

GULYA AND SCHUKNECHT'S
**ANATOMY OF THE
TEMPORAL BONE WITH
SURGICAL IMPLICATIONS**

THIRD EDITION



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Aina Julianna Gulya
*The George Washington University
Washington, DC, USA*

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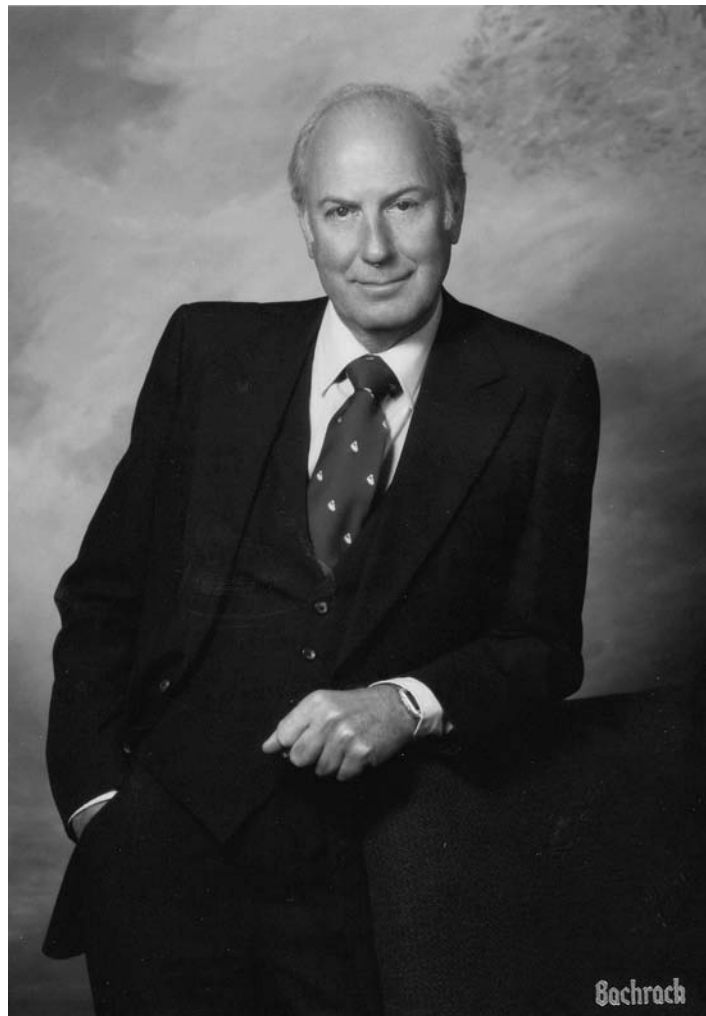
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To the memory of my mentor, colleague, and friend—
Harold Frederick Schuknecht, M.D.
February 10, 1917–October 19, 1996



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Preface to the Third Edition

More than 20 years have passed since the publication of the first edition and over 10 years since the publication of the second edition of *Anatomy of the Temporal Bone with Surgical Implications*. In that time there has been some evolution in our understanding of the normal and anomalous anatomy of the human temporal bone, most notably the recognition of the anomaly referred to as dehiscence of the superior semicircular canal. However, and more relevant to the decision to publish this third edition, are the remarkable changes in information acquisition, storage, and retrieval propelled by modern technology.

Accordingly, although there is little substantive change in the text, this edition strives to take advantage of digitization of information to make it a more useful teaching tool. In particular, the teaching slide set that was created as a companion to the first edition is included in a digital version in the accompanying CD-ROM. Similarly, the somewhat cumbersome three-dimensional reels have been supplanted by digital image pairs intended to be visualized on a monitor. With a little practice, most individuals can “see” the depth of the images.

This book has been designed as a companion volume to *Pathology of the Ear*, second edition (Schuknecht, 1993) and *Surgery of the Ear and Temporal Bone*, third edition (Nadol and McKenna, 2005).

As stated in the preface to the preceding editions of this book, the goal of the authors was to assist in the acquisition of a sophisticated, three-dimensional understanding of the intricate anatomy of the human temporal bone by providing a practical compendium on basic surgical anatomy written for clinicians by clinicians. Sadly, the senior author is now deceased. Nonetheless, the goal remains the same, and I believe that were he here, Dr. Schuknecht would agree that this third edition continues to achieve our goal.

Aina Julianna Gulya

Preface from the Second Edition

The human temporal bone collection at the Massachusetts Eye and Ear Infirmary, comprising 1518 specimens from 862 individuals, most of whom had otologic disorders, served as the primary resource for the material contained in this book. The senior author, in the course of a 30-year career of correlating pathological findings with clinical manifestations through light microscopic study of serially sectioned temporal bones, systematically accumulated photomicrographs depicting various aspects of normal anatomy. As an otolaryngology resident in training, the junior author, frustrated with available anatomy texts, sought to develop a resident teaching manual. With the encouragement and collaboration of the senior author, the manual grew to the current text, which includes some 350 selected photomicrographs as well as sets of horizontally and vertically serially sectioned specimens, depicting normal and variant anatomy of the human temporal bone. Chapter 9 includes 40 photomicrographs of fetal (from two months' gestation) and newborn temporal bones and is designed to review development in an easily assimilated manner. Recognizing that modern otologic/neurotologic surgery demands a three-dimensional conceptualization of the temporal bone, three-dimensional stereo reels are included. Through these stereo reels, each with an accompanying labeled, two-dimensional photograph, the reader can explore the celloidin-embedded temporal bone undergoing horizontal serial sectioning, study a variety of pathological conditions, view surgical cases, and complete a temporal bone dissection.

New to this second edition are color photographs of the macroscopic human temporal bone, and an expansion of the descriptive text accompanying the temporal bone dissection series.

This book is meant to serve as a companion to the books *Pathology of the Ear*, second edition (Schuknecht, 1993) and *Surgery of the Ear and Temporal Bone* (Nadol and Schuknecht, 1993). Expansion of the frontiers of temporal bone surgery, as manifested in the growth of neurotologic skull base surgery, has increased the importance of acquiring a sophisticated understanding of the intricate anatomy of the temporal bone to anyone contemplating invasive therapeutic procedures. We believe that this book, as a practical compendium on basic surgical anatomy written for clinicians by clinicians, will facilitate the acquisition of such knowledge.

Aina Julianna Gulya

Harold F. Schuknecht

Preface from the First Edition

The principal source of material for this book is the human temporal bone collection housed at the Massachusetts Eye and Ear Infirmary. The collection consists of 1500 temporal bones from 850 subjects, most of whom had otologic disorders. The specimens were prepared for light microscopic study by fixation, decalcification, embedding in celloidin, and serial sectioning at a thickness of 20 μ , with every tenth section stained and mounted on glass slides. The primary purpose for collecting these temporal bones was to study the pathologic basis of ear disease. The extent to which this objective was realized is evidenced in a book entitled *Pathology of the Ear* (Schuknecht, 1974). The temporal bone collection also provides numerous examples of normal anatomy and its variations, which provides the basis for this book on anatomy and its surgical implications. It is meant to be a practical compendium written by clinicians for clinicians. As such, it contains a minimum of cellular and ultrastructural detail, which would have little relevance to the practicing otologist. It is meant to complement the excellent books *Surgical and Microscopic Anatomy of the Temporal Bone* (Wolff, Bellucci, and Eggston, 1971) and *Surgical Anatomy of the Temporal Bone* (Anson and Donaldson, 1981).

The sequence of presentation of the material begins with Chapter 1 showing low-power photomicrographs of serial sections in horizontal and vertical planes. Chapters 2 through 7 present selected views in the following sequence: pinna and external canal, middle ear, pneumatization, inner ear, neuroanatomy and vascular anatomy.

Photomicrographs present a two-dimensional display of anatomy in a single plane which leads to an appreciation, although somewhat imperfect, of the size and spatial relationships of these structures. Realizing that we live in a three-dimensional world and that the temporal bone is a three-dimensional structure, part of Chapter 1 and all of Chapter 8 have been devoted to stereoscopic anatomy. The photographs were made with a Donaldson camera (designed by Dr. David Donaldson, ophthalmologist at the Massachusetts Eye and Ear Infirmary and Harvard Medical School). These color stereoscopic transparencies are mounted into View-Master® reels (Sawyer's Inc., Portland, Oregon) and can be viewed with the View-Master three-dimensional viewer that can be purchased at department and toy stores. To assist in orientation of anatomic structures, the book contains labeled photographs matching each of the stereo views.

Chapter 1 features two reels (14 views) of partially sectioned temporal bones in celloidin blocks that expose to view the intimate anatomy of the middle and inner ears. Chapter 8 provides a set of four reels (28 views) showing a method of progressive dissection of the fresh temporal bone, as well as one (seven views) of pathologic anatomy, and two (14 views) of otologic surgery.

Congenital anomalies of the ear are often the result of faulty or arrested development and present in recurring patterns of dysplasia which are best

understood by a knowledge of the normal embryologic process. With this in mind we present in Chapter 9 a series of photomicrographs from three embryos of progressive gestational ages.

The appendices present a glossary of terms and a history of anatomic discoveries of the ear. We had originally hoped that the history section could be brought up-to-date. However, the recent contributors to ear morphology have been so numerous and the assessment of relative importance to new knowledge so difficult to judge that we are limiting the presentation to those who are deceased, leaving to subsequent generations the task of pinpointing the principal contributors of our time.

Finally, we are making available a set of 163 selected color, 35-mm paper-mounted transparencies, each of which matches a photomicrograph in the book. This teaching set should be useful in augmenting lectures in both the basic and clinical sciences.

We are grateful to the histologic technicians, especially Diane DeLeo Jones, Barbara Burgess, Richard Cortese, and Clarinda Northrop DuBois, who have provided such technically excellent temporal bone sections. We appreciate the superb quality of the photomicrographs prepared by Arthur Bowden. To Carol Ota and Linda Joyce we are especially grateful for preparation and editing of the manuscript as well as mounting and labeling of photomicrographs. Others who contributed significantly to editing and preparation were Eileen Nims, Cheryl Hurley, Anne Schuknecht, and Tomomi Kimura; we thank them. Finally, we are indebted to the publishing house of Lea & Febiger, and especially to R. Kenneth Bussy, for their willingness to publish a book with so many illustrations as well as View-Master reels and slide sets.

Otology is both a medical and surgical specialty. The anatomy is complex with many important structures sequestered deeply in bone. A sophisticated knowledge of anatomy is necessary if invasive therapeutic procedures are to be performed safely. We believe this book will serve that end.

Harold F. Schuknecht

Aina Julianna Gulya

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Many thanks to Joseph B. Nadol, Carol Y. Ota, and Bob Galla who helped resurrect this phoenix from its ashes. Also much gratitude to those who contributed their talents to the previous editions, including Anne Schuknecht, Eileen Nims, Linda Joyce, Diane DeLeo Jones, Barbara Burgess, Richard Cortese, Clarinda Northrop Dubois, Arthur Bowden, Cheryl Hurley, and Tomomi Kimura. R. Kenneth Bussey (Lea & Febiger) and Nat Russo (The Parthenon Publishing Group) played important roles in the publication of the previous editions of the book, and a debt of gratitude is owed them, as well as Geoffrey Greenwood, Alyssa Fried, and Sherri Niziolek (Informa Healthcare, USA) who worked on this third edition. Many loving thanks to my parents, Sylvia and Aladar Gulya, for all their encouragement and support. And last, but certainly not least, words cannot adequately describe all I owe my husband, William R. Wilson, for his many years of faithful love and support.

This book represents the accumulated experience and observations of the authors (and their clinical and research associates) in a single volume. As a result, numerous illustrations were previously published in several journals and books.

The authors are grateful to these publishers for permission to use illustrations that have appeared previously as indicated below. (The corresponding figure number in this book is set in parentheses, double-numbered with chapter and figure number.)

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 85:1730, 1975—Figure 4 (Figure 3.113)
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LITTLE, BROWN AND COMPANY

Stapedectomy, Schuknecht, 1971
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