

С.М. Зиматкин

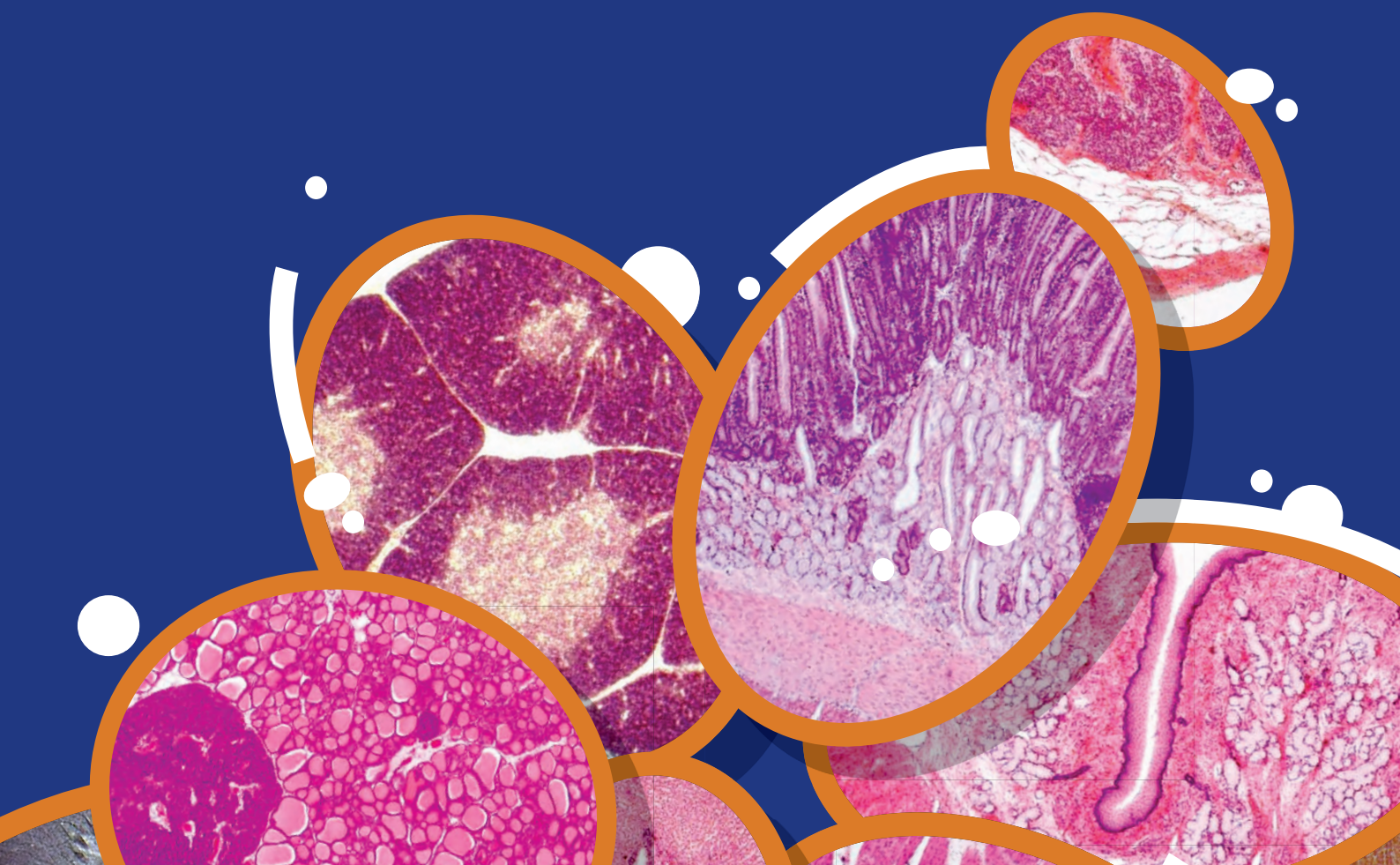
S.M. Zimatkin

ГИСТОЛОГИЯ, ЦИТОЛОГИЯ И ЭМБРИОЛОГИЯ

HISTOLOGY, CYTOLOGY, EMBRYOLOGY

Атлас
учебных
препаратов

Atlas
of practice
preparations



Допущено
Министерством образования Республики Беларусь в качестве учебного пособия
для иностранных студентов учреждений высшего образования по медицинским специальностям



Минск
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Учебное пособие составлено в соответствии с типовой учебной программой. Представлено более 300 цифровых цветных микрофотографий всех основных и демонстрационных гистологических препаратов, изучаемых в учреждениях высшего медицинского образования, с необходимыми обозначениями и описанием. Приведены базовые электронограммы с краткой характеристикой. Издание может использоваться при подготовке к лабораторным занятиям, экзамену, при изучении медико-биологических и клинических дисциплин.

Для иностранных студентов учреждений высшего образования по медицинским специальностям.

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Preface

Histology, Cytology and Embryology is a fundamental science forming the basis of medical knowledge. It is built upon visual images – microscopic views of cells, tissues and organs. The major part (over 70%) of classroom-based time of the discipline is spared for practical classes aimed to students' investigating educational histological preparations. The tasks that student have to do are really complicated. There are plenty of national and foreign textbooks and educational manuals in Histology, Cytology and Embryology for students of medical universities; among these are the books by the author of this Atlas. However, the multicolor atlases of practice histological preparations, vital for practical classes in the discipline, are still lacking. Russian atlases available are of poor quality, they are too massive, expensive and inconvenient for use.

The intention of the Atlas was to create as best as one can a simple, comprehensible and easily demonstrational manual in Histology, Cytology and Embryology designed to help the students in investigating histological preparations. It provides original high-quality digital multicolor micrographs (taken at various magnifications) of basic and demonstration histological preparations to be investigated by students of Belarusian medical universities. In addition, the Atlas contains histological preparations of the developing organs obtained from the dead fetuses and newborn human beings. They are all manufactured at the Department of Histology, Cytology and Embryology of the Grodno State Medical University under the supervision and at personal participation of Professor Ya.R. Matsuk. Beyond that, the author expresses profound gratitude to the English translator Yanina Razvodovskaya for the correction of the text and laboratory assistant of the Department T.V. Klimut for technical assistance in the course of preparing the Atlas for publication.

In addition, the Atlas contains main educational electron micrographs from the Atlas by Eliseev (1970) which are considered to be the basic educational electronograms and are used at the examination in Histology, Cytology and Embryology.

To avoid overlapping with the existing textbooks and educational manuals in the discipline, the well-known figures, schemes and text information blocks are not included into the Atlas.

The Atlas can help the students in independently investigating histological preparations in laboratory classes, and particularly in making up missed classes as well as in getting ready for final lessons and examination in Histology, Cytology and Embryology. In the long view, it can be used in studying various biological, medical and clinical disciplines as well.

The Atlas is intended to fill the gap in the medical education courseware with demonstration educational manuals. Considering a high cost of full-color printing, the introduced micrographs are arranged in an efficient and space-saving manner in order to minimize the Atlas size. As a result, we have created an Atlas which is very space effective, convenient for students and comparatively inexpensive. The Atlas is highly competitive with the world analogues, though it is created based on the domestic educational preparations investigated by students in practical classes in accordance with our academic programme.

We hope that this Atlas will be useful for students and improve the effectiveness and quality of training at medical universities.

Professor S.M. Zimatkin

Introduction

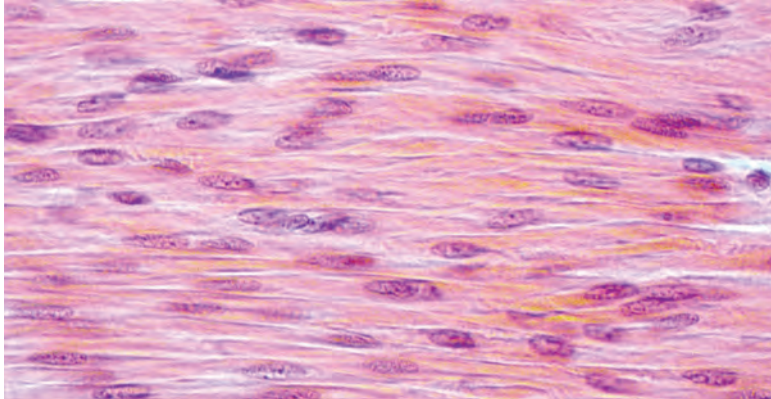
The Atlas is designed in accordance with the current standard academic programme and curricular in Histology, Cytology and Embryology for the students of medical universities, principally for the Faculties of General Medicine. It represents high-quality digital micrographs (taken at various magnifications) of all basic and demonstration domestic histological preparations to be investigated by the students of medical universities. All the pictures are original, i.e. taken by the author personally using the microscope Axioscop 2 plus (Zeiss) and digital video camera Leica DFC 320 (Germany). All the micrographs have accurate focus control and color reproduction of the images as well as optimal size of pictures for better comprehension depending on the information load of the illustrated object. The micrographs are grouped in accordance with topics covered by the discipline syllabus. They are supplied with all necessary descriptions and notations in a format which is very convenient for students' perception. The educational material is in full accordance with the students' Manual in the discipline which provides figures and descriptions of similar educational histological preparations. The preparations which are included into final lessons are labeled with *, those included into final exam tests – labeled with **, for students of the pediatric faculty – labeled with ^{ped}.

UNIT 1

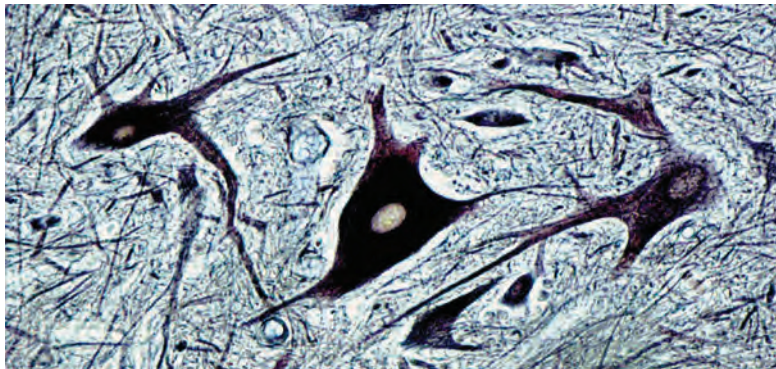
Structural Components of Tissues (Tissue Elements)

The shape of cells to the fullest extent corresponds to the functions performed.

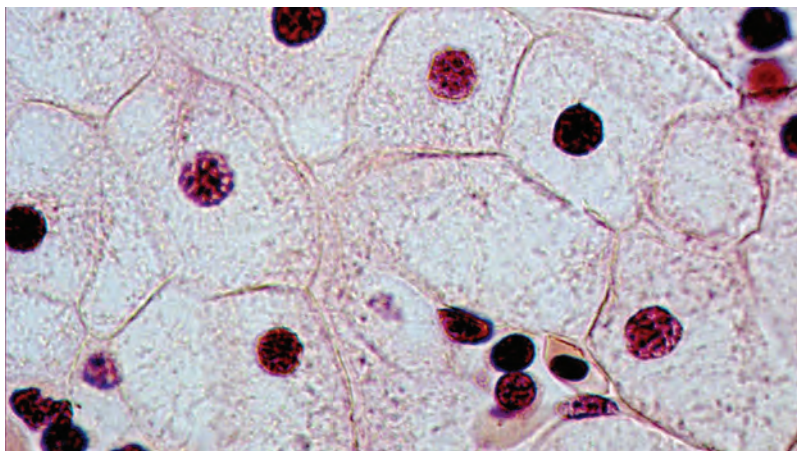
Preparation 1.1. Muscle cells (hematoxylin and eosin (H&E) stain):
spindle-like cells with oxyphilic, pink cytoplasm, and rod-shaped, basophilic, violet nuclei (×400)



Preparation 1.2. Nerve cells of the spinal cord (silver impregnation):
star-shaped cells (with processes) (×400)

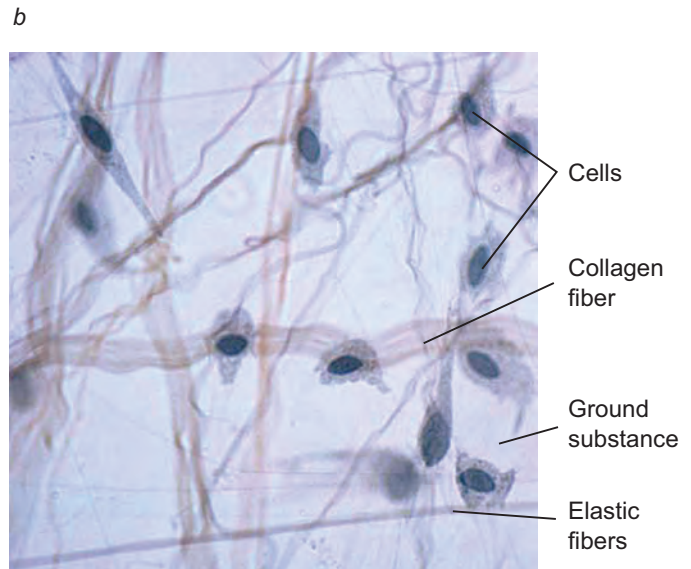
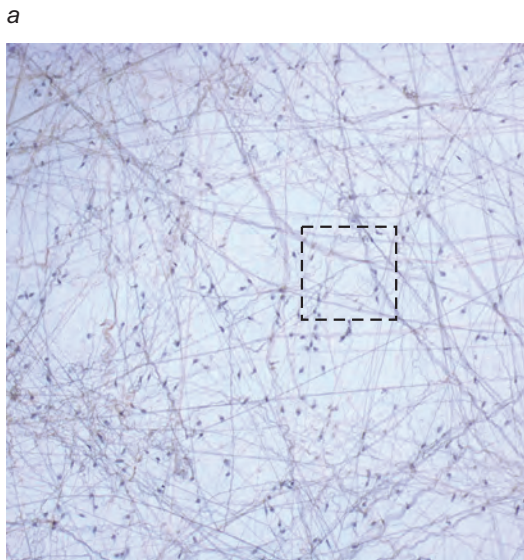


Preparation 1.3. Cells of the liver (H&E stain):
polygonal (with many angles) cells with round nuclei in the center (×400)



Loose connective tissue is a good example of “tissue”. It is made of cells and their derivatives – intercellular matrix, consisting of ground substance and fibers.

Preparation 1.4. Pellicle of loose connective tissue – cells and intercellular matrix (iron hematoxylin stain):
a – x25; *b* – x400

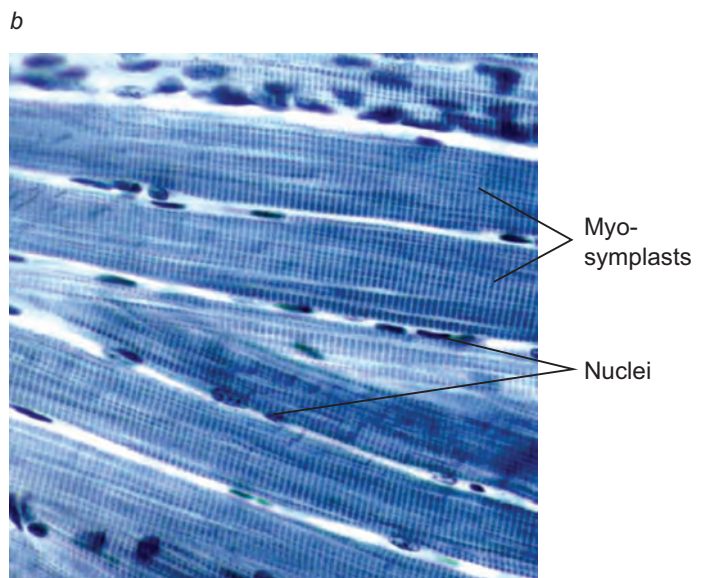
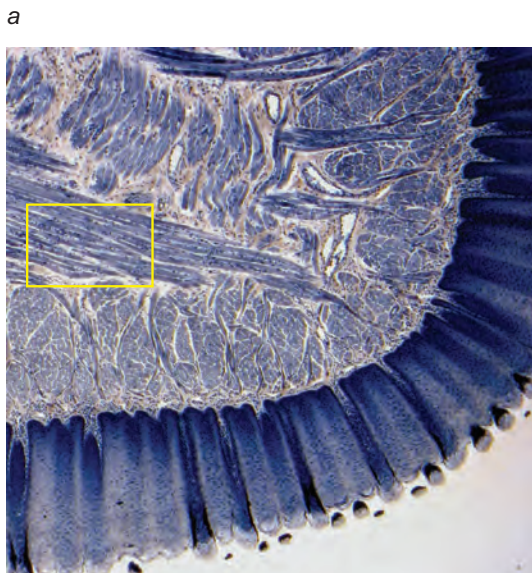


Cells are visible like spots. Between them, in the intercellular matrix, the fibers and homogenous ground substance are seen.

The cells of different shape and their derivatives – fibers (collagen – as thick fibers, elastic – thin ones and branching) and the ground substance between them as the pale homogenous mass.

The main part of muscle fibers are myosymplasts, containing a huge amount of cytoplasm and thousands of rod-shaped nuclei, located at the periphery of symplasts. Myosymplasts are a ground example of “symplasts” – cell derivatives, ‘supracellular structures’, formed by the cells fusion.

Preparation 1.5.* Symplast. Striated muscle fibers (iron hematoxylin stain):
a – x25; *b* – x400



Preparation of the tongue, in its center the sections of muscle fibers going in all three directions are seen.

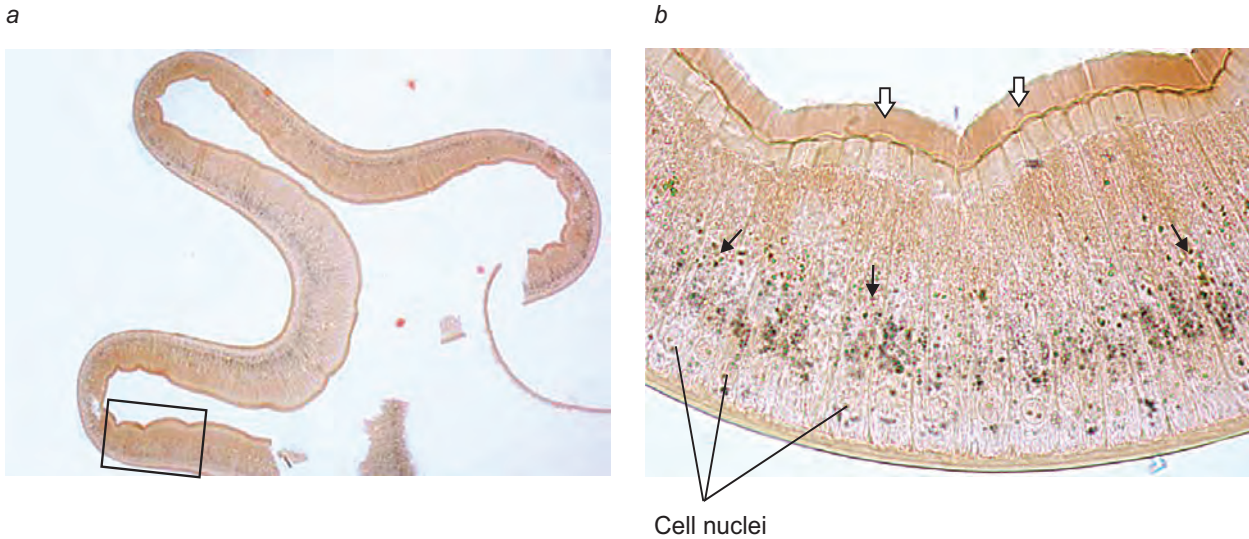
The longitudinally sectioned muscle fiber (myosymplasts) with striations and numerous rod-shaped nuclei at the periphery are seen.

UNIT 2

Basic Cytology. Organelles and Inclusions of Cytoplasm

Cell's organelles are seen well under electron microscopy, but they are revealed with great difficulty by light microscopy.

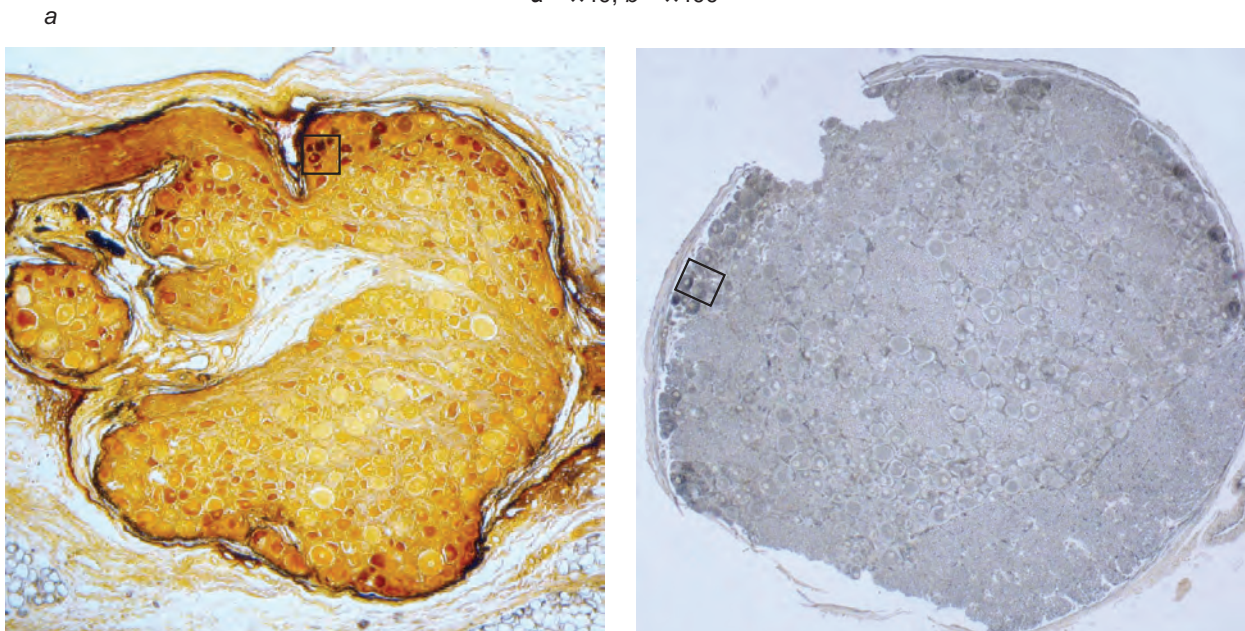
Preparation 2.1. Mitochondria in ascarid intestinal epithelial cells (acid fuchsin stain by the Altman method):
a – x40; *b* – x400



Layer of epithelial cells is seen as a ribbon.

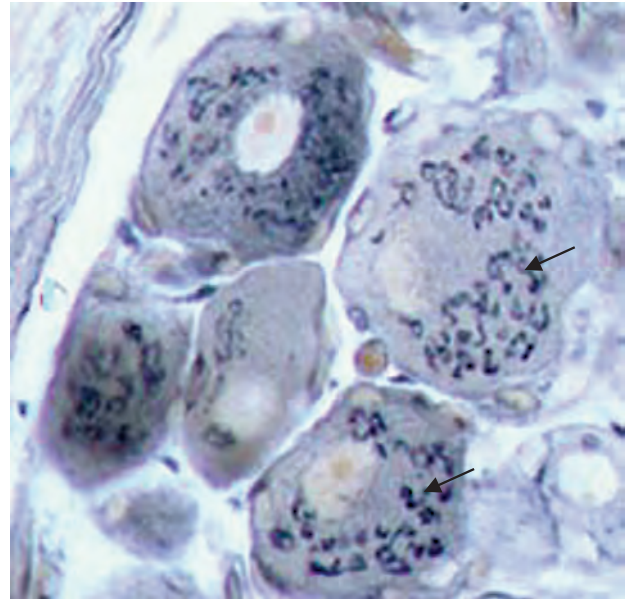
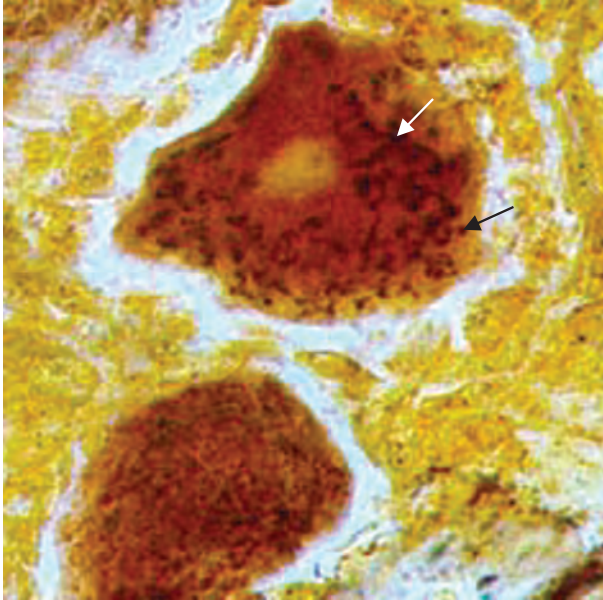
In cell cytoplasm mitochondria are seen as dark grains (black arrows) and microvilli compose the brush border (empty arrows).

*Preparation 2.2**. Golgi complex in nerve cell of spinal ganglion (impregnation with osmium acid (two modifications)):
a – x40; *b* – x400



At the periphery of spinal ganglion nerve cells are seen.

b

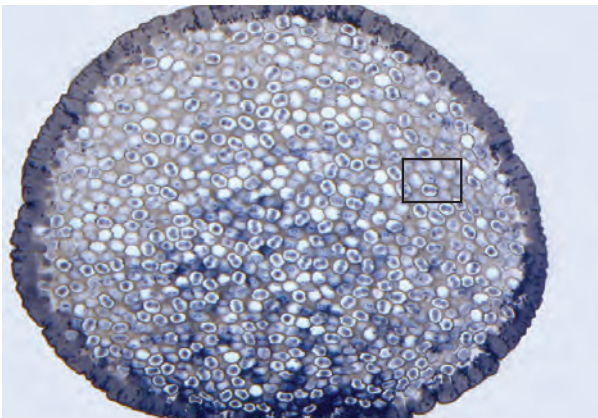


In the cytoplasm of neurons the fragments of Golgi complex are seen as grains, commas, and rings. They are situated around the light nucleus of the cell.

Preparation 2.3. Cell center in a fertilized oocyte (iron hematoxylin stain):

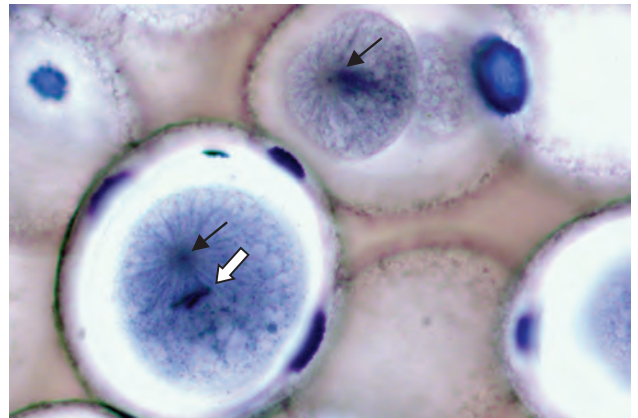
a – x40; b – x400

a



In an ascaride uterus cavity numerous round oocytes are seen.

b

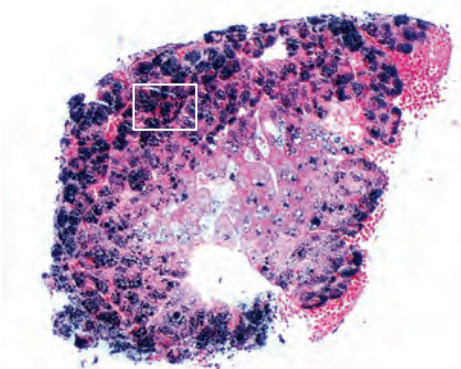


In the cytoplasm of a fertilized oocyte the spots are seen – centrioles (black arrows) and the microtubules of mitotic spindle branching from them as sun rays, as well as chromosomes (empty arrows).

Inclusions are temporary structures of a cell, reflecting its functional state at the moment of study. Fat and glycogen are the examples of trophic inclusions, melanin – pigment inclusion.

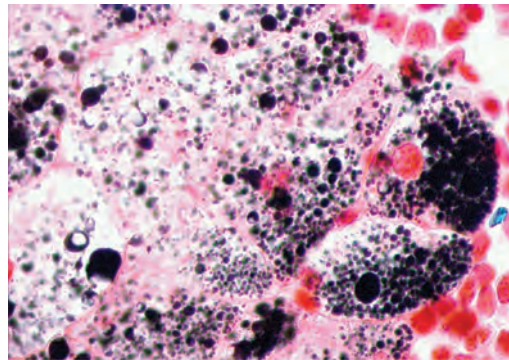
*Preparation 2.4**. Fat inclusions in liver cells (Sudan Black stain):
a – x40; b – x400

a



Liver section is stained for detection of lipids.

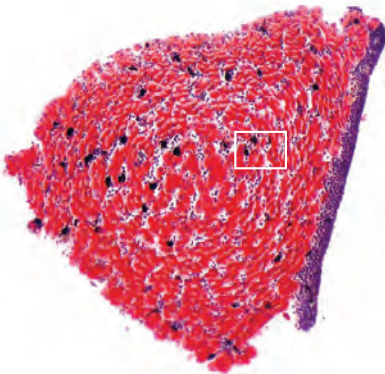
b



In the cytoplasm of liver cells the black drops of stained fat are seen.

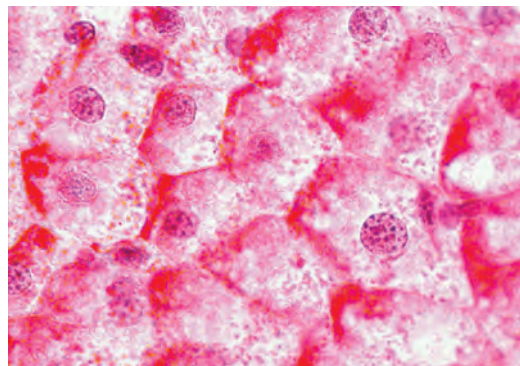
*Preparation 2.5**. Glycogen inclusions in liver cells (carmine and hematoxylin stain):
a – x40; b – x400

a



Liver section is stained for detection of glycogen.

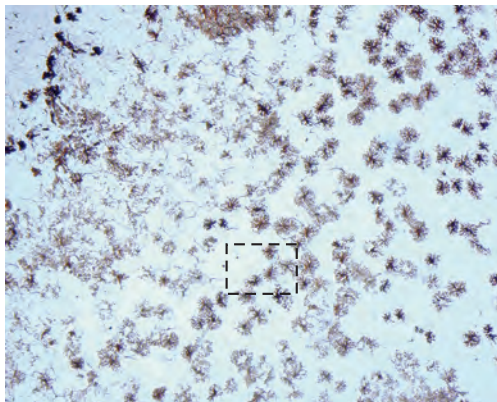
b



In the cytoplasm of liver cells the small pink granules of stained glycogen are seen.

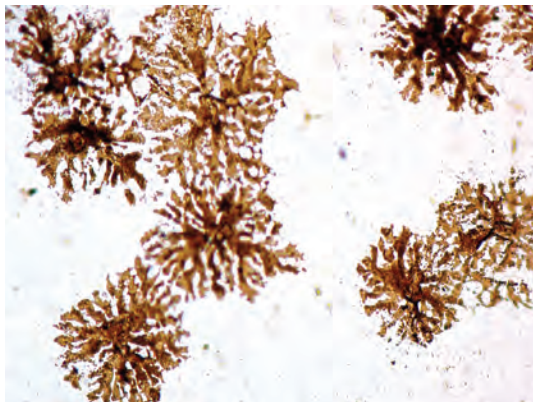
*Preparation 2.6**. Pigment inclusions (stainless preparation):
a – x25; b – x200

a



Numerous pigment cells of natural brown color are seen.

b



Pigment cells, melanocytes – cells with processes containing the small granules of pigment inclusion, melanin. They provide dark brown color to the skin, hair or iris.

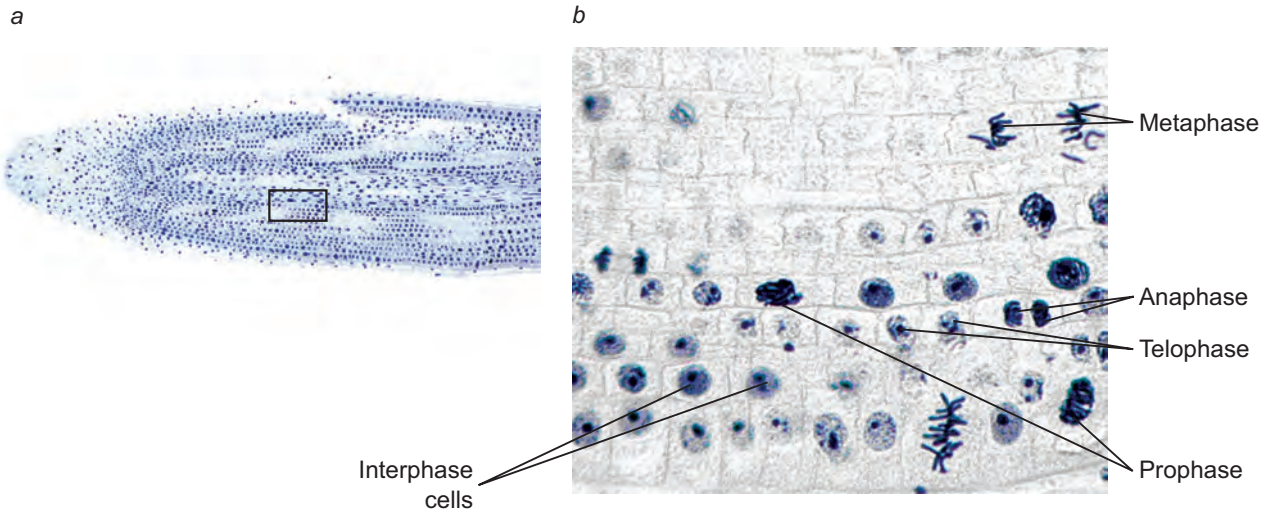
UNIT 3

Nucleus. Cell Cycle

In the onion root there are many dividing cells, in which the figures of mitosis are well seen.

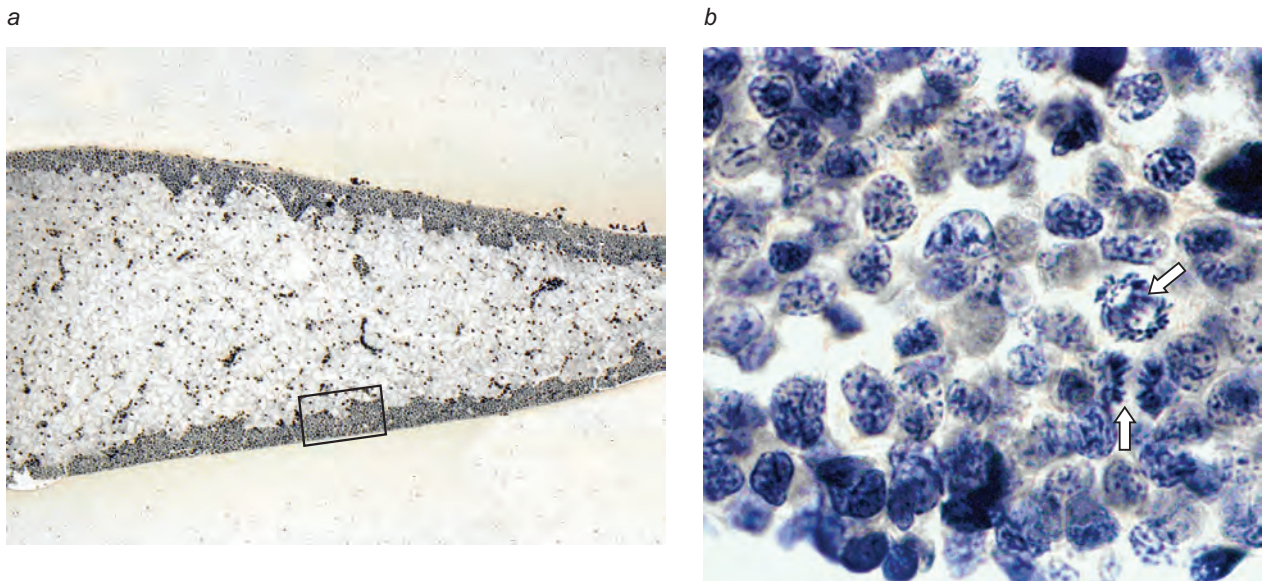
*Preparation 3.1**. Mitosis in plant cell (iron hematoxylin stain):

a – general view of onion root (x40); *b* – interphase cells and cells in different phases of mitosis (x400)



Preparation 3.2. Mitosis in animal cell (iron hematoxylin stain):

a – x40; *b* – x400



Section of an primitive animal liver with a darker cambial zone at the periphery where the dividing cells are situated.

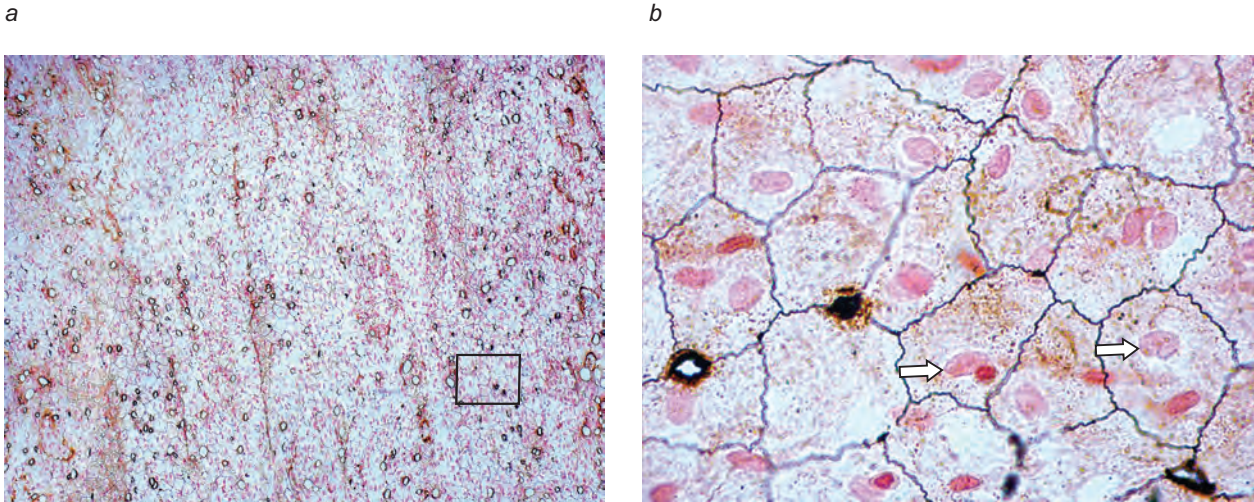
Part of a cambial zone with dividing cells. In the center two cells in anaphase are shown by empty arrows.

UNIT 4

Epithelial Tissues. Glands

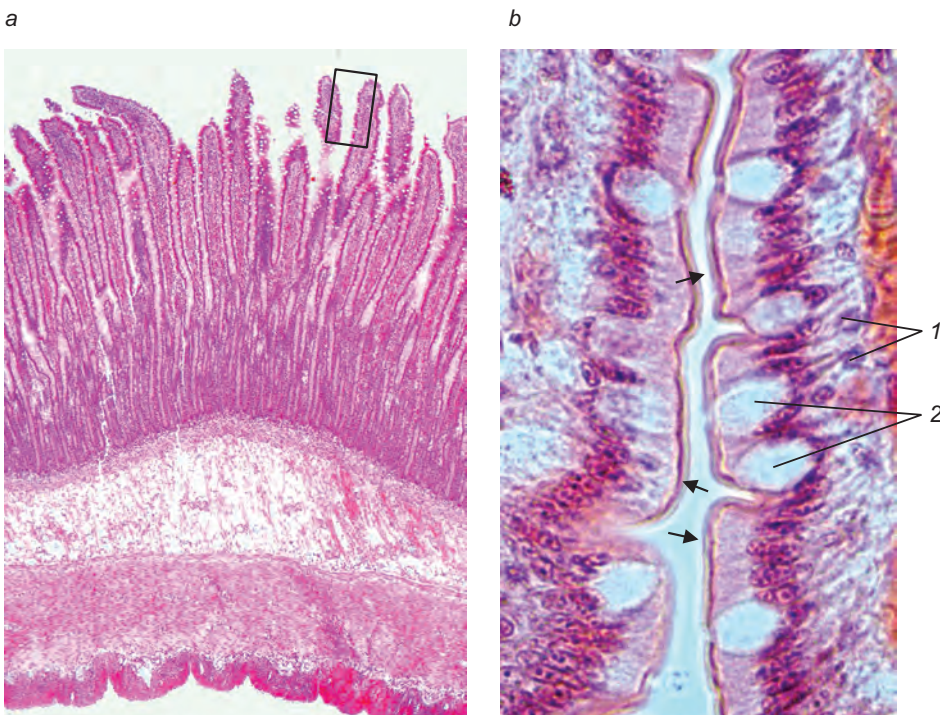
*Preparation 4.1**. Simple squamous epithelium (mesothelium) – a piece of serous membrane glued to the specimen glass (stained with silver nitrate impregnation and counterstained nuclei):

a – surface of the serous membrane with mesothelium (×40); *b* – mesothelium cells with uneven borders and nuclei (arrows) (×400)

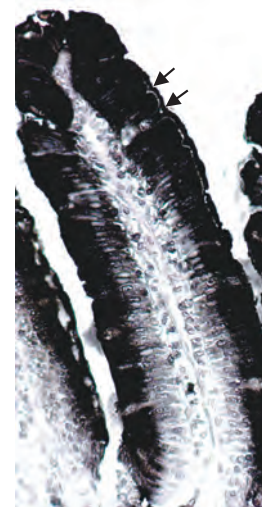


*Preparation 4.2**. Simple columnar epithelium of small intestine (H&E stain):

a – section of the small intestine (×25); *b* – simple columnar epithelium of the intestinal villus (microvillous border is shown by arrows) (×400): 1 – nuclei of columnar epithelial cells; 2 – goblet cells

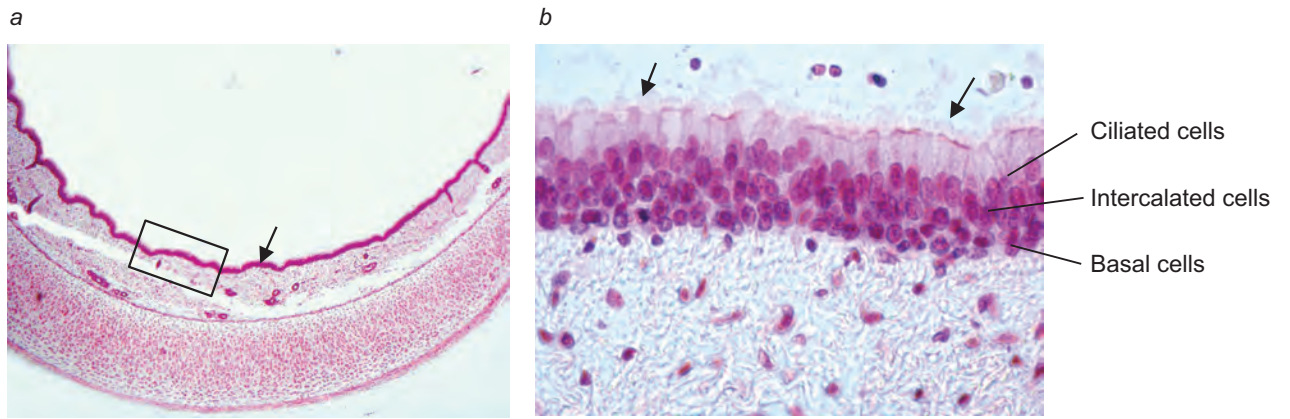


Preparation 4.3. Alkaline phosphatase in brush border of small intestine (Gomory method) (×200)

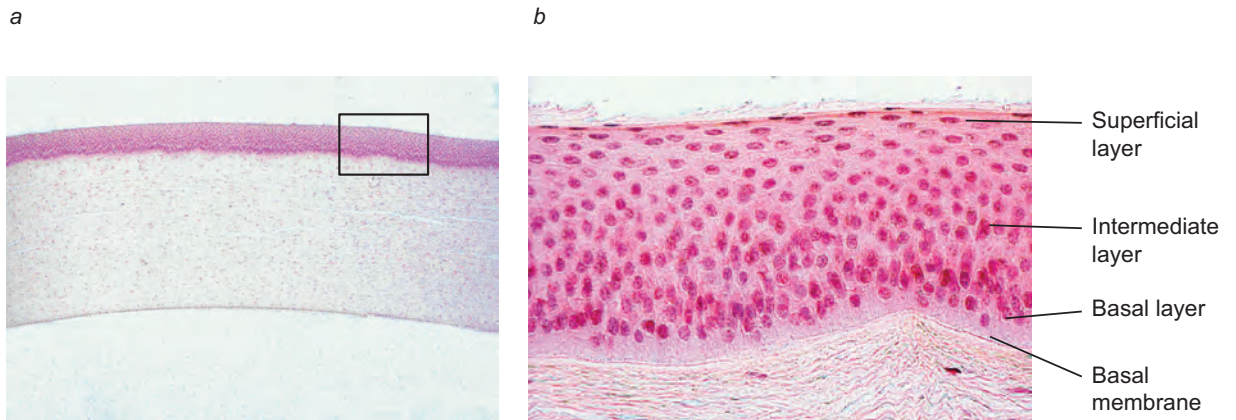


High activity of enzyme in the field of microvillous border (arrows) and apical part of cells.

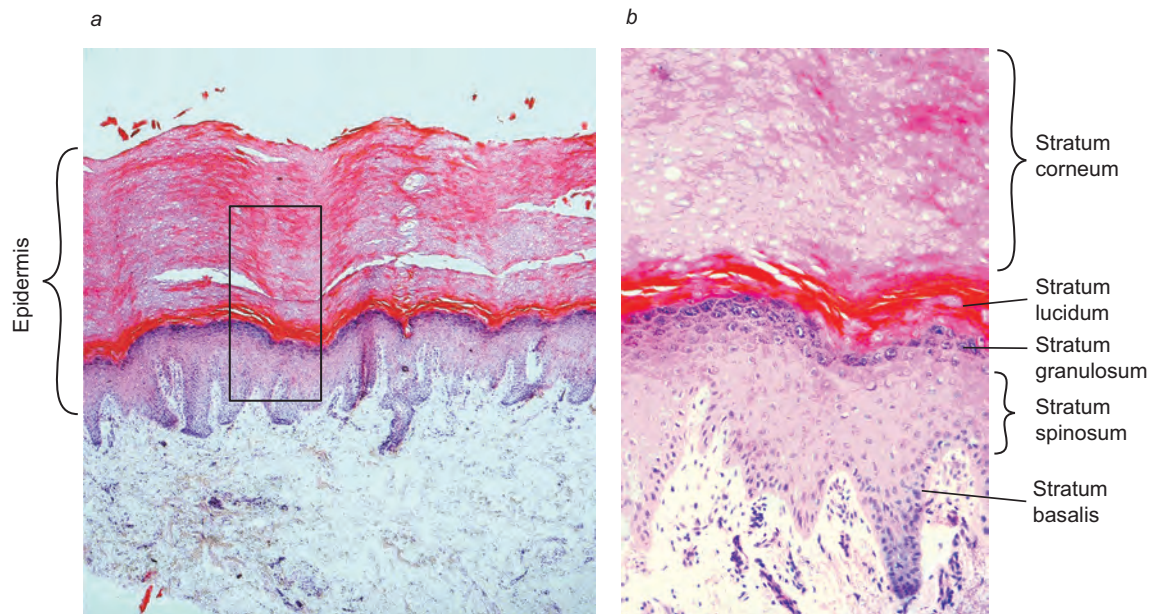
Preparation 4.4*. Simple pseudostratified ciliated columnar epithelium of trachea (H&E stain):
a – tracheal wall is lined with epithelium (arrow) (x25); *b* – pseudostratified columnar epithelium (cilia are indicated with arrows) (x400)



Preparation 4.5*. Stratified squamous nonkeratinized epithelium of cornea (H&E stain):
a – cornea covered by epithelium (x40); *b* – stratified squamous nonkeratinized epithelium (x400)



Preparation 4.6*. Stratified squamous keratinized epithelium of finger skin (epidermis) (H&E stain):
a – finger skin covered by stratified squamous keratinized epithelium (x25); *b* – layers of stratified squamous keratinized epithelium (x100)



Contents

Preface	3
Introduction.....	4
UNIT 1. Structural Components of Tissues (Tissue Elements)	5
UNIT 2. Basic Cytology. Organelles and Inclusions of Cytoplasm	7
UNIT 3. Nucleus. Cell Cycle	10
UNIT 4. Epithelial Tissues. Glands	11
UNIT 5. Blood and Lymph. Hemopoiesis.	14
UNIT 6. Connective Tissues Proper	15
UNIT 7. Cartilage and Bone Tissues	18
UNIT 8. Muscle Tissues.	21
UNIT 9. Nerve Tissue. Neurons and Neuroglia	23
UNIT 10. Nerve Fibers and Terminals	24
UNIT 11. Nerve. Spinal Ganglion. Spinal Cord. Autonomic Nervous System	25
UNIT 12. Brain.	27
UNIT 13. Sense Organs. Olfactory Organ. Organ of Vision (Eye).....	28
UNIT 14. Organ of Taste (Gustatory Organ). Organ of Hearing and Equilibrium (Ear)	29
UNIT 15. Cardiovascular System. Arteries. Microvessels	30
UNIT 16. Veins. Lymphatic Vessels. Heart	32
UNIT 17. Hemopoietic and Immunogenesis Organs. Bone Marrow	34
UNIT 18. Thymus. Lymph Node. Spleen.	35
UNIT 19. Endocrine System. Central Organs	38
UNIT 20. Peripheral Endocrine Organs.	39
UNIT 21. Digestive System. Oral Cavity	42
UNIT 22. Oesophagus. Stomach.	46
UNIT 23. Intestine	50
UNIT 24. Liver and Pancreas	53
UNIT 25. Integument. Skin and its Appendages	55
UNIT 26. Respiratory System	57
UNIT 27. Urinary System.	59
UNIT 28. Male Reproductive System	61
UNIT 29. Female Reproductive System. Ovaries. Corpus Luteum.....	63
UNIT 30. Uterine Tubes (Oviducts). Uterus. Mammary Gland	65
UNIT 31. Human Embryology. Early Stages of Embryonic Development	66
UNIT 32. Provisional Organs.	69
Practice Electron Micrographs (Electronograms)	70
List of Histological Preparations for the Final Exam	90
List of Electron Micrographs for the Final Exam	91
Recommendations for the Study of Histological Preparations and Electronograms before the Final Lessons and Exam	92
Differential Diagnostic of Examination Histological Preparations	94
References	98

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АТЛАС УЧЕБНЫХ ПРЕПАРАТОВ**

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ATLAS OF PRACTICE PREPARATIONS**

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