

A synopsis of
Otolaryngology

John Groves FRCS

Roger F. Gray FRCS

04151
R76

E10-4

(2)

A synopsis of
Otolaryngology

John Groves FRCS

Consultant Surgeon, Ear, Nose and Throat Department
Royal Free Hospital, London

Roger F. Gray FRCS

Consultant Ear, Nose and Throat Surgeon
Addenbrooke's Hospital, Cambridge

In collaboration with

David Downton FDS RCS

Senior Consultant Oral Surgeon,
Royal Free Hospital, London

Joseph N. Blau MD FRCP

Consultant Neurologist to The National Hospitals
for Nervous Diseases, Queen Square and Maudsley,
London, The Royal National Throat, Nose and Ear Hospital,
London and Northwick Park Hospital, Harrow, Middlesex

Fourth edition

WRIGHT
1985 Bristol

© John Wright & Sons Ltd. 1985

All Rights Reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without the prior permission of the Copyright owner.

Published by
John Wright & Sons Ltd, Techno House, Redcliffe Way,
Bristol BS1 6NX, England.

First edition, 1957

Second edition, 1967

Third edition, 1978

Fourth edition, 1985

British Library Cataloguing in Publication Data

Groves, John

A synopsis of otolaryngology.—4th ed.

1. Otolaryngology

I. Title II. Gray, Roger F. III. Ballantyne, John.

Synopsis of otolaryngology

616.2'2 RF46

ISBN 0 7236 0772 9

Typeset by
Activity Ltd, Salisbury, Wiltshire

Printed in Great Britain by
John Wright & Sons (Printing) Ltd, at The Stonebridge Press,
Bristol BS4 5NU.

Preface to the Fourth Edition

Developments in otolaryngology since the last edition have made a thorough revision very necessary. We are seeing a broadening of the specialty to embrace on a larger scale than even ten years ago the surgery of the head and neck (including plastic surgery), the surgery of the skull base, and the functional and pathological investigation of the eighth and seventh cranial nerves made possible by the exploitation of today's electronic revolution. Fibre-optic endoscopy and computerized tomography have brought new precision in diagnosis, to a degree that their availability in E.N.T. practice is (or ought to be) taken for granted. With all these good new things, the original concept of the book remains unchanged — to provide a quick reference for portable study, and a synoptic account of the specialty for postgraduate examination revision work. We hope that the new style of print and presentation will please.

Those familiar with earlier editions will miss the greatly cherished names of John Ballantyne and Harold Edwards, who after more than twenty years since the first edition have now retired from active hospital practice and the toils of authorship. We thank them on behalf of generations of trainees in otolaryngology for the high standards they set us all in this work. Mr David Downton has again revised all those sections relating to the mouth and to oral surgery, and he is now the sole remaining contributor from the first edition. Dr J. N. Blau has undertaken with great cheerfulness and enthusiasm the revision of the section 'Neurology of the Ear, Nose and Throat' and we are grateful to him. We wish to thank equally warmly those many friends and colleagues who have given their time and expert help with particular topics. These include Dr David Skeggs, Consultant Radiotherapist, Mr Kenneth Lindsay, Consultant Neurosurgeon, and Dr Stewart Clarke, Consultant Physician in Thoracic Medicine, all of the Royal Free Hospital. Our especial gratitude goes to Mr Maurice Hawthorne (now Senior E.N.T. Registrar, Bristol Royal Infirmary) for his tireless and constructively critical efforts in the earlier stages of the work. Many of the important changes are due to him.

JG RFG

Preface to the First Edition

We hope that this book will prove to be a useful addition to the 'Synopsis' series. It is intended for quick reference and revision, especially by those who are studying for postgraduate examinations in the specialty.

Much material has inevitably been drawn from the current standard textbooks and journals dealing with the subject. In this respect we wish particularly to acknowledge the liberal help we have obtained from the book by the late Sir StClair Thomson and Sir Victor Negus, and from those edited by Mr Maxwell Ellis, Mr W. G. Scott-Brown, and Mr F. W. Watkyn-Thomas. Many other sources have been consulted, including original articles in the *Journal of Laryngology and Otology*, the *Archives of Otolaryngology* of the American Medical Association, and the *Annals of Otology, Rhinology and Laryngology*.

The principles of operative procedures are stated but the details of technique are not considered to lie within the compass of such a book. So rapidly have chemotherapy and the antibiotics developed in the past few years that we have thought it wise, in many instances, to use a generic term — Systemic Disinfection — when such drugs are indicated.

We feel that the association between neurology and diseases of the ear, nose, and throat deserves special attention, and for this reason a section on the subject has been incorporated. We thank Dr Charles Harold Edwards for his valued collaboration in writing this section. Conversely, we have reduced the chapters on the trachea and bronchi to a minimum, as this subject is being increasingly absorbed by the rapidly-expanding specialty of Thoracic Surgery.

We are much indebted to Mrs Murray Laing, who has produced many of the illustrations and whose skill and advice in this respect have been much appreciated. Mr John Groves, Senior Registrar to the Ear, Nose and Throat Department of St Mary's Hospital, has rendered great assistance by reading the early drafts, and we have gladly taken advantage of his many pertinent criticisms and suggestions. He has also drawn a considerable number of the illustrations. He has our most sincere thanks.

We wish to thank Mr Henry J. Shaw, Assistant Director to the Professorial Unit at the Institute of Laryngology and Otology, London, W.C.1, for cheerfully undertaking the labour of correcting the final proofs.

Finally, we should like to record the friendly co-operation and help that we have received from Mr L. G. Owens, BSc, Director of the firm of John Wright & Sons Ltd, throughout the preparation of this volume.

JFS IGR JCB

Contents

Part 1 THE EAR

Chapter	Section 1. SURGICAL ANATOMY	
1	Development of the ear	3
2	Development of the temporal bone	5
3	Anatomy of the ear	7
4	Physical examination of the ear	26
5	Radiographic examination of the temporal bone	27
6	Anatomical principles of temporal bone surgery	31
	Section 2. AUDIOLOGY	
7	Physical properties of sound	37
8	Physiology of hearing	38
9	Functional examination of hearing	45
10	Hearing aids	60
	Section 3. EQUILIBRIUM	
11	Physiology of the vestibular labyrinth	65
12	Functional examination of the labyrinth	66
	Section 4. DISEASES OF THE EXTERNAL EAR	
13	Congenital malformations	71
14	Injuries	72
15	Otitis externa	73
16	Neoplasms of external ear	81
17	Miscellaneous conditions of the external ear	83
	Section 5. DISEASES OF THE MIDDLE EAR CLEFT	
18	Congenital malformations	85
19	Injuries	87
20	Otitis media	91
21	Neoplasms of the middle ear cleft	109
	Section 6. DISEASES OF THE OTIC CAPSULE	
22	Otosclerosis	113
23	Miscellaneous conditions of the otic capsule	116
	Section 7. DISEASES OF THE INNER EAR	
24	Congenital deafness	119
25	Trauma	122
26	Inflammatory conditions	128
27	Miscellaneous conditions of the inner ear	133

Part 2 THE NOSE AND PARANASAL SINUSES

Section 8. SURGICAL ANATOMY

28	Development of the nose	147
29	Development of the paranasal sinuses	149
30	Anatomy of the nose and paranasal sinuses	150
31	Physical examination of nose and paranasal sinuses	160
32	Radiographic examination of nose and paranasal sinuses	161
33	Anatomical principles of sinus surgery	164

Section 9. APPLIED PHYSIOLOGY OF NOSE AND PARANASAL SINUSES

34	Nasal respiration	167
35	Protective functions of the nose	168
36	Smell	169
37	Functions of the paranasal sinuses	171

Section 10. DISEASES OF THE NOSE AND PARANASAL SINUSES

38	Congenital malformations	173
39	Injuries to nose, paranasal sinuses and jaws	176
40	Inflammations of the nose	188
41	Inflammations of the paranasal sinuses (general)	199
42	Infections of the individual paranasal sinuses	204
43	Sinusitis in children	210
44	Complications of suppurative sinusitis	211
45	Tumours and cysts of the nose, paranasal sinuses, and jaws	215
46	Miscellaneous conditions of the nose and paranasal sinuses	226

Part 3 THE MOUTH AND PHARYNX

Section 11. SURGICAL ANATOMY

47	Development of the mouth and pharynx	243
48	Anatomy of the mouth and pharynx	244
49	Physical examination of the mouth and pharynx	259
50	Radiographic examination of the teeth, jaws and pharynx	260
51	Anatomical principles of pharyngeal surgery	262

Section 12. PHYSIOLOGY OF THE MOUTH, PHARYNX AND SALIVARY GLANDS

52	Functions of the subepithelial lymphoid tissue	265
53	Salivation	266
54	Deglutition	267
55	Respiration, speech and taste	268

Section 13. DISEASES OF THE MOUTH AND PHARYNX

56	Congenital anomalies of the mouth and pharynx	271
57	Injuries of the pharynx	272

58	Inflammations of the oral and pharyngeal mucous membrane (stomatitis and pharyngitis)	273
59	Inflammations of the pharyngeal lymphoid tissue	290
60	Peritonsillar abscess; parapharyngeal abscess; retropharyngeal abscess	295
61	Adenoidectomy and tonsillectomy	298
62	Tumours and cysts of the mouth and pharynx	303
63	Miscellaneous conditions of the mouth and pharynx	316

Part 4 THE OESOPHAGUS

Section 14. SURGICAL ANATOMY AND APPLIED PHYSIOLOGY

64	Development of the oesophagus	327
65	Anatomy of the oesophagus	327
66	Examination of the oesophagus	330
67	Applied physiology of the oesophagus	330

Section 15. DISEASES OF THE OESOPHAGUS

68	Congenital abnormalities of the oesophagus	333
69	Traumatic conditions of the oesophagus	335
70	Inflammation and ulceration of the oesophagus	339
71	Neoplasms of the oesophagus	340
72	Miscellaneous conditions of the oesophagus	343

Part 5 THE LARYNX

Section 16. SURGICAL ANATOMY

73	Development of the larynx	351
74	Anatomy of the larynx	353
75	Physical examination of the larynx	361
76	Radiographic examination of the larynx	362
77	Anatomical principles of laryngeal surgery	363

Section 17. APPLIED PHYSIOLOGY OF THE LARYNX

78	Functions of the larynx	367
79	Mechanics of laryngeal movements	369

Section 18. DISEASES OF THE LARYNX

80	Congenital abnormalities of the larynx	371
81	Traumatic conditions of the larynx	373
82	Inflammation of the larynx	379
83	Neoplasms and cysts of the larynx	395
84	Miscellaneous conditions of the larynx	403

Part 6 THE TRACHEA AND TRACHEOBRONCHIAL TREE

Section 19. SURGICAL ANATOMY

85	Development of the trachea and bronchi	413
86	Anatomy of the trachea	413
87	Endoscopic anatomy of the tracheobronchial tree	415
88	Examination of the trachea and bronchi	418
89	Laryngotomy and tracheostomy	418

Section 20. APPLIED PHYSIOLOGY OF THE TRACHEA AND BRONCHI

90	Functions of the trachea and bronchi	426
-----------	--------------------------------------	-----

Section 21. DISEASES OF THE TRACHEA AND BRONCHI

91	Congenital abnormalities of the trachea and bronchi	427
92	Traumatic conditions of the trachea and bronchi	427
93	Inflammations of the trachea and tracheobronchial tree	430
94	Neoplasms of the tracheobronchial tree	432
95	Stenosis of the trachea	437

Part 7. NEUROLOGY OF THE EAR, NOSE AND THROAT

Section 22. ANATOMY AND PHYSIOLOGY OF THE NERVOUS SYSTEM

96	The cerebrum	441
97	The brainstem and the cranial nerves	443
98	The cerebellum	454
99	The meninges	456
100	The cerebrospinal fluid	458
101	The arterial blood supply of the brain and meninges	459
102	The venous drainage of the brain and other cranial contents	460

Section 23. DISEASES OF THE NERVOUS SYSTEM IN RELATION TO OTOLARYNGOLOGY

103	Intracranial complications of infections arising in the ear, nose and throat	463
104	Lesions of the cranial nerves	477
105	Headache	493
106	Facial pain	499
107	Vertigo	504
108	Speech and its disorders	511

Index	517
--------------	-----

Part 1

The Ear

The Boy

Part I

Section

1

Surgical Anatomy

Chapter 1

DEVELOPMENT OF THE EAR

Visceral Arches and Clefts

During the early stages of fetal development, a series of six *visceral arches* appears on the lateral aspect of the head. These mesenchymal arches form ridges in the overlying ectoderm and corresponding projections in the entoderm of the pharynx. The ridges become separated from one another by a series of furrows where ectoderm and entoderm come into contact with one another. The ectodermal furrows form the *visceral clefts*. The entodermal furrows form the *pharyngeal pouches* (Fig. 1.1).

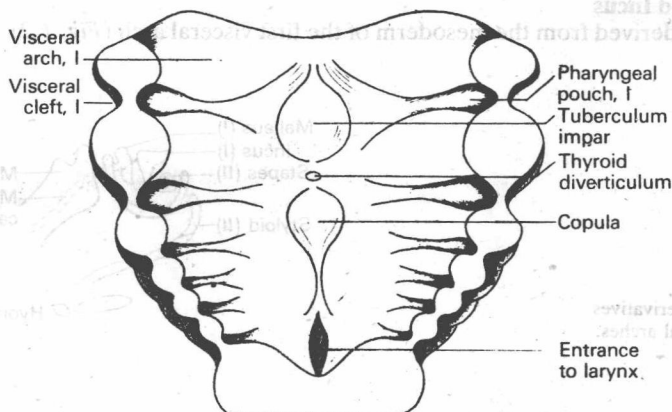


Fig. 1.1. Visceral arches and clefts, and pharyngeal pouches.

Each arch has its own nerve supply. The mandibular division of the trigeminal supplies the mandibular arch, the facial supplies the second or hyoid arch. The glossopharyngeal nerve supplies the third, and vagus and accessory nerves the remainder. The recurrent laryngeal nerve is associated with the sixth arch and the superior laryngeal with the fourth. The fifth arch is lost.

Auricle

Develops from a series of six tubercles which form round the margins of the first visceral cleft.

External Auditory Canal

This is formed from the ectoderm of the first visceral cleft.

Tympanic membrane

This has three layers:

1. An outer *epithelial* layer, from the ectoderm of the cleft.
2. A middle *fibrous* layer, from the mesoderm between the first visceral cleft and the tubotympanic recess.
3. An inner '*mucosal*' layer, from a part of the recess (entodermal).

Eustachian Tube and Tympanic Cavity

These are developed from the entoderm of the *tubotympanic recess*, between the first and second visceral arches. The tubotympanic recess lies at first on the inferolateral aspect of the cartilaginous inner ear capsule, but as the capsule enlarges the recess comes to lie anterolaterally. A cartilaginous process grows out from the lateral part of the capsule to form the *tegmen tympani*. This process grows downwards to form the lateral wall of the Eustachian tube. In this way the tympanic cavity and proximal part of the tube are included in the petrous temporal bone. During the sixth or seventh month the mastoid antrum appears as a dorsal expansion of the middle ear cavity.

Malleus and Incus

These are derived from the mesoderm of the first visceral arch (Fig. 1.2).

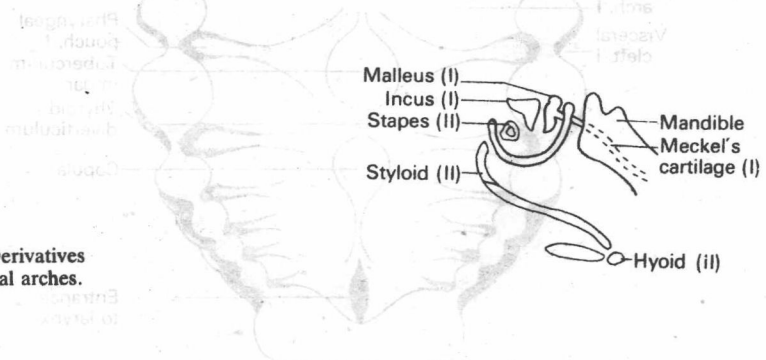


Fig. 1.2. Derivatives of the visceral arches.

Stapes

The head, neck and crura are derived from the mesoderm of the second visceral arch; the footplate comes from the otic capsule which develops in the mesoderm surrounding the membranous labyrinth (Fig. 1.2).

Inner Ear

Inner ear is developed from ectoderm in the region of the hindbrain. The ectoderm invaginates to form an *auditory pit*, which is later converted into an *auditory vesicle* (Fig. 1.3). The *membranous labyrinth* is formed from the vesicle. The mesoderm surrounding it becomes the *cartilaginous ear capsule*, which finally ossifies to form the *bony labyrinth*. The inner ear has reached its full adult size and form by the end of the fourth fetal month.

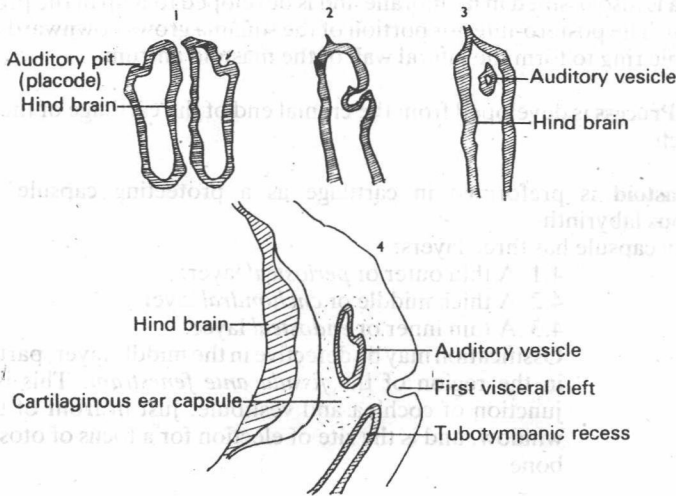


Fig. 1.3. Development of inner ear.

Chapter 2

DEVELOPMENT OF THE TEMPORAL BONE

Morphological Elements

There are four distinct elements which become fused together (Fig. 2.1).

1. Tympanic Ring is formed in membrane and is an incomplete circle deficient above. Its concavity is grooved by the *tympanic sulcus* for the attachment of the greater part of the circumference of the tympanic membrane. This circumference is thickened into a definite rim which allows the surgeon to dislocate the membrane out of the sulcus without tearing. The ring grows laterally and slightly backwards to form the tympanic plate, but the anterior and posterior portions grow more rapidly than the rest. This leaves a foramen in the floor of the canal (the foramen of Huschke). This may persist through life.

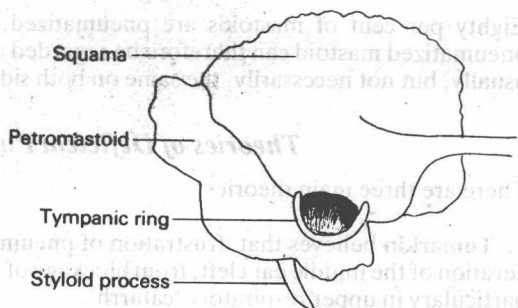


Fig. 2.1. Parts of the temporal bone.

2. **Squama** is also ossified in membrane and is developed to help in the protection of the brain. The postero-inferior portion of the squama grows downwards behind the tympanic ring to form the lateral wall of the mastoid antrum.

3. **Styloid Process** is developed from the cranial end of the cartilage of the second visceral arch.

4. **Petromastoid** is preformed in cartilage as a protecting capsule for the membranous labyrinth.

The bony capsule has three layers:

- 4.1 A thin outer or *periosteal* layer.
- 4.2 A thick middle or *enchondral* layer.
- 4.3 A thin inner or *endosteal* layer.

Ossification may be defective in the middle layer, particularly in the region of the *fissula ante fenestram*. This is at the junction of cochlea and vestibule, just in front of the oval window, and is the site of election for a focus of otosclerotic bone.

Development of Mastoid Process

The mastoid portion of the temporal bone is at birth flat and the stylomastoid foramen, through which the *facial nerve* emerges, lies immediately behind the tympanic ring. As air cells develop, the lateral part of the mastoid portion grows downwards and forwards to form the *mastoid process*. Hence the stylomastoid foramen comes to lie on the under-surface of the bone. This descent is accompanied by an increase in length of the facial nerve canal. The mastoid process does not form a definite elevation until the end of the second year of life. The mastoid antrum lies above the tympanic cavity in the infant, about 2 mm deep to the bony surface.

Mastoid Types

There are three types of definitive mastoid process (Fig. 2.2).

1. **Cellular**, where air cells are large and numerous.
2. **Diploic**, where cells are small and less numerous. Marrow spaces are present.
3. **Sclerotic** (or 'ivory'), where cells and marrow spaces are absent.

Pneumatization of Mastoid

Eighty per cent of mastoids are pneumatized, 20% diploic or sclerotic. The pneumatized mastoid can therefore be regarded as normal. The individual type is usually, but not necessarily, the same on both sides.

Theories of Deficient Pneumatization

There are three main theories:

1. **Tumarkin** believes that 'frustration of pneumatization' results from failure of aeration of the middle ear cleft, from blockage of the Eustachian tube. This occurs particularly in upper respiratory 'catarrh'.

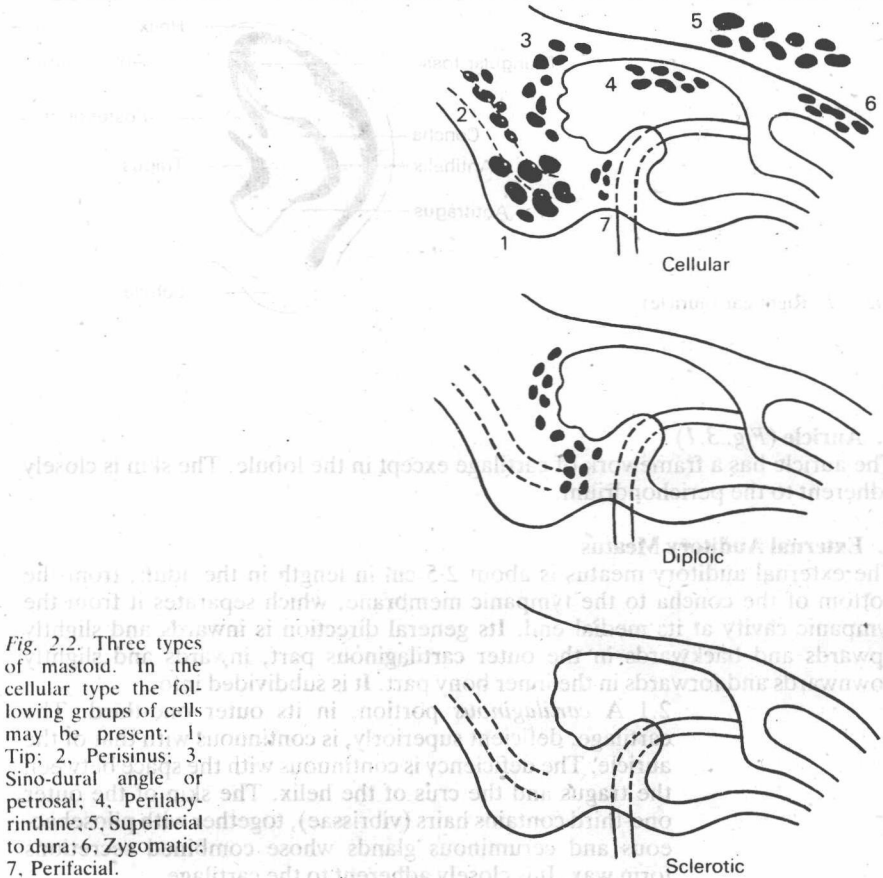


Fig. 2.2. Three types of mastoid. In the cellular type the following groups of cells may be present: 1, Tip; 2, Perisinus; 3, Sino-dural angle or petrosal; 4, Perilabyrinthine; 5, Superficial to dura; 6, Zygomatic; 7, Perifacial.

This view has been recently confirmed by further radiological studies in children with middle ear effusions by Lindeman.

2. **Diamant and Dahlberg** believed that dense bone is congenital and that all sizes of air-cell system may be normal variants.

3. **Wittmaack** believed that the dense mastoid resulted from infantile otitis media, which interfered with the normal absorption of diploë and hence with pneumatization. This is not supported by evidence.

Chapter 3

ANATOMY OF THE EAR

External Ear

The external ear consists of two parts:

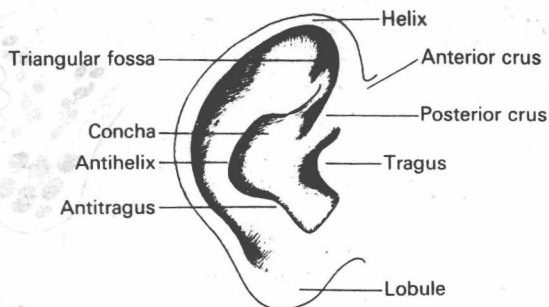


Fig. 3.1. Right ear (auricle).

1. Auricle (Fig. 3.1)

The auricle has a framework of cartilage except in the lobule. The skin is closely adherent to the perichondrium.

2. External Auditory Meatus

The external auditory meatus is about 2.5 cm in length in the adult, from the bottom of the concha to the tympanic membrane, which separates it from the tympanic cavity at its medial end. Its general direction is inwards and slightly upwards and backwards in the outer cartilaginous part, inwards and slightly downwards and forwards in the inner bony part. It is subdivided into:

2.1 A *cartilaginous* portion, in its outer one-third. The cartilage, deficient superiorly, is continuous with that of the auricle. The deficiency is continuous with the space between the tragus and the crus of the helix. The skin of the outer one-third contains hairs (vibrissae), together with pilosebaceous and ceruminous glands whose combined secretions form wax. It is closely adherent to the cartilage.

2.2 A *bony* portion, in its inner two-thirds. The postero-superior portion is formed by the squama, the remainder by the tympanic plate. The skin here contains no ceruminous glands or hairs. It is thin and closely adherent to the sutures between the tympanic plate and the squama. Prominent anterior and posterior bony meatal spines may project from the free outer border of the tympanic plate at the squamotympanic and tympanomastoid sutures (Fig. 3.2). The presence of these *endomeatal sutures and spines* adds to the difficulty of separating an intact cuff of skin from the bony canal.

Relations of External Auditory Meatus

1. Temporomandibular joint, in front.
2. Mastoid air cells, behind.
3. Middle cranial fossa, above.
4. Mastoid antrum, posteromedial and superomedial to the sloping squamous portion of the deep bony canal.