
Preface

Sensory organs constitute an elaborate and demanding chapter of the anatomical curriculum. The structures are confined to a small area, yet have to be discussed to a degree of detail that has no match in human anatomy except for neuroanatomy. Partly owing to tradition and partly because of a real practical significance, there is an unprecedented amount of nomenclature involved in the field of sensory organs, a comprehensive knowledge of which presents a difficult task even for medically qualified people. Given the great clinical importance of the topic, in particular the eye and the ear, the time allocated for the study of sensory organs is remarkably limited in most anatomical curricula, with the organs usually being discussed in the framework of (or as a supplement to) the nervous system. Diseases of the organs of vision and hearing are an everyday occurrence in the work of the general practitioner. Furthermore, the latter are dealt with by separate medical specialties: ophthalmology and otorhinolaryngology (ENT). Novel diagnostic and surgical results as well as new questions raised by these may widen the knowledge of modern anatomy and may also prompt, and rightfully expect, new answers from macroscopic and microscopic anatomy.

Specialized and comprehensive studies covering all sensory organs are rarely encountered in the medical literature. Sufficiently detailed descriptions can only be found in large and expensive handbooks, consisting of several volumes, often as a chapter of neuroanatomy. Shorter, more concise editions confined to the topic are either at the level of popular science, or deal with the subject from a specific aspect such as comparative anatomy, evolution, etc. Moreover, the different sensory organs are usually discussed in separate volumes. The current atlas is an attempt to demonstrate all major sensory systems together with their neural pathways, from primary sensation all the way to the brain.

The morphology of sensory organs is often described separately from their function and also from the results

and requirements of clinical research. However, both the surgery and diagnostics of ophthalmology and ENT have undergone an impressive development in the recent years.

In the case of ophthalmic surgery, laser treatment of retinal detachment, lens implantation, corneal grafts, and surgical treatment of ocular lesions or orbital tumors are well known interventions. Modern diagnostic methods have revealed more refined anatomical details in the living patient (e.g., mapping of retinal blood vessels by fluorescent dye markers, FLAG). Electrical signals of the retina (ERG) are indicative of functional disorders. Fine details of the anatomy of the living eye can be observed by using modern diagnostic imaging methods (e.g., keratometry, ultrasonography). Experimental research and medical applications have brought an impressive development in the analysis of the retina, visual pathway and cortical visual field. Retinal photoreceptors of specific function and chemical nature can now be demonstrated by fluorescent immunohistochemistry. Precise projections of the human visual pathway have been described using postmortem pathway degeneration and tract tracing methods (such data used to be available from animal experiments only). Further techniques of interest comprise the monitoring of a mitochondrial enzyme cytochrome oxidase histochemistry. The functionally active elements (and potential disorders) of the visual cortex of wakeful patients can now be detected by the most up-to-date diagnostic methods, such as event-related potentials (ERP), visually evoked potentials (VEP), magnetoencephalography (MEG) and direct intraoperative microelectrode recordings, all characterized by good time resolution. Further techniques of high spatial resolution (hence of particular anatomical relevance) comprise regional cerebral blood flow (rCBF) measurements using single photon emission spectroscopy (SPECT) or positron emission spectroscopy (PET). Apart from measurement of local blood

perfusion, oxygen and glucose uptake, the latter spectroscopic methods enable also the regional analysis of neurotransmitters and receptors.

Concerning the anatomy of the ear, important progress has been made by the use of modern surgical and endoscopic techniques. This prompted a reappraisal and led to a renaissance of previously existing refined preparatory methods demonstrating the highly complicated microanatomical relations of the organs of hearing and equilibrium. The size of their structural elements verges on the border of visibility, therefore the visualization of details requires microphotography and glass fiber endoscopy of fresh cadaver tissue. Modern diagnostic methods, worthy of mention in the proposed book, are available also for functional studies of the auditory and vestibular systems. Such methods comprise audiometry, oto-acoustic emission (electrophysiological investigation of the acoustic nerve), and recordings from the brainstem (BAEP). An important part of this chapter would include CT and MR images, demonstrating the osseous parts and soft tissues of the organs in different section planes.

The other special sensory organs—taste, olfaction and tactile sensation—also have clinical relevance and their investigation is rather difficult. However, they certainly have a place in a comprehensive study focused on the sensory organs. In *Atlas of the Sensory Organs: Functional and Clinical Anatomy*, the material is based primarily upon light and electron microscopic preparations supplemented by a few special semi-macroscopic anatomical preparations (e.g. microdissection specimens demonstrating the Pacinian corpuscles of the skin). All

of the chapters contain a considerable amount of original light and electron microscopic specimens and, in some cases, experimental studies, such as immunohistochemistry, have also been included.

The majority of original specimens and recordings are accompanied by schematic explanatory drawings. Furthermore, overview figures and tables assisting the understanding of the material are also included.

Each chapter begins with a detailed anatomical overview, covering also the development (ontogeny) of sensory organs, the functional aspect of sensory mechanisms. This introductory part is followed by original images from macroscopic, microscopic and functional/clinical materials, and a description of the central pathways relevant to the respective sensory organ. As a rule, only healthy and intact organs or tissues are shown, since the diseases fall beyond the scope of the work. The only exception can be if pathology is directly relevant to the understanding of normal structure and function.

The projected audience of this atlas includes undergraduate students majoring in medicine, dentistry, animal and human biology; graduate students of biomedical courses covering sensory organs or functions; general practitioners, particularly those wanting to specialize in the fields of ophthalmology, ENT, neurology, psychiatry and plastic surgery; optometrists, and radiographers. Given the level of information offered by the book, the main target groups would likely be medical students doing human anatomy, neuroanatomy or neurology courses; young clinicians, residents and post-docs.

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