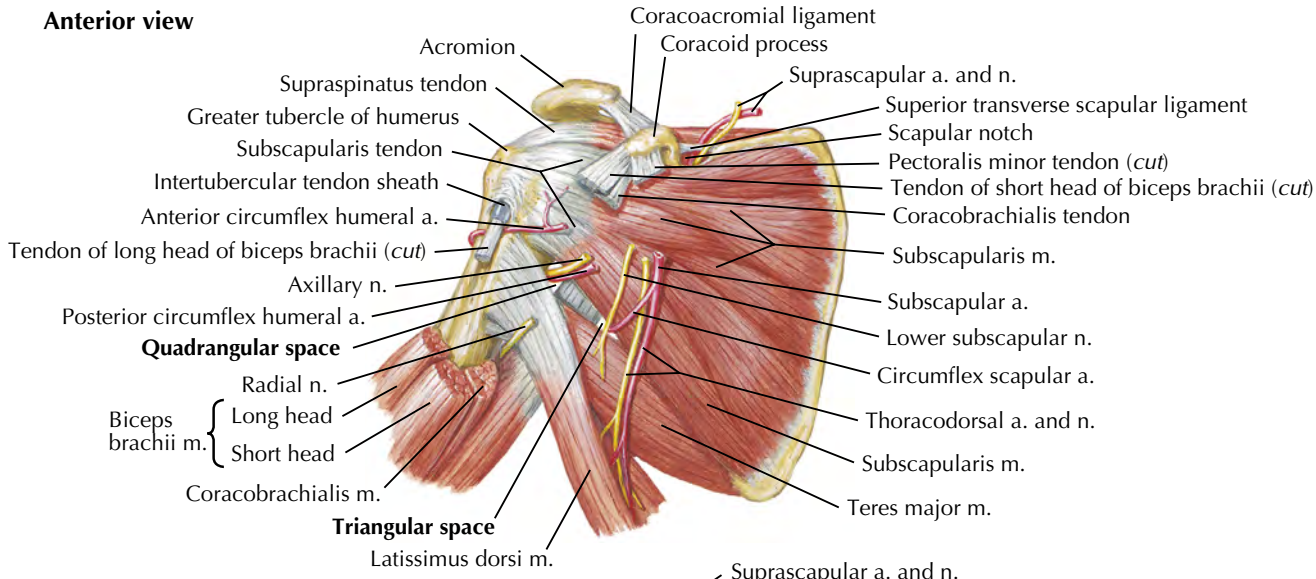


*Components of clavipectoral fascia

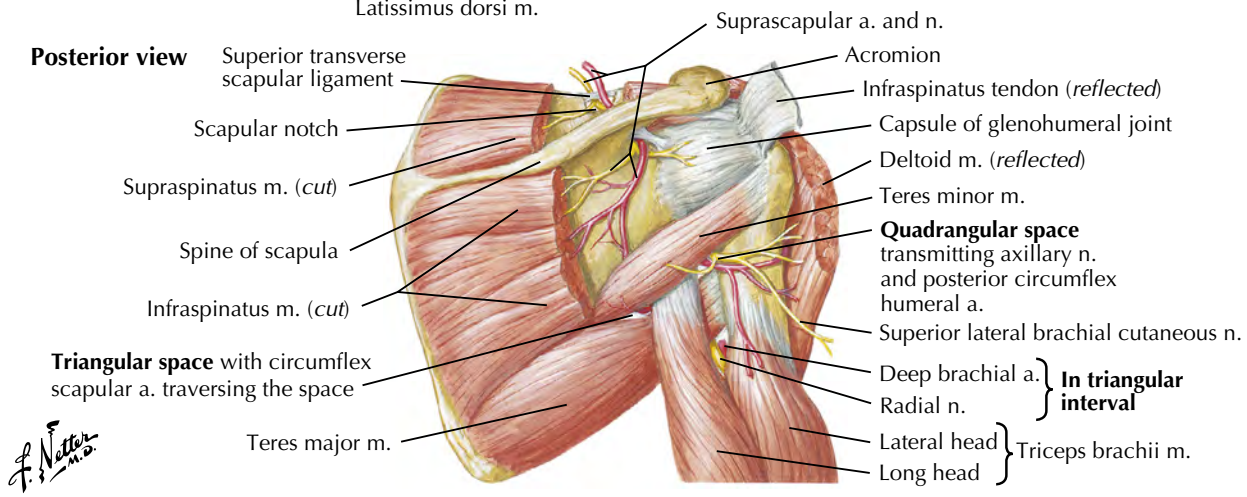
Lateral view



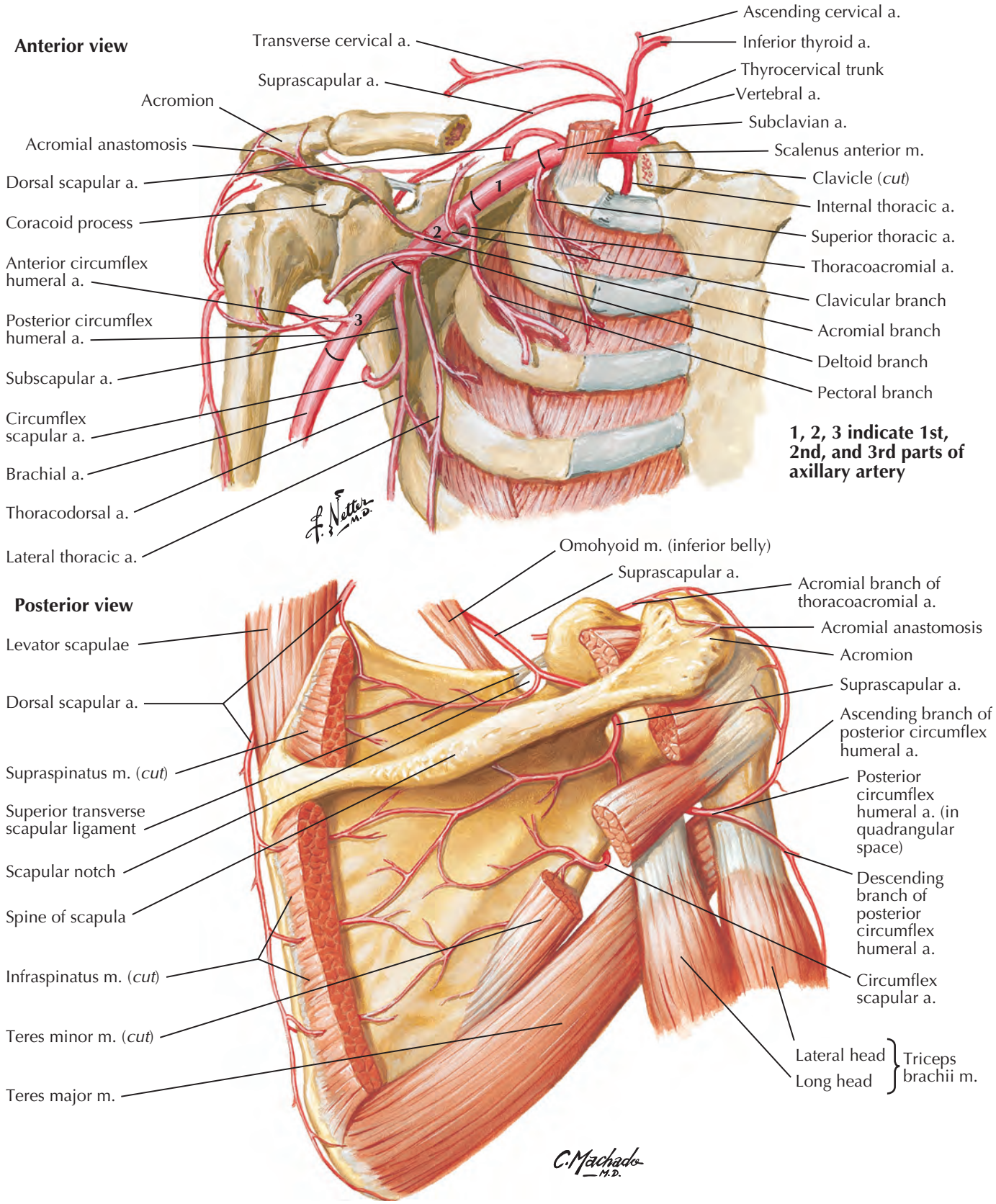
Anterior view



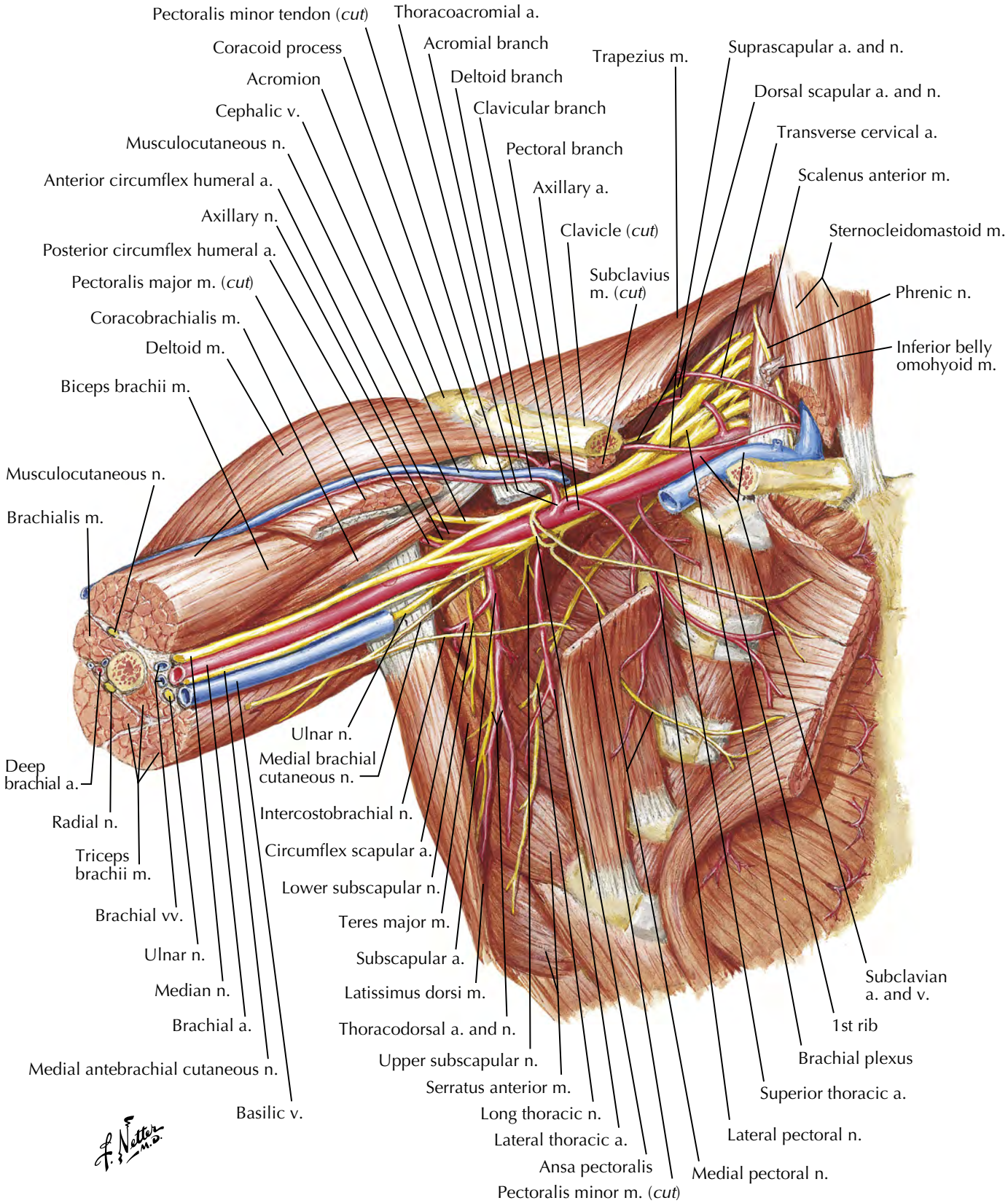
Posterior view



See also **Plates 57, 443, BP 24**

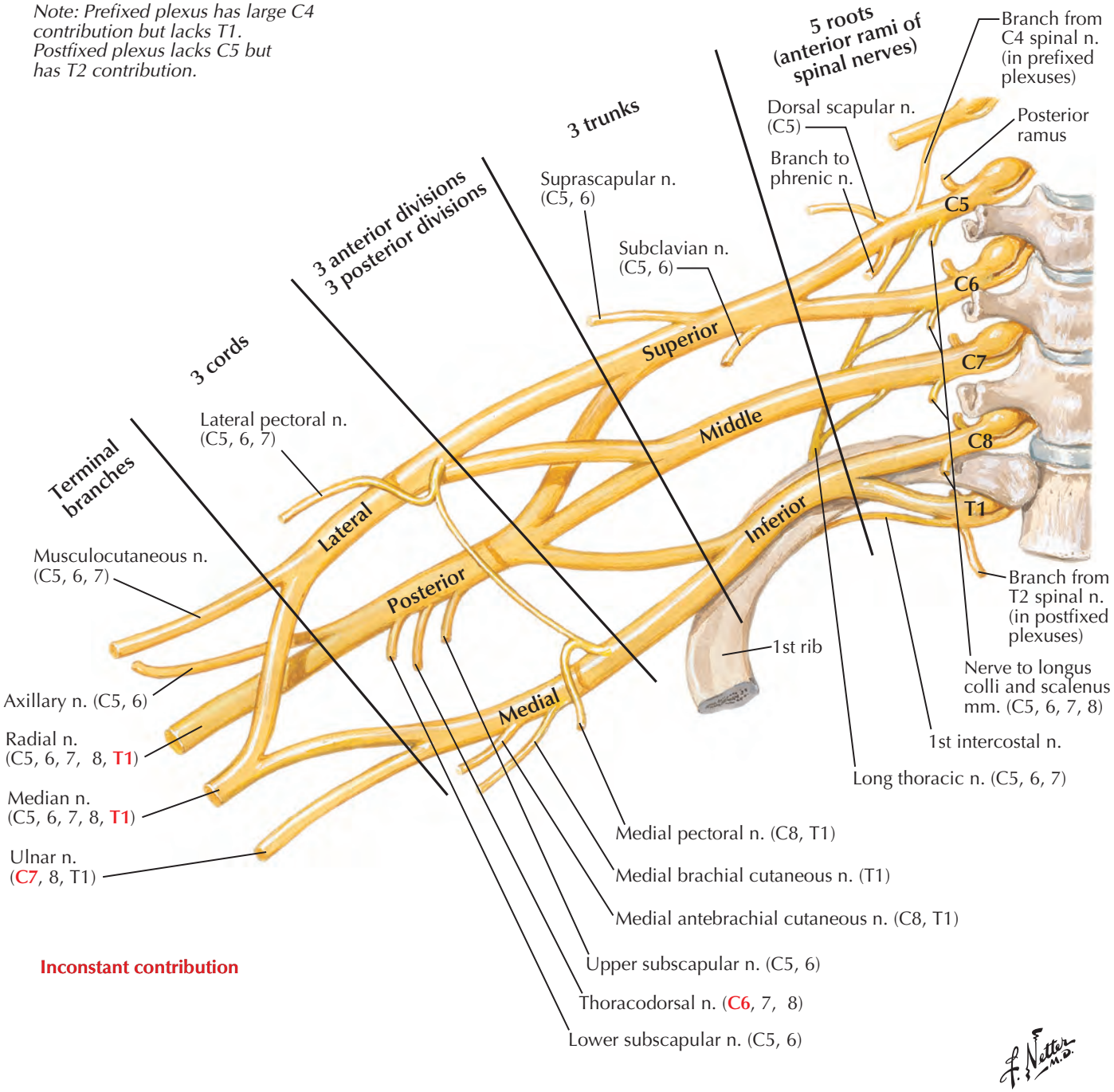


See also **Plates 433, 436, BP 41**

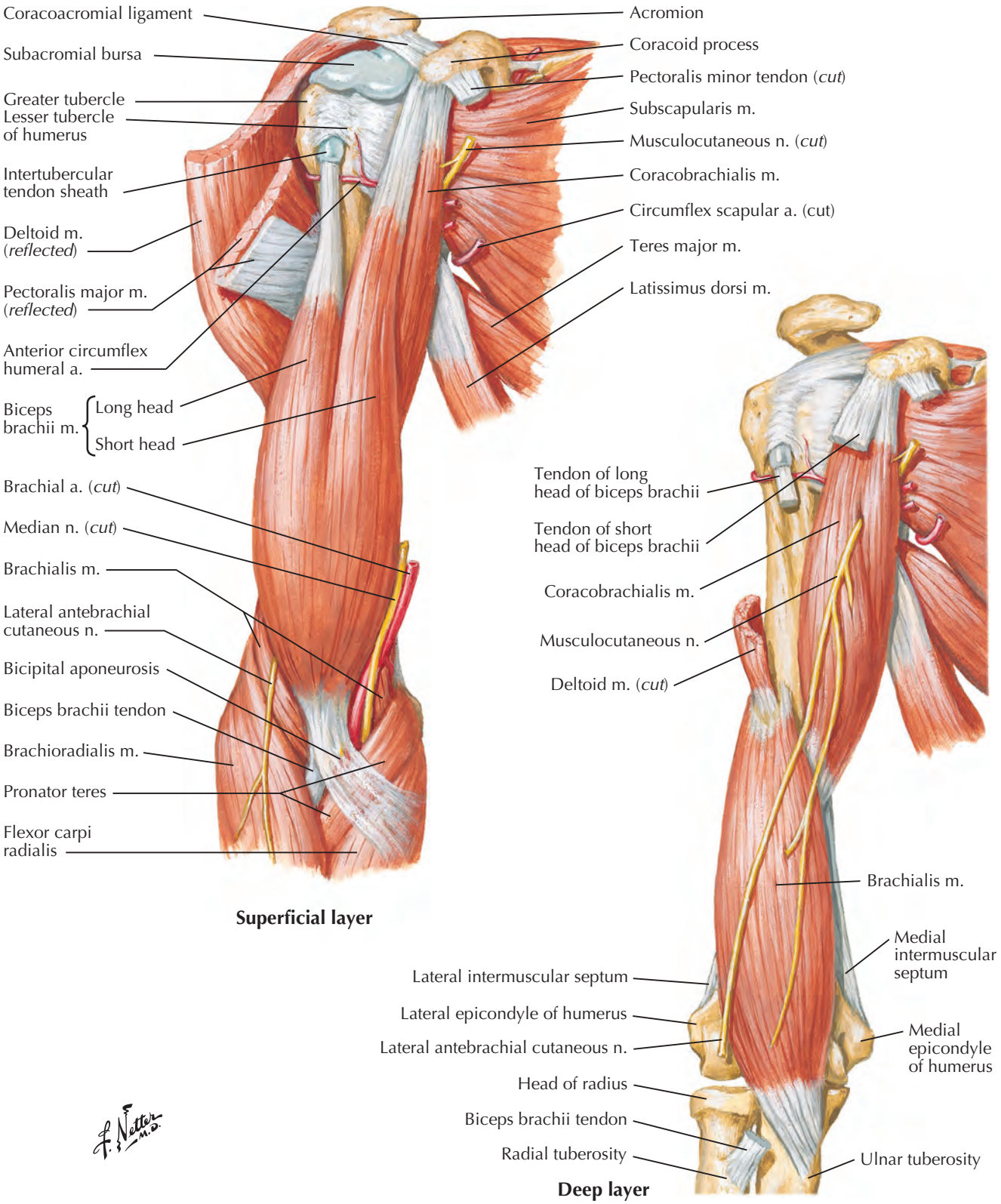


See also **Plates 483, 484**

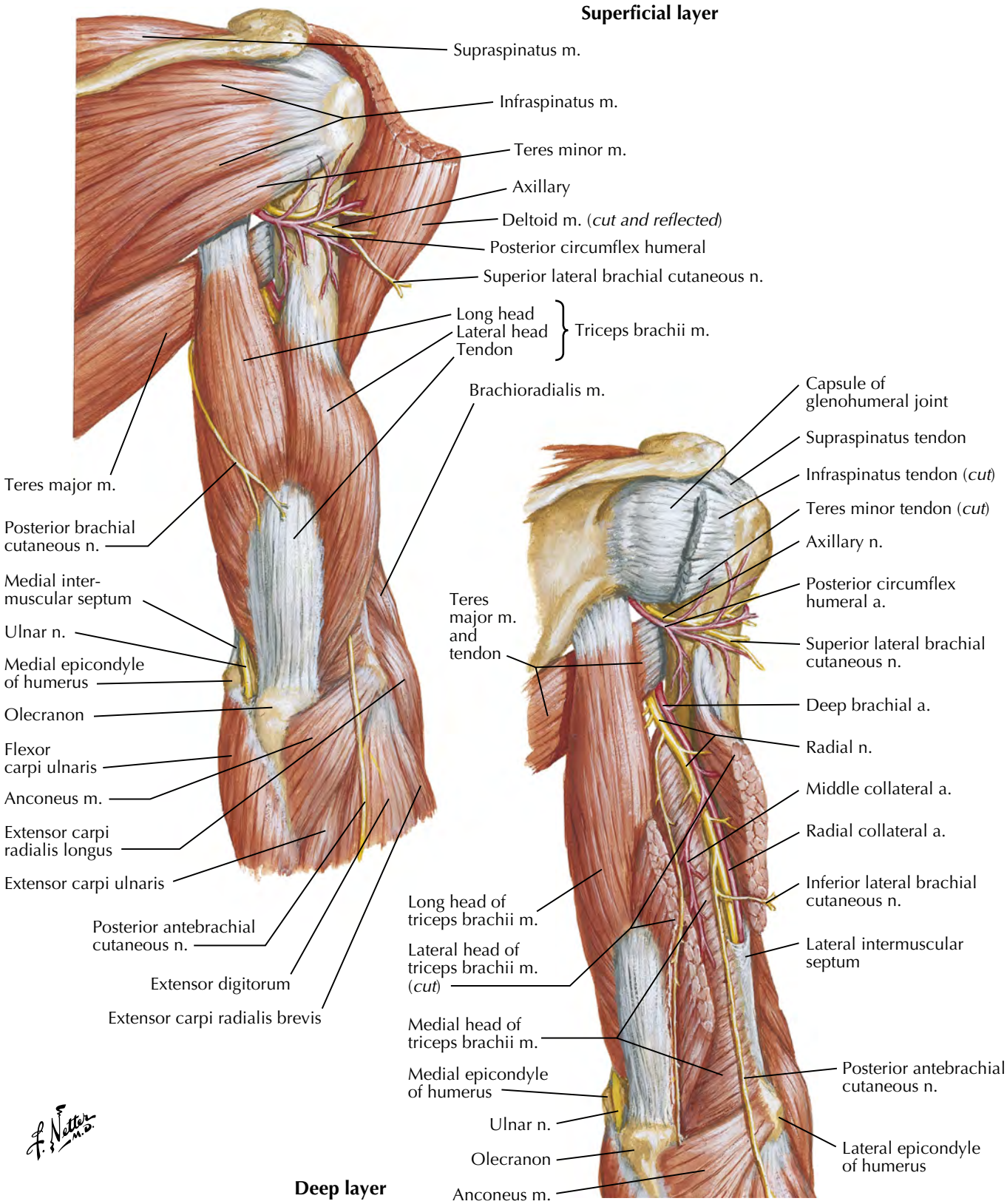
Note: Prefixed plexus has large C4 contribution but lacks T1. Postfixed plexus lacks C5 but has T2 contribution.

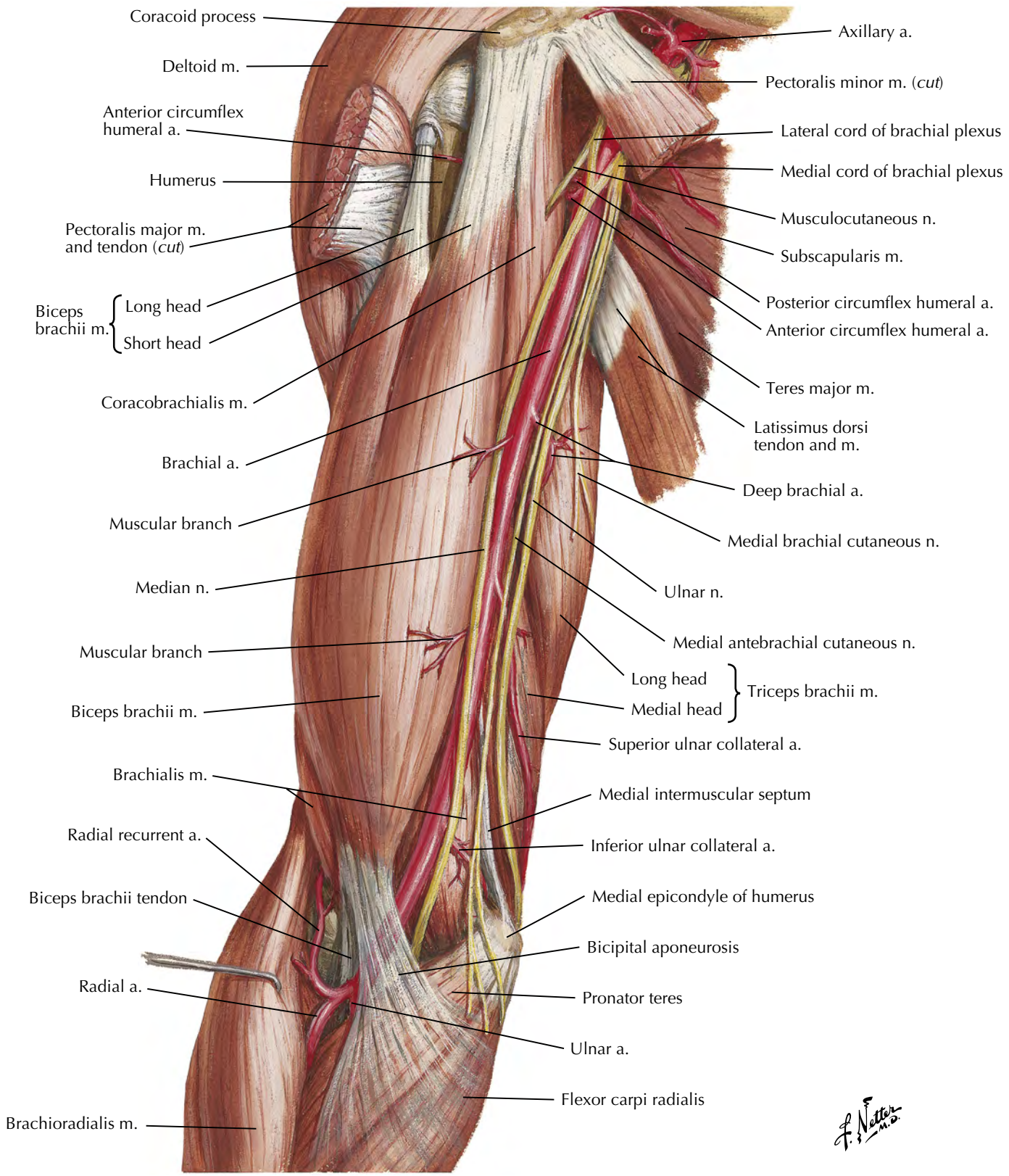


See also **Plates 434, 485**

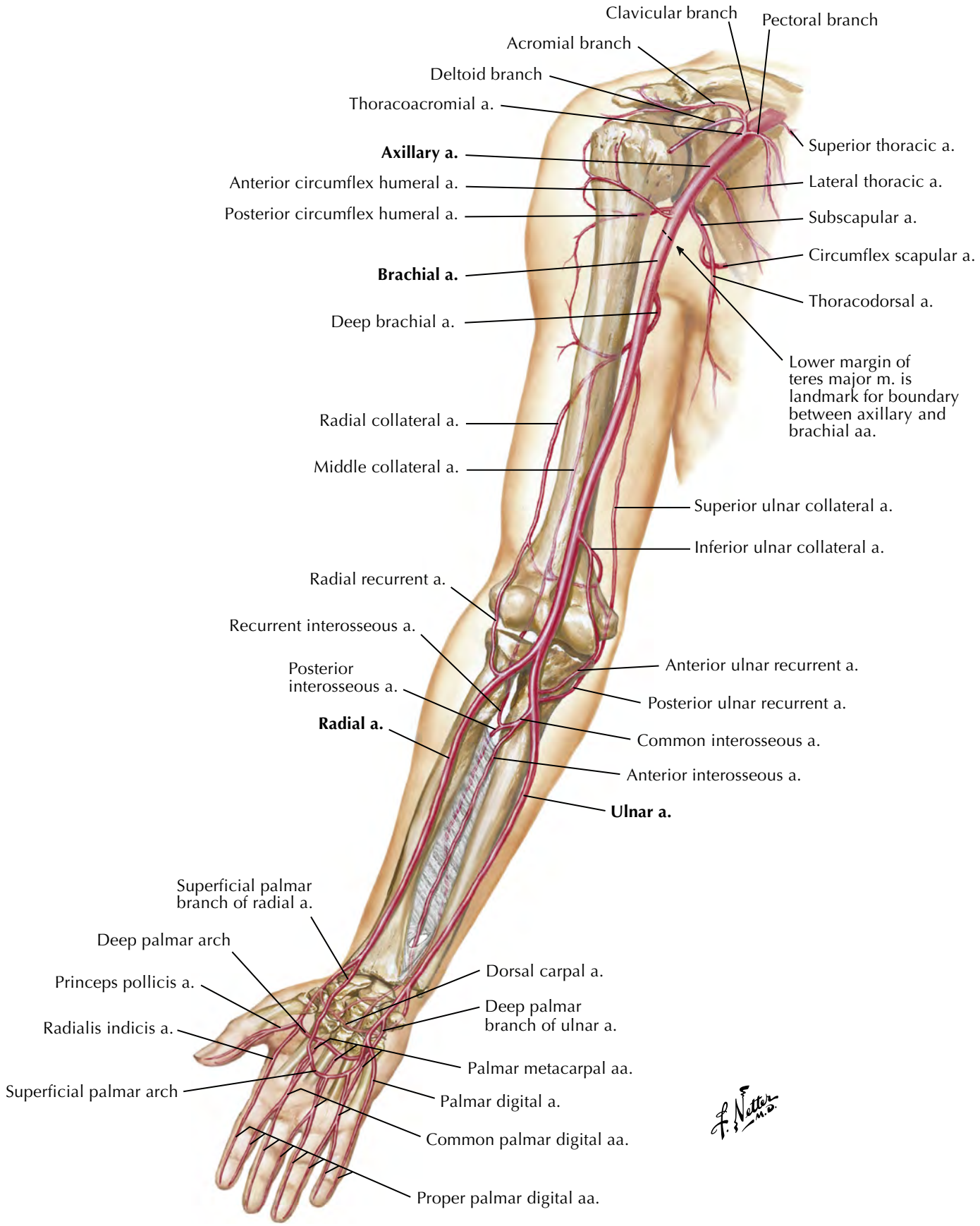


See also **Plates 434, 488**

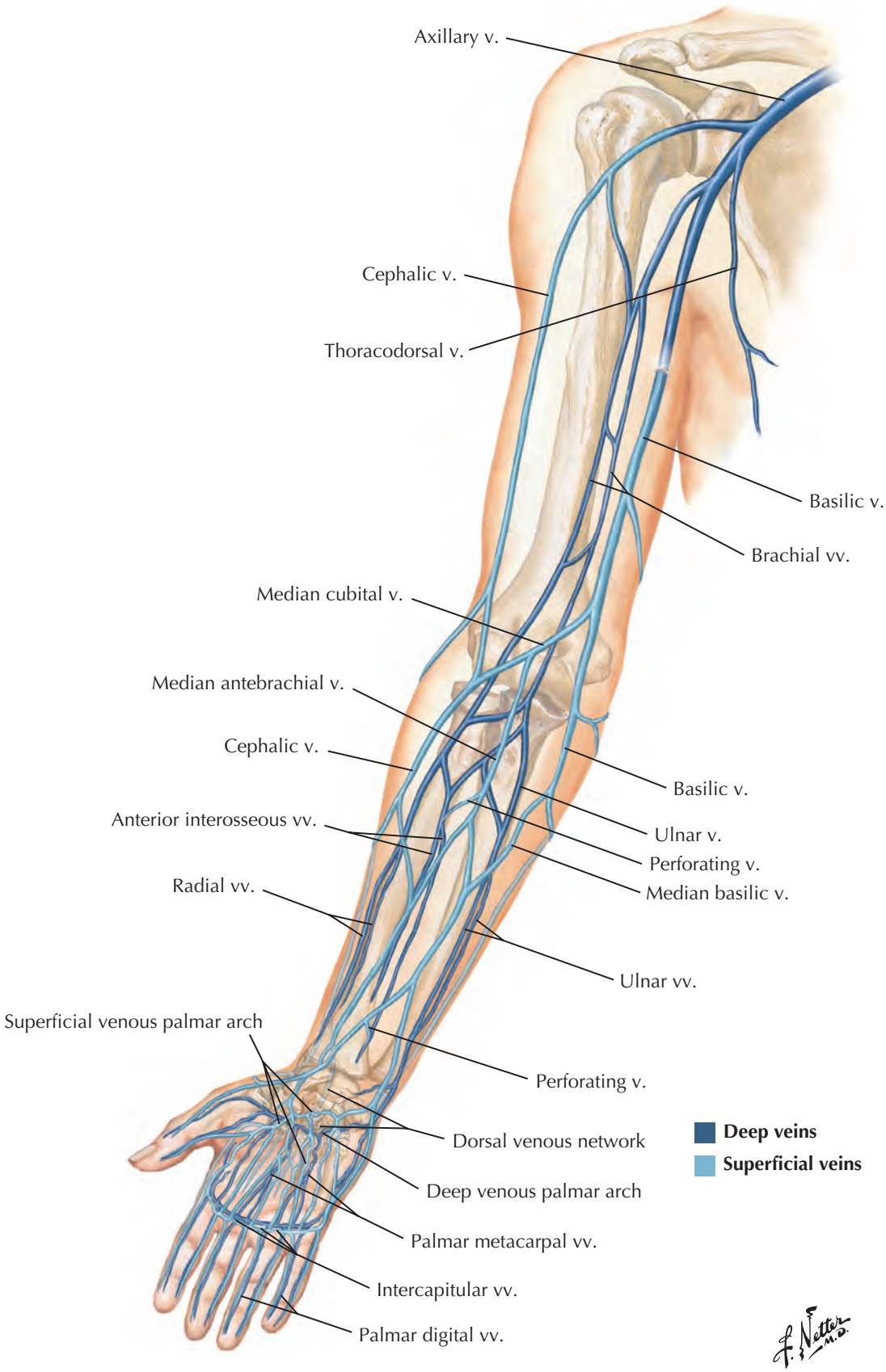


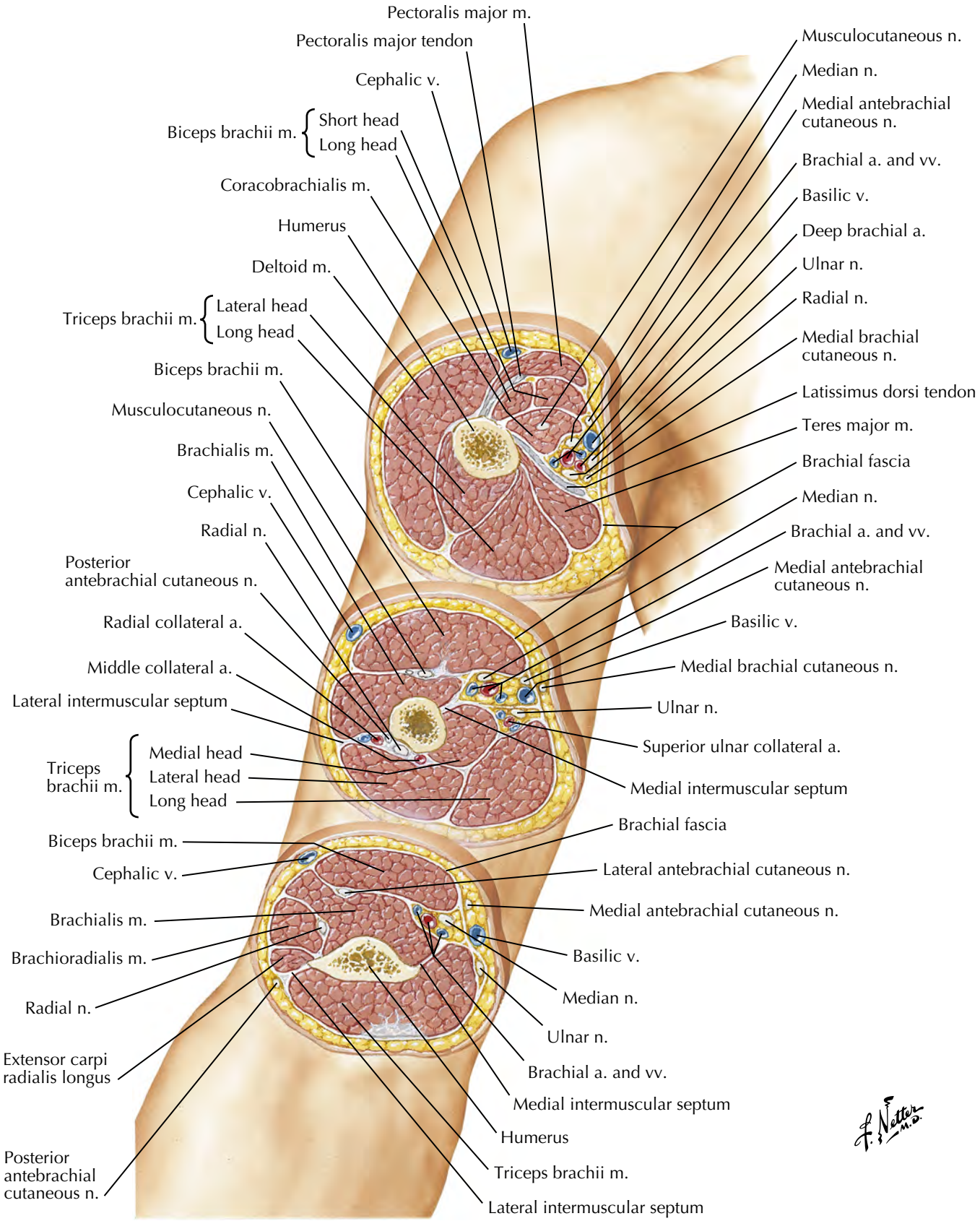

Coracoid process
Deltoid m.
Anterior circumflex humeral a.
Humerus
Pectoralis major m. and tendon (*cut*)
Biceps brachii m.
Long head
Short head
Coracobrachialis m.
Brachial a.
Muscular branch
Median n.
Muscular branch
Biceps brachii m.
Brachialis m.
Radial recurrent a.
Biceps brachii tendon
Radial a.
Brachioradialis m.
Axillary a.
Pectoralis minor m. (*cut*)
Lateral cord of brachial plexus
Medial cord of brachial plexus
Musculocutaneous n.
Subscapularis m.
Posterior circumflex humeral a.
Anterior circumflex humeral a.
Teres major m.
Latissimus dorsi tendon and m.
Deep brachial a.
Medial brachial cutaneous n.
Ulnar n.
Medial antebrachial cutaneous n.
Long head
Medial head
Triceps brachii m.
Superior ulnar collateral a.
Medial intermuscular septum
Inferior ulnar collateral a.
Medial epicondyle of humerus
Bicipital aponeurosis
Pronator teres
Ulnar a.
Flexor carpi radialis

See also **Plates 457, 476, BP 96, BP 97**

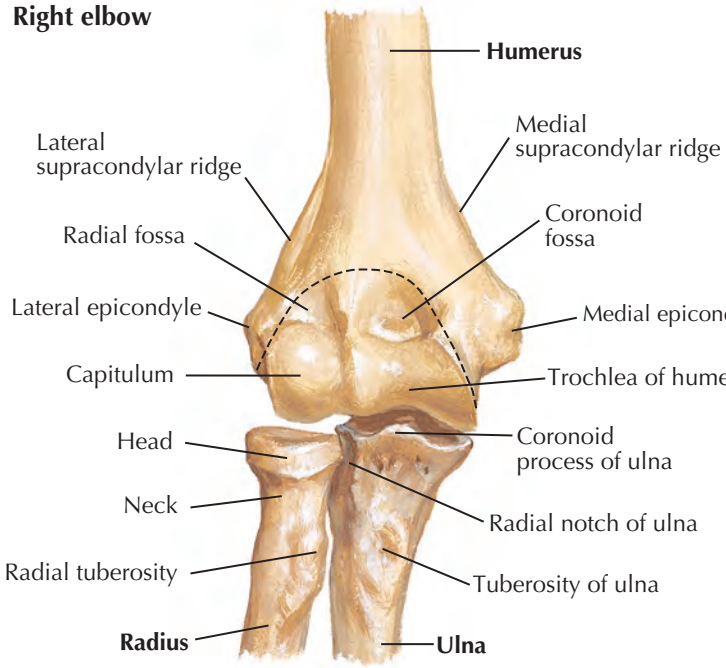


See also **Plate 426**

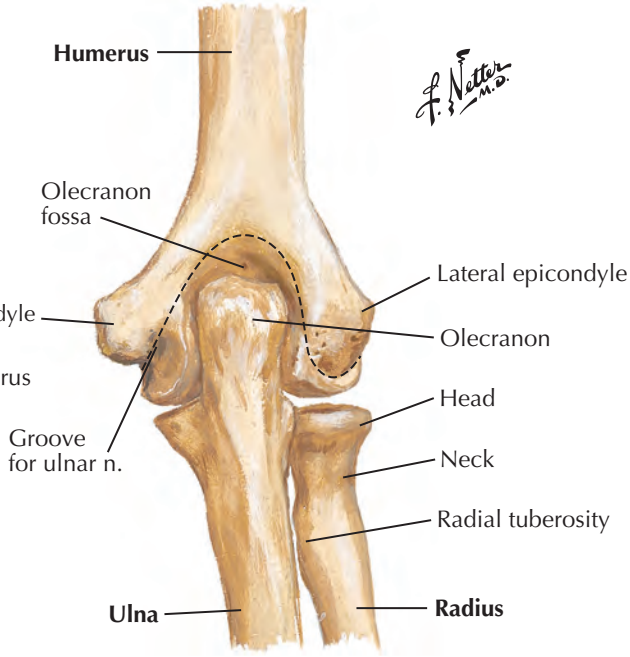



Pectoralis major m.
Pectoralis major tendon
Cephalic v.
Biceps brachii m.
Short head
Long head
Coracobrachialis m.
Humerus
Deltoid m.
Triceps brachii m.
Lateral head
Long head
Biceps brachii m.
Musculocutaneous n.
Brachialis m.
Cephalic v.
Radial n.
Posterior antebrachial cutaneous n.
Radial collateral a.
Middle collateral a.
Lateral intermuscular septum
Triceps brachii m.
Medial head
Lateral head
Long head
Biceps brachii m.
Cephalic v.
Brachialis m.
Brachioradialis m.
Radial n.
Extensor carpi radialis longus
Posterior antebrachial cutaneous n.
Musculocutaneous n.
Median n.
Medial antebrachial cutaneous n.
Brachial a. and vv.
Basilic v.
Deep brachial a.
Ulnar n.
Radial n.
Medial brachial cutaneous n.
Latissimus dorsi tendon
Teres major m.
Brachial fascia
Median n.
Brachial a. and vv.
Medial antebrachial cutaneous n.
Basilic v.
Medial brachial cutaneous n.
Ulnar n.
Superior ulnar collateral a.
Medial intermuscular septum
Brachial fascia
Lateral antebrachial cutaneous n.
Medial antebrachial cutaneous n.
Basilic v.
Median n.
Ulnar n.
Brachial a. and vv.
Medial intermuscular septum
Humerus
Triceps brachii m.
Lateral intermuscular septum

Right elbow

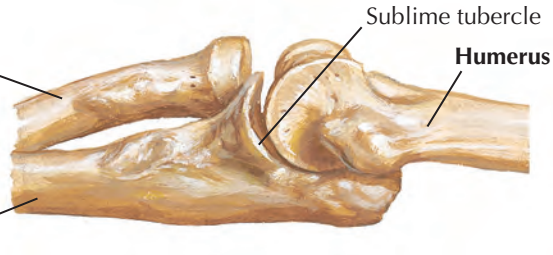


In extension: anterior view

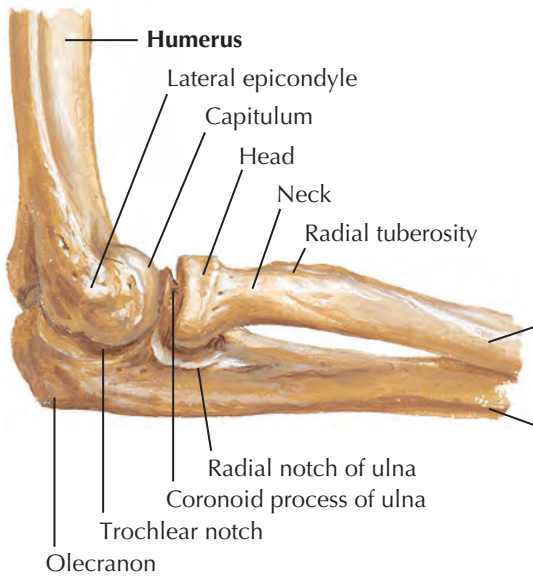


In extension: posterior view

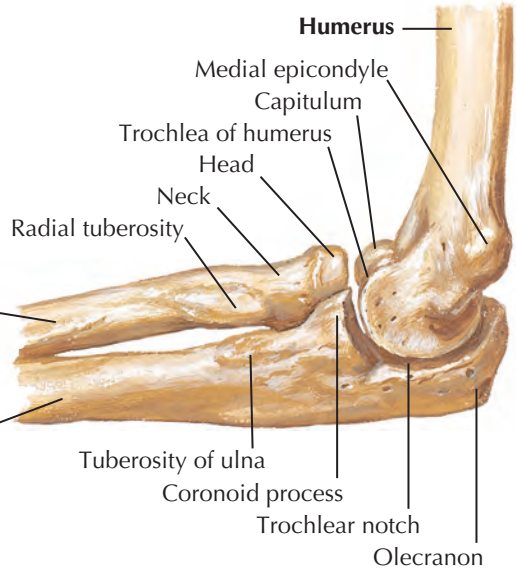
In extension: lateral view



In extension: medial view

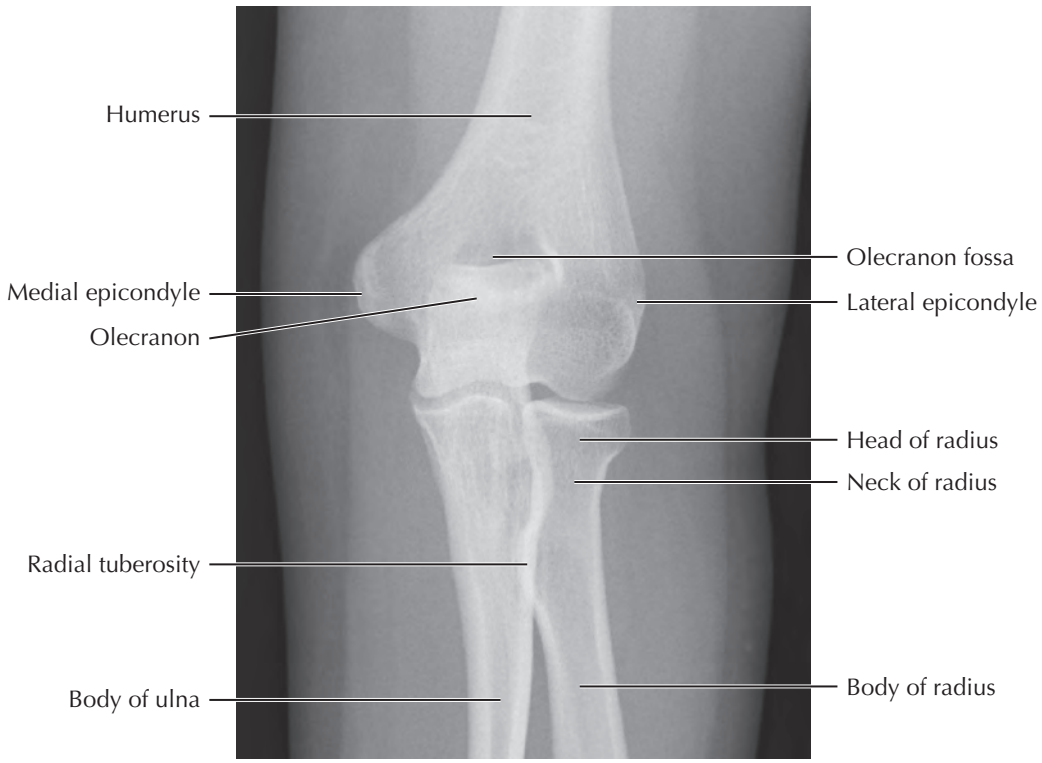


In 90 degrees of flexion: lateral view

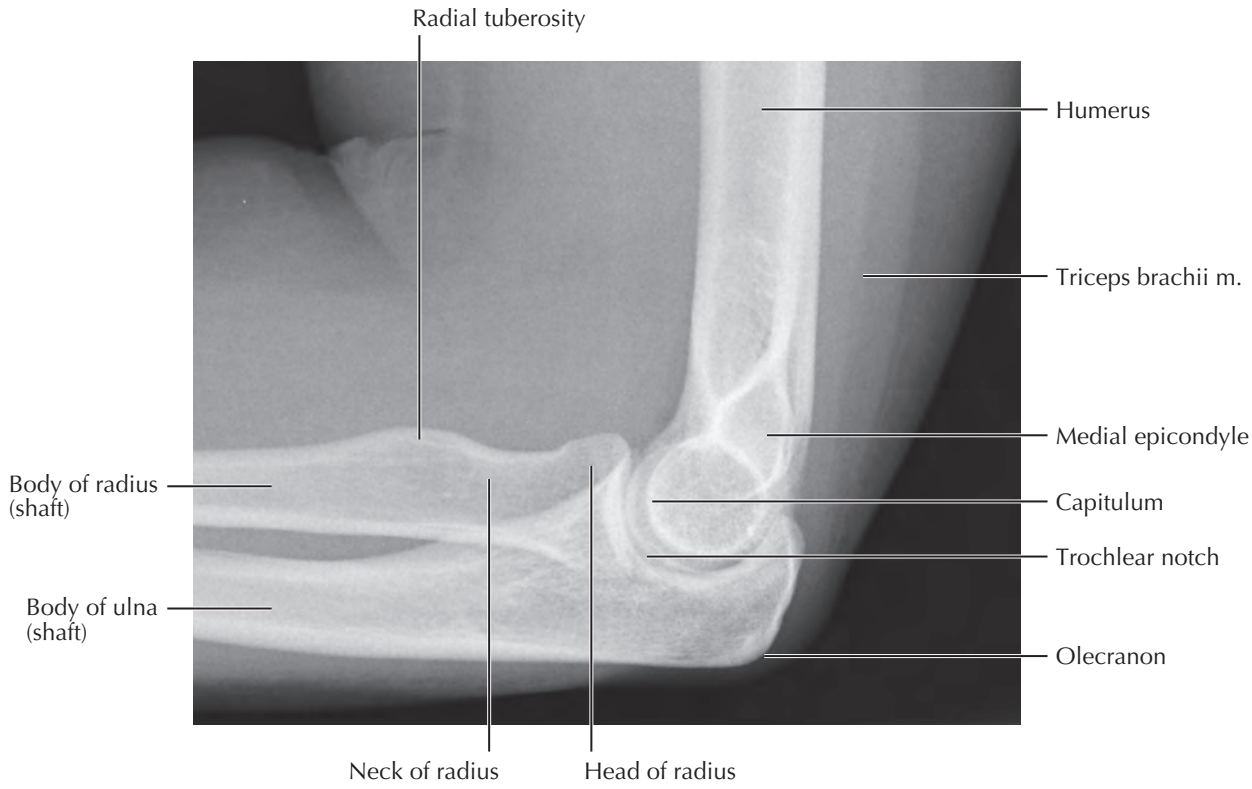


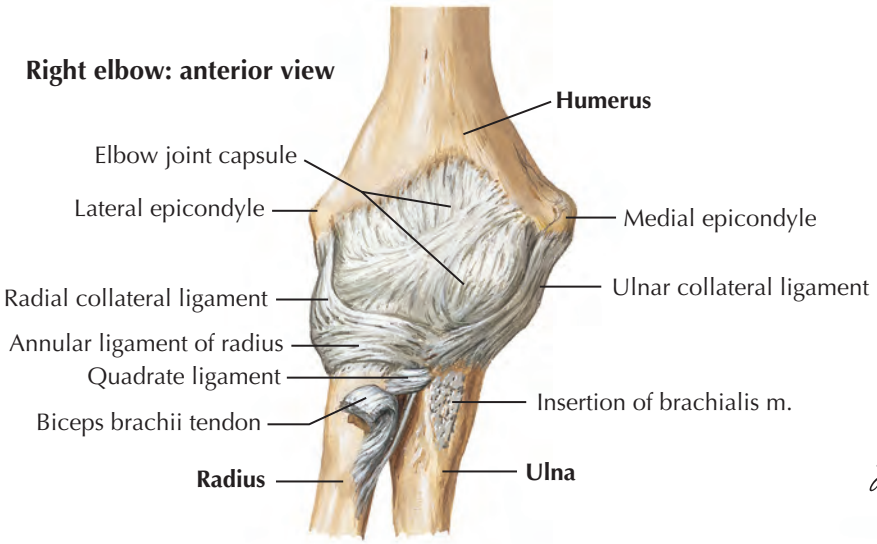
In 90 degrees of flexion: medial view

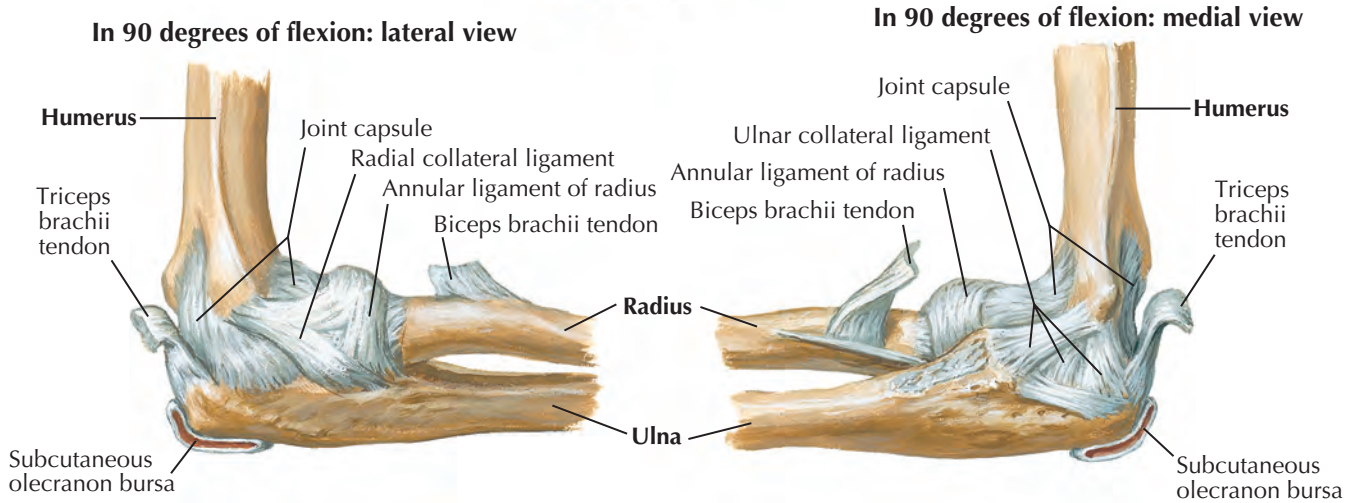
Anteroposterior view

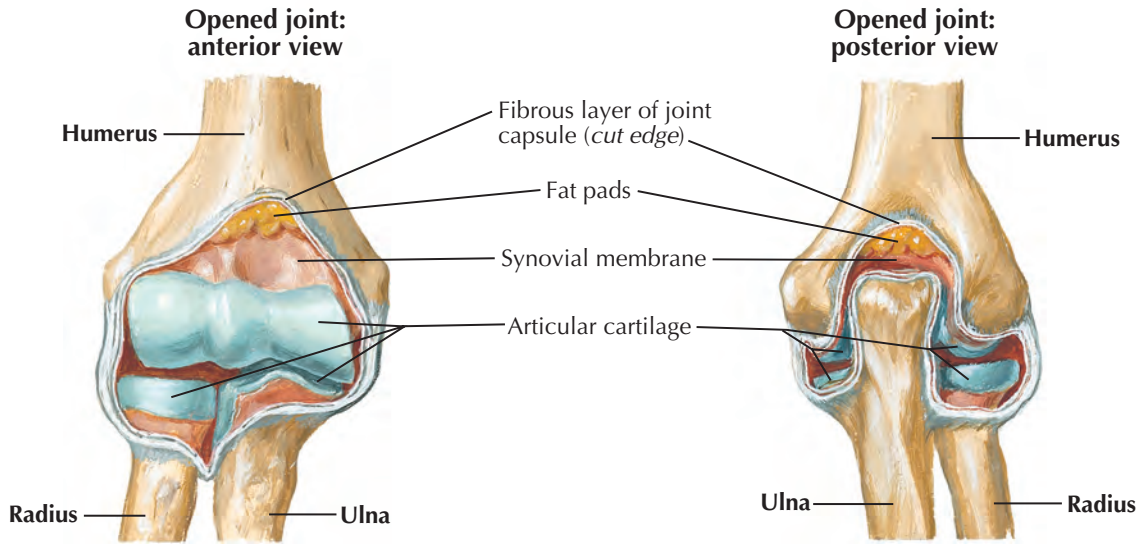


Lateral view

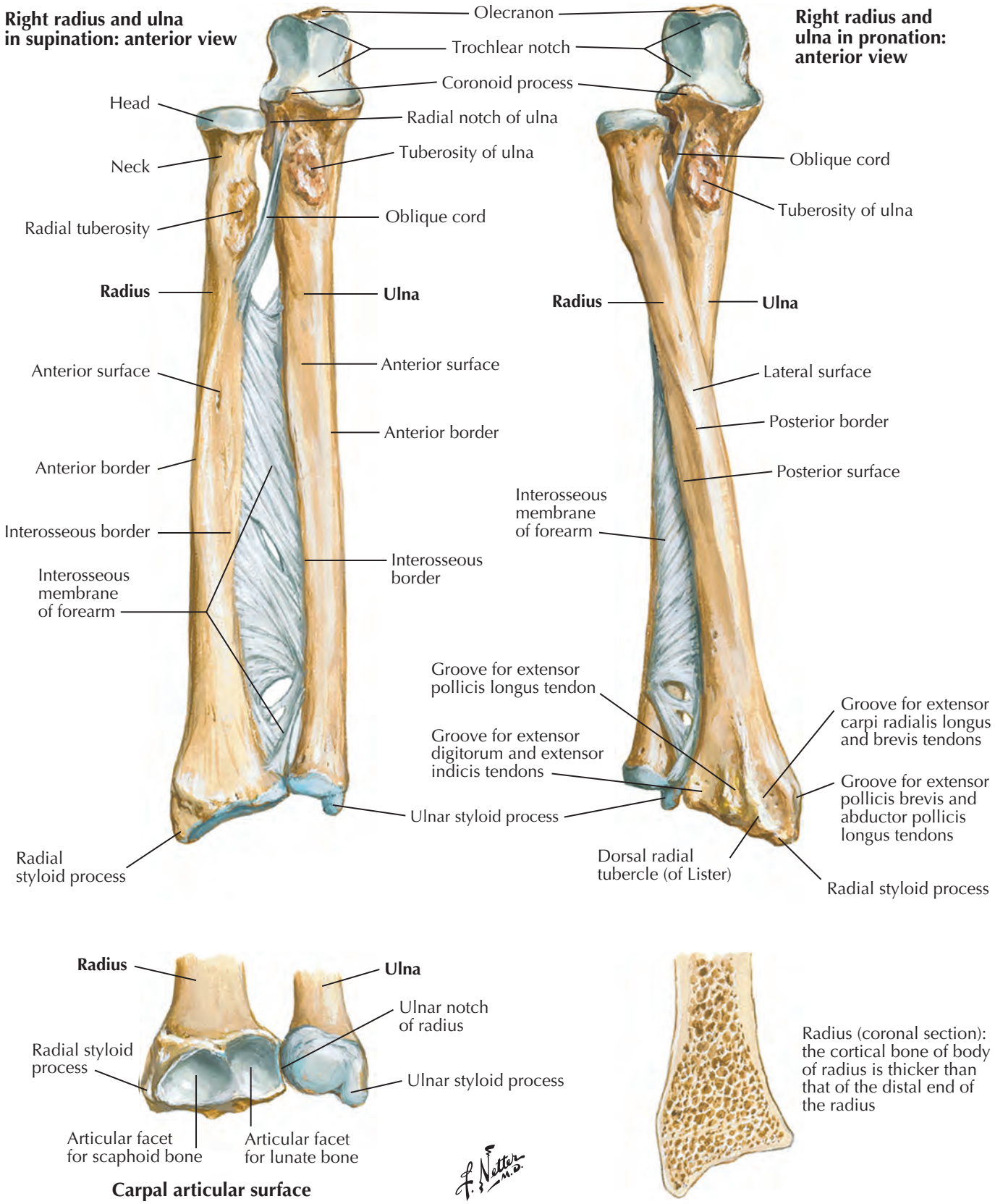



Right elbow: anterior view
Humerus
Elbow joint capsule
Lateral epicondyle
Medial epicondyle
Radial collateral ligament
Ulnar collateral ligament
Annular ligament of radius
Quadrate ligament
Insertion of brachialis m.
Biceps brachii tendon
Radius
Ulna

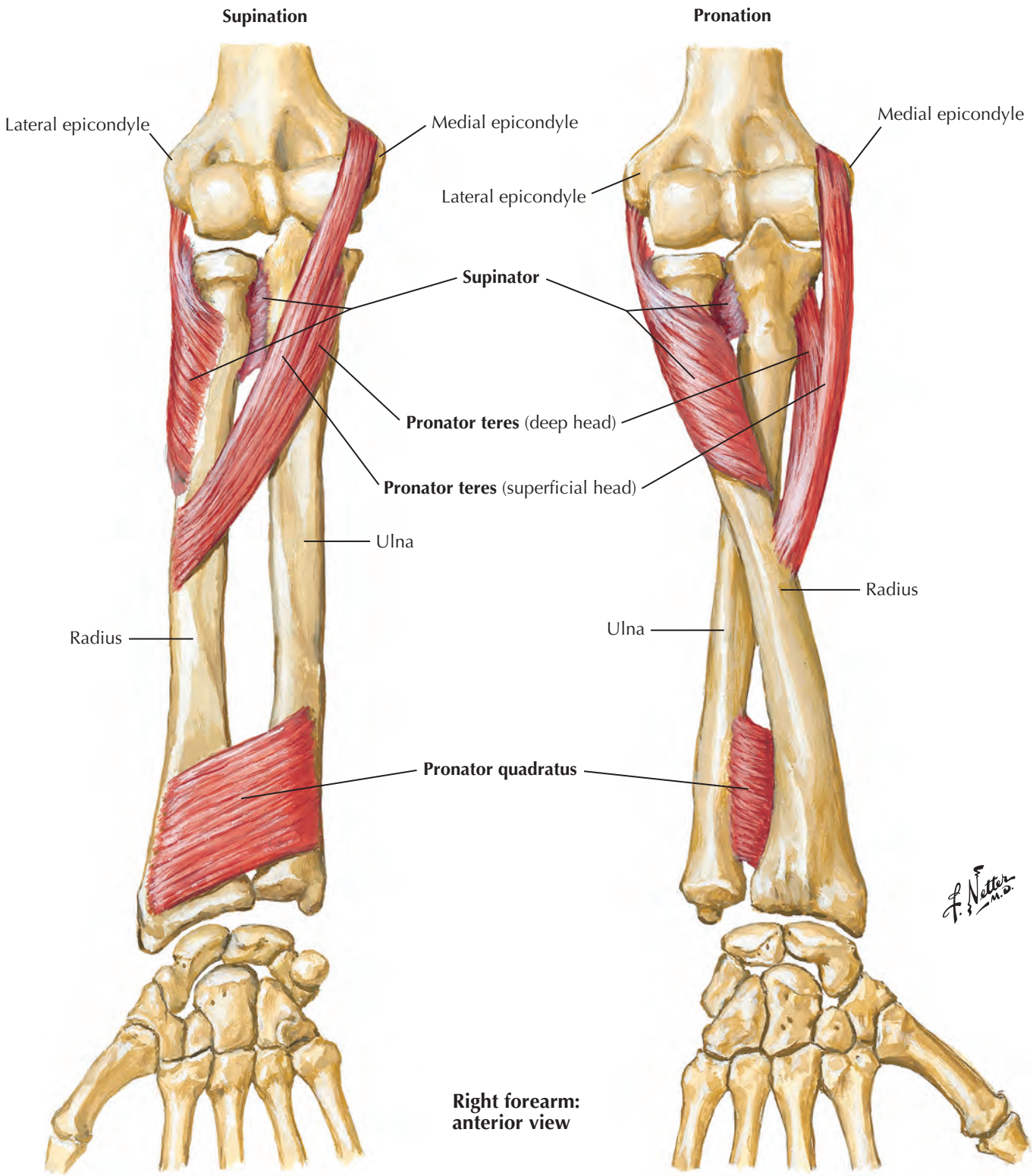

In 90 degrees of flexion: lateral view
Humerus
Joint capsule
Radial collateral ligament
Annular ligament of radius
Biceps brachii tendon
Triceps brachii tendon
Radius
Ulna
Subcutaneous olecranon bursa
In 90 degrees of flexion: medial view
Joint capsule
Humerus
Ulnar collateral ligament
Annular ligament of radius
Biceps brachii tendon
Triceps brachii tendon
Subcutaneous olecranon bursa


Opened joint: anterior view
Humerus
Fibrous layer of joint capsule (cut edge)
Fat pads
Synovial membrane
Articular cartilage
Radius
Ulna
Opened joint: posterior view
Humerus
Ulna
Radius

See also **Plate 460**

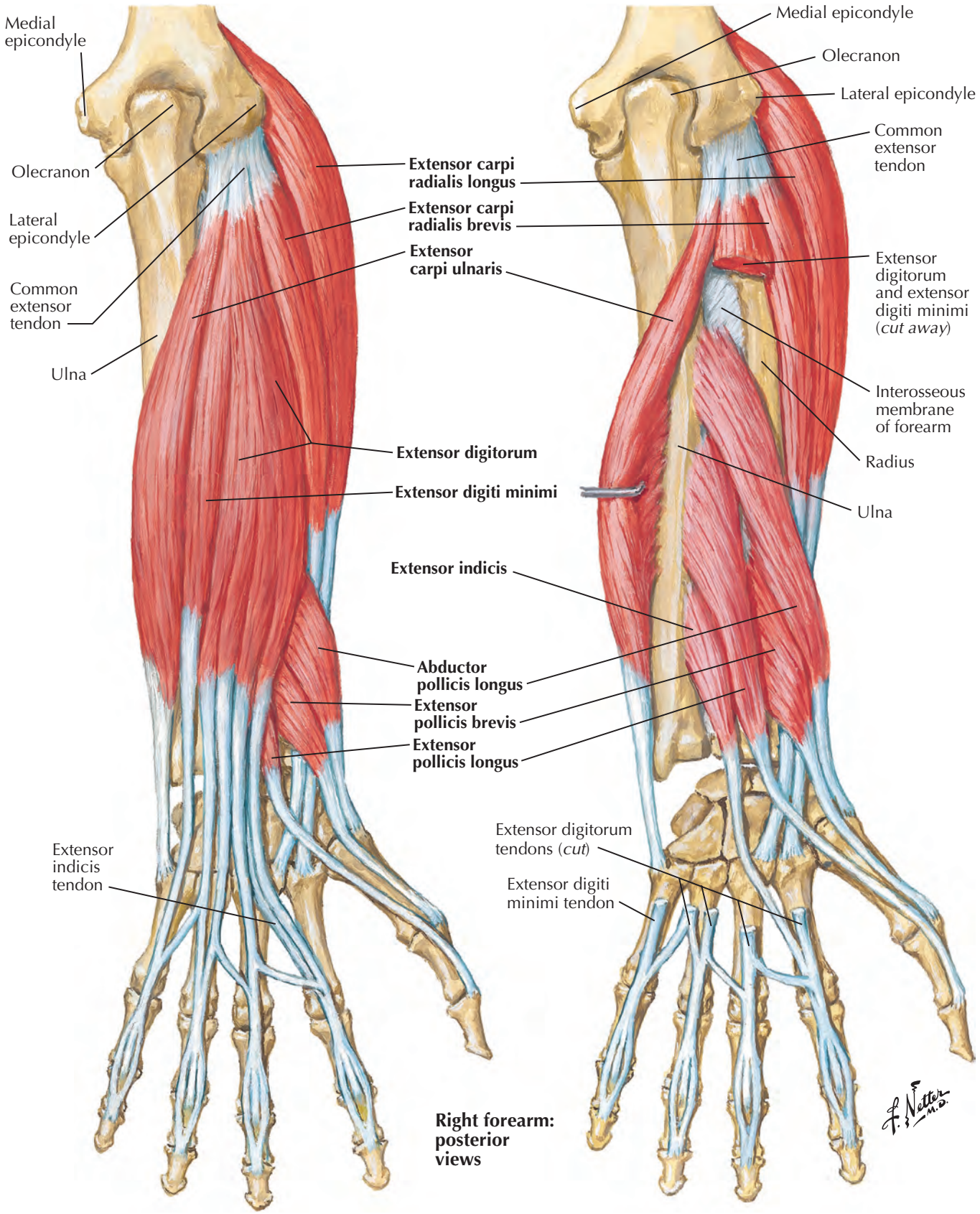


See also **Plate 458**

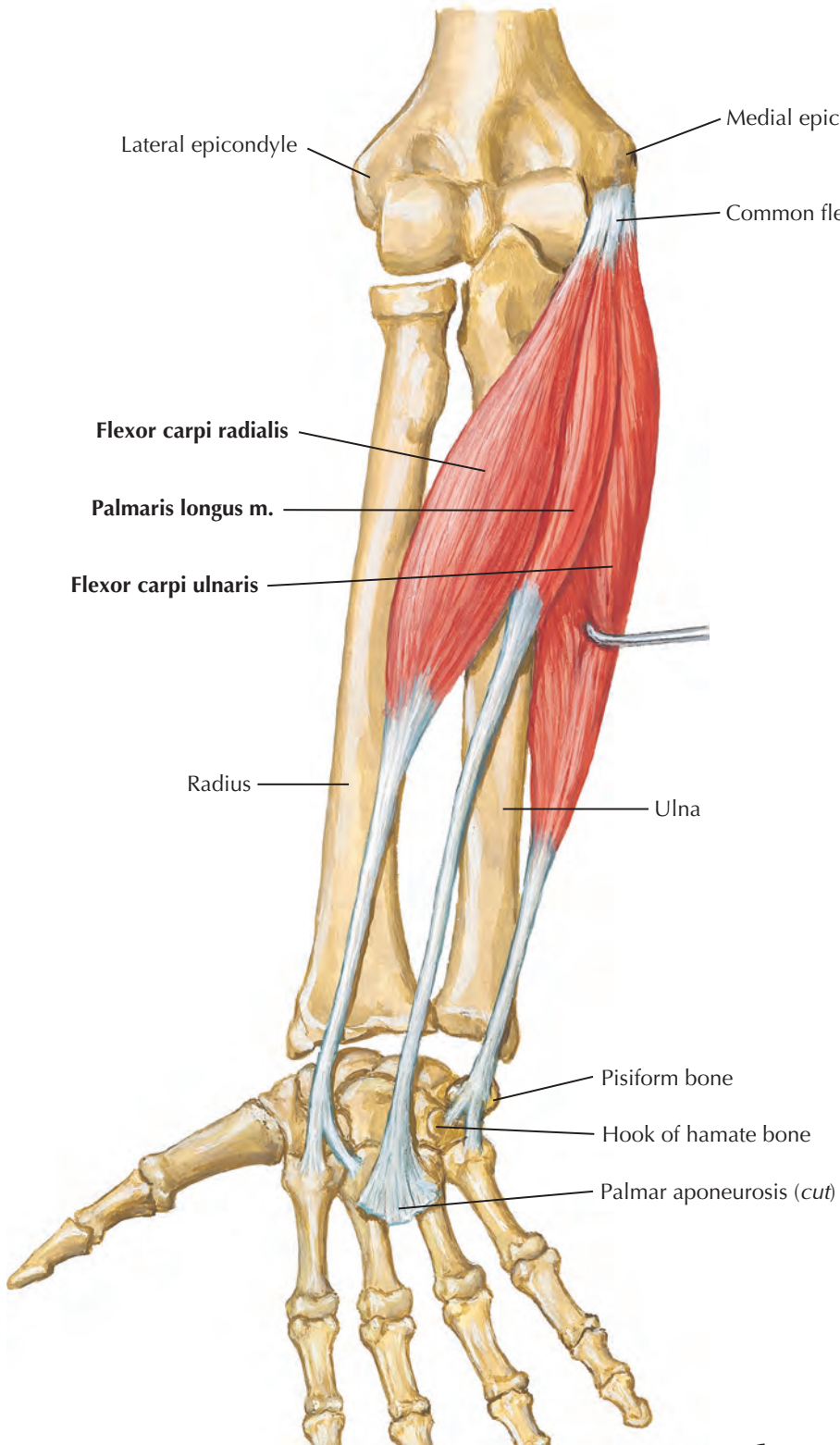


Right forearm: anterior view

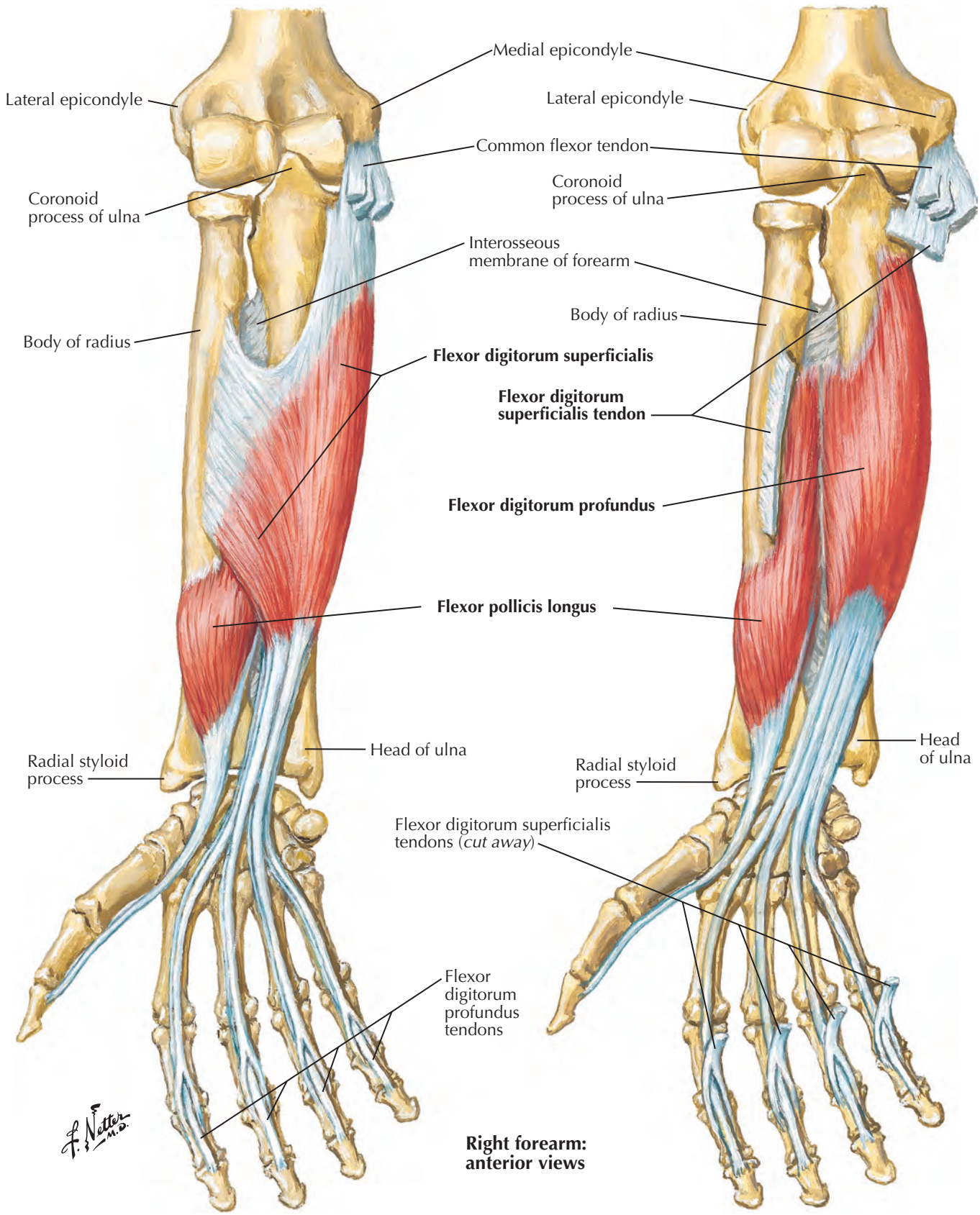
See also **Plate 461**



Right forearm: posterior views

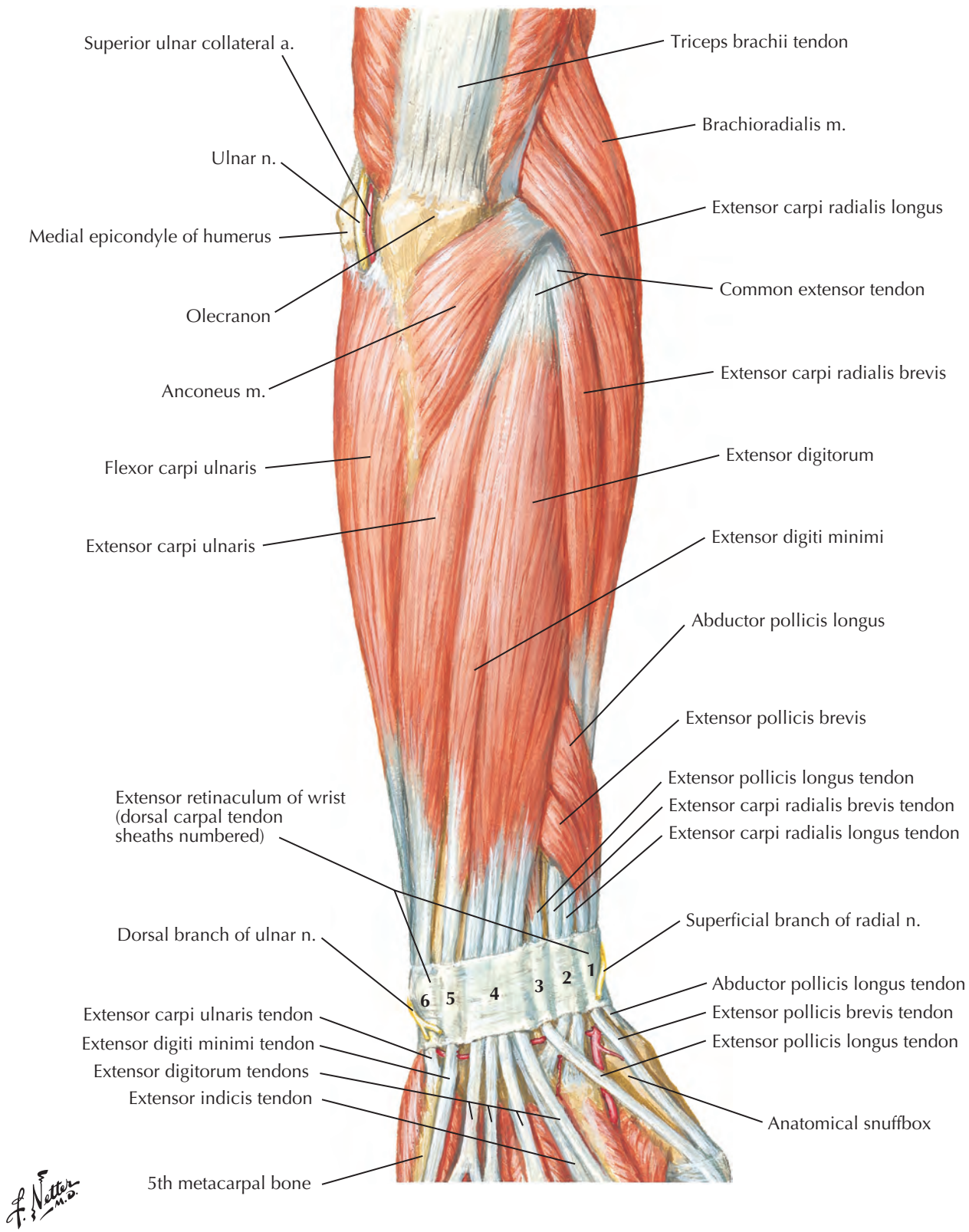


Right forearm: anterior view

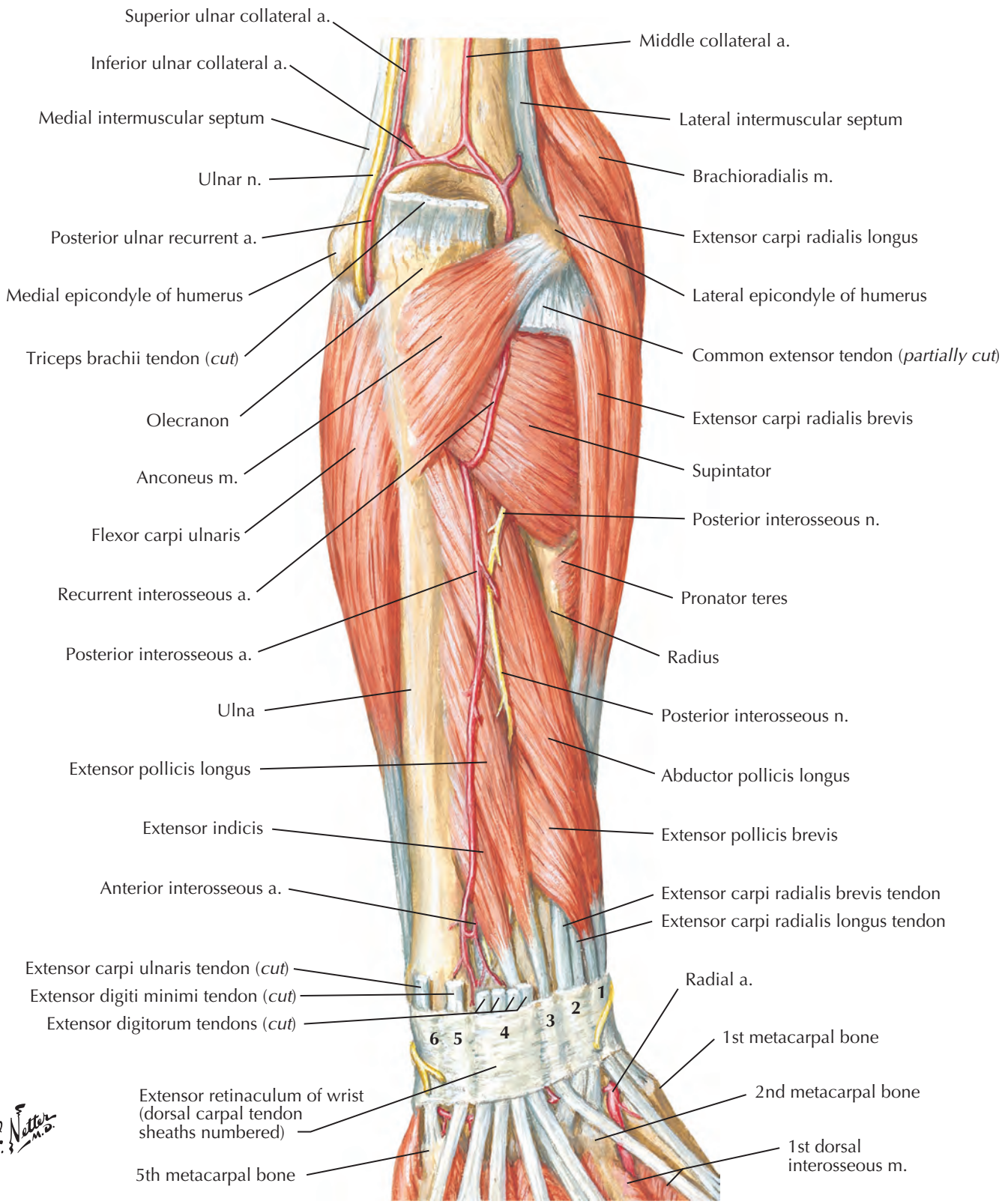


Right forearm: anterior views

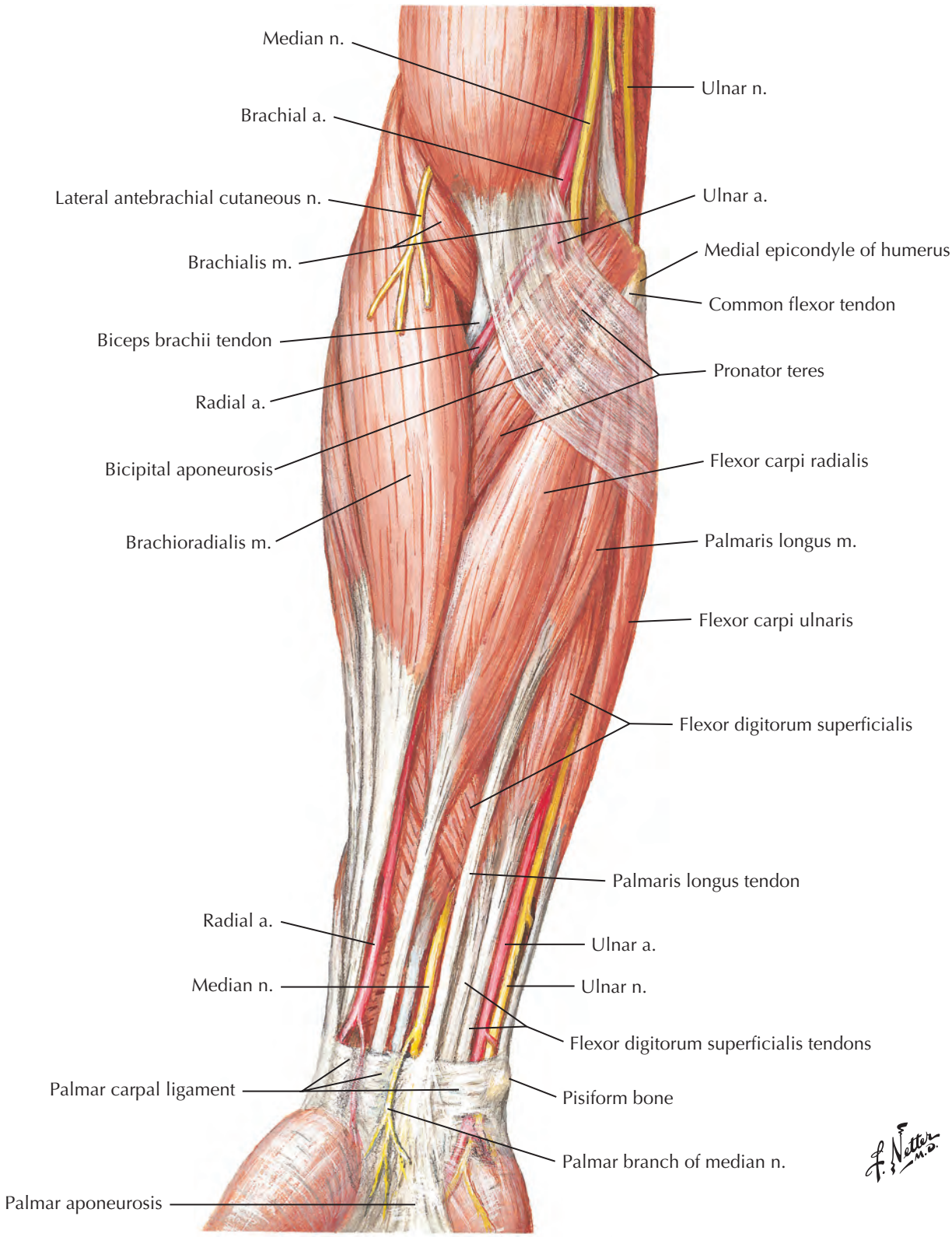
See also **Plates 480, 489**



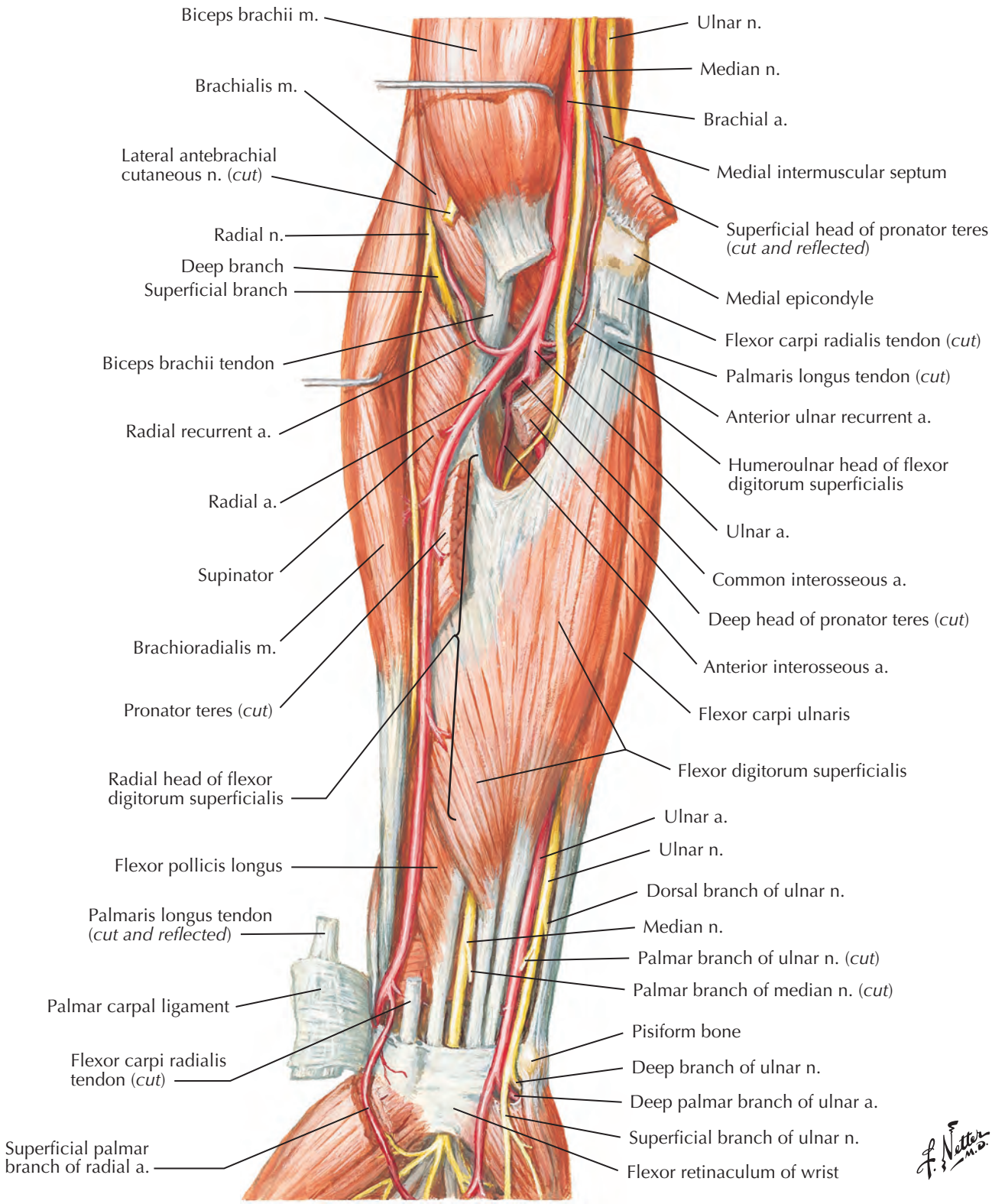
See also **Plate 480**



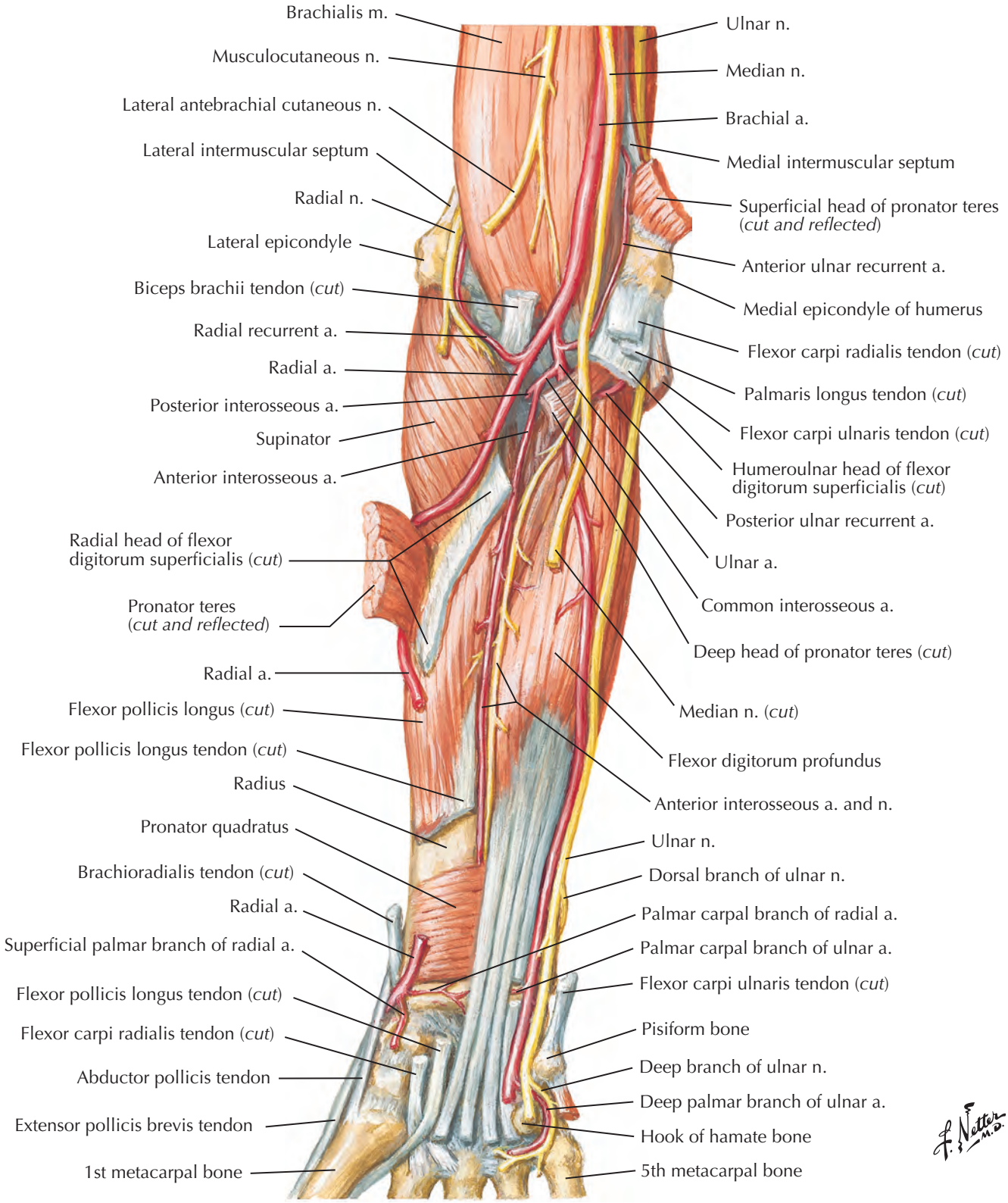
See also **Plates 486, 487**

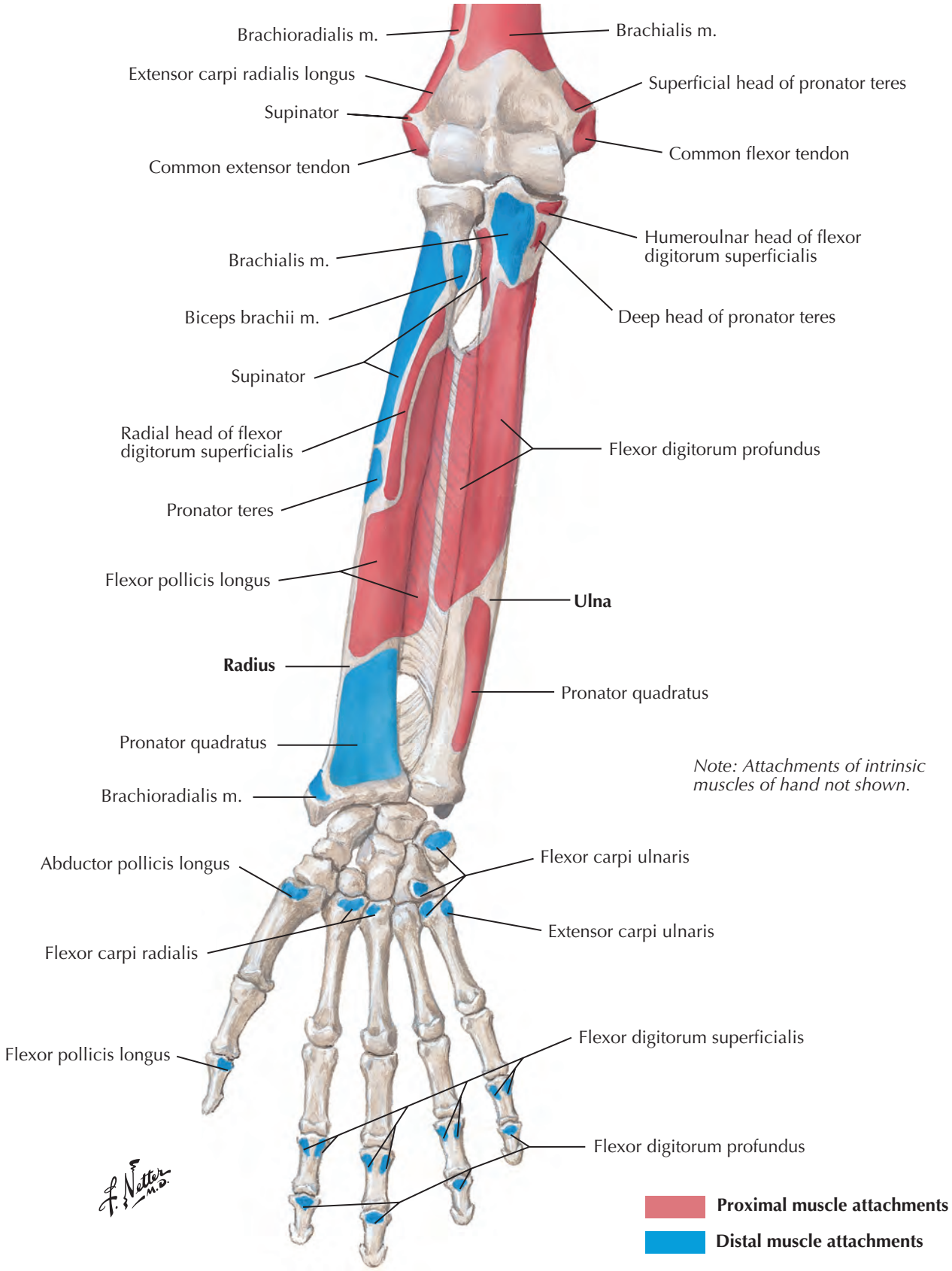


See also **Plates 443, 486**

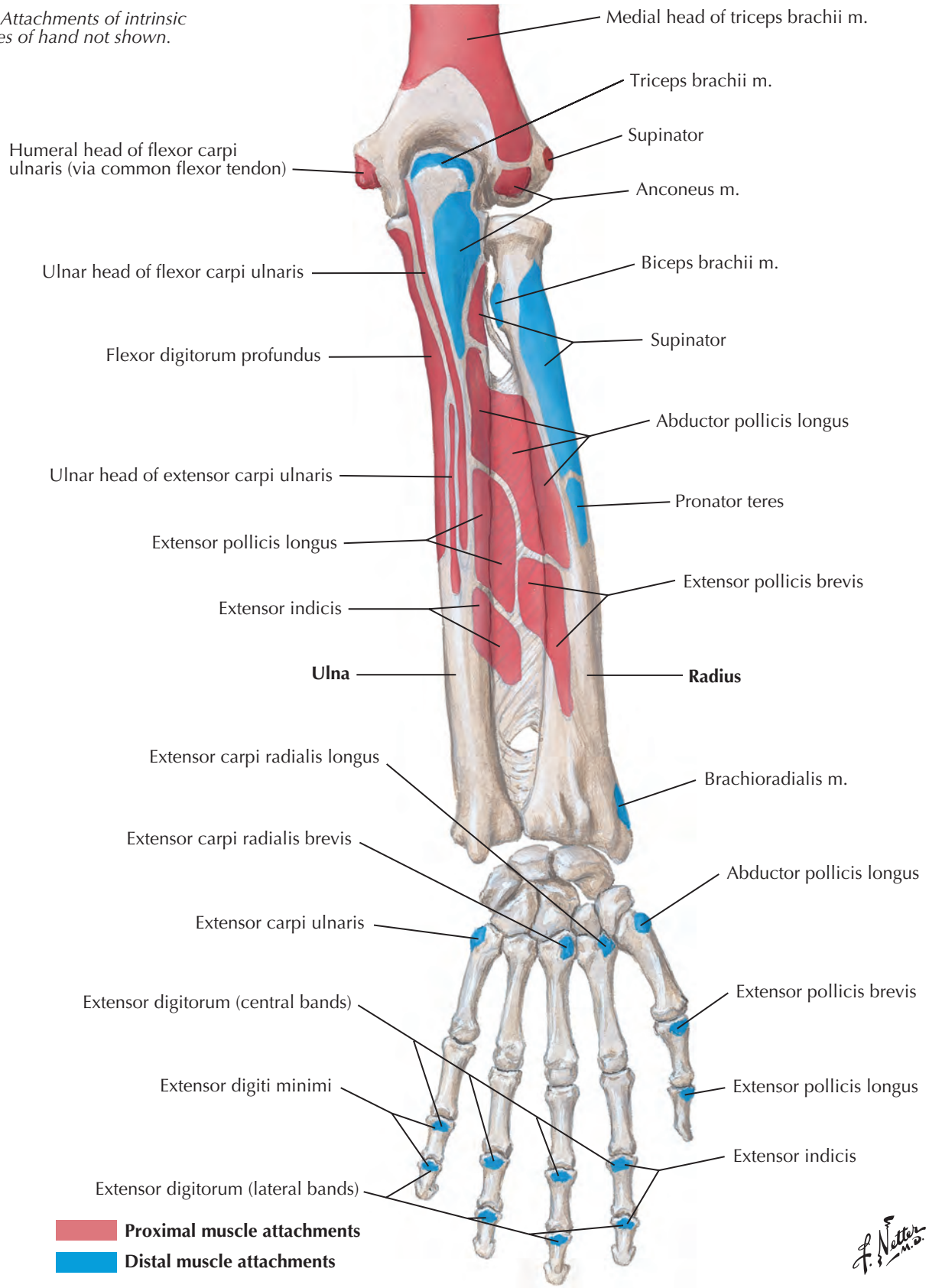


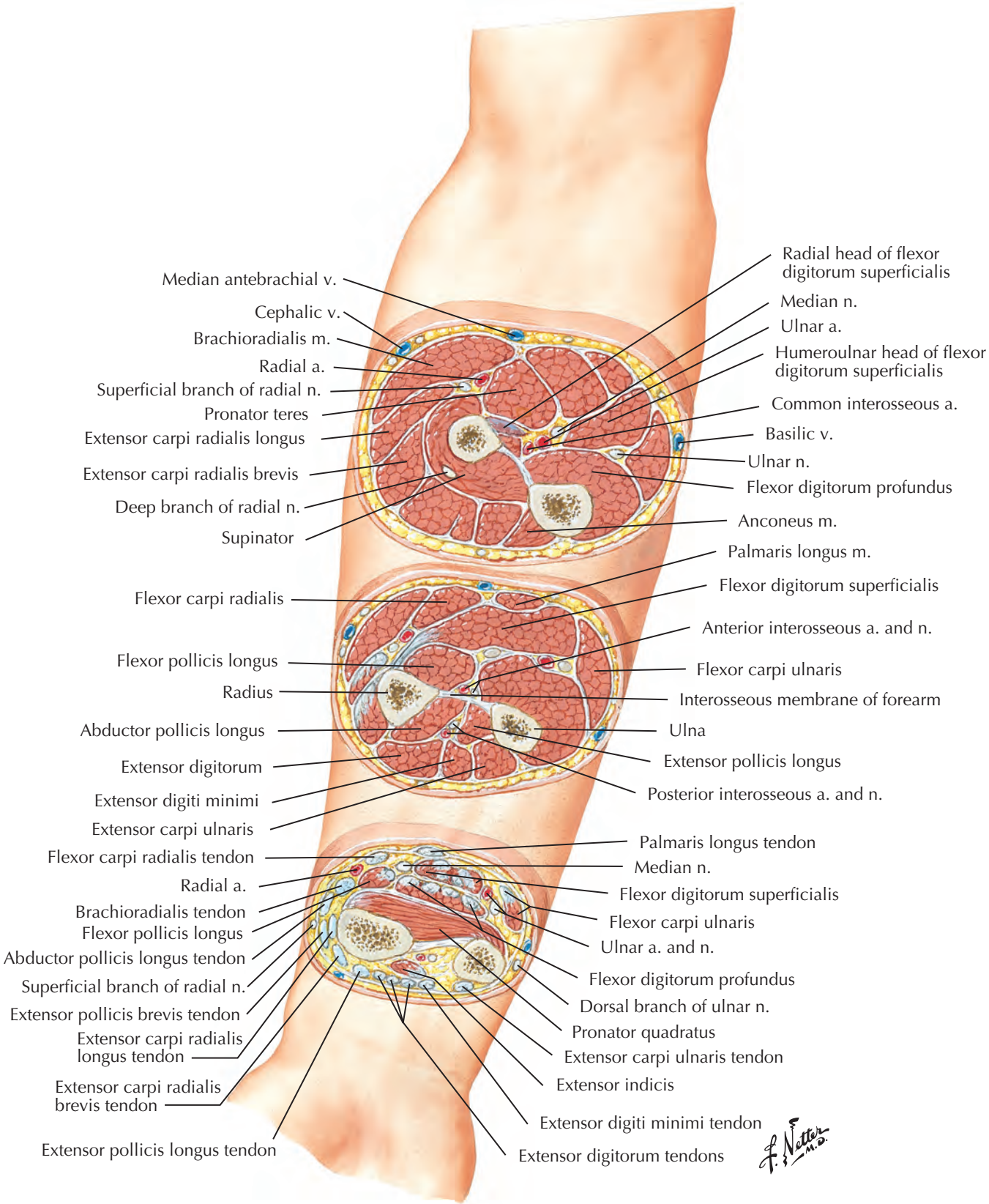
See also **Plates 440, 487**

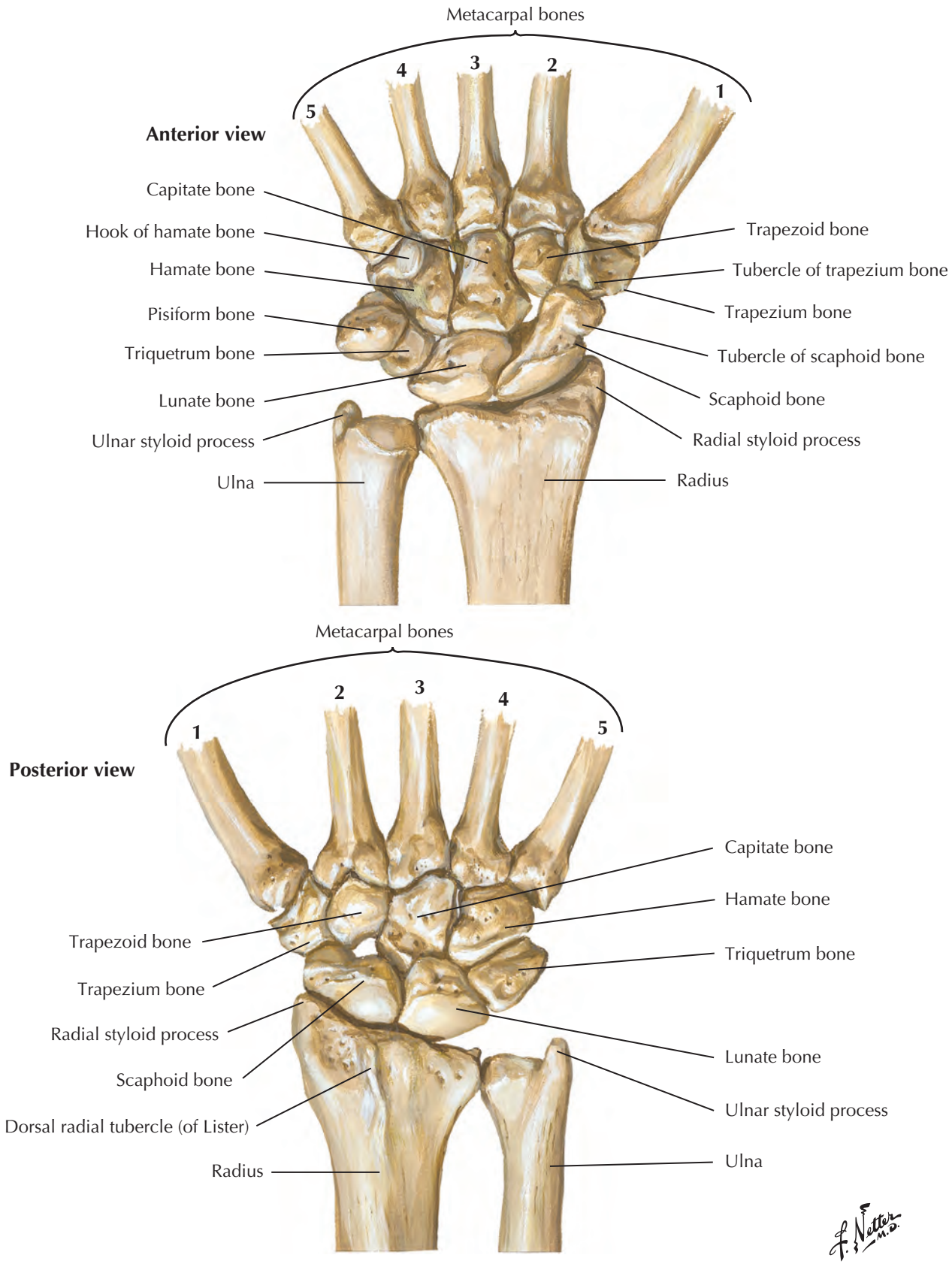



Brachioradialis m.
Brachialis m.
Extensor carpi radialis longus
Superficial head of pronator teres
Supinator
Common flexor tendon
Common extensor tendon
Humeroulnar head of flexor digitorum superficialis
Brachialis m.
Deep head of pronator teres
Biceps brachii m.
Supinator
Radial head of flexor digitorum superficialis
Flexor digitorum profundus
Pronator teres
Flexor pollicis longus
Ulna
Radius
Pronator quadratus
Pronator quadratus
Brachioradialis m.
Note: Attachments of intrinsic muscles of hand not shown.
Abductor pollicis longus
Flexor carpi ulnaris
Extensor carpi ulnaris
Flexor carpi radialis
Flexor digitorum superficialis
Flexor pollicis longus
Flexor digitorum profundus
Proximal muscle attachments
Distal muscle attachments

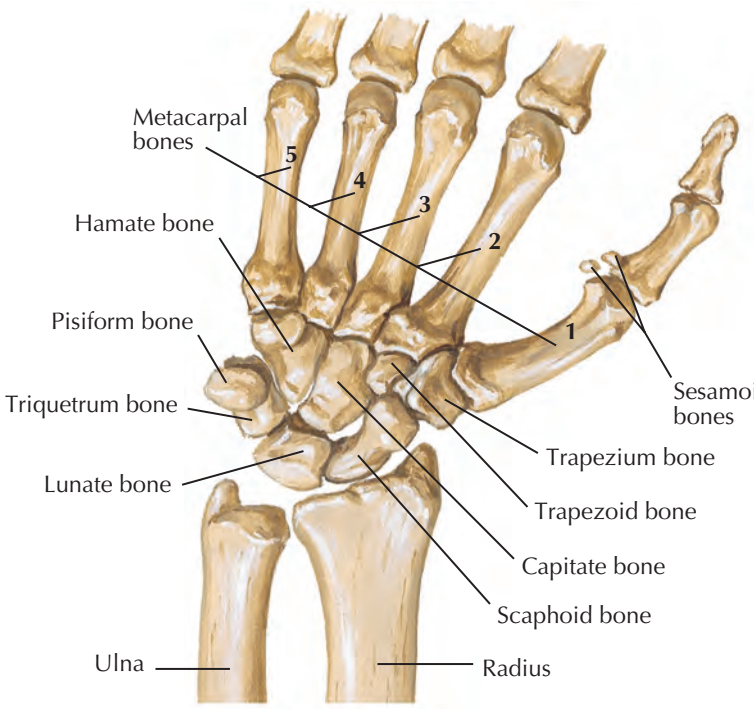
Note: Attachments of intrinsic muscles of hand not shown.



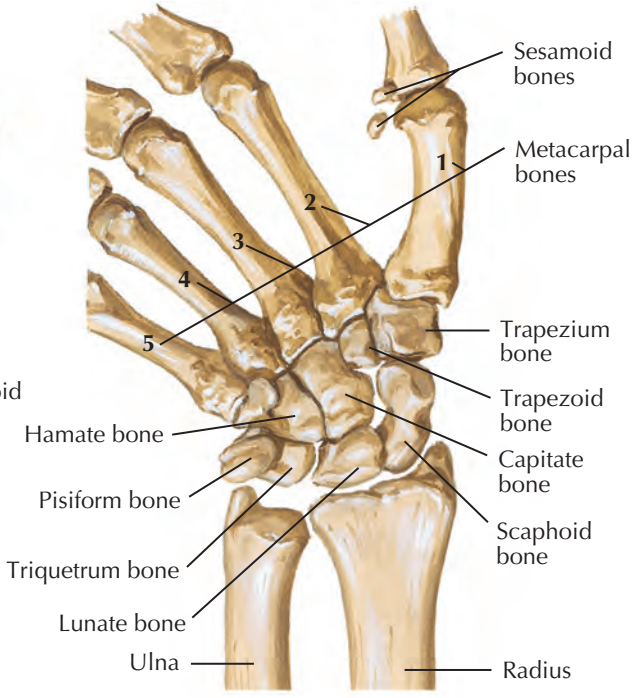

Median antebrachial v.
Cephalic v.
Brachioradialis m.
Radial a.
Superficial branch of radial n.
Pronator teres
Extensor carpi radialis longus
Extensor carpi radialis brevis
Deep branch of radial n.
Supinator
Flexor carpi radialis
Flexor pollicis longus
Radius
Abductor pollicis longus
Extensor digitorum
Extensor digiti minimi
Extensor carpi ulnaris
Flexor carpi radialis tendon
Radial a.
Brachioradialis tendon
Flexor pollicis longus
Abductor pollicis longus tendon
Superficial branch of radial n.
Extensor pollicis brevis tendon
Extensor carpi radialis longus tendon
Extensor carpi radialis brevis tendon
Extensor pollicis longus tendon
Radial head of flexor digitorum superficialis
Median n.
Ulnar a.
Humeroulnar head of flexor digitorum superficialis
Common interosseous a.
Basilic v.
Ulnar n.
Flexor digitorum profundus
Anconeus m.
Palmaris longus m.
Flexor digitorum superficialis
Anterior interosseous a. and n.
Flexor carpi ulnaris
Interosseous membrane of forearm
Ulna
Extensor pollicis longus
Posterior interosseous a. and n.
Palmaris longus tendon
Median n.
Flexor digitorum superficialis
Flexor carpi ulnaris
Ulnar a. and n.
Flexor digitorum profundus
Dorsal branch of ulnar n.
Pronator quadratus
Extensor carpi ulnaris tendon
Extensor indicis
Extensor digiti minimi tendon
Extensor digitorum tendons


Metacarpal bones
1
2
3
4
5
Anterior view
Capitate bone
Hook of hamate bone
Hamate bone
Pisiform bone
Triquetrum bone
Lunate bone
Ulnar styloid process
Ulna
Trapezoid bone
Tubercle of trapezium bone
Trapezium bone
Tubercle of scaphoid bone
Scaphoid bone
Radial styloid process
Radius
Metacarpal bones
1
2
3
4
5
Posterior view
Trapezoid bone
Trapezium bone
Radial styloid process
Scaphoid bone
Dorsal radial tubercle (of Lister)
Radius
Capitate bone
Hamate bone
Triquetrum bone
Lunate bone
Ulnar styloid process
Ulna

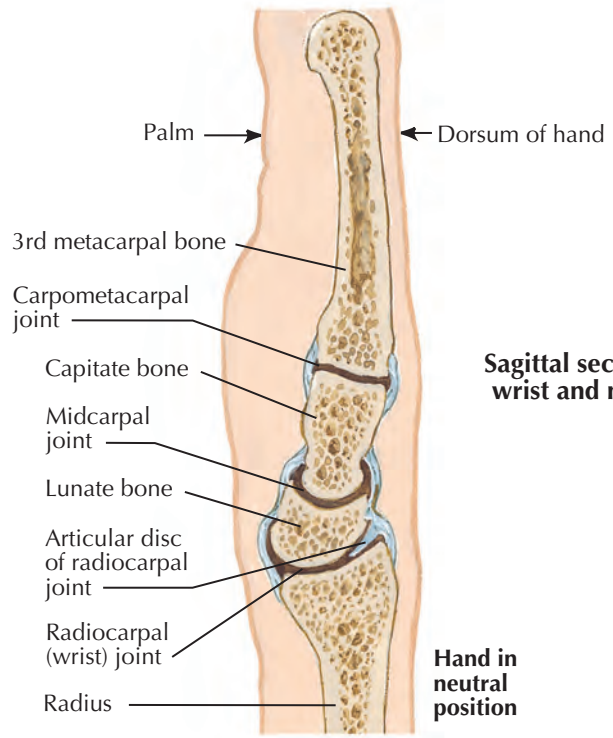
See also **Plates 466, 467**



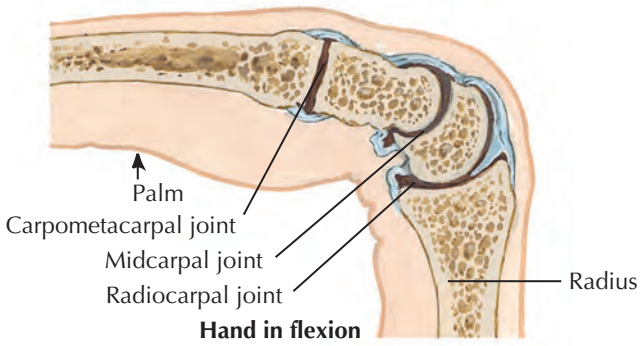
Position of carpal bones with hand abducted anterior view



Position of carpal bones with hand adducted anterior view

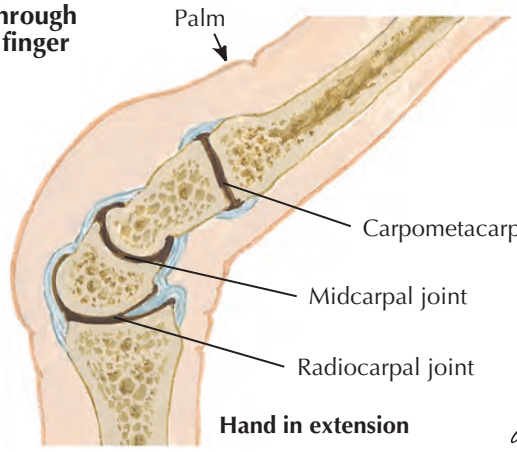


Hand in neutral position



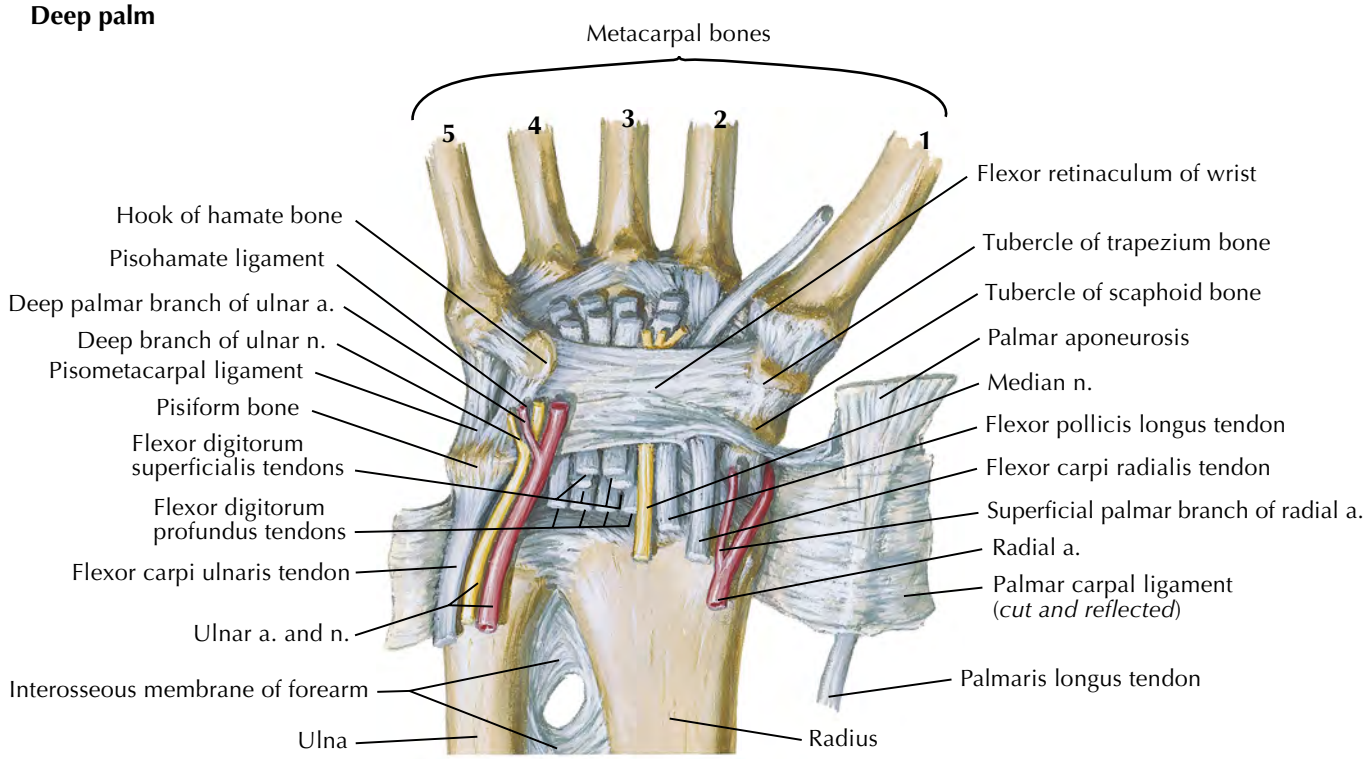
Hand in flexion

Sagittal sections through wrist and middle finger

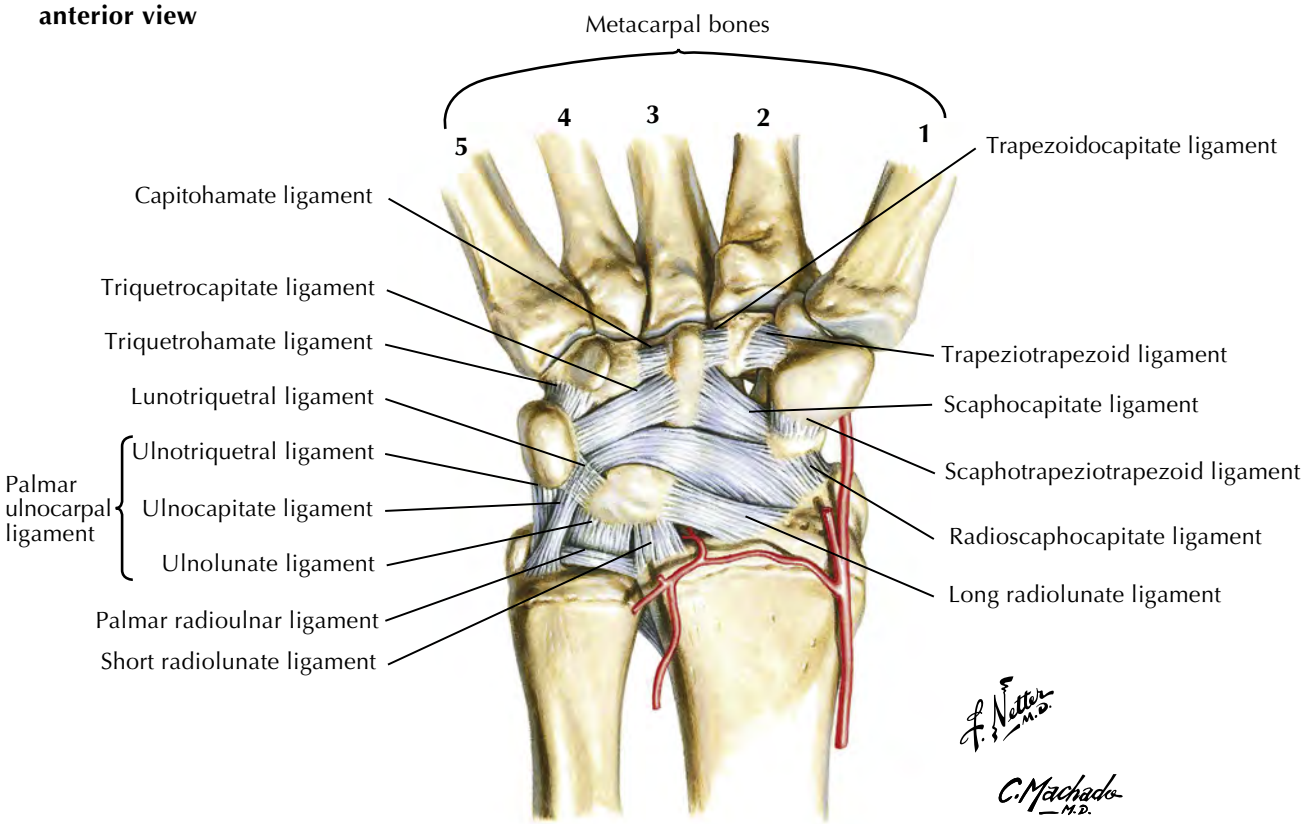


Hand in extension

Deep palm

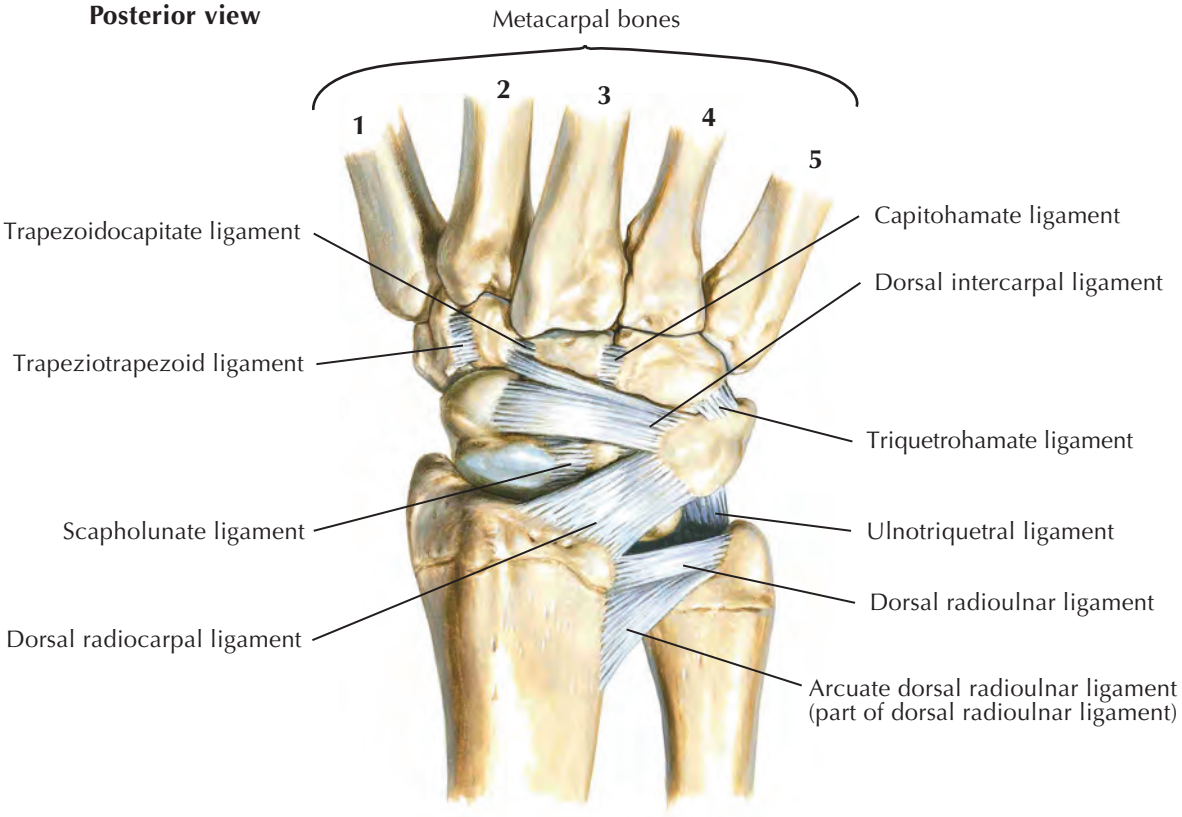


Flexor retinaculum of wrist removed: anterior view

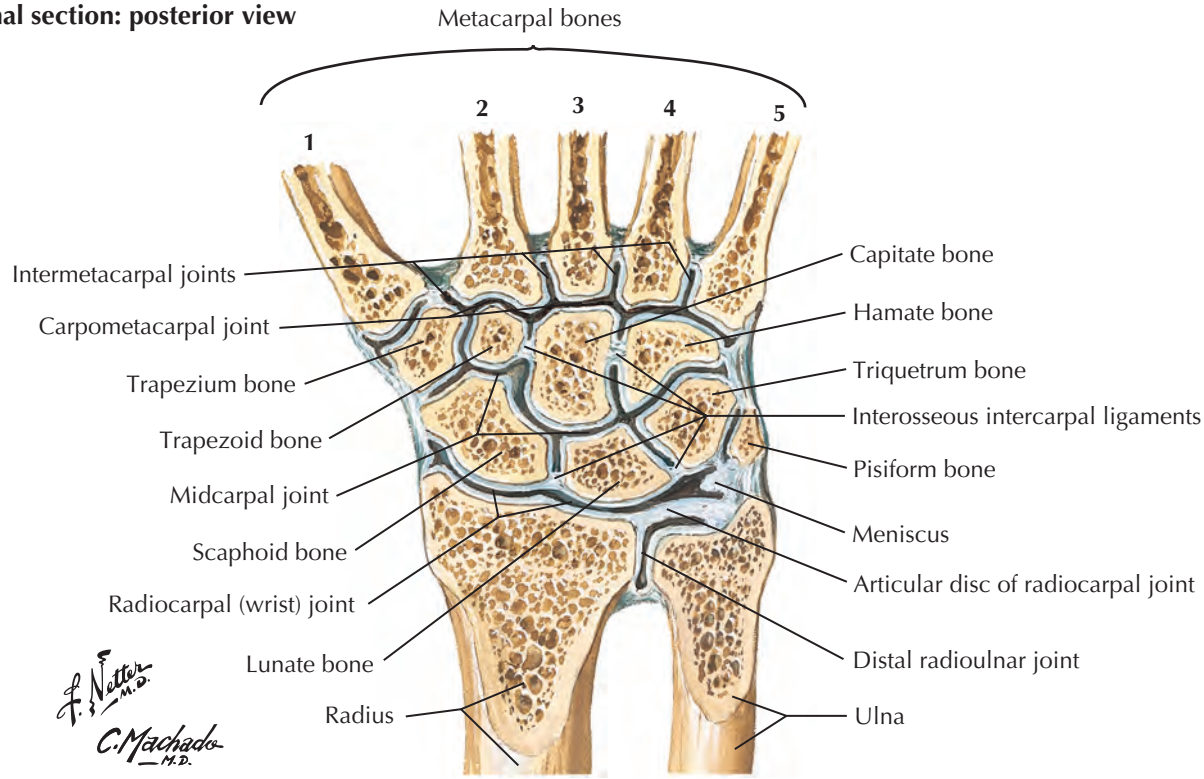


See also **Plates 467, BP 98**

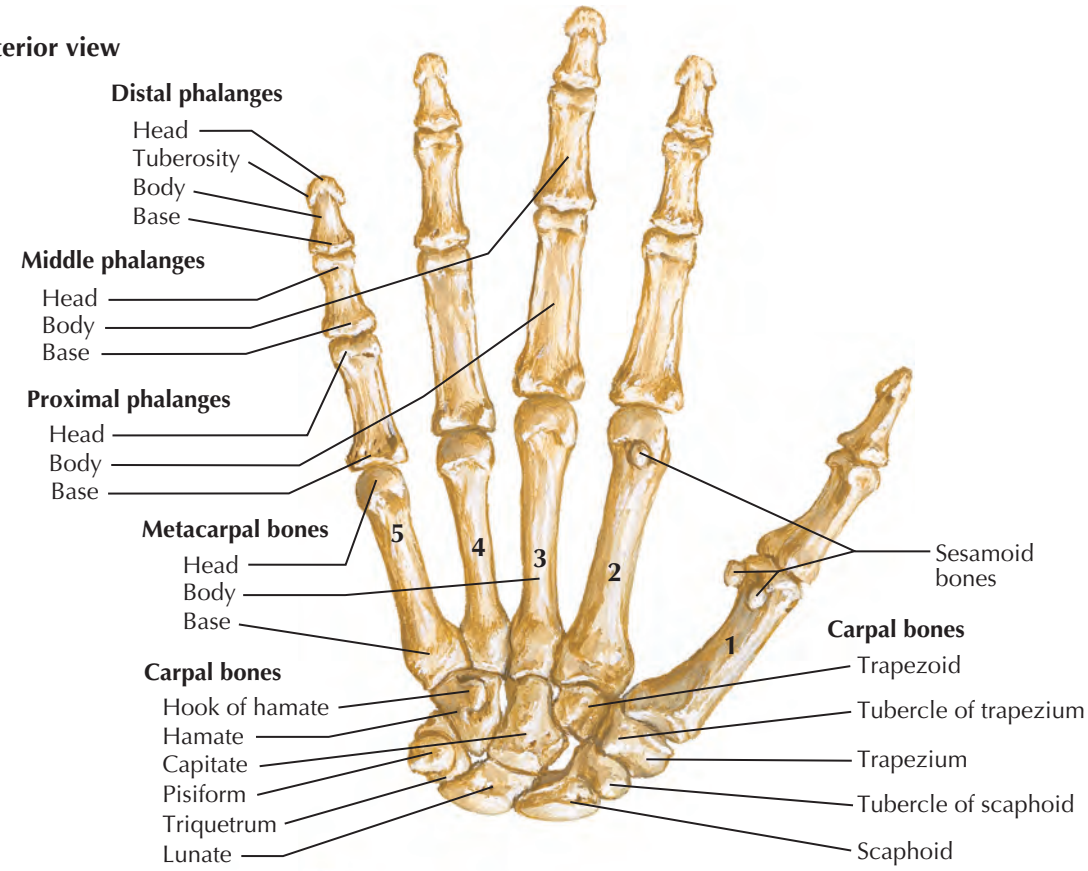
Posterior view



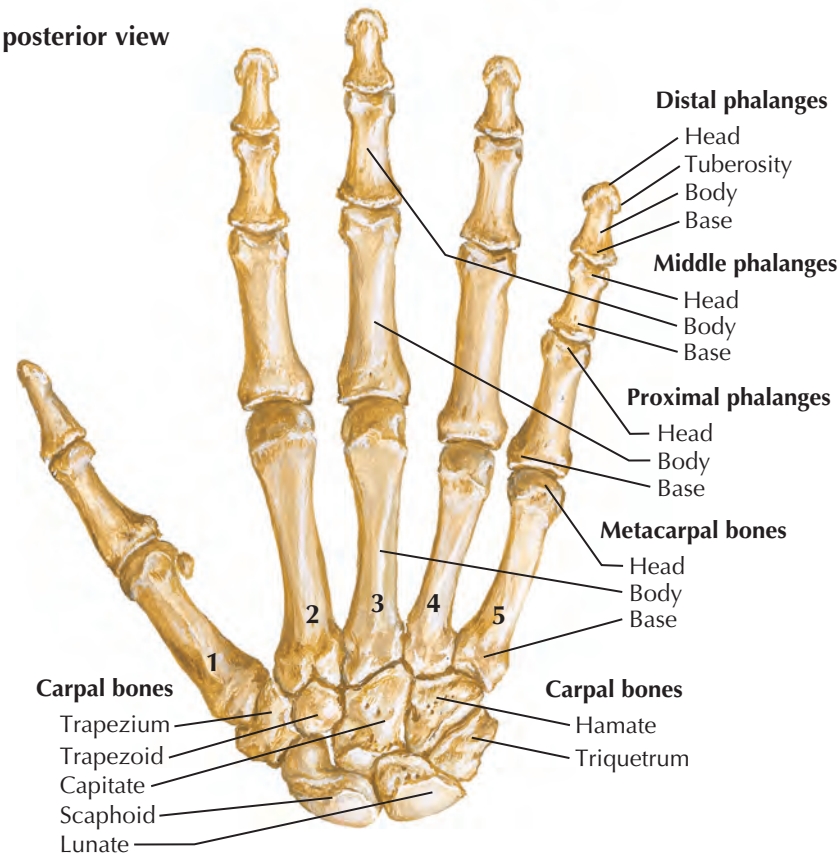
Coronal section: posterior view



Right hand: anterior view

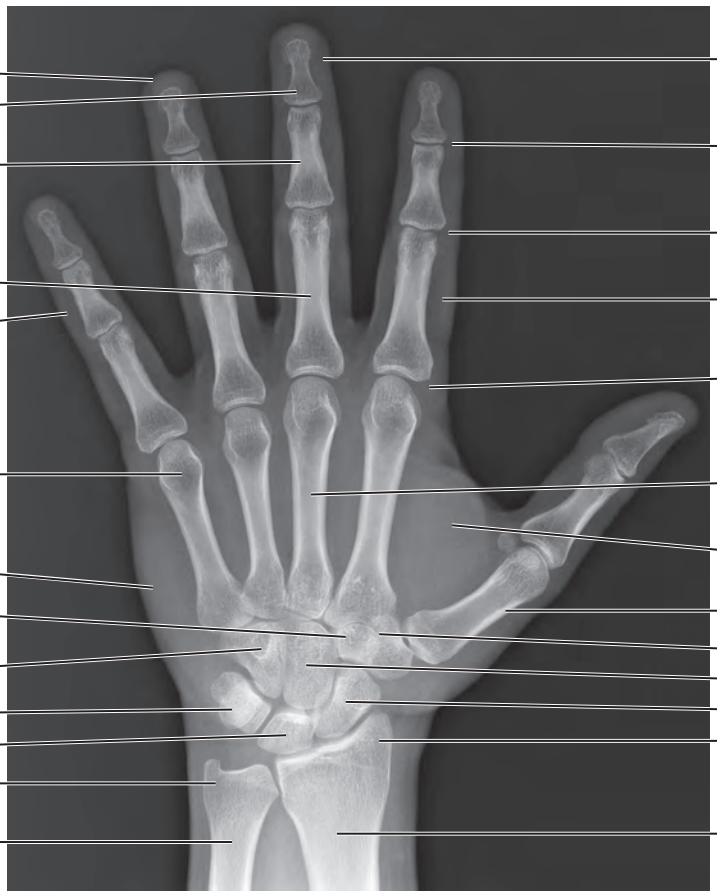


Right hand: posterior view



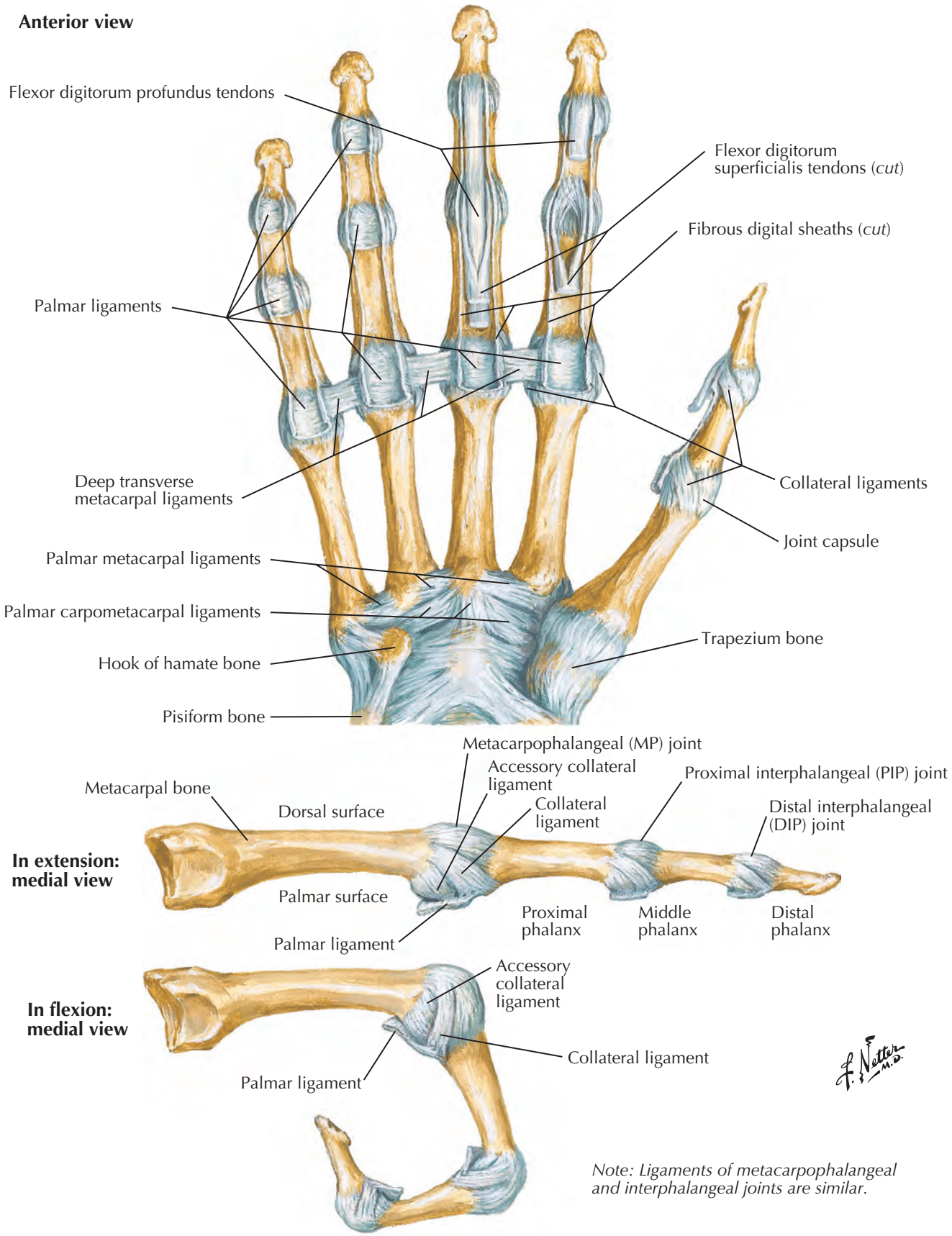
See also **Plate 466**

Anteroposterior view



Lateral view

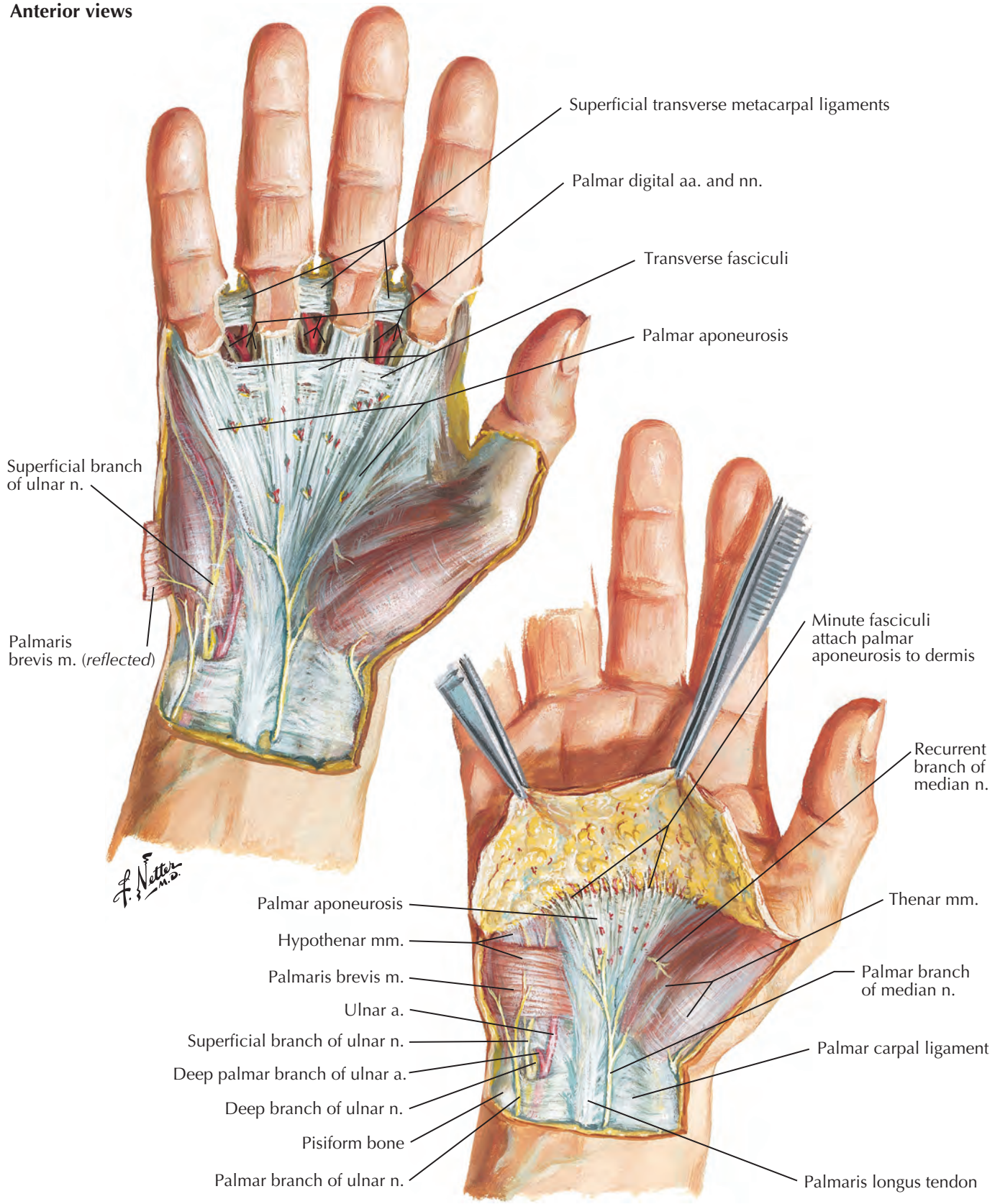
See also **Plate 471**

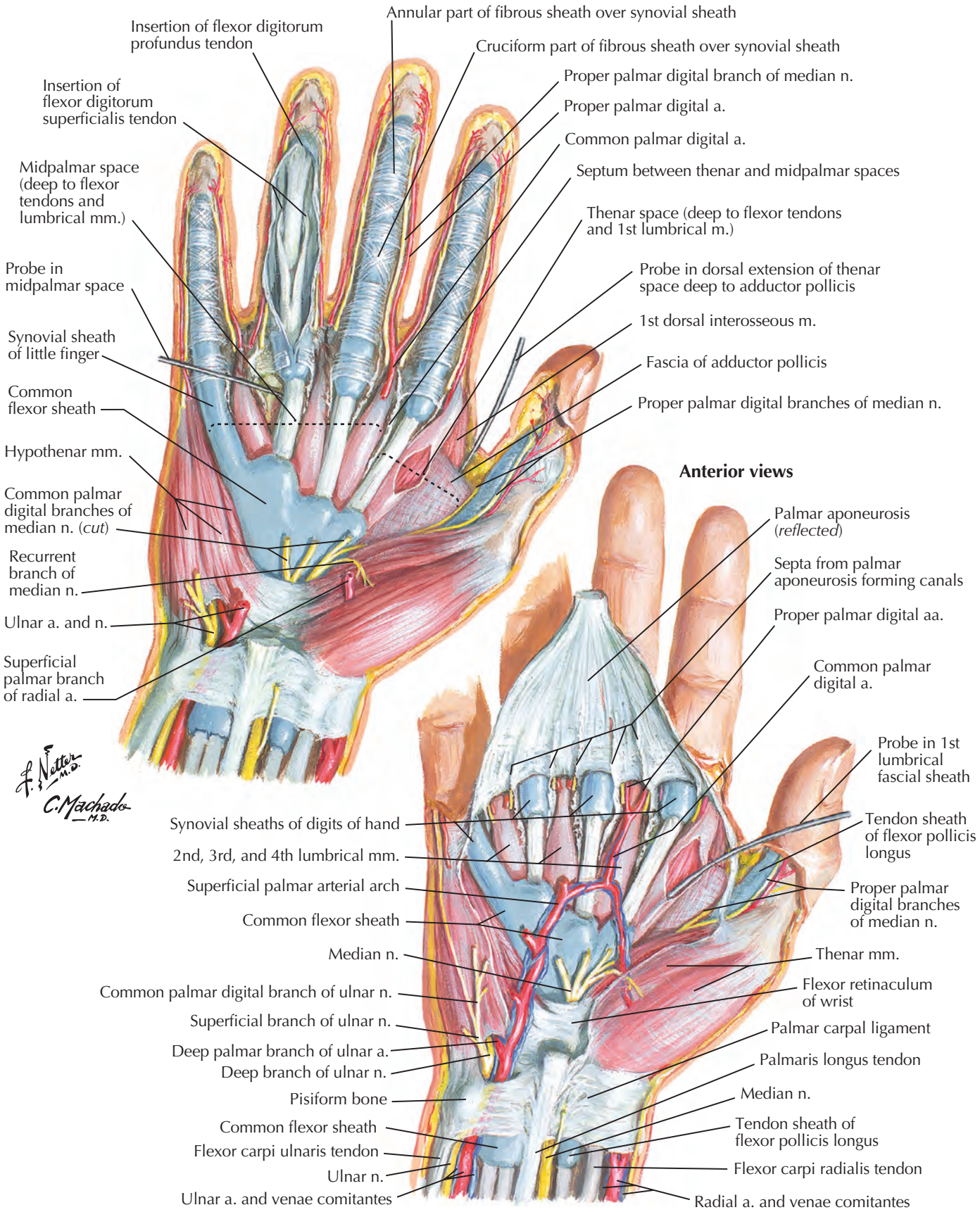


Note: Ligaments of metacarpophalangeal and interphalangeal joints are similar.

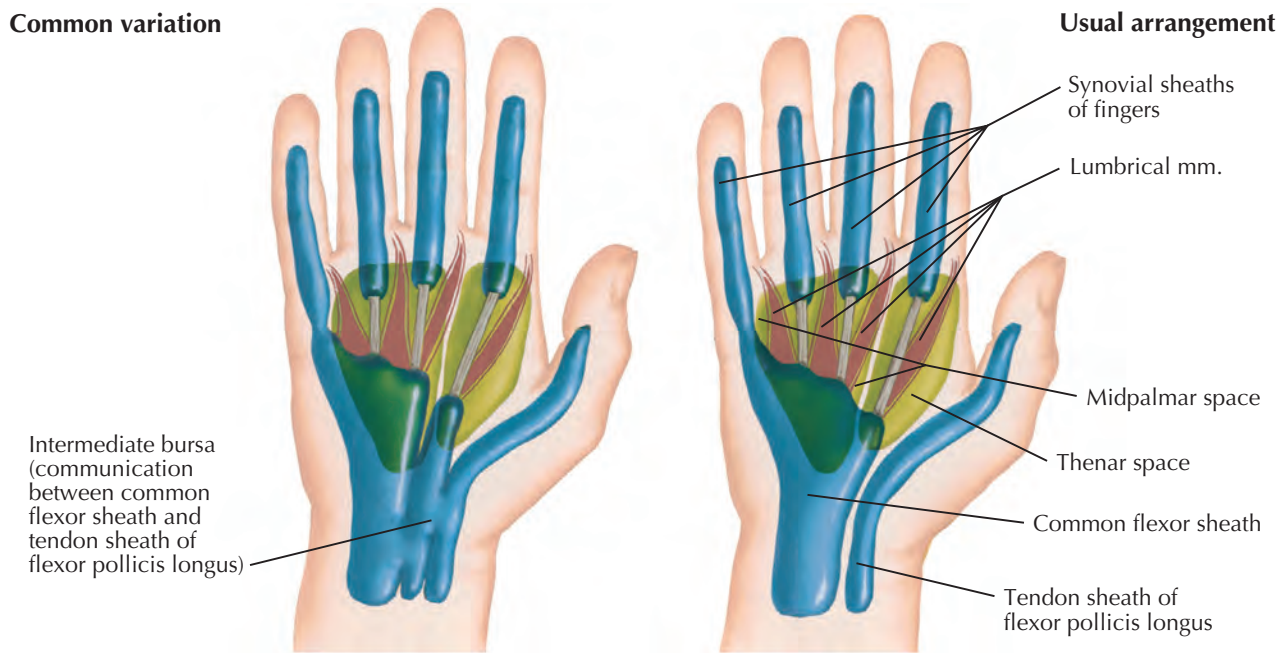
See also **Plate 482**

Anterior views

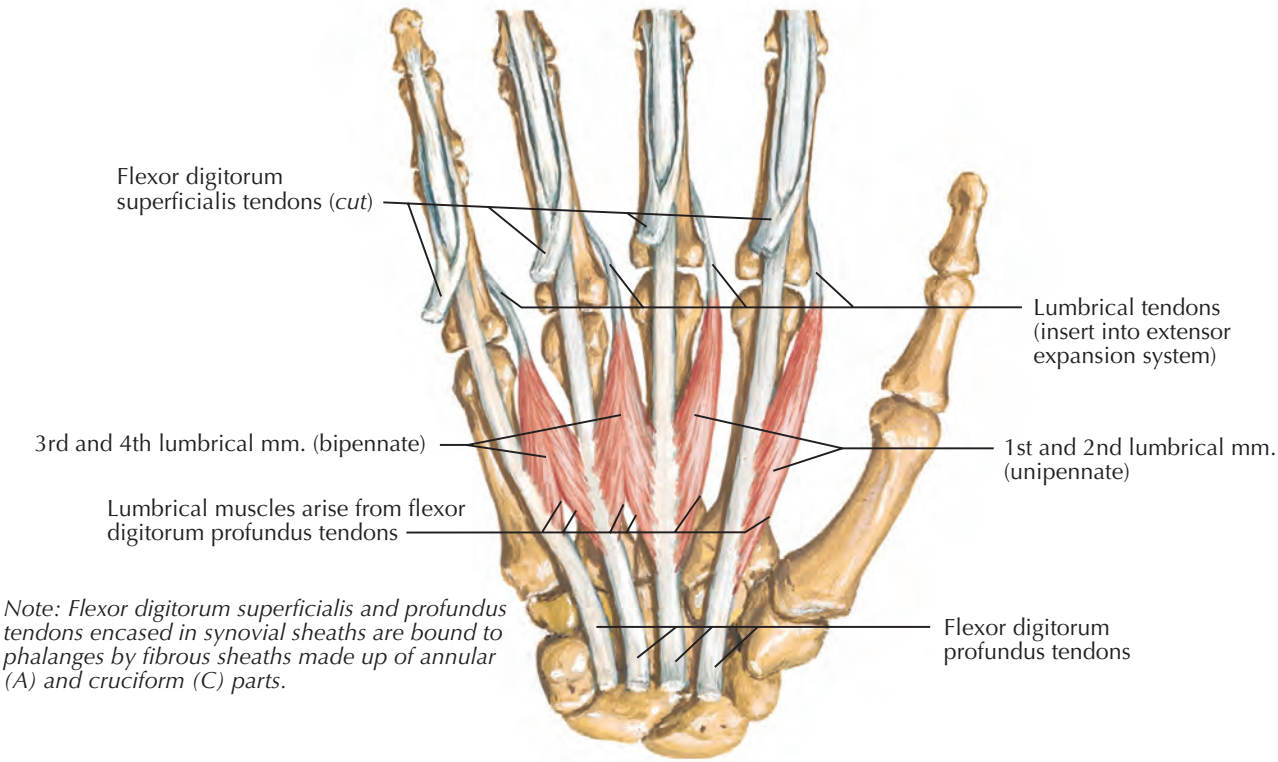



Annular part of fibrous sheath over synovial sheath
Insertion of flexor digitorum profundus tendon
Cruciform part of fibrous sheath over synovial sheath
Proper palmar digital branch of median n.
Insertion of flexor digitorum superficialis tendon
Proper palmar digital a.
Common palmar digital a.
Midpalmar space (deep to flexor tendons and lumbrical mm.)
Septum between thenar and midpalmar spaces
Thenar space (deep to flexor tendons and 1st lumbrical m.)
Probe in midpalmar space
Probe in dorsal extension of thenar space deep to adductor pollicis
1st dorsal interosseous m.
Synovial sheath of little finger
Fascia of adductor pollicis
Common flexor sheath
Proper palmar digital branches of median n.
Hypothenar mm.
Anterior views
Common palmar digital branches of median n. (cut)
Palmar aponeurosis (reflected)
Recurrent branch of median n.
Septa from palmar aponeurosis forming canals
Ulnar a. and n.
Proper palmar digital aa.
Superficial palmar branch of radial a.
Common palmar digital a.
Probe in 1st lumbrical fascial sheath
Synovial sheaths of digits of hand
Tendon sheath of flexor pollicis longus
2nd, 3rd, and 4th lumbrical mm.
Superficial palmar arterial arch
Proper palmar digital branches of median n.
Common flexor sheath
Median n.
Thenar mm.
Common palmar digital branch of ulnar n.
Flexor retinaculum of wrist
Superficial branch of ulnar n.
Palmar carpal ligament
Deep palmar branch of ulnar a.
Palmaris longus tendon
Deep branch of ulnar n.
Median n.
Pisiform bone
Tendon sheath of flexor pollicis longus
Common flexor sheath
Flexor carpi ulnaris tendon
Flexor carpi radialis tendon
Ulnar n.
Ulnar a. and venae comitantes
Radial a. and venae comitantes
F. Netter M.D.
C. Machado M.D.

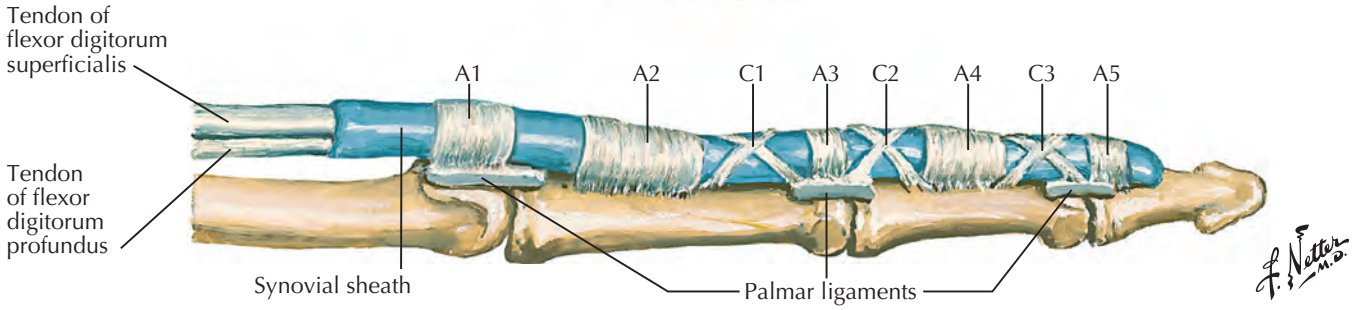
See also **Plate 468**



Lumbrical muscles: schema

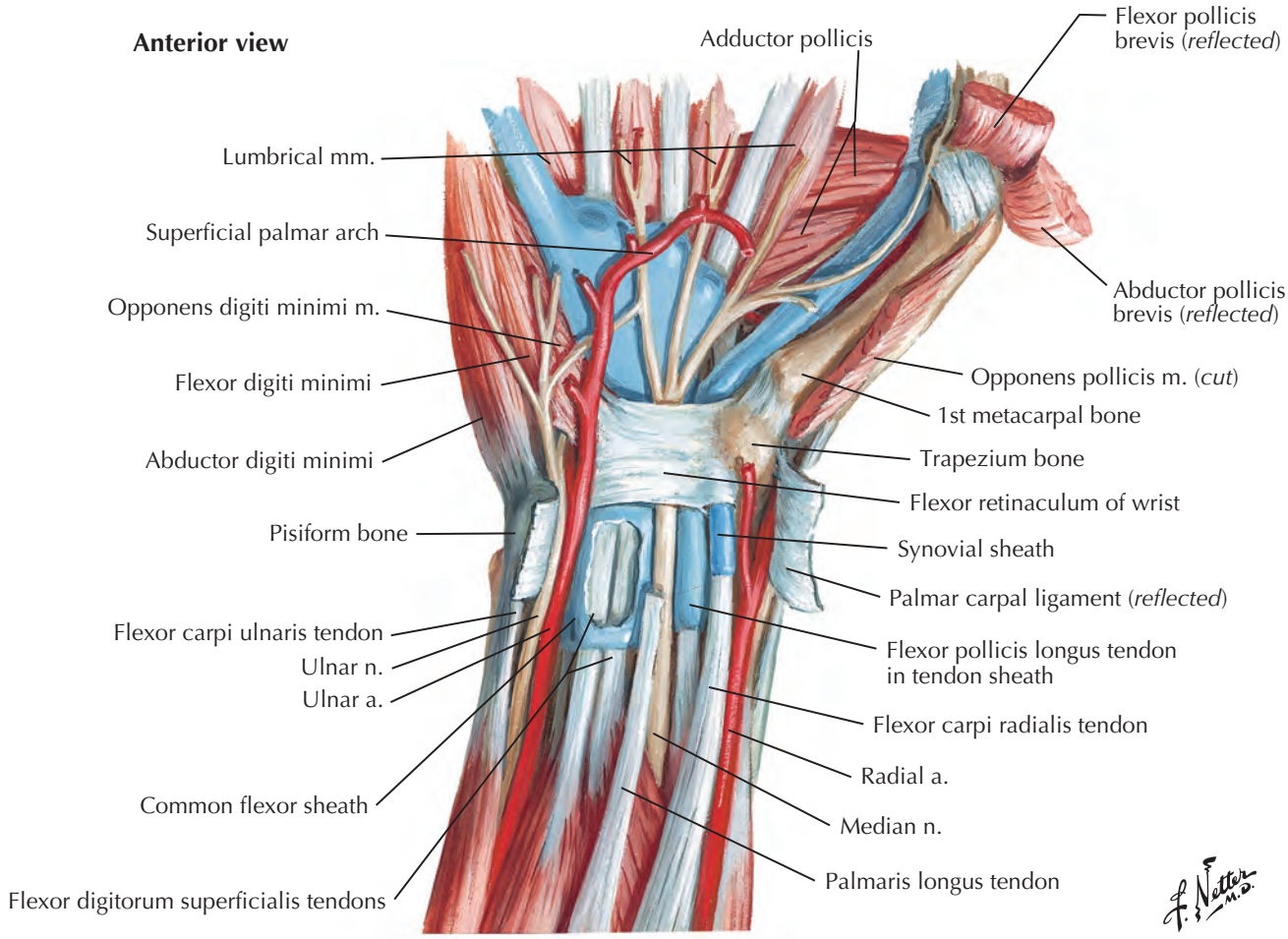


Note: Flexor digitorum superficialis and profundus tendons encased in synovial sheaths are bound to phalanges by fibrous sheaths made up of annular (A) and cruciform (C) parts.

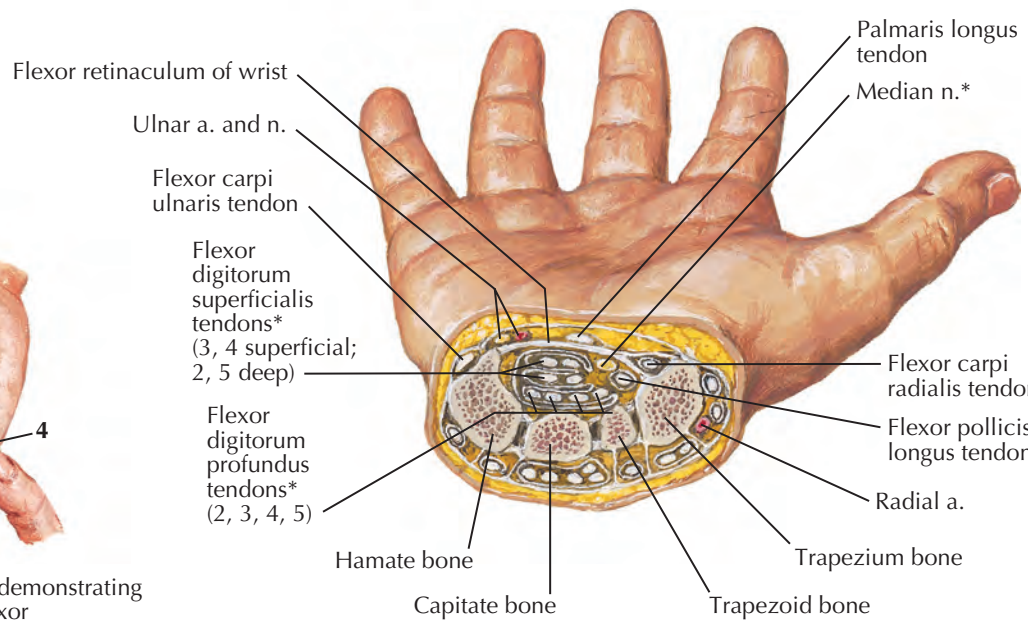


See also **Plates 482, 483, BP 100**

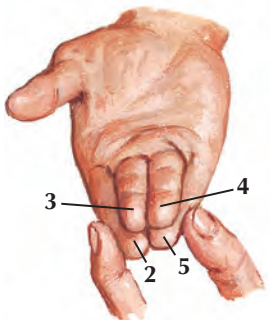
Anterior view



Cross section of wrist demonstrating carpal tunnel

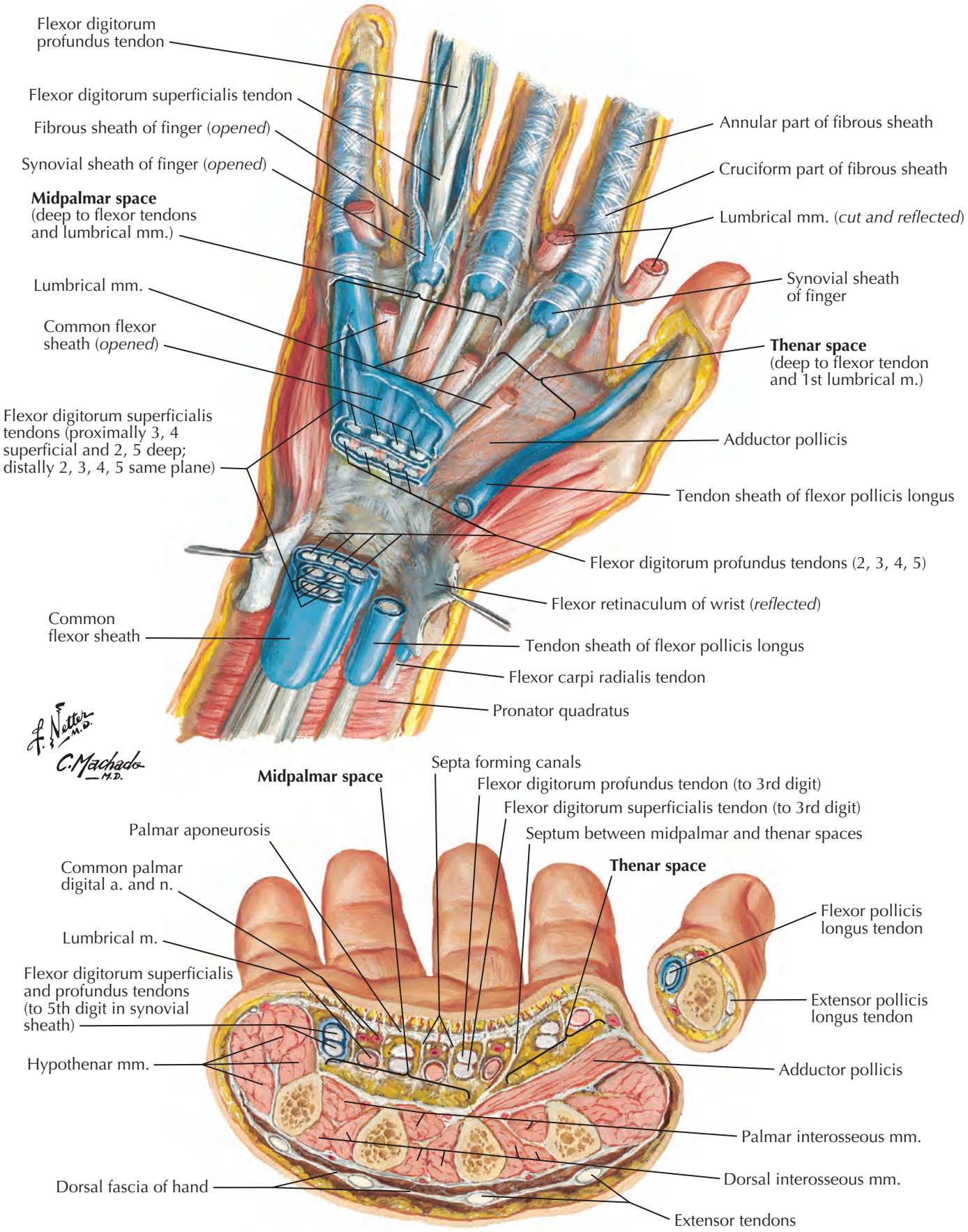


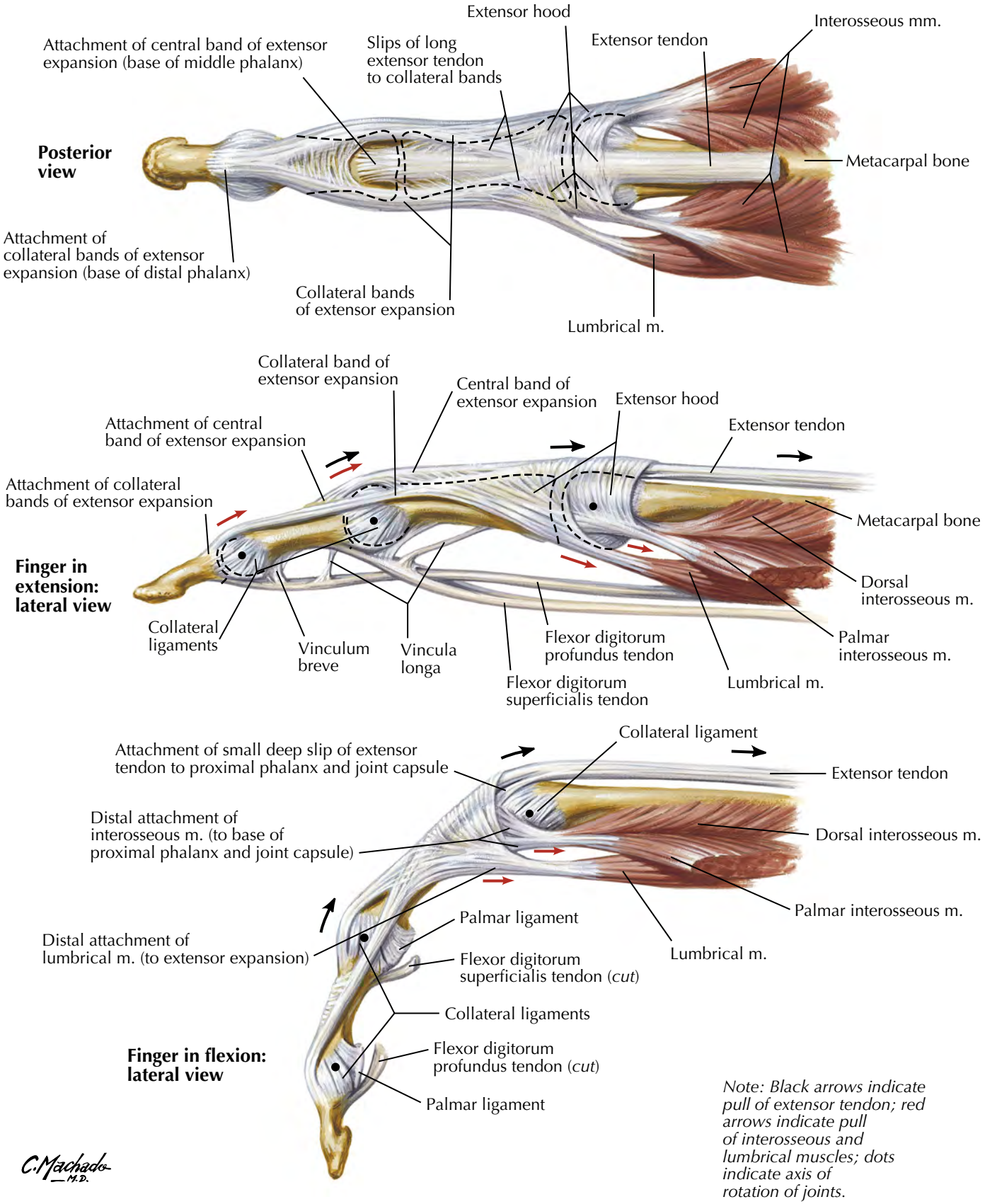
*Contents of carpal tunnel



Simple method of demonstrating arrangement of flexor digitorum superficialis tendons within carpal tunnel

See also **Plate BP 100**

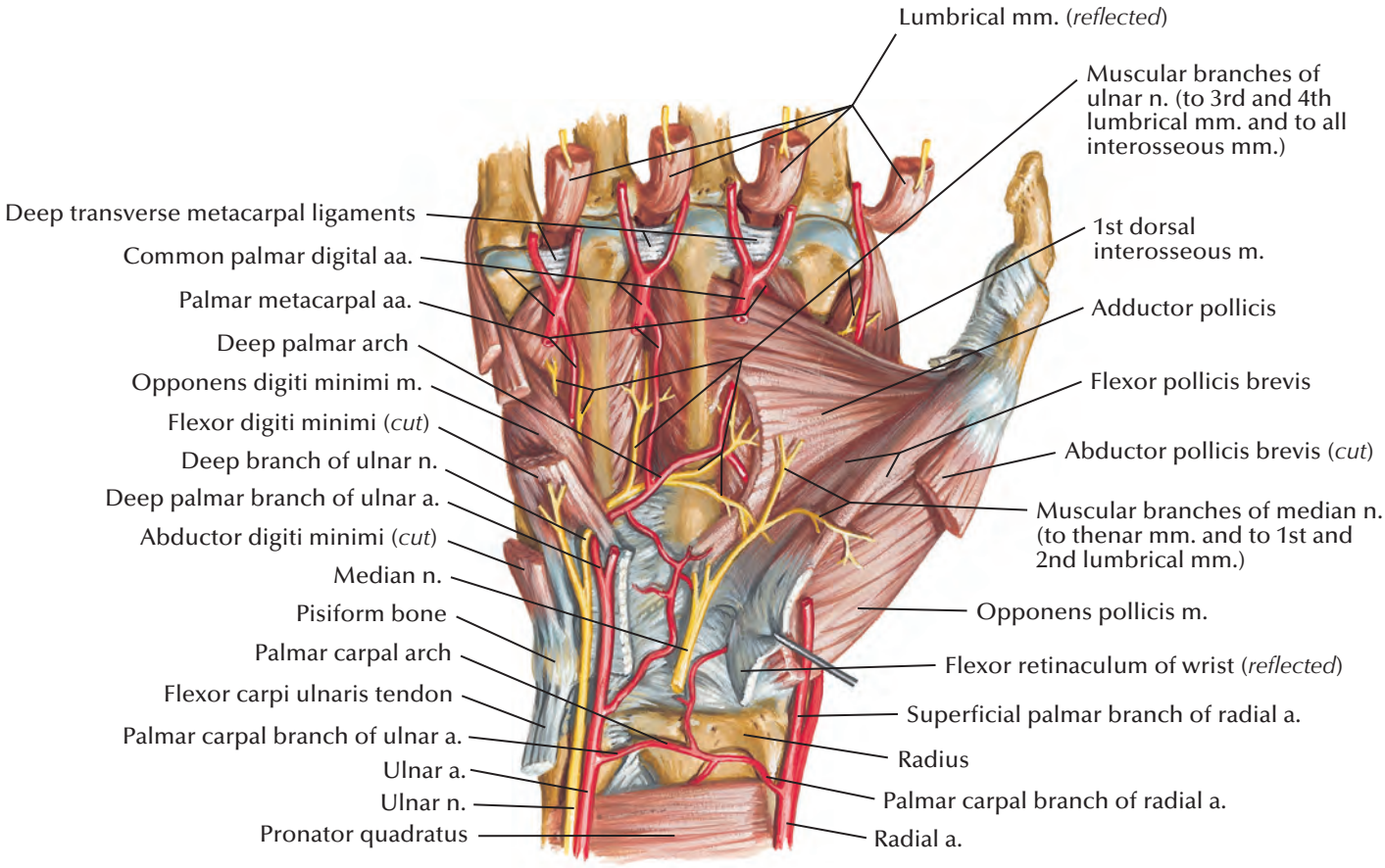




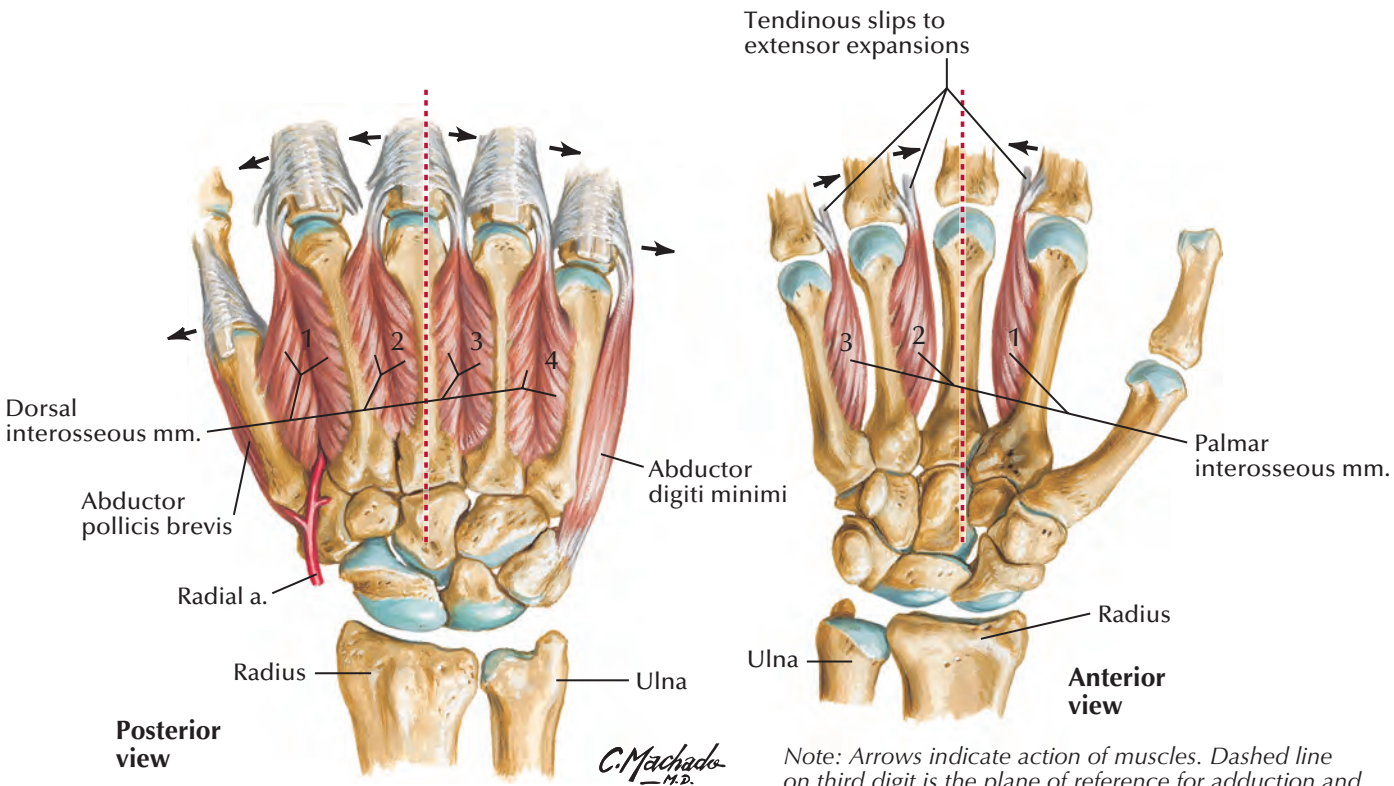
C. Machado M.D.

Note: Black arrows indicate pull of extensor tendon; red arrows indicate pull of interosseous and lumbrical muscles; dots indicate axis of rotation of joints.

See also **Plate BP 101**



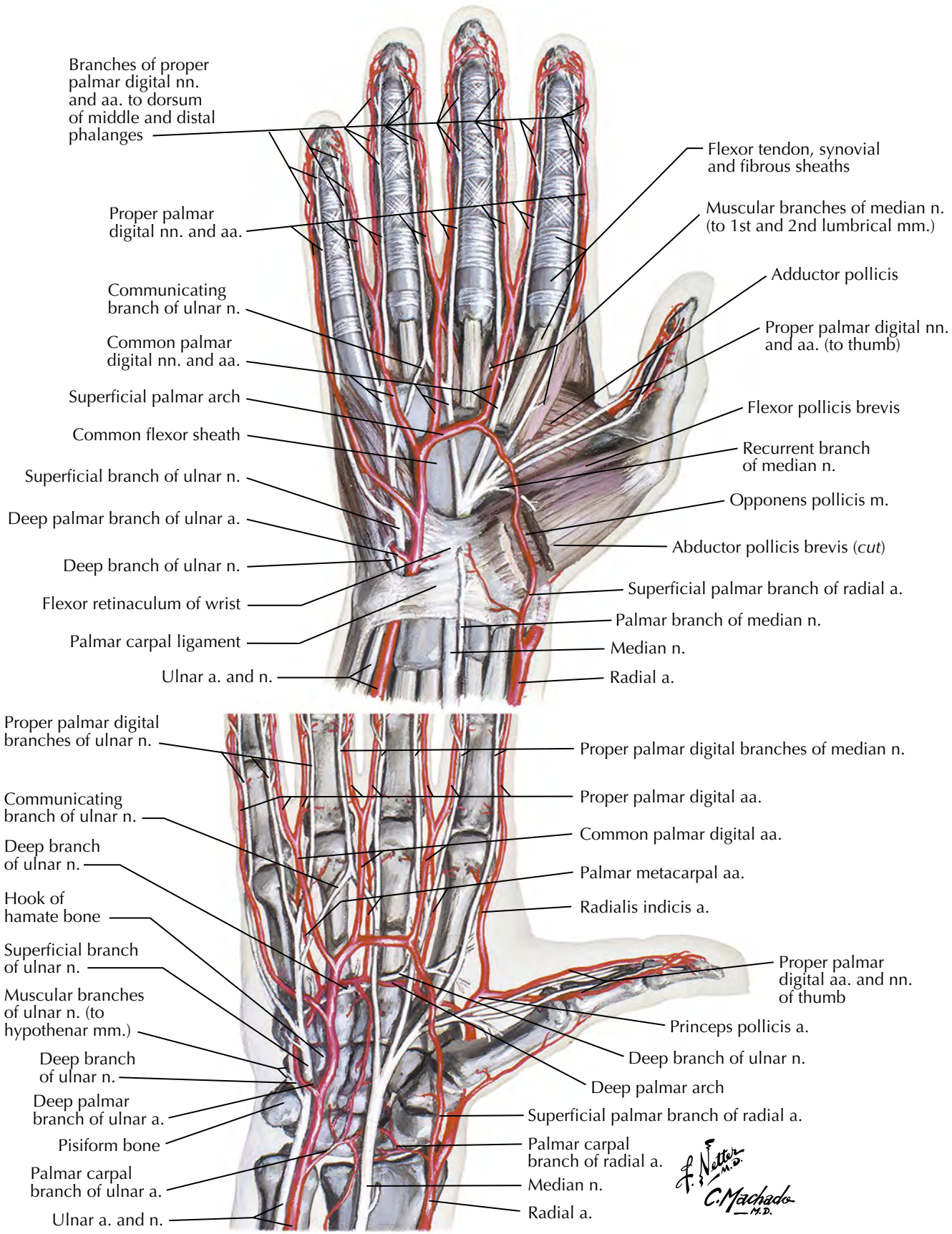
Anterior view



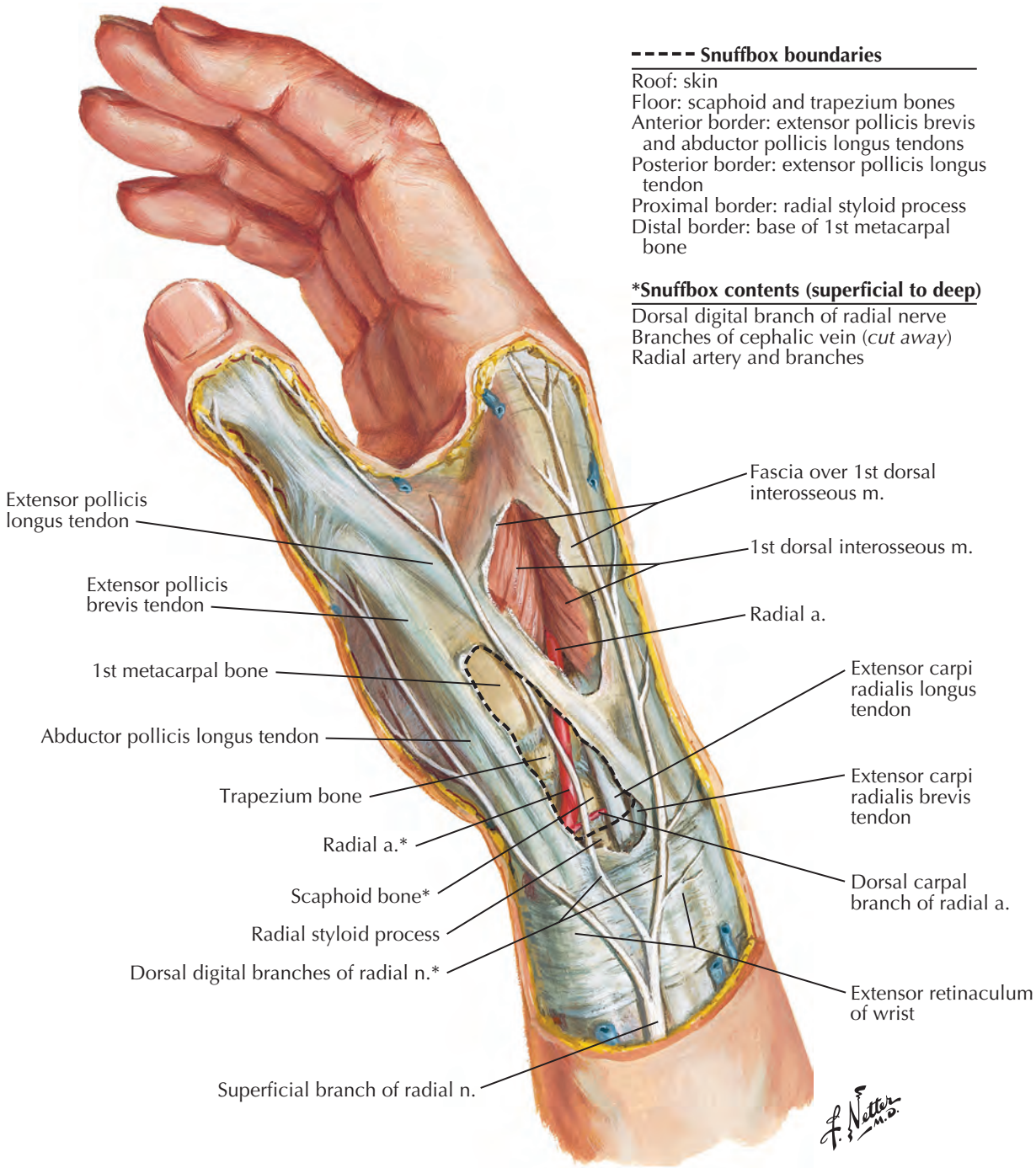
Posterior view

Anterior view

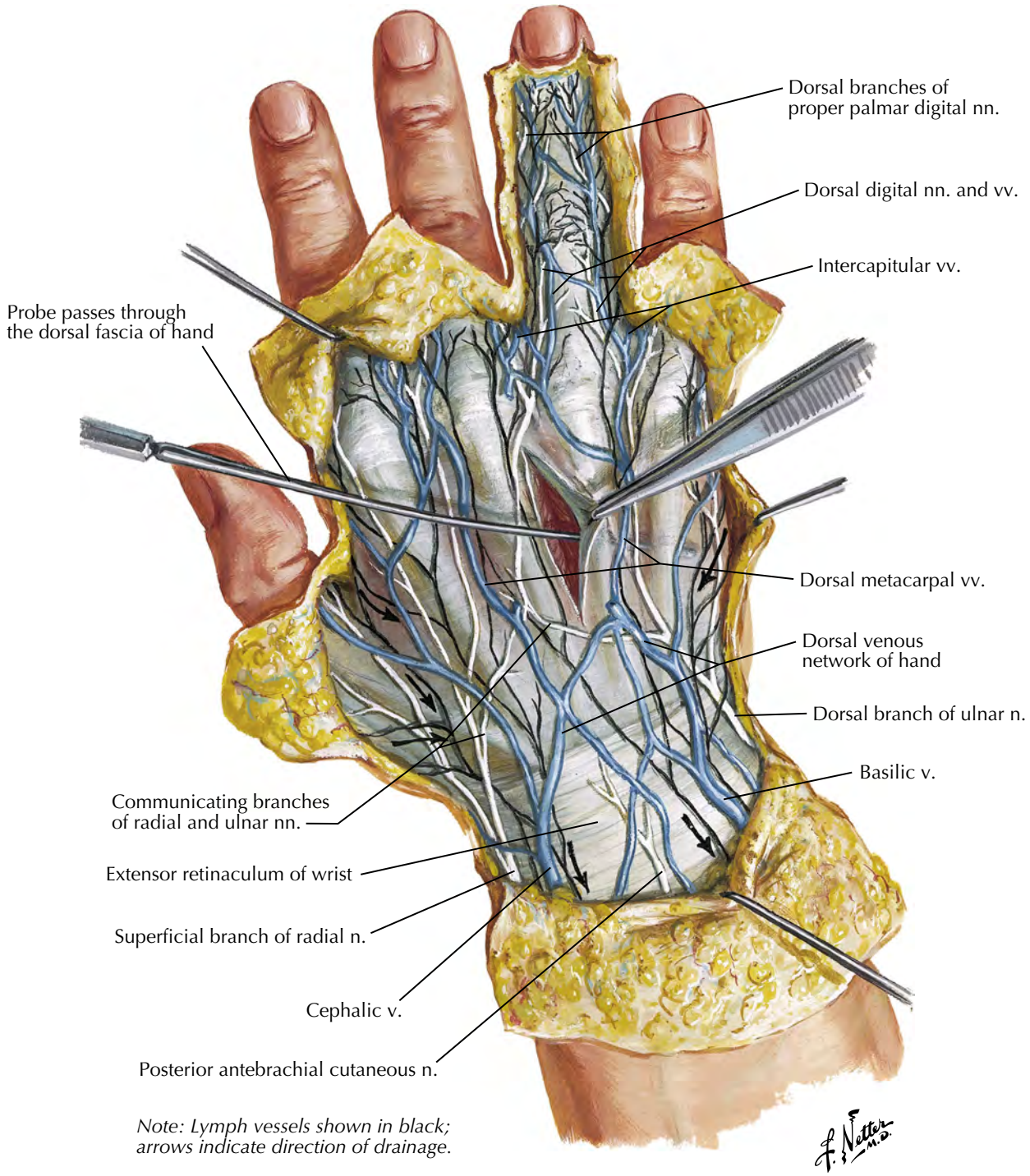
Note: Arrows indicate action of muscles. Dashed line on third digit is the plane of reference for adduction and abduction of the digits.


Branches of proper palmar digital nn. and aa. to dorsum of middle and distal phalanges
Proper palmar digital nn. and aa.
Communicating branch of ulnar n.
Common palmar digital nn. and aa.
Superficial palmar arch
Common flexor sheath
Superficial branch of ulnar n.
Deep palmar branch of ulnar a.
Deep branch of ulnar n.
Flexor retinaculum of wrist
Palmar carpal ligament
Ulnar a. and n.
Flexor tendon, synovial and fibrous sheaths
Muscular branches of median n. (to 1st and 2nd lumbrical mm.)
Adductor pollicis
Proper palmar digital nn. and aa. (to thumb)
Flexor pollicis brevis
Recurrent branch of median n.
Opponens pollicis m.
Abductor pollicis brevis (*cut*)
Superficial palmar branch of radial a.
Palmar branch of median n.
Median n.
Radial a.
Proper palmar digital branches of ulnar n.
Communicating branch of ulnar n.
Deep branch of ulnar n.
Hook of hamate bone
Superficial branch of ulnar n.
Muscular branches of ulnar n. (to hypothenar mm.)
Deep branch of ulnar n.
Deep palmar branch of ulnar a.
Pisiform bone
Palmar carpal branch of ulnar a.
Ulnar a. and n.
Proper palmar digital branches of median n.
Proper palmar digital aa.
Common palmar digital aa.
Palmar metacarpal aa.
Radialis indicis a.
Proper palmar digital aa. and nn. of thumb
Princeps pollicis a.
Deep branch of ulnar n.
Deep palmar arch
Superficial palmar branch of radial a.
Palmar carpal branch of radial a.
Median n.
Radial a.
F. Netter M.D.
C. Machado M.D.

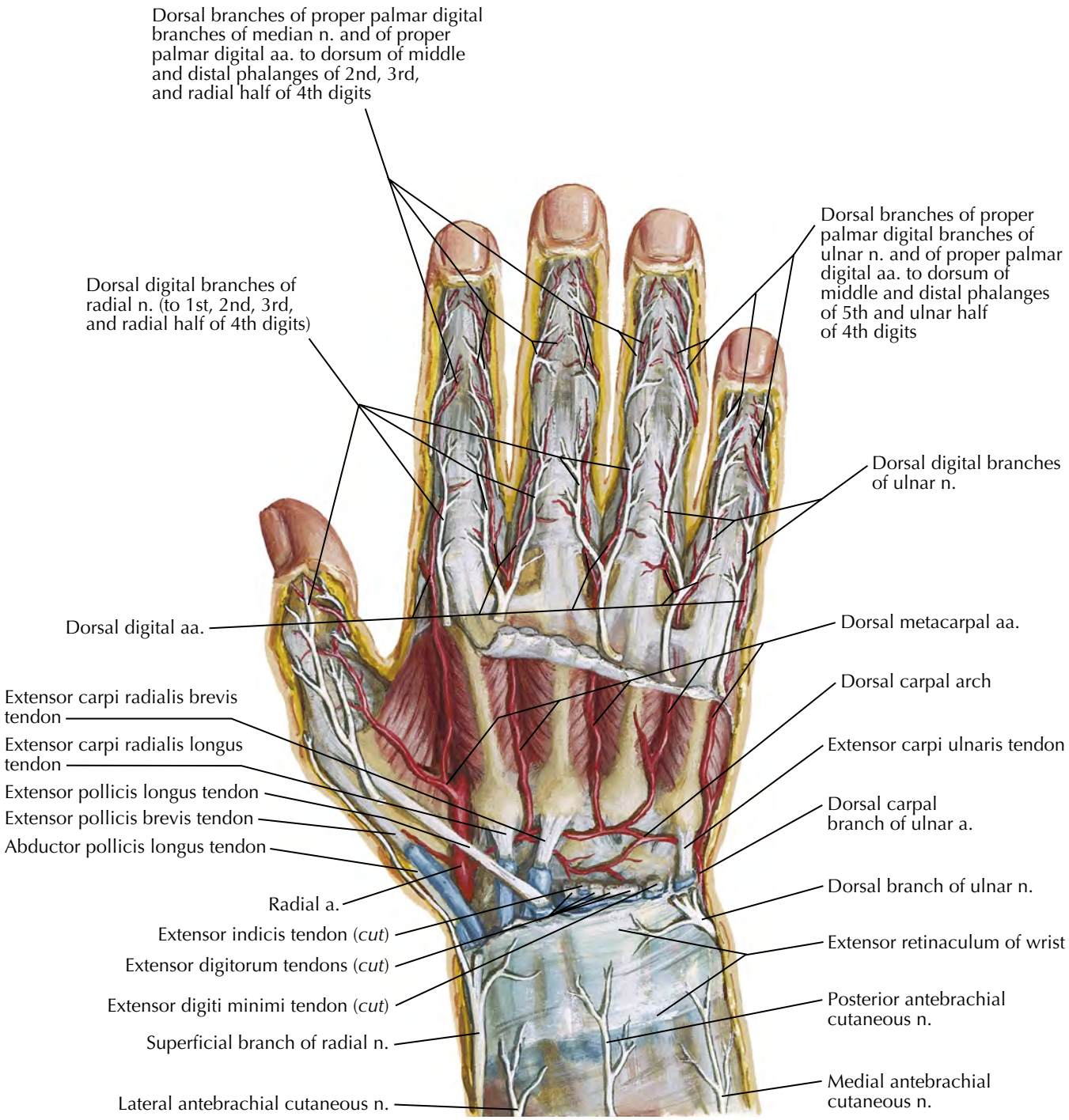
See also **Plate 489**



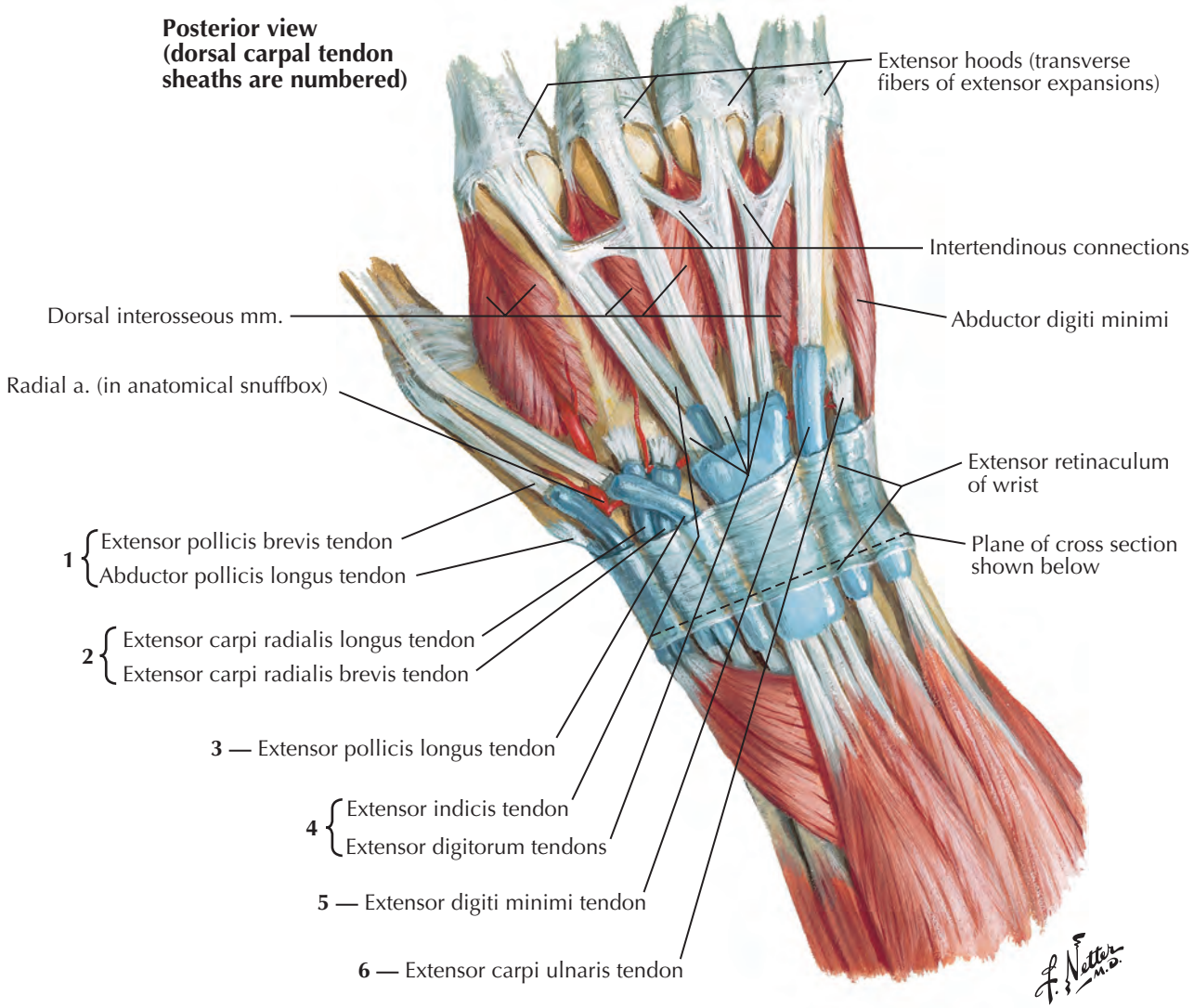
See also **Plate 425**



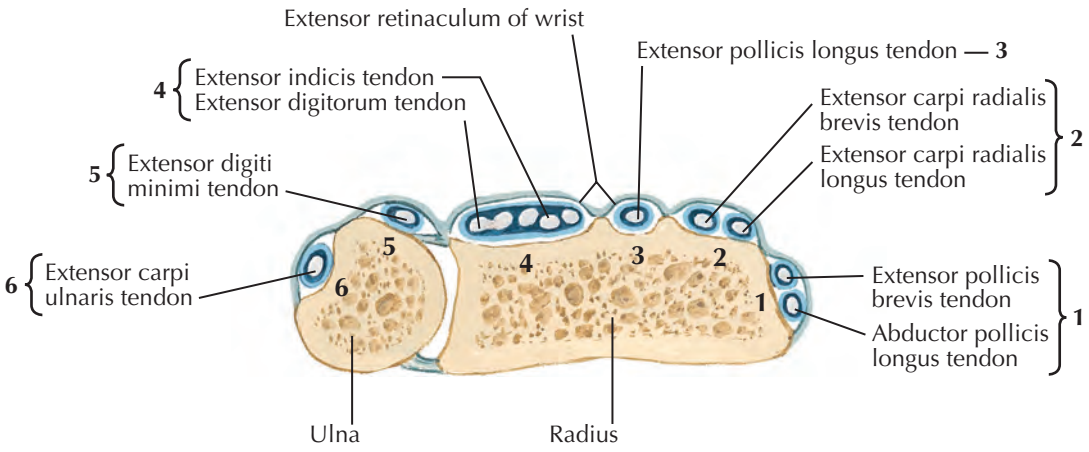
See also **Plate 480**

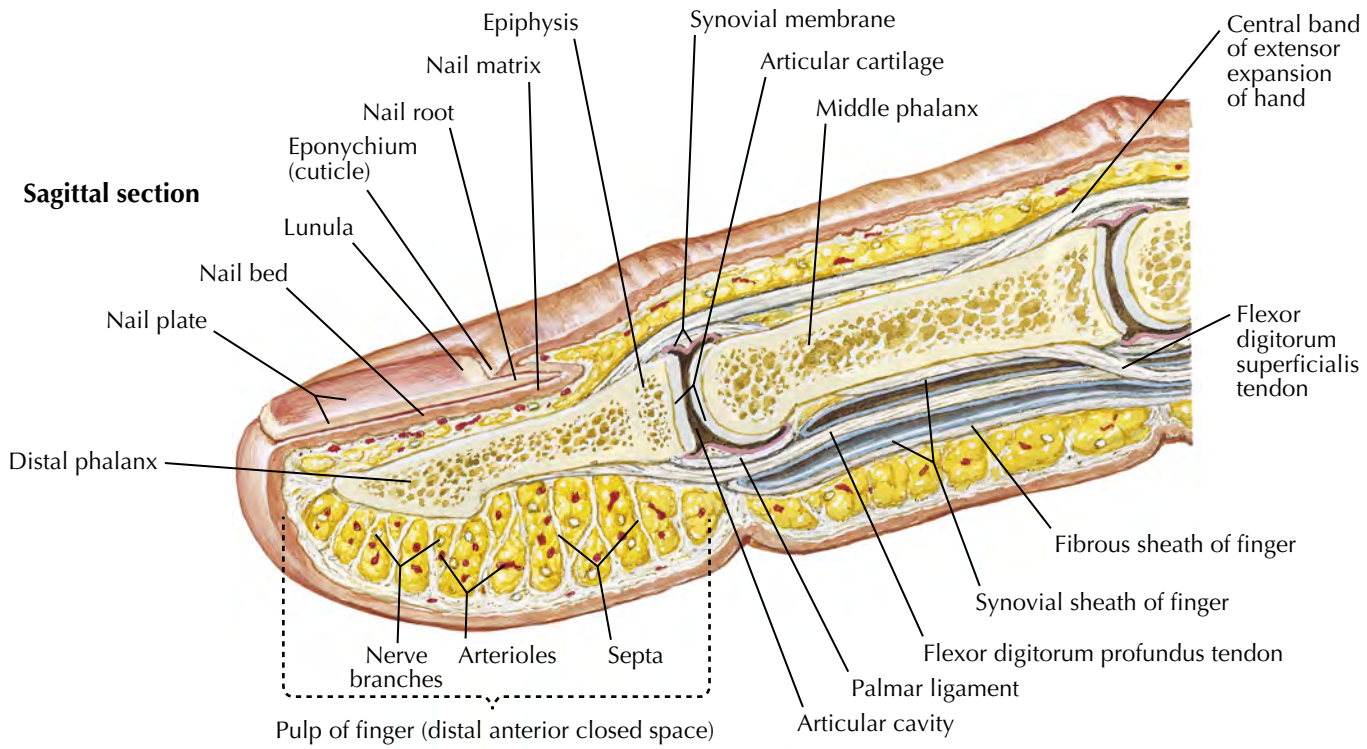


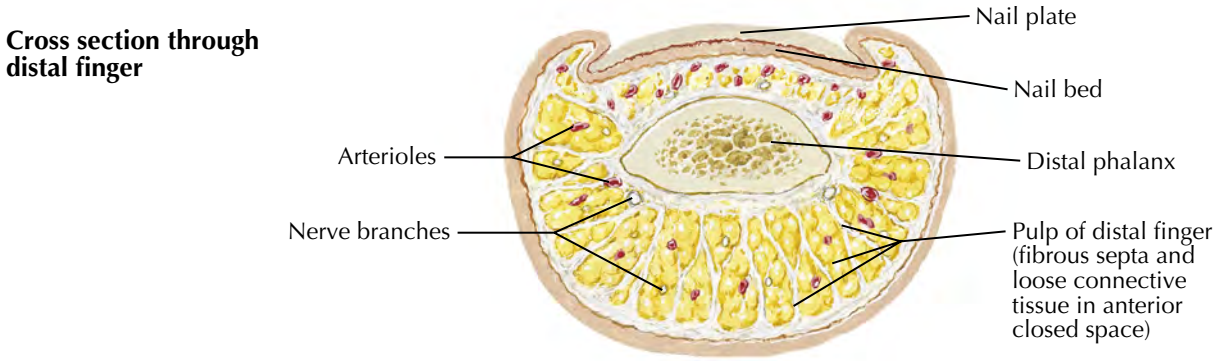
See also **Plates 454, 455**

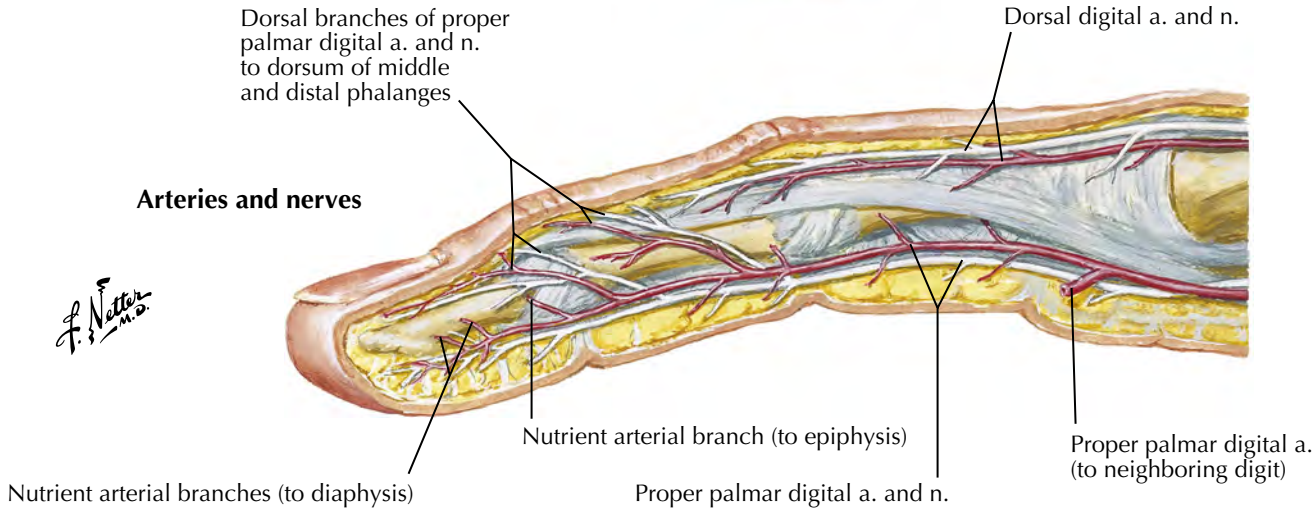


Cross section of distal forearm

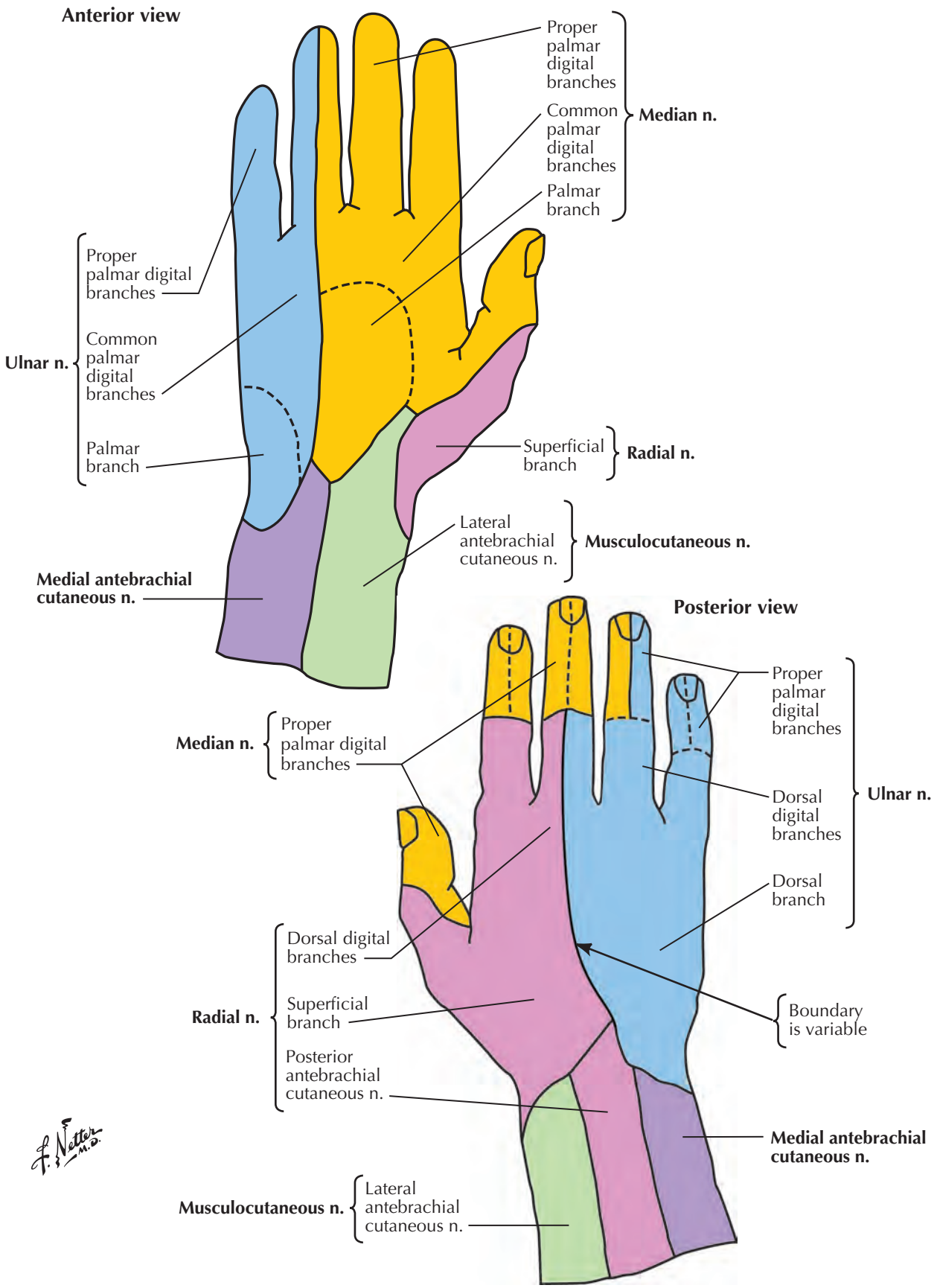



Sagittal section
Epiphysis
Synovial membrane
Central band of extensor expansion of hand
Nail matrix
Articular cartilage
Nail root
Middle phalanx
Eponychium (cuticle)
Lunula
Nail bed
Nail plate
Flexor digitorum superficialis tendon
Distal phalanx
Fibrous sheath of finger
Synovial sheath of finger
Nerve branches
Arterioles
Septa
Flexor digitorum profundus tendon
Palmar ligament
Articular cavity
Pulp of finger (distal anterior closed space)

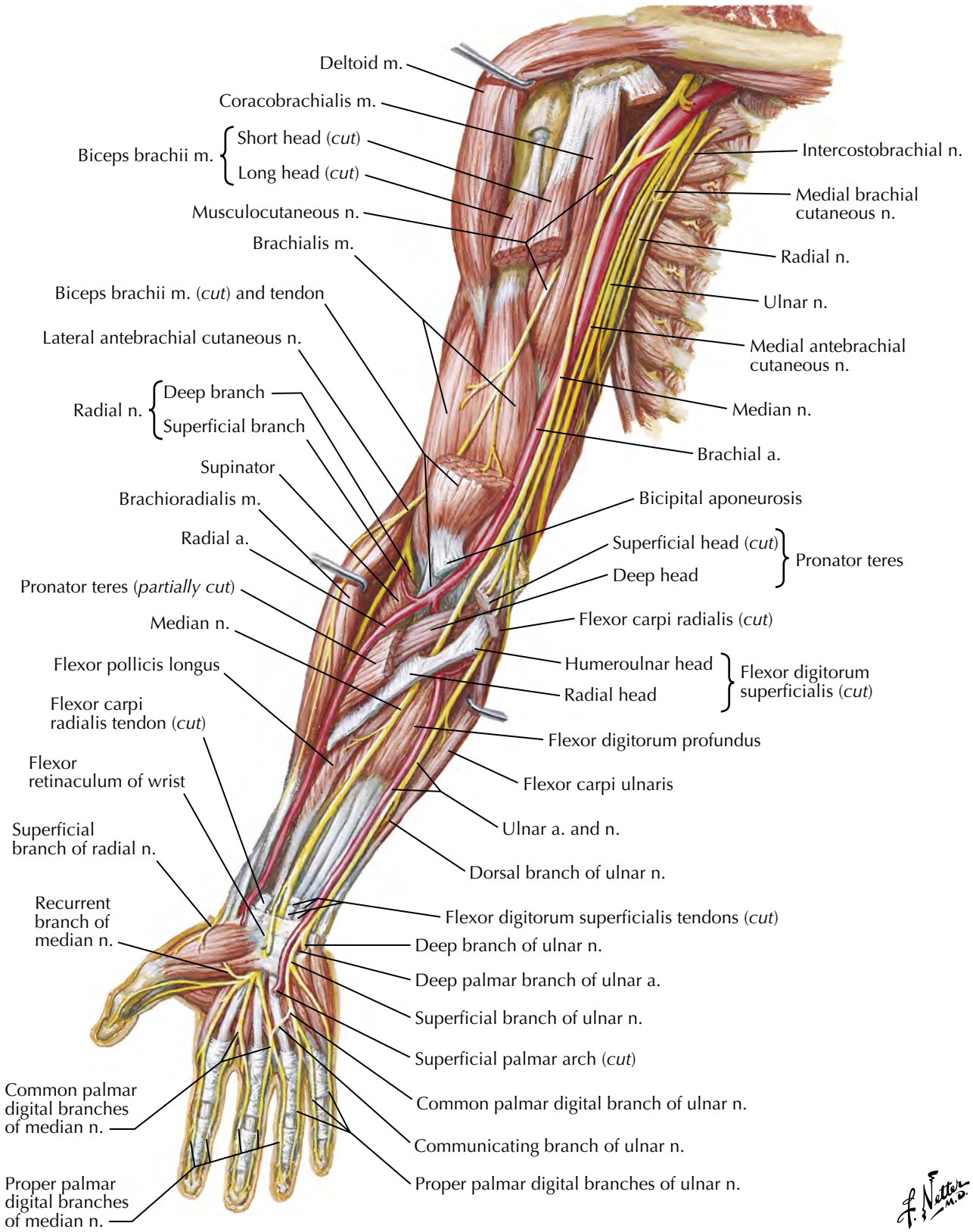

Cross section through distal finger
Nail plate
Nail bed
Arterioles
Distal phalanx
Nerve branches
Pulp of distal finger (fibrous septa and loose connective tissue in anterior closed space)

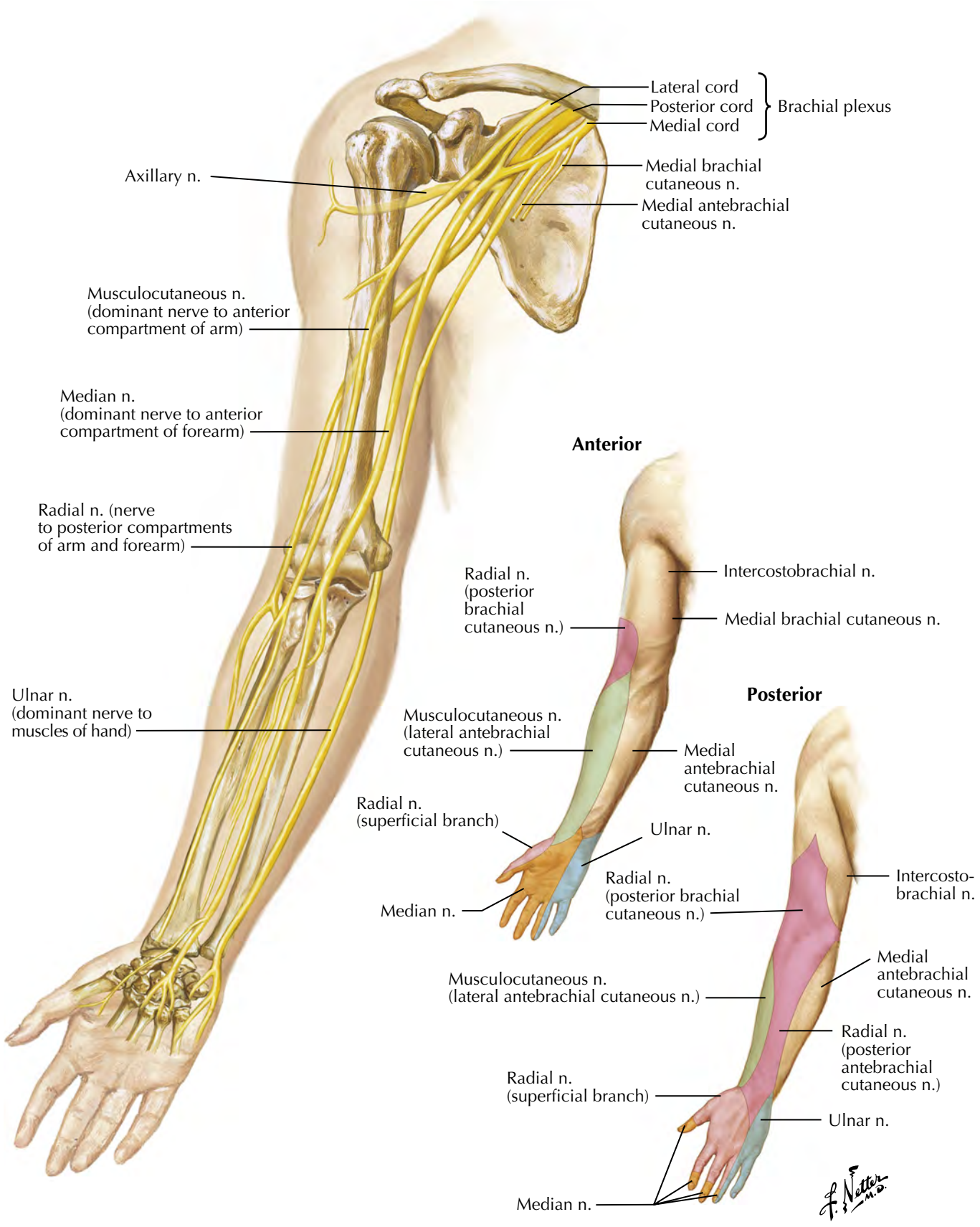

Dorsal branches of proper palmar digital a. and n. to dorsum of middle and distal phalanges
Dorsal digital a. and n.
Arteries and nerves
Nutrient arterial branch (to epiphysis)
Proper palmar digital a. (to neighboring digit)
Nutrient arterial branches (to diaphysis)
Proper palmar digital a. and n.

See also **Plates 423, 472**

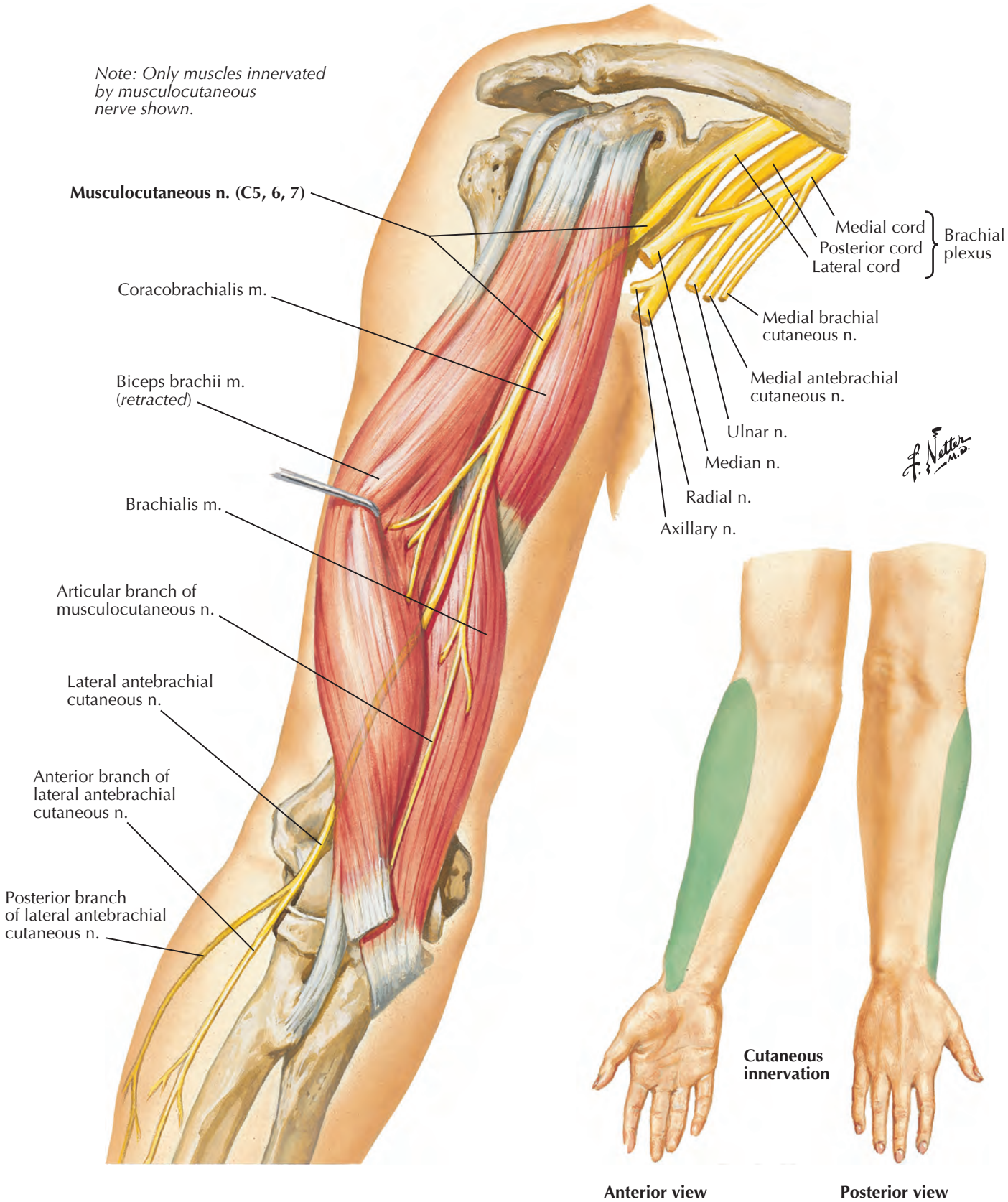


See also **Plates 442, 458**



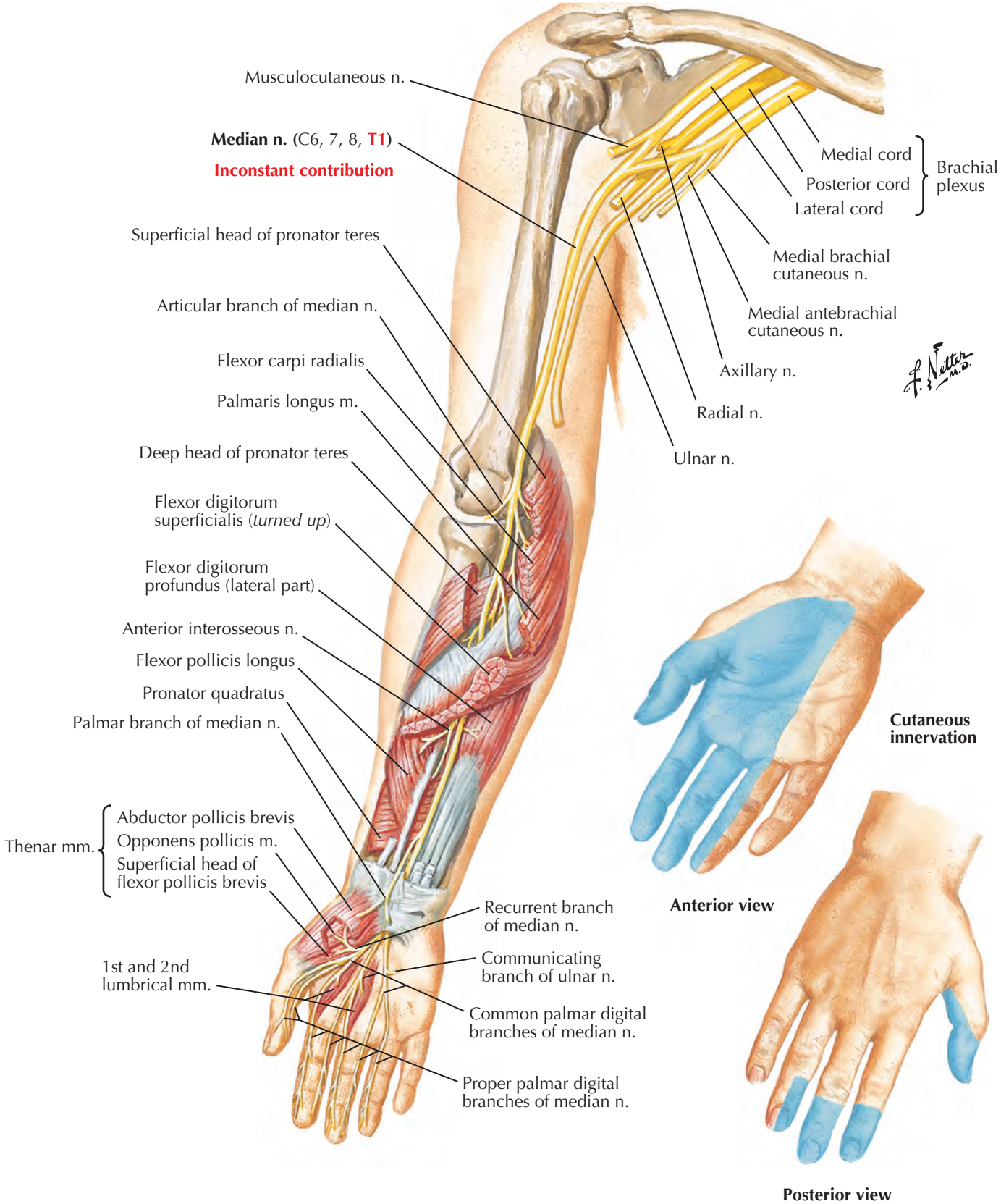

Lateral cord
Posterior cord
Medial cord
Brachial plexus
Axillary n.
Medial brachial cutaneous n.
Medial antebrachial cutaneous n.
Musculocutaneous n. (dominant nerve to anterior compartment of arm)
Median n. (dominant nerve to anterior compartment of forearm)
Radial n. (nerve to posterior compartments of arm and forearm)
Ulnar n. (dominant nerve to muscles of hand)
Anterior
Radial n. (posterior brachial cutaneous n.)
Intercostobrachial n.
Medial brachial cutaneous n.
Musculocutaneous n. (lateral antebrachial cutaneous n.)
Medial antebrachial cutaneous n.
Radial n. (superficial branch)
Ulnar n.
Median n.
Radial n. (posterior brachial cutaneous n.)
Posterior
Intercosto-brachial n.
Medial antebrachial cutaneous n.
Musculocutaneous n. (lateral antebrachial cutaneous n.)
Radial n. (posterior antebrachial cutaneous n.)
Radial n. (superficial branch)
Ulnar n.
Median n.
F. Netter M.D.

See also **Plate 440**

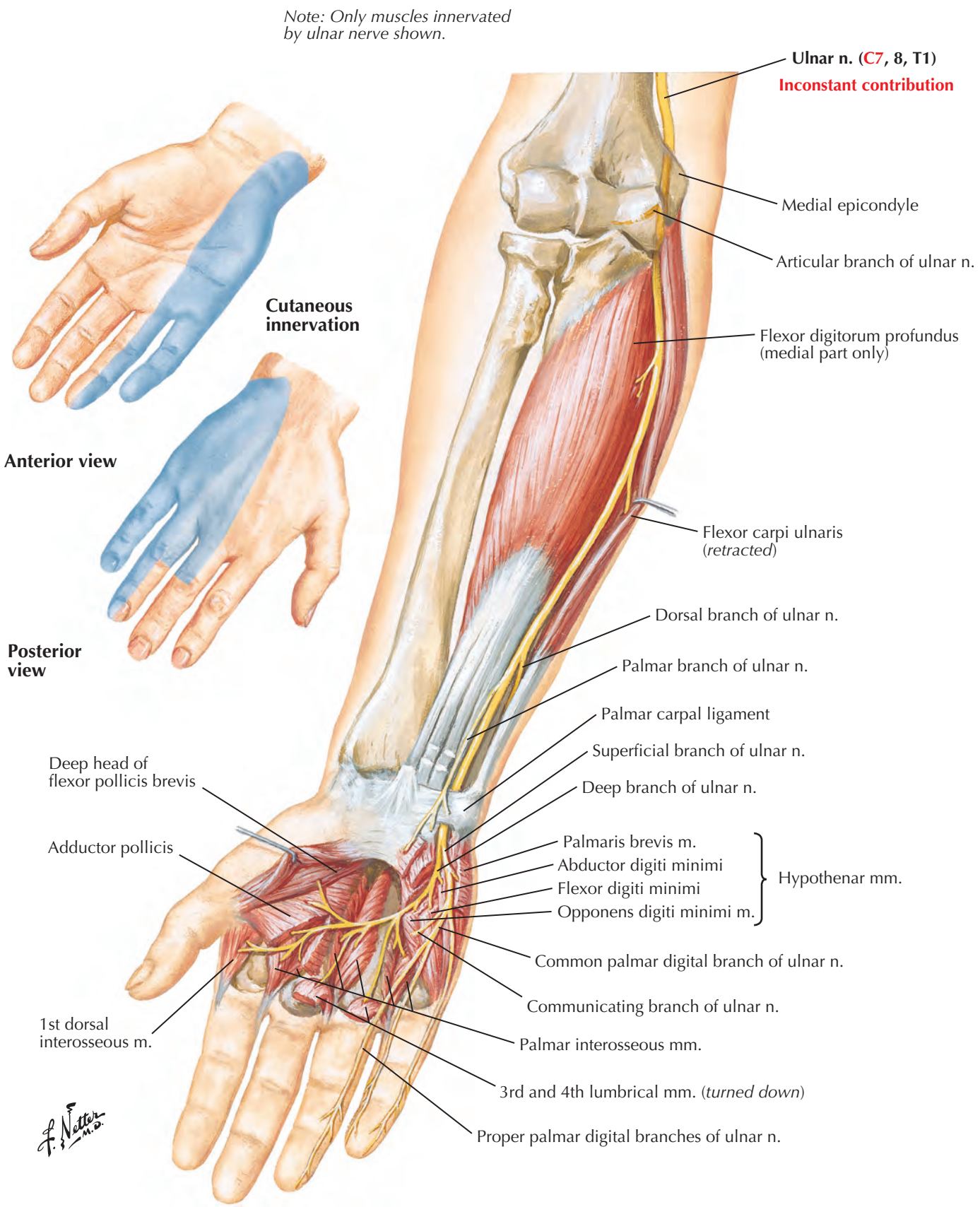


See also **Plates 423, 456, 457**

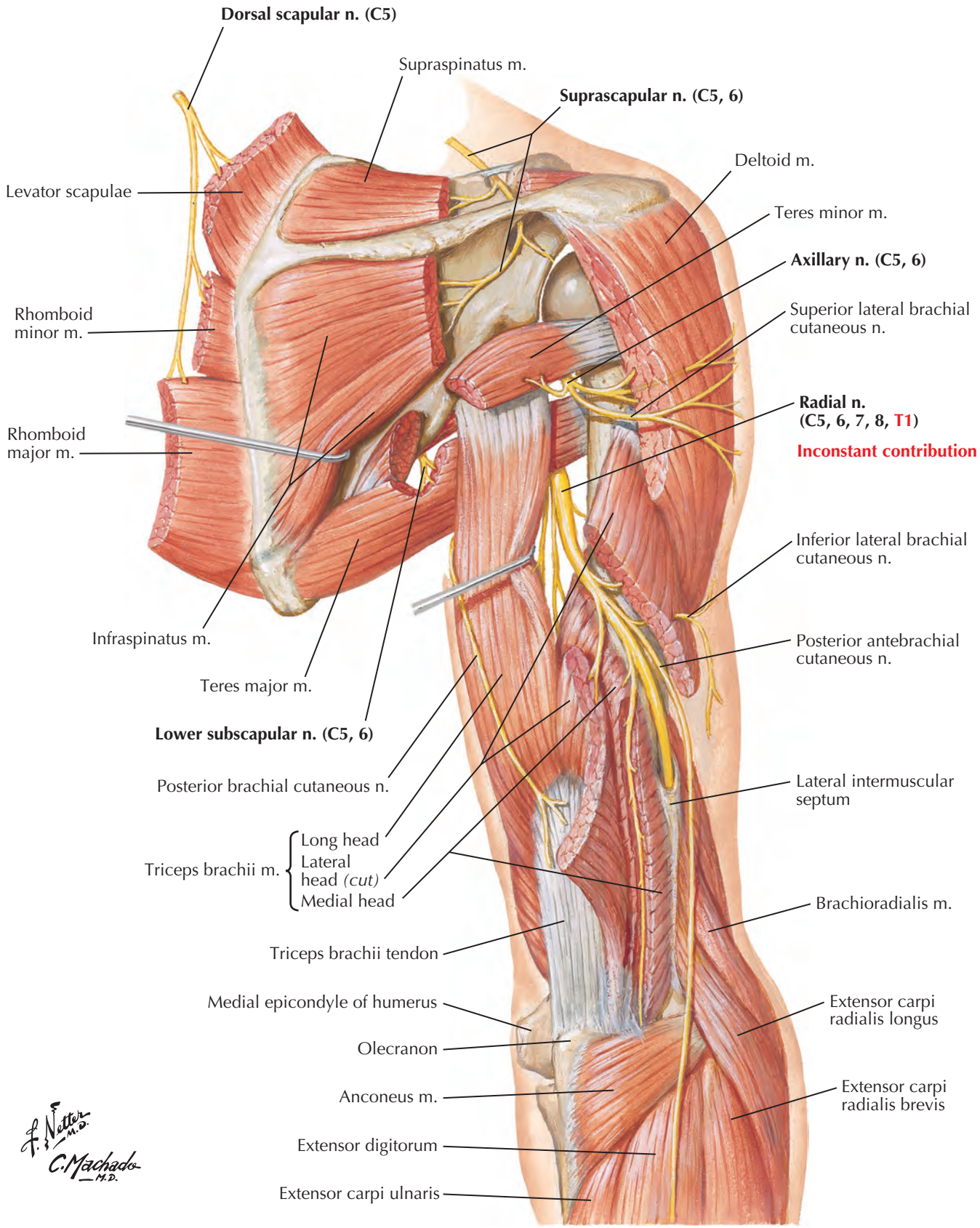
Note: Only muscles innervated by median nerve shown.



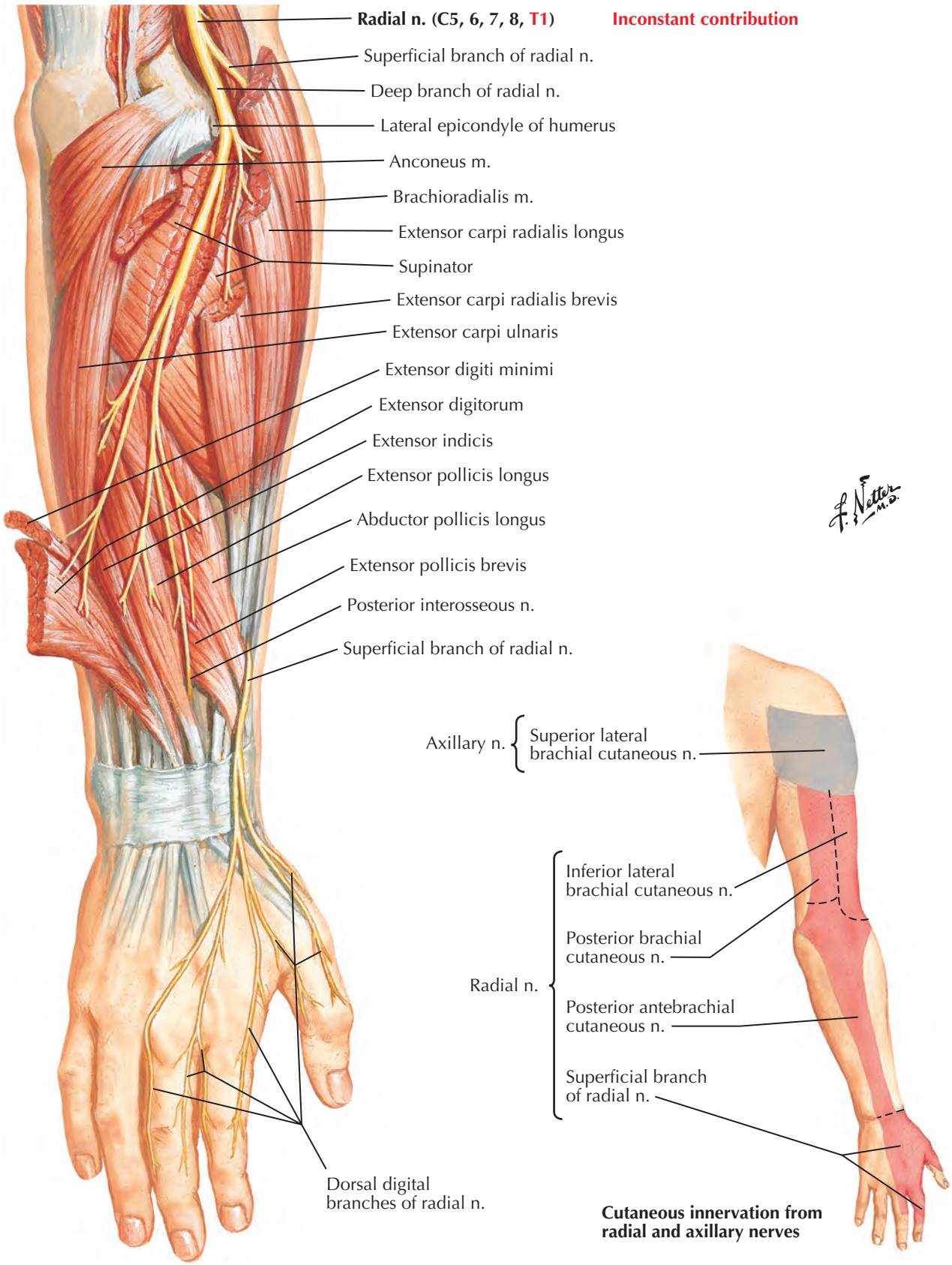
See also **Plates 456, 457**



See also **Plates 436, 441**

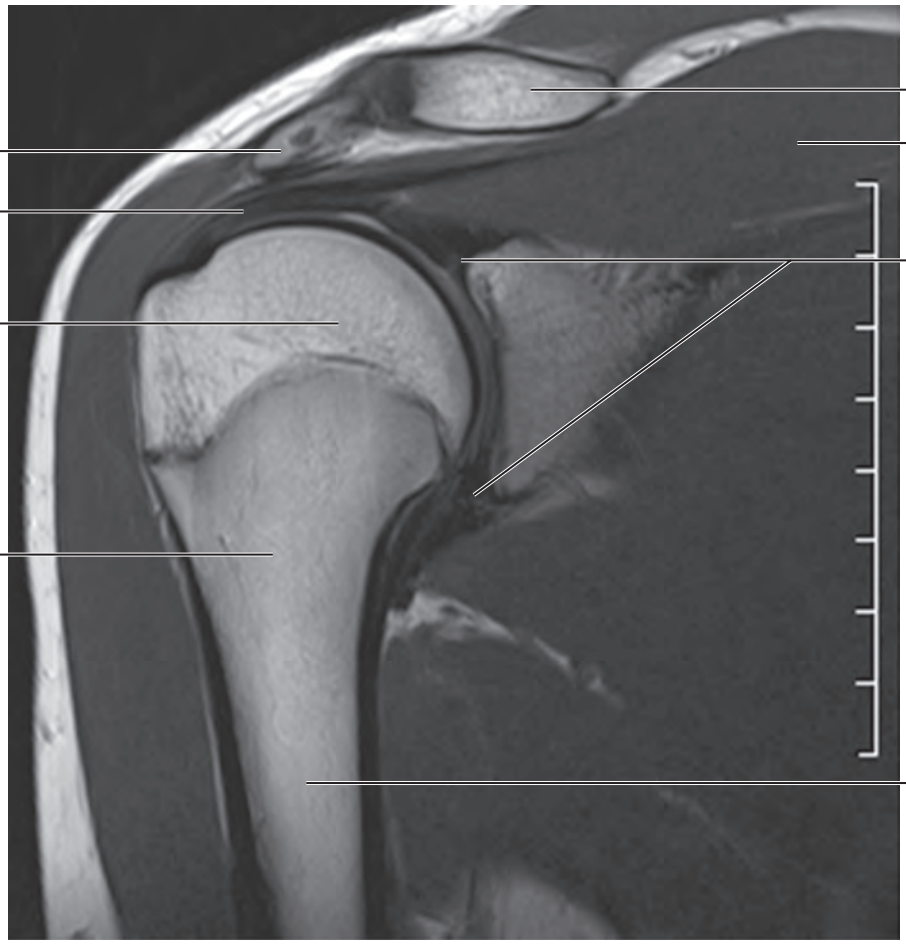


See also **Plates 454, 477**

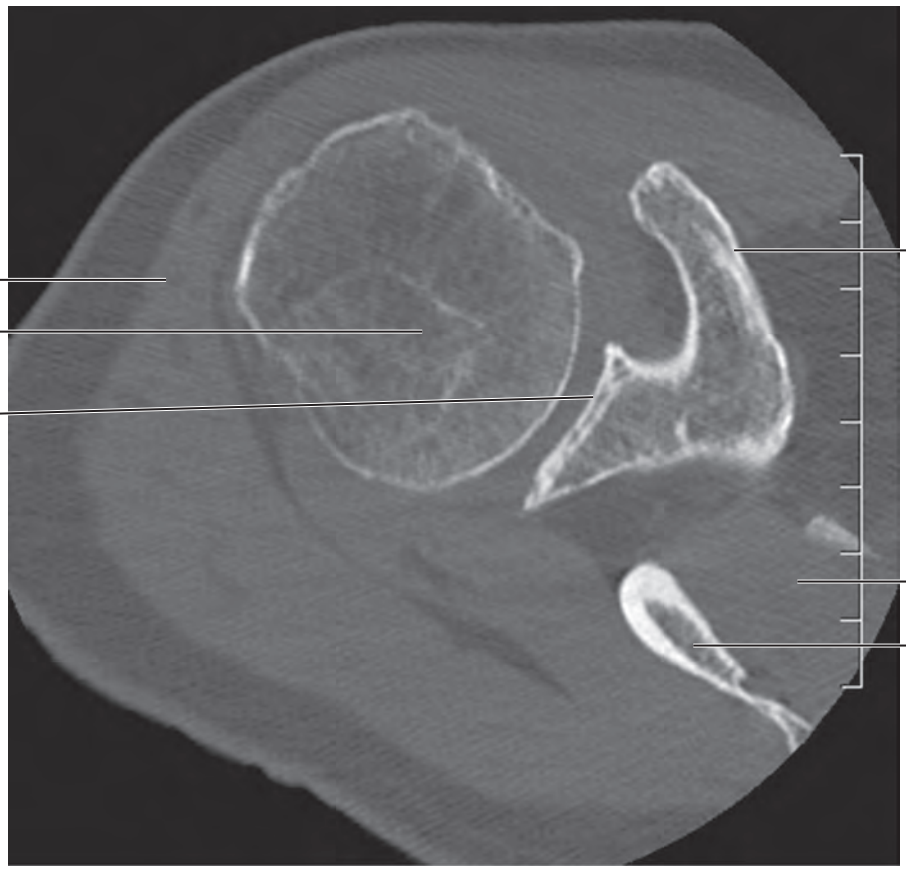


See also **Plates 263, 431**

Coronal proton-density MRI of right glenohumeral joint



Axial CT image of right glenohumeral joint



ANATOMICAL STRUCTURE	CLINICAL COMMENT	PLATE NUMBERS
Nervous System and Sense Organs		
Long thoracic nerve	Injury may produce "winged scapula" caused by denervation of serratus anterior muscle; can be injured with repetitive overhead motion	436, 438
Axillary nerve	Position of nerve close to surgical neck of humerus makes it vulnerable to injury with fractures or dislocations of humerus; poorly fitting crutches can also compress axillary nerve	441
Median nerve	Compressed in carpal tunnel syndrome, producing pain and paresthesia in lateral three and one-half digits; major risk factors include obesity, pregnancy, diabetes, and hypothyroidism	470, 486
Recurrent branch of median nerve	May be injured in superficial lacerations of palm over thenar eminence	469
Ulnar nerve	Vulnerable to compression or injury where it passes posterior to medial epicondyle of humerus, and at wrist in ulnar tunnel (Guyon's canal)	483, 487
Radial nerve	Vulnerable to compression or injury where it lies against humerus in radial groove (e.g., with humerus fracture); common symptom is wrist drop due to weakness of wrist extensors; poorly fitting crutches can also compress radial nerve	488, 489
Skeletal System		
Clavicle	Most clavicular fractures are caused from fall on outstretched arm or direct trauma delivered to lateral side of shoulder; middle third of clavicle is most commonly fractured; supraclavicular nerve block relieves acute pain associated with fracture	427, 429
Humerus	Proximal humerus, especially surgical neck, is fractured due to low-energy falls in elderly persons and high-energy trauma in young persons; axillary nerve and circumflex humeral arteries can be injured; hematoma from anterior/posterior circumflex humeral artery damage as result of dislocation may complicate reductions; midbody fractures are also relatively common and may affect radial nerve and/or deep brachial artery; distal humerus fractures may affect ulnar nerve medially and radial nerve laterally	427, 428, 430
Ulna	Subcutaneous location of olecranon makes it vulnerable to fracture by direct trauma, especially when elbow is flexed; ulnar styloid process may also be fractured with distal radial fractures	446, 449
Radius	Fractures of distal radius are most common fracture of upper limb (Colles' fracture), typically caused by fall on outstretched hand (FOOSH)	449
Scaphoid bone	Most commonly fractured carpal bone, typically from fall on outstretched hand (FOOSH)	459, 460, 462
Muscular System		
Palmar aponeurosis	Progressive fibrosis may result in nodules and eventually a palpable cord that limits finger extension (Dupuytren's contracture)	469
Rotator cuff muscles	Injuries to this group of muscles can result from acute injury or chronic overuse and are a common cause of shoulder pain and disability	431, 434, 441
Supraspinatus tendon	Most commonly torn rotator cuff tendon	434–436, 441
Biceps brachii tendon	Can rupture from sudden load on muscle when contracting; used in flexor compartment reflex assessing C5 and C6 spinal nerves	440, 442
Long head of biceps brachii muscle	Tendon of long head of biceps brachii muscle can cause shoulder pain from tendinosis of intraarticular portion and can rupture in elderly persons from falls on outstretched arm; when long head has been ruptured, it usually tears from supraglenoid tubercle and retracts down into arm; muscle commonly bulges (Popeye deformity) at midbody of humerus; spontaneous rupture may occur in amyloidosis, infiltrative disease that also causes cardiomyopathy	440

ANATOMICAL STRUCTURE	CLINICAL COMMENT	PLATE NUMBERS
Muscles of posterior compartment of forearm	Repetitive use of muscles arising from common extensor origin can damage tendons and produce pain over lateral epicondyle region (epicondylitis); activities such as swinging tennis racquet and poor technique with hammer can result in "tennis elbow"; muscle most likely involved is extensor carpi radialis brevis	451
Muscles of anterior compartment of forearm	Repetitive use of muscles arising from common flexor origin can damage tendons and produce pain over medial epicondyle region (golfer's elbow)	452, 453
Cardiovascular System		
Median cubital vein	Accessed in cubital fossa for venipuncture	424
Suprascapular, dorsal scapular, and circumflex scapular arteries	Provide collateral circulation around scapula, allowing blood to reach distal part of upper limb if axillary artery is blocked or compressed	437
Brachial artery	During deflation of sphygmomanometer on upper arm, brachial artery is auscultated for Korotkoff sounds to measure systolic and diastolic blood pressure; identified medial to biceps brachii tendon and deep to bicipital aponeurosis in cubital fossa	442, 443
Radial artery	Palpated at lateral aspect of wrist to assess radial pulse; common site of vascular access for percutaneous cardiac procedures, such as angioplasty, and for sampling of arterial blood	14, 443
Ulnar artery	Provides important collateral circulation to hand via palmar arch during catheterization of radial artery; patency is assessed prior to procedure using Allen test, in which both radial and ulnar arteries are compressed, then pressure over ulnar artery is released; return of color to wrist within a few seconds indicates patent ulnar artery	443, 476

*Selections were based largely on clinical data and commonly discussed clinical correlations in macroscopic ("gross") anatomy courses.

Nerves of Brachial Plexus

The roots of the brachial plexus are typically the anterior rami of the C5–T1 spinal nerves. Variation in the spinal nerve contributions to the plexus, and the nerves that arise from this plexus, is common, due to prefixed (high) and postfixed (low) plexuses.

NERVE	ORIGIN	COURSE	BRANCHES	MOTOR	CUTANEOUS
Dorsal scapular nerve	Anterior ramus of C5 spinal nerve	Pierces scalenus medius muscle to run posteriorly and inferiorly on levator scapulae along vertebral border of scapula		Rhomboid major and minor muscles, levator scapulae	
Long thoracic nerve	Anterior rami of C5–C7 spinal nerves	C5–C6 join within scalenus medius muscle, and at 1st rib are joined by C7; runs inferiorly and posterior to brachial plexus and axillary vessels; follows midaxillary line on surface of serratus anterior muscle		Serratus anterior muscle	
Suprascapular nerve	Superior trunk (C5–C6)	Traverses posterior cervical triangle, coursing posterior to inferior belly of omohyoid muscle and border of trapezius muscle to pass through scapular notch deep to superior transverse scapular ligament; continues laterally and then through spinoglenoid notch into infraspinous fossa		Supraspinatus and infraspinatus muscles	
Subclavian nerve	Superior trunk (C5–C6)	Runs inferiorly at distal aspect of anterior rami		Subclavius muscle	
Lateral pectoral nerve	Lateral cord (C5–C7)	Emerges lateral and superficial to axillary artery and vein, coursing just medial to pectoralis minor muscle		Pectoralis major and minor muscles	
Musculocutaneous nerve	Lateral cord (C5–C7)	Emerges at inferior border of pectoralis minor muscle, pierces coracobrachialis muscle to run between brachialis and biceps brachii muscles; just proximal to elbow, pierces deep fascia to continue as lateral antebrachial cutaneous nerve	Muscular branches, lateral antebrachial cutaneous nerve	Anterior compartment of arm	See lateral antebrachial cutaneous nerve
Lateral antebrachial cutaneous nerve	Musculocutaneous nerve	Runs posterior to cephalic vein and travels along lateral surface of forearm	Divides at elbow joint into anterior and posterior branches		Lateral forearm
Subscapular nerves	Posterior cord (C5–C6)	Upper and lower subscapular nerves emerge to traverse anterior surface of subscapularis muscle; lower subscapular nerve ends in teres major muscle		Teres major and subscapularis muscles	
Thoracodorsal nerve	Posterior cord (C6–C8)	Emerges between upper and lower subscapular nerves, courses with thoracodorsal artery along posterior axillary wall, diving deep to latissimus dorsi muscle		Latissimus dorsi muscle	
Radial nerve	Posterior cord (C5–T1)	Runs anterior to latissimus dorsi muscle to inferior border of teres major muscle, where it accompanies deep brachial artery along radial groove of humerus to course between medial and lateral heads of triceps brachii muscle	Posterior and inferior lateral brachial cutaneous nerves, posterior antebrachial cutaneous nerve, muscular, deep, and superficial branches and posterior interosseous nerve	Triceps brachii, anconeus, and brachioradialis muscles, extensores carpi radiales longus and brevis, supinator (also see posterior interosseous nerve)	Lateral part of dorsum of hand (also see cutaneous branches)
Posterior brachial cutaneous nerve	Radial nerve	Emerges from radial nerve in medial axilla			Posterior part of medial arm

NERVE	ORIGIN	COURSE	BRANCHES	MOTOR	CUTANEOUS
Inferior lateral brachial cutaneous nerve	Radial nerve	Perforates lateral head of triceps brachii muscle below deltoid tuberosity, coursing anteriorly with cephalic vein			Distal part of lateral arm
Posterior antebrachial cutaneous nerve	Radial nerve	Emerges from plane between lateral and medial heads of triceps brachii muscle to become cutaneous			Posterior part of lateral forearm
Posterior interosseous nerve	Deep branch of radial nerve	Continuation of deep radial nerve courses under cover of supinator distally along posterior surface of interosseous membrane of forearm		Posterior compartment of forearm (some exceptions)	
Axillary nerve	Posterior cord (C5–C6)	Passes anterior to subscapularis muscle to exit axilla with posterior circumflex humeral artery through quadrangular space	Muscular branches, superior lateral brachial cutaneous nerve	Deltoid and teres minor muscles	See superior lateral brachial cutaneous nerve
Superior lateral brachial cutaneous nerve	Axillary nerve	Pierces deep fascia at posteroinferior edge of deltoid muscle to become cutaneous			Proximal part of lateral arm
Medial pectoral nerve	Medial cord (C8–T1)	Emerges and runs between axillary artery and vein to pierce pectoralis minor muscle en route to pectoralis major muscle		Pectoralis minor and major muscles	
Medial brachial cutaneous nerve	Medial cord (T1)	Emerges and traverses axilla anterior to latissimus dorsi muscle, running posteromedial with axillary vein, piercing deep fascia to descend with basilic vein	Anterior and posterior branches		Anterior part of medial arm
Medial antebrachial cutaneous nerve	Medial cord (C8–T1)	Emerges medial to axillary artery, traverses axilla to pierce deep fascia supplying anterior arm, and continues on ulnar side of forearm with basilic vein	Anterior and posterior branches		Anterior arm, medial part of forearm
Ulnar nerve	Medial cord (C7–T1)	Emerges medial to axillary artery, continuing medial to brachial artery along medial head of triceps brachii muscle in groove for ulnar nerve between olecranon and medial epicondyle; enters forearm between heads of flexor carpi ulnaris; runs distally between flexor carpi ulnaris and flexor digitorum profundus, giving off dorsal branch before entering hand	Muscular, dorsal, palmar, superficial, and deep branches	Flexor carpi ulnaris, flexor digitorum profundus (medial half), adductor pollicis, hypothenar muscles, dorsal and palmar interosseous muscles, lumbrical muscles (medial two)	Medial part of palm and dorsum of hand, 5th finger and part of 4th
Median nerve	Medial and lateral cords (C6–T1)	Emerges and runs distally with brachial artery to enter forearm between heads of pronator teres; courses distally on deep surface of flexor digitorum superficialis to become superficial at flexor retinaculum of wrist; traverses carpal tunnel deep to flexor retinaculum of wrist	Anterior interosseous nerve, muscular, palmar, recurrent, and common palmar digital branches	Anterior compartment of forearm (*some exceptions*), lumbricals (lateral two), and thenar muscles (also see anterior interosseous nerve)	Lateral part of palm, thumb, 2nd and 3rd fingers, and part of 4th finger
Anterior interosseous nerve	Median nerve	At elbow runs distally with anterior interosseous artery along anterior surface of interosseous membrane of forearm		Flexor pollicis longus, pronator quadratus, flexor digitorum profundus (lateral half)	

MUSCLE	MUSCLE GROUP	PROXIMAL ATTACHMENT	DISTAL ATTACHMENT	INNERVATION	BLOOD SUPPLY	MAIN ACTIONS
Abductor digiti minimi of hand	Hand	Pisiform bone, tendon of flexor carpi ulnaris	Medial surface of base of proximal phalanx of little finger (5th digit)	Ulnar nerve (deep branch)	Deep palmar branch of ulnar artery	Abducts little finger
Abductor pollicis brevis	Hand	Flexor retinaculum of wrist, tubercles of scaphoid and trapezium bones	Base of proximal phalanx of thumb	Median nerve (recurrent branch)	Superficial palmar branch of radial artery	Abducts thumb
Abductor pollicis longus	Posterior forearm	Posterior surfaces of ulna, radius, and interosseous membrane of forearm	Base of 1st metacarpal	Posterior interosseous nerve	Posterior interosseous artery	Abducts and extends thumb
Adductor pollicis	Hand	*Oblique head:* bases of 2nd and 3rd metacarpals, capitate and adjacent carpal bones *Transverse head:* anterior surface of 3rd metacarpal	Base of proximal phalanx of thumb	Ulnar nerve (deep branch)	Deep palmar arch	Adducts thumb
Anconeus m.	Posterior forearm	Posterior surface of lateral epicondyle of humerus	Lateral surface of olecranon, posterior surface of proximal ulna	Radial nerve	Deep brachial artery	Assists triceps brachii m. in extending elbow
Biceps brachii m.	Anterior arm	*Long head:* supraglenoid tubercle of scapula *Short head:* coracoid process of scapula	Radial tuberosity, fascia of forearm (via bicipital aponeurosis)	Musculocutaneous nerve	Brachial artery	Flexes and supinates forearm
Brachialis m.	Anterior arm	Distal half of anterior surface of humerus	Coronoid process and tuberosity of ulna	Musculocutaneous and radial nerves	Radial recurrent and brachial arteries	Flexes forearm
Brachioradialis m.	Posterior forearm	Proximal two thirds of lateral supracondylar ridge of humerus	Lateral surface of distal end of radius	Radial nerve	Radial recurrent artery	Weak flexion of forearm when forearm is in midpronation
Coracobrachialis m.	Anterior arm	Coracoid process of scapula	Middle one third of medial surface of humerus	Musculocutaneous nerve	Brachial artery	Flexes and adducts arm
Deltoid m.	Shoulder	*Clavicular part:* lateral one third of clavicle *Acromial part:* acromion *Spinous part:* spine of scapula	Deltoid tuberosity of humerus	Axillary nerve	Posterior circumflex humeral artery Deltoid branch of thoraco-acromial artery	*Clavicular part:* flexes and medially rotates arm *Acromial part:* abducts arm beyond initial 15 degrees done by supraspinatus m. *Spinous part:* extends and laterally rotates arm
Dorsal interosseous mm. of hand	Hand	Facing surfaces of adjacent metacarpal bones	Base of proximal phalanges, and extensor expansions of digits 2–4	Ulnar nerve (deep branch)	Deep palmar arch	Abduct digits; flex digits at metacarpophalangeal joint and extend interphalangeal joints
Extensor carpi radialis brevis	Posterior forearm	Lateral epicondyle of humerus	Bases of 3rd and 2nd metacarpal bones	Radial nerve (deep branch)	Radial and radial recurrent arteries	Extends and abducts hand
Extensor carpi radialis longus	Posterior forearm	Distal one third of lateral supracondylar ridge of humerus	Base of 2nd metacarpal	Radial nerve	Radial and radial recurrent arteries	Extends and abducts hand

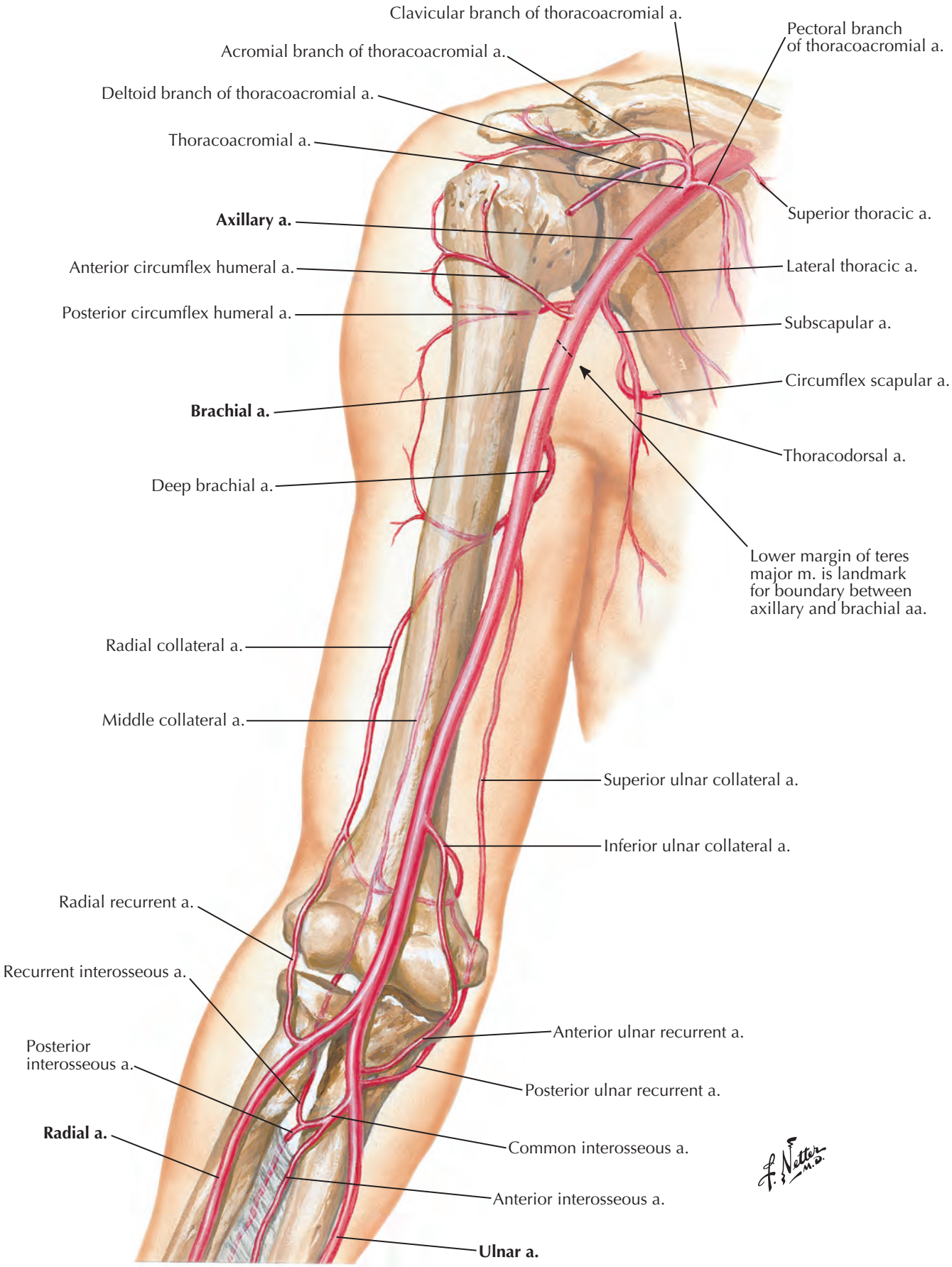
MUSCLE	MUSCLE GROUP	PROXIMAL ATTACHMENT	DISTAL ATTACHMENT	INNERVATION	BLOOD SUPPLY	MAIN ACTIONS
Extensor carpi ulnaris	Posterior forearm	Lateral epicondyle of humerus, posterior border of ulna	Base of 5th metacarpal bone	Posterior interosseous nerve	Posterior interosseous artery	Extends and adducts hand
Extensor digiti minimi	Posterior forearm	Lateral epicondyle of humerus	Extensor expansion of little finger	Posterior interosseous nerve	Posterior interosseous artery	Extends 5th digit
Extensor digitorum	Posterior forearm	Lateral epicondyle of humerus	Extensor expansions of digits 2–5	Posterior interosseous nerve	Posterior interosseous artery	Extends medial four metacarpophalangeal joints, assists in wrist extension
Extensor indicis	Posterior forearm	Posterior surfaces of ulna and interosseous membrane of forearm	Extensor expansion of 2nd digit	Posterior interosseous nerve	Posterior interosseous artery	Extends 2nd digit and helps extend hand
Extensor pollicis brevis	Posterior forearm	Posterior surfaces of radius and interosseous membrane of forearm	Dorsal surface of base of proximal phalanx of thumb	Posterior interosseous nerve	Posterior interosseous artery	Extends proximal phalanx of thumb
Extensor pollicis longus	Posterior forearm	Posterior surfaces of middle one third of ulna and interosseous membrane of forearm	Dorsal surface of base of distal phalanx of thumb	Posterior interosseous nerve	Posterior interosseous artery	Extends distal phalanx of thumb
Flexor carpi radialis	Anterior forearm	Medial epicondyle of humerus	Base of 2nd metacarpal bone	Median nerve	Radial artery	Flexes and abducts hand
Flexor carpi ulnaris	Anterior forearm	*Superficial head:* medial epicondyle of humerus *Deep head:* olecranon and posterior border of ulna	Pisiform bone, hook of hamate bone, base of 5th metacarpal bone	Ulnar nerve	Posterior ulnar recurrent artery	Flexes and adducts hand
Flexor digiti minimi of hand	Hand	Flexor retinaculum of wrist, hook of hamate bone	Medial surface of base of proximal phalanx of little finger	Ulnar nerve (deep branch)	Deep palmar branch of ulnar artery	Flexes proximal phalanx of little finger
Flexor digitorum profundus	Anterior forearm	Medial and anterior surfaces of proximal three fourths of ulna, interosseous membrane of forearm	Palmar surface of base of distal phalanges of digits 2–5	Medial part: ulnar nerve Lateral part: median nerve	Anterior interosseous and ulnar arteries	Flexes distal phalanges of medial four digits, assists with flexion of hand
Flexor digitorum superficialis	Anterior forearm	*Humeroulnar head:* medial epicondyle of humerus, coronoid process of ulna, ulnar collateral ligament *Radial head:* anterior surface of proximal radius	Bodies of middle phalanges of medial four digits	Median nerve	Ulnar and radial arteries	Flexes middle and proximal phalanges of medial four digits, flexes hand
Flexor pollicis brevis	Hand	*Superficial head:* flexor retinaculum, tubercle of trapezium bone *Deep head:* trapezoid and capitate bones	Lateral surface of base of proximal phalanx of thumb	Superficial head: median nerve (recurrent branch) Deep head: ulnar nerve (deep branch)	Superficial palmar branch of radial artery	Flexes proximal phalanx of thumb
Flexor pollicis longus	Anterior forearm	Anterior surfaces of radius and interosseous membrane	Palmar base of distal phalanx of thumb	Anterior interosseous nerve	Anterior interosseous artery	Flexes thumb

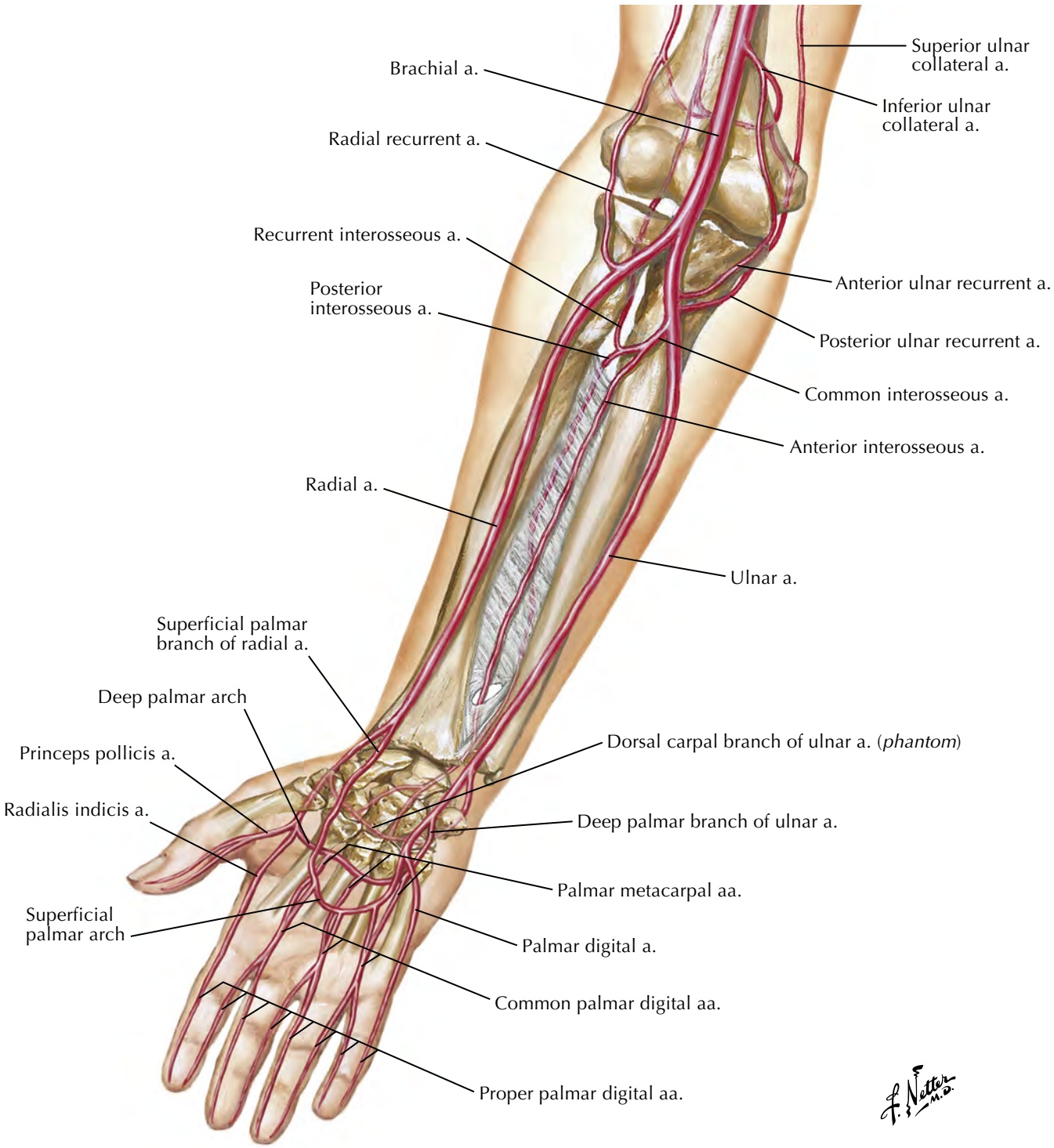
Continued

MUSCLE	MUSCLE GROUP	PROXIMAL ATTACHMENT	DISTAL ATTACHMENT	INNERVATION	BLOOD SUPPLY	MAIN ACTIONS
Infraspinatus m.	Shoulder	Infraspinous fossa of scapula, infraspinatus fascia	Greater tubercle of humerus	Suprascapular nerve	Suprascapular artery	Lateral rotation of arm
Lumbrical mm. of hand	Hand	Tendons of flexor digitorum profundus	Lateral sides of extensor expansions of digits 2–5	*Lateral two:* median nerve (digital branches) *Medial two:* ulnar nerve (deep branch)	Superficial and deep palmar arches	Extend digits, flex metacarpophalangeal joints
Opponens digiti minimi m. of hand	Hand	Flexor retinaculum of wrist, hook of hamate bone	Palmar surface of 5th metacarpal bone	Ulnar nerve (deep branch)	Deep palmar branch of ulnar artery	Draws 5th metacarpal bone anteriorly and rotates it to face thumb
Opponens pollicis m.	Hand	Flexor retinaculum of wrist, tubercle of trapezium bone	Lateral surface of 1st metacarpal bone	Median nerve (recurrent branch)	Superficial palmar branch of radial artery	Draws 1st metacarpal forward and rotates it medially
Palmar interosseous mm.	Hand	Palmar surfaces of metacarpal bones 2, 4, and 5	Bases of proximal phalanges and extensor expansions of digits 2, 4, and 5	Ulnar nerve (deep branch)	Deep palmar arch	Adduct digits; flex digits and extend interphalangeal joints
Palmaris brevis m.	Hand	Palmar aponeurosis, flexor retinaculum	Skin of medial border of palm	Ulnar nerve (superficial branch)	Superficial palmar arch	Deepens hollow of hand, assists grip
Palmaris longus m.	Anterior forearm	Medial epicondyle of humerus	Distal half of flexor retinaculum of wrist, palmar aponeurosis	Median nerve	Posterior ulnar recurrent artery	Flexes hand and tenses palmar aponeurosis
Pronator quadratus	Anterior forearm	Distal one fourth of anterior surface of ulna	Distal one fourth of anterior surface of radius	Anterior interosseous nerve	Anterior interosseous artery	Pronates forearm
Pronator teres	Anterior forearm	*Humeral head:* medial epicondyle of humerus *Ulnar head:* coronoid process of ulna	Middle part of lateral surface of radius	Median nerve	Anterior ulnar recurrent artery	Pronates forearm and flexes elbow
Subscapularis m.	Shoulder	Subscapular fossa	Lesser tubercle of humerus	Upper and lower subscapular nerves	Subscapular and lateral thoracic arteries	Medially rotates and adducts arm; helps hold humeral head in glenoid fossa
Supinator	Posterior forearm	Lateral epicondyle of humerus, radial collateral and annular ligaments, supinator fossa, and crest of ulna	Lateral, posterior, and anterior surfaces of proximal one third of radius	Radial nerve	Radial recurrent and posterior interosseous arteries	Supinates forearm
Supraspinatus m.	Shoulder	Supraspinous fossa of scapula, supraspinatus fascia	Greater tubercle of humerus	Suprascapular nerve	Suprascapular artery	Initiates arm abduction
Teres major m.	Shoulder	Posterior surface of inferior angle of scapula	Medial lip of intertubercular sulcus of humerus	Lower subscapular nerve	Circumflex scapular artery	Adducts and medially rotates arm
Teres minor m.	Shoulder	Superior two-thirds of posterior surface of lateral border of scapula	Greater tubercle of humerus	Axillary nerve	Circumflex scapular artery	Laterally rotates arm

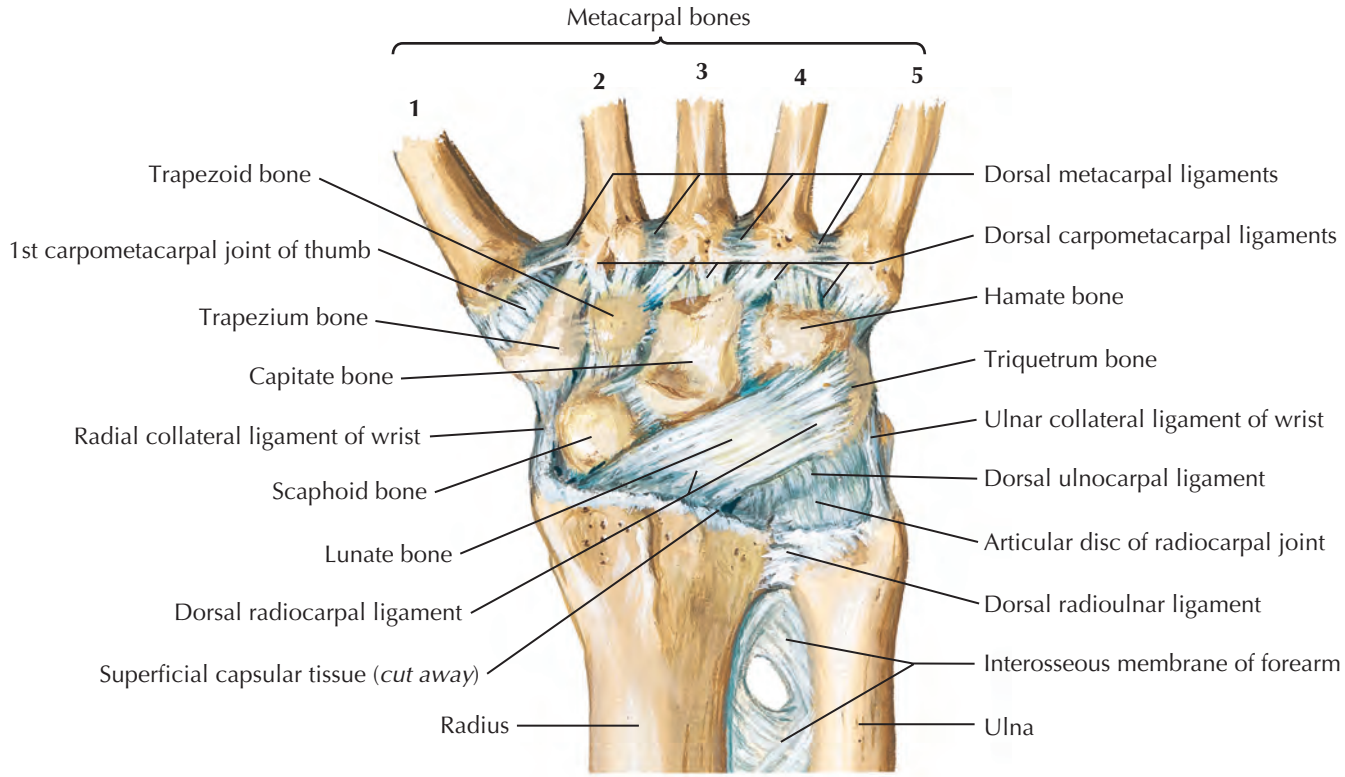
MUSCLE	MUSCLE GROUP	PROXIMAL ATTACHMENT	DISTAL ATTACHMENT	INNERVATION	BLOOD SUPPLY	MAIN ACTIONS
Triceps brachii m.	Posterior arm	*Long head:* infraglenoid tubercle of scapula	Posterior surface of olecranon	Radial nerve	Deep brachial artery	Extends forearm; long head stabilizes head of abducted humerus and extends and adducts arm
		Lateral head: proximal half of posterior humerus				
		Medial head: distal two thirds of medial and posterior humerus				

Variations in spinal nerve contributions to the innervation of muscles, their arterial supply, their attachments, and their actions are common themes in human anatomy. Therefore, expect differences between texts and realize that anatomical variation is normal.

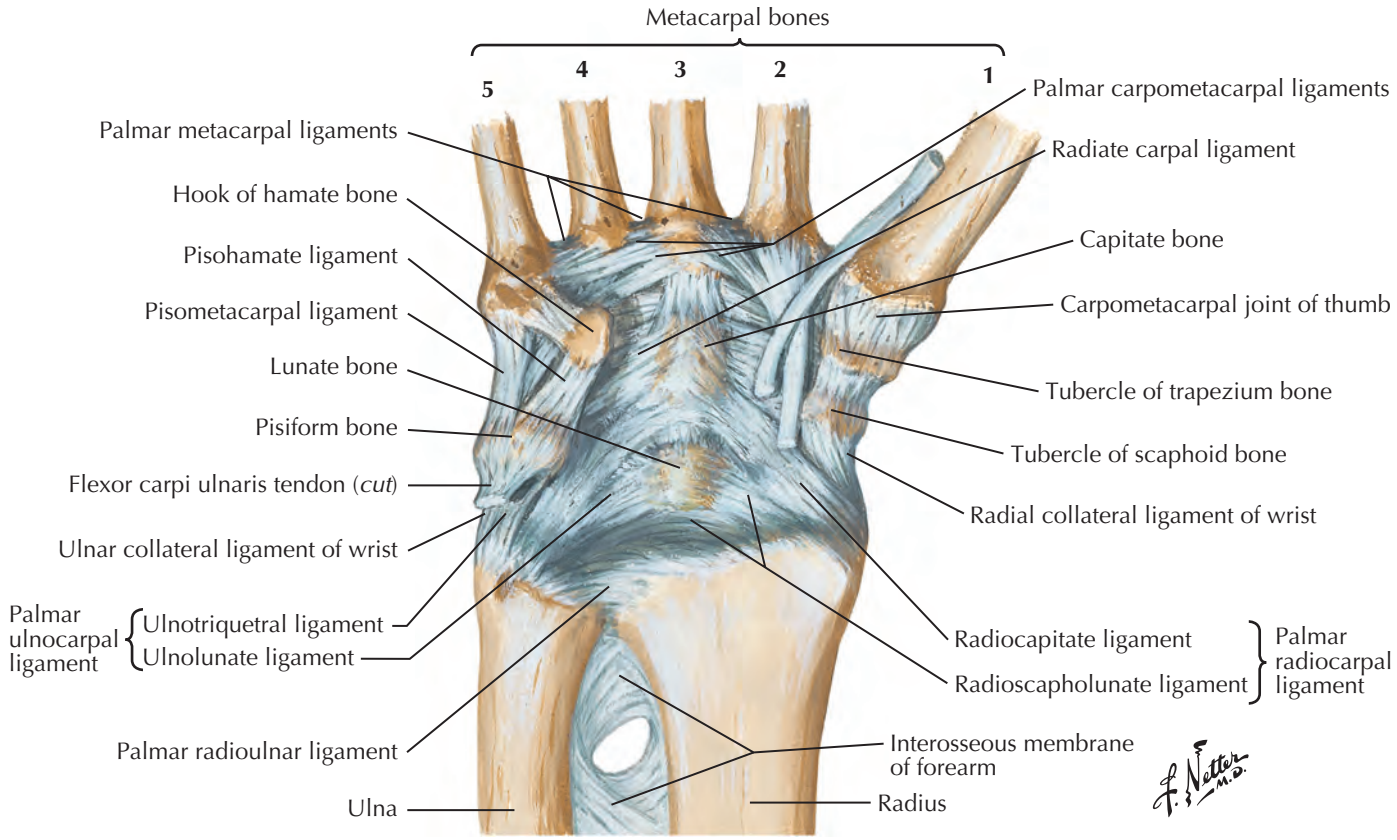

Clavicular branch of thoracoacromial a.
Pectoral branch of thoracoacromial a.
Acromial branch of thoracoacromial a.
Deltoid branch of thoracoacromial a.
Thoracoacromial a.
Superior thoracic a.
Axillary a.
Anterior circumflex humeral a.
Lateral thoracic a.
Posterior circumflex humeral a.
Subscapular a.
Circumflex scapular a.
Brachial a.
Thoracodorsal a.
Deep brachial a.
Lower margin of teres major m. is landmark for boundary between axillary and brachial aa.
Radial collateral a.
Middle collateral a.
Superior ulnar collateral a.
Inferior ulnar collateral a.
Radial recurrent a.
Recurrent interosseous a.
Anterior ulnar recurrent a.
Posterior interosseous a.
Posterior ulnar recurrent a.
Radial a.
Common interosseous a.
Anterior interosseous a.
Ulnar a.


Brachial a.
Radial recurrent a.
Recurrent interosseous a.
Posterior interosseous a.
Radial a.
Superficial palmar branch of radial a.
Deep palmar arch
Princeps pollicis a.
Radialis indicis a.
Superficial palmar arch
Superior ulnar collateral a.
Inferior ulnar collateral a.
Anterior ulnar recurrent a.
Posterior ulnar recurrent a.
Common interosseous a.
Anterior interosseous a.
Ulnar a.
Dorsal carpal branch of ulnar a. (*phantom*)
Deep palmar branch of ulnar a.
Palmar metacarpal aa.
Palmar digital a.
Common palmar digital aa.
Proper palmar digital aa.

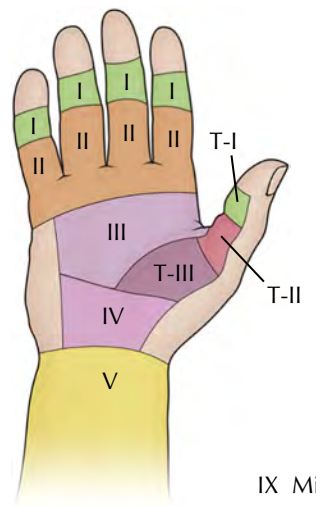
Posterior view

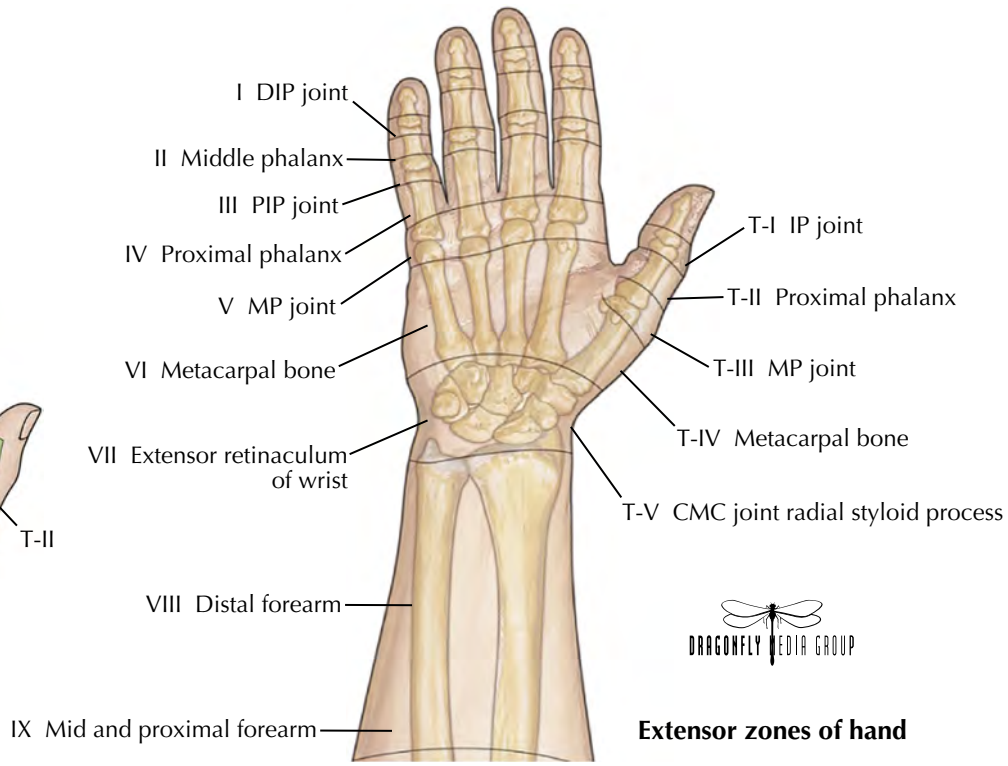


Flexor retinaculum of wrist removed: anterior view



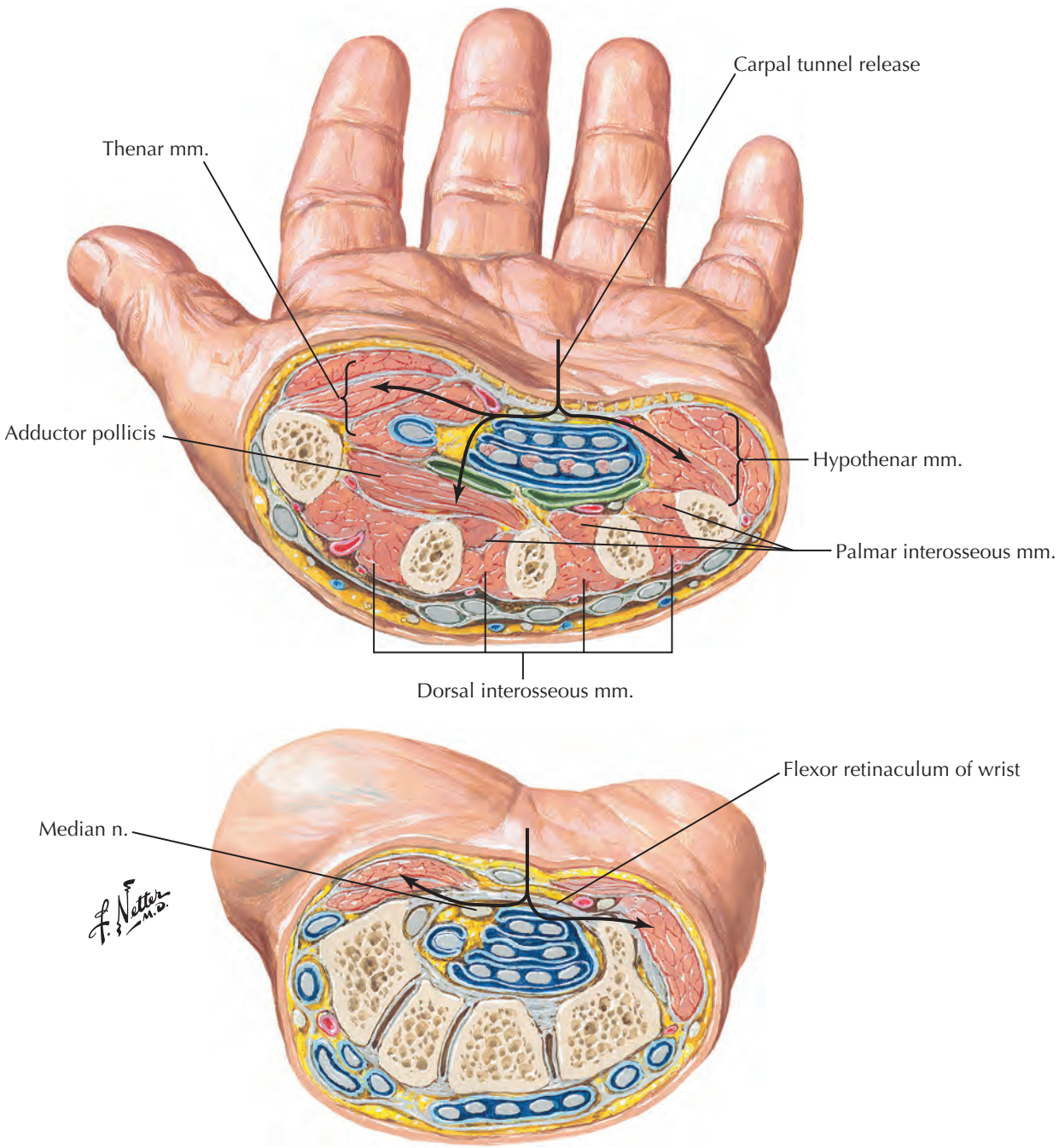
Flexor zones of hand





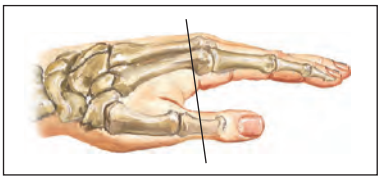
Extensor zones of hand

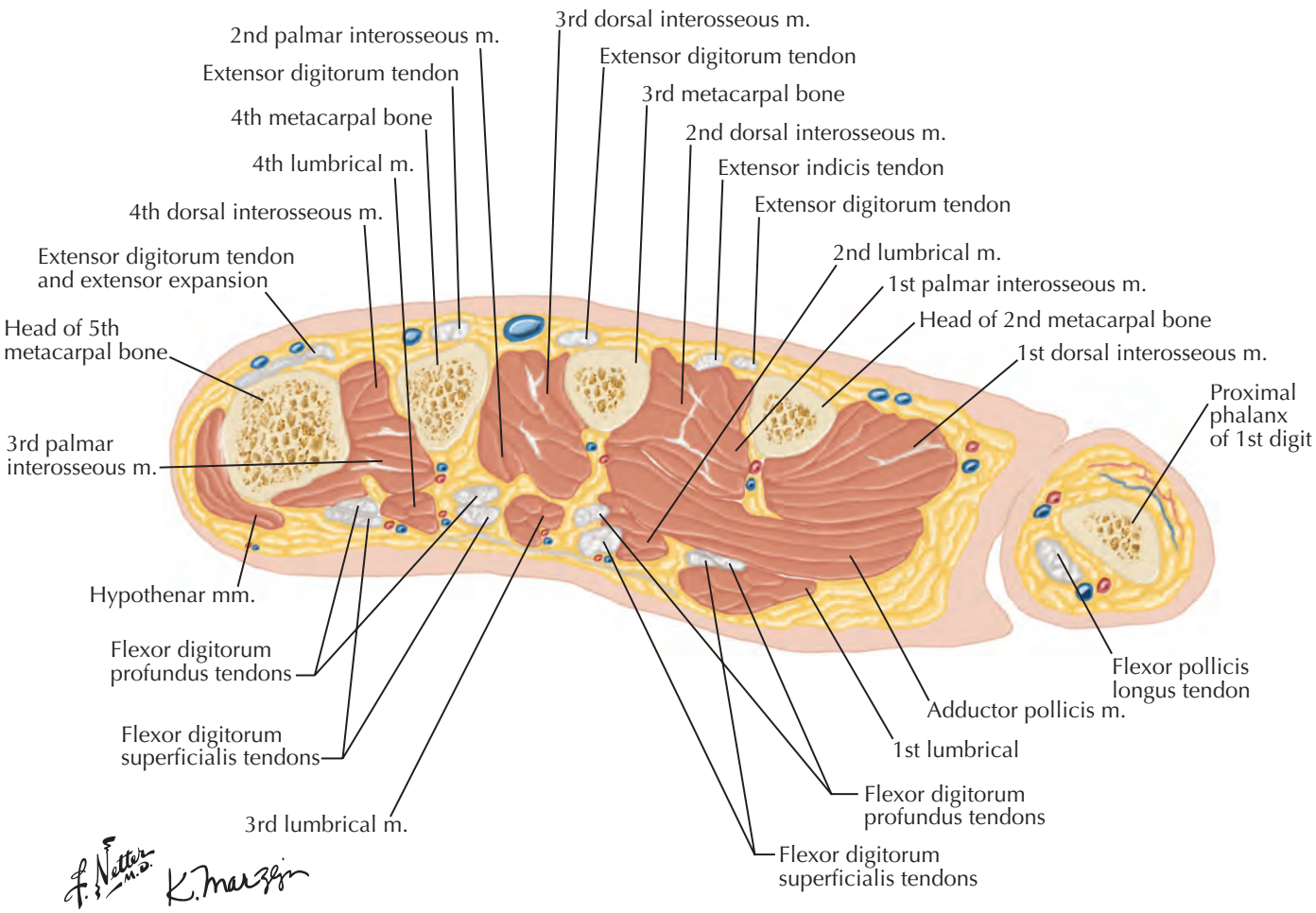
I FDS insertion
II Flexor sheath
III Lumbrical origin
IV Carpal tunnel
V Distal forearm
T-I Distal to IP joint
T-II Thumb MP joint to IP joint
T-III Thenar eminence


Carpal tunnel release
Thenar mm.
Adductor pollicis
Hypothenar mm.
Palmar interosseous mm.
Dorsal interosseous mm.
Flexor retinaculum of wrist
Median n.

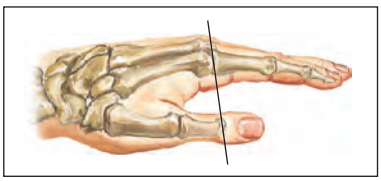
Cross Section of Hand: Axial View

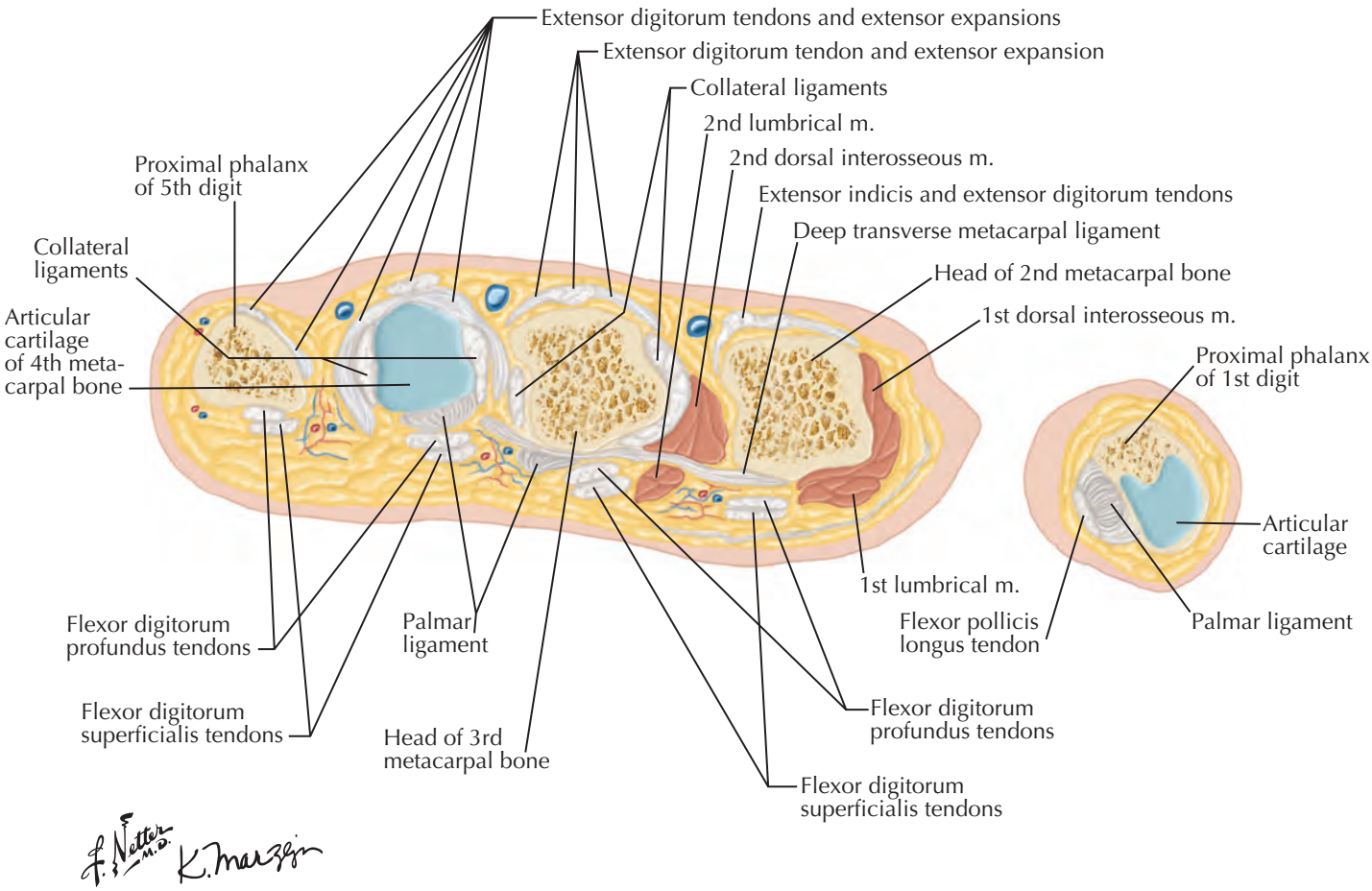
See also **Plate BP 102**





See also **Plate BP 101**



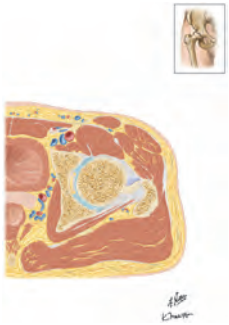


LOWER LIMB 8

Surface Anatomy	491–494	**Structures with High Clinical Significance**	Tables 8.1–8.2
Hip, Buttock, and Thigh	495–515	**Nerves of Lumbosacral Plexus**	Tables 8.3–8.4
Knee	516–523	**Muscles**	Tables 8.5–8.8
Leg	524–534	**Electronic Bonus Plates**	BP 103–BP 112
Ankle and Foot	535–549		
Nerves	550–554		
Regional Imaging	555–556		

ELECTRONIC BONUS PLATES

BP 103 Arteries of Knee and Foot



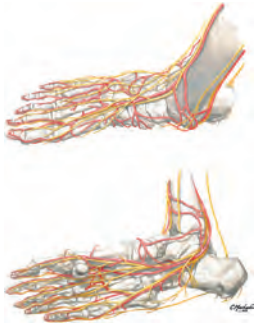
BP 104 Cross-Sectional Anatomy of Hip: Axial View

BP 105 Arteries of Thigh and Knee

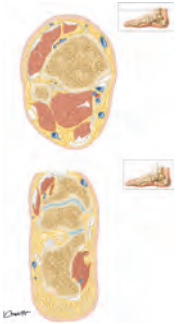
BP 106 Leg: Serial Cross Sections

BP 107 Osteology of Knee

BP 108 Knee Radiograph: Lateral View



BP 109 Foot: Nerves and Arteries



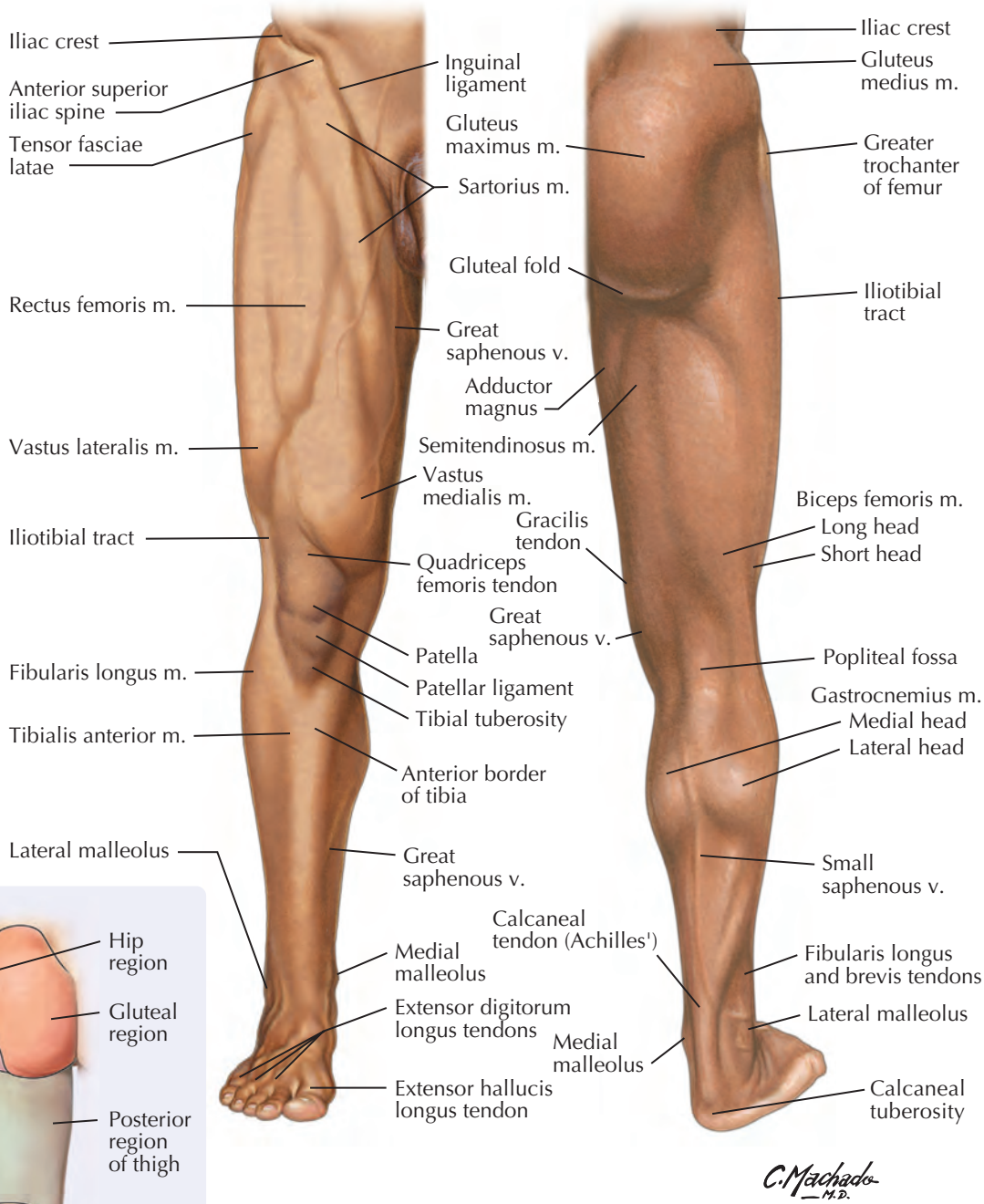
BP 110 Cross-Sectional Anatomy of Ankle and Foot

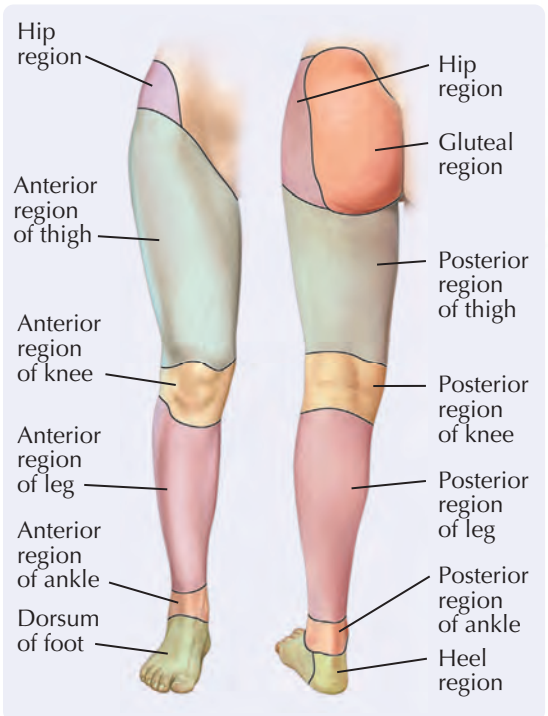
ELECTRONIC BONUS PLATES—*cont'd*

BP 111 Cross-Sectional Anatomy of Ankle and Foot (continued)

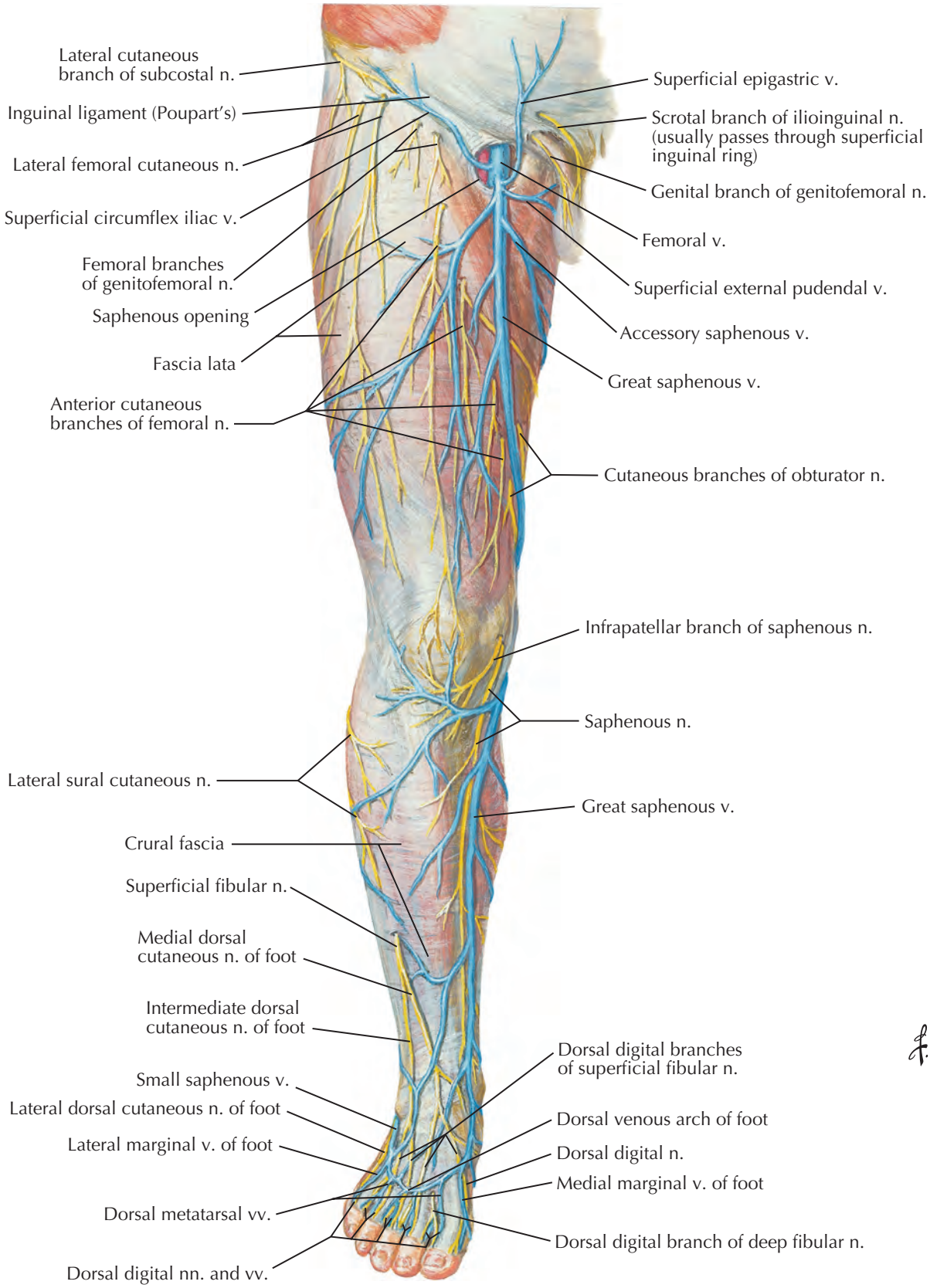
BP 112 Anatomy of Toenail

See also **Plates 5, 11, 492, 493**

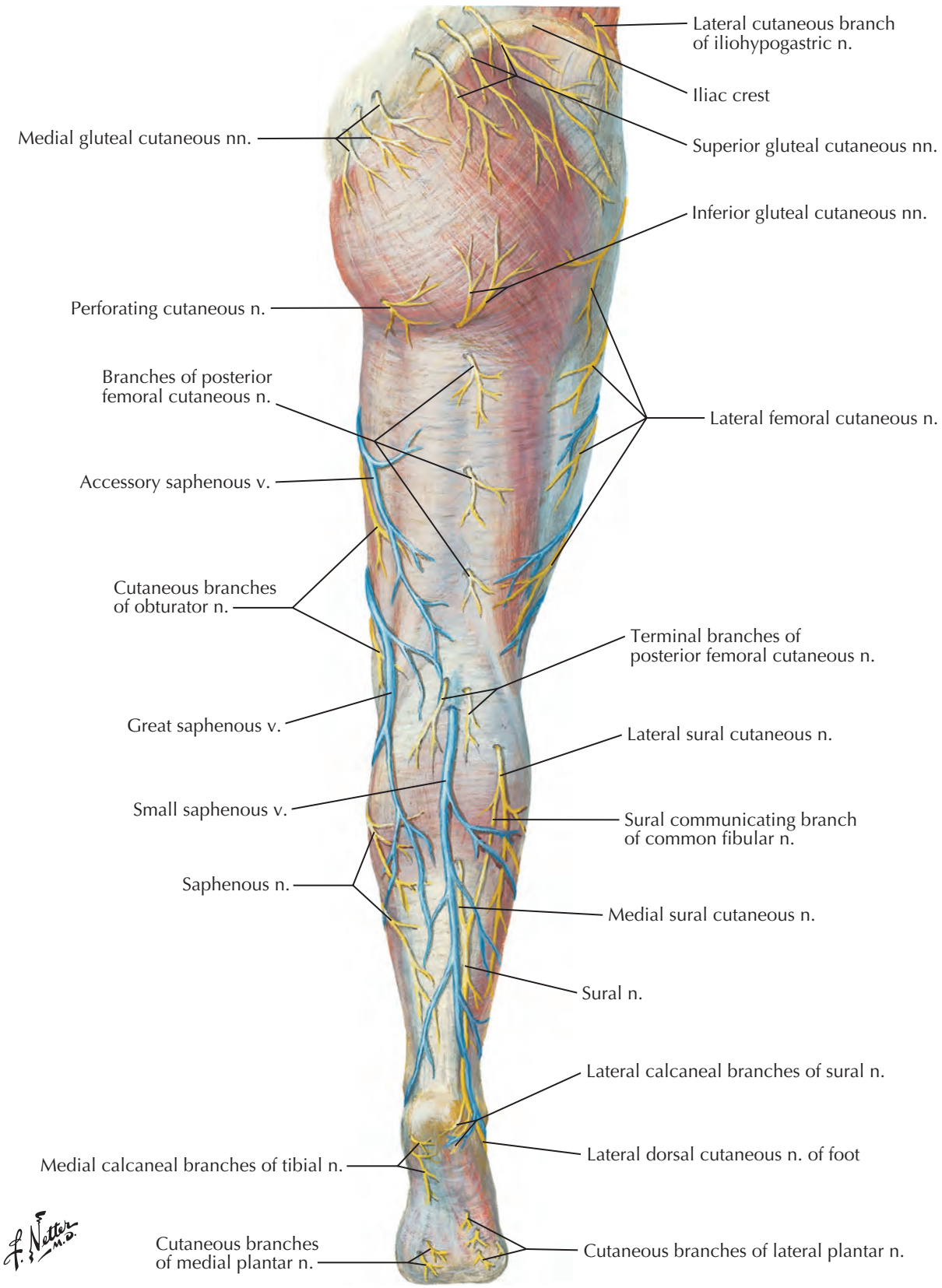




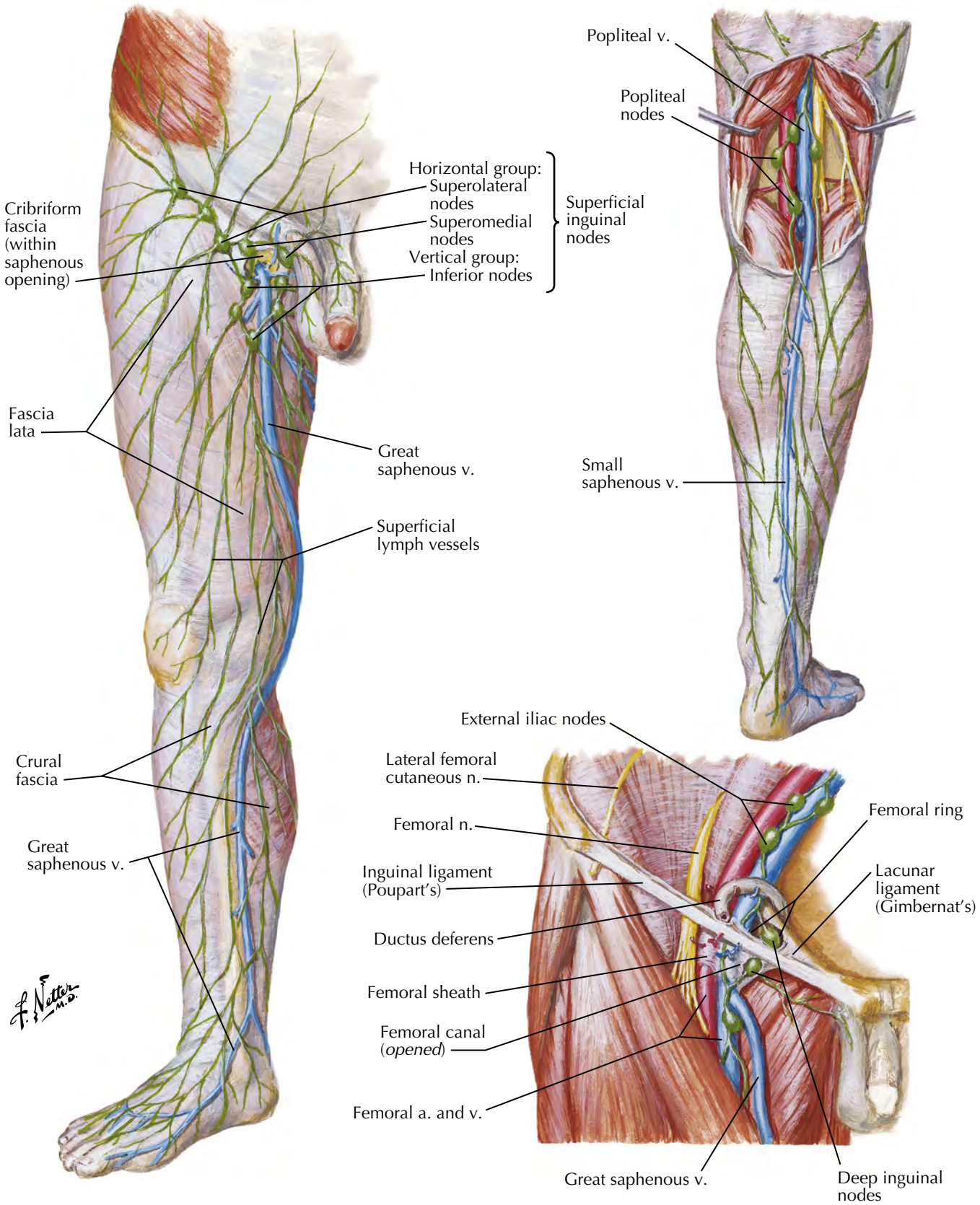
See also **Plates 523, 550, 551, 554**



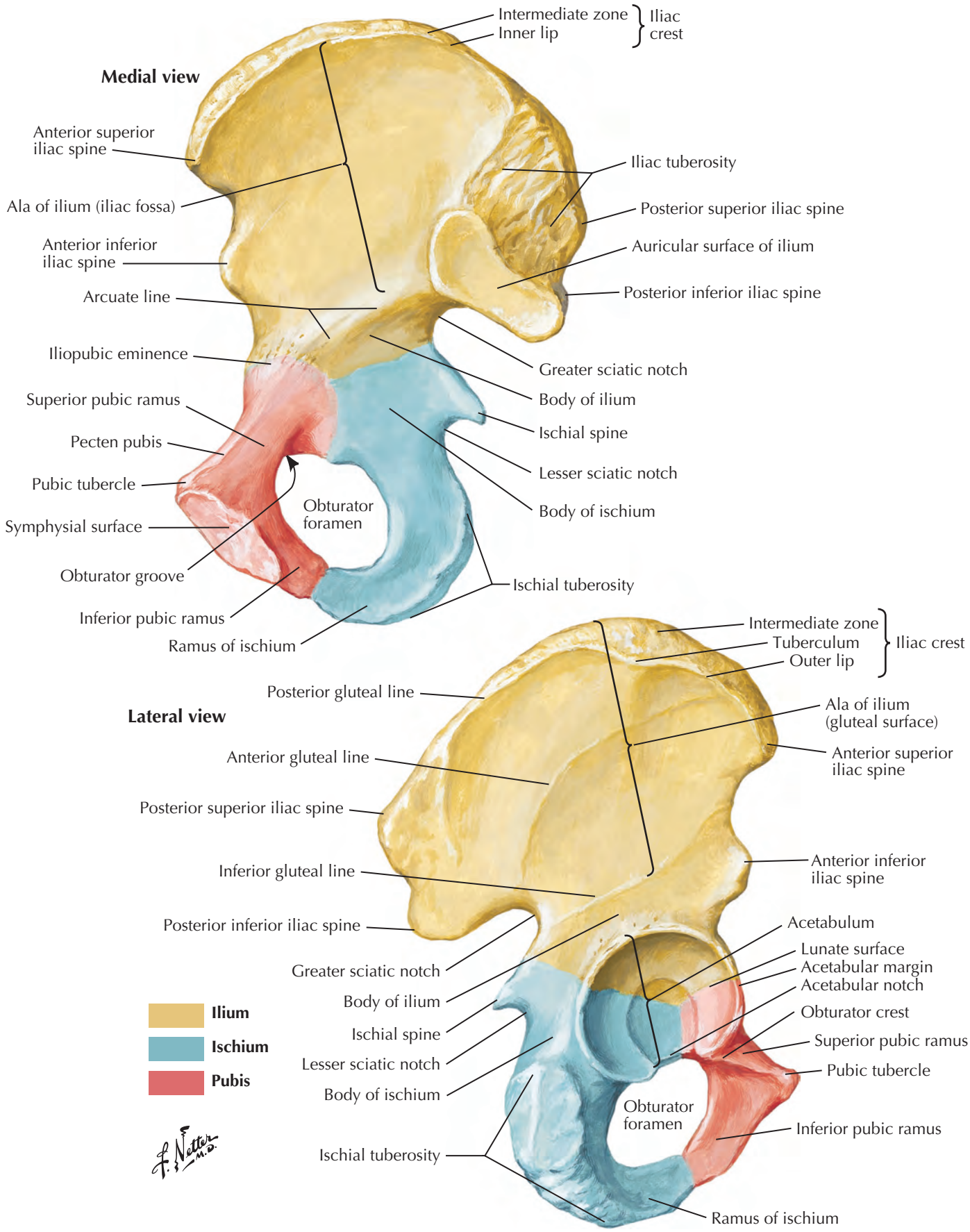
See also **Plates 523, 552, 553**



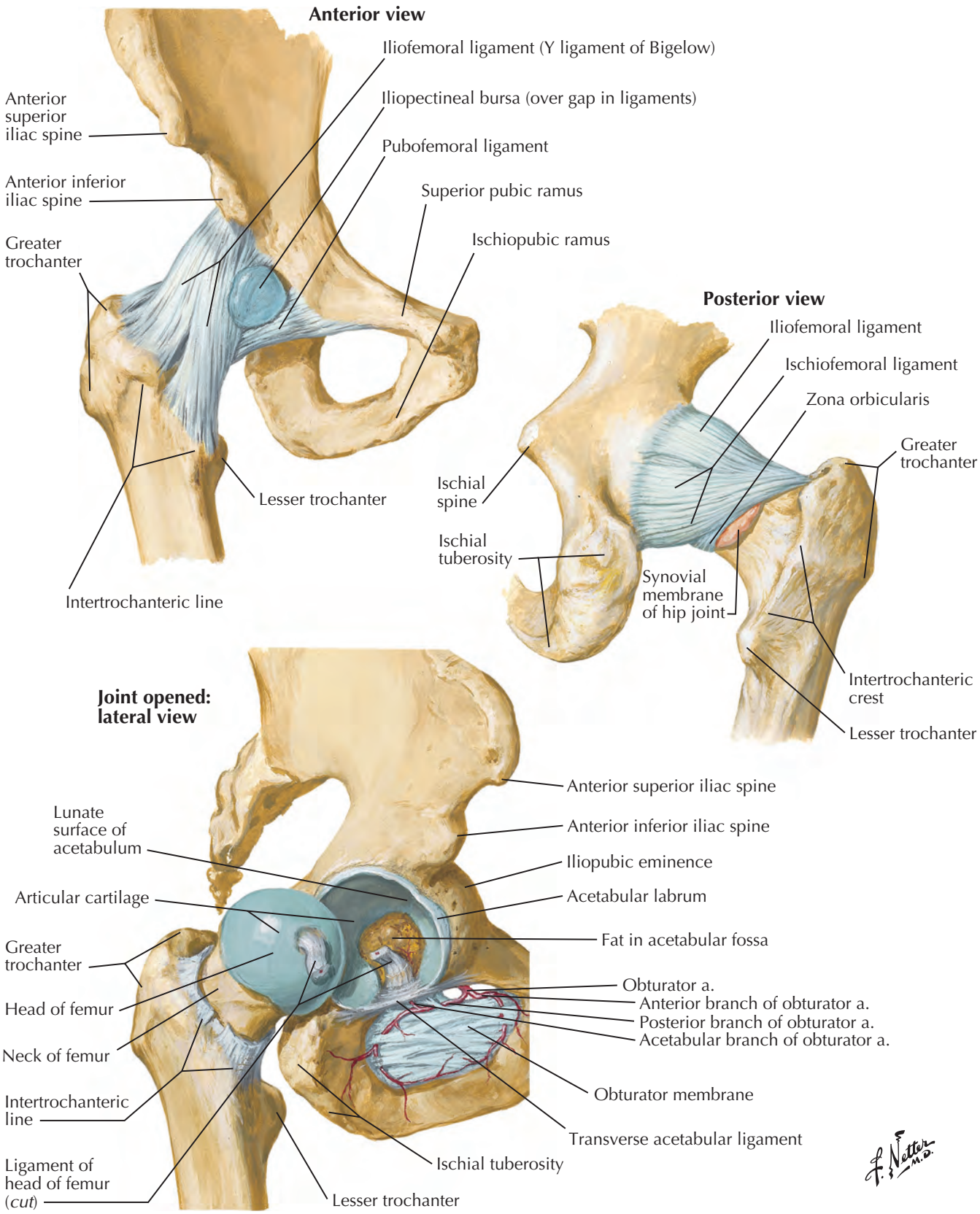
See also **Plates 409, 410**



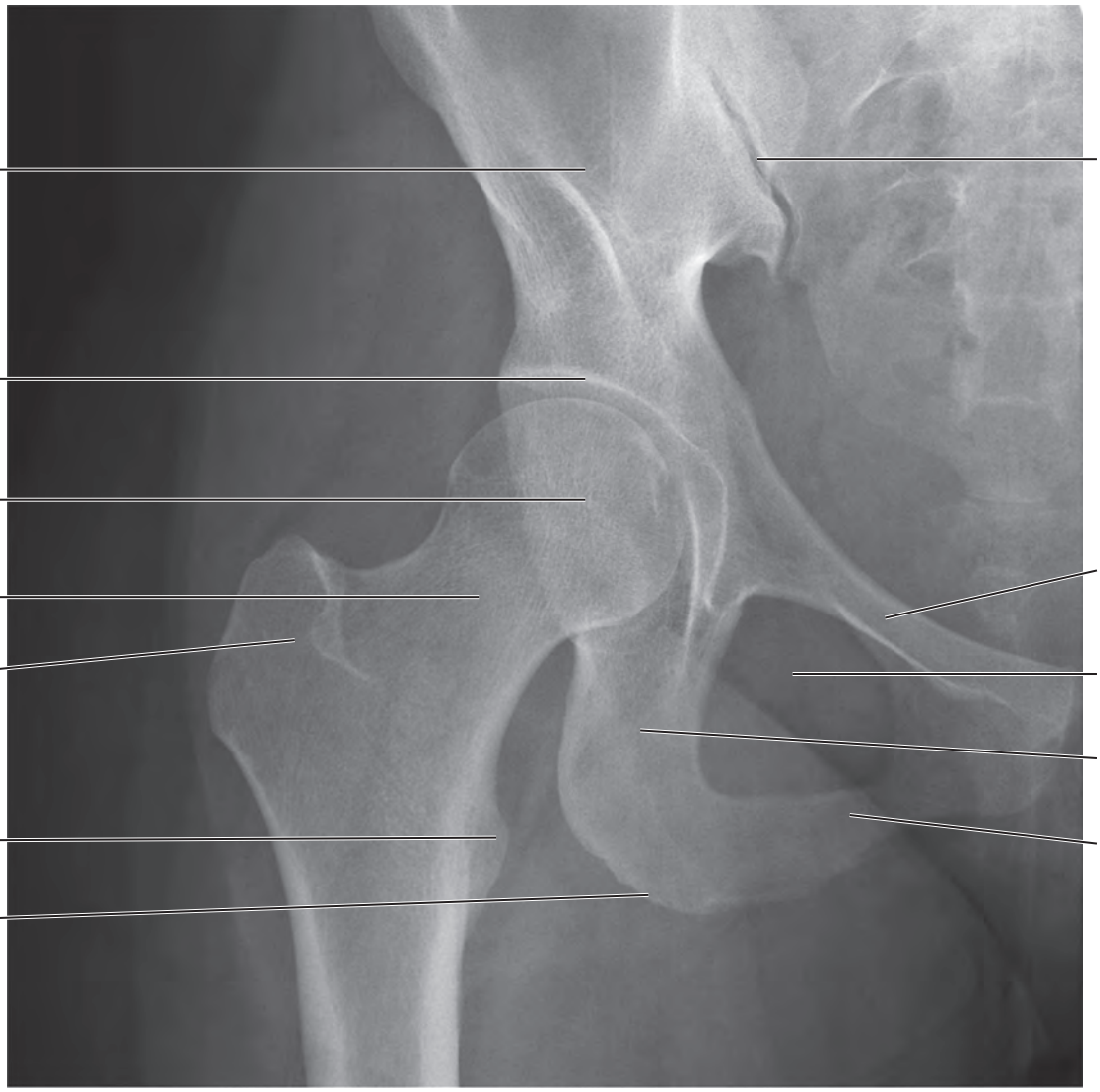
See also **Plates 268, 356, 357**



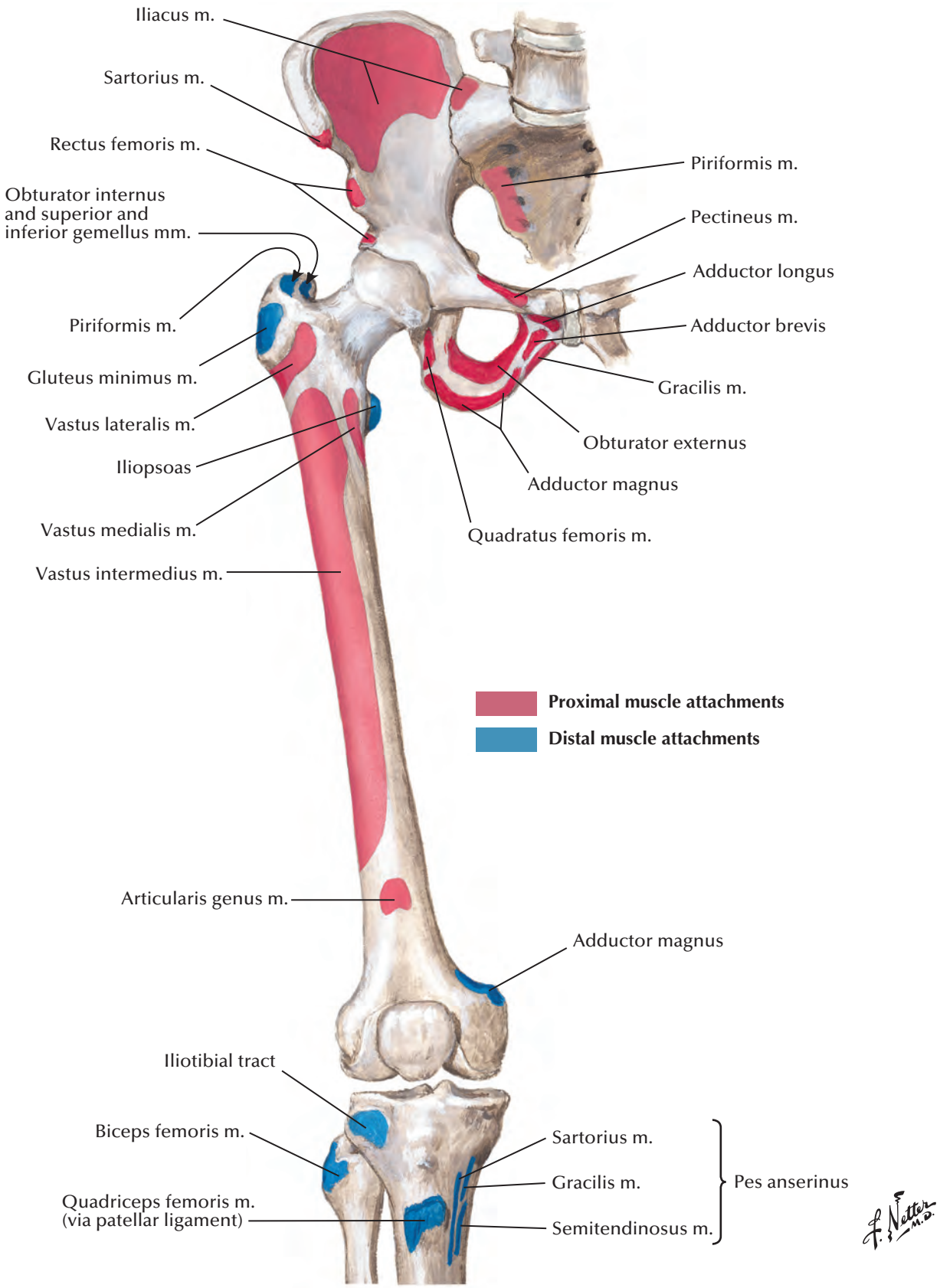
See also **Plates 353, 357, BP 11**



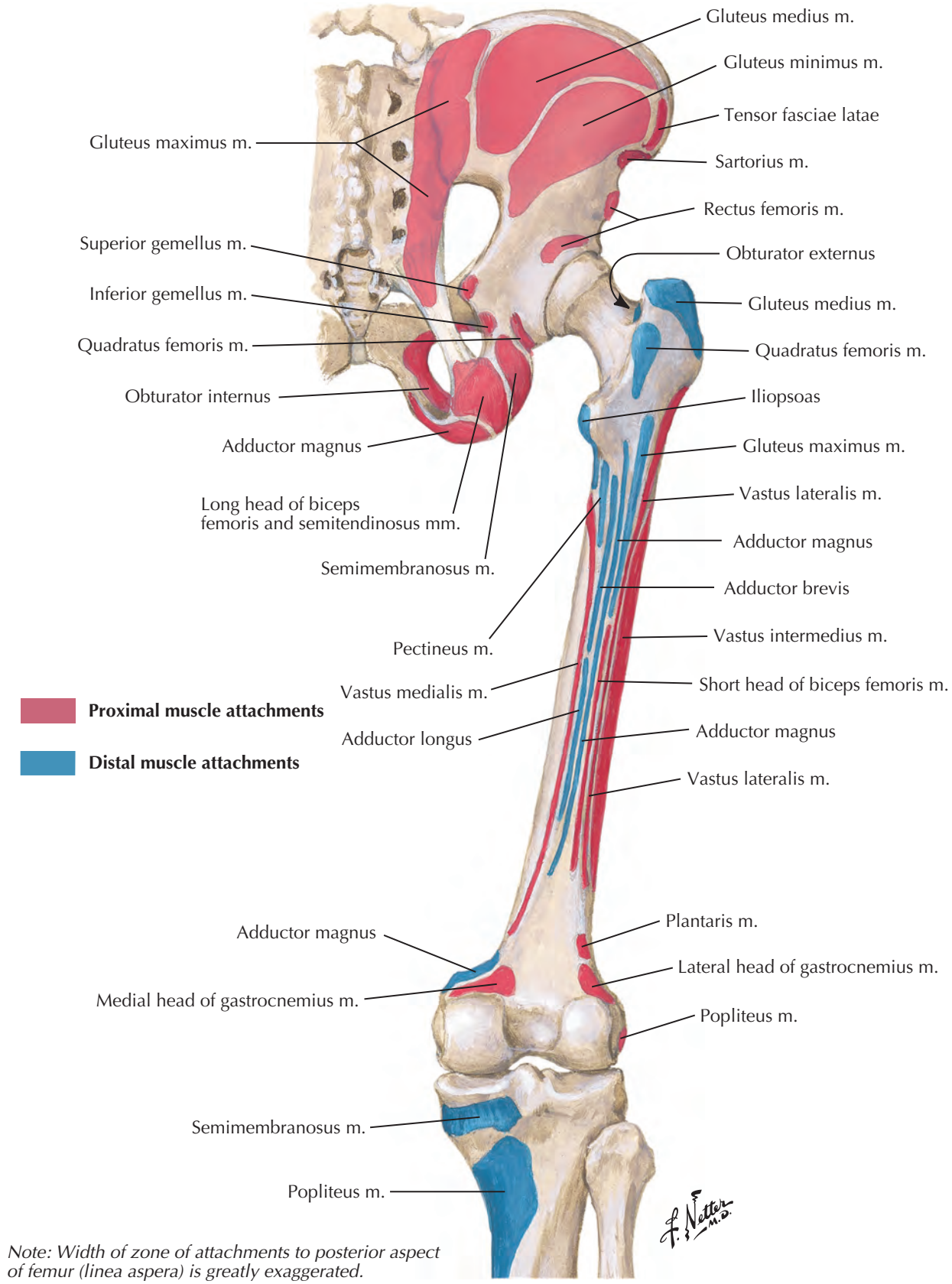
See also **Plates 354, 496, 498**



See also **Plates 497, 555**

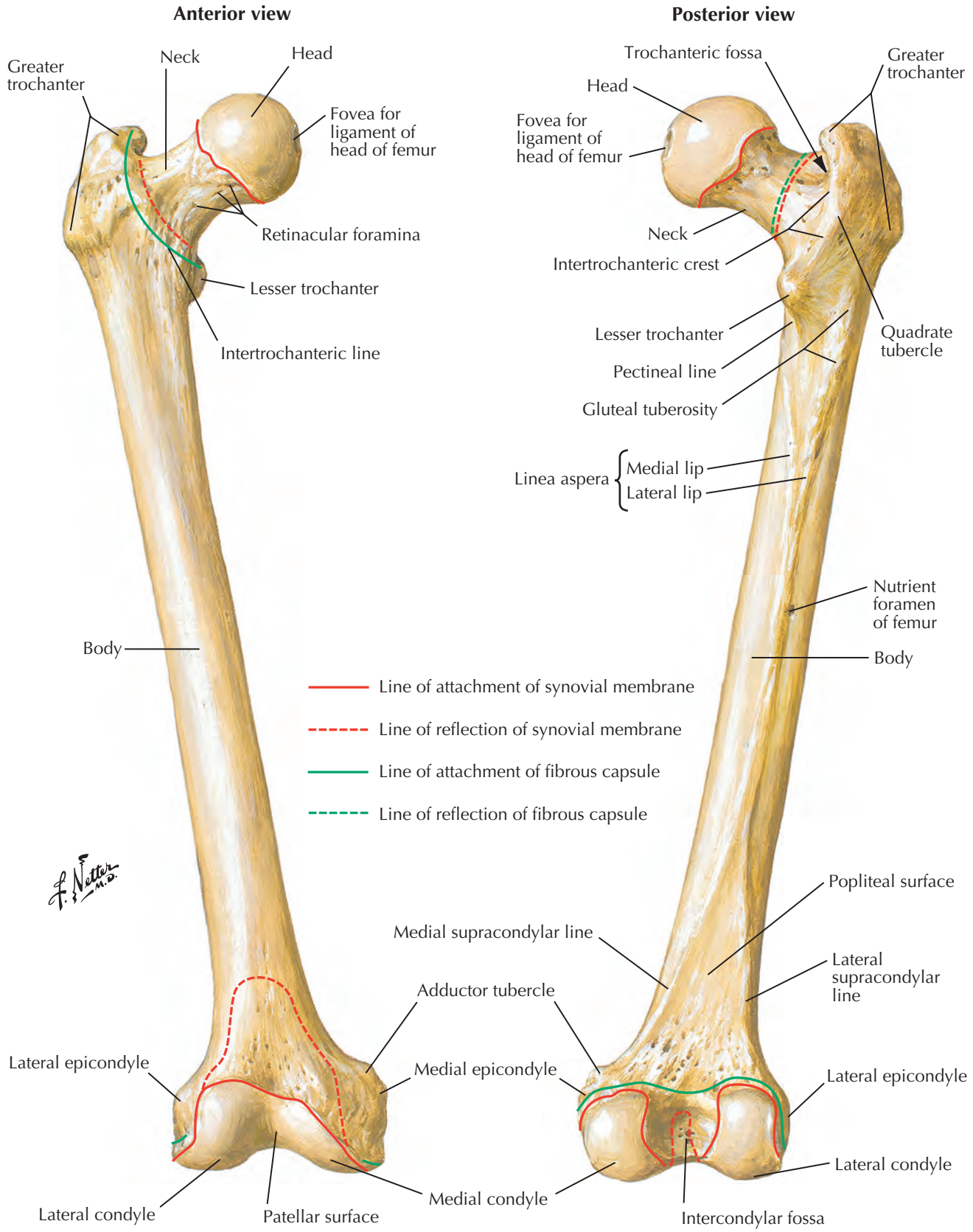


See also **Plate 497**

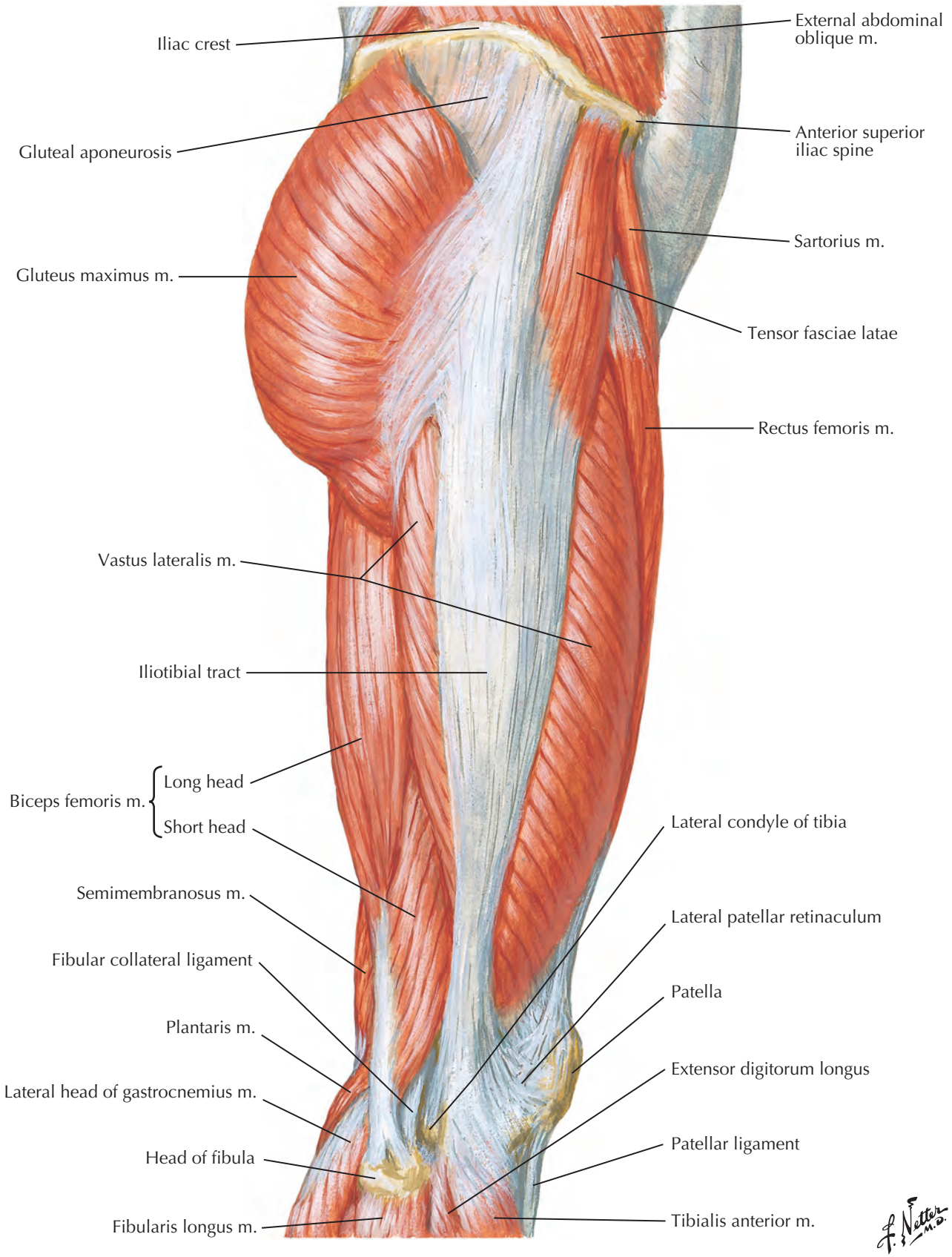


Note: Width of zone of attachments to posterior aspect of femur (linea aspera) is greatly exaggerated.

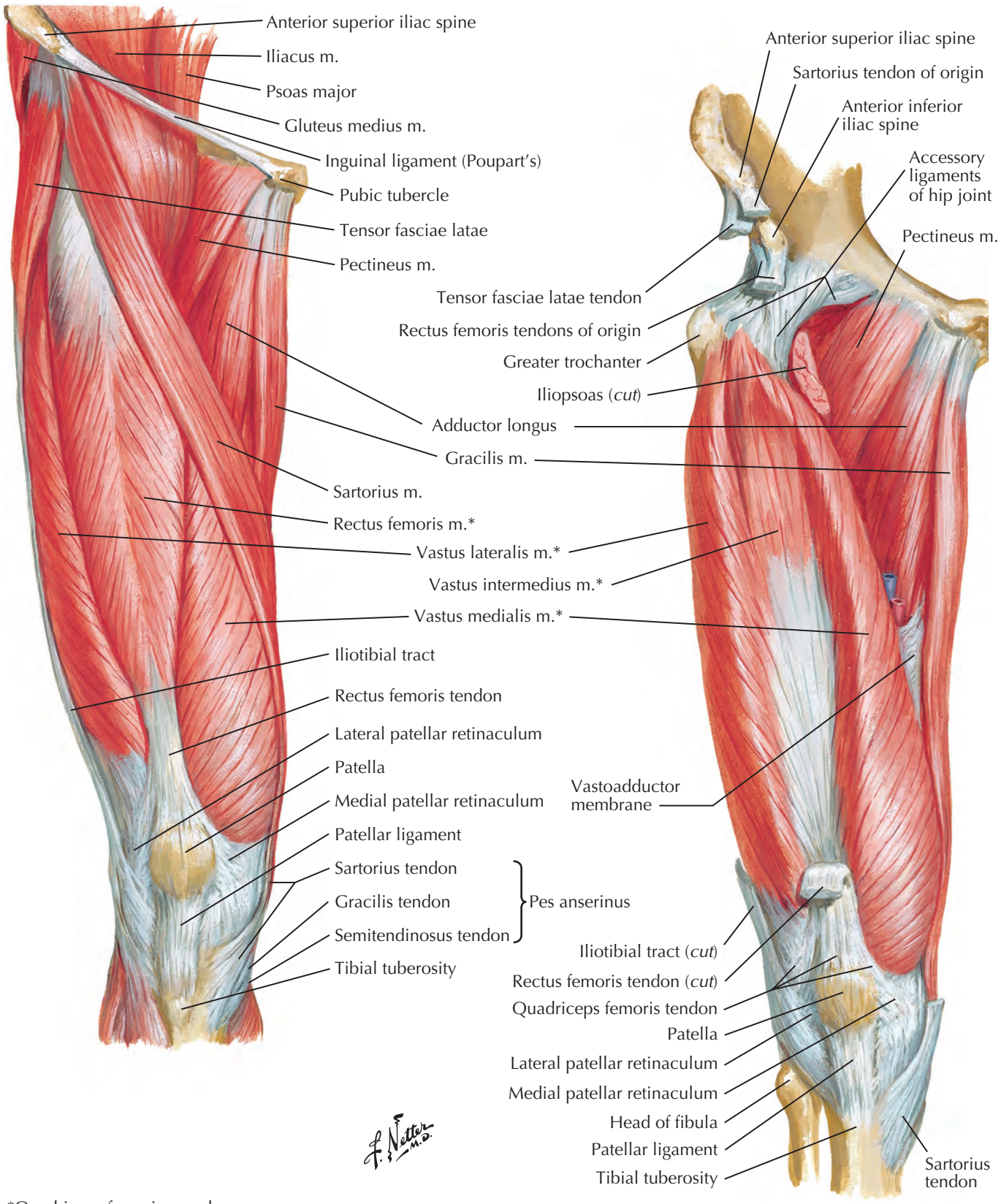
See also **Plates 514, BP 9**



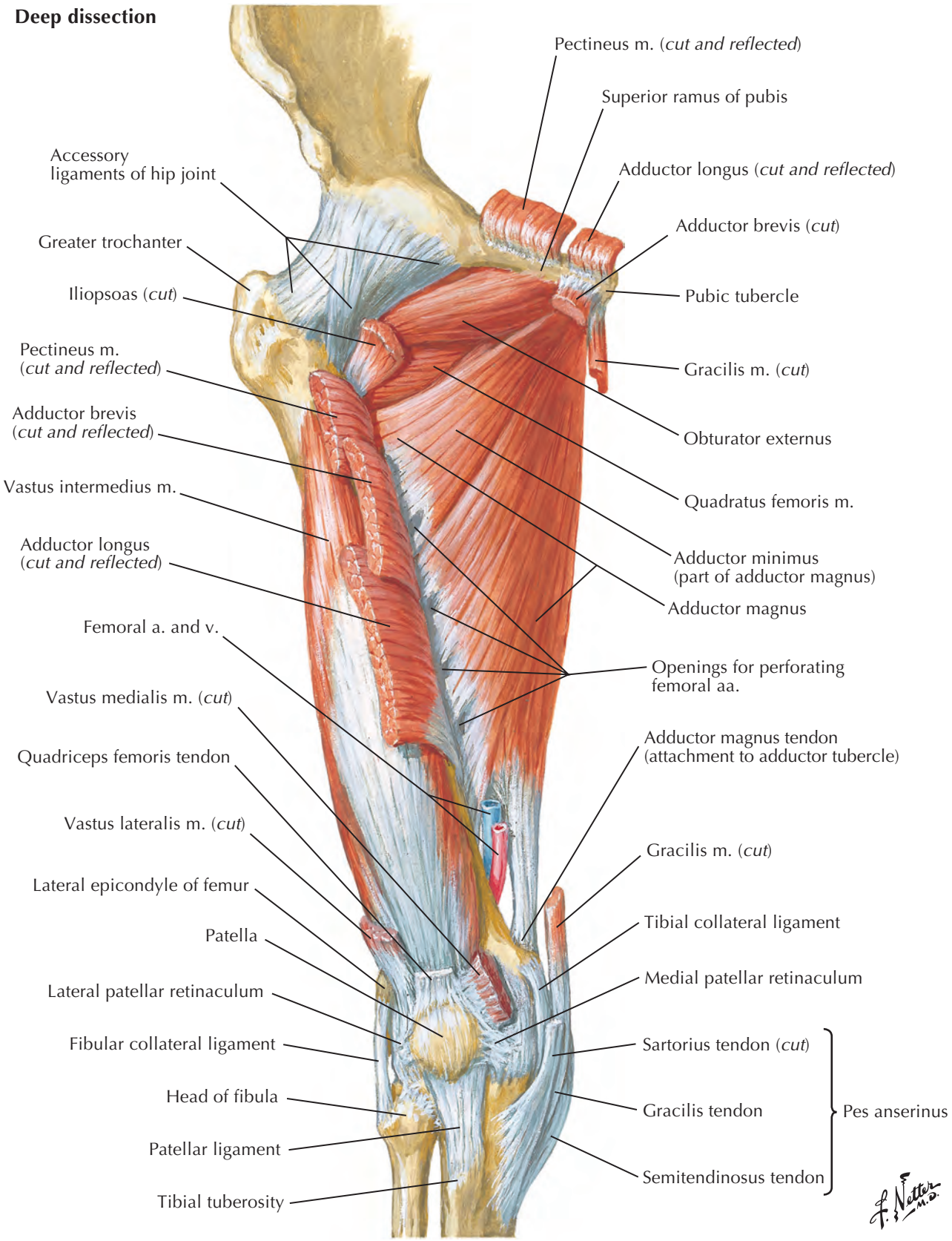
See also **Plate 515**



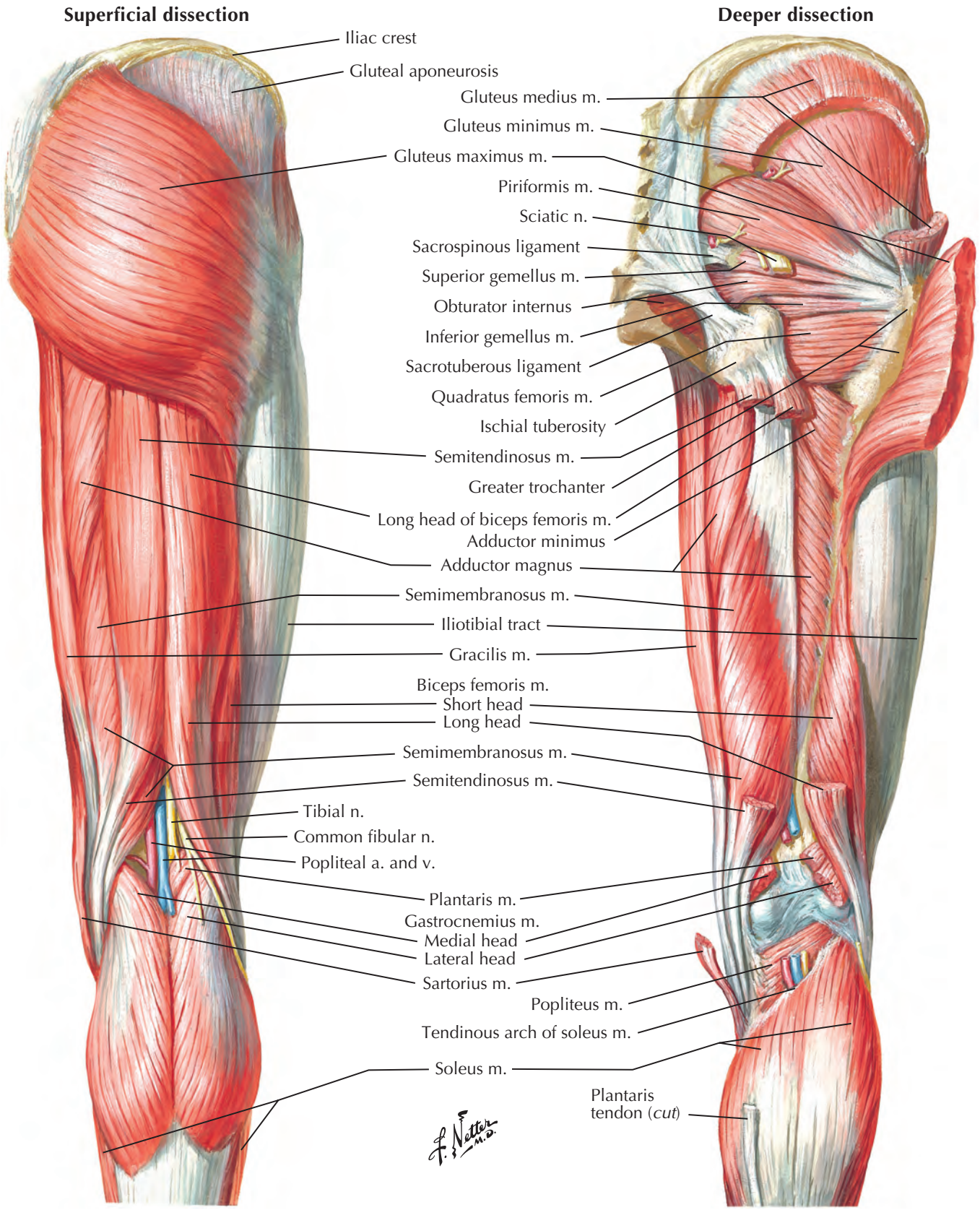
See also **Plate 283**



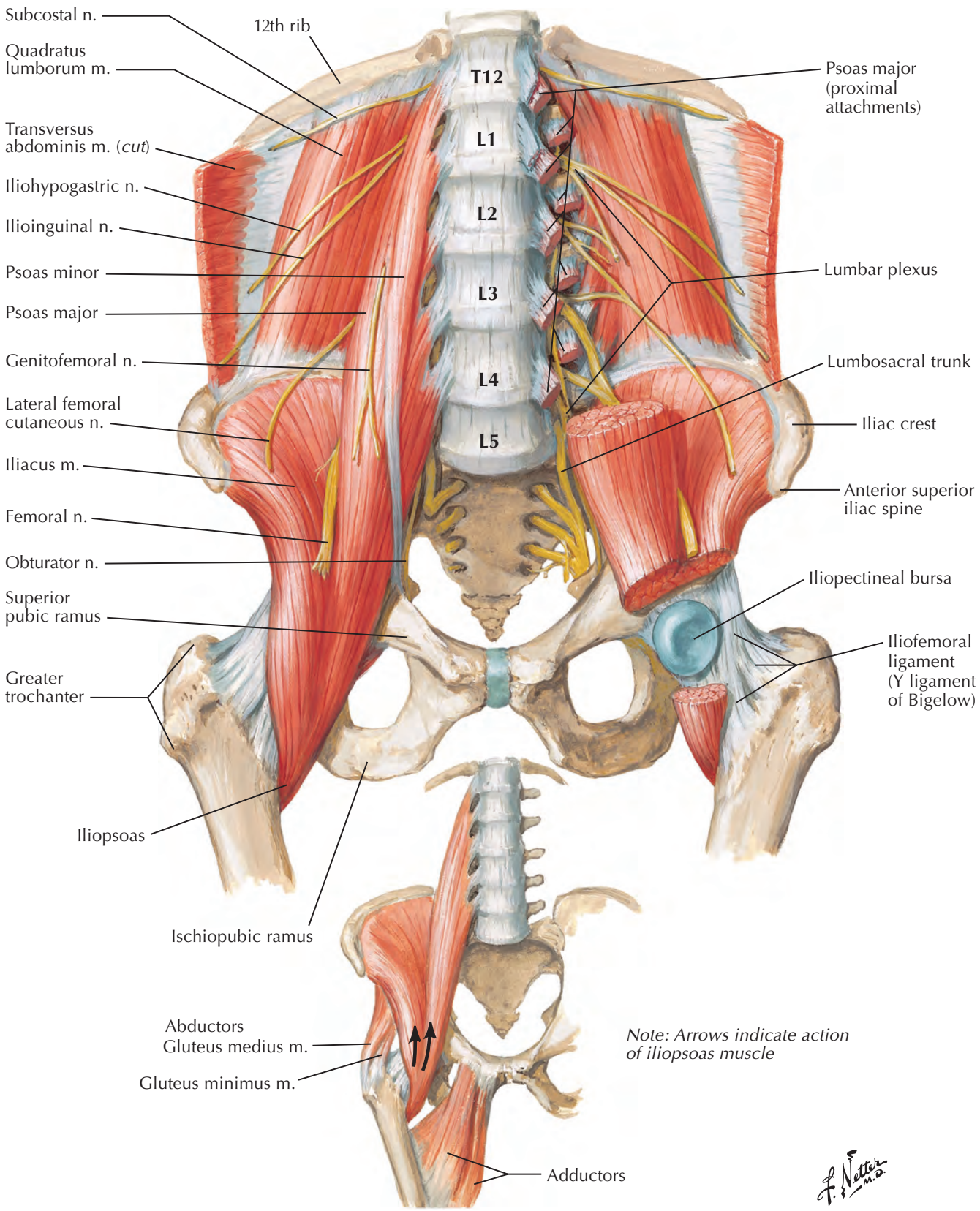
*Quadriceps femoris muscle


Deep dissection
Pectineus m. (cut and reflected)
Superior ramus of pubis
Accessory ligaments of hip joint
Adductor longus (cut and reflected)
Adductor brevis (cut)
Greater trochanter
Iliopsoas (cut)
Pubic tubercle
Pectineus m. (cut and reflected)
Gracilis m. (cut)
Adductor brevis (cut and reflected)
Obturator externus
Vastus intermedius m.
Quadratus femoris m.
Adductor longus (cut and reflected)
Adductor minimus (part of adductor magnus)
Adductor magnus
Femoral a. and v.
Openings for perforating femoral aa.
Vastus medialis m. (cut)
Adductor magnus tendon (attachment to adductor tubercle)
Quadriceps femoris tendon
Vastus lateralis m. (cut)
Gracilis m. (cut)
Lateral epicondyle of femur
Tibial collateral ligament
Patella
Medial patellar retinaculum
Lateral patellar retinaculum
Sartorius tendon (cut)
Fibular collateral ligament
Gracilis tendon
Pes anserinus
Head of fibula
Semitendinosus tendon
Patellar ligament
Tibial tuberosity
F. Netter M.D.

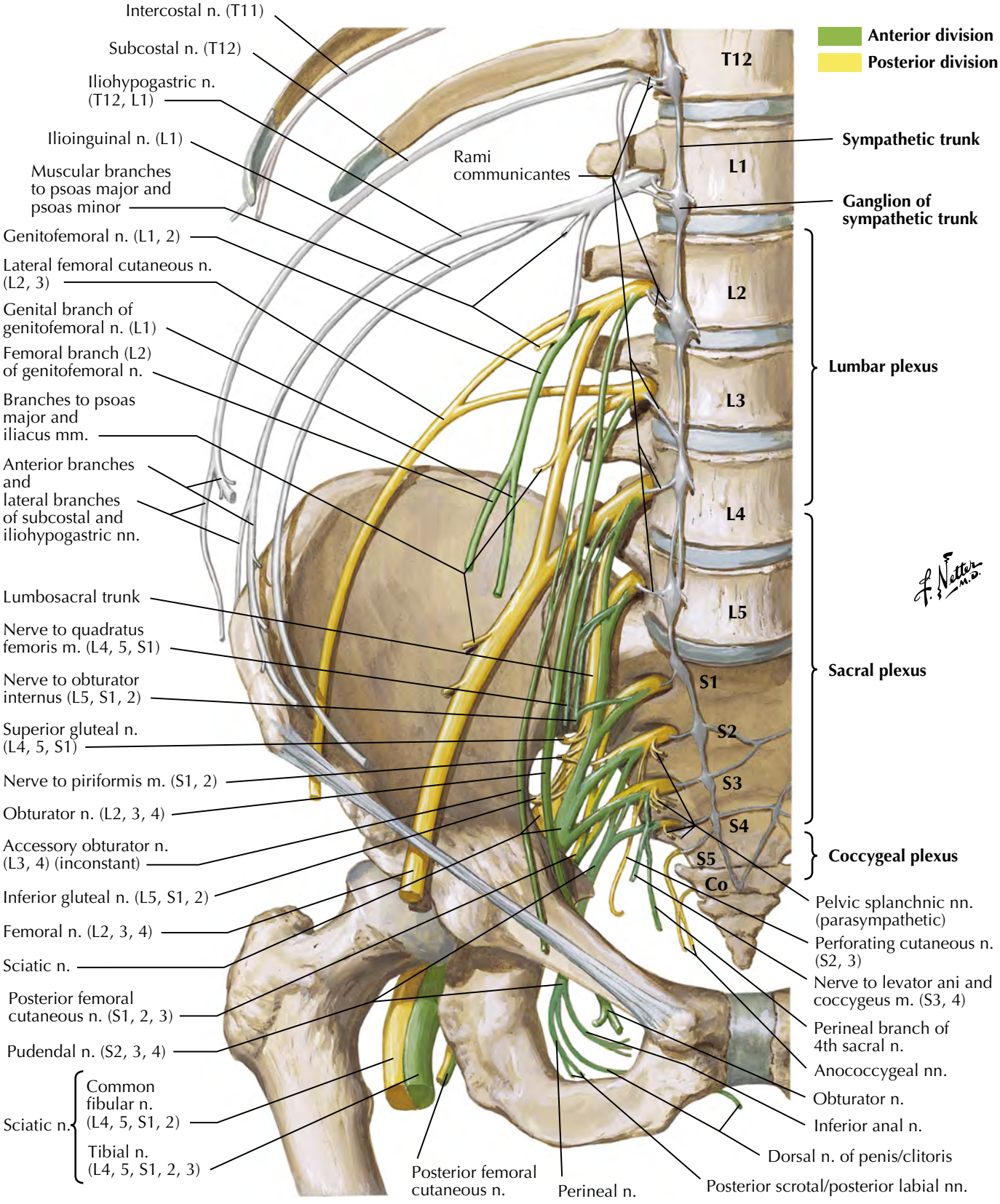
See also **Plates 361, 362, 510**

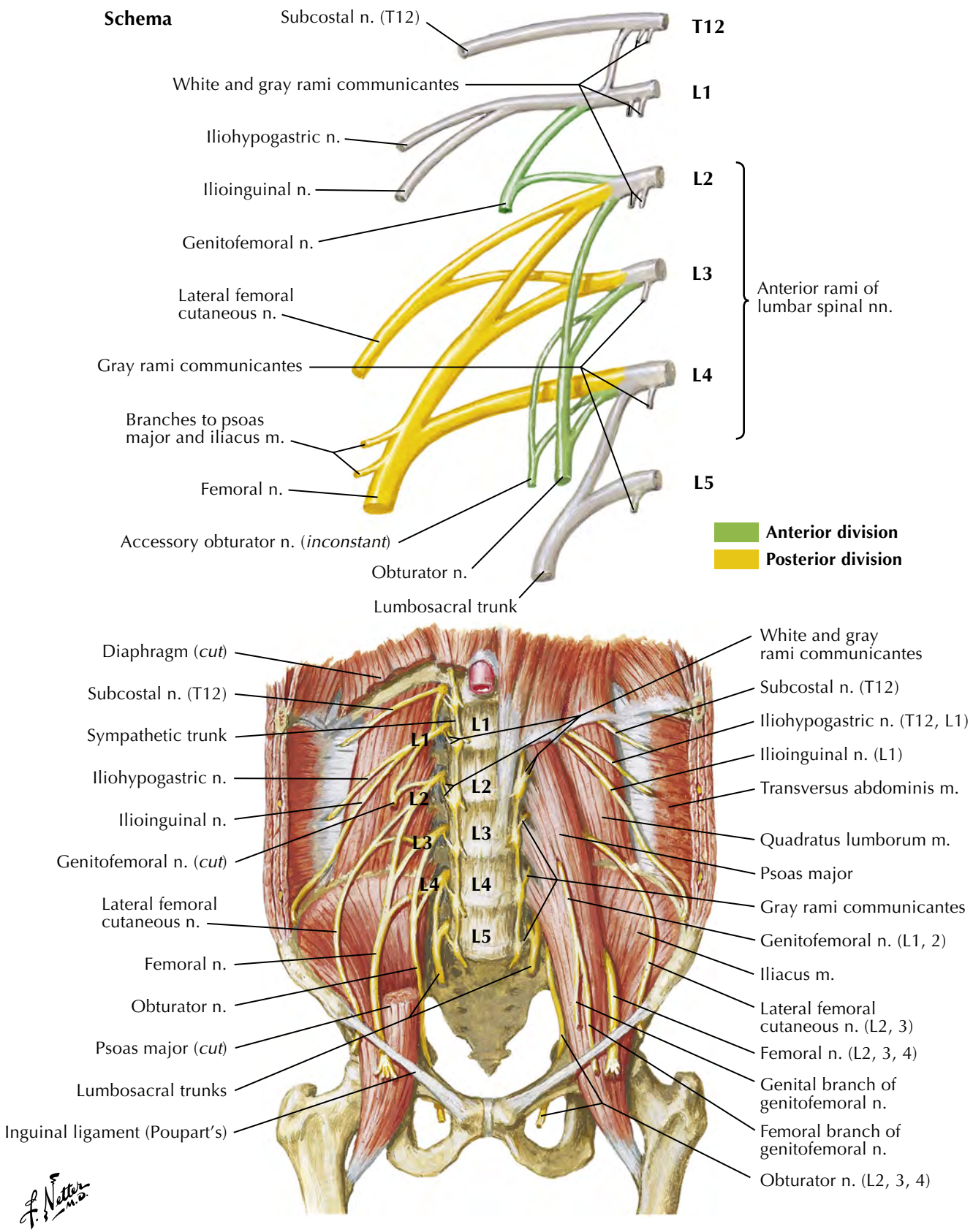


See also **Plates 283, 287**

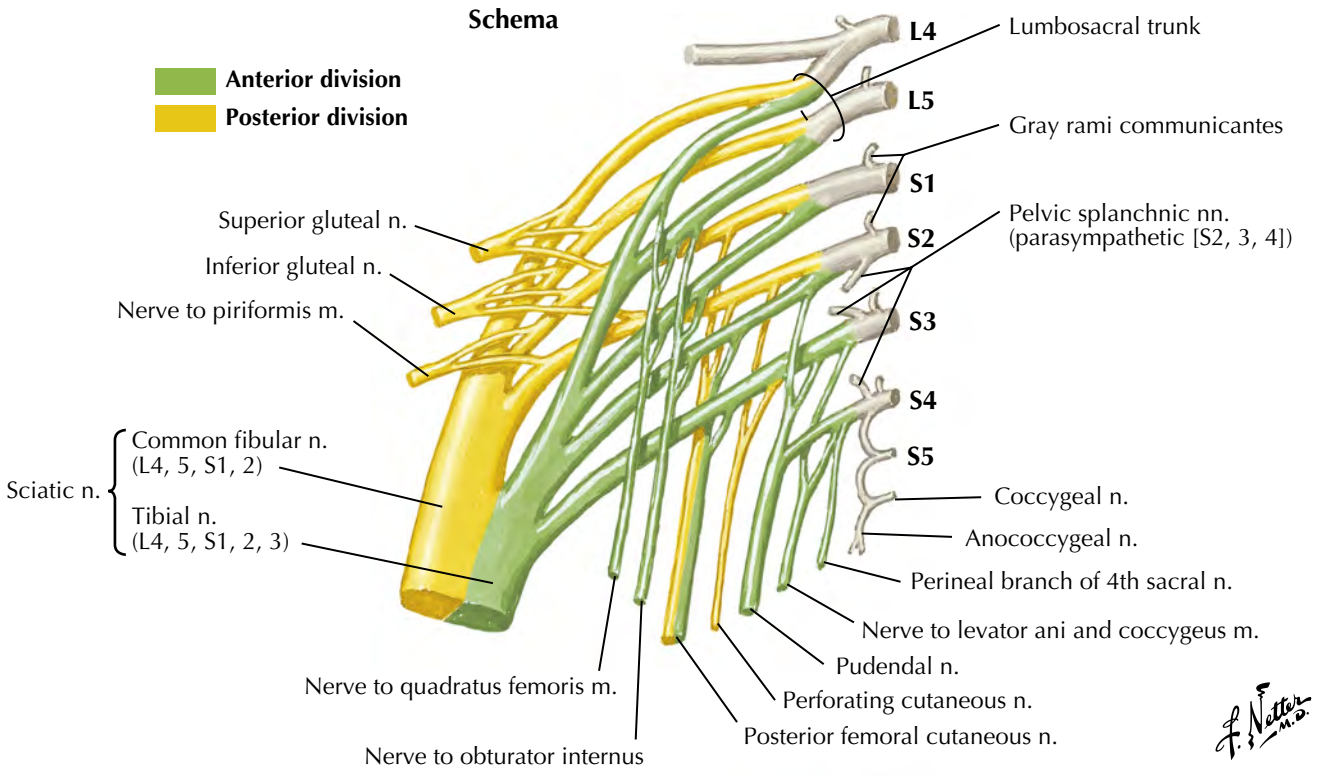


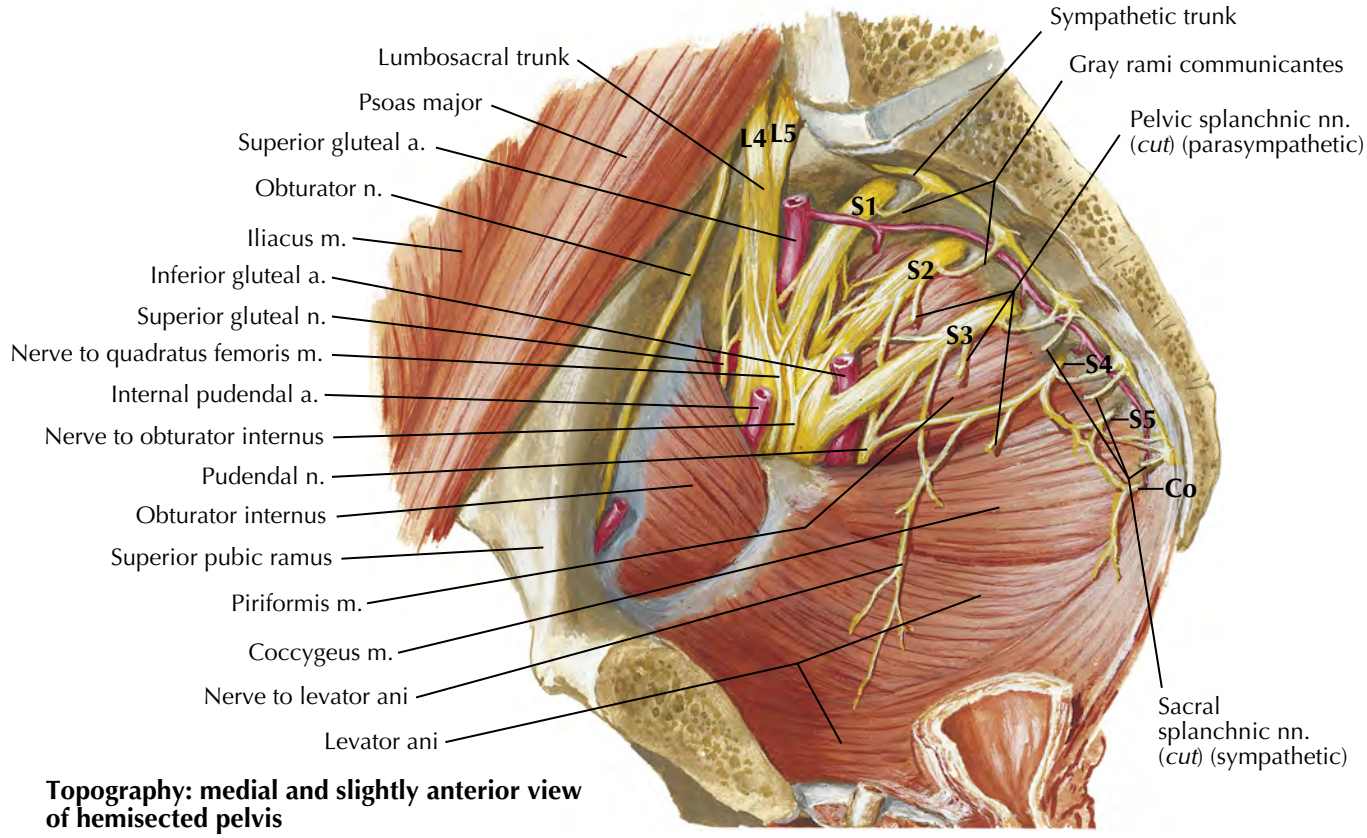
See also **Plate 287**




Schema
Subcostal n. (T12)
White and gray rami communicantes
Iliohypogastric n.
Ilioinguinal n.
Genitofemoral n.
Lateral femoral cutaneous n.
Gray rami communicantes
Branches to psoas major and iliacus m.
Femoral n.
Accessory obturator n. (inconstant)
Obturator n.
Lumbosacral trunk
T12
L1
L2
L3
L4
L5
Anterior rami of lumbar spinal nn.
Anterior division
Posterior division
Diaphragm (cut)
Subcostal n. (T12)
Sympathetic trunk
Iliohypogastric n.
Ilioinguinal n.
Genitofemoral n. (cut)
Lateral femoral cutaneous n.
Femoral n.
Obturator n.
Psoas major (cut)
Lumbosacral trunks
Inguinal ligament (Poupart's)
White and gray rami communicantes
Subcostal n. (T12)
Iliohypogastric n. (T12, L1)
Ilioinguinal n. (L1)
Transversus abdominis m.
Quadratus lumborum m.
Psoas major
Gray rami communicantes
Genitofemoral n. (L1, 2)
Iliacus m.
Lateral femoral cutaneous n. (L2, 3)
Femoral n. (L2, 3, 4)
Genital branch of genitofemoral n.
Femoral branch of genitofemoral n.
Obturator n. (L2, 3, 4)

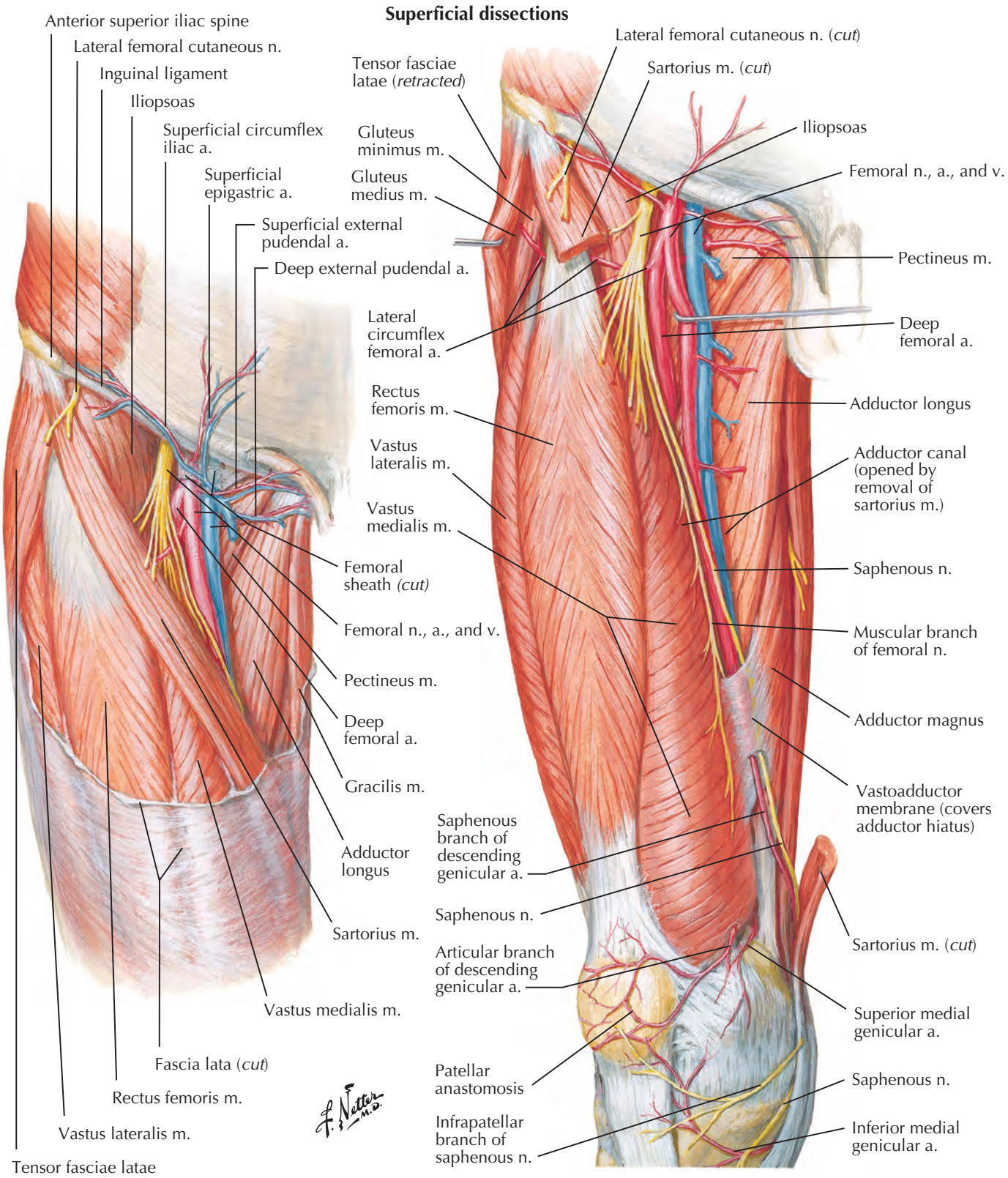
See also **Plate 287**





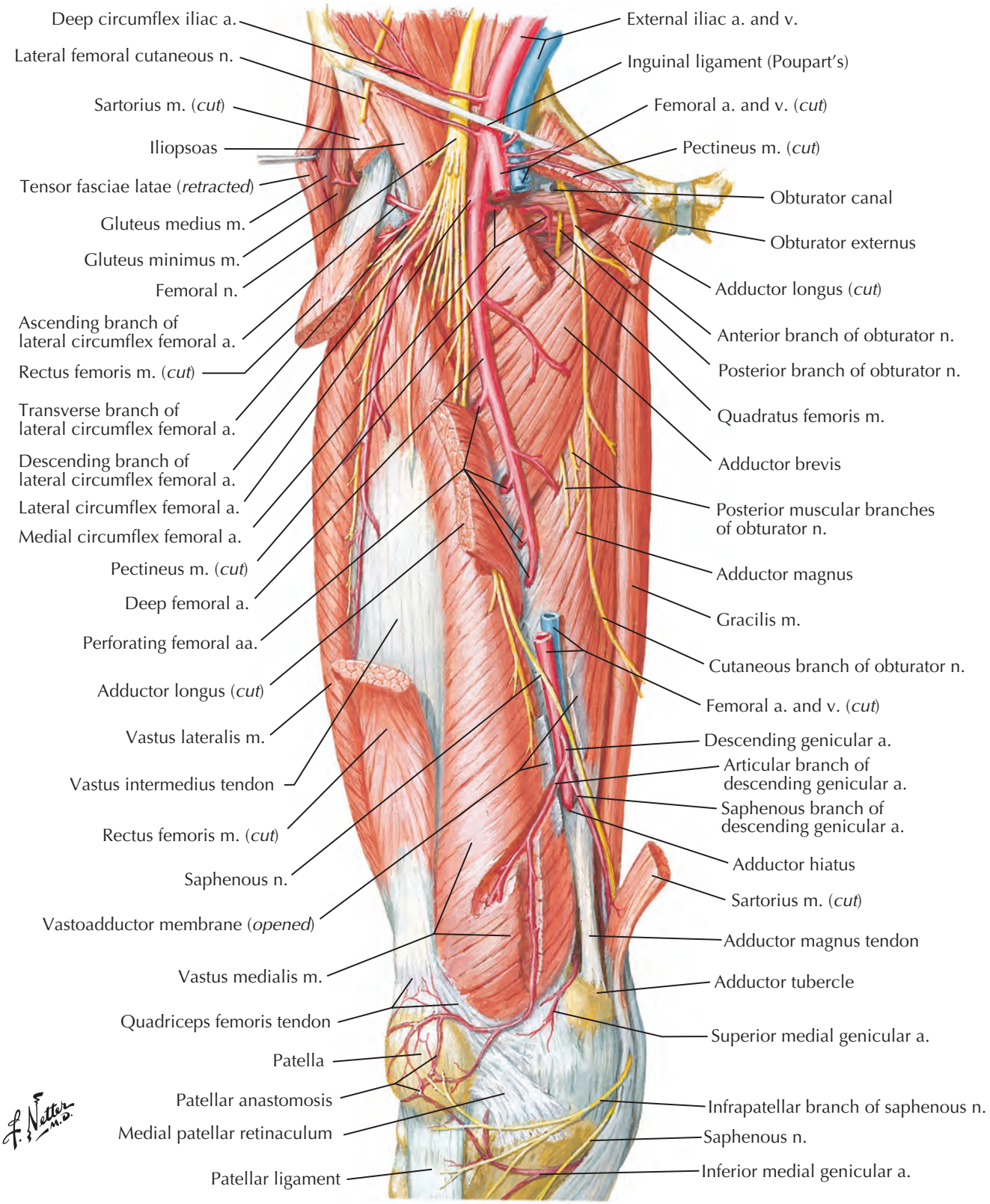
Topography: medial and slightly anterior view of hemisected pelvis

See also **Plates 522, 550, BP 103**



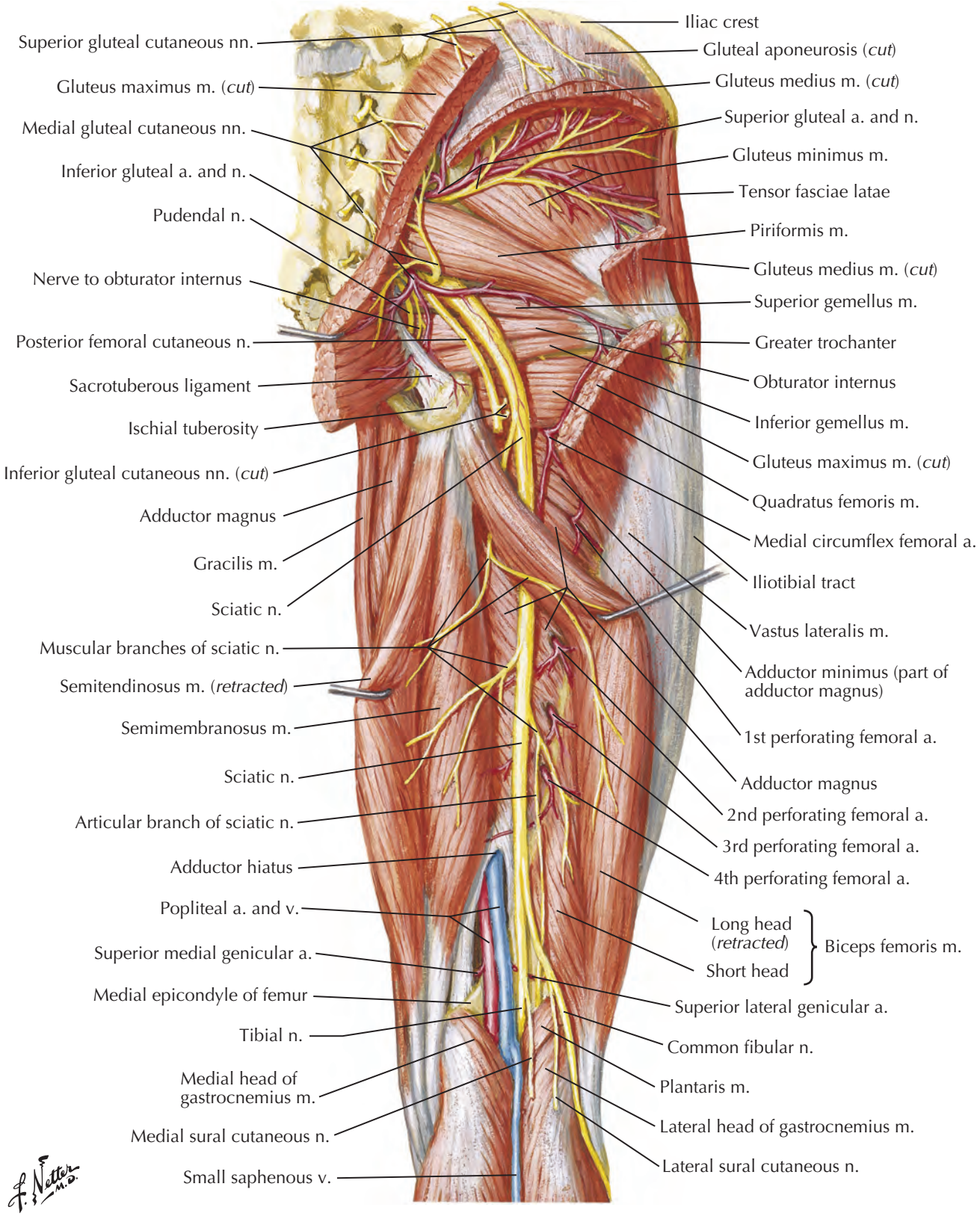
See also **Plates 550, 551, BP 103**

Deep dissection

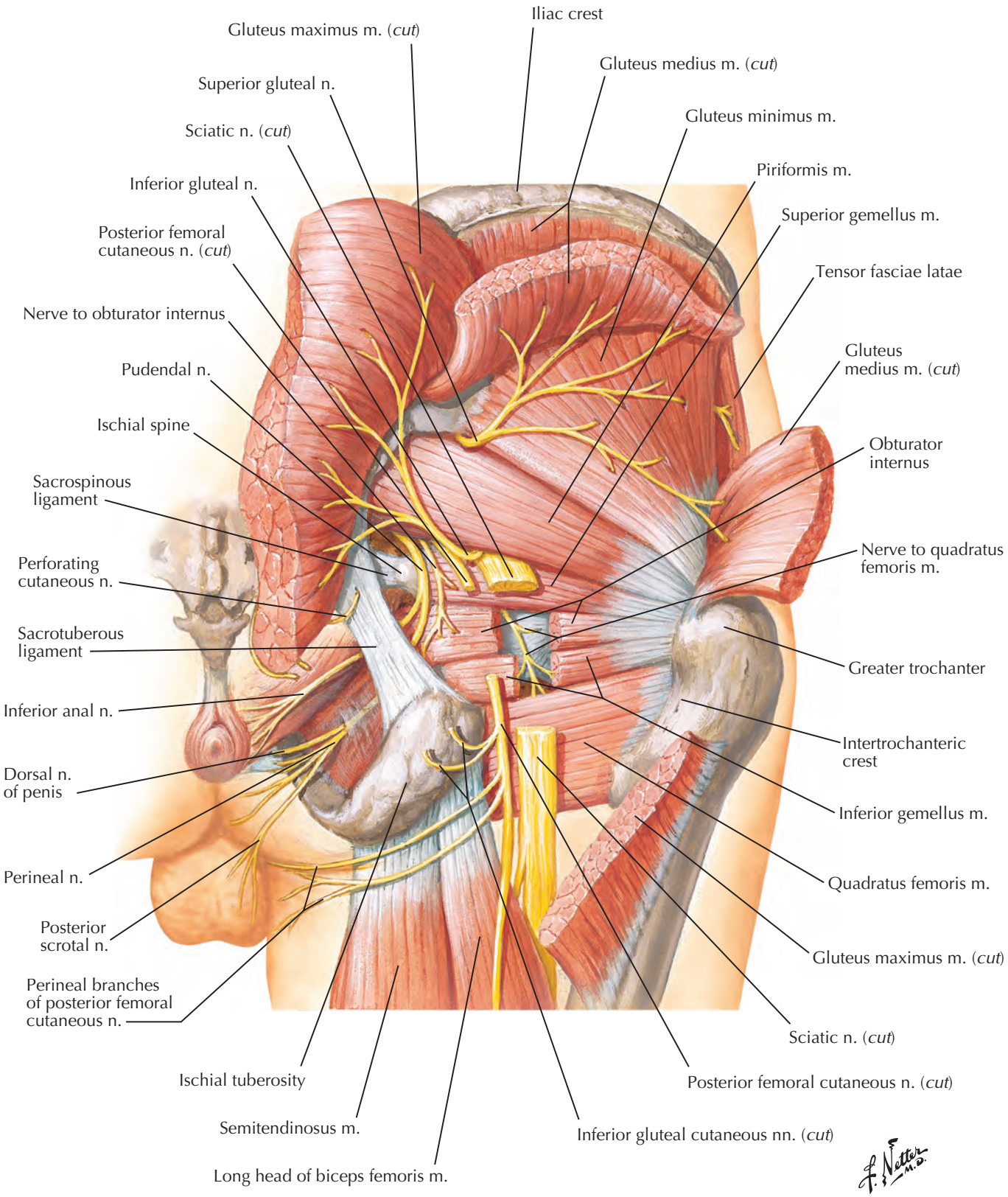


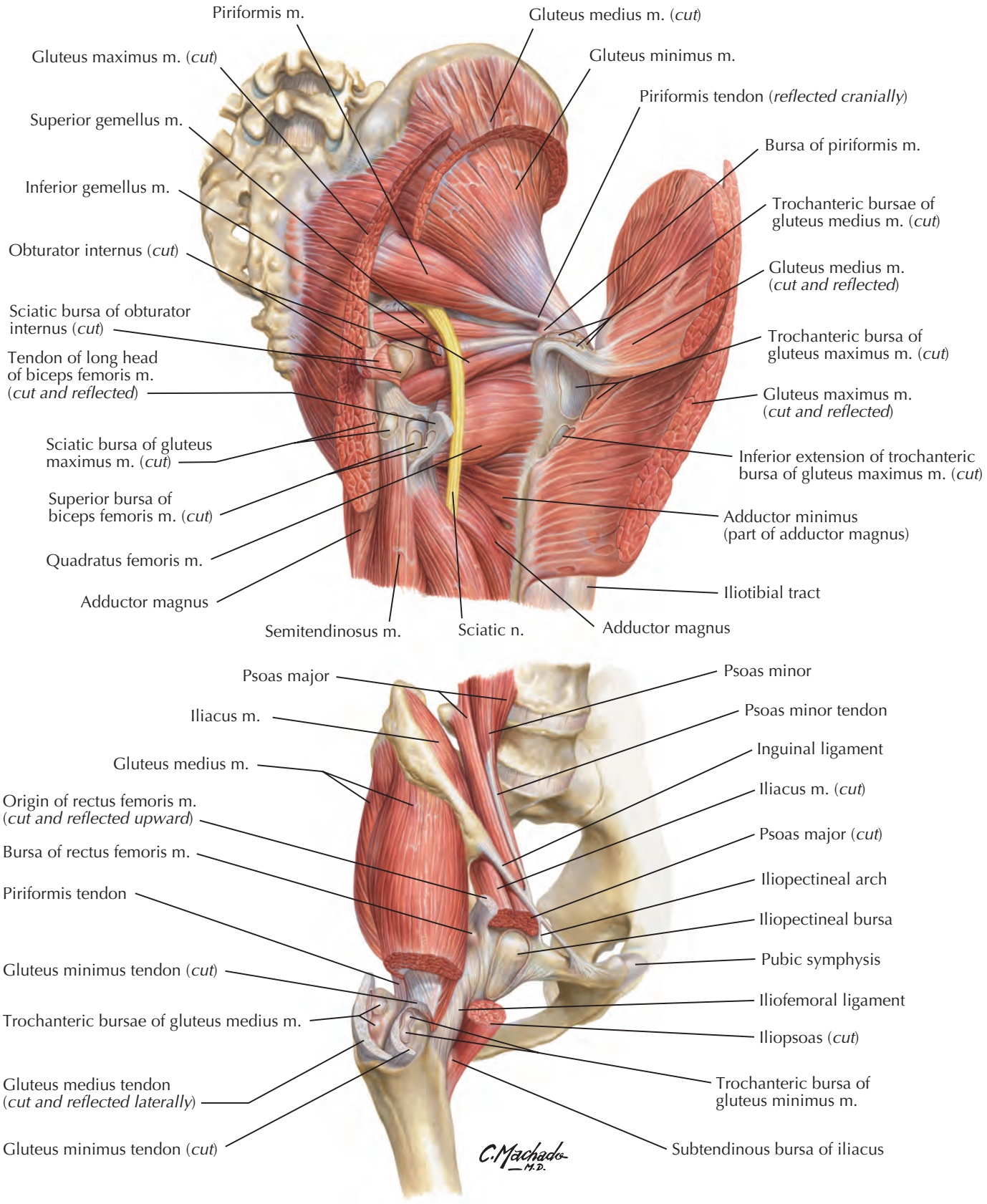
See also **Plates 552, BP 103**

Deep dissection

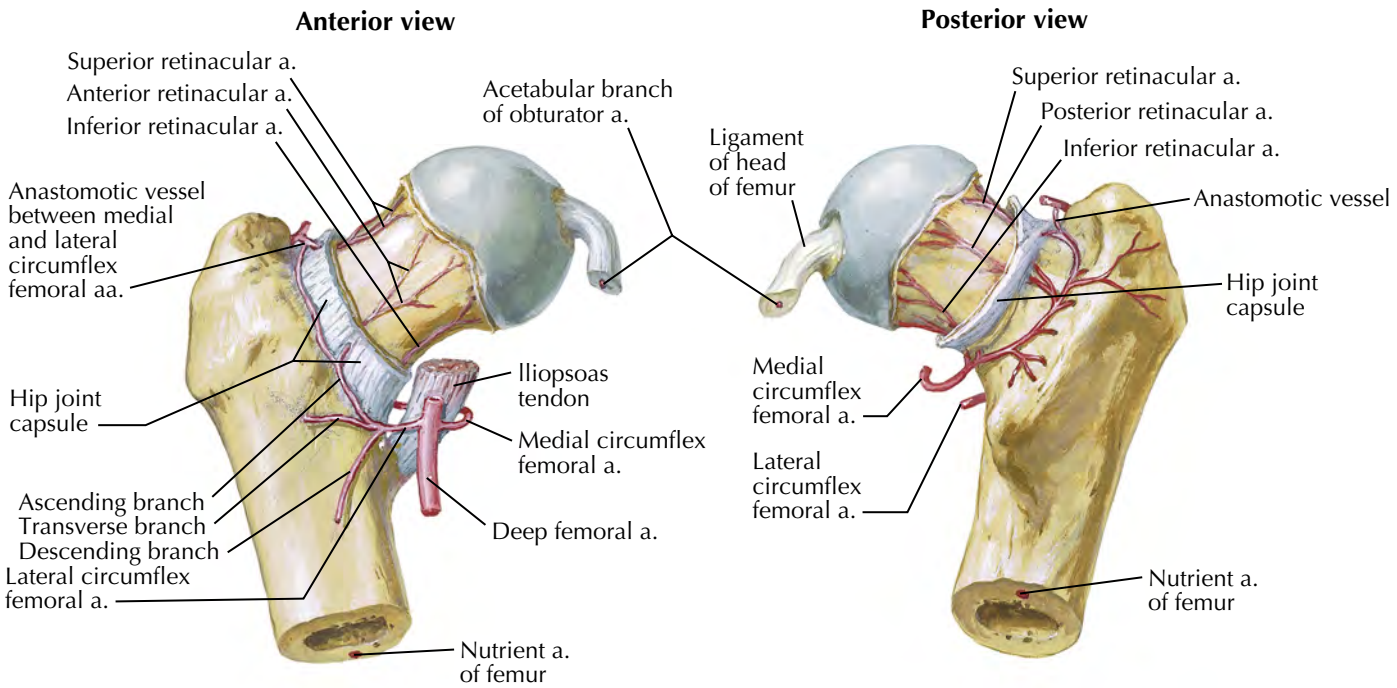


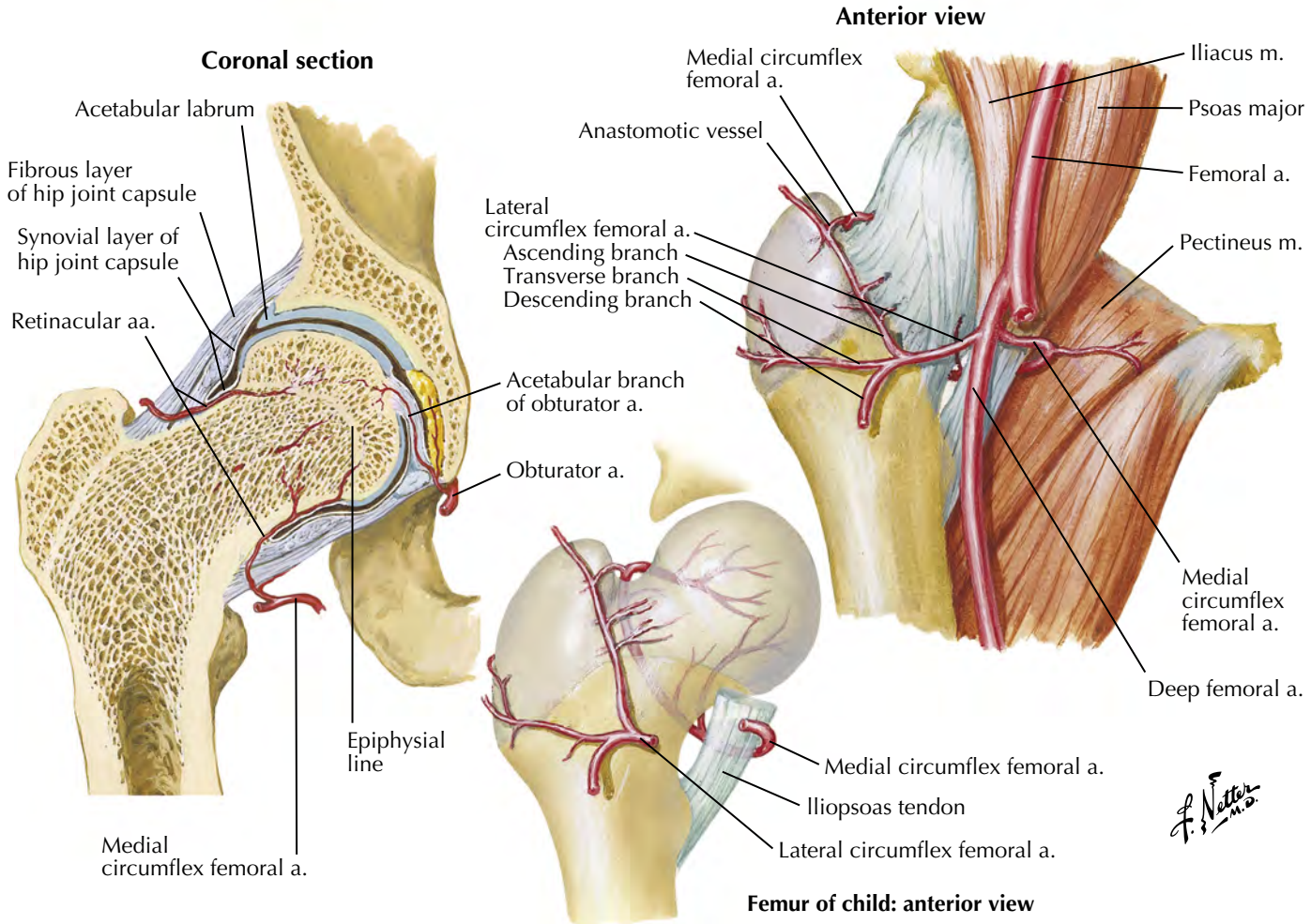
See also **Plates 356, 413**

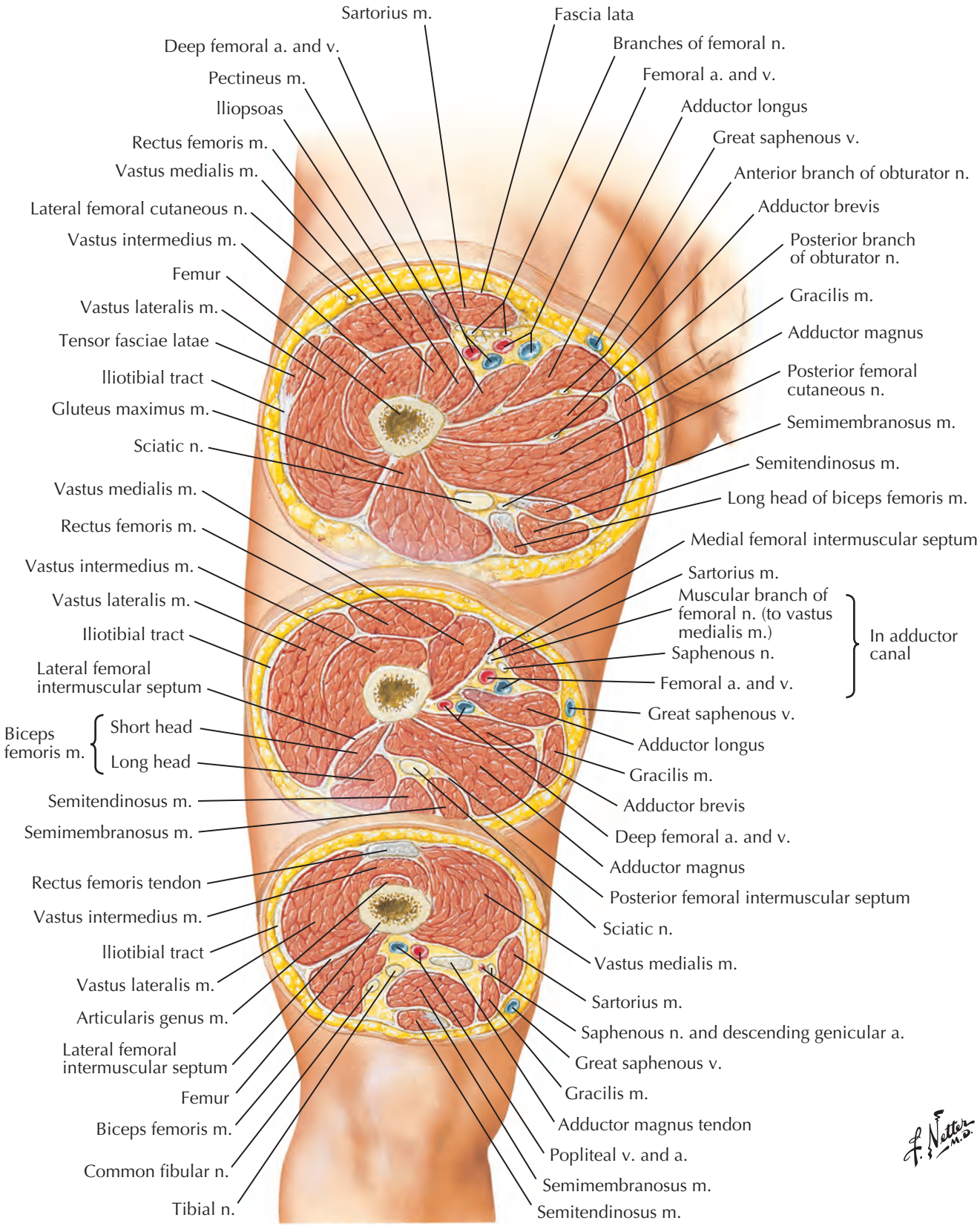



Piriformis m.
Gluteus medius m. (cut)
Gluteus maximus m. (cut)
Gluteus minimus m.
Piriformis tendon (reflected cranially)
Superior gemellus m.
Bursa of piriformis m.
Inferior gemellus m.
Trochanteric bursae of gluteus medius m. (cut)
Obturator internus (cut)
Gluteus medius m. (cut and reflected)
Sciatic bursa of obturator internus (cut)
Trochanteric bursa of gluteus maximus m. (cut)
Tendon of long head of biceps femoris m. (cut and reflected)
Gluteus maximus m. (cut and reflected)
Sciatic bursa of gluteus maximus m. (cut)
Inferior extension of trochanteric bursa of gluteus maximus m. (cut)
Superior bursa of biceps femoris m. (cut)
Adductor minimus (part of adductor magnus)
Quadratus femoris m.
Adductor magnus
Iliotibial tract
Semitendinosus m.
Sciatic n.
Adductor magnus
Psoas major
Psoas minor
Iliacus m.
Psoas minor tendon
Gluteus medius m.
Inguinal ligament
Origin of rectus femoris m. (cut and reflected upward)
Iliacus m. (cut)
Bursa of rectus femoris m.
Psoas major (cut)
Piriformis tendon
Iliopectineal arch
Iliopectineal bursa
Gluteus minimus tendon (cut)
Pubic symphysis
Trochanteric bursae of gluteus medius m.
Iliofemoral ligament
Iliopsoas (cut)
Gluteus medius tendon (cut and reflected laterally)
Trochanteric bursa of gluteus minimus m.
Gluteus minimus tendon (cut)
Subtendinous bursa of iliacus
C. Machado M.D.

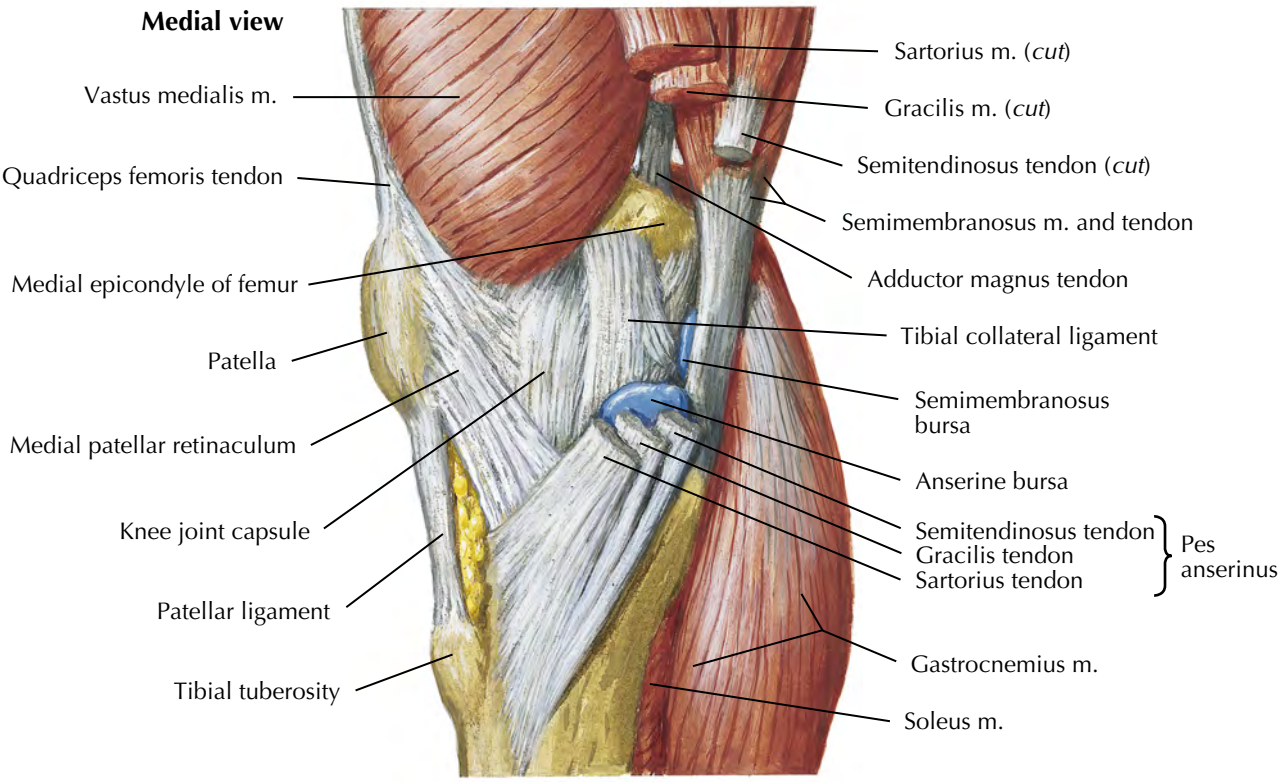
See also **Plates 496, 522**



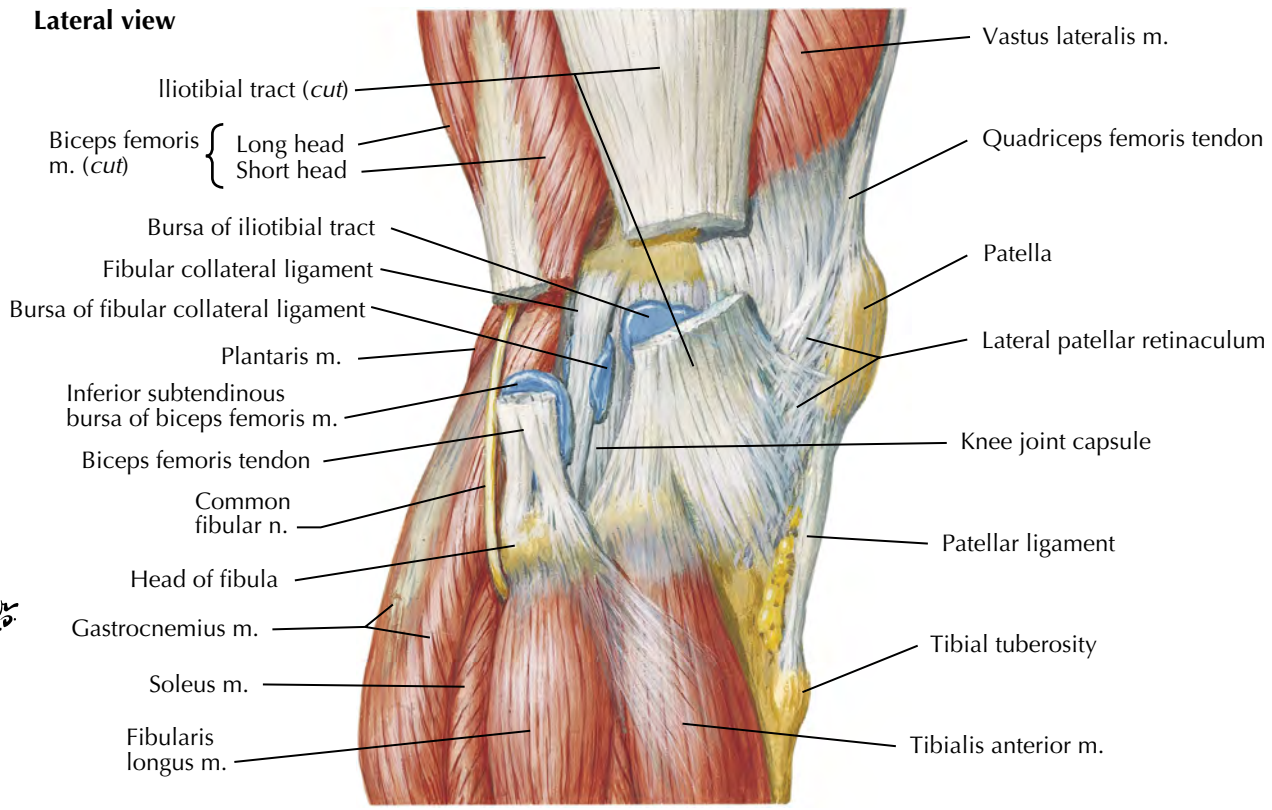



Sartorius m.
Fascia lata
Deep femoral a. and v.
Branches of femoral n.
Pectineus m.
Femoral a. and v.
Iliopsoas
Adductor longus
Rectus femoris m.
Great saphenous v.
Vastus medialis m.
Anterior branch of obturator n.
Lateral femoral cutaneous n.
Adductor brevis
Vastus intermedius m.
Posterior branch of obturator n.
Femur
Gracilis m.
Vastus lateralis m.
Adductor magnus
Tensor fasciae latae
Posterior femoral cutaneous n.
Iliotibial tract
Gluteus maximus m.
Semimembranosus m.
Sciatic n.
Semitendinosus m.
Vastus medialis m.
Long head of biceps femoris m.
Rectus femoris m.
Medial femoral intermuscular septum
Vastus intermedius m.
Sartorius m.
Vastus lateralis m.
Muscular branch of femoral n. (to vastus medialis m.)
Iliotibial tract
Saphenous n.
In adductor canal
Lateral femoral intermuscular septum
Femoral a. and v.
Great saphenous v.
Biceps femoris m.
Short head
Long head
Adductor longus
Gracilis m.
Semitendinosus m.
Adductor brevis
Semimembranosus m.
Deep femoral a. and v.
Adductor magnus
Rectus femoris tendon
Posterior femoral intermuscular septum
Vastus intermedius m.
Sciatic n.
Iliotibial tract
Vastus medialis m.
Vastus lateralis m.
Sartorius m.
Articularis genus m.
Saphenous n. and descending genicular a.
Lateral femoral intermuscular septum
Great saphenous v.
Femur
Gracilis m.
Biceps femoris m.
Adductor magnus tendon
Popliteal v. and a.
Common fibular n.
Semimembranosus m.
Tibial n.
Semitendinosus m.

Medial view

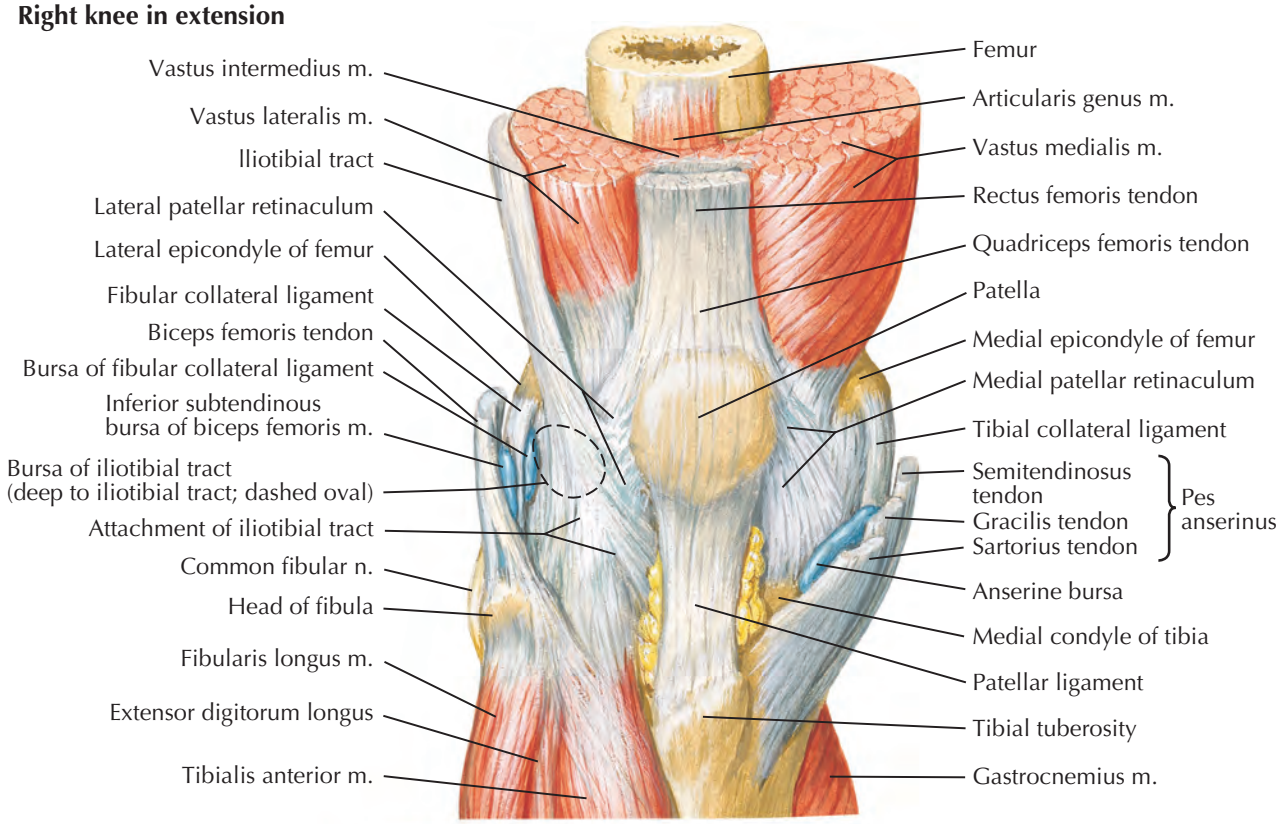


Lateral view

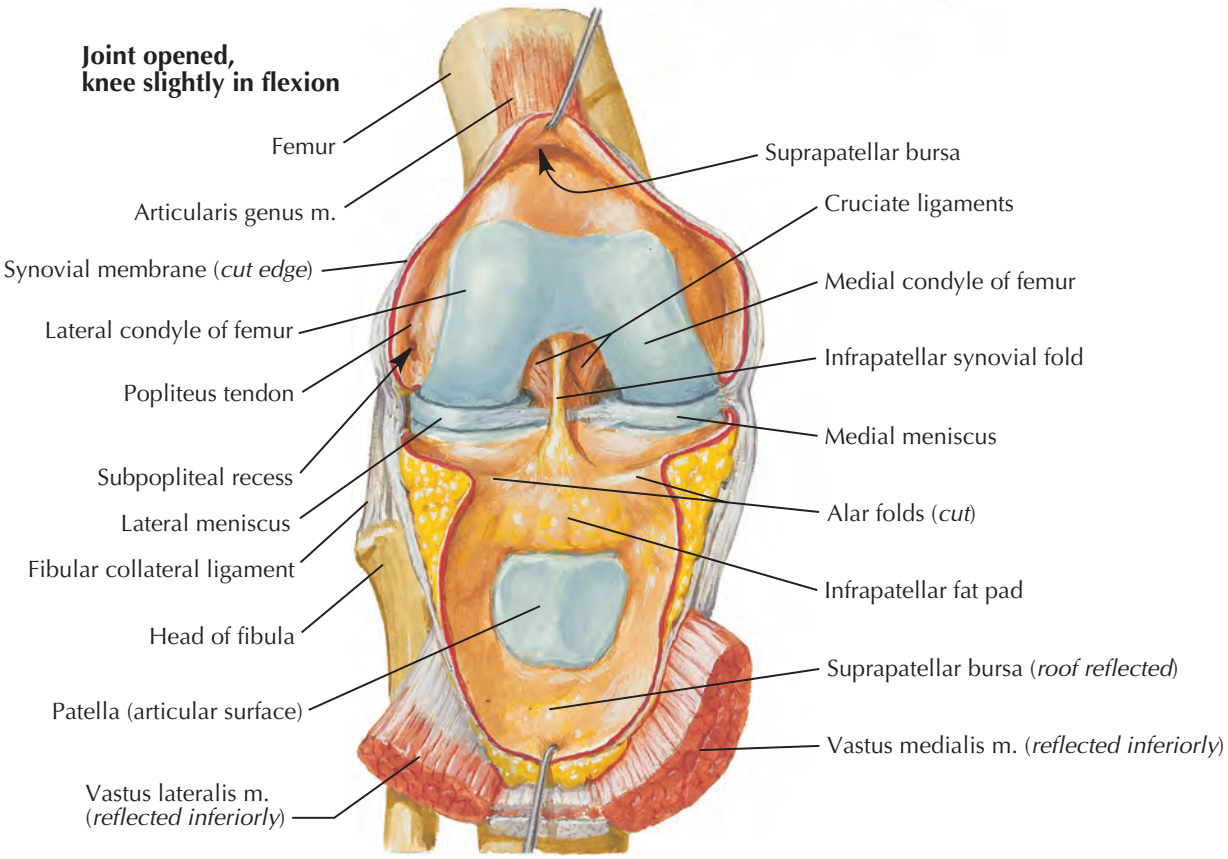


See also **Plates 520, BP 107**

Right knee in extension

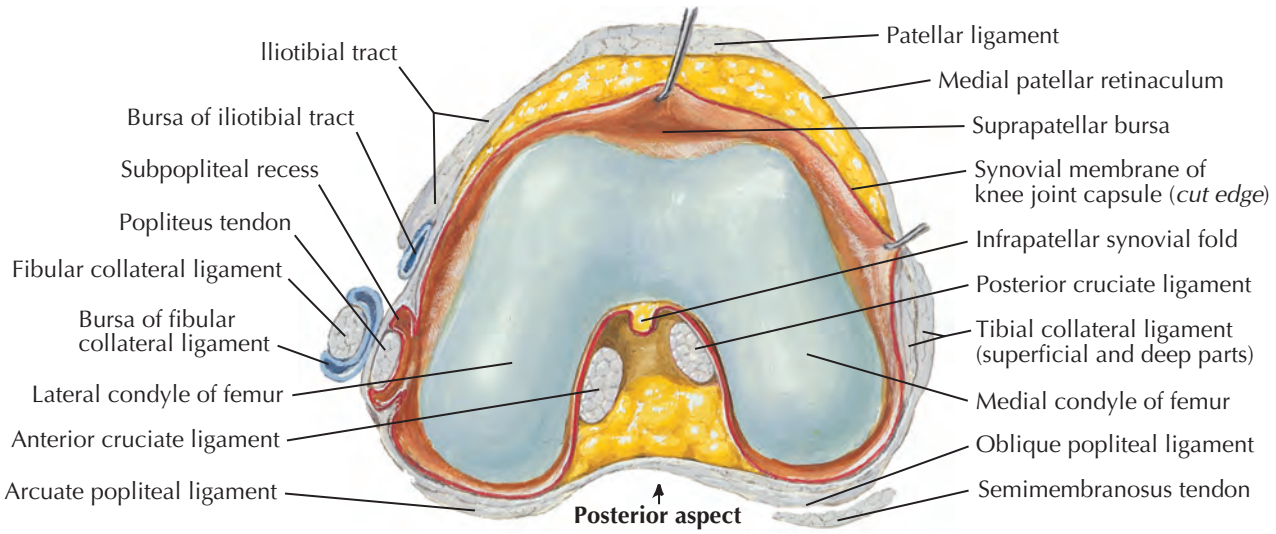


Joint opened, knee slightly in flexion

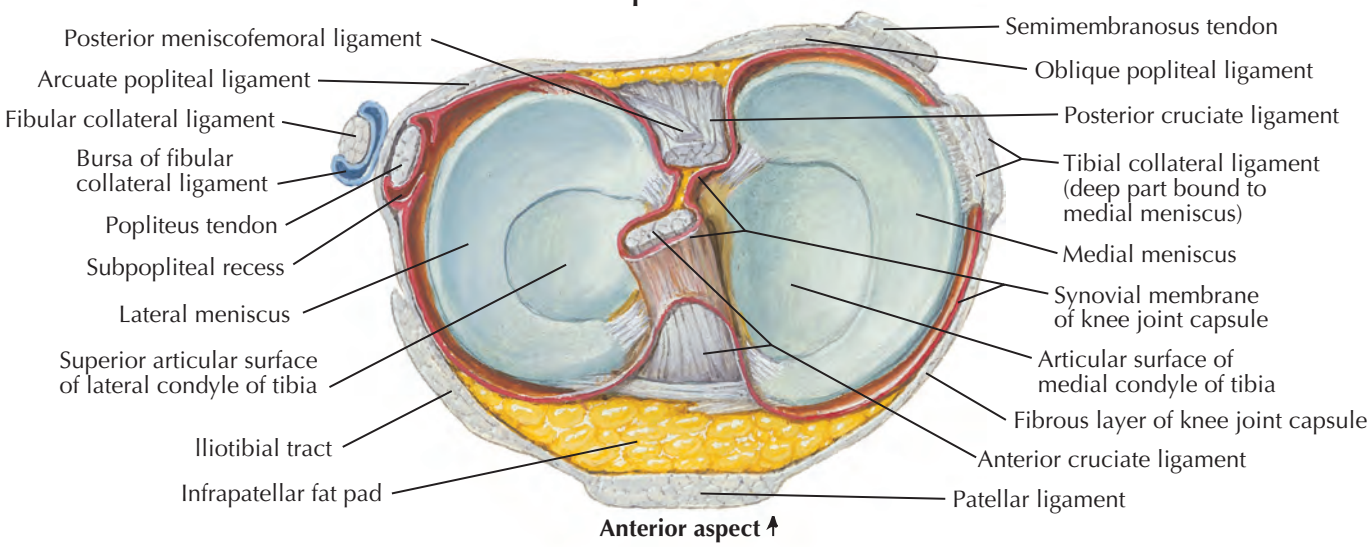


See also **Plate 525**

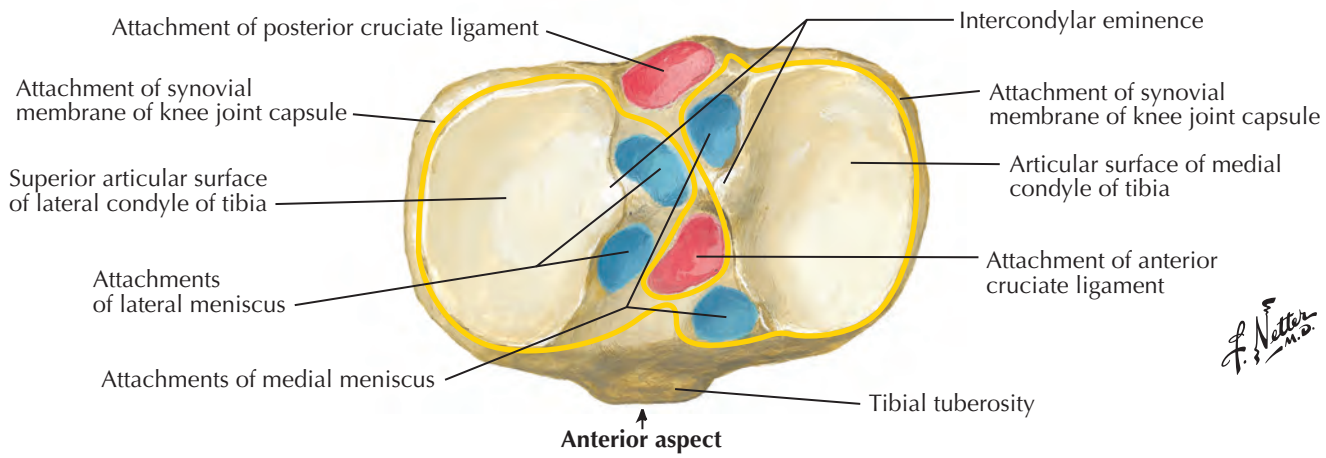
Inferior view



Superior view

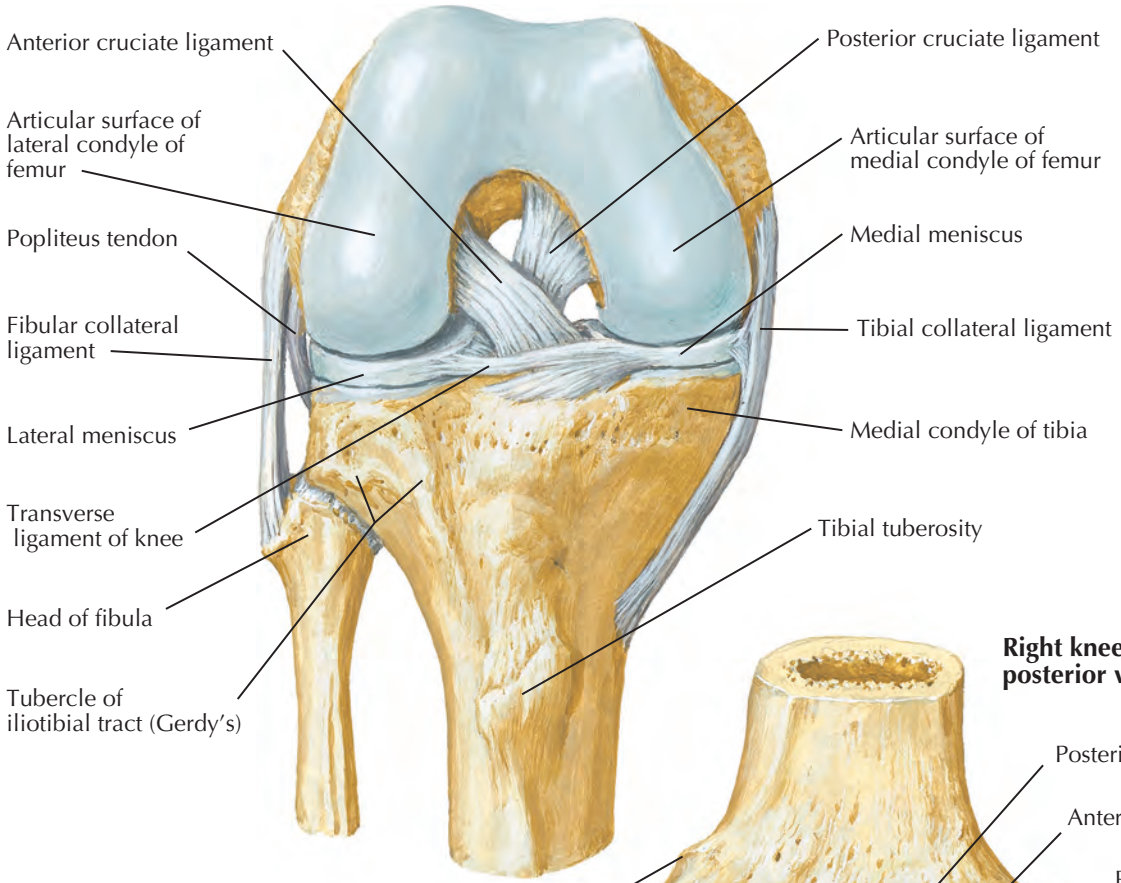


Superior view: ligaments and cartilage removed

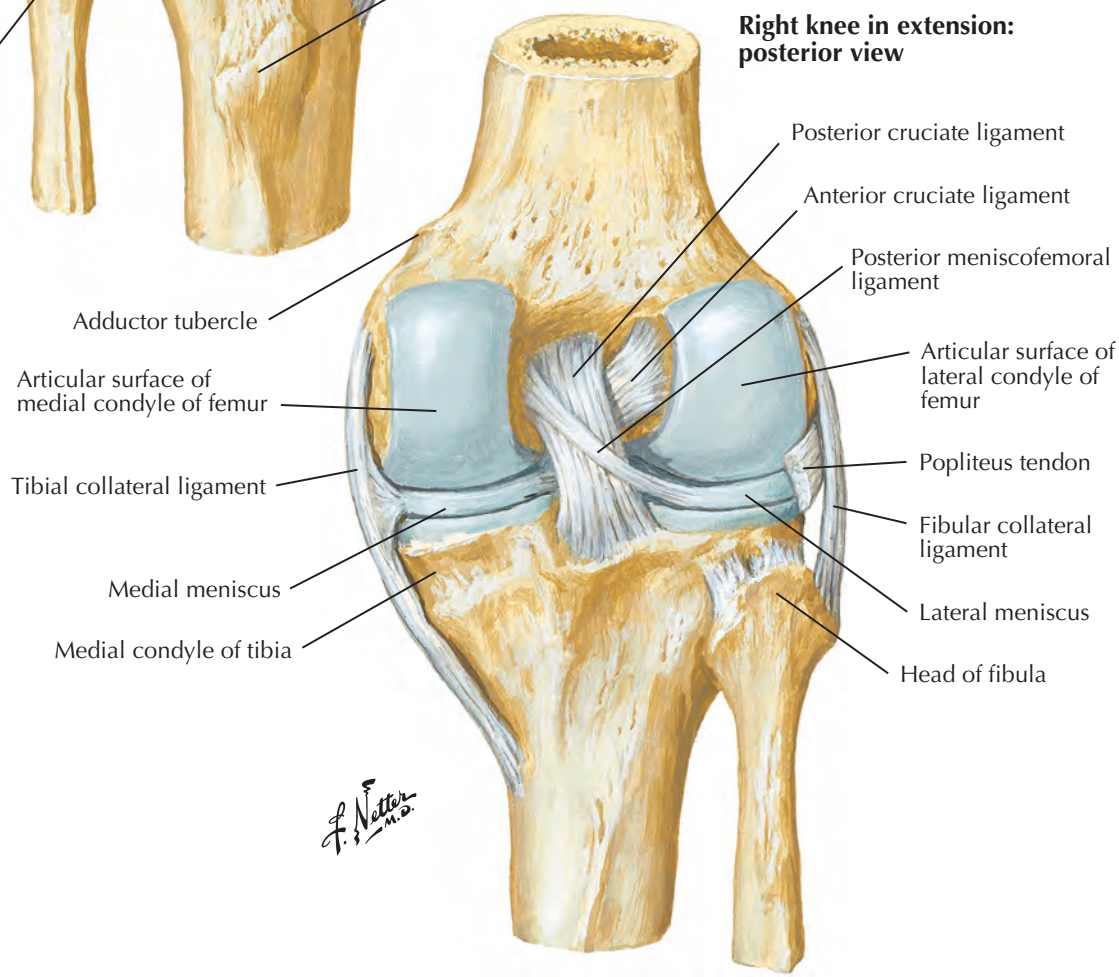


See also **Plate BP 107**

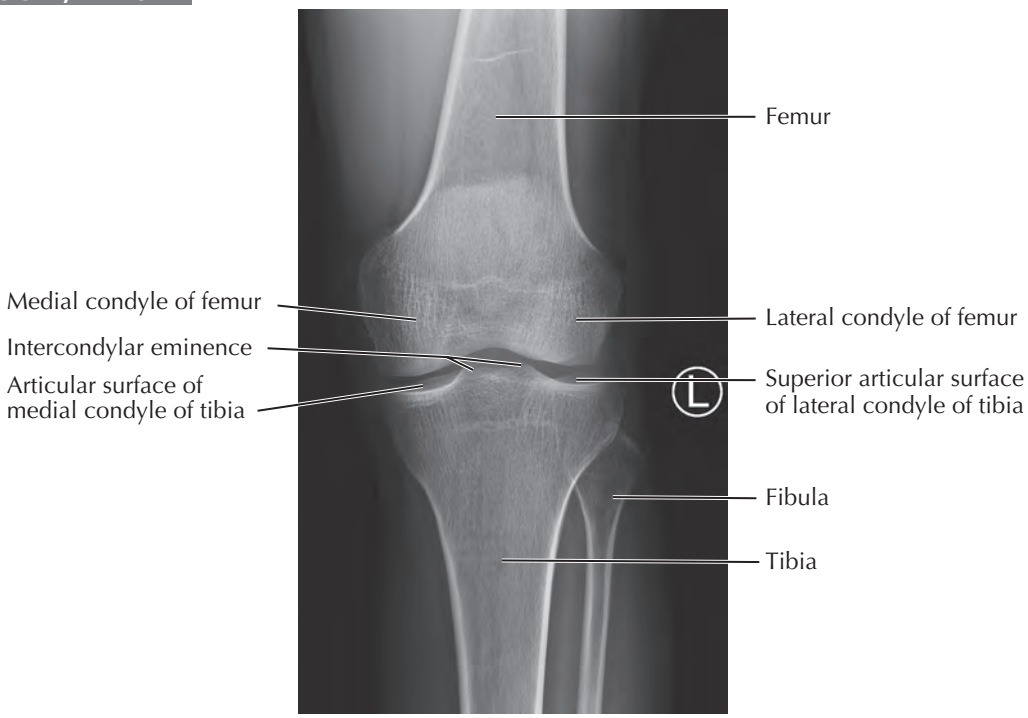
Right knee in flexion: anterior view

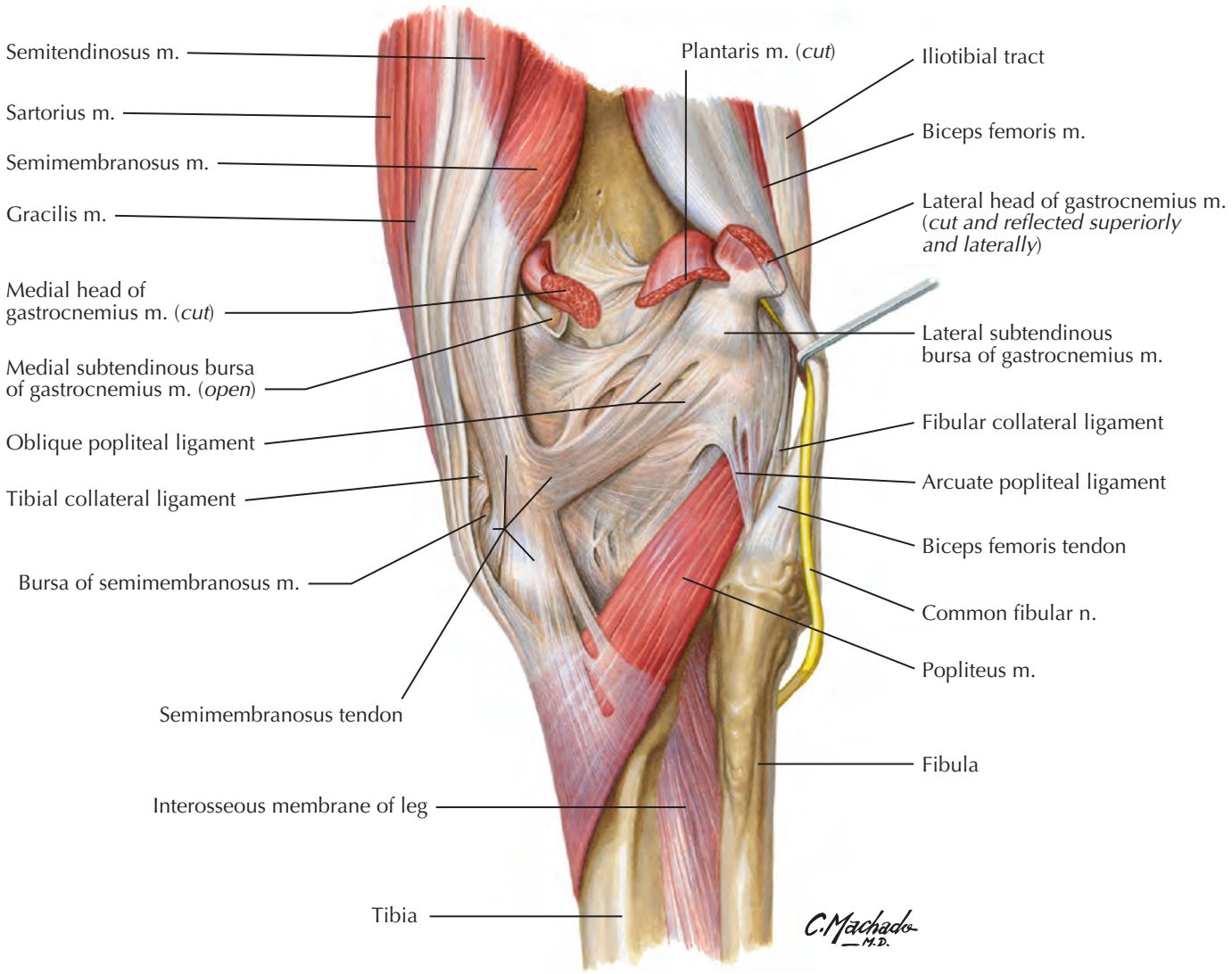


Right knee in extension: posterior view

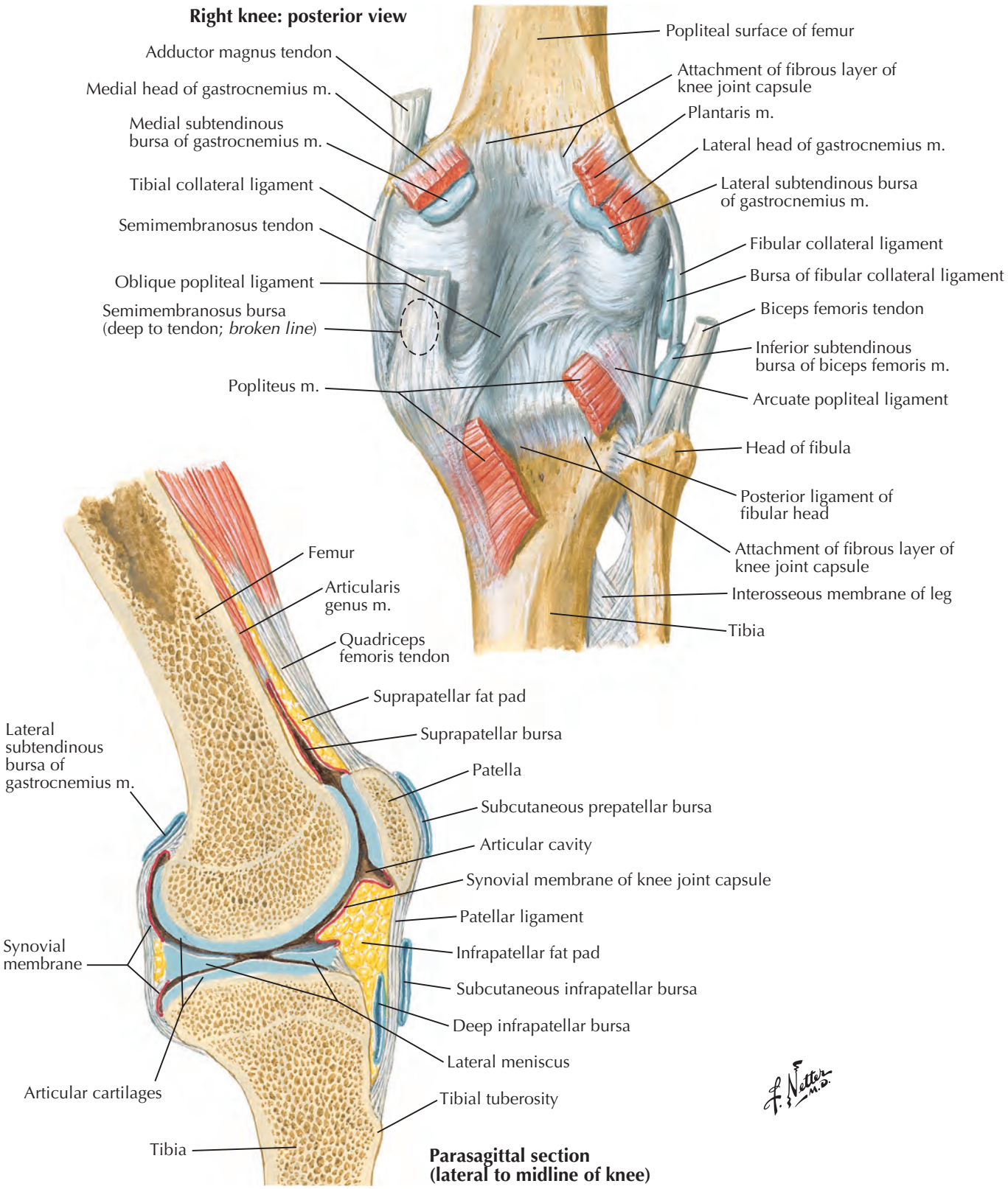


See also **Plates 517, BP 107**

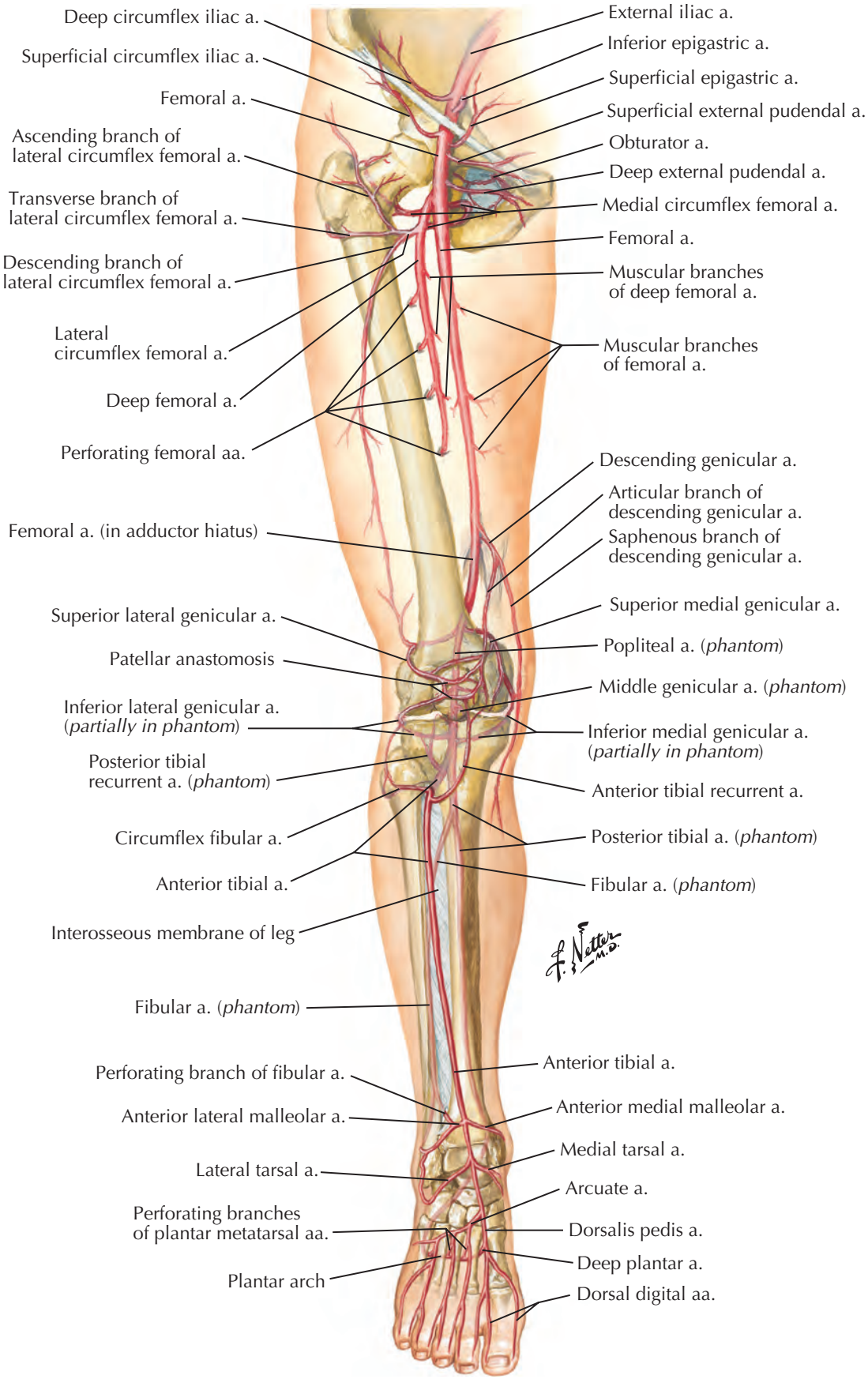


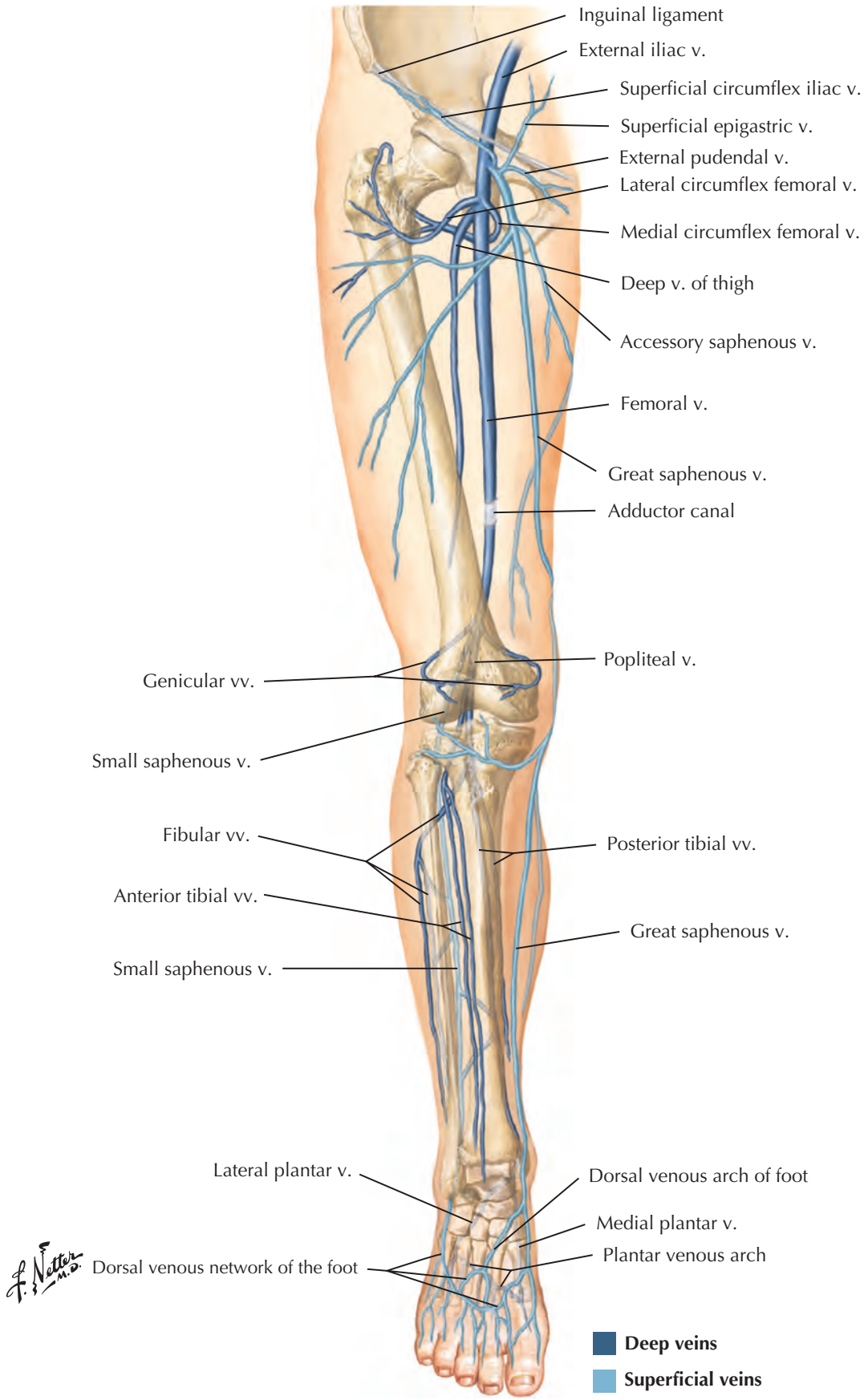


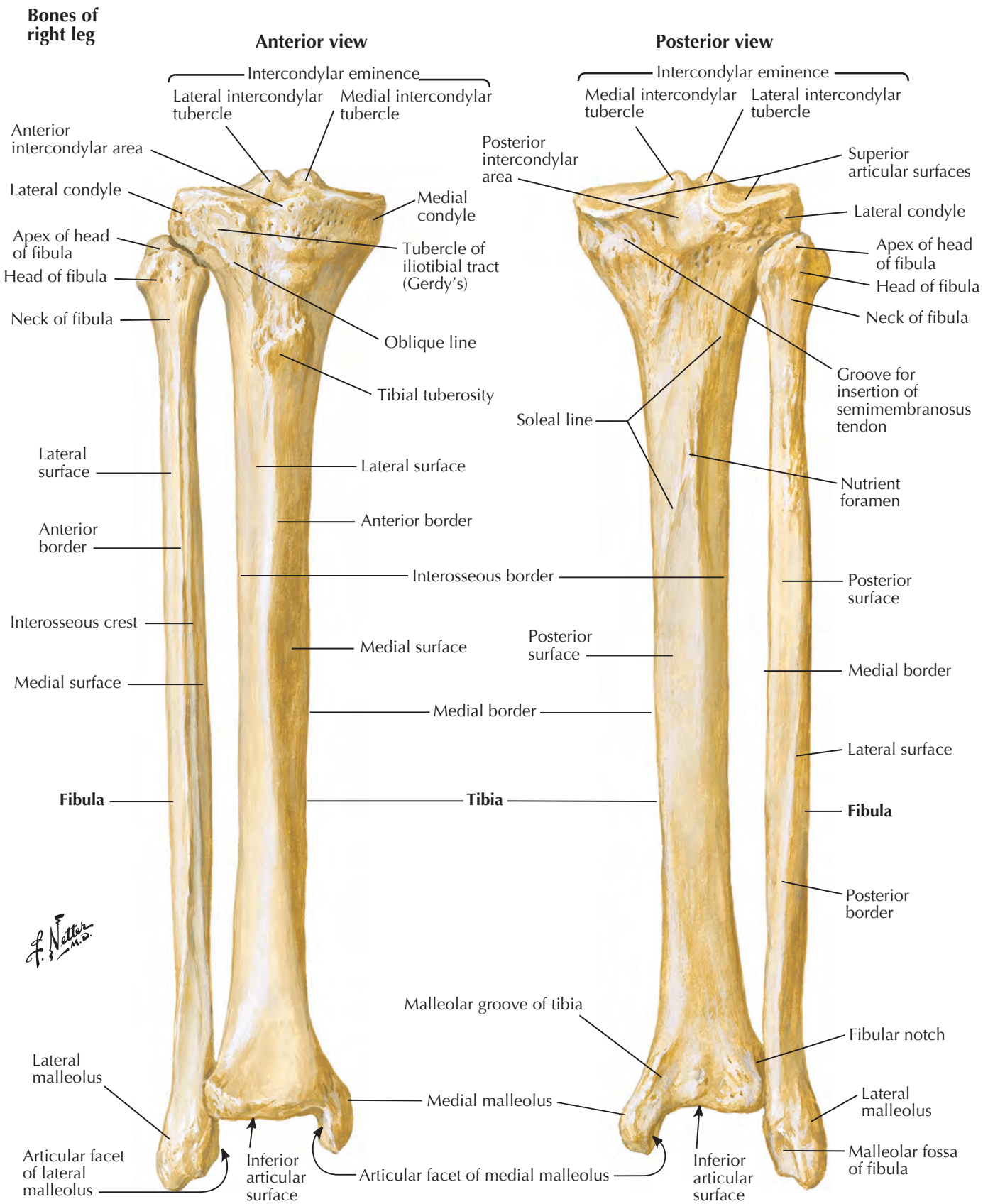
See also **Plates BP 107, BP 108**



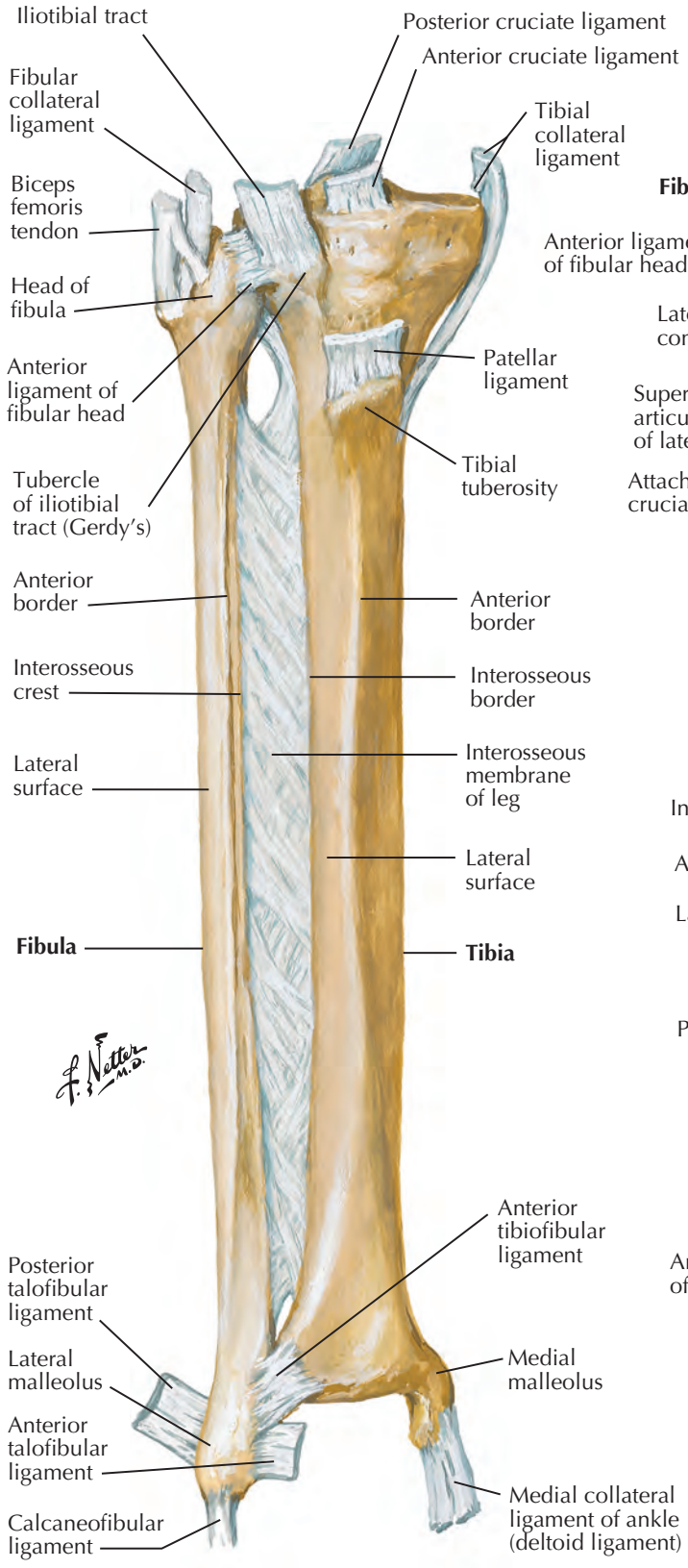
See also **Plates 514, 532, BP 103**



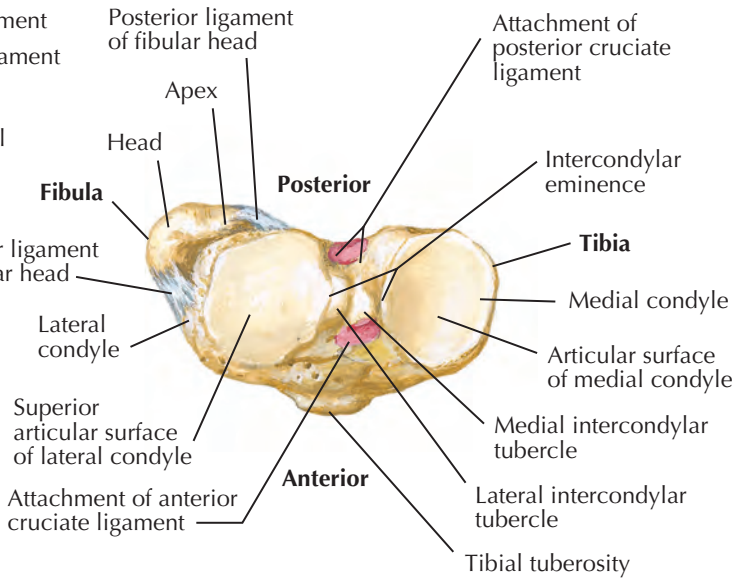

Inguinal ligament
External iliac v.
Superficial circumflex iliac v.
Superficial epigastric v.
External pudendal v.
Lateral circumflex femoral v.
Medial circumflex femoral v.
Deep v. of thigh
Accessory saphenous v.
Femoral v.
Great saphenous v.
Adductor canal
Popliteal v.
Genicular vv.
Small saphenous v.
Fibular vv.
Posterior tibial vv.
Anterior tibial vv.
Great saphenous v.
Small saphenous v.
Lateral plantar v.
Dorsal venous arch of foot
Medial plantar v.
Plantar venous arch
Dorsal venous network of the foot
Deep veins
Superficial veins


Bones of right leg
Anterior view
Intercondylar eminence
Lateral intercondylar tubercle
Medial intercondylar tubercle
Anterior intercondylar area
Lateral condyle
Medial condyle
Apex of head of fibula
Tubercle of iliotibial tract (Gerdy's)
Head of fibula
Neck of fibula
Oblique line
Tibial tuberosity
Lateral surface
Lateral surface
Anterior border
Anterior border
Interosseous border
Interosseous crest
Medial surface
Medial surface
Medial border
Fibula
Tibia
Lateral malleolus
Medial malleolus
Articular facet of lateral malleolus
Inferior articular surface
Articular facet of medial malleolus
Posterior view
Intercondylar eminence
Medial intercondylar tubercle
Lateral intercondylar tubercle
Posterior intercondylar area
Superior articular surfaces
Lateral condyle
Apex of head of fibula
Head of fibula
Neck of fibula
Groove for insertion of semimembranosus tendon
Soleal line
Nutrient foramen
Posterior surface
Posterior surface
Medial border
Lateral surface
Fibula
Posterior border
Malleolar groove of tibia
Fibular notch
Lateral malleolus
Malleolar fossa of fibula
Inferior articular surface

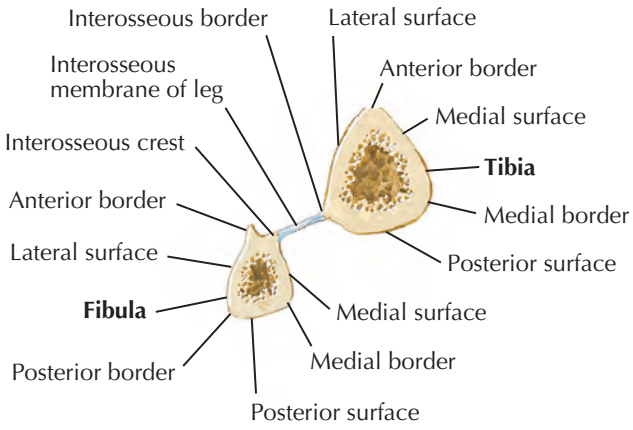
Anterior view with ligament attachments



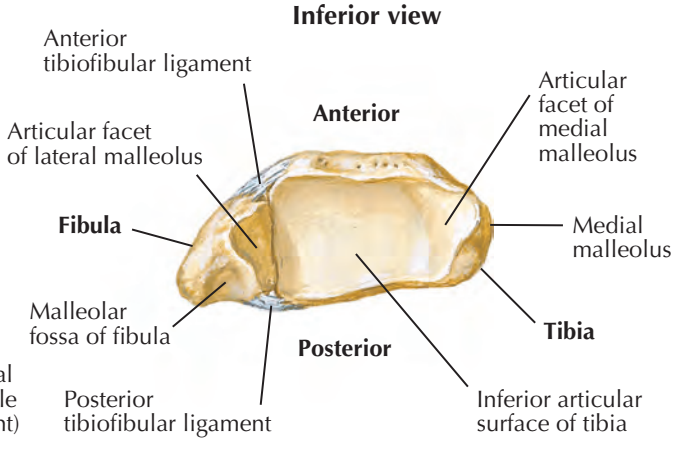
Superior view



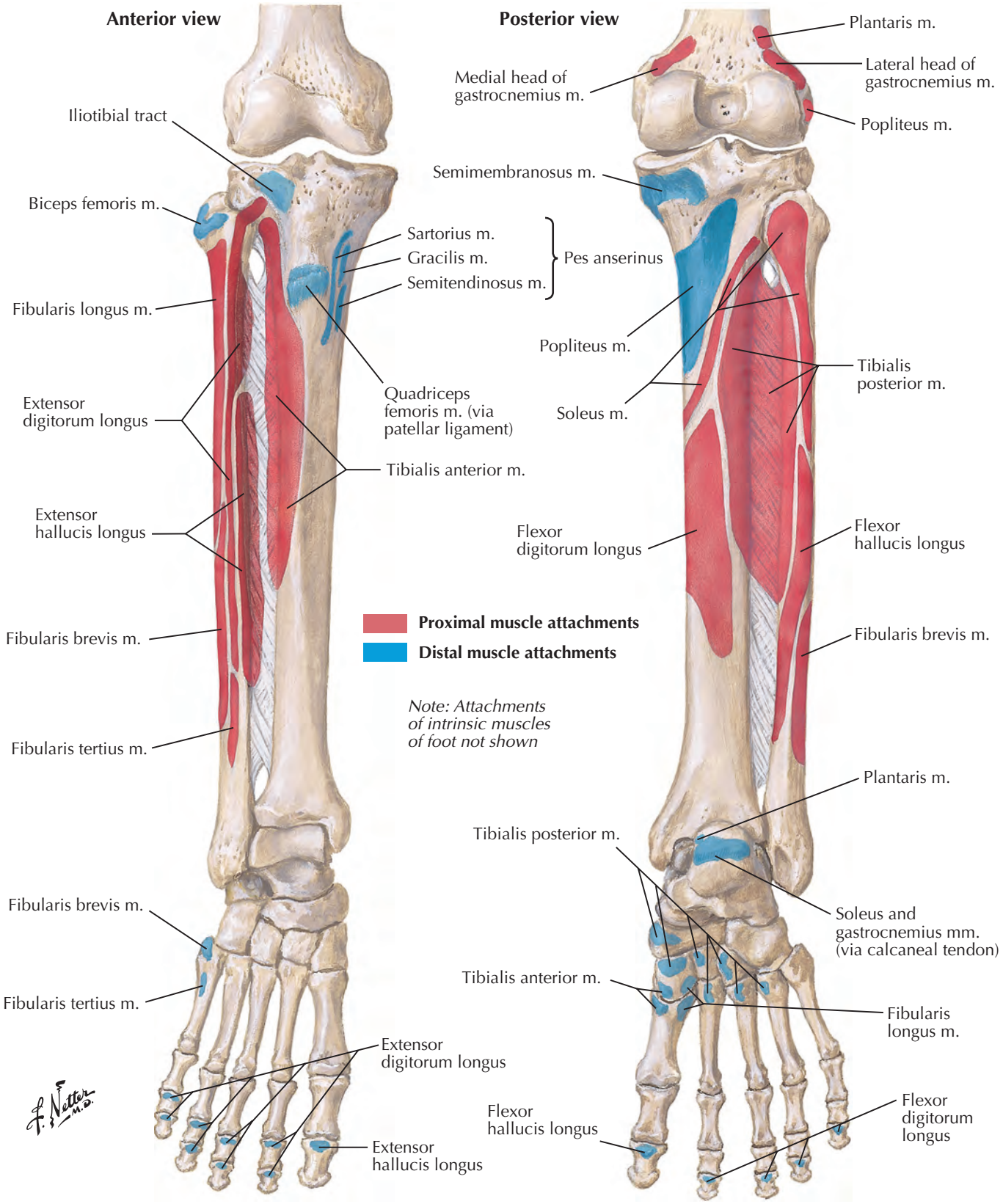
Cross section



Inferior view

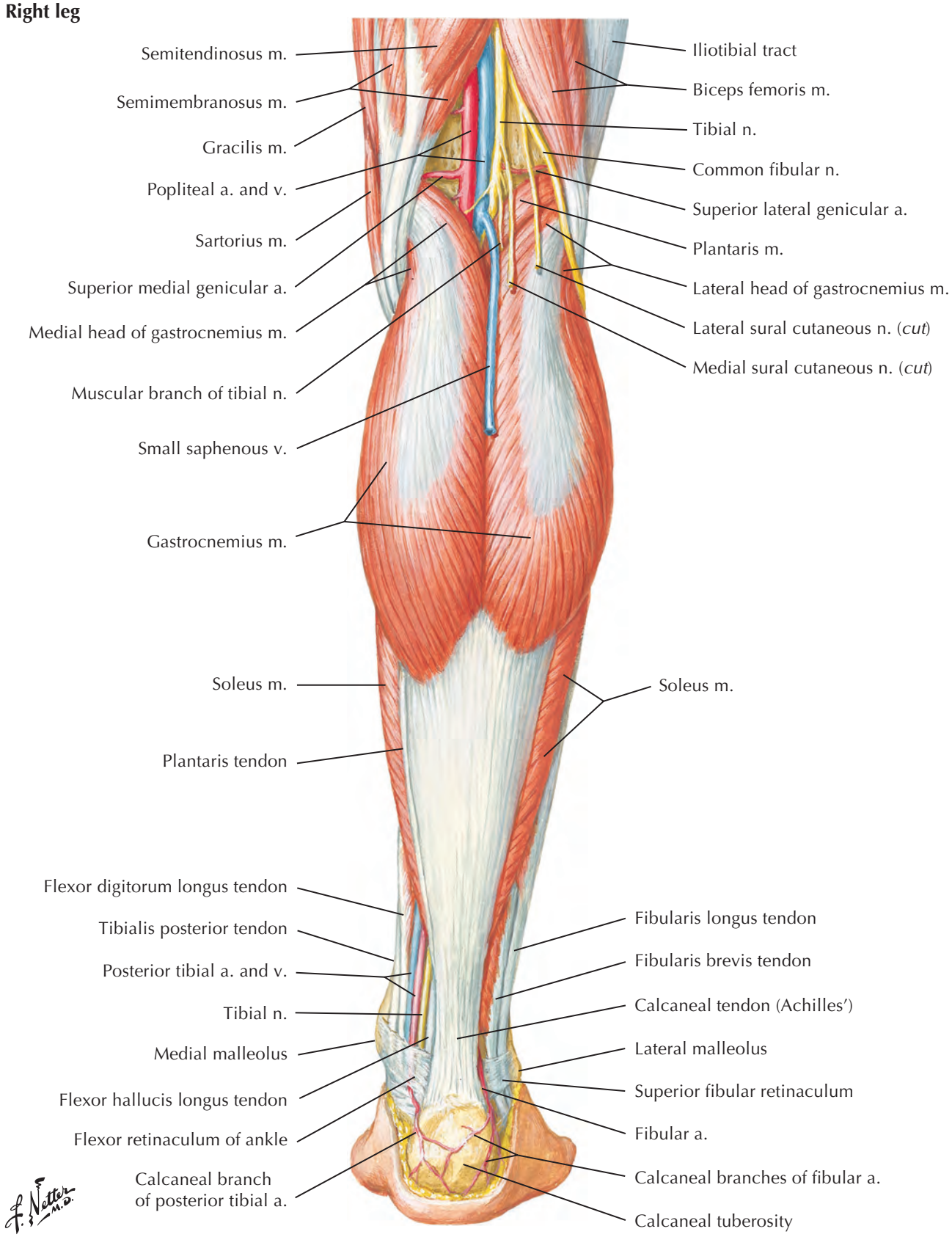


See also **Plates 529, 532**



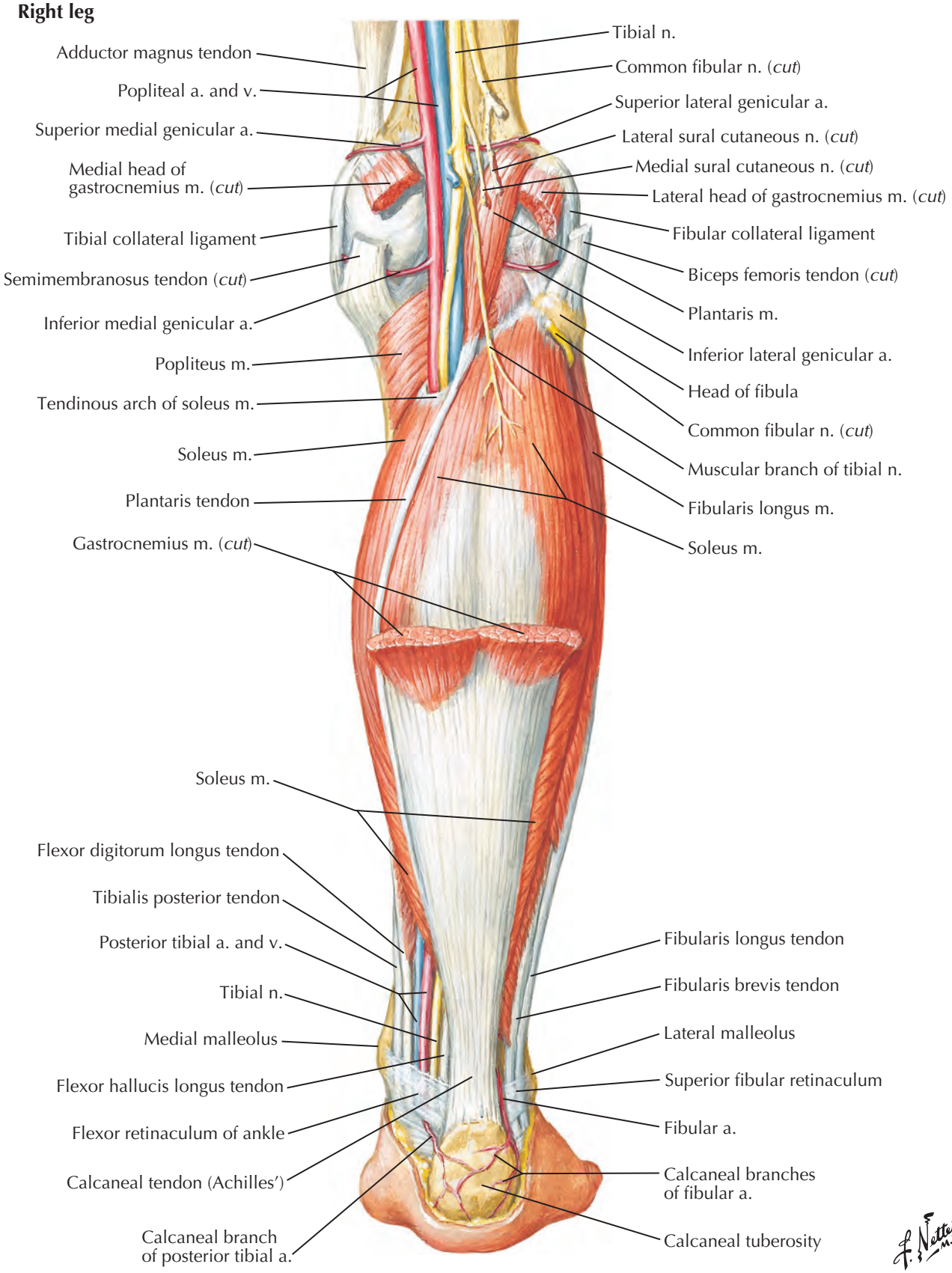
See also **Plates 553, BP 106**

Right leg



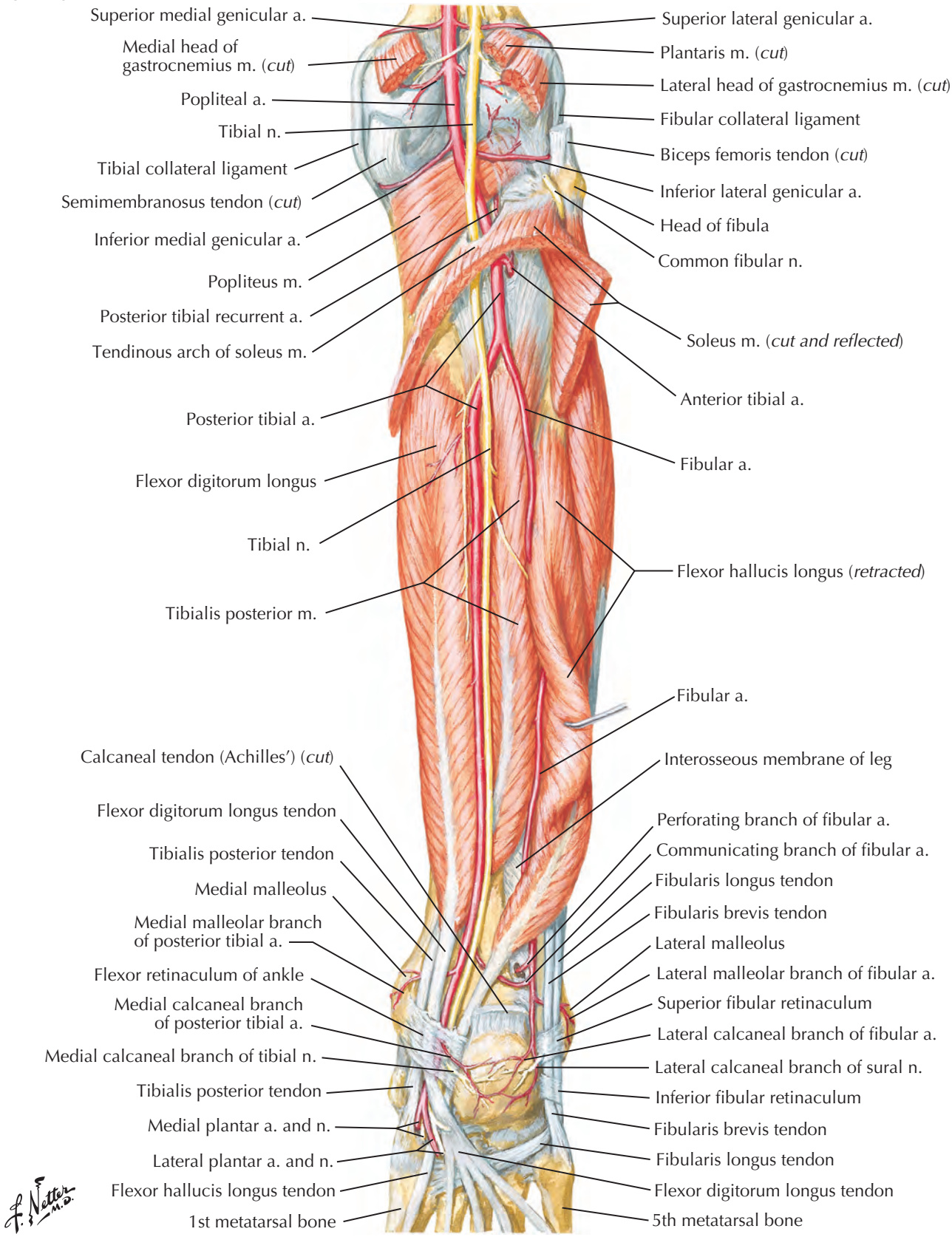
See also **Plates 553, BP 105, BP 106**

Right leg



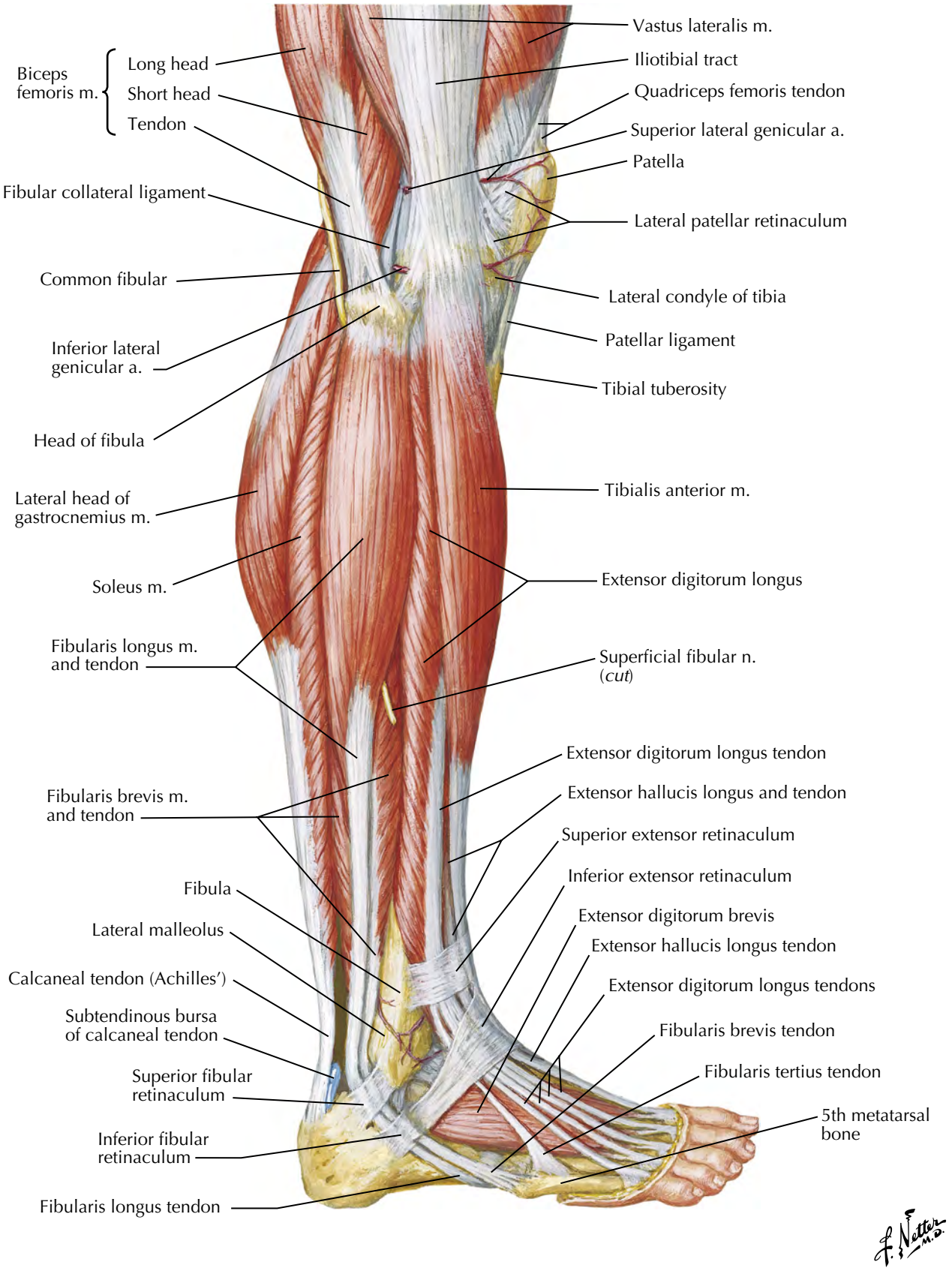
See also **Plates 553, BP 105, BP 106**

Right leg

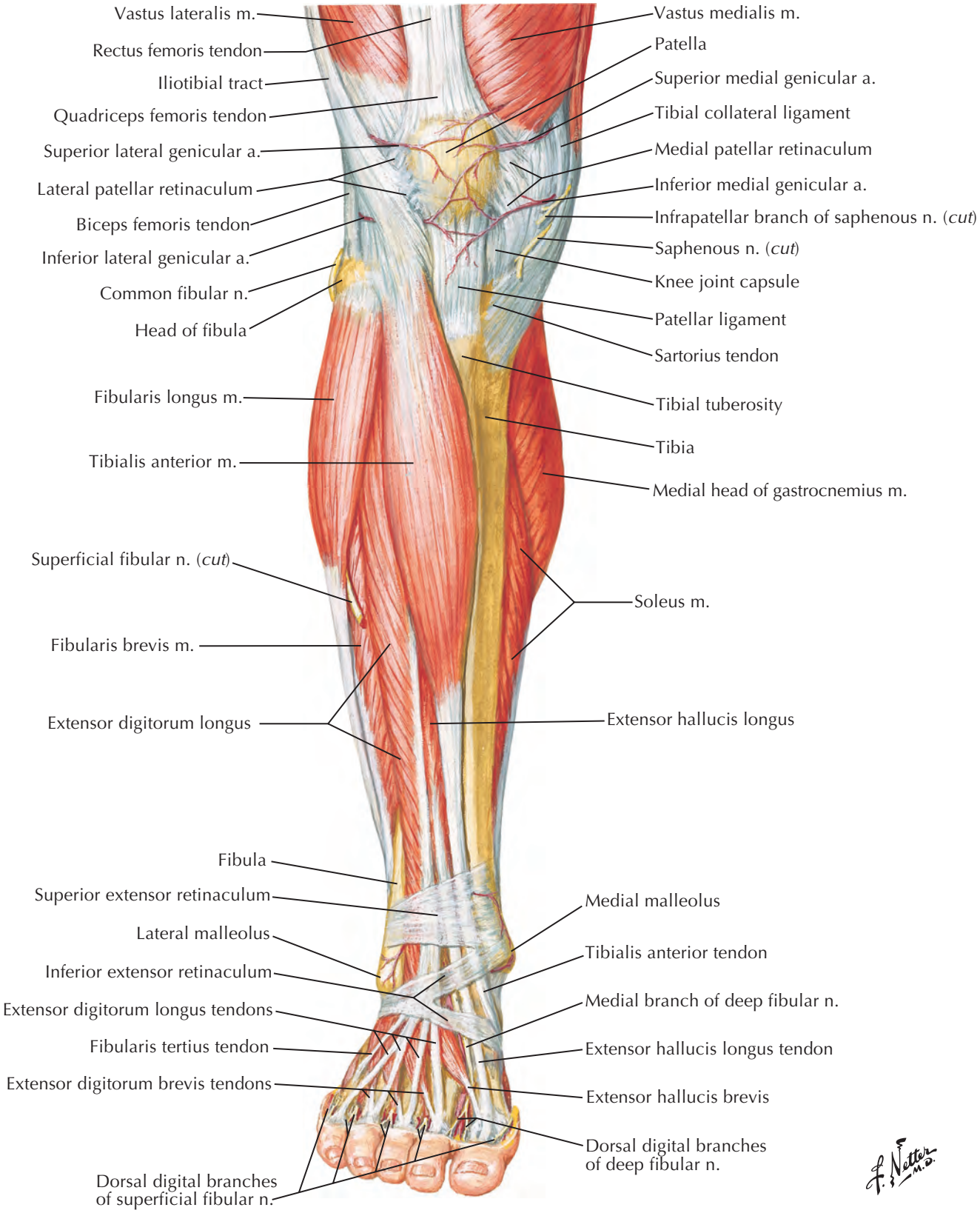


Muscles of Leg: Lateral Compartment

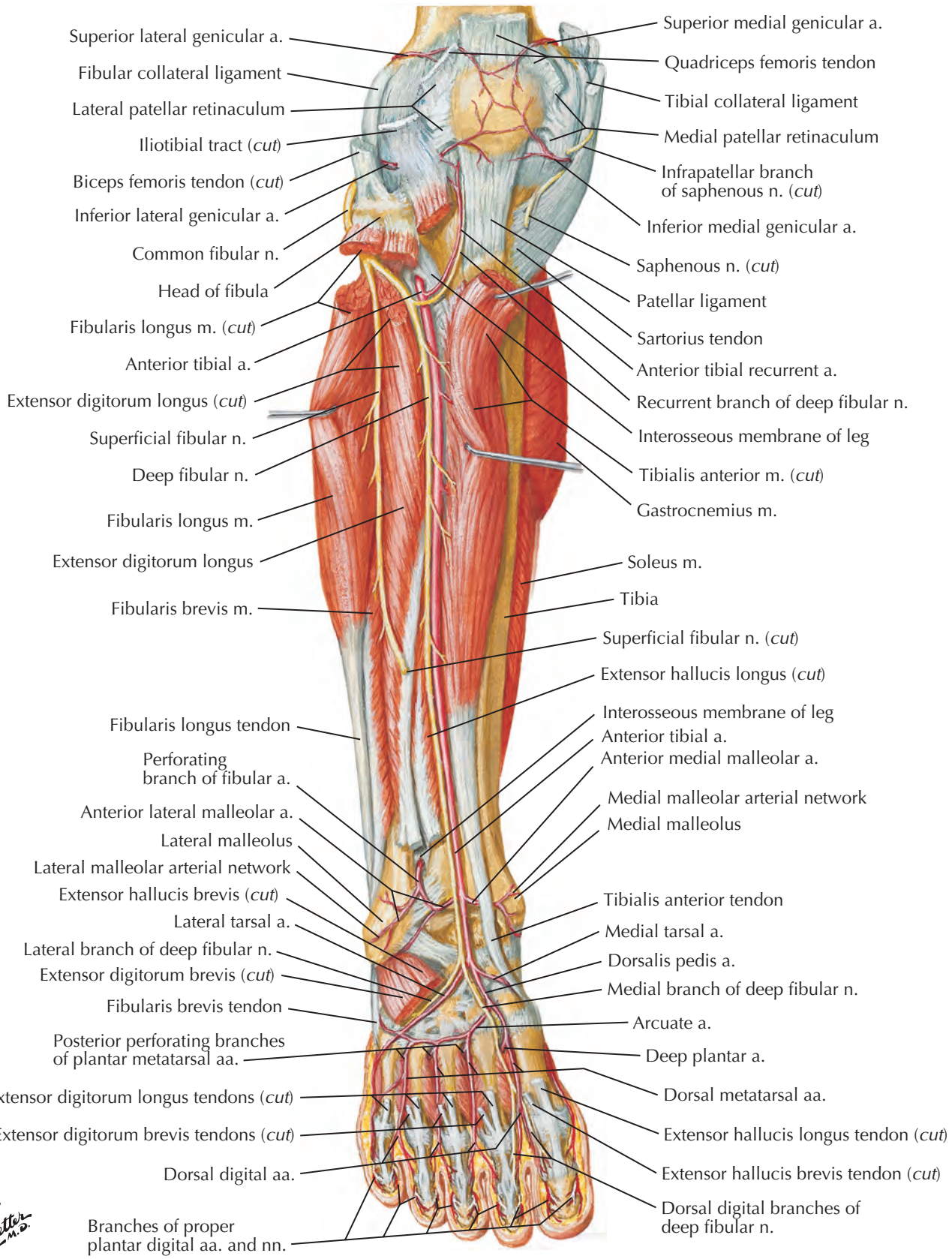
See also **Plates 540, 554, BP 106**



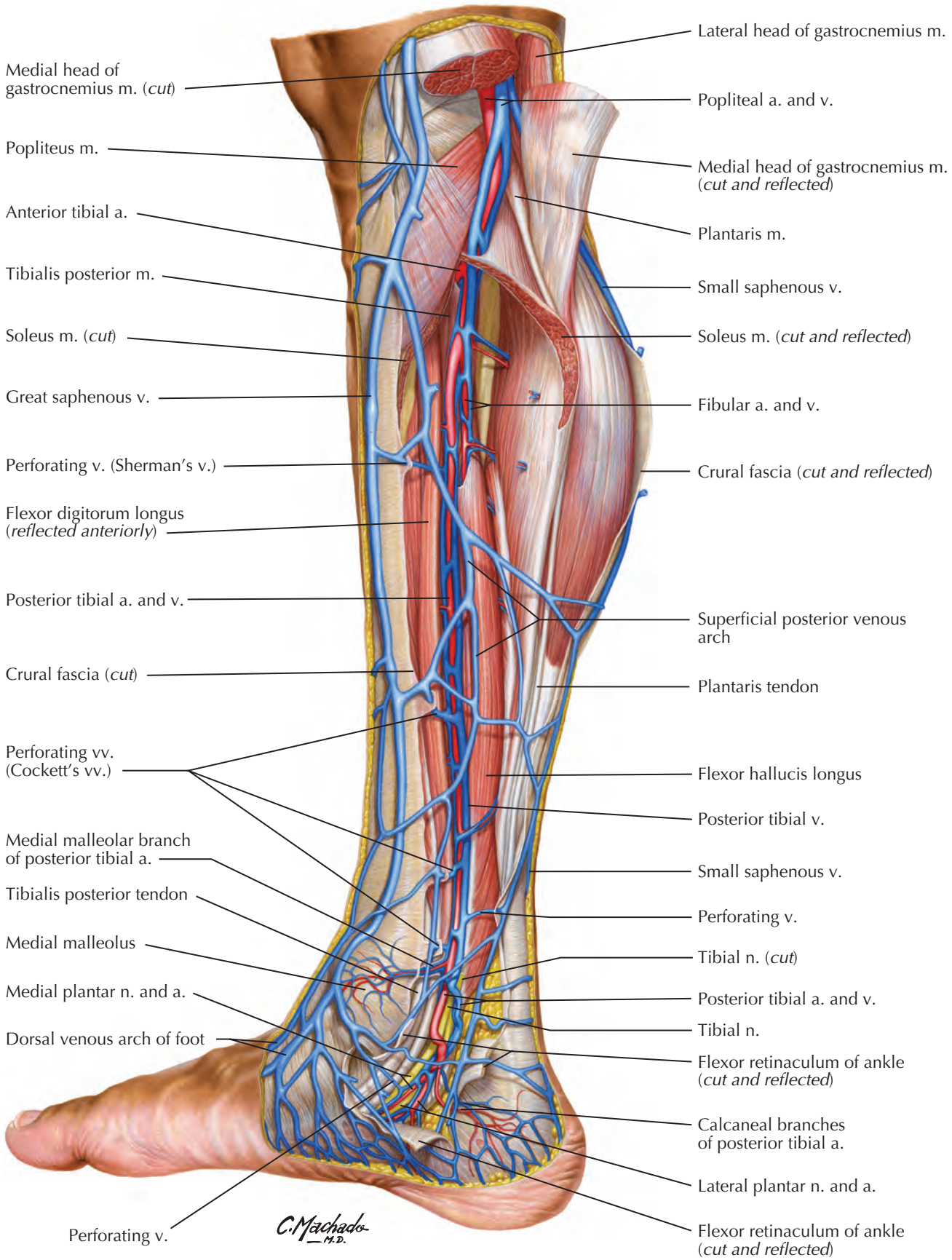
See also **Plates 554, BP 106**



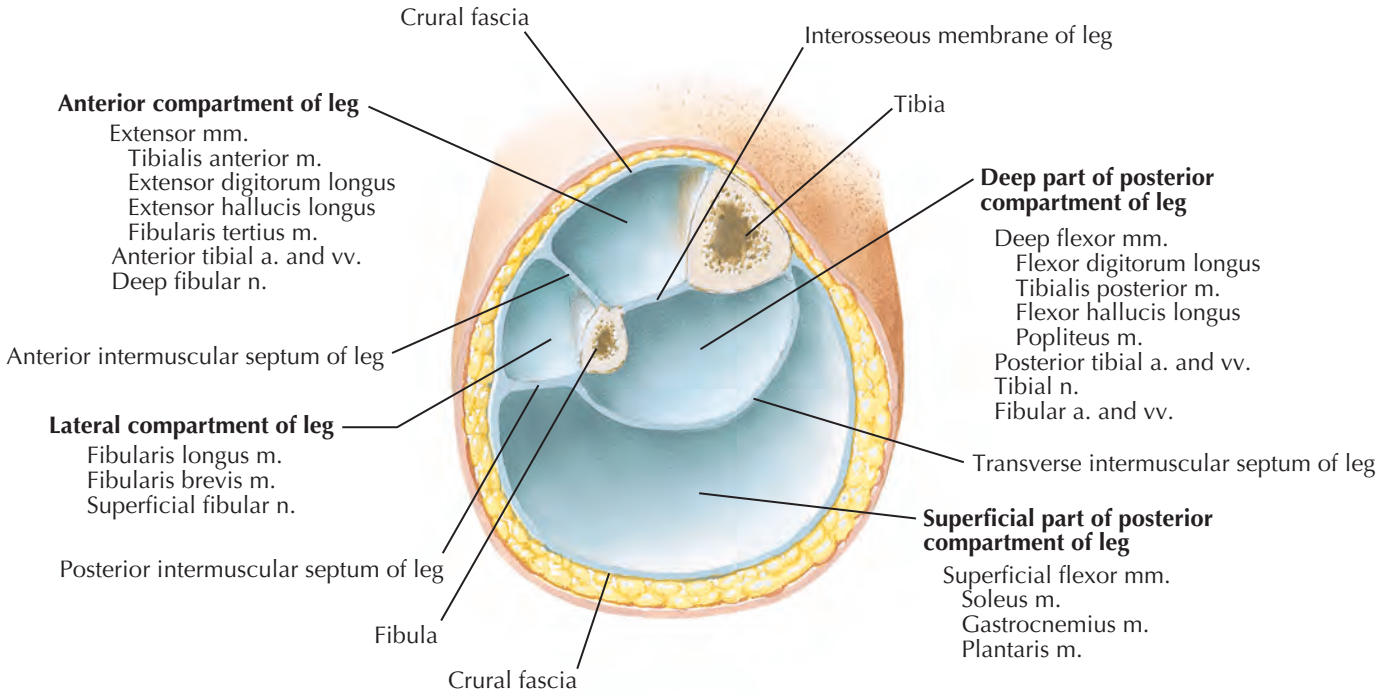
See also **Plates 541, 554, BP 105, BP 106**



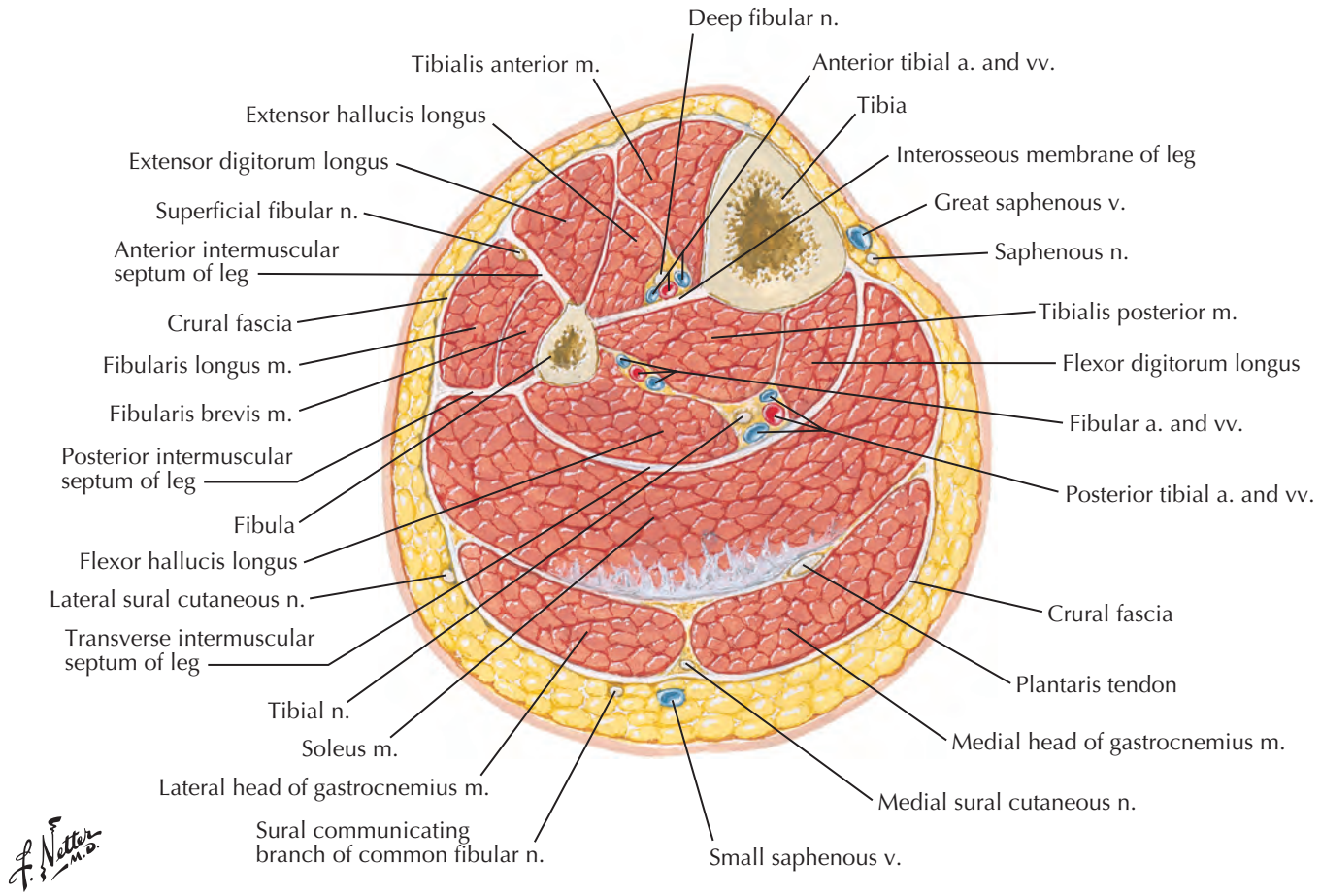
See also **Plates 492, 493, 523**

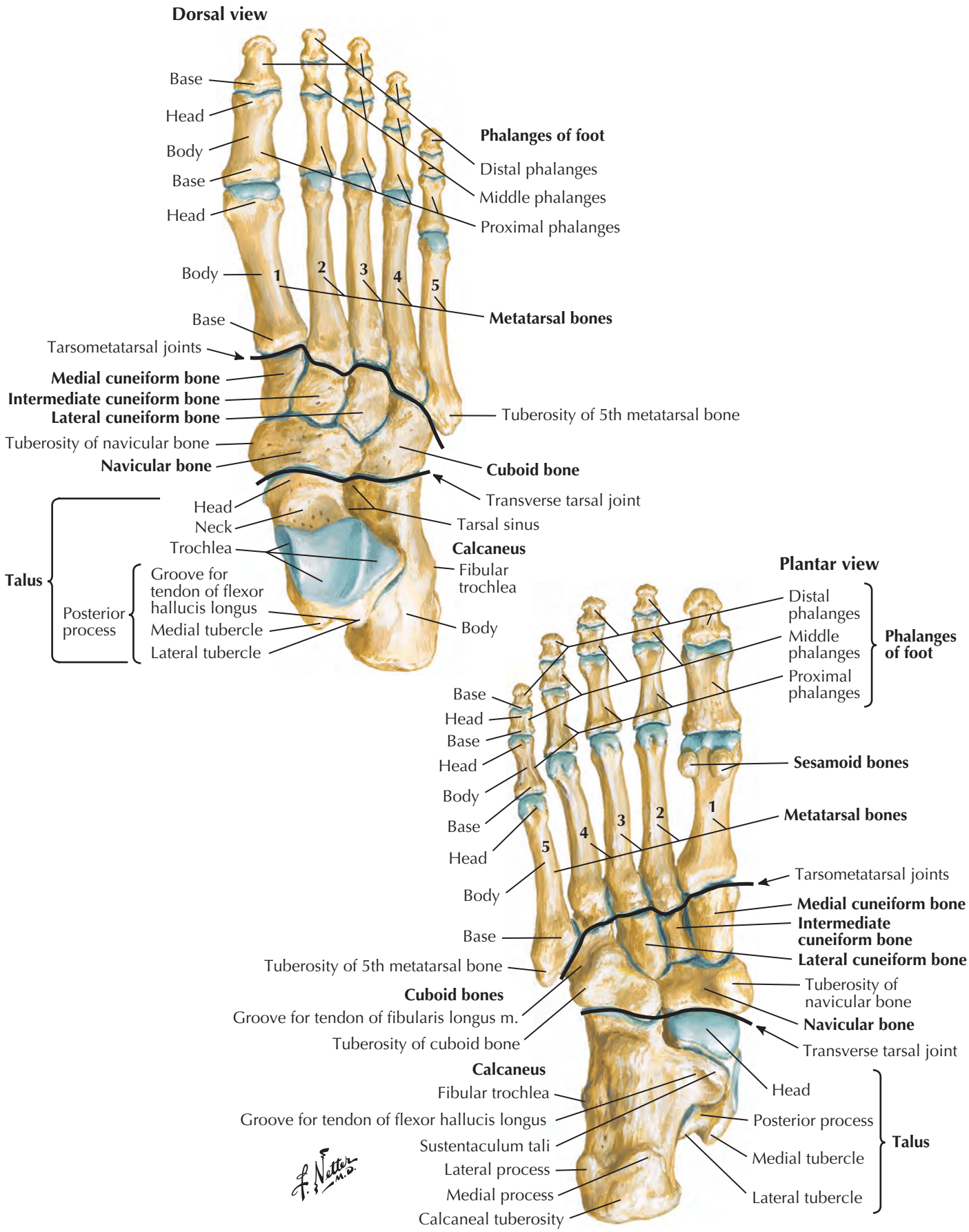


See also **Plate BP 106**

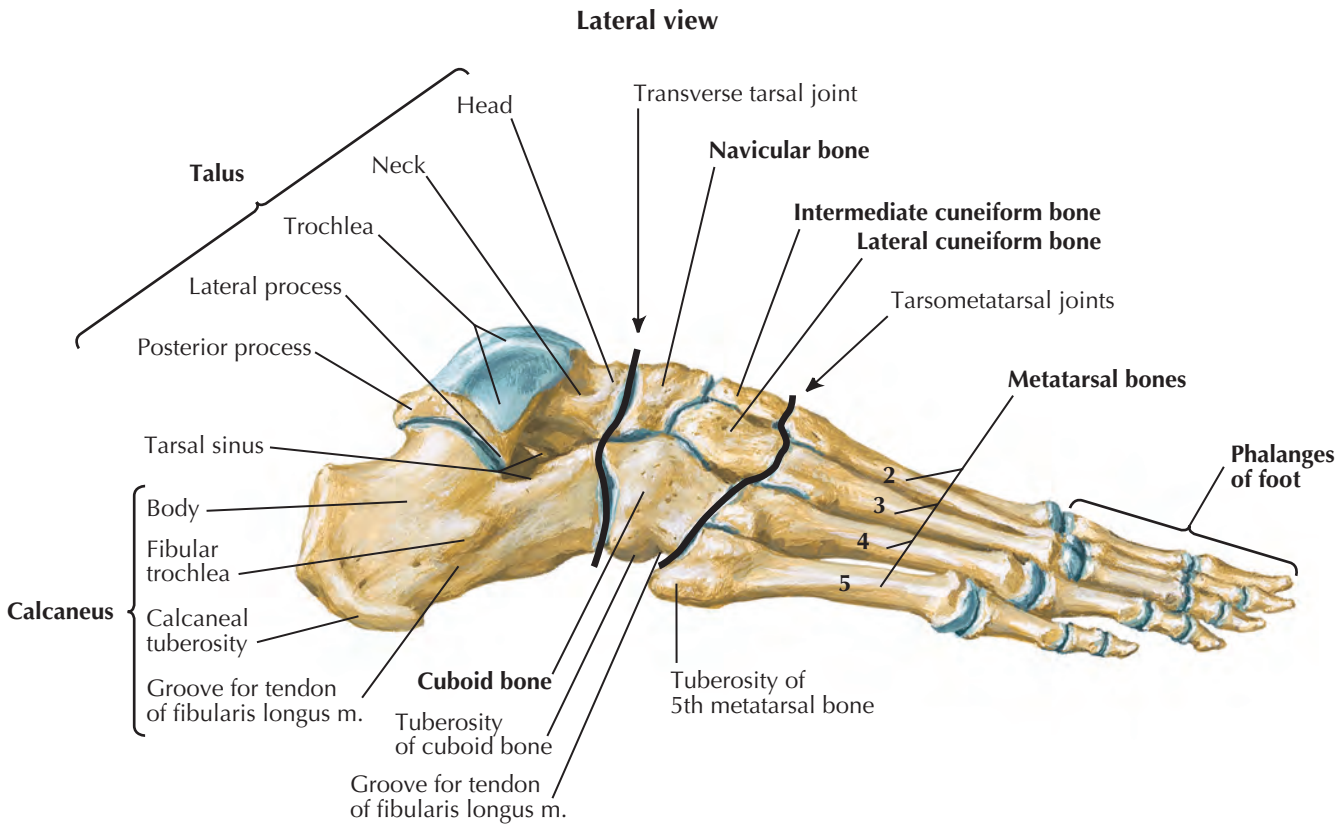


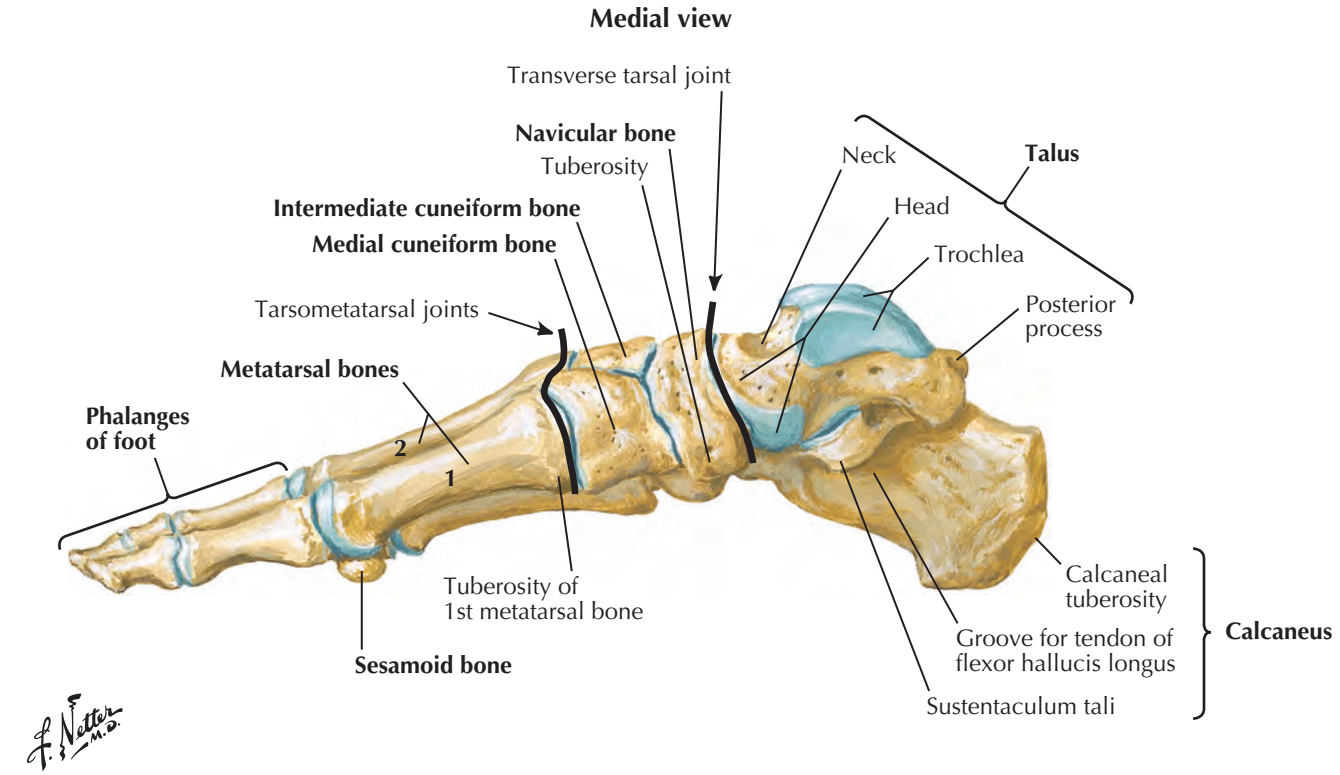
Cross section just above middle of leg



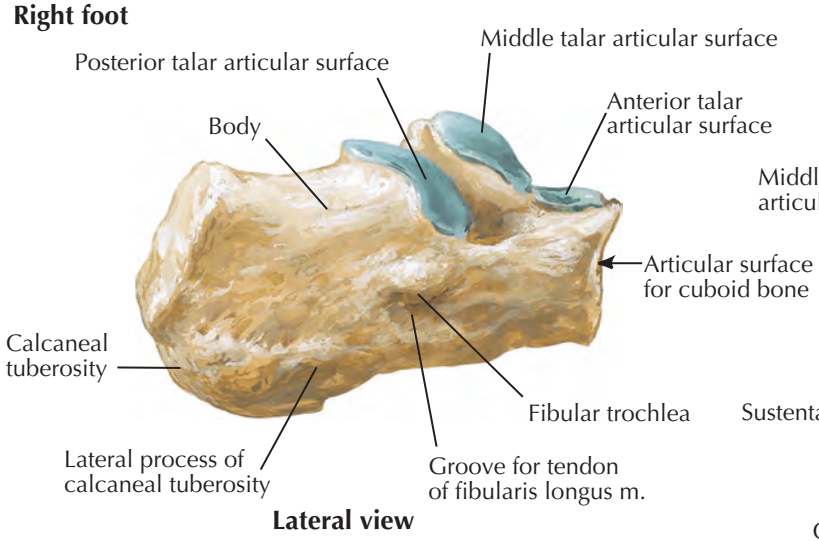

Dorsal view
Base
Head
Body
Base
Head
Phalanges of foot
Distal phalanges
Middle phalanges
Proximal phalanges
Body
1
2
3
4
5
Metatarsal bones
Base
Tarsometatarsal joints
Medial cuneiform bone
Intermediate cuneiform bone
Lateral cuneiform bone
Tuberosity of 5th metatarsal bone
Tuberosity of navicular bone
Navicular bone
Cuboid bone
Transverse tarsal joint
Head
Neck
Trochlea
Tarsal sinus
Calcaneus
Fibular trochlea
Talus
Posterior process
Groove for tendon of flexor hallucis longus
Medial tubercle
Lateral tubercle
Body
Plantar view
Distal phalanges
Middle phalanges
Proximal phalanges
Phalanges of foot
Base
Head
Base
Head
Sesamoid bones
Body
Base
Head
Metatarsal bones
1
2
3
4
5
Body
Tarsometatarsal joints
Medial cuneiform bone
Intermediate cuneiform bone
Base
Lateral cuneiform bone
Tuberosity of 5th metatarsal bone
Tuberosity of navicular bone
Cuboid bones
Navicular bone
Groove for tendon of fibularis longus m.
Transverse tarsal joint
Tuberosity of cuboid bone
Calcaneus
Head
Fibular trochlea
Posterior process
Groove for tendon of flexor hallucis longus
Medial tubercle
Sustentaculum tali
Lateral process
Lateral tubercle
Medial process
Talus
Calcaneal tuberosity

See also **Plate 556**

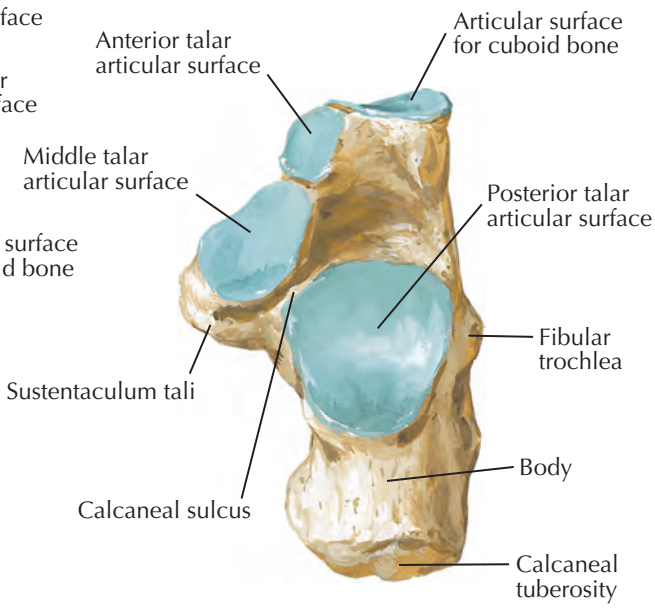




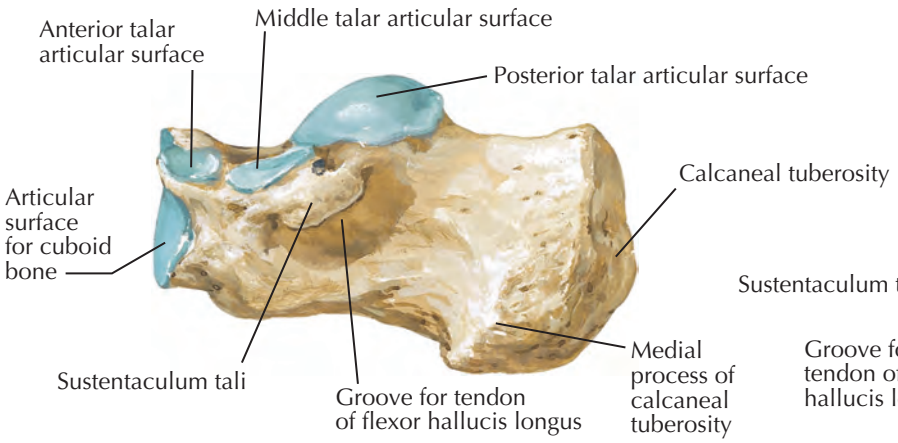
Right foot



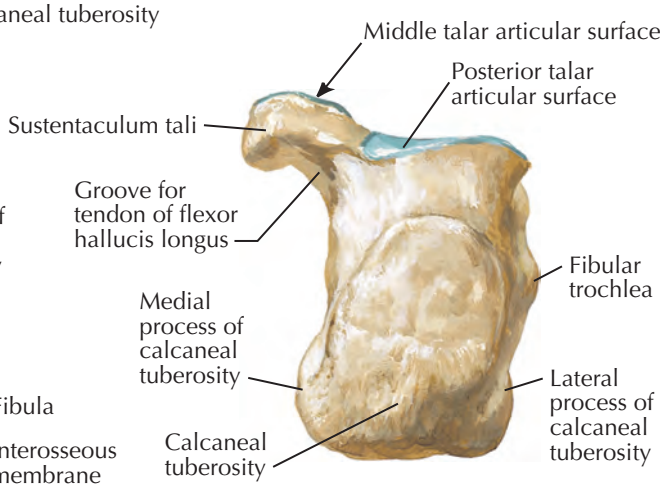
Lateral view



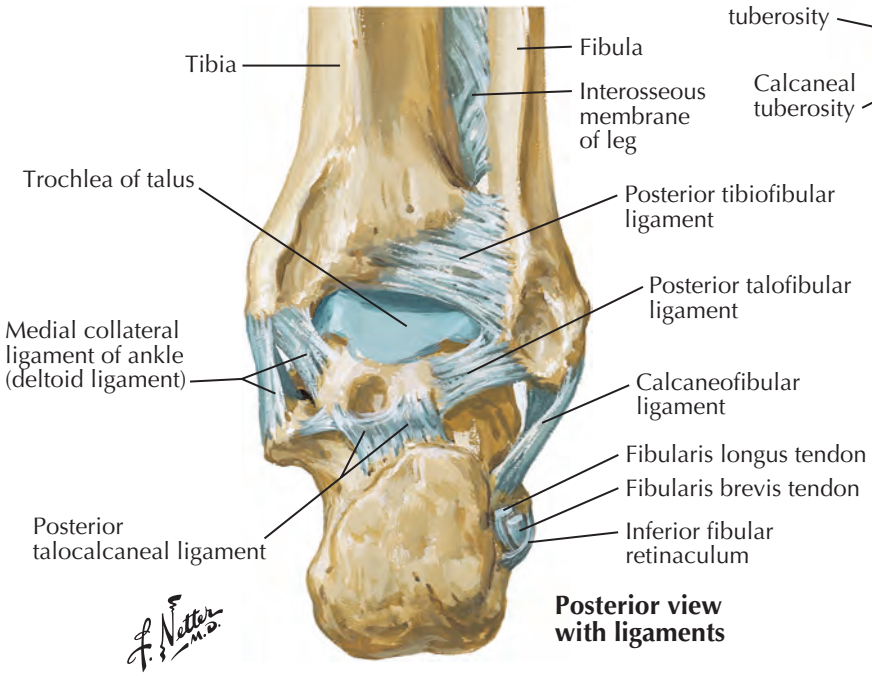
Superior view



Medial view

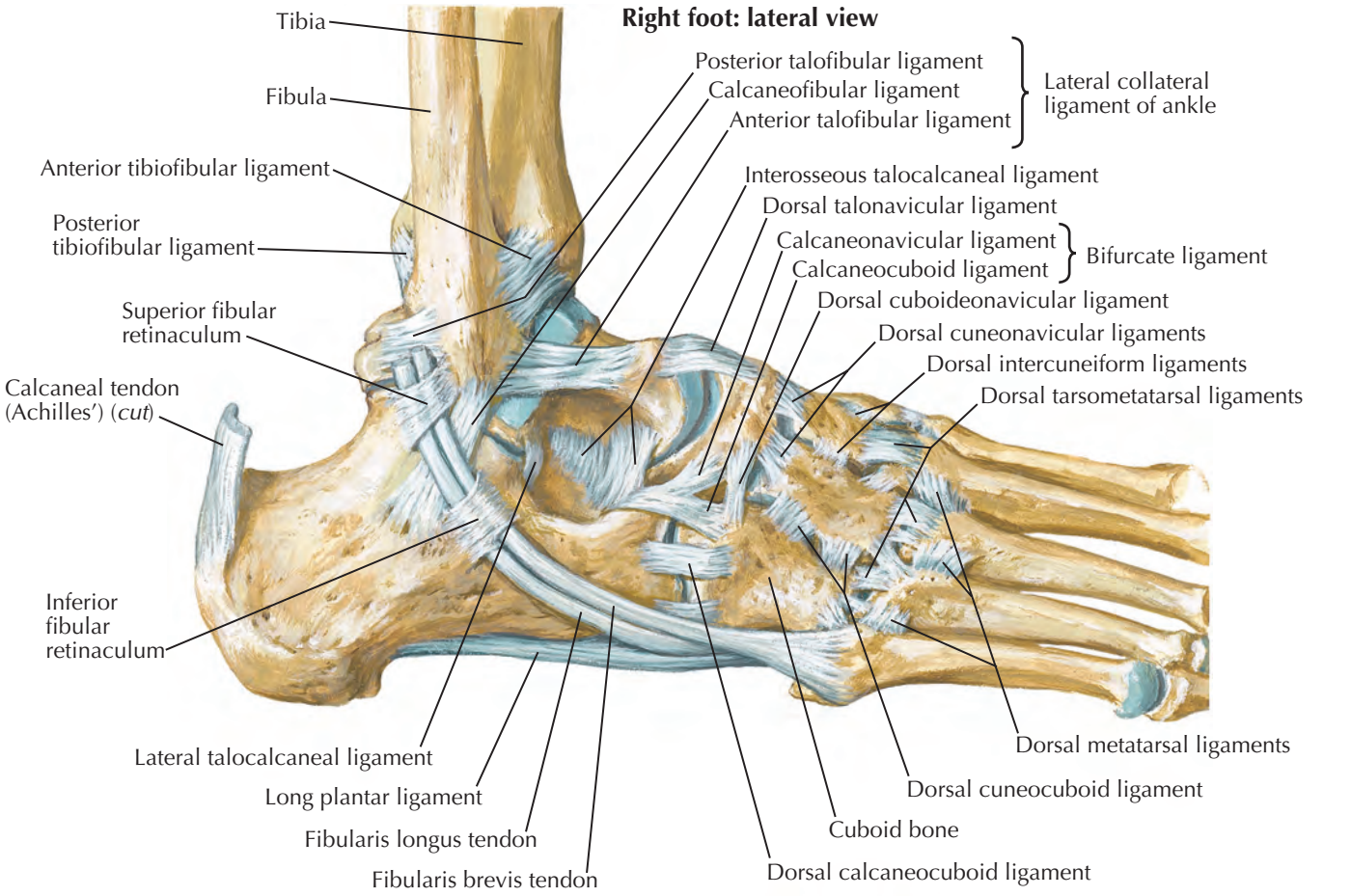


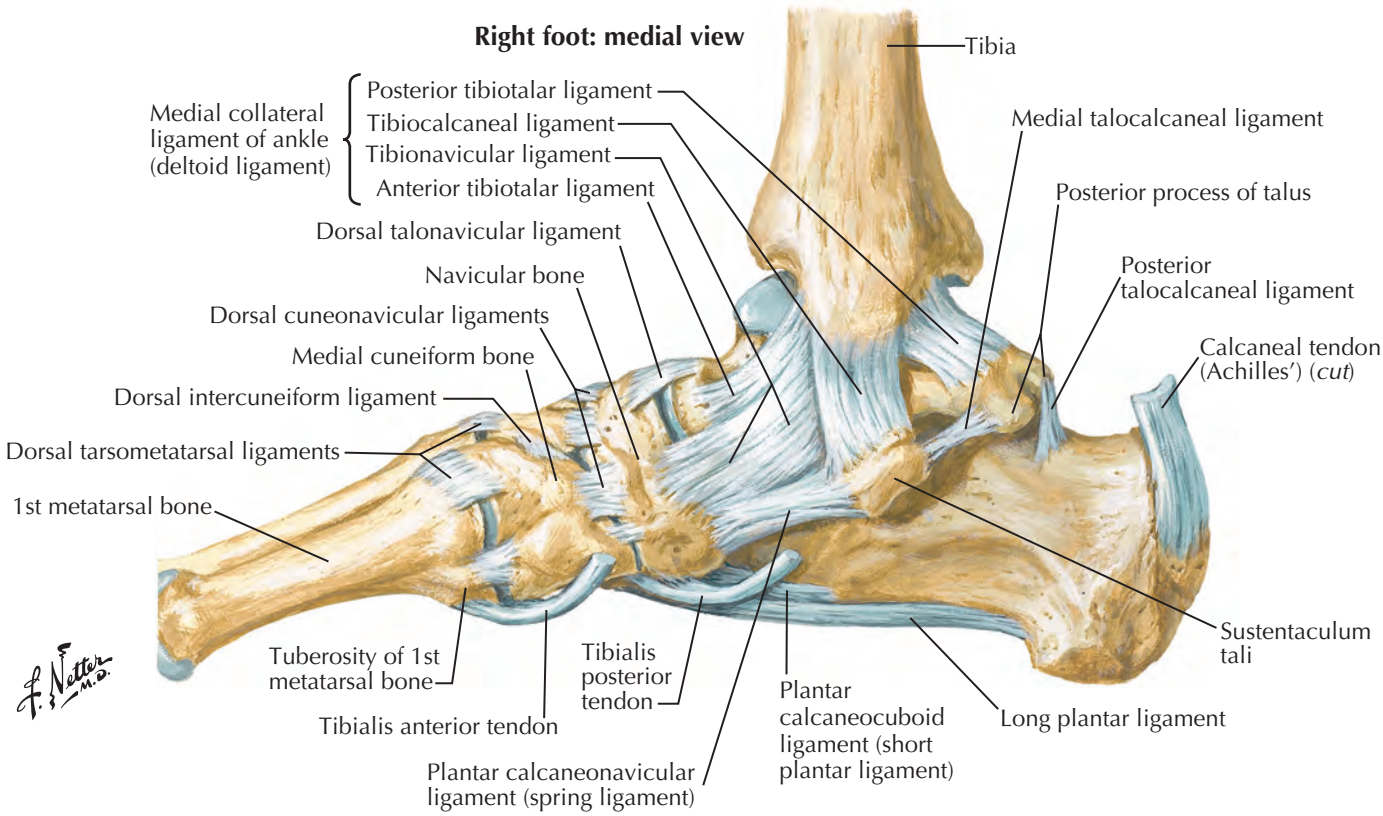
Posterior view



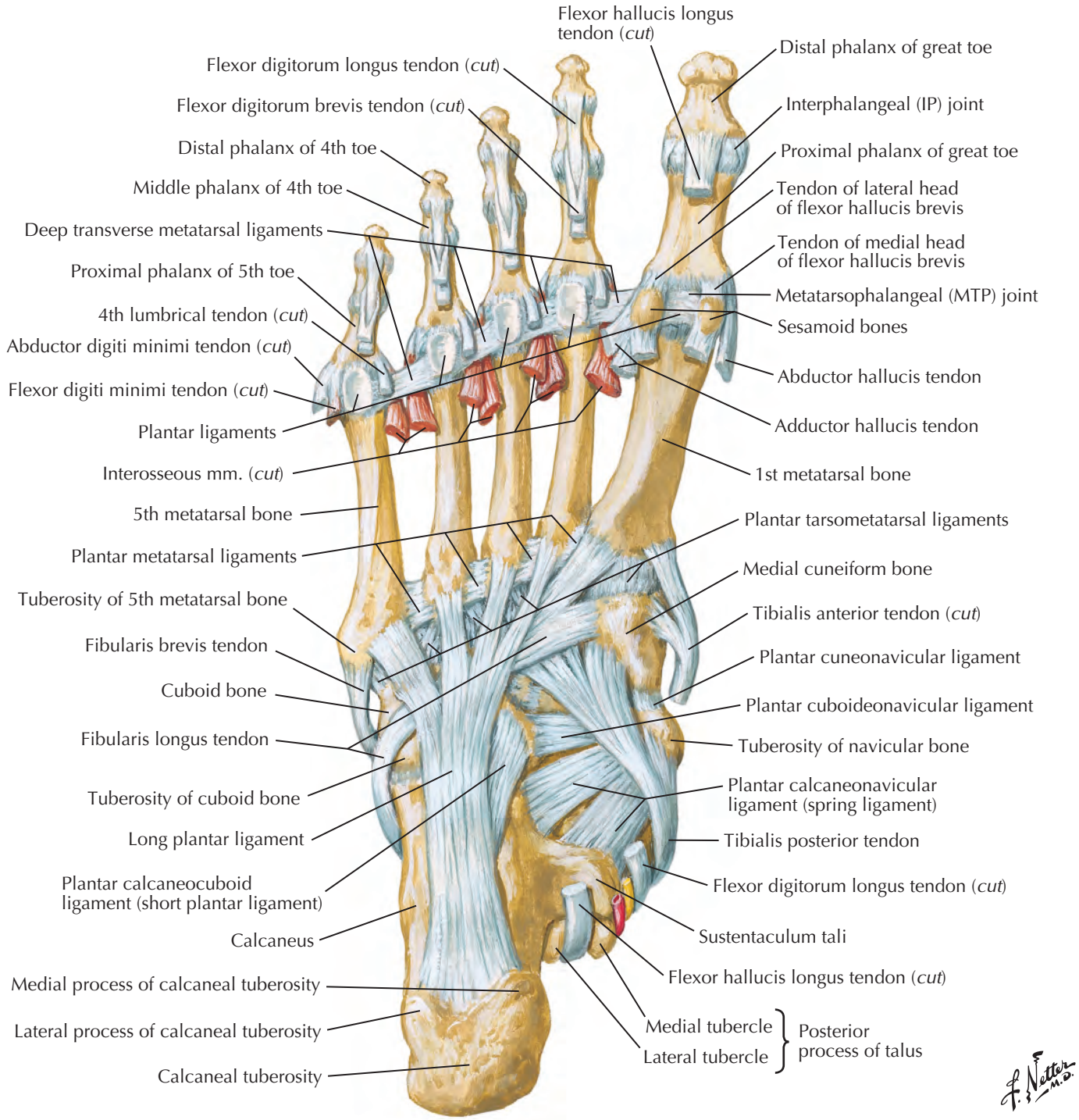
Posterior view with ligaments

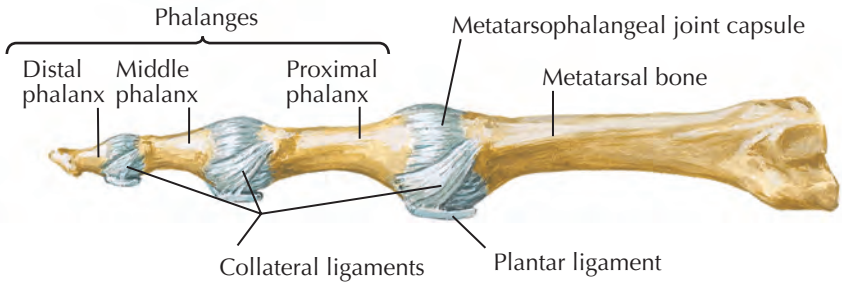
See also **Plate 556**





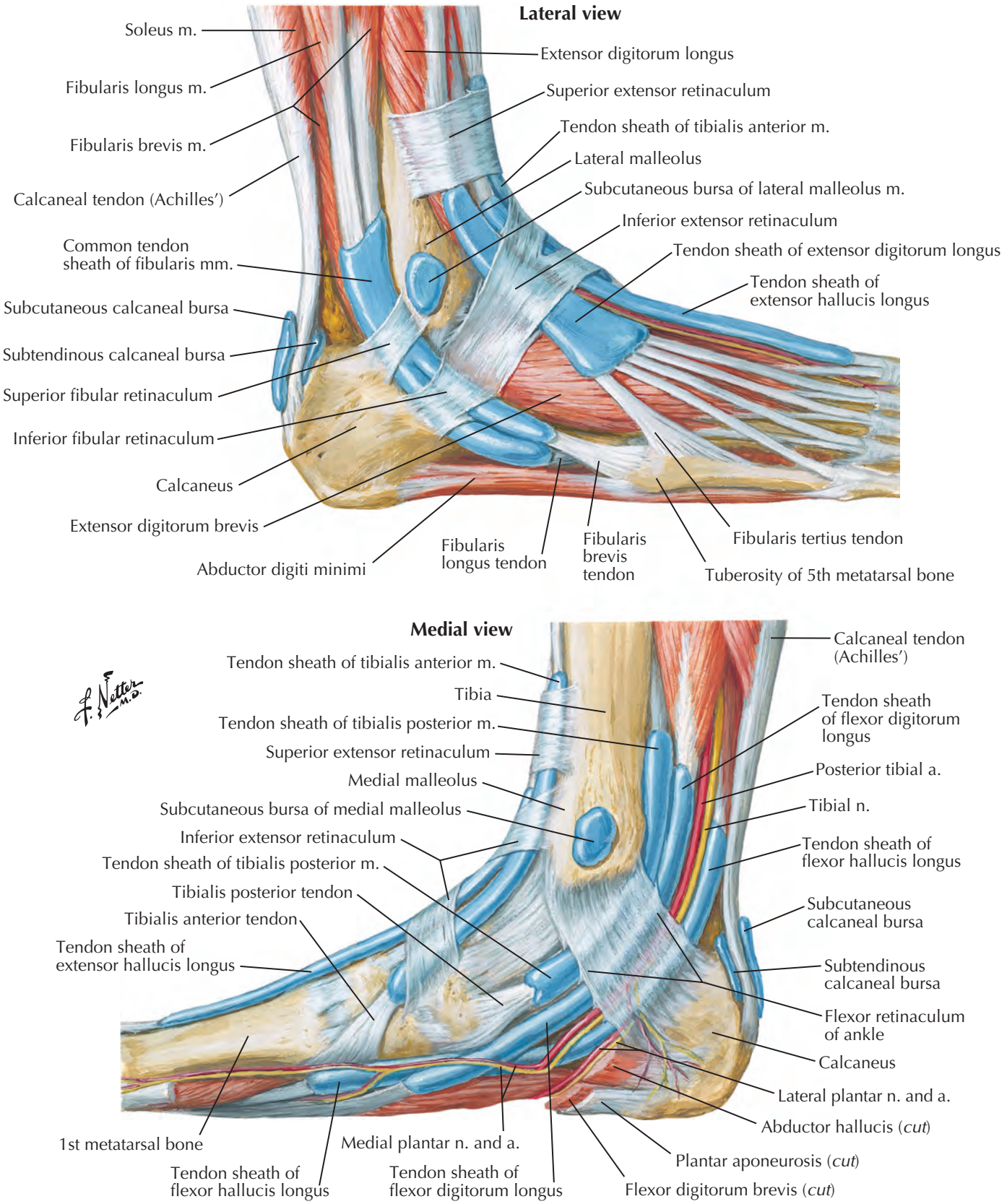
See also **Plates 546, 547**



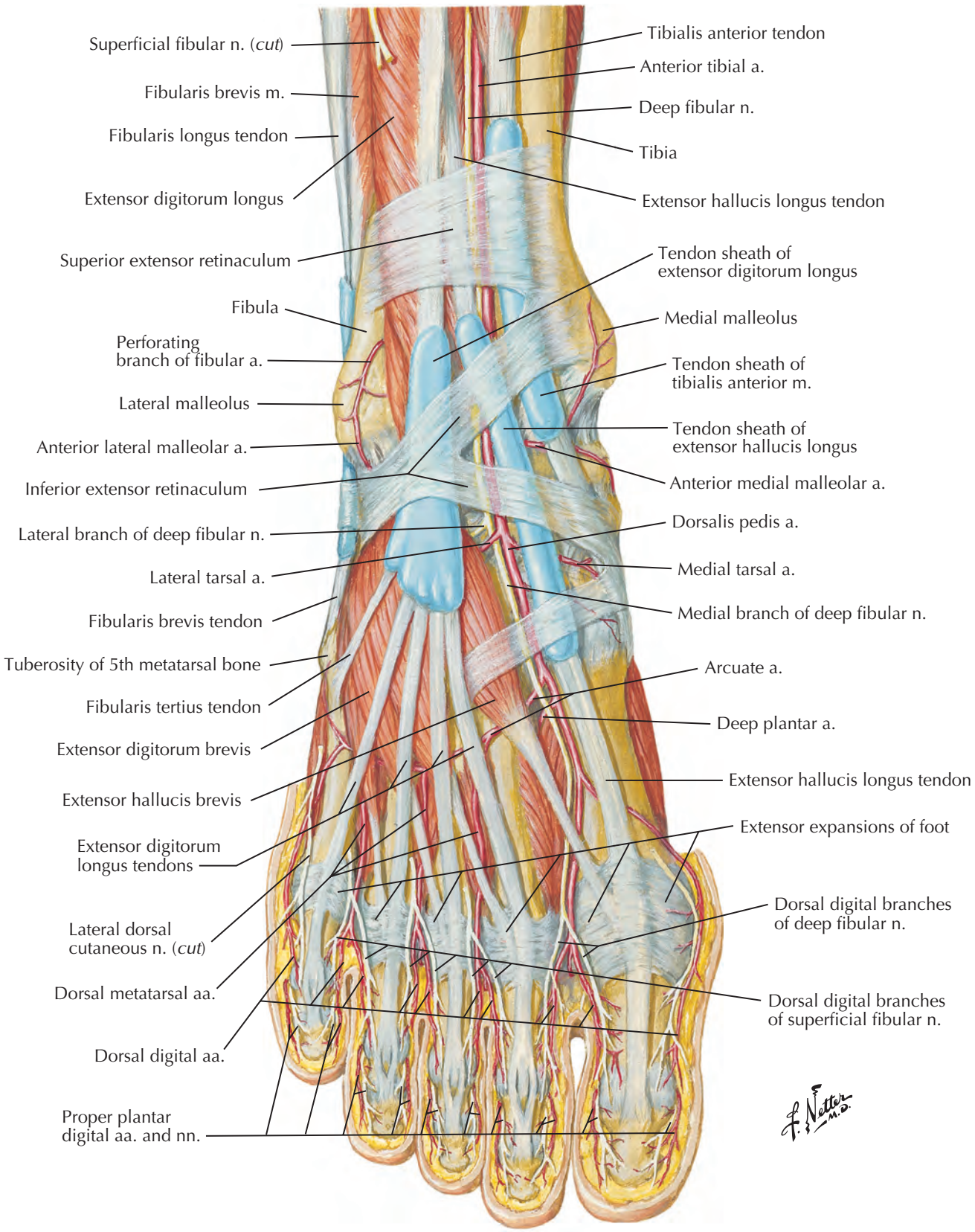


Capsules and ligaments of metatarsophalangeal and interphalangeal joints: lateral view

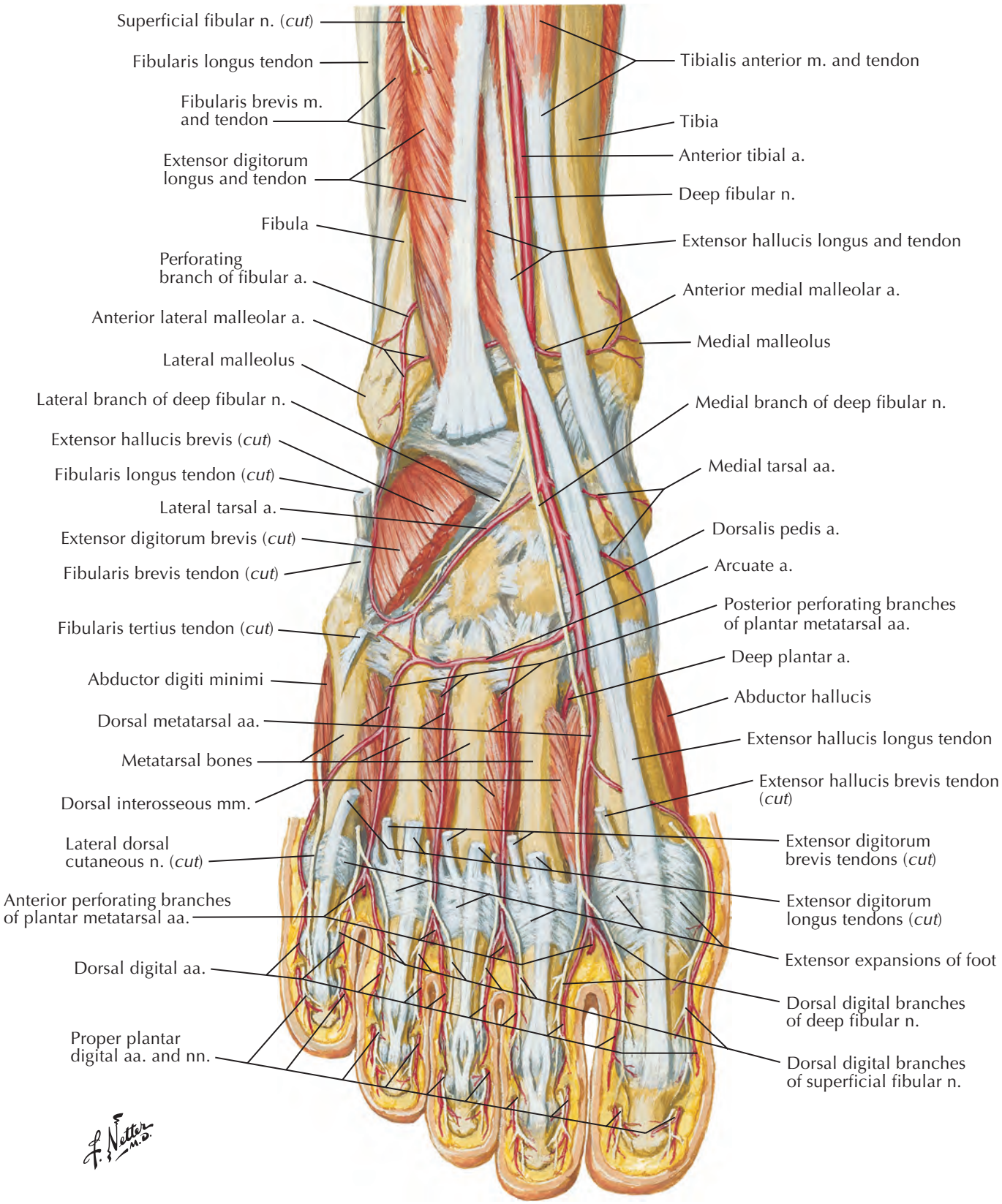
See also **Plate 530**

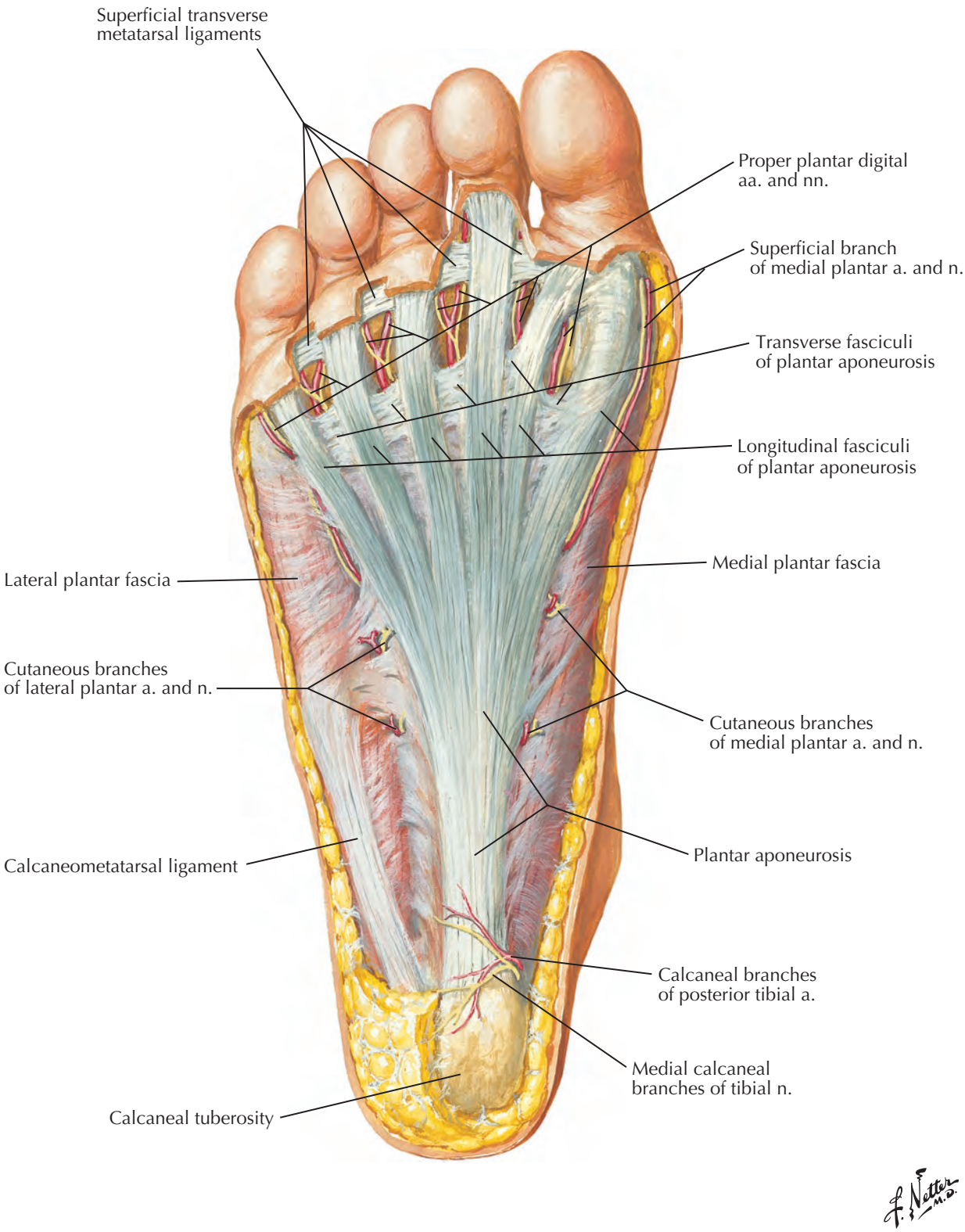


See also **Plates 554, BP 109**



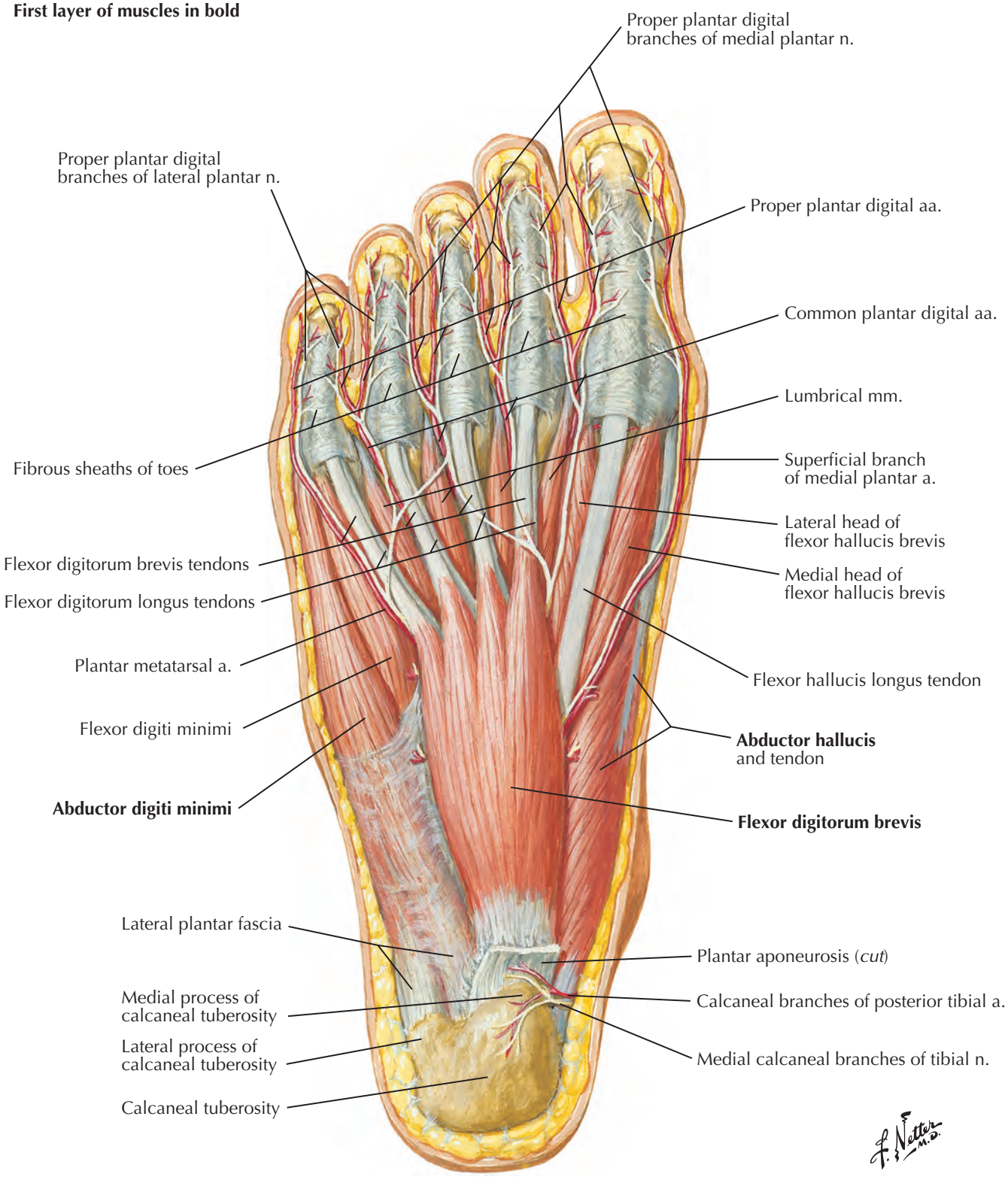
See also **Plates 547, BP 109**



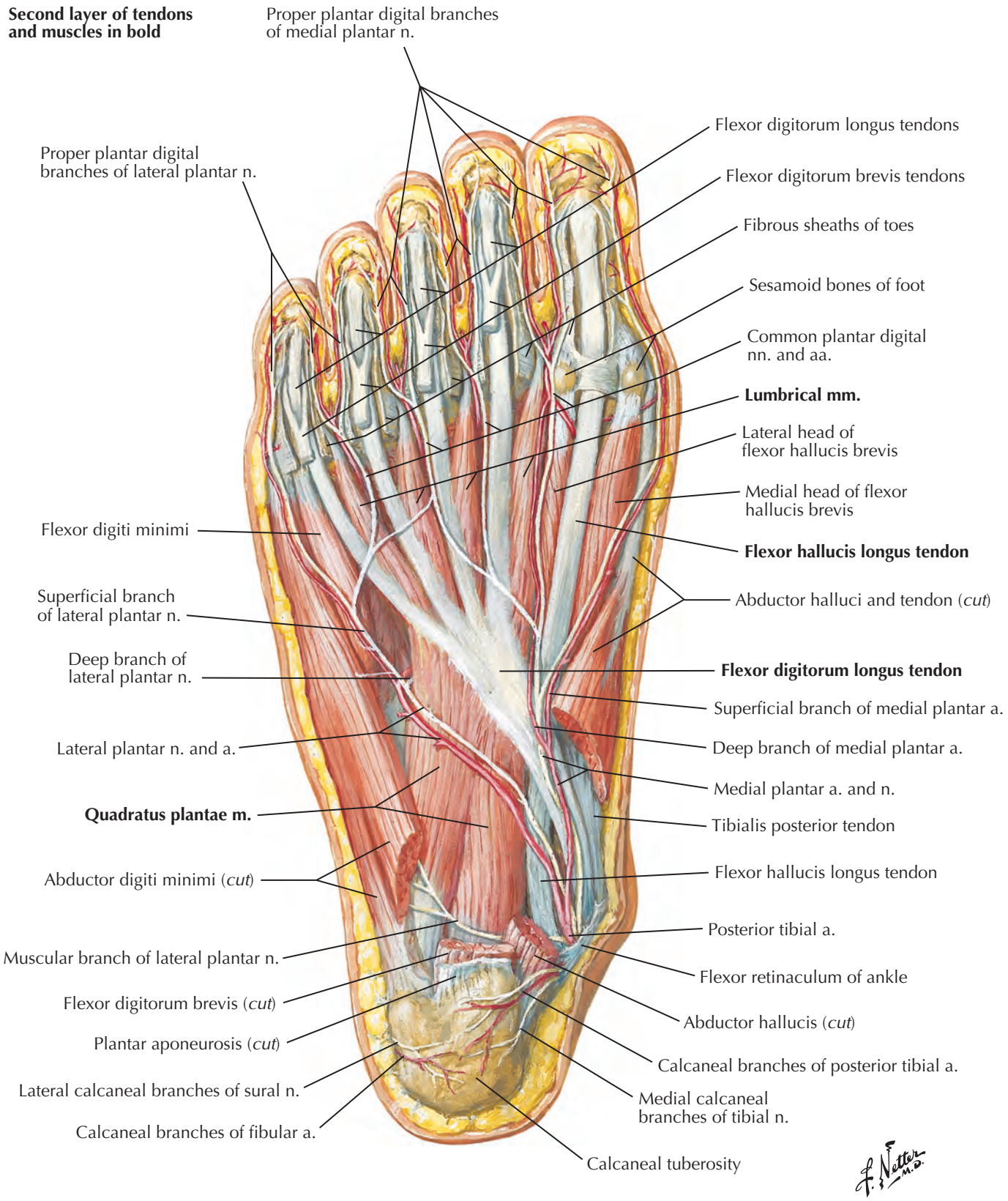

Superficial transverse metatarsal ligaments
Proper plantar digital aa. and nn.
Superficial branch of medial plantar a. and n.
Transverse fasciculi of plantar aponeurosis
Longitudinal fasciculi of plantar aponeurosis
Medial plantar fascia
Lateral plantar fascia
Cutaneous branches of lateral plantar a. and n.
Cutaneous branches of medial plantar a. and n.
Calcaneometatarsal ligament
Plantar aponeurosis
Calcaneal branches of posterior tibial a.
Medial calcaneal branches of tibial n.
Calcaneal tuberosity

See also **Plates 553, BP 109**

First layer of muscles in bold

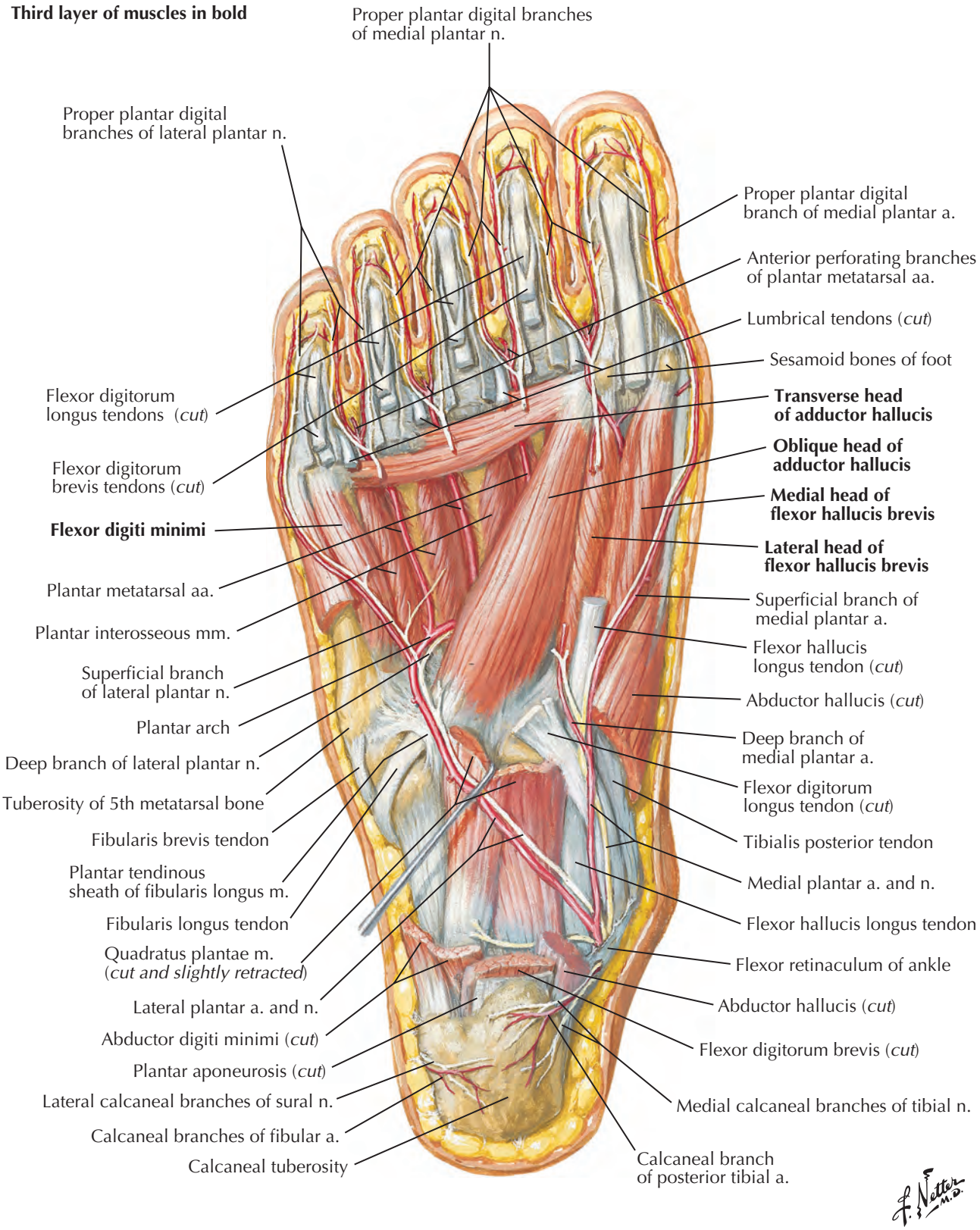


See also **Plates 553, BP 109**



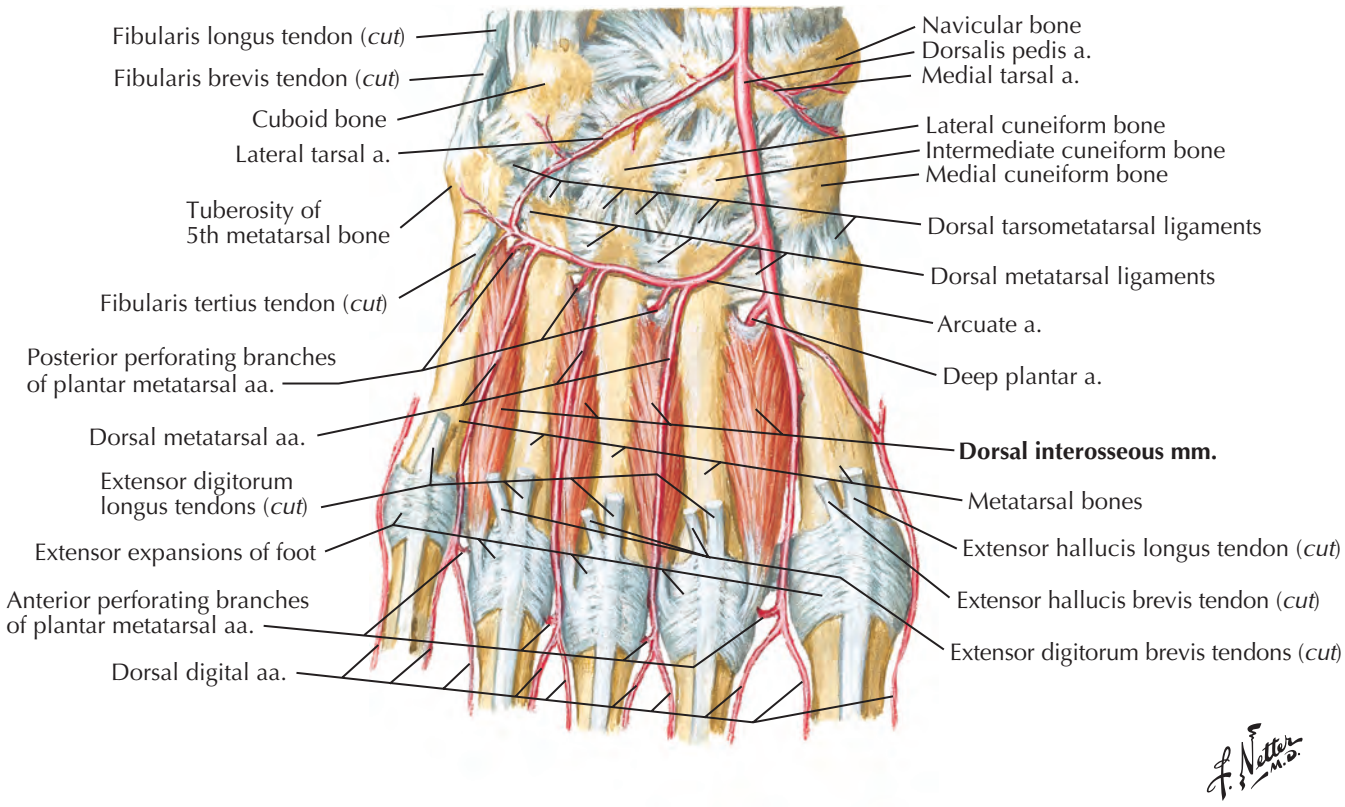
See also **Plate BP 109**

Third layer of muscles in bold

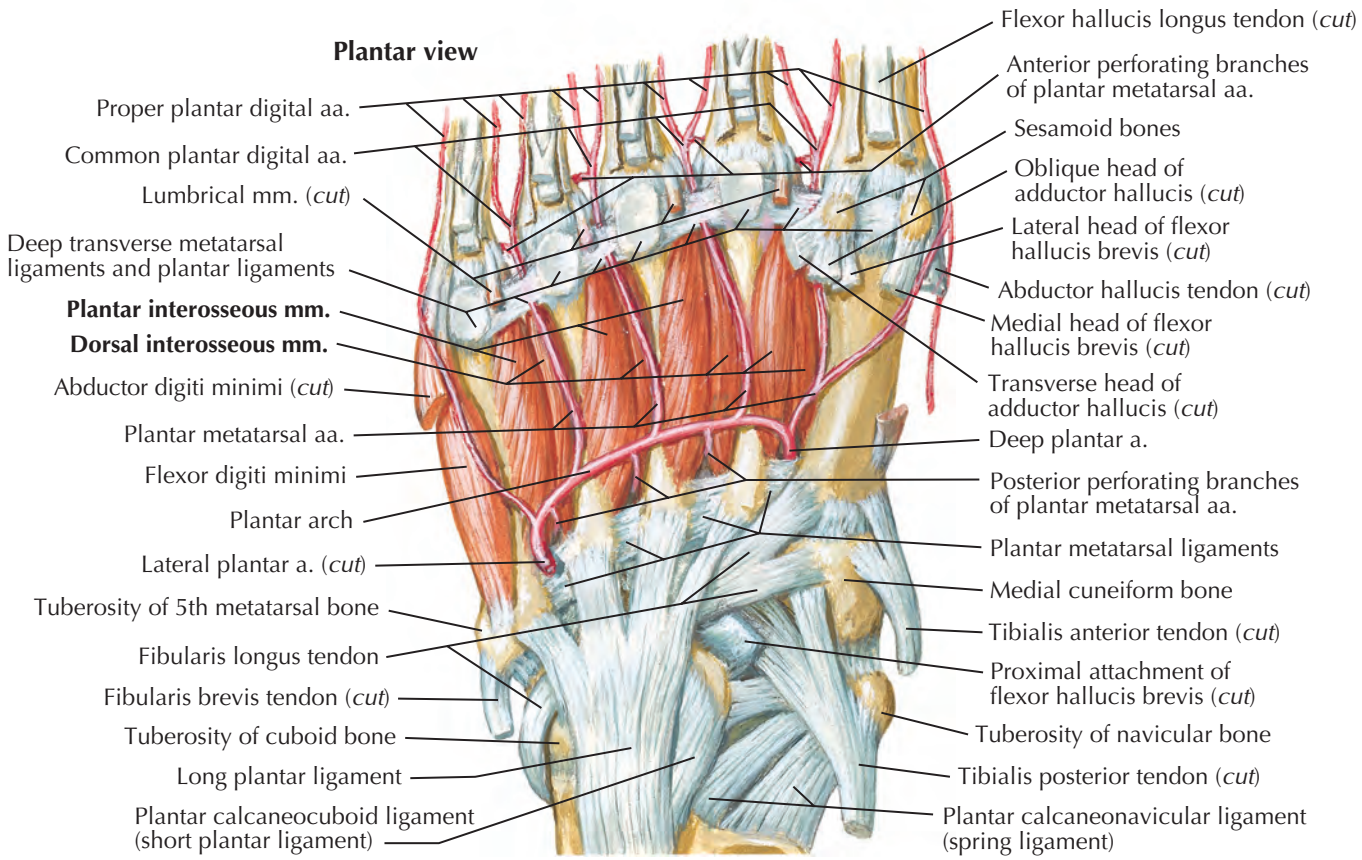


See also **Plates 532, 542, 546, BP 109**

Dorsal view

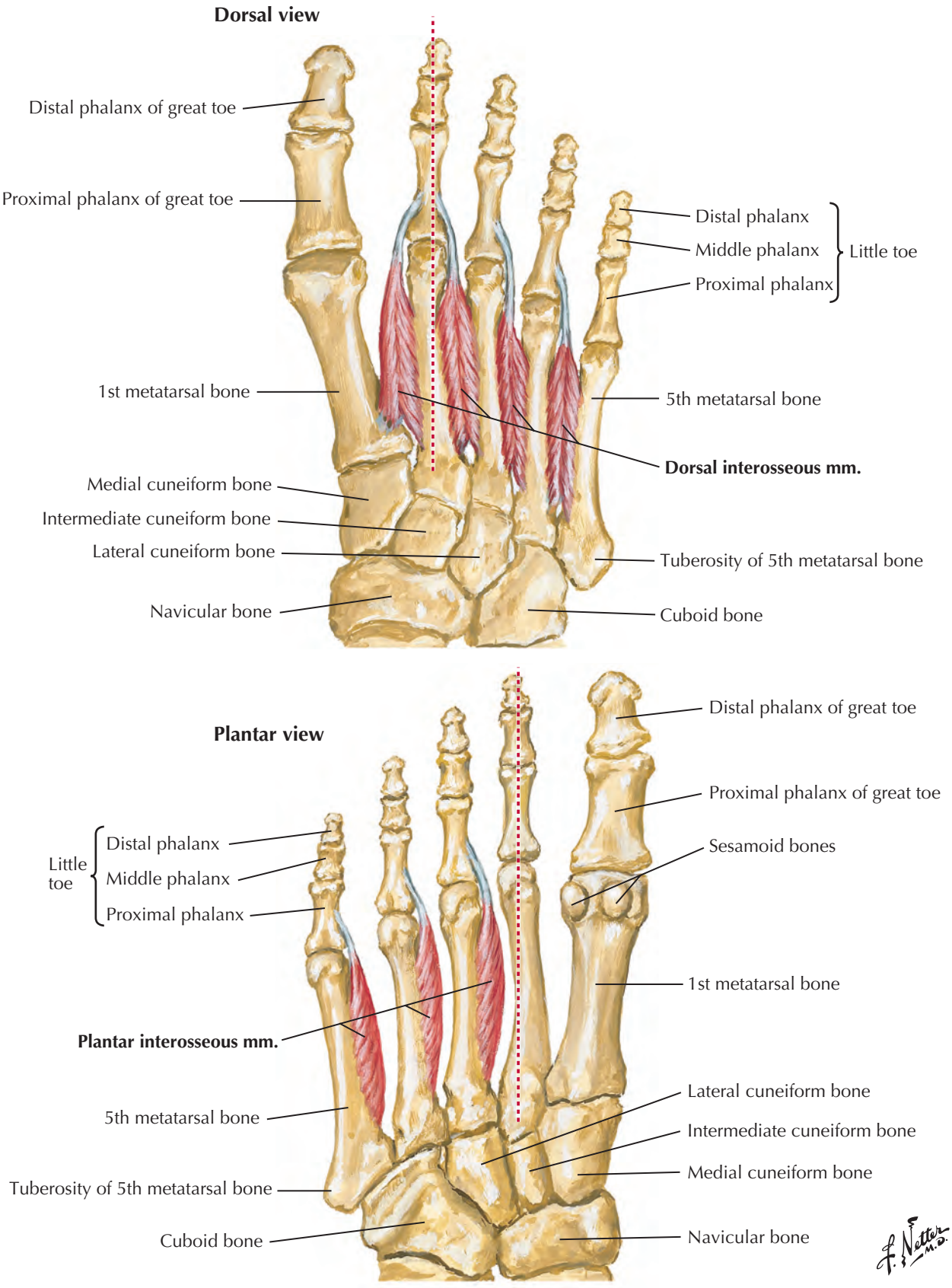


Plantar view

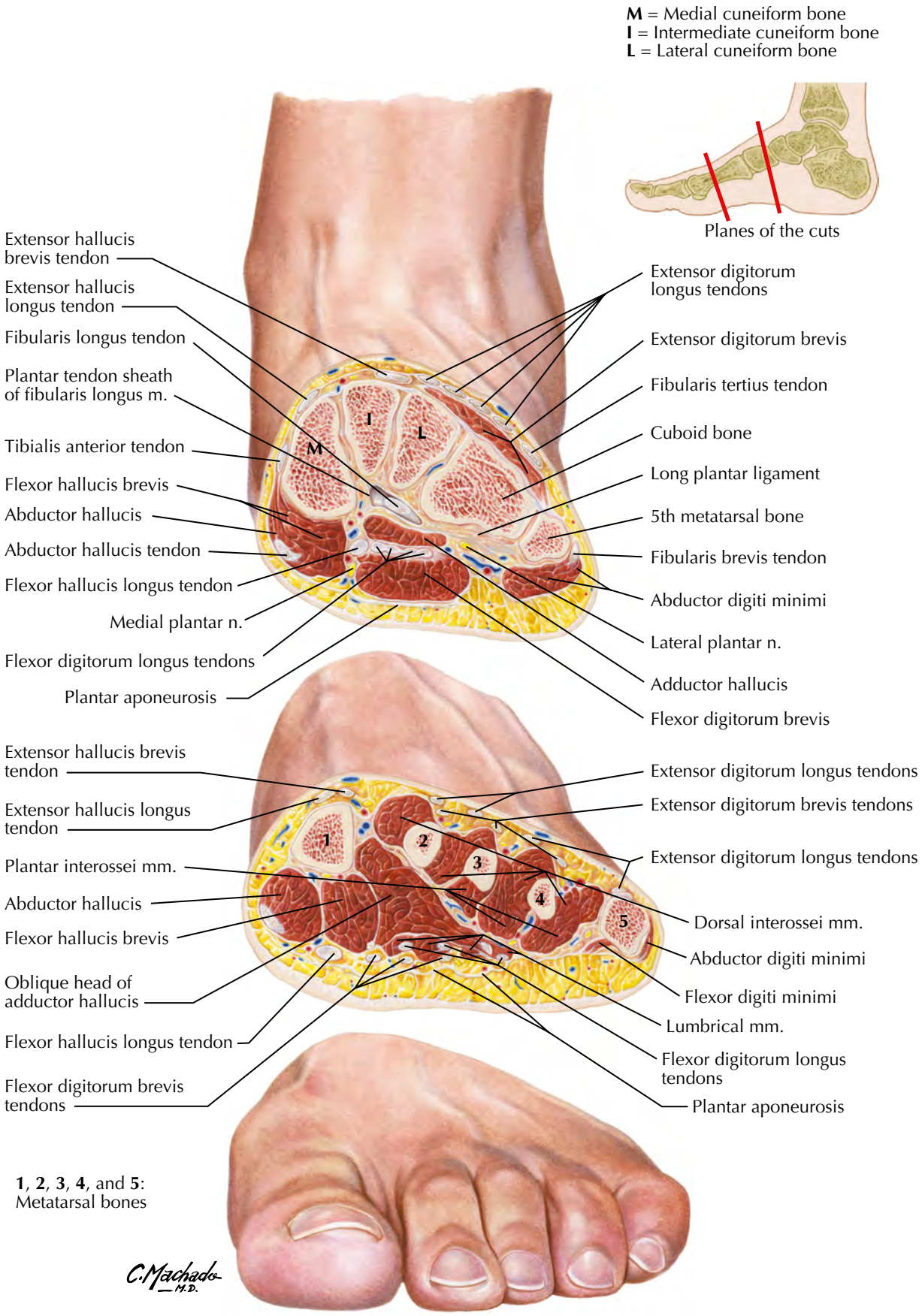


Fourth layer of muscles in bold

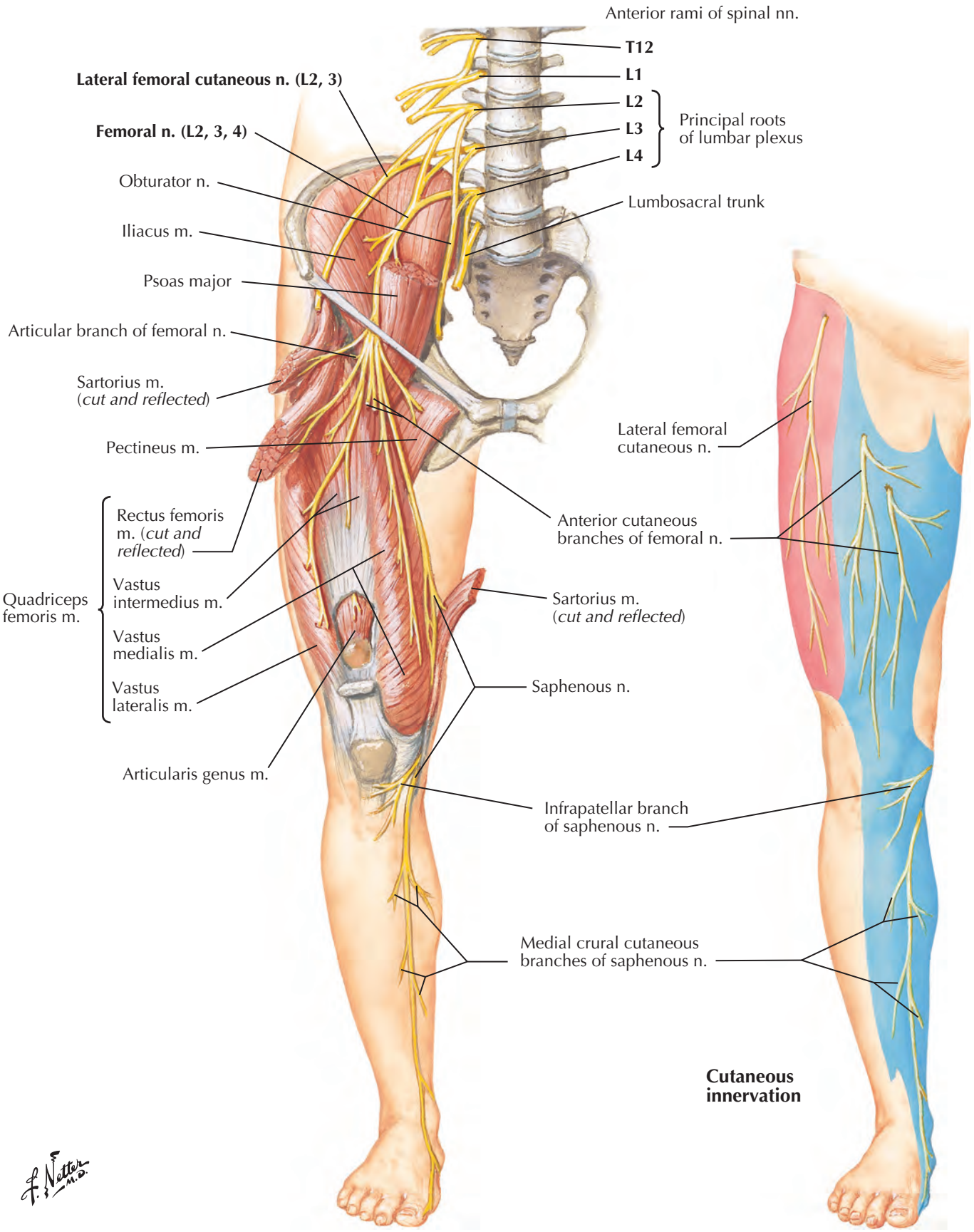
See also **Plate 547**

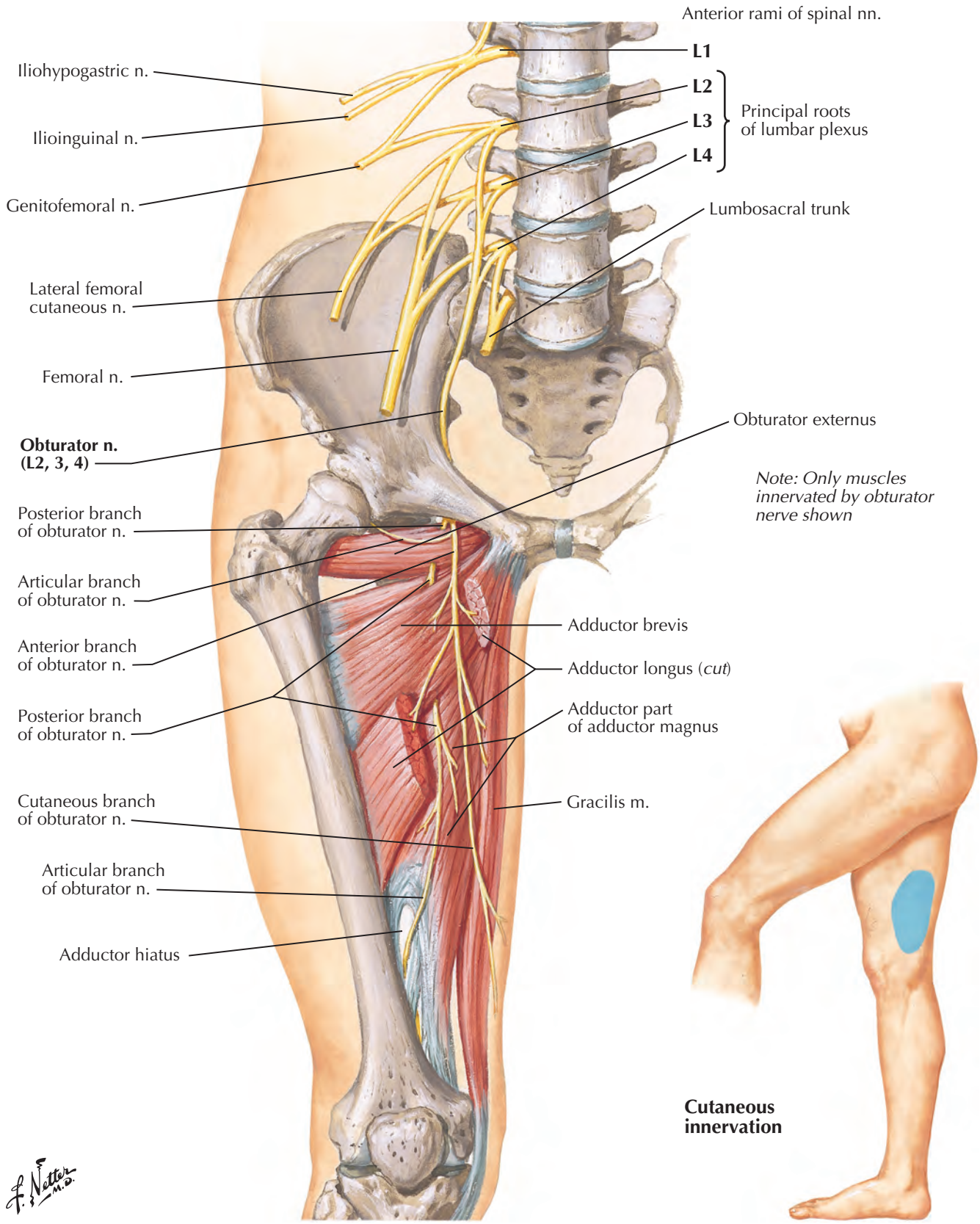


Note: dashed line is the line of reference for abduction and adduction of the toes

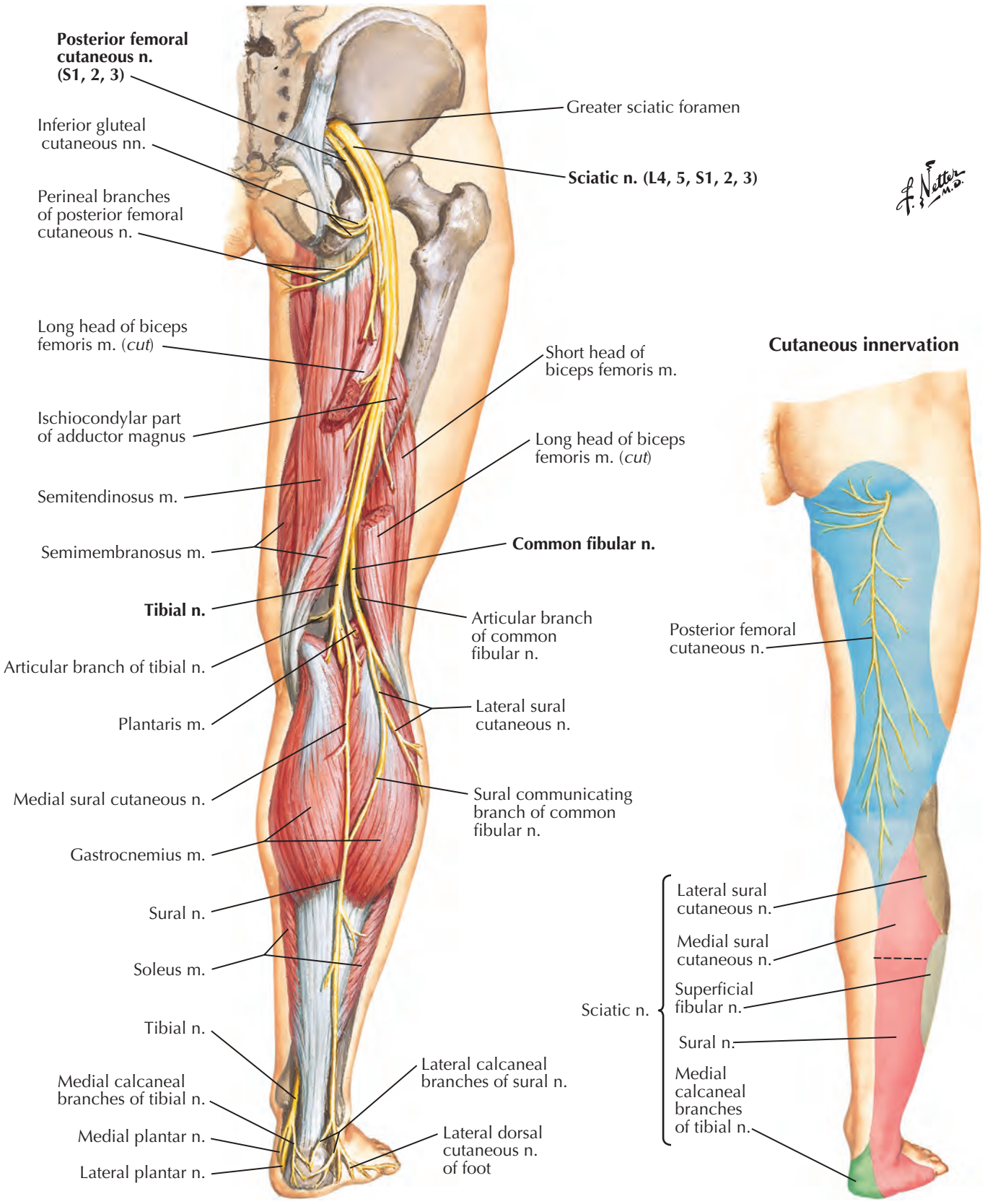

M = Medial cuneiform bone
I = Intermediate cuneiform bone
L = Lateral cuneiform bone
Planes of the cuts
Extensor hallucis brevis tendon
Extensor hallucis longus tendon
Fibularis longus tendon
Plantar tendon sheath of fibularis longus m.
Tibialis anterior tendon
Flexor hallucis brevis
Abductor hallucis
Abductor hallucis tendon
Flexor hallucis longus tendon
Medial plantar n.
Flexor digitorum longus tendons
Plantar aponeurosis
Extensor digitorum longus tendons
Extensor digitorum brevis
Fibularis tertius tendon
Cuboid bone
Long plantar ligament
5th metatarsal bone
Fibularis brevis tendon
Abductor digiti minimi
Lateral plantar n.
Adductor hallucis
Flexor digitorum brevis
Extensor hallucis brevis tendon
Extensor hallucis longus tendon
Plantar interossei mm.
Abductor hallucis
Flexor hallucis brevis
Oblique head of adductor hallucis
Flexor hallucis longus tendon
Flexor digitorum brevis tendons
Extensor digitorum longus tendons
Extensor digitorum brevis tendons
Extensor digitorum longus tendons
Dorsal interossei mm.
Abductor digiti minimi
Flexor digiti minimi
Lumbrical mm.
Flexor digitorum longus tendons
Plantar aponeurosis
1, 2, 3, 4, and 5: Metatarsal bones
C. Machado M.D.

See also **Plates 287, 509, 510**

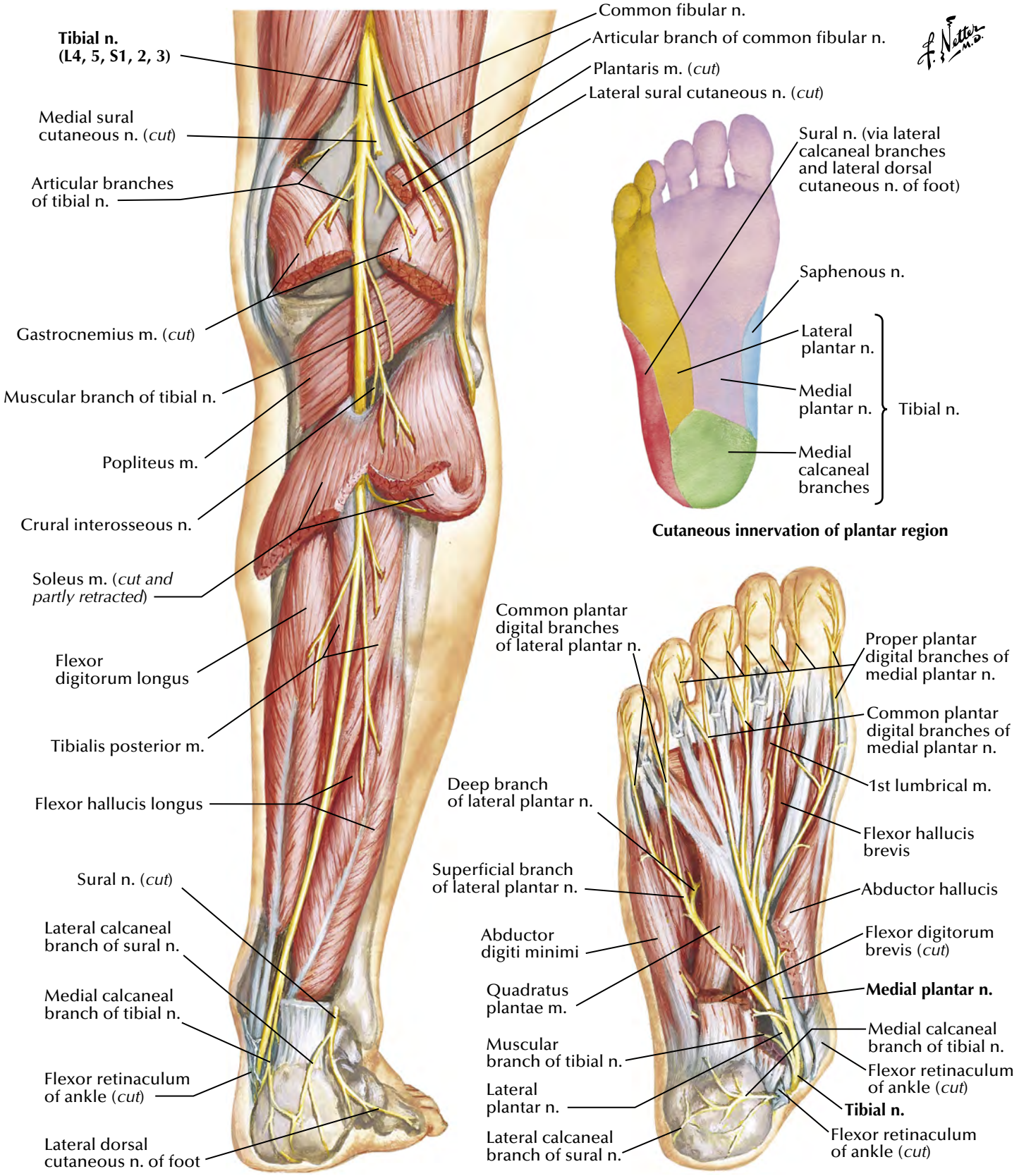



Anterior rami of spinal nn.
L1
L2
L3
L4
Principal roots of lumbar plexus
Lumbosacral trunk
Iliohypogastric n.
Ilioinguinal n.
Genitofemoral n.
Lateral femoral cutaneous n.
Femoral n.
Obturator n. (L2, 3, 4)
Obturator externus
Note: Only muscles innervated by obturator nerve shown
Posterior branch of obturator n.
Articular branch of obturator n.
Anterior branch of obturator n.
Posterior branch of obturator n.
Adductor brevis
Adductor longus (cut)
Adductor part of adductor magnus
Gracilis m.
Cutaneous branch of obturator n.
Articular branch of obturator n.
Adductor hiatus
Cutaneous innervation

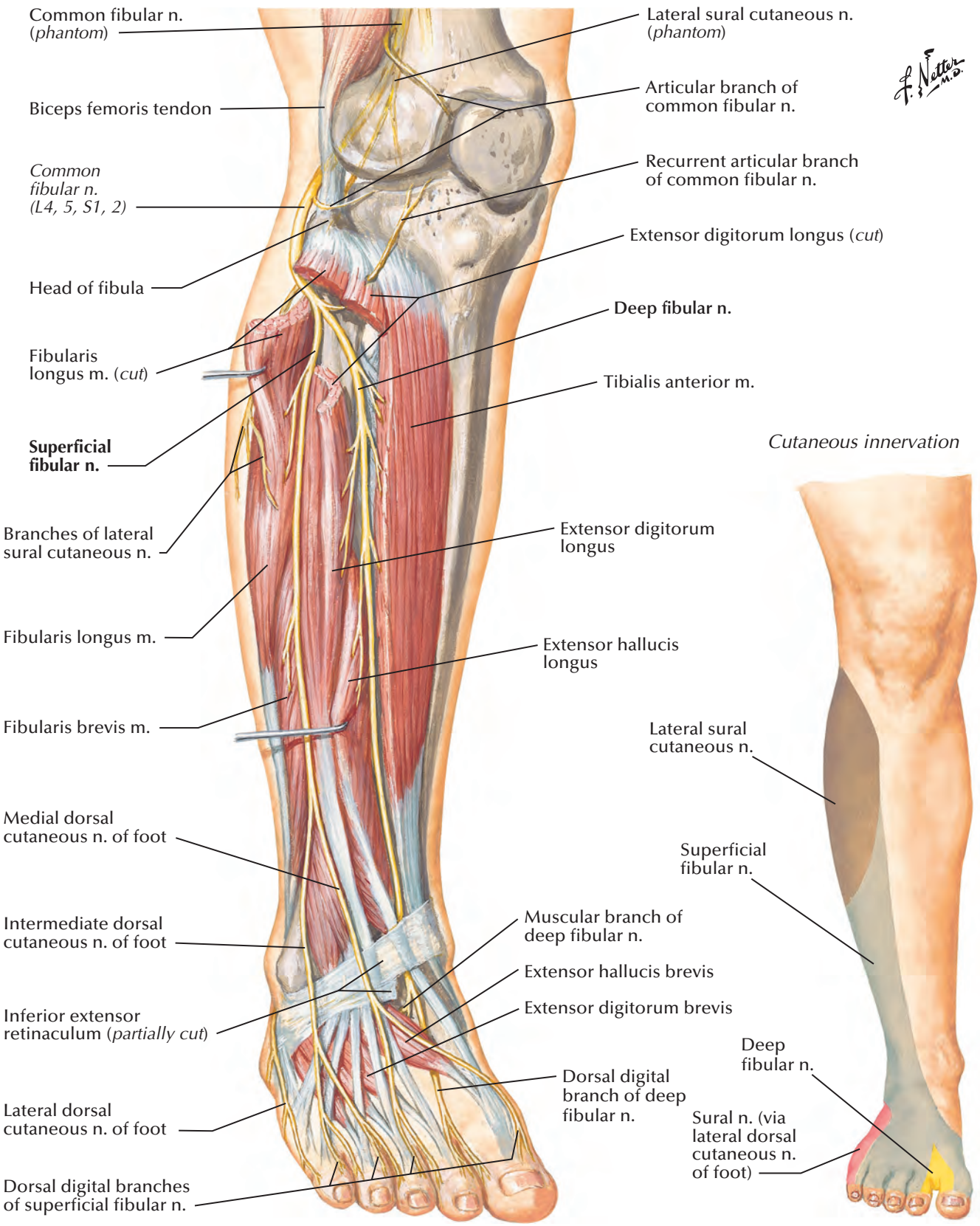
See also **Plate 511**



See also **Plates 527, 544, 545**

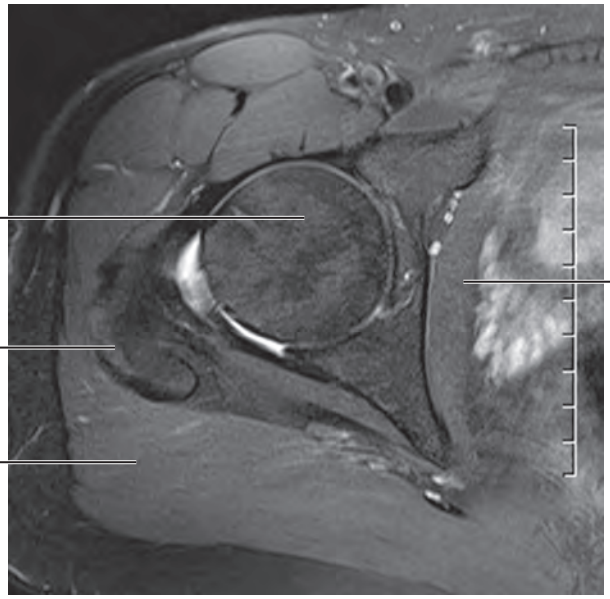


See also **Plates 530, 532**

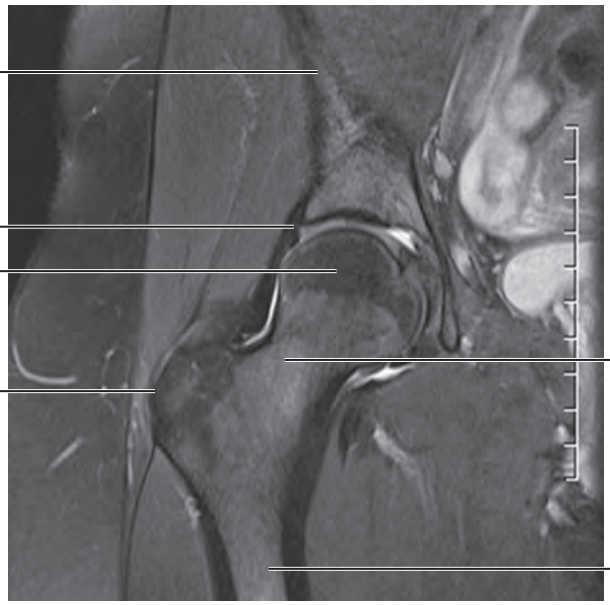


See also **Plates 353, 420, 514**

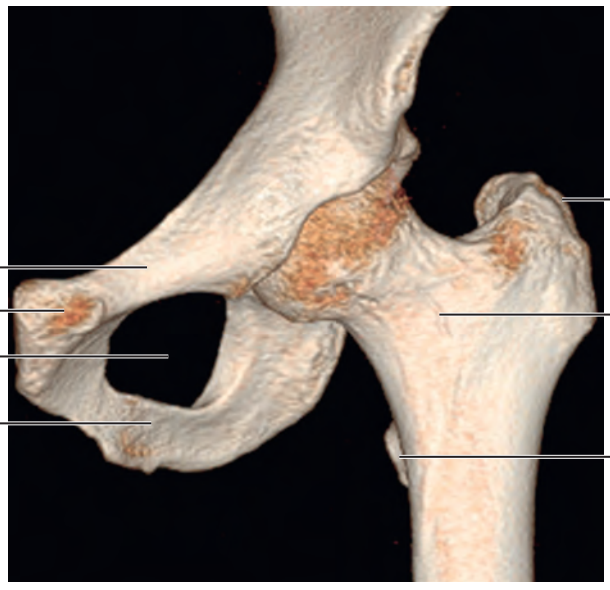
Axial T2-weighted MRI



Coronal T2-weighted MRI



3D CT of hip



See also **Plates 530, 537, 538**

Lateral view

Anterior view

ANATOMICAL STRUCTURE	CLINICAL COMMENT	PLATE NUMBERS
Nervous System and Sense Organs		
Sural nerve	Nerve is commonly biopsied for peripheral neuropathies and commonly used as donor graft in neurotization procedures	493, 552
Common fibular nerve	Injury to this nerve from blunt trauma or compression by leg cast weakens dorsiflexion and results in foot drop	550, 552, 554
Obturator nerve	Nerve is blocked or transected for adductor muscle spasticity in cerebral palsy; may be injured during pelvic fractures or pelvic surgical procedures such as lymphadenectomy	551
Femoral nerve	Can be compressed from femoral artery hematoma and can be anesthetized for procedures of lower limb just below inguinal ligament	507, 509, 550
Saphenous nerve	Can be anesthetized in adductor canal to provide pain relief after knee replacement surgery	492, 509, 550
Lateral femoral cutaneous nerve	Compression at inguinal ligament leads to meralgia paresthetica, a pain and paresthesia syndrome of anterolateral thigh; risk factors include obesity, pregnancy, and tight-fitting waistbands	509, 550
Skeletal System		
Neck of femur	Common fracture in elderly persons from falls; can lead to avascular necrosis of head of femur because of disrupted blood supply	497, 500, 514
Body of femur	Midbody is common fracture site in high-energy trauma (motor vehicle collisions)	500
Hip joint	Potential for avascular necrosis of head of femur in hip dislocations or fractures	496, 514
Anterior cruciate ligament	Most commonly injured knee ligament, typically from sudden pivot of knee causing excessive valgus stress coupled with medial rotation of tibia	517-519
Tibial (medial) collateral and anterior cruciate ligaments and medial meniscus	"Unhappy triad of the knee"; damage to these structures can result from blow to lateral aspect of joint in extension	517-519
Tibia and fibula	High-energy fractures of body (boot-top skiing fracture) from falling forward at high speed	524
First metatarsophalangeal joint	Joint misalignment leads to hallux valgus (bunion); wearing narrow shoes can contribute, though there is also a strong genetic component	535
Calcaneus	Most common tarsal bone fracture, usually caused by landing forcefully on heel after falling from height	537
Ankle joint	Most sprains are inversion injuries that occur when foot is plantar flexed, placing stress on lateral collateral ligaments of ankle; fractures often occur to lateral malleolus of fibula and inferior articular surface of tibia	538
Muscular System		
Muscles of medial compartment of thigh	Excessive stretching or tearing of adductor and gracilis muscles is common in sports that require repeated sprints or quick changes in direction (e.g., soccer, hockey)	502, 503
Patellar ligament	Striking patellar ligament with reflex hammer elicits patellar (knee jerk) reflex to test L3 to L4 spinal cord levels (innervation of quadriceps femoris muscle by femoral nerve)	502, 517
Iliotibial tract	Can cause lateral knee pain in runners when tight iliotibial tract rubs repetitively across lateral epicondyle of femur (iliotibial band syndrome)	501, 516

ANATOMICAL STRUCTURE	CLINICAL COMMENT	PLATE NUMBERS
Muscular System—Continued		
Semitendinosus and semimembranosus muscles and long head of biceps femoris muscle	Excessive stretching or tearing of hamstring muscles occurs most often during high-speed running or activities with high kicks	504
Piriformis muscle	Piriformis muscle strain or structural variations (e.g., split piriformis muscle) may produce compression of sciatic nerve	511
Gluteus medius and minimus muscles	Paralysis results in contralateral pelvic dip due to weakened hip abduction when standing on affected limb (Trendelenburg sign or gait)	512
Calcaneal (Achilles') tendon	Inflammation results from repetitive stress on tendon, often from running on uneven surfaces; extreme stress may cause tendon to rupture; striking calcaneal tendon with reflex hammer elicits ankle (ankle jerk) reflex to test S1–S2 spinal cord levels (innervation of superficial calf muscles by tibial nerve)	527, 528, 538
Compartments of leg	Acute compartment syndrome may occur after trauma, such as long bone fracture, that increases compartment pressure and thereby compromises vascular flow; symptoms include pain, paresthesias, pallor, pulselessness, and paralysis (five P's); fasciotomy often required to relieve pressure	534
Plantar aponeurosis	Inflammation results from increased tension, weight, or overuse, causing heel and foot pain (plantar fasciitis)	543
Cardiovascular System		
Femoral vein	Common site of vascular access for central venous catheters; however, risk of catheter infection is greater than with jugular or subclavian vein access	509
Deep veins of lower limb	Venous thrombosis of deep leg veins is due to venous stasis, vessel injury, and/or coagulation disorders (Virchow's triad); can lead to thrombus formation and thromboemboli, such as to the lungs	533
Great saphenous vein	Often used as graft in coronary artery bypass surgery	492
Superficial veins of lower limb	Varicose veins are dilated, tortuous superficial veins, often associated with reflux of superficial and/or deep veins; progressive venous disease may cause edema, pain, and ulceration	492, 533
Femoral artery	Common site of vascular access for percutaneous cardiac and vascular procedures; target is segment between origins of inferior epigastric and deep femoral arteries, generally identified using fluoroscopy by its location alongside the femoral head; "high stick" (too cephalad) may result in retroperitoneal hemorrhage	522
Femoral, popliteal, tibial, and fibular arteries	Peripheral arterial disease due to atherosclerosis may occur in major arteries of lower limb, resulting in reduced blood flow; patients experience claudication (cramping pain in thigh or calf) upon exertion	522
Arteries of lower limb	Pulse points: femoral artery in femoral triangle, popliteal artery in deep popliteal region of knee, anterior tibial artery between extensor hallucis longus and extensor digitorum longus at ankle joint, dorsalis pedis artery on dorsum of foot, and posterior tibial artery in tarsal tunnel posterior to medial malleolus	14, 509, 527, 540, 541
Lymph Vessels and Lymphoid Organs		
Superficial inguinal nodes	Superficial inguinal nodes drain lower limb, gluteal region, lower abdominal region, and perineum; are palpable when enlarged	494
Lymph vessels of lower limb	Lymphedema (stasis of lymph flow in lymph vessels obstructed by inflammation, fibrosis, tumor, or abnormally small diameter)	494

*Selections were based largely on clinical data and commonly discussed clinical correlations in macroscopic ("gross") anatomy courses.

The lumbosacral plexus includes the lumbar, sacral, and coccygeal plexuses, whose roots are the anterior rami of spinal nerves (lumbar plexus: typically L2–L4 with a small contribution from L1; sacral plexus: L4–S4; coccygeal plexus: S4–Co). Variation in the spinal nerve contributions to the plexuses, and the nerves that arise from these plexuses, is common and can be due to a prefixed (high) or postfixed (low) plexus.

NERVE	ORIGIN	COURSE	BRANCHES	MOTOR	CUTANEOUS
Lateral femoral cutaneous nerve	Posterior divisions of lumbar plexus (L2–L3)	Courses posterior to or through inguinal ligament medial to anterior superior iliac spine, then travels superficially in lateral thigh			Lateral thigh
Femoral nerve	Posterior divisions of lumbar plexus (L2–L4)	Passes posterior to inguinal ligament to lie on iliacus muscle in femoral triangle	Muscular and anterior cutaneous branches, saphenous nerve	Anterior compartment of thigh, iliacus and pectineus muscles	Anterior thigh
Saphenous nerve	Femoral nerve	Leaves femoral nerve in adductor canal, pierces fascia lata to travel superficially with great saphenous vein	Infrapatellar and medial crural cutaneous branches		Medial knee, leg, ankle, and foot
Genitofemoral nerve	Anterior divisions of lumbar plexus (L1–L2)	Runs on anterior surface of psoas major; genital branch traverses inguinal canal; femoral branch courses into femoral triangle by passing deep to inguinal ligament	Genital and femoral branches	Cremaster	Lateral part of femoral triangle, anterior scrotum/vulva
Obturator nerve	Anterior divisions of lumbar plexus (L2–L4)	At L5 vertebra passes deep to common iliac vessels, enters medial thigh via obturator foramen	Anterior and posterior branches	Medial compartment of thigh	Medial thigh
Superior gluteal nerve	Posterior divisions of sacral plexus (L4–S1)	Exits pelvis via greater sciatic foramen superior to piriformis muscle		Gluteus medius and minimus muscles, tensor fasciae latae	
Inferior gluteal nerve	Posterior divisions of sacral plexus (L5–S2)	Exits pelvis via greater sciatic foramen inferior to piriformis muscle		Gluteus maximus muscle	
Nerve to piriformis muscle	Posterior divisions of sacral plexus (S1–S2)			Piriformis muscle	
Perforating cutaneous nerve	Posterior divisions of sacral plexus (S2–S3)	Exits pelvis and pierces sacrotuberous ligament			Inferomedial gluteal region
Nerve to obturator internus	Anterior divisions of sacral plexus (L5–S2)	Exits pelvis via greater sciatic foramen, inferior to piriformis muscle; re-enters pelvis via lesser sciatic foramen to innervate obturator internus		Obturator internus and superior gemellus muscle	
Nerve to quadratus femoris muscle	Anterior divisions of sacral plexus (L4–S1)	Exits pelvis via greater sciatic foramen inferior to piriformis muscle		Quadratus femoris and inferior gemellus muscles	
Nerve to levator ani	Anterior divisions of sacral plexus (S3–S4)	From its source, travels on superior surface of levator ani		Iliococcygeus and pubococcygeus muscles	
Nerve to coccygeus muscle	Anterior divisions of sacral plexus (S3–S4)	From its source, travels on superior surface of coccygeus muscle		Coccygeus (ischiococcygeus) muscle	
Pudendal nerve	Anterior divisions of sacral plexus (S2–S4)	Exits pelvis via greater sciatic foramen inferior to piriformis muscle; enters perineum via lesser sciatic foramen, coursing through ischioanal fossa and pudendal (Alcock's) canal	Inferior anal and perineal nerves, dorsal nerve of clitoris or penis	Perineal muscles, external anal sphincter, pubococcygeus muscle	Posterior scrotum/vulva, clitoris or penis
Posterior femoral cutaneous nerve	Anterior and posterior divisions of sacral plexus (S1–S3)	Exits pelvis via greater sciatic foramen inferior to piriformis muscle; runs inferiorly to gluteus maximus muscle and continues distally to popliteal fossa	Inferior gluteal cutaneous nerves, perineal branches		Inferior gluteal region, posterior thigh, popliteal region

Continued

NERVE	ORIGIN	COURSE	BRANCHES	MOTOR	CUTANEOUS
Sciatic nerve	Anterior and posterior divisions of sacral plexus (L4–S3)	Exits pelvis via greater sciatic foramen inferior to piriformis muscle, passing superficial to lateral rotators and deep to gluteus medius muscle to access thigh between greater trochanter of femur and ischial tuberosity	Muscular branches, tibial and common fibular nerves	Posterior compartment of thigh (also see branches)	See branches
Tibial nerve	Sciatic nerve	Courses through popliteal fossa and sural region deep to soleus muscle, traversing tarsal tunnel posterior to medial malleolus	Muscular and medial calcaneal branches, crural interosseous nerve, medial sural cutaneous nerve, medial and lateral plantar nerves	Posterior compartment of leg (also see branches)	Heel (also see branches)
Common fibular nerve	Sciatic nerve	Courses medial to biceps femoris muscle and lateral to lateral head of gastrocnemius muscle and neck of fibula	Superficial and deep fibular nerves, lateral sural cutaneous nerve, sural communicating branch	*See branches*	*See branches*
Deep fibular nerve	Common fibular nerve	Courses deep to fibularis longus muscle and extensor digitorum longus on surface of interosseous membrane of leg deep to extensor retinaculum	Muscular and dorsal digital branches	Anterior compartment of leg	Dorsal aspect of adjacent parts of toes 1 and 2
Superficial fibular nerve	Common fibular nerve	Courses between fibularis longus and brevis muscles in lateral compartment of leg, piercing crural fascia distally	Muscular branches, medial and intermediate dorsal cutaneous nerves of foot	Lateral compartment of leg	Inferior part of anterior leg, dorsum of foot and toes
Lateral sural cutaneous nerve	Common fibular nerve	Branches from common fibular nerve just proximal to plantaris muscle			Lateral leg
Medial sural cutaneous nerve	Tibial nerve	Branches from tibial nerve just proximal to plantaris muscle, runs between both heads of gastrocnemius muscle, pierces crural fascia	Sural nerve		Proximal posterolateral leg
Sural nerve	Union of medial sural cutaneous nerve and sural communicating branch of common fibular nerve	Descends sural region along lateral calcaneal tendon and into foot between lateral malleolus and calcaneus	Lateral dorsal cutaneous nerve of foot		Distal posterolateral leg, lateral foot
Lateral plantar nerve	Tibial nerve	Passes deep to abductor hallucis brevis and travels between flexor digitorum brevis and quadratus plantae muscle	Superficial and deep branches	Abductor digiti minimi, adductor hallucis, flexor digiti minimi, quadratus plantae muscle, dorsal and plantar interossei muscles, lumbrical muscles (lateral three)	Lateral sole, plantar aspect of 5th toe and part of 4th toe
Medial plantar nerve	Tibial nerve	Passes deep to abductor hallucis brevis and runs anteriorly along medial border of flexor digitorum brevis	Muscular and common plantar digital branches	Abductor hallucis, flexor digitorum brevis, flexor hallucis brevis, lumbrical muscles (most medial one)	Medial sole, plantar aspect of toes 1–3, and part of 4th toe

MUSCLE	MUSCLE GROUP	PROXIMAL ATTACHMENT	DISTAL ATTACHMENT	INNERVATION	BLOOD SUPPLY	MAIN ACTIONS
Abductor digiti minimi of foot	Foot	Medial and lateral tubercles of tuberosity of calcaneus, plantar aponeurosis, intermuscular septum	Lateral surface of base of proximal phalanx of 5th digit	Lateral plantar nerve	Lateral plantar artery, plantar metatarsal and plantar digital arteries to 5th digit	Abducts and flexes 5th digit
Abductor hallucis	Foot	Medial tubercle of tuberosity of calcaneus, flexor retinaculum, plantar aponeurosis	Medial surface of base of proximal phalanx of 1st digit	Medial plantar nerve	Medial plantar and 1st plantar metatarsal arteries	Abducts and flexes 1st digit
Adductor brevis	Medial thigh	Body and inferior ramus of pubis	Pectineal line and proximal part of linea aspera of femur	Obturator nerve	Deep femoral, medial circumflex femoral, and obturator arteries	Adducts thigh at hip, weak hip flexor
Adductor hallucis	Foot	*Oblique head:* bases of 2nd through 4th metatarsals *Transverse head:* ligaments of metatarsophalangeal joints of digits 3–5	Lateral surface of base of proximal phalanx of 1st digit	Lateral plantar nerve	Medial and lateral plantar arteries, plantar arch, plantar metatarsal arteries	Adducts 1st digit, maintains transverse arch of foot
Adductor longus	Medial thigh	Body of pubis inferior to pubic crest	Middle one-third of linea aspera of femur	Obturator nerve	Deep femoral and medial circumflex femoral arteries	Adducts thigh at hip
Adductor magnus	Medial thigh	*Adductor part:* ischiopubic ramus *Hamstring part:* ischial tuberosity	*Adductor part:* gluteal tuberosity, linea aspera, medial supracondylar line *Hamstring part:* adductor tubercle of femur	*Adductor part:* obturator nerve *Hamstring part:* sciatic nerve (tibial division)	Femoral, deep femoral, and obturator arteries	*Adductor part:* adducts and flexes thigh *Hamstring part:* extends thigh
Articularis genus m.	Anterior thigh	Anterior surface of distal femur	Suprapatellar bursa	Femoral nerve	Femoral artery	Pulls suprapatellar bursa superiorly with extension of knee
Biceps femoris m.	Posterior thigh	*Long head:* ischial tuberosity *Short head:* linea aspera and lateral supracondylar line of femur	Lateral surface of head of fibula	*Long head:* sciatic nerve (tibial division) *Short head:* sciatic nerve (common fibular division)	Perforating femoral arteries, inferior gluteal and medial circumflex femoral arteries	Flexes and laterally rotates leg, extends thigh
Dorsal interossei mm. of foot	Foot	Adjacent surfaces of 1st through 5th metatarsals	*Medial one:* medial surface of proximal phalanx of 2nd digit *Lateral three:* lateral surfaces of proximal phalanges of digits 2–4	Lateral plantar nerve	Arcuate artery, dorsal and plantar metatarsal arteries	Abduct 2nd through 4th digits of foot, flex metatarsophalangeal joints, and extend phalanges
Extensor digitorum brevis	Foot	Superolateral surface of calcaneus, lateral talocalcaneal ligament, deep surface of inferior extensor retinaculum	Lateral sides of tendons of extensor digitorum longus to digits 2–4	Deep fibular nerve	Dorsalis pedis, lateral tarsal, arcuate, and fibular arteries	Extends 2nd through 4th digits at metatarsophalangeal and interphalangeal joints
Extensor digitorum longus	Anterior leg	Lateral condyle of tibia, proximal three-fourths of anterior surfaces of interosseous membrane and fibula	Middle and distal phalanges of digits 2–5	Deep fibular nerve	Anterior tibial artery	Extends lateral four digits and dorsiflexes foot
Extensor hallucis brevis	Foot	Superolateral surface of calcaneus	Dorsal surface of proximal phalanx of great toe	Deep fibular nerve	Dorsalis pedis, lateral tarsal, arcuate, and fibular arteries	Extends great toe at metatarsophalangeal and interphalangeal joints

Continued

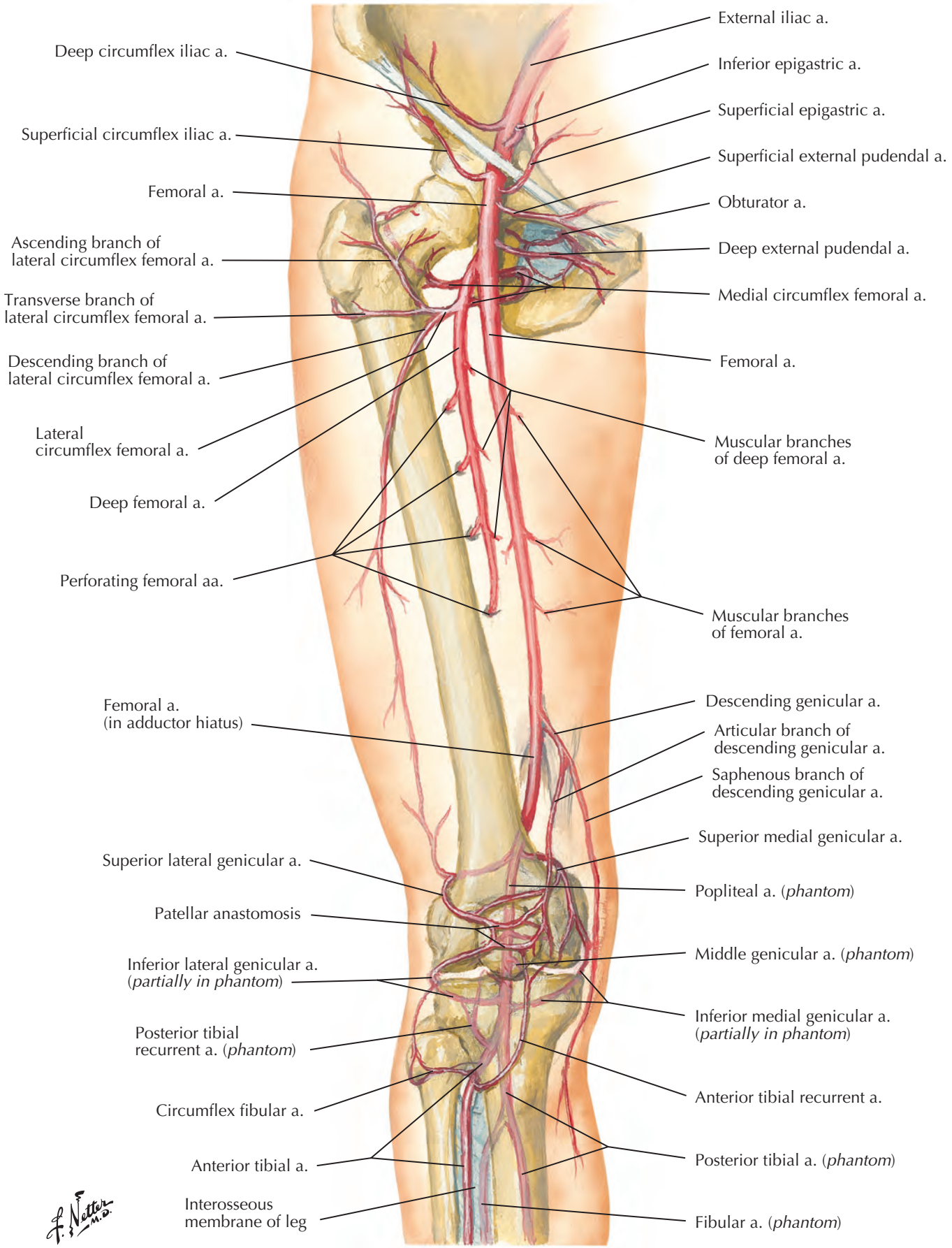
MUSCLE	MUSCLE GROUP	PROXIMAL ATTACHMENT	DISTAL ATTACHMENT	INNERVATION	BLOOD SUPPLY	MAIN ACTIONS
Extensor hallucis longus	Anterior leg	Middle part of anterior surfaces of fibula and interosseous membrane of leg	Dorsal surface of base of distal phalanx of great toe	Deep fibular nerve	Anterior tibial artery	Extends great toe, dorsiflexes foot
Fibularis brevis m.	Lateral leg	Distal two-thirds of lateral surface of fibula	Dorsal surface of tuberosity on lateral side of 5th metatarsal bone	Superficial fibular nerve	Anterior tibial and fibular arteries	Everts and plantar flexes foot
Fibularis longus m.	Lateral leg	Head of fibula, proximal two-thirds of lateral surface of fibula	Plantar surfaces of base of 1st metatarsal and of medial cuneiform bones	Superficial fibular nerve	Anterior tibial and fibular arteries	Everts and plantar flexes foot
Fibularis tertius m.	Anterior leg	Distal one-third of anterior surfaces of fibula and interosseous membrane of leg	Dorsal surface of base of 5th metatarsal bone	Deep fibular nerve	Anterior tibial artery	Dorsiflexes and everts foot
Flexor digiti minimi of foot	Foot	Base of 5th metatarsal bone	Lateral surface of base of proximal phalanx of 5th digit	Lateral plantar nerve	Lateral plantar artery, plantar digital artery to 5th digit, arcuate artery	Flexes proximal phalanx of 5th digit
Flexor digitorum brevis	Foot	Medial tubercle of tuberosity of calcaneus, plantar aponeurosis, intermuscular septum	Both sides of middle phalangeal bones of digits 2–5	Medial plantar nerve	Medial and lateral plantar arteries, plantar arch, plantar metatarsal and plantar digital arteries	Flexes lateral four digits
Flexor digitorum longus	Posterior leg	Medial part of posterior tibia inferior to soleal line	Plantar surfaces of bases of distal phalanges of digits 2–5	Tibial nerve	Posterior tibial artery	Flexes lateral four digits and plantar flexes foot; supports longitudinal arches of foot
Flexor hallucis brevis	Foot	Plantar surfaces of cuboid bone and lateral cuneiform bone	Both sides of base of proximal phalanx of 1st digit	Medial plantar nerve	Medial plantar and 1st plantar metatarsal arteries	Flexes proximal phalanx of 1st digit
Flexor hallucis longus	Posterior leg	Distal two-thirds of posterior surfaces of fibula and interosseous membrane of leg	Base of distal phalanx of great toe	Tibial nerve	Fibular artery	Flexes all joints of great toe, plantar flexes foot
Gastrocnemius m.	Posterior leg	*Lateral head:* lateral surface of lateral condyle of femur *Medial head:* popliteal surface above medial condyle of femur	Posterior surface of calcaneus (via calcaneal tendon)	Tibial nerve	Popliteal and posterior tibial arteries	Plantar flexes foot, assists in flexion of knee
Gluteus maximus m.	Superficial gluteal	Ilium posterior to posterior gluteal line, dorsal surfaces of sacrum and coccyx, sacrotuberous ligament	Lateral condyle of tibia (via iliotibial tract), gluteal tuberosity of femur	Inferior gluteal nerve	Inferior and superior gluteal arteries	Extends flexed thigh, assists in lateral rotation, and abducts thigh
Gluteus medius m.	Superficial gluteal	Gluteal surface of ilium between anterior and posterior gluteal lines	Lateral surface of greater trochanter of femur	Superior gluteal nerve	Superior gluteal artery	Abducts and medially rotates thigh
Gluteus minimus m.	Superficial gluteal	Gluteal surface of ilium between anterior and inferior gluteal lines	Anterior surface of greater trochanter of femur	Superior gluteal nerve	Superior gluteal artery	Abducts and medially rotates thigh
Gracilis m.	Medial thigh	Body and inferior ramus of pubis	Superior part of medial surface of tibia	Obturator nerve	Deep femoral and medial circumflex femoral arteries	Adducts thigh, flexes and medially rotates leg

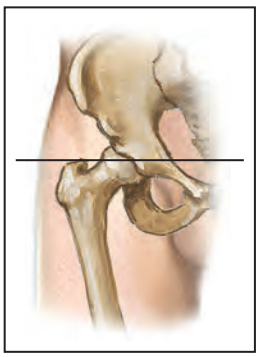
MUSCLE	MUSCLE GROUP	PROXIMAL ATTACHMENT	DISTAL ATTACHMENT	INNERVATION	BLOOD SUPPLY	MAIN ACTIONS
Iliacus m.	Iliopsoas	Superior two-thirds of iliac fossa, iliac crest, ala of sacrum, anterior sacroiliac ligament	Lesser trochanter and body of femur	Femoral nerve	Iliac branch of iliolumbar artery	Flexes thigh
Inferior gemellus m.	Deep gluteal	Ischial tuberosity	Greater trochanter of femur	Nerve to quadratus femoris muscle	Medial circumflex femoral artery	Laterally rotates extended thigh and abducts flexed thigh
Lumbrical mm. of foot	Foot	Tendons of flexor digitorum longus	Medial side of dorsal digital expansions of digits 2–5	*Medial one:* medial plantar nerve *Lateral three:* lateral plantar nerve	Lateral plantar artery, plantar metatarsal arteries	Flex proximal phalanges at metatarsophalangeal joint, extend phalanges at proximal interphalangeal and distal interphalangeal joints
Obturator externus	Medial thigh	Margins of obturator foramen, external surface of obturator membrane	Trochanteric fossa of femur	Obturator nerve	Medial circumflex femoral and obturator arteries	Laterally rotates thigh
Obturator internus	Deep gluteal	Pelvic surface of obturator membrane, margins of obturator foramen	Greater trochanter of femur	Nerve to obturator internus muscle	Internal pudendal and obturator arteries	Laterally rotates extended thigh, abducts flexed thigh
Pectineus m.	Medial thigh	Superior ramus of pubis	Pectineal line of femur	Femoral nerve (sometimes also obturator nerve)	Medial circumflex femoral and obturator arteries	Adducts and flexes thigh
Piriformis m.	Deep gluteal	Anterior surface of sacral segments 2–4, sacrotuberous ligament (inconstant)	Superior border of greater trochanter of femur	Nerve to piriformis muscle	Superior and inferior gluteal arteries, internal pudendal artery	Laterally rotates extended thigh, abducts flexed thigh
Plantar interossei mm.	Foot	Bases and medial sides of 3rd through 5th metatarsals	Medial surfaces of bases of proximal phalangeal bones of digits 3–5	Lateral plantar nerve	Lateral plantar artery, plantar arch, plantar metatarsal and plantar digital arteries	Adduct digits (3–5), flex metatarsophalangeal joint, and extend phalanges
Plantaris m.	Posterior leg	Inferior end of lateral supracondylar line of femur, oblique popliteal ligament	Posterior surface of calcaneus (via calcaneal tendon)	Tibial nerve	Popliteal artery	Weakly assists gastrocnemius
Popliteus m.	Posterior leg	Lateral surface of lateral condyle of femur, lateral meniscus	Posterior tibia superior to soleal line	Tibial nerve	Inferior medial and lateral genicular arteries	Flexes knee
Psoas major	Iliopsoas	Transverse processes of lumbar vertebrae, sides of bodies of T12–L5 vertebrae, intervening intervertebral discs	Lesser trochanter of femur	Anterior rami of L1–L3 spinal nerves	Lumbar branch of iliolumbar artery	Acting superiorly with iliacus, flexes hip; acting inferiorly, flexes vertebral column laterally; used to balance trunk in sitting position; acting inferiorly with iliacus, flexes trunk
Psoas minor	Iliopsoas	Lateral surfaces of bodies of T12 and L1 vertebrae, T12–L1 intervertebral disc	Pectineal line, iliopubic eminence	Anterior ramus of L1 spinal nerve	Lumbar branch of iliolumbar artery	Flexes pelvis on vertebral column
Quadratus femoris m.	Deep gluteal	Lateral margin of ischial tuberosity	Quadrate tubercle	Nerve to quadratus femoris muscle	Medial circumflex femoral artery	Laterally rotates thigh
Quadratus plantae m.	Foot	Medial and lateral margins of plantar surface of calcaneus	Posterolateral edge of flexor digitorum longus tendon	Lateral plantar nerve	Medial and lateral plantar arteries, plantar arch	Corrects for oblique pull of flexor digitorum longus tendon, thus assisting in flexion of digits of foot

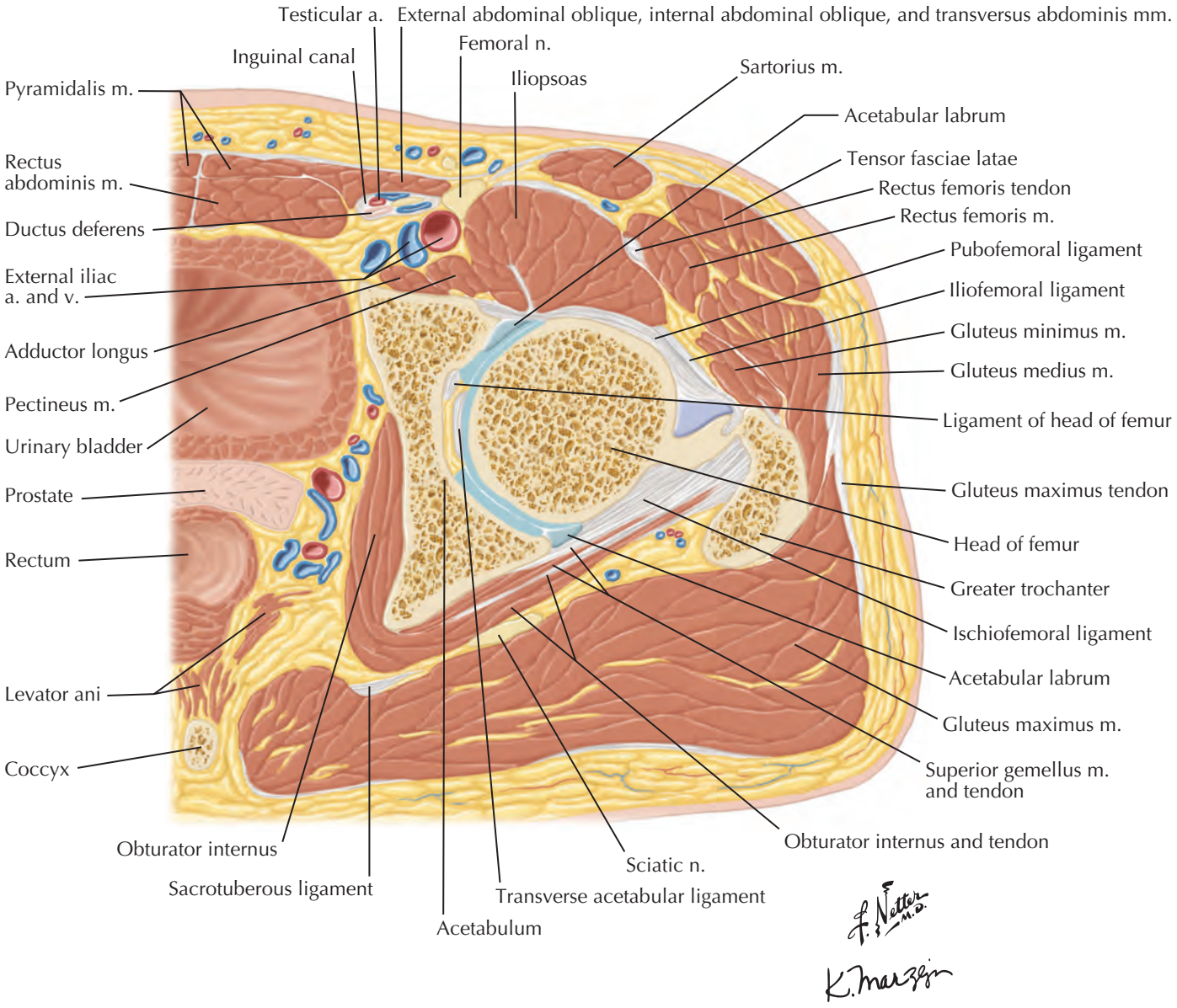
Continued

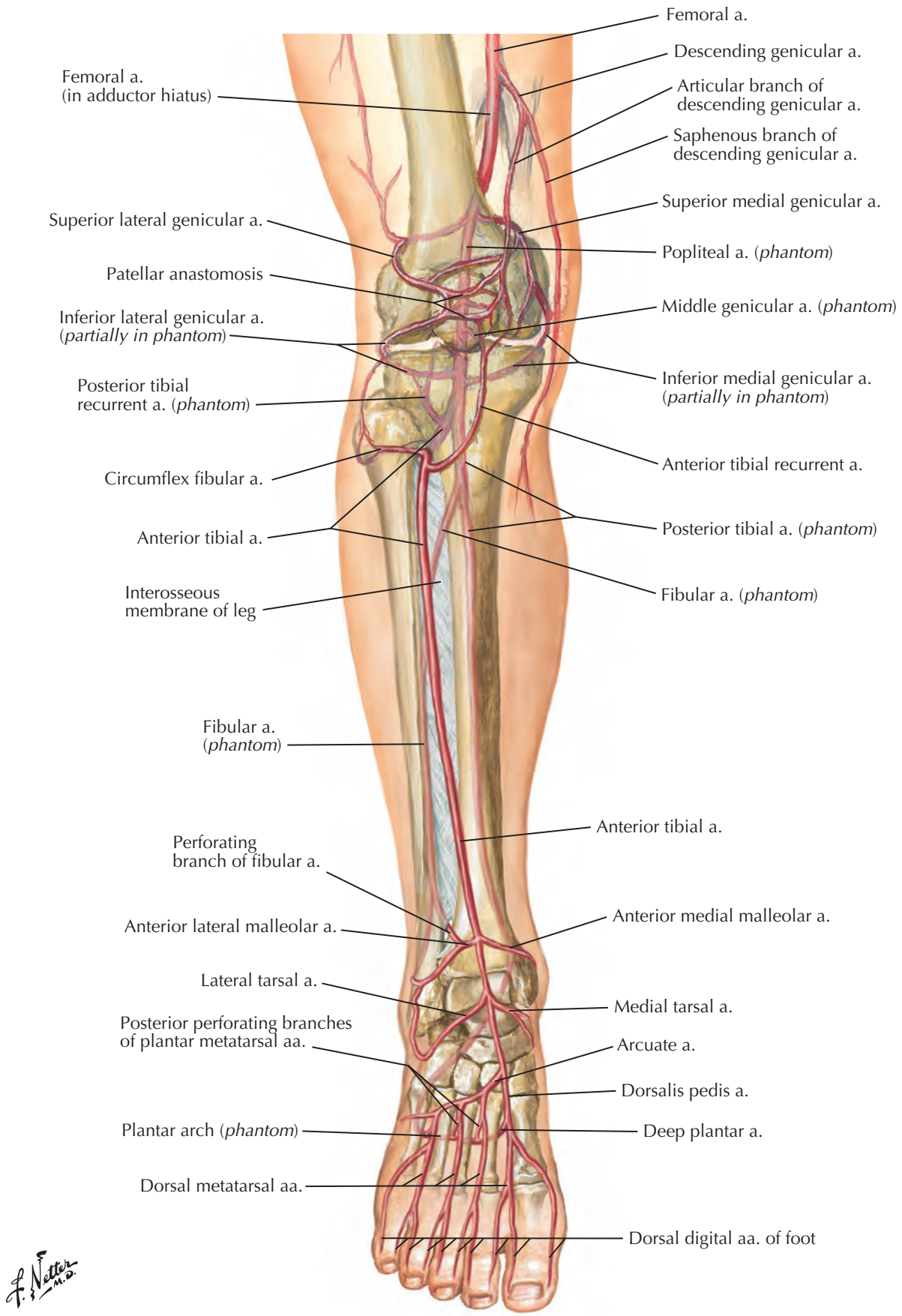
MUSCLE	MUSCLE GROUP	PROXIMAL ATTACHMENT	DISTAL ATTACHMENT	INNERVATION	BLOOD SUPPLY	MAIN ACTIONS
Rectus femoris m.	Anterior thigh (quadriceps femoris)	Anterior inferior iliac spine, ilium superior to acetabulum	Tibial tuberosity (via patellar ligament)	Femoral nerve	Deep femoral and lateral circumflex femoral arteries	Extends leg and flexes thigh
Sartorius m.	Anterior thigh	Anterior superior iliac spine, ilium inferior to that spine	Superior part of medial surface of tibia	Femoral nerve	Femoral artery	Abducts, laterally rotates, and flexes thigh; flexes knee
Semimembranosus m.	Posterior thigh	Ischial tuberosity	Posterior part of medial condyle of tibia	Sciatic nerve (tibial division)	Perforating femoral arteries, medial circumflex femoral artery	Flexes leg, extends thigh
Semitendinosus m.	Posterior thigh	Ischial tuberosity	Superior part of medial surface of tibia	Sciatic nerve (tibial division)	Perforating femoral arteries, medial circumflex femoral artery	Flexes leg, extends thigh
Soleus m.	Posterior leg	Posterior surface of head of fibula, proximal one-fourth of posterior surface of fibula, soleal line of tibia	Posterior surface of calcaneus (via calcaneal tendon)	Tibial nerve	Popliteal, posterior tibial, and fibular arteries	Plantar flexes foot
Superior gemellus m.	Deep gluteal	External surface of ischial spine	Medial surface of greater trochanter of femur	Nerve to obturator internus muscle	Inferior gluteal and internal pudendal arteries	Laterally rotates extended thigh and abducts flexed thigh
Tensor fasciae latae	Superficial gluteal	Anterior superior iliac spine, anterior part of iliac crest	Lateral condyle of tibia (via iliotibial tract)	Superior gluteal nerve	Ascending branch of lateral circumflex femoral artery	Abducts, medially rotates, and flexes thigh; helps to keep knee extended
Tibialis anterior m.	Anterior leg	Lateral condyle of tibia, proximal half of lateral tibia, interosseous membrane of leg	Medial cuneiform bone and base of 1st metatarsal bone	Deep fibular nerve	Anterior tibial artery	Dorsiflexes foot and inverts foot
Tibialis posterior m.	Posterior leg	Posterior tibia below soleal line, interosseous membrane, proximal half of posterior fibula	Tuberosity of navicular bone, all cuneiform bones, cuboid bone, bases of 2nd through 4th metatarsal bones	Tibial nerve	Fibular artery	Plantar flexes foot and inverts foot
Vastus intermedius m.	Anterior thigh (quadriceps femoris)	Anterior and lateral surfaces of body of femur	Tibial tuberosity (via patellar ligament)	Femoral nerve	Lateral circumflex femoral and deep femoral arteries	Extends leg
Vastus lateralis m.	Anterior thigh (quadriceps femoris)	Greater trochanter, gluteal tuberosity, lateral lip of linea aspera	Tibial tuberosity (via patellar ligament)	Femoral nerve	Lateral circumflex femoral and deep femoral arteries	Extends leg
Vastus medialis m.	Anterior thigh (quadriceps femoris)	Intertrochanteric line, greater trochanter, gluteal tuberosity, lateral lip of linea aspera	Tibial tuberosity (via patellar ligament)	Femoral nerve	Femoral and deep femoral arteries	Extends leg

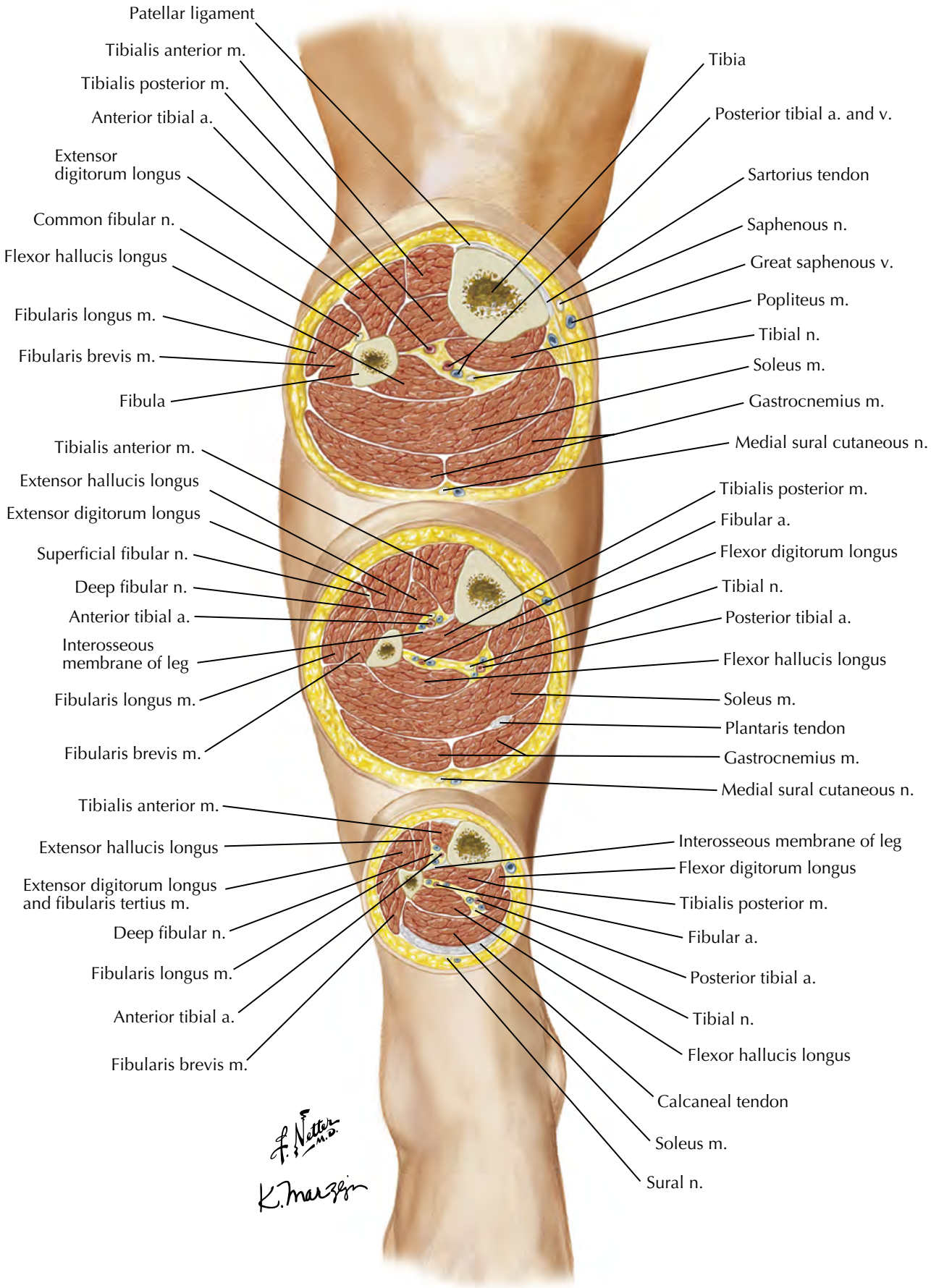
Variations in spinal nerve contributions to the innervation of muscles, their arterial supply, their attachments, and their actions are common themes in human anatomy. Therefore, expect differences between texts and realize that anatomical variation is normal.

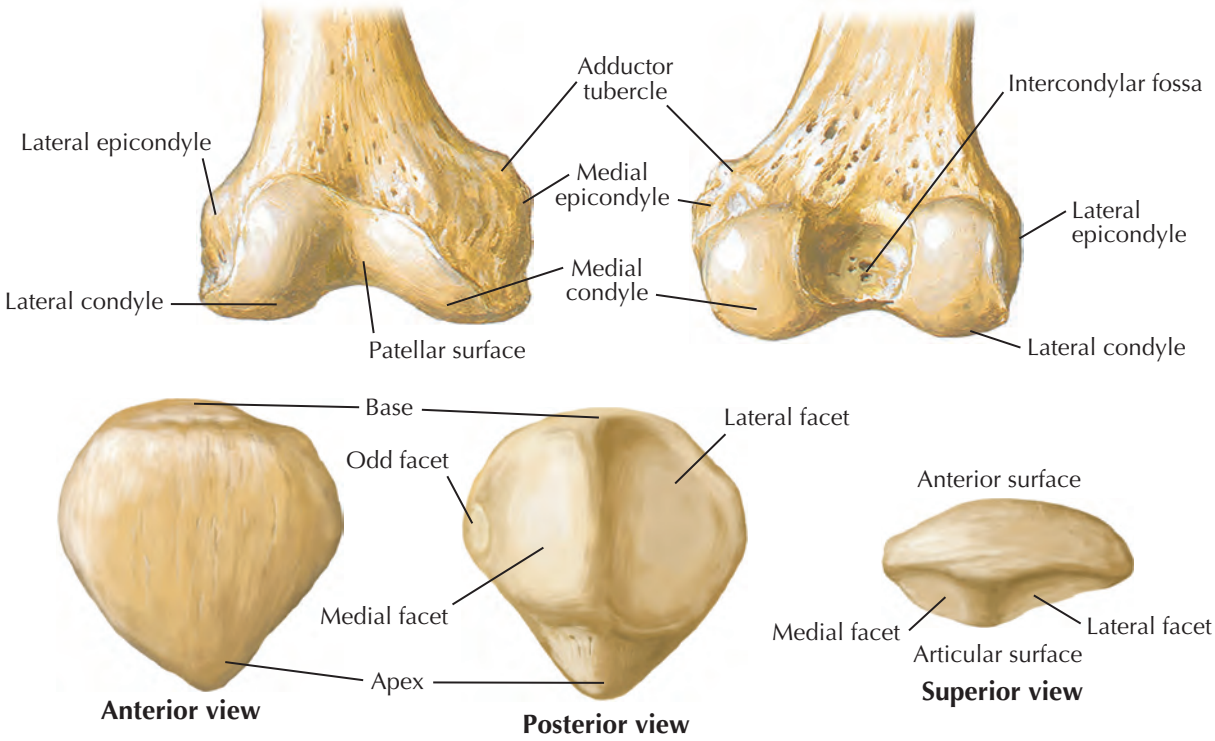

Deep circumflex iliac a.
Superficial circumflex iliac a.
Femoral a.
Ascending branch of lateral circumflex femoral a.
Transverse branch of lateral circumflex femoral a.
Descending branch of lateral circumflex femoral a.
Lateral circumflex femoral a.
Deep femoral a.
Perforating femoral aa.
Femoral a. (in adductor hiatus)
Superior lateral genicular a.
Patellar anastomosis
Inferior lateral genicular a. (partially in phantom)
Posterior tibial recurrent a. (phantom)
Circumflex fibular a.
Anterior tibial a.
Interosseous membrane of leg
External iliac a.
Inferior epigastric a.
Superficial epigastric a.
Superficial external pudendal a.
Obturator a.
Deep external pudendal a.
Medial circumflex femoral a.
Femoral a.
Muscular branches of deep femoral a.
Muscular branches of femoral a.
Descending genicular a.
Articular branch of descending genicular a.
Saphenous branch of descending genicular a.
Superior medial genicular a.
Popliteal a. (phantom)
Middle genicular a. (phantom)
Inferior medial genicular a. (partially in phantom)
Anterior tibial recurrent a.
Posterior tibial a. (phantom)
Fibular a. (phantom)

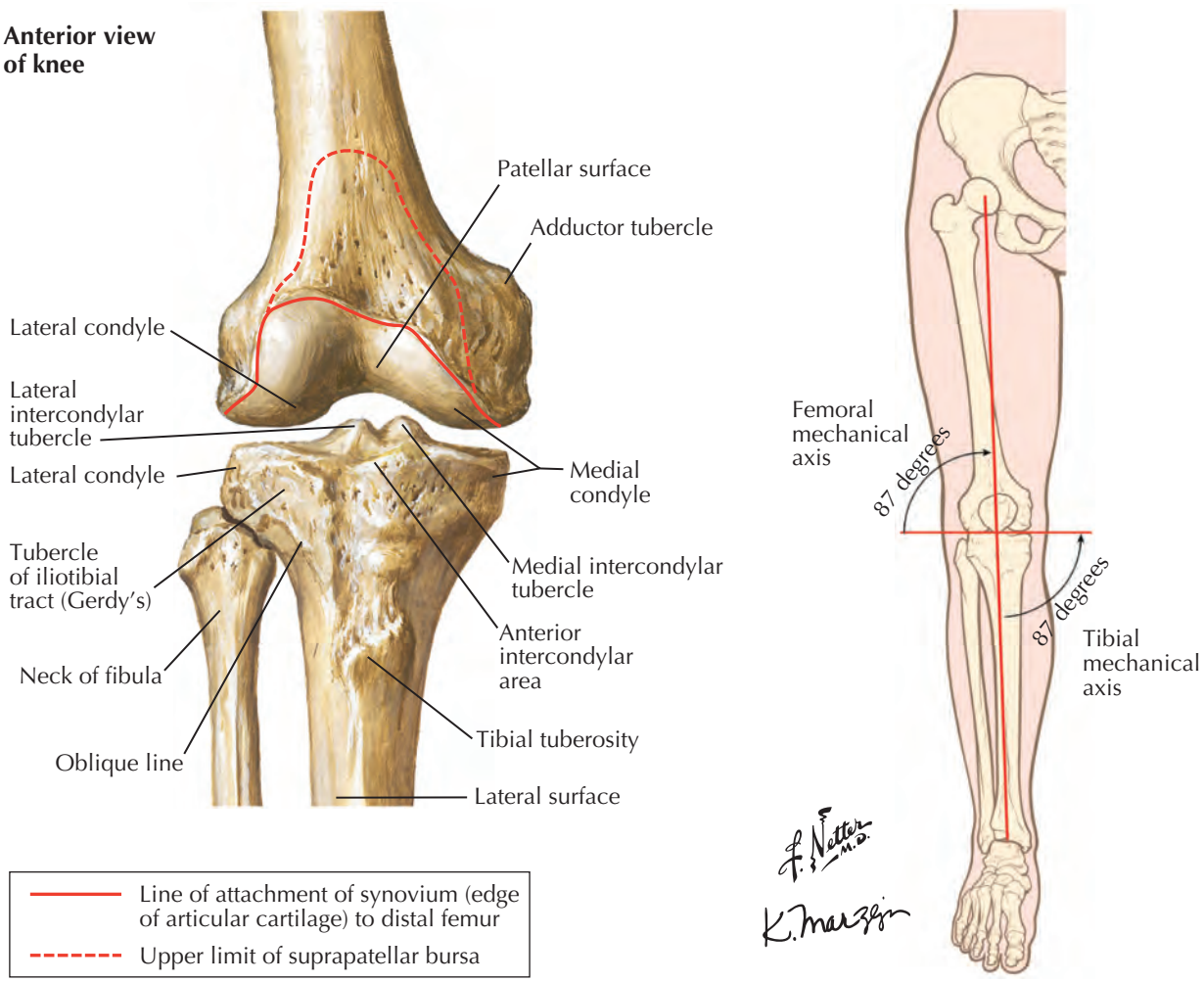


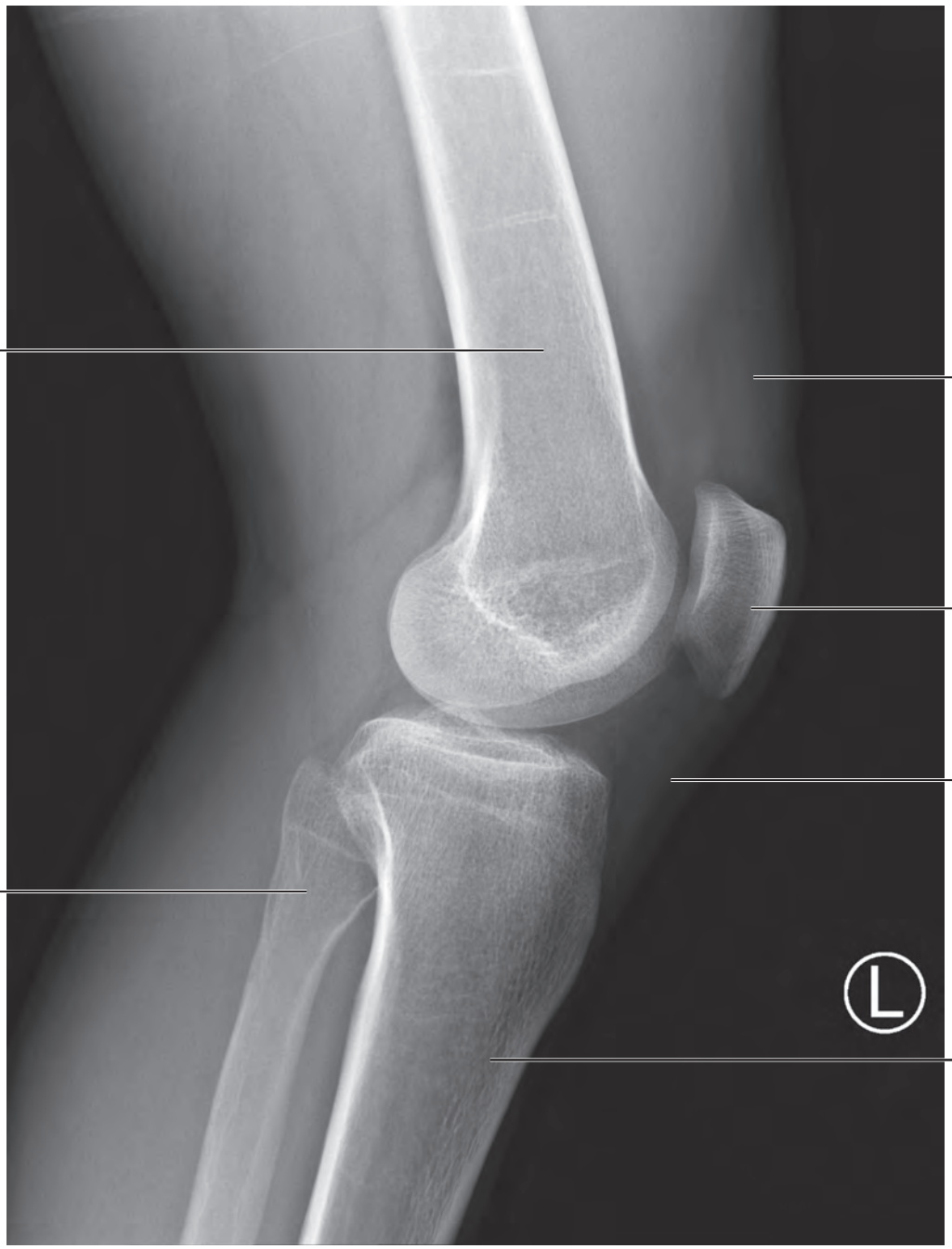

Testicular a.
External abdominal oblique, internal abdominal oblique, and transversus abdominis mm.
Femoral n.
Inguinal canal
Iliopsoas
Sartorius m.
Pyramidalis m.
Acetabular labrum
Rectus abdominis m.
Tensor fasciae latae
Rectus femoris tendon
Ductus deferens
Rectus femoris m.
Pubofemoral ligament
External iliac a. and v.
Iliofemoral ligament
Gluteus minimus m.
Adductor longus
Gluteus medius m.
Pectineus m.
Ligament of head of femur
Urinary bladder
Gluteus maximus tendon
Prostate
Head of femur
Rectum
Greater trochanter
Ischiofemoral ligament
Acetabular labrum
Levator ani
Gluteus maximus m.
Superior gemellus m. and tendon
Coccyx
Obturator internus and tendon
Obturator internus
Sciatic n.
Sacrotuberous ligament
Transverse acetabular ligament
Acetabulum


Femoral a.
Descending genicular a.
Femoral a.
(in adductor hiatus)
Articular branch of
descending genicular a.
Saphenous branch of
descending genicular a.
Superior medial genicular a.
Superior lateral genicular a.
Popliteal a. (*phantom*)
Patellar anastomosis
Middle genicular a. (*phantom*)
Inferior lateral genicular a.
(*partially in phantom*)
Inferior medial genicular a.
(*partially in phantom*)
Posterior tibial
recurrent a. (*phantom*)
Anterior tibial recurrent a.
Circumflex fibular a.
Posterior tibial a. (*phantom*)
Anterior tibial a.
Fibular a. (*phantom*)
Interosseous
membrane of leg
Fibular a.
(*phantom*)
Anterior tibial a.
Perforating
branch of fibular a.
Anterior medial malleolar a.
Anterior lateral malleolar a.
Lateral tarsal a.
Medial tarsal a.
Posterior perforating branches
of plantar metatarsal aa.
Arcuate a.
Dorsalis pedis a.
Plantar arch (*phantom*)
Deep plantar a.
Dorsal metatarsal aa.
Dorsal digital aa. of foot

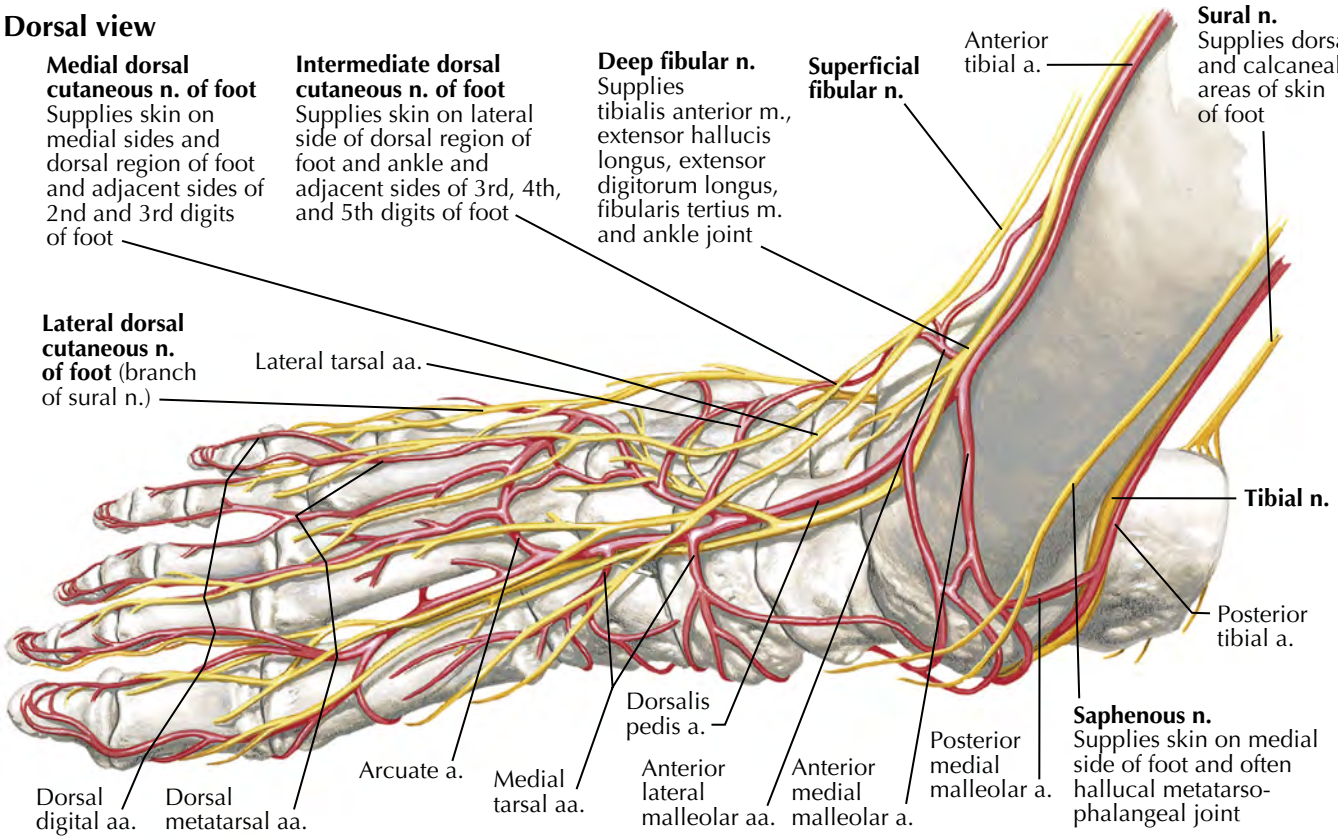

Patellar ligament
Tibialis anterior m.
Tibialis posterior m.
Anterior tibial a.
Extensor digitorum longus
Common fibular n.
Flexor hallucis longus
Fibularis longus m.
Fibularis brevis m.
Fibula
Tibia
Posterior tibial a. and v.
Sartorius tendon
Saphenous n.
Great saphenous v.
Popliteus m.
Tibial n.
Soleus m.
Gastrocnemius m.
Medial sural cutaneous n.
Tibialis anterior m.
Extensor hallucis longus
Extensor digitorum longus
Superficial fibular n.
Deep fibular n.
Anterior tibial a.
Interosseous membrane of leg
Fibularis longus m.
Fibularis brevis m.
Tibialis posterior m.
Fibular a.
Flexor digitorum longus
Tibial n.
Posterior tibial a.
Flexor hallucis longus
Soleus m.
Plantaris tendon
Gastrocnemius m.
Medial sural cutaneous n.
Tibialis anterior m.
Extensor hallucis longus
Extensor digitorum longus and fibularis tertius m.
Deep fibular n.
Fibularis longus m.
Anterior tibial a.
Fibularis brevis m.
Interosseous membrane of leg
Flexor digitorum longus
Tibialis posterior m.
Fibular a.
Posterior tibial a.
Tibial n.
Flexor hallucis longus
Calcaneal tendon
Soleus m.
Sural n.


Lateral epicondyle
Adductor tubercle
Medial epicondyle
Lateral condyle
Medial condyle
Patellar surface
Intercondylar fossa
Lateral epicondyle
Lateral condyle
Base
Lateral facet
Odd facet
Medial facet
Apex
Anterior view
Posterior view
Anterior surface
Medial facet
Lateral facet
Articular surface
Superior view

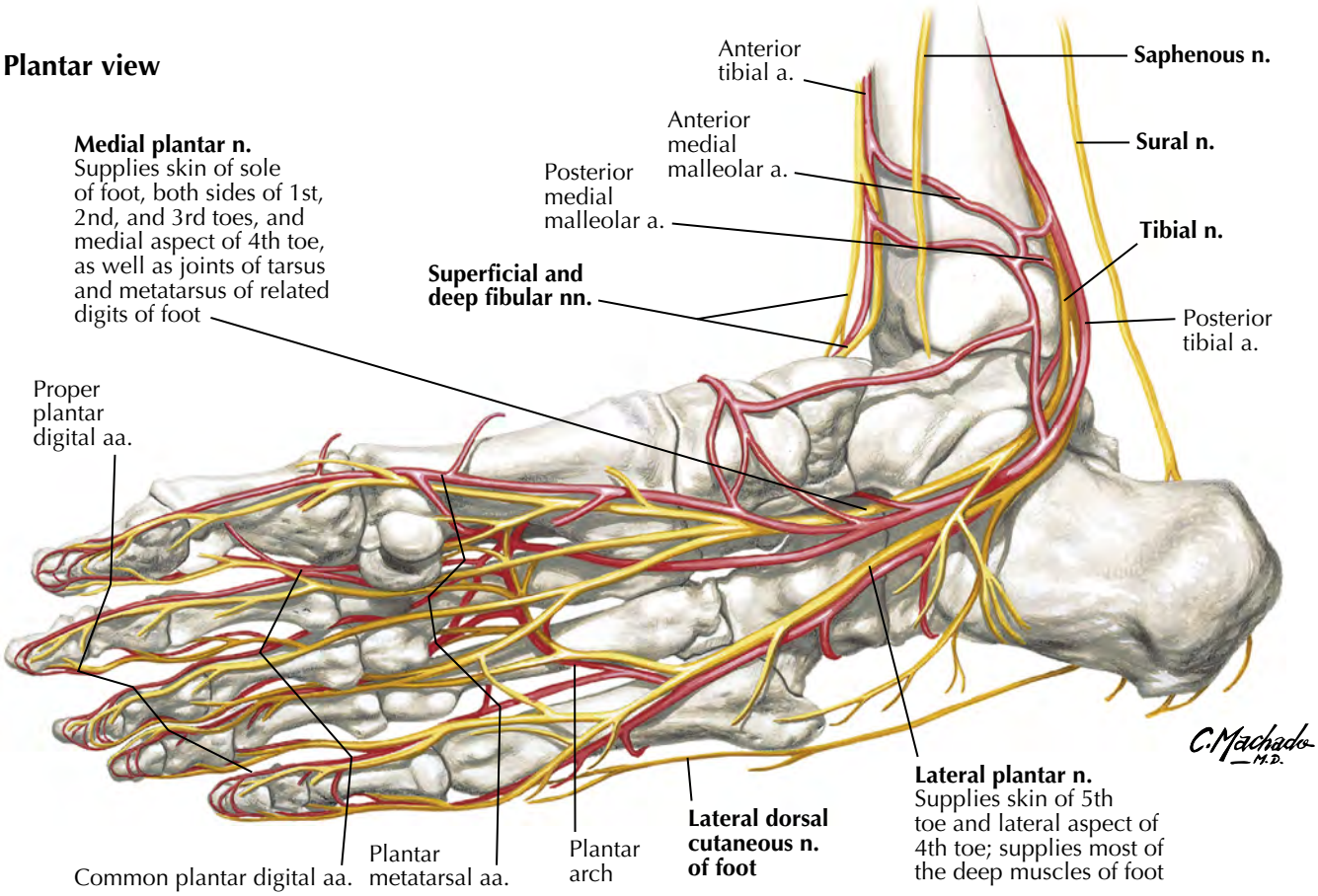

Anterior view of knee
Patellar surface
Adductor tubercle
Lateral condyle
Lateral intercondylar tubercle
Lateral condyle
Medial condyle
Tubercle of iliotibial tract (Gerdy's)
Medial intercondylar tubercle
Anterior intercondylar area
Neck of fibula
Tibial tuberosity
Oblique line
Lateral surface
Femoral mechanical axis
87 degrees
87 degrees
Tibial mechanical axis
Line of attachment of synovium (edge of articular cartilage) to distal femur
Upper limit of suprapatellar bursa

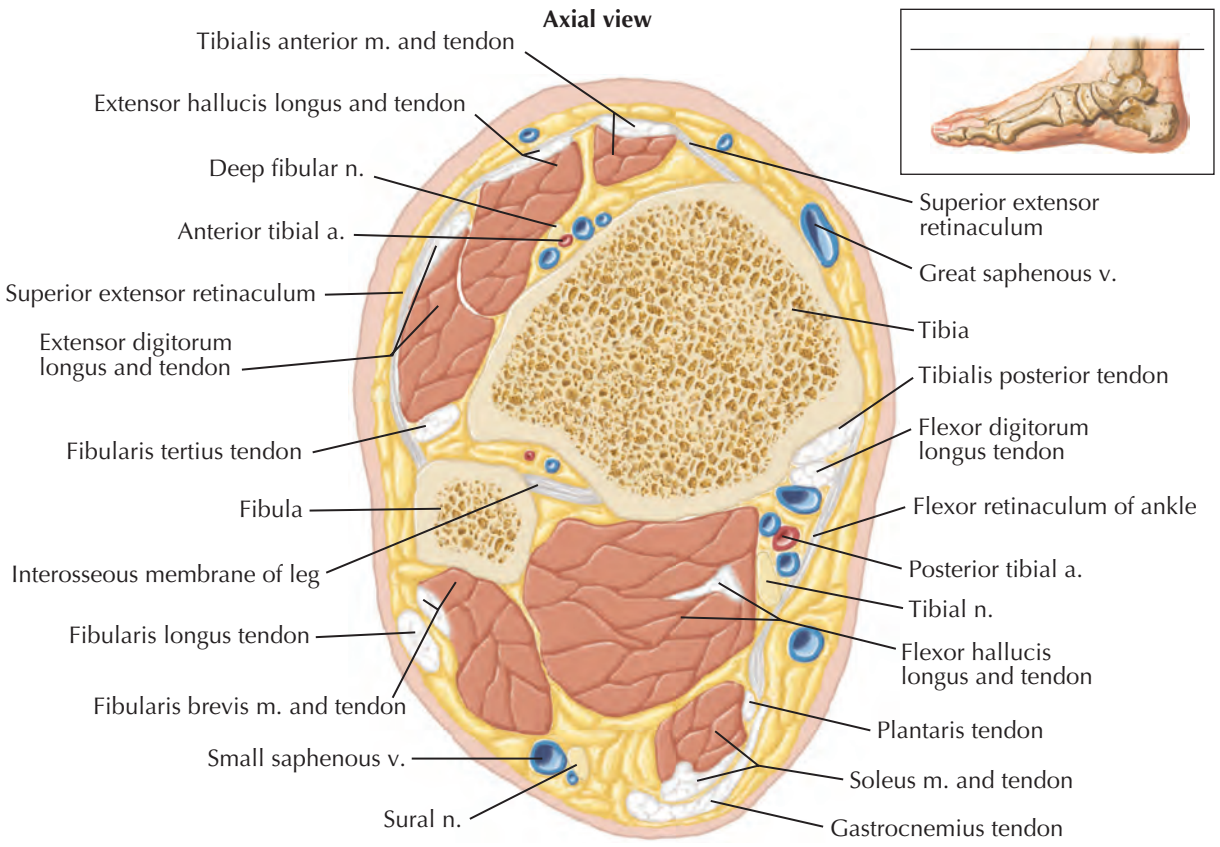

Femur
Quadriceps femoris tendon
Patella
Patellar ligament
Fibula
L
Tibia

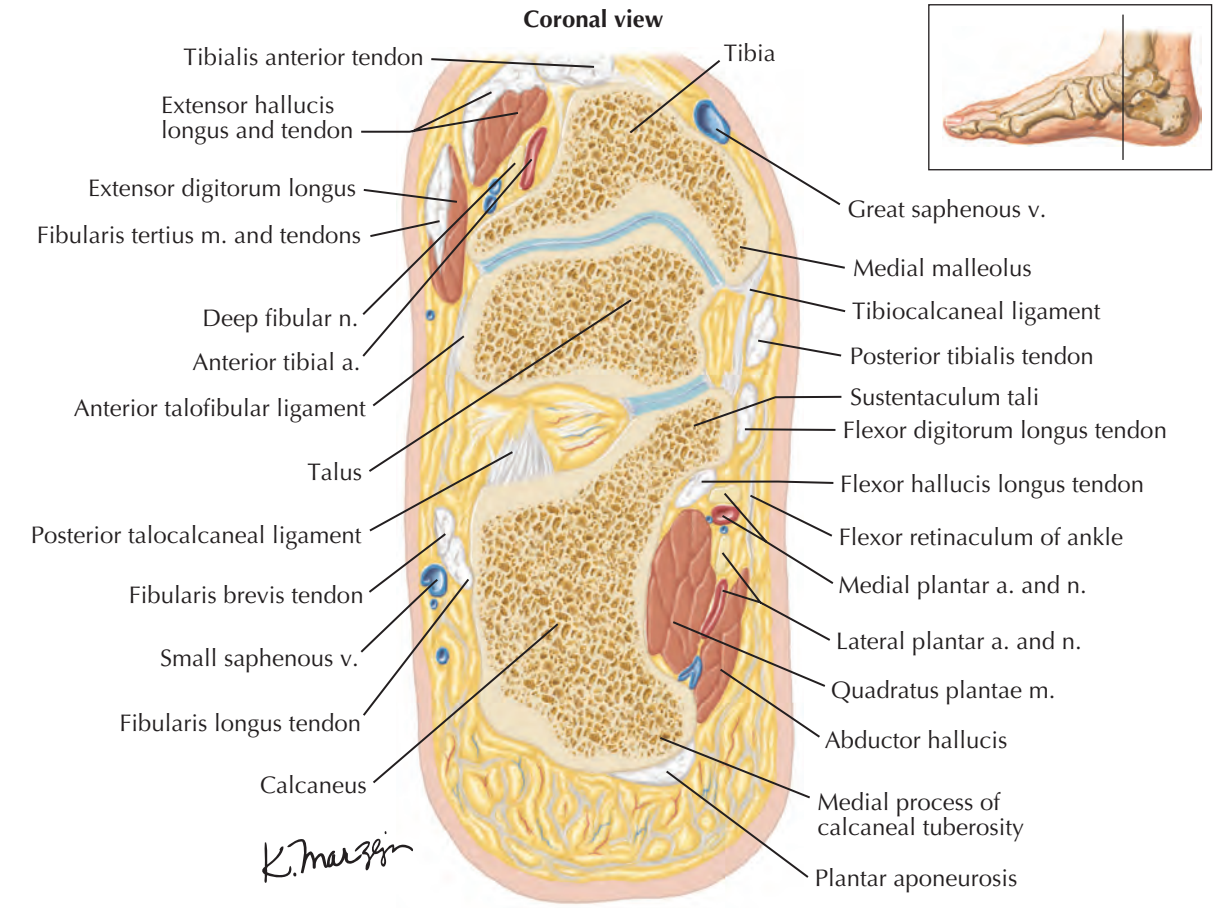
Dorsal view

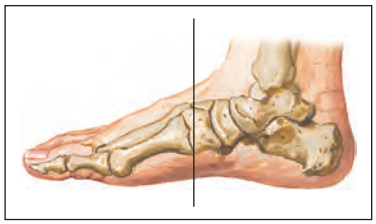


Plantar view

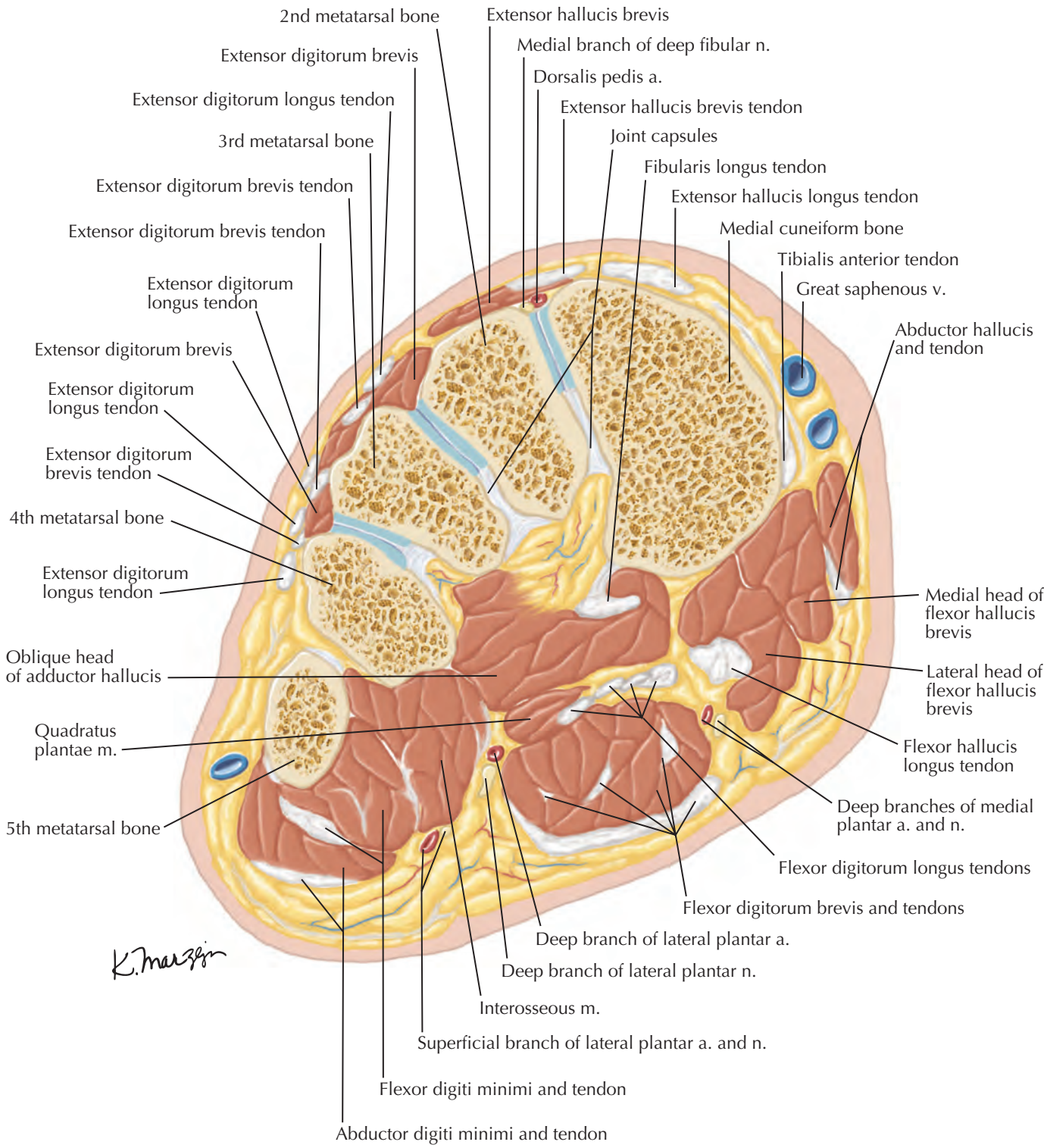


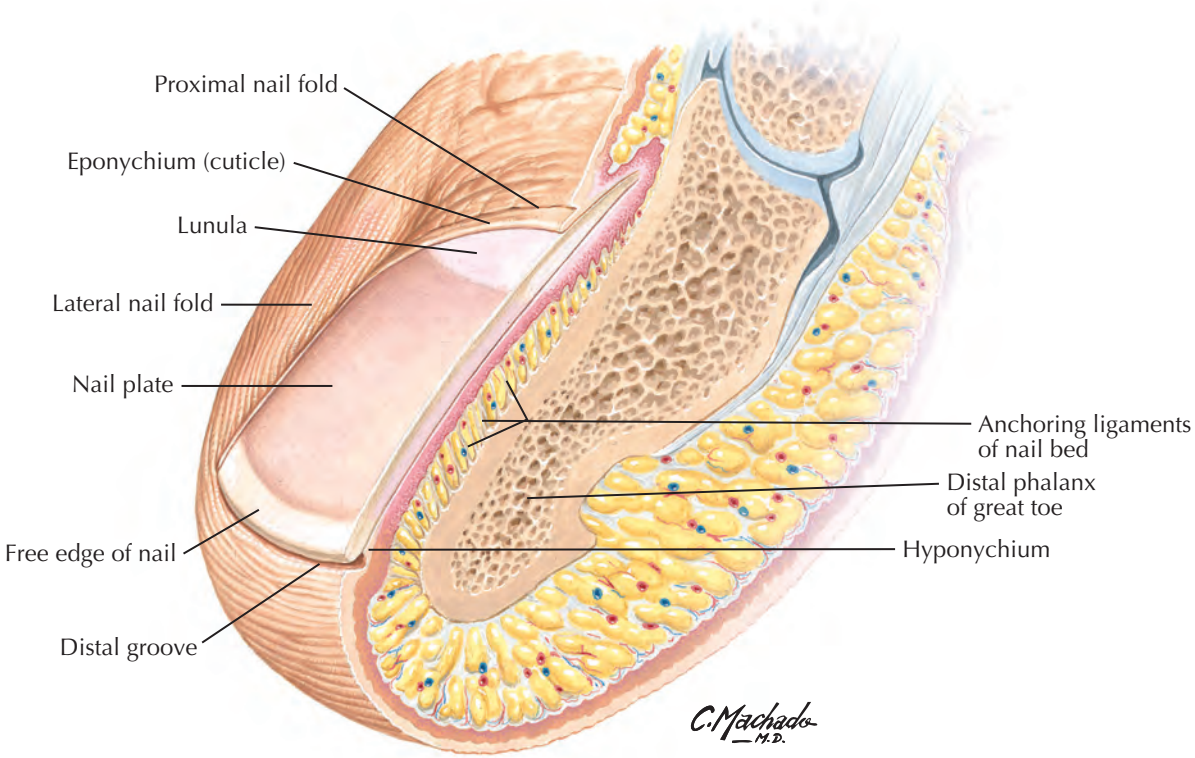

Axial view
Tibialis anterior m. and tendon
Extensor hallucis longus and tendon
Deep fibular n.
Anterior tibial a.
Superior extensor retinaculum
Extensor digitorum longus and tendon
Fibularis tertius tendon
Fibula
Interosseous membrane of leg
Fibularis longus tendon
Fibularis brevis m. and tendon
Small saphenous v.
Sural n.
Superior extensor retinaculum
Great saphenous v.
Tibia
Tibialis posterior tendon
Flexor digitorum longus tendon
Flexor retinaculum of ankle
Posterior tibial a.
Tibial n.
Flexor hallucis longus and tendon
Plantaris tendon
Soleus m. and tendon
Gastrocnemius tendon


Coronal view
Tibialis anterior tendon
Extensor hallucis longus and tendon
Extensor digitorum longus
Fibularis tertius m. and tendons
Deep fibular n.
Anterior tibial a.
Anterior talofibular ligament
Talus
Posterior talocalcaneal ligament
Fibularis brevis tendon
Small saphenous v.
Fibularis longus tendon
Calcaneus
Tibia
Great saphenous v.
Medial malleolus
Tibiocalcaneal ligament
Posterior tibialis tendon
Sustentaculum tali
Flexor digitorum longus tendon
Flexor hallucis longus tendon
Flexor retinaculum of ankle
Medial plantar a. and n.
Lateral plantar a. and n.
Quadratus plantae m.
Abductor hallucis
Medial process of calcaneal tuberosity
Plantar aponeurosis

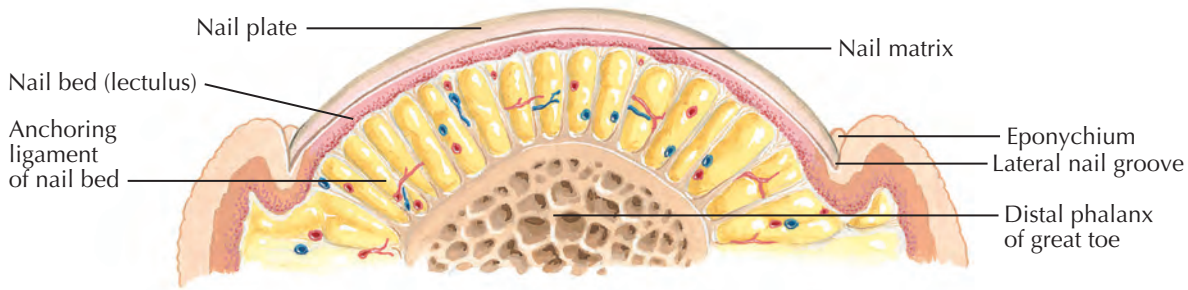


Coronal view

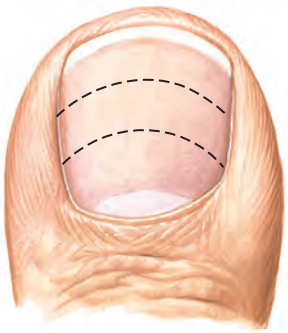




Sagittal section of great toe



Cross section of toenail



Toenail growth

The average growth rate of toenails is about 1 mm a month.

The rounded shape of the free edge of the nails is dictated by the shape of the lunula. After avulsion of a nail, the free edge of the new one grows parallel to the lunula.

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Plate 47
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Plate 52
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Plate 69
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Plate 72
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Plate 76
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