
ATLAS OF EAR SURGERY

Andrew W. Miglets, M.D.

Michael M. Paparella, M.D.

William H. Saunders, M.D.

FOURTH EDITION

05483
R764.9-64
M634N04

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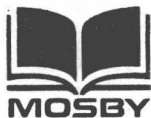


With 207 plates of illustrations

Illustrations by *Beverly A. Etter* and *Nancy Sally*

THE C. V. MOSBY COMPANY

ST. LOUIS • TORONTO • PRINCETON 1986



A TRADITION OF PUBLISHING EXCELLENCE

Editor: Carol Trumbold

Assistant editor: Anne Gunter

Manuscript editors: Pat Milstein, Suzanne Seeley

Production: Suzanne Seeley, Susan Trail

Cover art was redrawn by Susan E. Lane from
Leonardo da Vinci: Anatomical Drawings
from the Royal Library, Windsor Castle,
The Metropolitan Museum of Art, 1983.

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Previous editions copyrighted 1968, 1971, 1980

Printed in the United States of America

The C.V. Mosby Company

11830 Westline Industrial Drive, St. Louis, Missouri 63146

Library of Congress Cataloging-in-Publication Data

Saunders, William H., 1920-

Atlas of ear surgery.

Bibliography: p.

Includes index.

1. Ear—Surgery—Atlases. I. Miglets, Andrew W.,
1934- . II. Paparella, Michael M. III. Title.
[DNLM: 1. Ear—surgery—atlases. WV 17 S257a]
RF126.S28 1986 617.8'059 85-25950
ISBN 0-8016-4319-8

VT/MV/MV 9 8 7 6 5 4 3 2 1 01/A/034

PREFACE

This book is intended to serve primarily as an illustrative guide for residents and graduates in otolaryngology who wish a reference on techniques of otologic surgery. It will also serve as a convenient reference for other physicians and colleagues interested in the current status of otologic surgery.

We have not considered it within our purview to discuss diagnosis of otologic diseases or indications for surgery; thus this text may well be used in conjunction with other references.

Although bibliographies are omitted except for Chapter 1, we recognize our debt to the many otologists who have given us advice and encouragement during the preparation of this volume. We wish to acknowledge the work of medical illustrators Beverly A. Etter, Rosalind Hagerman, and Nancy Sally.

**Andrew W. Miglets
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William H. Saunders**

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Chapter 1

CHRONOLOGIC OUTLINE OF THE DEVELOPMENT OF OTOLOGY

E. Arthur Bolz, M.D.

500 BC	Alcmaeon	Discovered otopharyngeal (eustachian) tube. (Quoted from Jonathan Wright, 1898.)
450	Empedocles	Knew sounds were vibrations, movements in air reaching ear. However, he knew only of tympanic membrane and cavity beyond it.
400	Hippocrates	First to inspect tympanic membrane and recognize it as part of organ of hearing. He clearly described acute otitis.
350	Aristotle	Mentioned cochlea as being inner counterpart of outer ear.
50 AD	Aurelius	Described otitis and foreign bodies in ear and discussed reconstruction of pinna and surgery for canal stenosis.
200	Galen	Noted auditory nerves leading to brain but thought they terminated in middle ear cavity. He first applied term <i>labyrinth</i> to inner ear. He advocated that "carious bone should be removed after making incision behind ear," but there is no evidence that he performed procedure.
690	Paul of Aegina	Described treatment of ear and stated that congenital deafness is incurable.
1350	Guy de Chauliac	First to use ear speculum.
1494	Niccole	Employed silver and iron tubes as hearing aids.
1512	Achillini	Credited with discovery of incus and is thought to have discovered malleus.
1514	Berengario da Carpi	Mentioned malleus and incus in literature and so knew of their existence.
1543	Vesalius	Gave first accurate description of malleus and incus.
1546	Ingrassia	Discovered and named stapes, described oval and round windows, and discovered bone conduction of sound.
1550	Fallopian	Named cochlea, tympanum, chorda tympani, and auditory nerve. He described facial canal, which now bears his name, as aqueduct. He carefully described ossicles and their articulations and distinguished two principal divisions of inner ear.

- 1562 Eustachius** Wrote *Epistola de Auditus Organis*, first book exclusively about the ear. Although otopharyngeal tube was known to Greeks and mentioned in writings of Aristotle, Eustachius described its structure, course, and relations accurately, and it now bears his name. He also described tensor tympani muscle and stapes.
- 1572 Coiter** Wrote *De Auditus Instrumento*, first textbook of anatomy and physiology of ear. He traced sound vibrations from external auditory meatus through tympanic membrane to vestibule and cochlea.
- 1575 Varolius** Described accurately stapedius muscle.
- 1584 Ponce de Leon** Pioneered instruction of deaf mutes.
- 1584 Mercuriali** Wrote first clinical manual of otology.
- 1600 Casserio** Gave one of earliest descriptions of ear, including three and one-half turns of cochlea.
- 1648 Kircher** Described ear trumpet.
- 1649 Riolanus** Performed mastoidectomy to relieve eustachian tube blockage and tinnitus.
- 1672 Willis** Described paracusis and recognized division of cochlea.
- 1683 Duverney** Called "father of otology," according to some. As anatomist, he was first to show that mastoid air cells communicated with tympanic cavity. As physiologist, he corrected belief that eustachian tube was avenue of breathing or hearing and stated that it was simply channel through which air of tympanum was renewed. He was first to suggest that different pitches were perceived in different areas of cochlea. As pathologist, he established that pus drainage from ear did not necessarily represent overflow from brain. As author, he published first monograph on otology and wrote *Traite de L'orange de Louie*, describing tensing of tympanic membrane by muscles that he thought tuned in various pitches. He noted that sound could be transmitted by air in middle ear and noted that this route was inferior to ossicular transmission.

1691	Rivinus	Described notch in bony tympanic ring that now bears his name.
1704	Valsalva	Wrote <i>De Aure Humana</i> , describing anatomy as seen in over 1000 temporal-bone dissections. He distinguished areas of ear as outer, middle, and inner and named scala vestibuli and scala tympani. He described muscles of pinna, auditory nerve, and ankylosis of stapes. He first rationalized treatment in otology and put maneuver bearing his name on rational basis, first advocating it for expelling pus in otitis, later for replenishing air in middle ear when eustachian tube was obstructed. He noted relationship of preauricular lymph node to surrounding tissues and its significance. He clearly described incisura of external ear.
1711	Shore	Invented tuning fork.
1724	Guyot	Postmaster in Paris who invented eustachian catheter and used it transorally to relieve his own deafness.
1736	Petit	Performed first successful operation for mastoiditis.
1736	Morgagni	First to recognize otitis as cause of brain abscess rather than brain abscess as causing otitis.
1741	Cleland	Used eustachian catheter through nose.
1760	Eli	Performed first myringotomy in attempt to relieve deafness.
1760	Cotunnus	Credited with discovering labyrinthine fluids (although they were described by Pyl in 1742) and vestibular aqueduct (aqueduct of Cotunnus). He correctly described fibers of basilar membrane as being longest at apex and shortest at base, making his theory of hearing the first of its kind, similar to that of Helmholtz and almost in accordance with modern teaching. He was first to maintain that only fluid is present in cochlear space and also theorized that basilar membrane is auditory receptor made up of series of vibrating strings of different lengths.
1768	Morand	First to successfully treat by surgery brain abscess secondary to otitis.
1774	Meckel	Proved that only fluid is in cochlear space by exposing temporal bones to freezing temperatures and showing labyrinth filled with ice on dissection.

- 1783 Braidwood** Founded first British school for deaf mutes.
- 1789 Scarpa** Discovered membranous labyrinth and showed that round window is capable of acting as secondary tympanic membrane. Also, his name is applied to ganglion of vestibular division of eighth nerve.
- 1791 Baron von Berger** Court physician who died from mastoidectomy, putting operation into disrepute.
- 1801 Cooper** Advised paracentesis of tympanic membrane for cases of deafness arising from blocked eustachian tube. He described deafness resulting from obstruction of auditory nerve.
- 1806 Saunders** First to advise performing myringotomy for acute otitis, syringing suppurating ear with zinc sulfate, and attempting to suppress purulent discharge rather than to favor it.
- 1807 Bozzini** Devised aural speculum provided with mirror reflectors and illumination.
- 1814 Blainville** Described congenital asymmetry of two ears (Blainville ears).
- 1818 Jacobson** Described tympanic nerve and plexus and nerves supplying tympanum.
- 1821 Itard** One of first surgeons to specialize in otology and wrote excellent text.
- 1824 Flourens** By observing peculiar head movements of animals after sectioning their semicircular canals, he first deduced role of canals in maintenance of equilibrium and coordination. He described cochlear and vestibular parts of eighth nerve and correctly identified their function.
- 1828 Buchanan** Made detailed measurements of pinna, external meatus, and tympanic membrane.
- 1828 Arnold** Described otic ganglion (Arnold's ganglion), which sends fibers to tympanic muscles.
- 1829 Saissy** Invented and was first to use bougie for eustachian tube.
- 1832 Shrapnell** Noted local differences in tympanic membrane and described portion (pars flaccida) now bearing his name.

- 1834 Huguier** Described canal (Huguier's canal) in temporal bone, which serves as passage for chorda tympani nerve.
- 1834 Breschet** Introduced term *helicotrema* to designate structure in cochlea.
- 1835 Huschke** With microscope, saw limbus and outward extension as vestibular lip, and distinguished these parts from bony spiral lamina.
- 1837 Müller** Noted difference between acoustic properties of air and water and need for transformer mechanism to convert air vibrations of high amplitude and low pressure to liquid vibrations of low amplitude and high pressure.
- 1838 Henle** Described suprameatal spine (spine of Henle), extending from temporal bone behind auditory meatus.
- 1841 Savort** Demonstrated conclusively that sound is conducted directly to tympanic membrane by air, not through skull bones.
- 1841 Hofmann** Designed first otologic head mirror for drumhead illumination.
- 1850 Yearsley** First to practice as ear, nose, and throat specialist. He founded Metropolitan Ear, Nose & Throat Hospital in London, first of its kind. He was first to excise tissue blocking pharyngeal orifice of eustachian tube and to patch perforations of drum, using cotton-wool pellet.
- 1851 Corti** Described tectorial membrane, basilar membrane, hair cells, and supporting structures (organ of Corti).
- 1851 Reissner** Discovered membrane dividing cochlear duct and vestibule (bearing his name) and described membranous canal of cochlea (bearing his name).
- 1853 Wilde** Wrote medical classic *Practical Observations on Aural Surgery and the Nature and Treatment of Diseases of the Ear*. He recommended incision of mastoid down through periosteum in fluctuant mastoiditis; Wilde's incision survives today. He invented angled shaft on aural instruments. As result of his publicizing ear diseases and thereby fostering growth of otology as specialty, he is known as "father of modern otology."

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|-------------|---------------------|--|
| 1855 | Rinne | Described tuning fork test that bears his name. |
| 1857 | Morel | Described deformed ear (Morel ear), which is degenerate in nature and marked by partial obliteration of folds, thin edge, and general prominence. |
| 1858 | Schultze | First to describe nerve endings in labyrinth. |
| 1860 | Toynbee | First to systematically dissect temporal bones (2000) and correlate pathology with clinical history. Disproved belief that stricture of eustachian tube was common affliction, noting that tube was normally closed and opened only during yawning and swallowing. Described 10 osteomas, numerous cholesteatomas, calling them <i>molluscosus</i> tumors, and fistula of lateral canal and was one of first to describe otosclerosis (160 cases). Invented successful artificial drumhead made of gutta-percha disc mounted on silver wire. While trying to treat his own tinnitus experimentally by inhaling chloroform and performing Valsalva maneuver, he died. |
| 1860 | von Tröltsch | Credited with devising first modern otoscope. |
| 1860 | Woolner | Described apex of helix of ear, known as <i>Woolner's tip</i> . |
| 1861 | Meniere | Established that vertigo is affection of internal ear and accurately described symptom complex that bears his name. |
| 1862 | Turnbull | Performed first mastoidectomy in United States. |
| 1863 | Hinton | Noted that aural polyps did not arise from external meatus, but could grow through perforation in tympanic membrane. He showed how molluscosus tumors can cause death by eroding bone and allowing infection to spread to brain. He advised early myringotomy in cases of acute suppuration within tympanum. Hinton was first in Great Britain to perform simple mastoidectomy. |
| 1864 | Siegle | Introduced pneumatic otoscope. |
| 1865 | Deiters | Described gray matter in floor of fourth ventricle, which is origin of median root of auditory nerve. |
| 1866 | Bell | Attempted to transmit speech to his deaf wife and, in so doing, invented telephone, which led to development of early audiometers. |

- 1867 Prussak** Described membranous pouch, which bears his name, in attic of middle ear.
- 1868 Böttcher** Described dark polyhedral cells (Böttcher's cells) on basilar membrane between it and cells of Claudius.
- 1869 Helmholtz** Correctly theorized that different frequencies of sound stimulate different regions of cochlea; correctly placed site of low-frequency stimulation in apex and high in base but attributed phenomenon incorrectly to resonance. He described transformer mechanism of middle ear structures, including lever action of drumhead and ossicles and hydraulic action of large tympanic membrane acting on small stapedial footplate.
- 1870 Lucae** First to evaluate transmission of sounds through cranial bones as aid in diagnosis of ear diseases.
- 1870 Goltz** Described physiologic significance of semicircular canals.
- 1871 Knapp** Suggested that Meniere's disease and glaucoma might be similar entities.
- 1873 Schwartze** Established indications and method of simple mastoidectomy. Put paracentesis on a rational basis. He described faint pink blush that occurs on promontory in otosclerosis, which bears his name.
- 1874 Charcot** Completed description of aural vertigo syndrome of Meniere.
- 1874 Brewer** Noted that rotation of animals caused same head movements as Flourens had noted, correlated these movements with ocular nystagmus in man, and was first to demonstrate that nystagmus was labyrinthine reflex.
- 1874 Brown** Suggested that semicircular canals were associated with position sense.
- 1876 Roosa** First to mention promotion of healing of tympanic membrane perforations by silver nitrate cautery.
- 1877 Bezold** Gave first clear description of mastoiditis.
- 1878 Hartmann** Devised first audiometer utilizing electric current.

- 1878 Berthold** Performed first myringoplasties. He removed epithelium with court plaster and grafted skin.
- 1878 Kessel** First employed endaural approach to temporal bone. He described first radical mastoidectomy, using endaural approach, in 1885. In 1878 he performed stapes extraction, but because of infection, switched to stapes mobilization. He described sound projection of round window in 1879, using remnants of drum membrane. Later, in 1885, he reported hearing improvements by adhesion of drum membrane to head of stapes.
- 1881 von Tröltsch** Named otosclerosis, thinking stapes fixation was caused by sclerosing changes in tympanic mucosa. He devised modification of Schwartze's simple mastoidectomy, which included essentials of modern radical mastoidectomy.
- 1883 Kiesselbach** Performed first operation for congenital meatal atresia.
- 1885 Schwabach** Criticized tuning fork tests of Weber and Rinne and proposed one that bears his name.
- 1886 Mott** Studied propagation of auditory impulses and demonstrated that projection from each ear is bilateral.
- 1887 Blake** Introduced use of paper patch for tympanic membrane perforations.
- 1888 Boucheron** Mobilized 60 stapes.
- 1889 von Bergmann** Gave radical mastoidectomy its name.
- 1889 Stacke** Developed operation of ossicle excision.
- 1889 Küster** Enumerated steps on which radical mastoidectomy operation is based, defined indications, and also advocated removal of posterior osseous meatal wall to gain access to more areas of chronic disease.
- 1890 Zaufal** Described Küster's technique in detail. Zaufal's name is most often associated with the operation.
- 1890 Rosenthal** Described spiral tube (Rosenthal's canal) that turns about modiolus of cochlea.