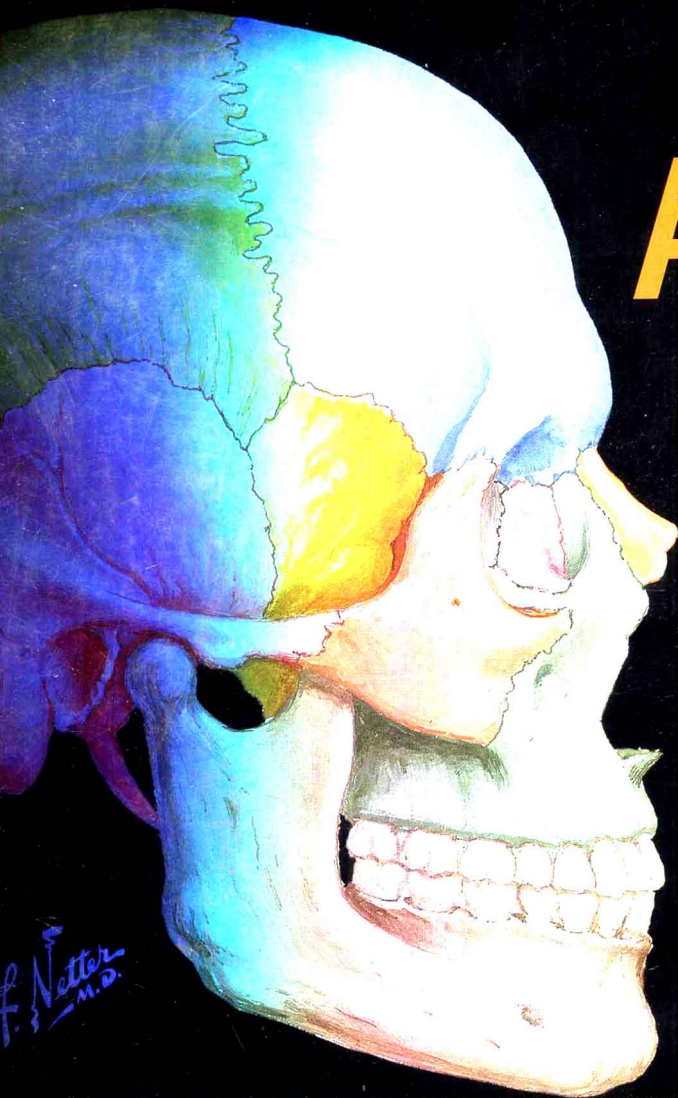


FRANK H. NETTER, MD



ATLAS OF HUMAN ANATOMY

5
EDITION



Atlas of **Human Anatomy**

Fifth Edition

Frank H. Netter, MD



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Fifth Edition

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Jennifer K. Brueckner, PhD

I am eternally grateful to my fiancé Kurt and to my parents, John and Rheba, for their patience, support, encouragement, and inspiration. Many thanks to John Hansen for the kind invitation and opportunity to contribute to this premier atlas! I would also like to thank the University of Kentucky College of Medicine Class of 2012 for their excellent input and suggestions for this edition; I am so lucky to have the privilege of working with such wonderful medical students! I am indebted to Carlos Machado for making the anatomical visions in my imagination come alive on paper with his magical artwork. Last but not least, I am so thankful for the Elsevier staff for their patience and support, including Marybeth Thiel, Anne Lenahan, and Linda Van Pelt.

Stephen W. Carmichael, PhD, DSc

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Noelle A. Granger, PhD

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John T. Hansen, PhD

I would like to thank Marybeth Thiel, Developmental Editor; Anne Lenahan, Acquisitions Editor; and Linda Van Pelt, Publishing Services Manager, for their meticulous shepherding of this fifth edition of the *Atlas of Human Anatomy* through each step of the publishing process. They, along with the entire Editorial, Production, Design, Illustration, and Marketing team at Elsevier, have been the epitome of professionalism. Also, I wish to express my thanks to my teaching colleagues at Rochester, and all my past and present students who have enriched my career and taught me much more than I have taught them. Finally, I am indebted to my entire family for their continued support, and especially to my wife Paula, whose love and encouragement has been the constant in my life and is the source of all the joy I know.

R. Shane Tubbs, MS, PA-C, PhD



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Foreword

The fifth edition of *Atlas of Human Anatomy* by Frank H. Netter, MD, has been updated by the Consulting Editor team, led by John T. Hansen, of Brion Benninger, Jennifer K. Brueckner, Stephen W. Carmichael, Noelle A. Granger, and R. Shane Tubbs. We have each reviewed, modified, and updated a section of the *Atlas*. In this new edition, the editorial team has updated the radiologic images in the print book and in the online ancillaries, bringing clinical imaging into context with anatomy. As anatomy does require new material, Carlos A.G. Machado, MD, has added outstanding new images and anatomic views to this edition. The Consulting Editor team has relied heavily on *Terminologica Anatomica* as the basis for updates to nomenclature and terminology. The genius of Dr. Netter's paintings is that the anatomy is portrayed clearly, realistically, and in a clinically relatable fashion while maintaining the balance between complexity and oversimplification. This fifth edition owes much to the consulting editors of the earlier editions, Drs. Sharon Colacino (Oberg) (first edition), Arthur F. Dalley II (second edition), and John T. Hansen (third edition), who shepherded their editions with great skill and uncompromising professionalism, making our task significantly easier. The fourth edition was the first published under Elsevier and included the contributions of Anil Walji and Thomas Gest, as well as many members of the current consulting editor team.

Overall global changes to all sections of the *Atlas* include re-organization of plate order to more accurately reflect the current practice of teaching anatomy; reduction of labeling of some images; and removal of dated clinical plates. The flow of images in each section is now oriented from superficial to deep layers. In the upper and lower limb sections, the images have been changed to reflect the orientation common for imaging anatomy. In addition, many plates throughout the book have been updated to improve the artwork for a more contemporary view of anatomic aspects. We hope you enjoy this new edition of the *Atlas of Human Anatomy* and that you find it useful for learning and for your career.

About the Online versions:

For the standard edition and enhanced international edition of the *Atlas*, we have included access to the website www.studentconsult.com. From student and faculty feedback, we learned that the inclusion of Netter: *Atlas of Human Anatomy* in Student Consult would further enrich this excellent site. Many of the tools that were available on www.Netteranatomy.com are now available on Student Consult, and there are extra features as well. In addition to the 80+ images from the print *Atlas*, there are over 250 clinical images that the Consulting Editors have added to the site, including many Netter clinical images. These images are clinical and radiologic images showing both normal anatomy and pathologic conditions. The Integration Links from Netter on Student Consult are expanded and enable the user to link to the major brands and products on this site that students and faculty love. Also on Student Consult are videos created from Interact Elsevier, *Netter's 3D Interactive Anatomy* product, and the Interactive Dissection Modules from the University of North Carolina, Chapel Hill. Additional online resources such as radiologic images, videos from UNC Dissection Modules, and many other resources are indicated by the symbol . The symbol  indicates videos from *Netter's 3D Interactive Anatomy*.

For the Professional edition of the *Atlas*, the online resource is through www.netterreference.com, the site for clinical Netter products. The *Atlas* online will have 80+ Netter images and the clinical images, as well as videos from *Netter's 3D Interactive Anatomy*. This site will be the jumping-off point for the new version of the Netter Presenter, which allows users to create custom Netter images.

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Noelle A. Granger, PhD
John T. Hansen, PhD
R. Shane Tubbs, MS, PA-C, PhD



Frank H. Netter, MD

Photograph by James L. Clayton

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 also, more important, 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.

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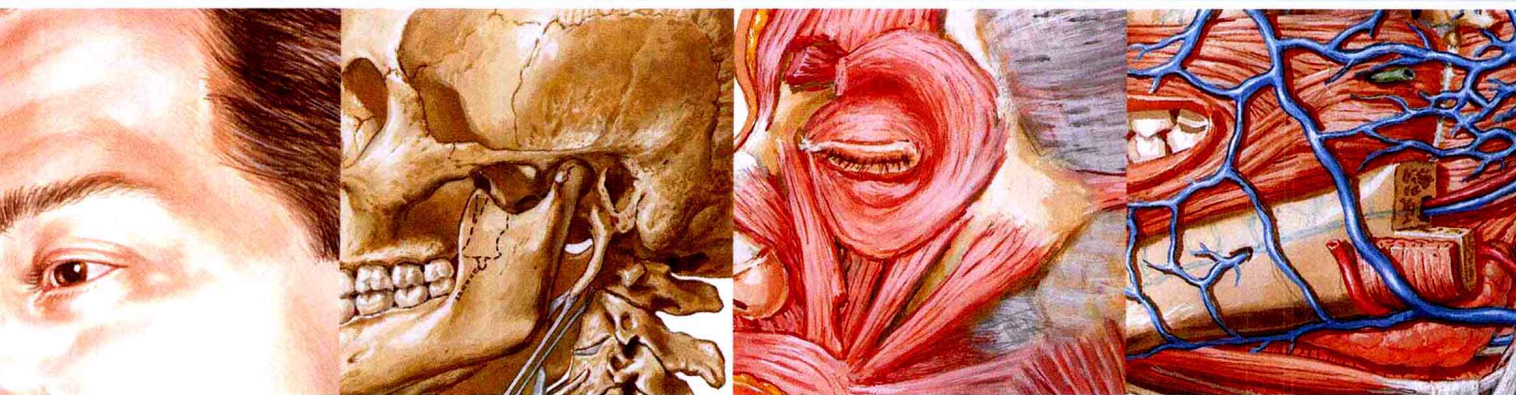
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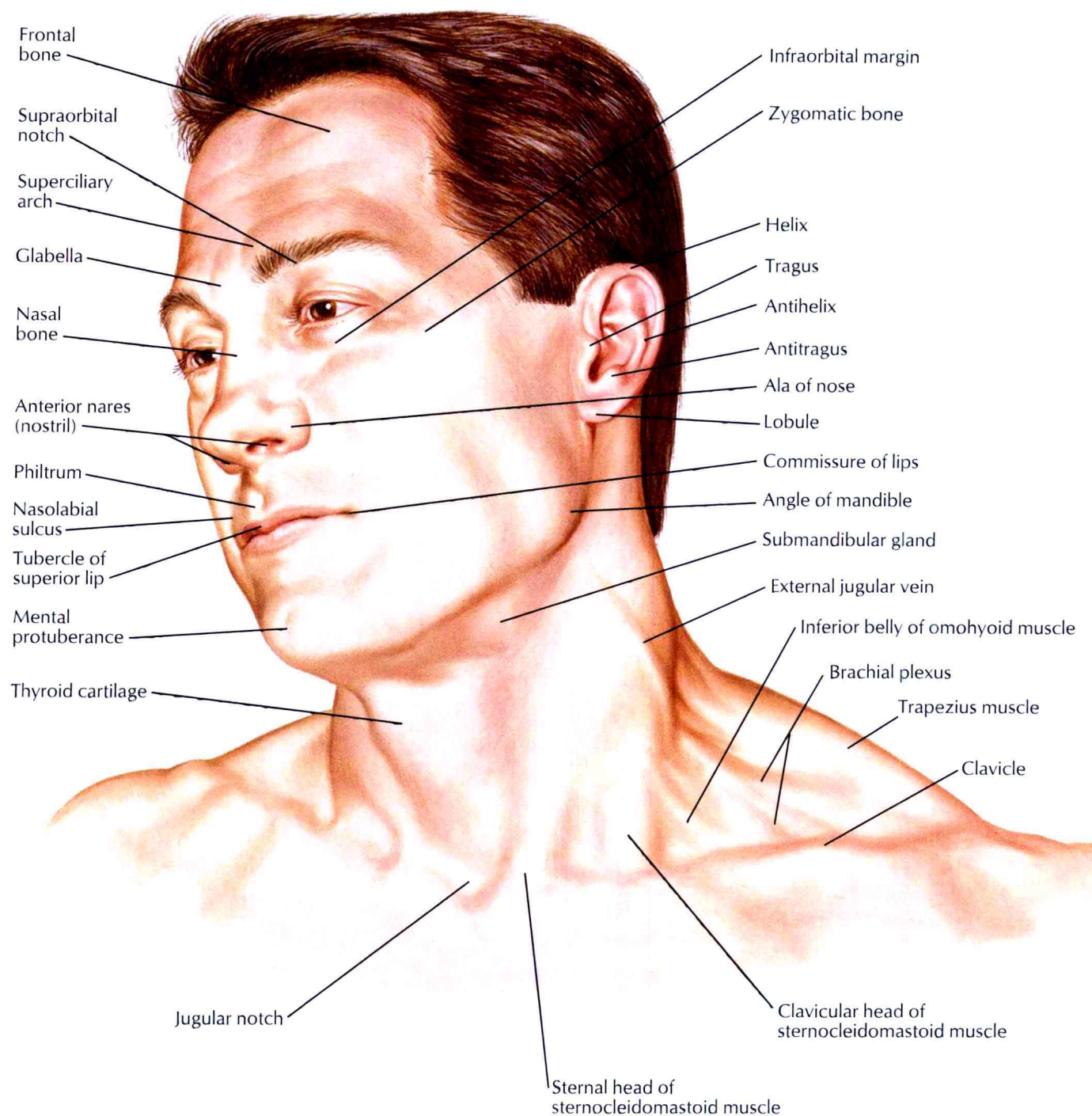
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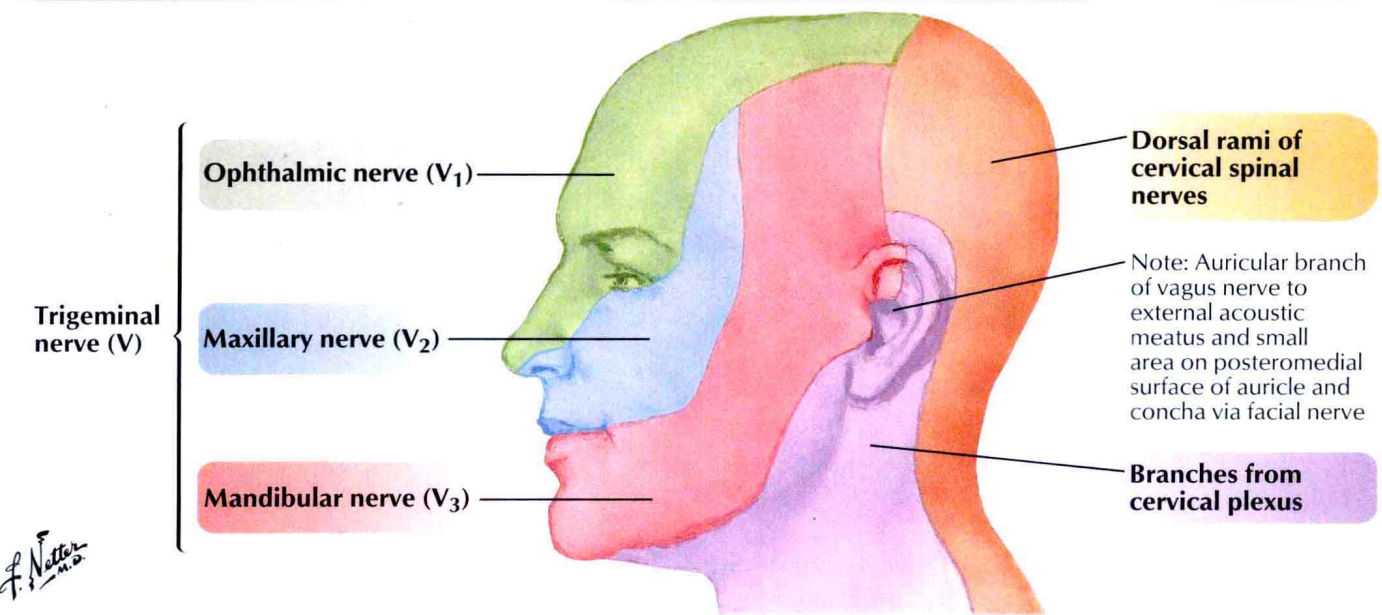
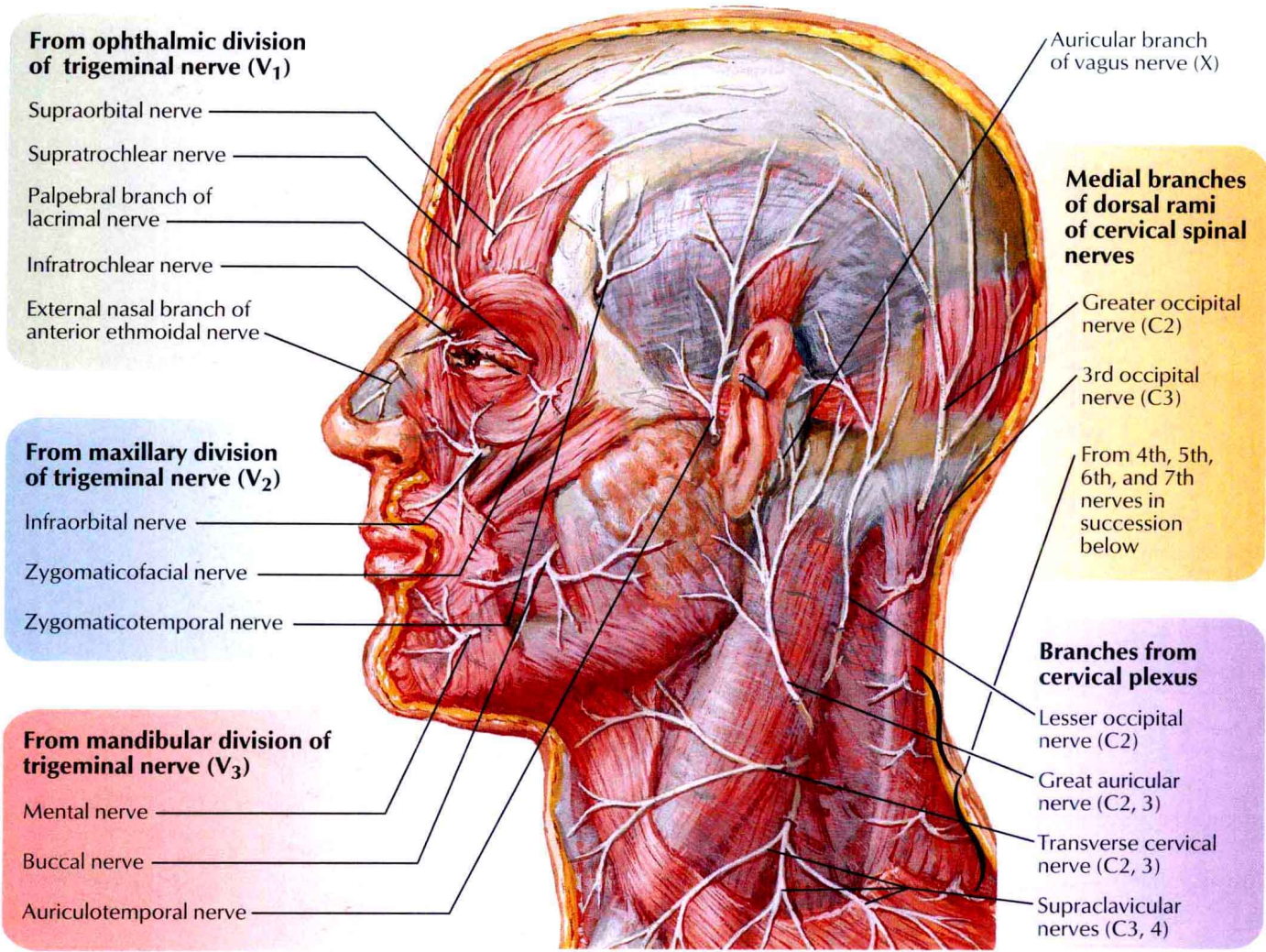
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C. Machado
—H.S.

Cutaneous Nerves of Head and Neck

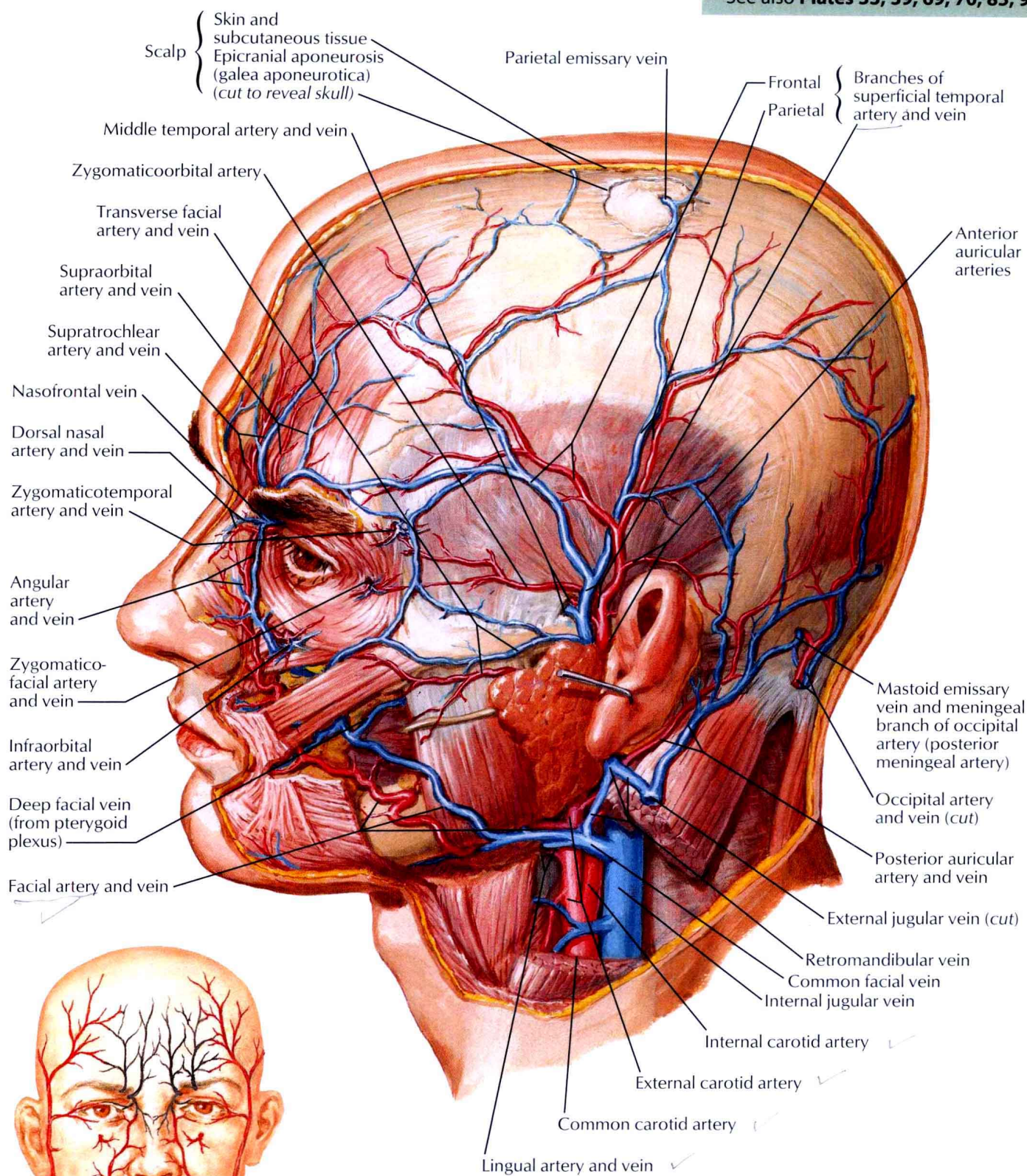
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F. Netter M.D.

Superficial Arteries and Veins of Face and Scalp

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Sources of arterial supply of face

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

F. Netter M.D.