

HISTO-
PATHOLOGY
OF THE
EAR, NOSE
AND
THROAT

—
EGGSTON
AND
WOLFF



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HISTOPATHOLOGY OF THE EAR, NOSE AND THROAT

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*This Book is Dedicated
To Our Friends in Otorhinolaryngology
Who for Many Years and in
Many Ways Aided and Stimulated
Us Toward this Effort*

PREFACE

A reference book devoted primarily to histopathology in the field of otorhinolaryngology, has long been overdue. While excellent contributions to this specialty have appeared in recent textbooks on surgery and medicine of the ear, nose and throat, publication of available data in a single volume seemed to the authors a timely contribution.

The key to histopathology in this field, even more than elsewhere in the body, is often found through the knowledge of comparative zoology, embryology and physiology. The basic sciences relating to this region of the body are therefore here presented with bibliographic references for those interested in further pursuit of certain phases of the subject.

We are aware of the many limitations of this volume, but it is hoped that we have accomplished something for the training of men and women in otorhinolaryngology, by the accumulation into one volume, of much valuable material that heretofore has been scattered widely over various books, medical journals, etc. We realize that many valuable contributions have been omitted because of the tremendous effort involved and lack of time. It is not to be inferred, however, that such presentations and observations are of less importance than the ones to which we have referred. It is regrettable that certain excellent contributions are not here represented. There are errors of omission and probably commission in such an undertaking as this, for which we are duly apologetic.

A tremendous and unappreciated amount of data and original investigations in relation to the basic sciences of ear, nose and throat are on historical record. It is our hope that some of these valuable contributions may be revived. Likewise it is our desire that these subjects will awaken a proper evaluation of the importance of the teaching of histopathology of the ear, nose and throat to undergraduate medical students.

The authors have drawn freely upon the publications and personal experience of eminent specialists in this field. Particularly helpful have been the contributions of J. Wright, Streeter and the Carnegie Institute Staff, Schaeffer, Nékám, Proetz, Jackson and Coates and others.

We are indebted to the Archives of Otolaryngology, Annals of Otology, Rhinology and Laryngology, Thos. Nelson & Sons, W. B. Saunders Co., and other publications for the privilege of reproducing in part some of the material herein contained. Technical aid in preparation of some of these illustrations was given by the American Otological Society, Central Bureau of Research, courtesy of Doctor Marvin Jones.

It would have been impossible for either of us alone to have assembled this volume. Therefore we combined our efforts and the material we had for publication. We sincerely trust that we have not made it too severe in its script. Such a style is necessary when the fundamentals of the various subjects are presented. Strictly morphological data are necessary as they are prerequisites. The student must have a working knowledge of the fundamentals in order that he may build

thereon an application of the sciences to clinical medicine. A great deal that is interesting in the clinical interpretation and surgical treatment of diseases of the ear, nose, and throat has intentionally been omitted, but these subjects are excellently treated in other books. Furthermore, they did not come within the province or intent of this volume.

In the compilation of this work, the authors wish to express their gratitude to Mr. James A. Weeks, for many of the micro-photographs. Dr. Imperatori has also been most obliging in making many illustrations. His enthusiasm has been a real contribution. For their devoted services we are indebted to Eyleen Massey, who recorded and transcribed the original manuscript, and to Madeline Zaruba who retyped it. It is with pleasure that we acknowledge our appreciation for the marvelous cooperation and many facilities of the Manhattan Eye, Ear and Throat Hospital and of Washington University in the preparation of the material and illustrations. For encouragement by their staff of physicians in many ways we are indeed deeply grateful.

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THE EAR

CHAPTER I

INTRODUCTION

The high percentage of patients entering the clinic or wards of any general hospital for treatment of ear, nose and throat conditions is a matter of record. This fact alone should warrant a careful consideration in the medical school curriculum of the anatomy, physiology and pathology of these regions of the body. Statistics show that among a group of fourteen thousand clerical workers in 1940 more than half of the time lost through absences of one week or less was caused by colds. Under this heading were included cases diagnosed as "grip" and "influenza" which were of less than eight days duration. It is estimated that one day a year for each worker, or the full time work of a hundred and fifty thousand persons for a year, is lost because of disorders of the upper respiratory tract.

Countless numbers of persons suffer from nasal allergy, sinusitis and symptomless petrositis without treatment or surgical care and therefore are never included in statistical records. Meningitis of otitic origin causes approximately three-fourths of all suppurative meningitis, according to McCaskey. Osteomyelitis of the cranial vault is commonly the result of infected nasal sinuses.

The necessity for some training of the general practitioner in the field of otorhinolaryngology increases with the development of aviation medicine. The proper functioning of the Eustachian tube and the prevention of loss of hearing in the aviator so that he may correctly interpret the radio beam are of grave importance in peace as well as in war.

The general practitioner has been inclined to be content with a casual superficial consideration of upper respiratory infections. Even the otorhinolaryngologist sometimes treats empirically a condition diagnosed solely on the basis of clinical manifestations. There is a gap due to faulty training, in the understanding of all physicians in regard to disease of the nose, throat and ear. To treat the patient adequately, the physician should be properly trained in order to visualize the physiological and pathological processes with which he is dealing.

Otorhinolaryngology has been regarded in this country, by the medical profession at large, as a "minor specialty" whose practitioners are mainly engaged in removing tonsils and adenoids. Now it should be evident to any thinking person that pathological conditions which may be directly responsible for such frequently fatal complications as meningitis or osteomyelitis of the skull cannot be lightly regarded. Certainly the nose, throat and ear infections which may lead to fatal complications are just as important as infections of the appendix or gall bladder which result in peritonitis. An accessory sinus disease which reacts upon the optic nerve causing blindness is only another example of the importance of the diseases of the upper respiratory apparatus. The proper management of these infections requires the consummate skill of the highly trained specialist.

It is quite true that chemotherapy will alter permanently the treatment of these diseases. But this does not absolve the profession from the necessity of a proper knowledge of the normal and pathologic conditions of these regions of the body. Pathologic principles will endure. Each patient will come to his physician in a different stage in the advancement of his particular disease. The attending physician must be able to recognize the condition presented. The mucous membranes which line the nasal cavity accessory sinuses and ear are among the most delicate and complex of body tissues. Recent investigations indicate their great importance in the etiology of allergic states and infectious diseases affecting the nervous system as well as the entire bodily organism.

A presentation in one volume of the histopathology of these areas may create a more general appreciation of the need of intensive study of the pathology of the nose, throat and ear by the general pathologist as well as by those who desire to specialize in otorhinolaryngology. The general pathologists are inclined to overlook the causal relationship of these regions to the intracranial infections and are content simply with uncapping the sinus or tympanum. Therefore these structures are rarely carefully removed *en mass* and examined microscopically.

A brief review of the anatomy of these organs is essential for an accurate knowledge of the pathological changes which may occur. Pathology of the human subject is occasionally explicable only on the basis of ontogenetic and phylogenetic history. This is particularly true for the regions of the body considered in this text. A brief review of comparative anatomy and embryology is therefore pertinent. Since the most important effect of a pathologic state is to hamper the normal function of an organ, it will also be necessary to review the physiology of the organs here treated.

CHAPTER II

COMPARATIVE ANATOMY OF THE EAR

THE INNER EAR

The juxtaposition of the organ of hearing and the organ of equilibrium as found in mammals, is explicable only on the basis of a thorough knowledge of the comparative anatomy and embryology of the subject. Vibratory phenomena of differing rates serve as stimuli for the sensory epithelium of these two organs. The organ of equilibrium is stimulated by very slow vibrations, the organ of hearing by more rapid ones. Comparative embryology clearly demonstrates that the organ of equilibrium arises from the lateral line system of fish (Fig. 1). This fact was first recorded by Wilson and has been well illustrated by Allis (Fig. 2). Further confirmation is found by comparison of the embryology of a unit of the lateral line system as illustrated by Johnson (Fig. 1B) and the early stages of development of the labyrinth of amphibians (Fig. 11) and even of man (Figs. 21 and 22).

All vertebrates, from fish to and including man have an organ of equilibrium bearing three semicircular canals occupying the three planes of space. There is a class of animals, however, the Cyclostomes, more primitive than fish, one genus of which, the Atlantic hagfish, *Myxinae*, has a single canal and two other genera, the *Petromyzon* and *Ichthyomyzon*, the lampreys, which have the two vertical canals but no horizontal canal. Whether the Cyclostomes represent degenerate forms or animals which have developed a specialization in response to their mode of life cannot be stated. They live as parasites attached to the body of larger fish upon which they feed. Kappers considers the *Petromyzon* brain to be the prototype of that of higher vertebrates. It is important to note also in this connection, that it is the horizontal canal which is the last of the three semicircular canals to form in the embryologic development of the labyrinth of all higher vertebrates, including man. Figure 3 illustrates the labyrinth of the *Ichthyomyzon* with its two vertical canals. Note also the two minute canals, one, the persistent invagination canal of embryonic development, the other the duct for the endolymphatic sac. Both of these undoubtedly represent tubules leading to the surface in modified lateral line organs.

The modern conception of the origin of vertebrates is that they are descended from Ostracoderms, creatures anatomically closely related to Cyclostomes but encased in an armour of scutes (Osborn, Gregory et al.). These animals are found in fossil form widely distributed over the earth's surface, in Scotland, Norway, China, and the large Colorado Lake Bed. They belong to the Paleozoic Era having lived in the Silurian-Devonian Period, approximately 450 million years ago when much of the land was below the sea but when mountains were forming (Romer). These animals were relatively small, being less than a hand's

length. They had an expanded head shield of bony plates and a fish-like tail (Fig. 4). They possessed a well developed lateral line system similar in pattern to that of modern fish (Figs. 4 and 5). Their vestibular labyrinth possessed the two vertical semicircular canals as well as numerous other canals leading off from the vestibule, which Stensiö interpreted as nerves leading to a possible electric organ. Careful study of Stensiö's stereoscopic photographs and excellent text-book descriptions leads to another plausible conclusion. It seems highly

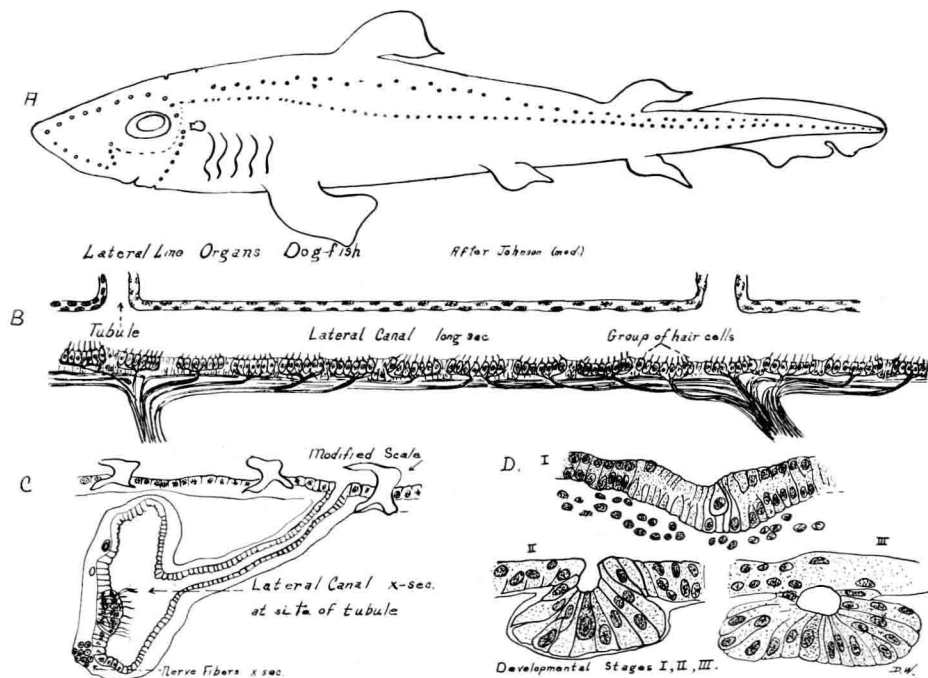


FIG. 1. Lateral line organs in Dogfish.

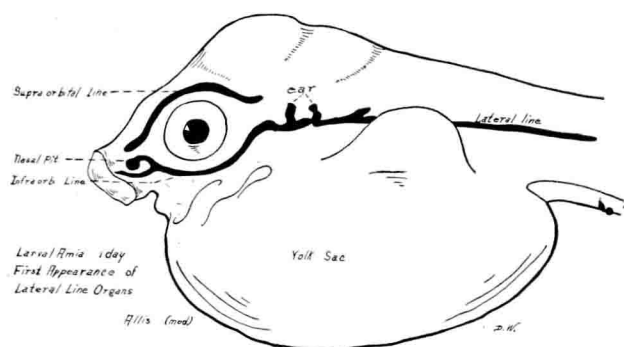
A. The definitive pattern down the side of the fish, from which comes the name *lateral line*.

B. A section through a lateral canal showing numerous patches of sensory epithelium or hair cells.

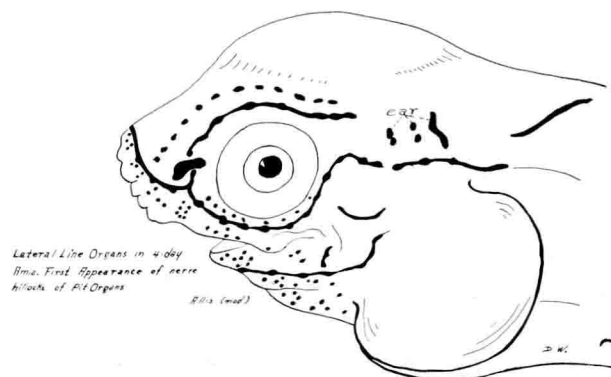
C. A tubule from a lateral canal opening on the surface beneath a dermal scale.

D. Embryonic development of the lateral line organ. This process is similar to that of the inner ear. Compare figures 11, 21 and 22. (After Johnson.)

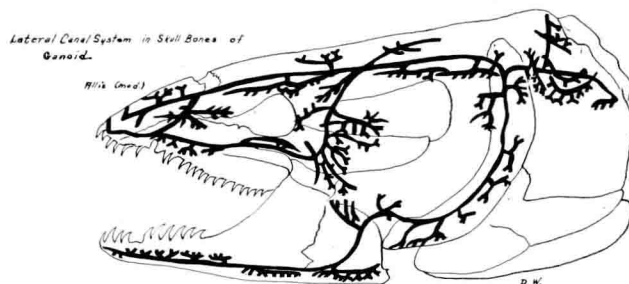
probable that at least two of the canals leading from the vestibule may be homologized as incipient horizontal canal elements still in open communication with the general lateral line system; that the vestibule in the Ostracoderms was like a lake or reservoir in the system; that the system which Stensiö designated as "electric organ" might better be interpreted as part of the lateral line system similar to that depicted in Parker and Haswell for certain rays. The canal labelled *Sel*, 1, 2 may well be considered the ampullated end of an incipient horizontal canal, while the canal labelled *dsw* instead of being a vein, may well



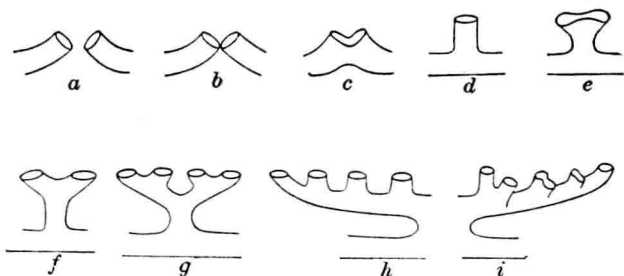
A



B



C



D

FIG. 2. A. The first appearance of the lateral line organs in the embryo fish and the derivation of the semicircular canals from the lateral line system. Larval Amia, 1 day. (After Allis.)

B. The separation of the vestibular system from the main system of canals in the 4 day Amia and the appearance of nerve hillocks. (After Allis.)

C. The elaborate bony canals for the lateral line system in the head of a bony fish. (After Allis.)

D. The elaboration of lateral line pores. Diagrammatic representation of a primary pore or tube: *a, b, c*, two half pores approaching each other and fusing; *d*, primary pore and tube; *e*, the same undergoing its first division which in *f* is completed; *g* dendritic system after second regular division; *h* and *i*, forms of creeper-like branches. (Allis.)

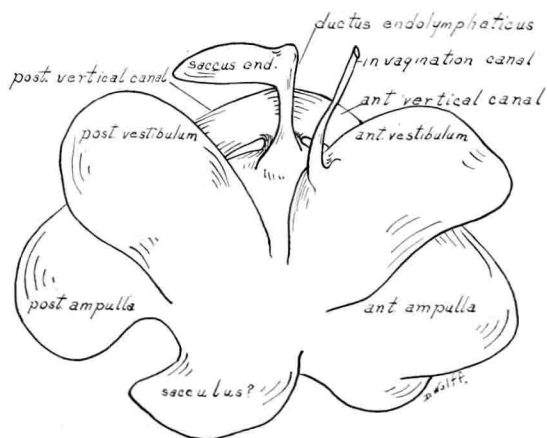


FIG. 3. Cyclostome labyrinth. Two vertical canals are present in this animal but no horizontal canal. Drawn from wax model constructed by H. W. Norris. Species *Ichthyomyzon*.

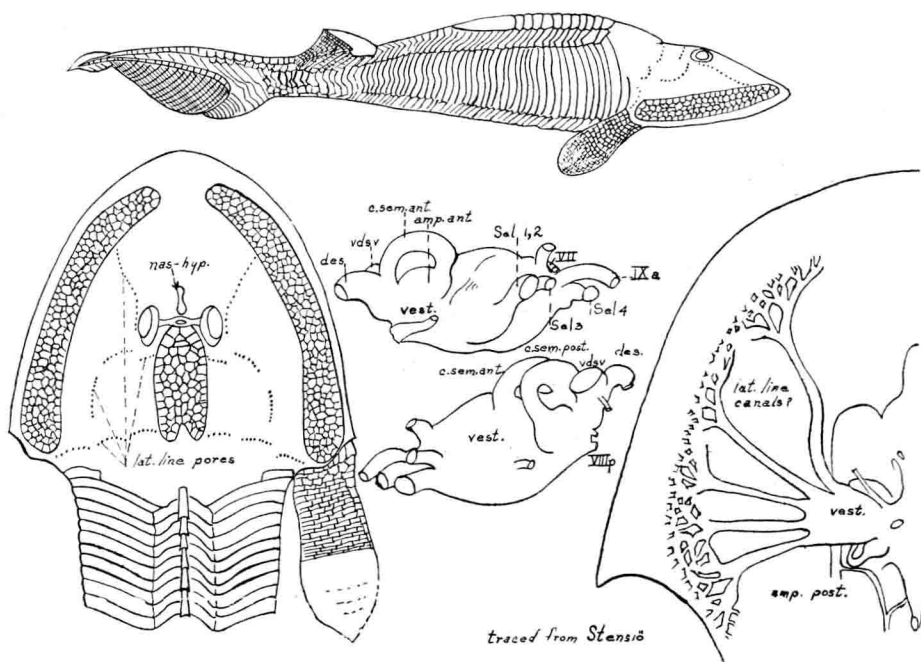


FIG. 4. The Ostracoderm, a stem-line fossil fish from which higher vertebrates are believed to have descended. Note the pores for the lateral line system, the lateral line canals (?) and the vestibular labyrinth with two vertical but no horizontal canals. The open canal marked *Sel 1, 2* and *vds* may represent the incipient horizontal canal which at this stage of evolution is still connected with the lateral line system. Drawing traced from Stensiö.

be the incipient non-ampullated end of the horizontal canal, the two ends being connected with each other only through the extensive ramifications of the system. The relations to the "commisural region" (*Crus commune* of living forms) bears out this possibility. The non-ampullated end passes medially to join the mate of the opposite side, as described by Stensiö. This reminds one of the condition in the frog in which the endolymphatic system is highly extensive and joins bilaterally. Stensiö himself considered the possibility of the canal

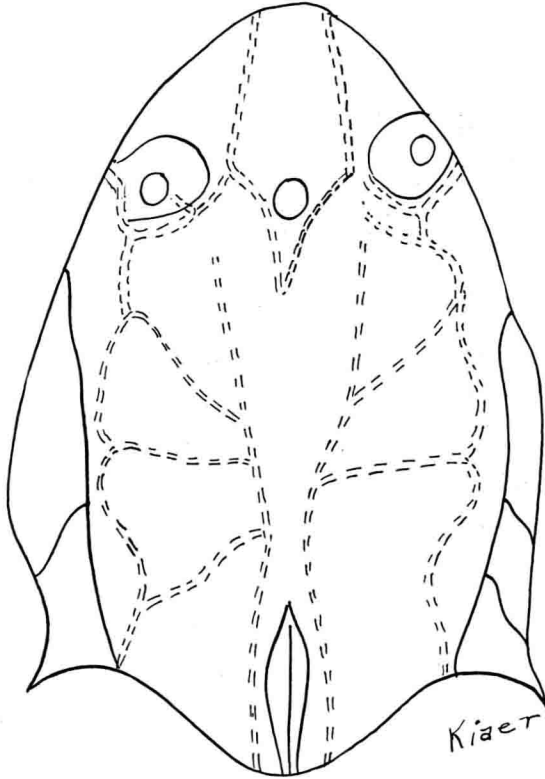


FIG. 5. The lateral line system in the Ostracoderm, Pteraspis. (After Kiaer)

d_1 being the endolymphatic duct leading to a median external opening as in the dogfish. This is undoubtedly the correct interpretation.

Careful observation of numerous labyrinths of lower forms and man reveals no instance where the nerve grooved the floor of the labyrinth as described for Ostracoderms by Stensiö but in all animals with a bony skeleton and lateral line canals traversing the bone, the canals do groove the bone as do the semicircular canals. This is added argument in favor of the interpretation suggested above. The fact that the vestibule is the center of radiation of the canals further suggests that they are lateral line organs rather than electric organs. Study of Stensiö's illustrations of cross sections further supports the hypothesis that the labyrinth was in open communication with the generalized lateral line system.