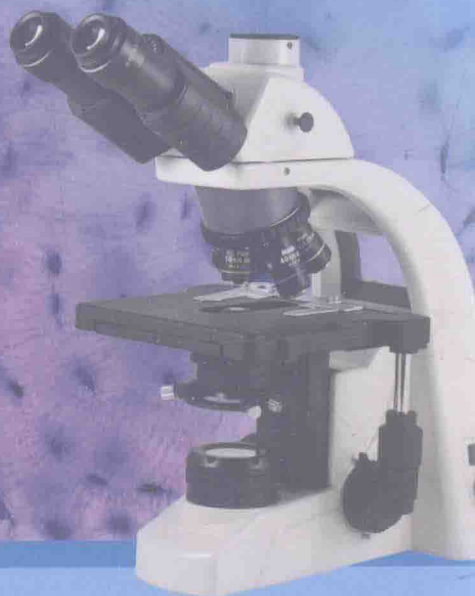


第三版

组织学与胚胎学 实验指南(双语)

Histology and Embryology Laboratory Manual
(Bilingual Edition)

汪琳 朱蕾 刘俊◎主编



长江出版传媒 湖北科学技术出版社

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主 编 汪 琳 朱 蕾 刘 俊

副主编 王燕舞 谈新提

编 委 汪 琳 武汉大学基础医学院

朱 蕾 湖北民族学院医学院

刘 俊 武汉大学基础医学院

王燕舞 武汉大学基础医学院

谈新提 武汉大学基础医学院

雷亚宁 湖北科技学院

熊海蓉 武汉大学基础医学院

罗 凡 武汉大学基础医学院

程秀娟 河南中医学院基础医学院

陈志国 新乡医学院基础医学院

胡瀚洋 武汉大学基础医学院

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前 言

高等医学教育的国际化为医学院校带来了前所未有的机遇和挑战。随着我国国际影响力的不断攀升,越来越多的留学生选择来华学医。为适应医学教育国际化发展的需求,我们编写了这本双语实验指南,为我国和来华留学的医学专业学生提供双语学习的资料。

组织学与胚胎学是两门独立的学科,但均属形态学,其中组织标本(包括切片、磨片、铺片、涂片等)及胚胎模型的实习在两门课程的学习中占有举足轻重的地位。本实验指南主要内容涵盖了人体四大基本组织及各器官系统的显微结构,并详细地介绍了如何借助显微镜对其进行观察和分辨。本教材适用于临床医学、口腔、护理、药学、法医及预防检验等不同医学专业学生的组织学与胚胎学的实验教学。

本书图文并茂,文字描述及彩色图谱之图注均采用中英文对照,对中国学生而言,有利于他们在熟悉和掌握中文知识点的同时学习相应的英文词汇;对来华留学生而言,可将此书作为学习本学科英文知识点及医学汉语的一个重要途径。本书共精选彩图 197 张,图片资源主要来源于武汉大学基础医学院组织学与胚胎学教研室多年的教学积累,部分图片截取自武汉大学医学形态学数字化教学平台中由山东易创电子有限公司提供的数字化切片库。本书中的彩图图像清晰,结构典型,可以帮助学生清晰地了解微观人体世界的奥秘,提高组织学与胚胎学的学习效果。

本书是在上一版的基础上进行了修订,增加了英文描述的比重,更换(组织学部分)或修改(胚胎学部分)的彩色图片共计 175 张。在此,对武汉大学基础医学院组织学与胚胎学教研室前辈们在前期所做出的贡献和在本书编写过程中所给予的指导和建议表示衷心的感谢!

此外,在本书的编写过程中,新东方武汉学校资深教师汪文君老师对本书英文部分进行了审阅与修正,对此也表示感谢!

尽管本书在编写的过程中进行了多次修改及校对,但仍难免存在疏漏之处,敬请读者批评指正,以利于我们今后改进。

汪 琳

2015 年 9 月

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组织学绪论

INTRODUCTION OF HISTOLOGY

1.1 光学显微镜 THE LIGHT MICROSCOPE (LM)

显微镜可分为机械部分和光学部分 (Fig.1-1) 。

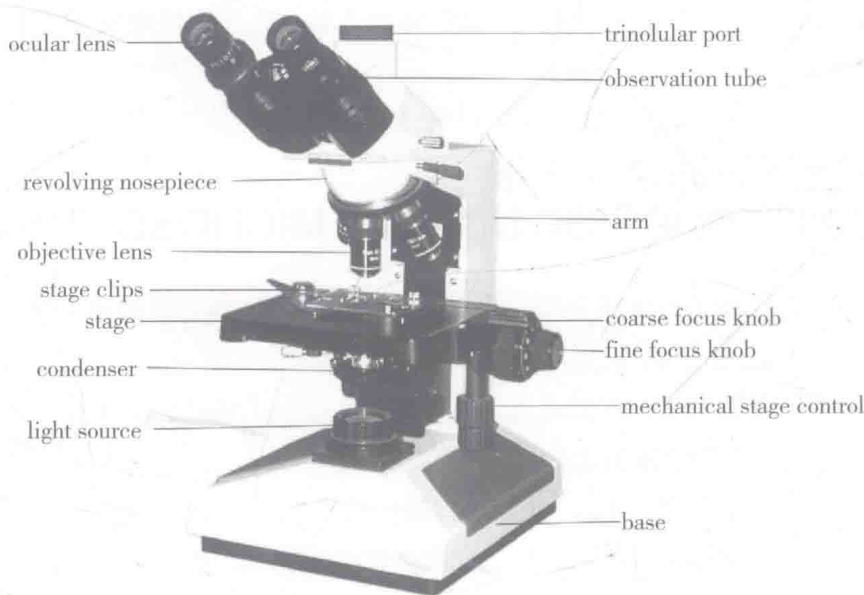


Fig.1-1 Parts of the light microscope

1.1.1 机械部分 Mechanical parts

镜座 (base) : 位于显微镜的最底部, 呈椭圆形或马蹄形。

镜臂 (arm) : 弯形, 供手持。

载物台 (stage) : 为放置标本的平台, 平台中央有一圆孔, 光线可通过该孔。平台上有

标本夹(stage clips),以固定标本。

镜筒(observation tube):为镜臂上端前方的圆筒,起暗室作用,上端接目镜,下端接物镜。

转换器(revolving nosepiece):位于镜筒下方,圆形,其上装有2~4个不同放大倍数的物镜。

调节轮(focus knob):调节焦距,使物像清晰。可分为粗调节轮(coarse focus knob)和细调节轮(fine focus knob),粗调节轮的调节范围较大,细调节轮的调节范围较小。

1.1.2 光学部分 Optical parts

目镜(ocular lens):常用的目镜有6倍、8倍和10倍($6\times$, $8\times$, $10\times$)等。

物镜(objective lens):位于转换器下方,一般有 $4\times$ 、 $10\times$ 、 $40\times$ 和 $100\times$ 等。 $100\times$ 为油镜头,必须滴加油剂才能使用。

物像的放大倍数=目镜的放大倍数 \times 物镜的放大倍数。

聚光镜(condenser):位于载物台下方,用以集合光源发出的光线,使光线透过标本。聚光镜可上下移动以调节光线的强度。

光源(light source):光从此处发出。聚光镜中还装有光圈,能随意开大和缩小以控制光量。

1.2 光学显微镜的使用方法

THE METHODS OF USING A MICROSCOPE

1. 打开电源开关,调节好光线强度。将低倍镜转至正中,然后依次调节聚光镜和光圈,至视野中光度适宜为止。

2. 将标本放置于载物台上,双眼通过显微镜观察,一只手移动标本,另一只手调节调节轮,直至镜下观察目标图像清晰为止。

观察时,一般先用低倍镜($4\times$ 、 $10\times$)观察。低倍镜视野范围较大,物像较小,利于观察标本全貌。对较为细小的细胞和结构,低倍镜常无法辨别,需要采用高倍镜($40\times$)观察。在转换至高倍镜之前必须将观察目标移至视野的正中,然后将高倍镜头转至正中即可进行观察。观察时一般使用细调节轮以调节物距。油镜镜头($100\times$ 以上)只有在观察极其细微的结构时才使用,一般情况下很少使用。使用油镜时玻片上要先滴加油剂(一般为香柏油或石蜡油),观察完毕后用擦镜纸沾少量二甲苯将油镜镜头和玻片上的油剂清洗干净,再用擦镜纸将二甲苯抹去。

观察标本时,如遇到物像模糊,调节物距不能使之清晰者,多是由于镜头不洁的缘故,可用擦镜纸沾少许二甲苯擦拭镜头,切勿使用手或粗纱布,以免损伤镜面。

How to Use the Microscope

Microscopes allow you to view tiny objects, such as small insects, microbes or cells, which cannot be observed with the naked eye. Magnifying the objects tens or hundreds times of the actual size, the microscope makes it possible for the researchers to study the microscopic universe.

Types of Microscopes

Light Microscope (LM) – the models found in most schools, use compound lenses to magnify objects. The lenses bend or refract light to make the object beneath them appear closer. Common magnifications: $40\times$, $100\times$, $400\times$.

Scanning Electron Microscope (SEM) – allow scientists to view a universe too small to be seen with a light microscope. SEMs do not use light waves; they use electrons (negatively charged electrical particles) to magnify objects up to two million times.

Transmission Electron Microscope (TEM) – also uses electrons, but instead of scanning the surface (as with SEM's) electrons are passed through very thin specimens.

Parts of the Light Microscope

1. Eyepiece: containing ocular lens.
2. Revolving nosepiece: holding the low and high-power objective lenses, can be rotated to change magnification.
3. Objective lenses: magnification ranges from $4\times$ to $100\times$.
4. Stage: supporting the slide being viewed.
5. Stage clips: holding the slide in place.
6. Light source: projects light upwards through the diaphragm, the specimen, and the lenses.
7. Arm: used to support the microscope when carried.
8. Coarse focus knob: moving the stage up and down for focusing.
9. Fine focus knob: moving the stage slightly in sharpen the image.
10. Condenser: directing light to pass the specimen.
11. Base: supporting the microscope.
12. Diaphragm: regulates the amount of light on the specimen.

Magnification

The light microscope has 4 magnifications: Scanning, low, high and oil lens. Each objective will have written the magnification. In addition to this, the ocular lens (eyepiece) has a magnification.

The total magnification is the ocular x objective

	magnification	ocular lens	total magnification
scanning	4 ×	10 ×	40 ×
low power	10 ×	10 ×	100 ×
high power	40 ×	10 ×	400 ×
oil lens	100 ×	10 ×	1000 ×

Focusing Specimens

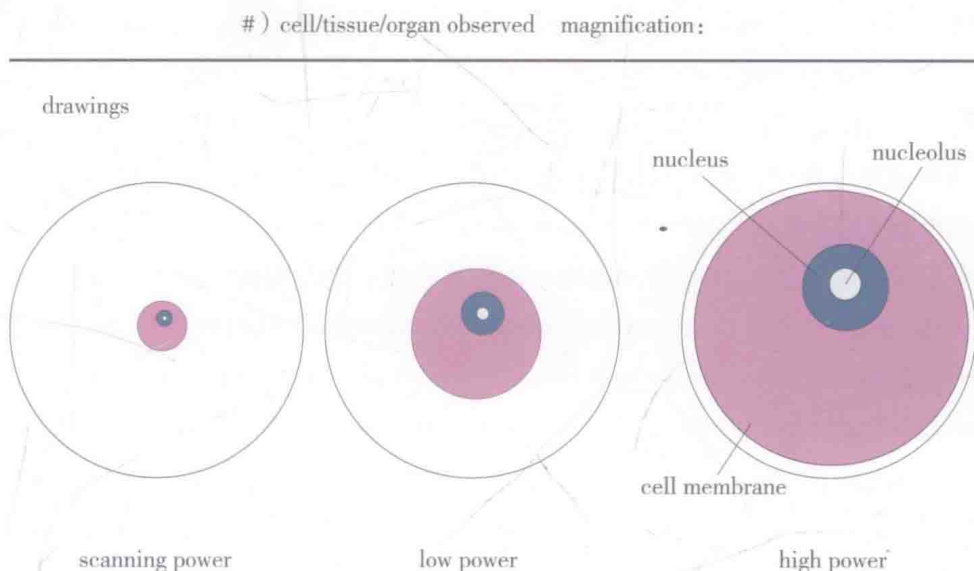
1. Place the microscope slide on the stage and fasten it with the stage clips.
2. Turn on the microscope light.
3. Always start with the scanning objective. Odds are, you will be able to see something on this setting. Use the Coarse Knob to focus, image may be small at this magnification, but you won't be able to find it on the higher powers without this first step. Do not use stage clips, try moving the slide around until you find something.
4. Once you've focused on Scanning, switch to Low Power. Use the Coarse Knob to refocus. Again, if you haven't focused on this level, you will not be able to move to the next level.
5. Now switch to High Power. (If you have a thick slide, or a slide without a cover, do NOT use the high power objective). At this point, ONLY use the Fine Adjustment Knob to focus specimens. Do not allow the objective lens to touch the slide!
6. If the specimen is too light or too dark, try adjusting the diaphragm.
7. If you see a line in your viewing field, try twisting the eyepiece, the line should move. That's because it's a pointer, and is useful for pointing out things to your lab partner or teacher.
8. Do not touch the glass part of the lenses with your fingers. Use only special lens paper to clean the lenses.
9. When finished, raise the tube (or lower the stage), click the low power lens into position and remove the slide.
10. Turn off the microscope light.
11. Always keep your microscope covered without being used.

Remember, microscopes are expensive scientific instruments. Handle them properly and carefully and they will last for many years!

Drawing Specimens

1. Use pencil – you can erase and shade areas.
2. All drawings should include clear and proper labels (large enough to view details). Drawings should be labeled with the specimen name and magnification.
3. Labels should be written outside of the circle. The circle indicates the viewing field as seen through the eyepiece, specimens should be drawn to scale—ie. if your specimen takes up the whole viewing field, make sure your drawing reflects that.

Example:



Troubleshooting

Occasionally you may have trouble in handling your microscope. Here are some common problems and solutions.

1. Image is too dark!

Adjust the diaphragm, make sure the microscope light is on.

2. There's a spot in my viewing field, even when I move the slide, the spot still stays in the same place!

Your lens is dirty. Use lens paper, and only lens paper to carefully clean the objective and ocular lens. The ocular lens can be removed to clean the inside.

3. I can't see anything under high power!

Remember the steps, if you can't focus under scanning and then low power, you won't be able to focus on anything under high power.

4. Only half of my viewing field is lit, it looks like there's a half-moon there!

You probably don't have your objective fully clicked into place.

1.3 组织学标本 THE SPECIMENS OF HISTOLOGY

组织学实验主要是通过光学显微镜的观察,了解人体各组织和器官的细微结构,为进一步了解它们的生理功能和病理变化奠定基础。组织学标本一般可分为两大类。①切片标本(section):获取人体(尸检或外科手术时)或动物某种器官的小块组织,经过固定、脱水、包埋、切片、染色等步骤制成薄片,然后显微镜下进行观察。常用的有石蜡切片、火棉胶切片和冰冻切片等。②非切片标本:凡不用切片机而制作的标本,统称之为非切片标本,包括血液涂片、结缔组织铺片和骨磨片等。

实验标本常用苏木精(hematoxylin, H)和伊红(eosin, E)两种染料染色(简称HE染色)。在这种染色标本中,胞质和纤维成分被伊红染成红色;胞核被苏木精染成紫蓝色。此外尚有其他特殊染色的标本。

电镜观察的标本,也经过固定、切片、染色等步骤,切片很薄,称为超薄切片,切片厚度一般在50nm左右。

第 2 章

上皮组织

EPITHELIAL TISSUE

2.1 教学目的 OBJECTIVES

1. Understand the general features and classification of epithelial tissue.
2. Master the structural features and functions of varieties of covering epithelium.
3. Master the L.M structure, E.M structural features and functions of microvilli and cilia.
4. Understand the ultra-structure features and functions of varieties of intercellular conjunctions.
5. Master the position, L.M structure, ultra-structure and function of basement membrane.
6. Know the conception of glandular cells, glandular epithelium and glands, and the morphological classification of exocrine glands.

2.2 教学内容 CONTENTS OF OBSERVATION

L.M. Specimens: simple squamous epithelium, simple cuboidal epithelium, simple columnar epithelium, pseudostratified ciliated columnar epithelium, stratified squamous epithelium, transitional epithelium.

Electron micrographs: tight junction, gap junction, intermediate junction, desmosome, cilia, microvilli, hemidesmosome, basement membrane.

2.2.1 间皮 Mesothelium

观察标本为肠系膜铺片，浸银法染色（silver stain）。镜下可见单层扁平上皮细胞呈多边形（表面观），相邻细胞间以锯齿状相互嵌合，细胞核显示不清（Fig.2-1）。

The observed specimen is the spreading preparation of mesentery treated with silver nitrate. Under the microscope, mesothelium is simple squamous epithelium. The cells, shaped like scales, are

best seen in a surface view and have irregular, serrated outlines that fit together like pieces of a jigsaw puzzle. The nucleus is unclear (Fig.2-1) .



Fig.2-1 Spread preparation of mesentery, showing mesothelium (superficial surface) . Silver stain. High magnification 细胞核: nucleus

2.2.2 单层扁平上皮 Simple squamous epithelium

观察标本为肾切片，HE 染色。肾皮质内可见许多球团状结构，称为肾小体。肾小体由血管球和肾小囊组成。镜下可见肾小囊壁层由单层扁平上皮细胞构成：细胞扁平，含核的部分稍厚，突向囊腔 (Fig.2-2) 。

The observed specimen is the section of the kidney stained by hematoxylin and eosin (HE stain) . There are many spherical structures, called as renal corpuscle, which consist of glomerular capillaries and Bowman's capsule. The outer layer of Bowman's capsule, the parietal layer, consists of simple squamous epithelium. The cells shape like scale. One nucleus is in the widest part of each cell, a local bulge protrudes into the capsular space (Fig.2-2) .

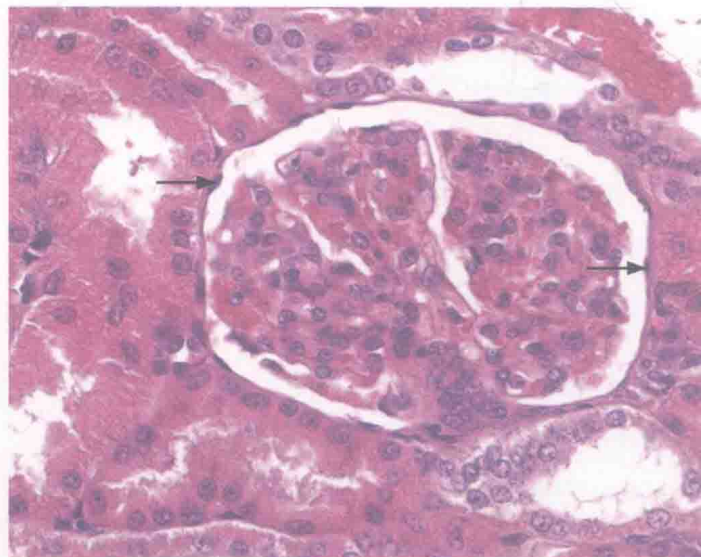


Fig.2-2 Section of kidney. HE stain. High magnification → 单层扁平上皮: simple squamous epithelium

2.2.3 内皮 Endothelium

观察标本为肾切片，HE 染色。其内可见纵切的血管（Fig.2-3）和横切的血管（Fig.2-4）血管壁上可见扁平的内皮细胞，其核突向管腔。

The observed specimen is the section of the kidney, HE stain, in which longitudinal plane (Fig.2-3) and transverse plane (Fig.2-4) of blood vessels are found. Flattened endothelium lines the vascular wall. One nucleus is a local bulge protrudes into vessel lumen.

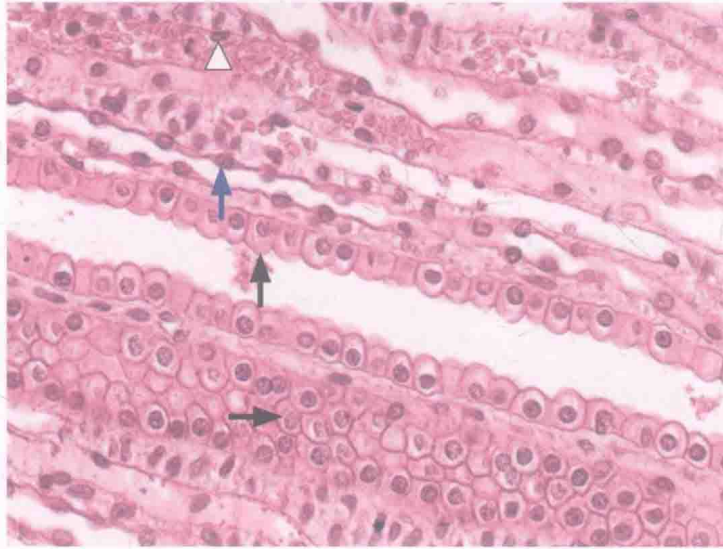


Fig.2-3 Section of kidney. \triangle 内皮: endothelium \blacktriangleup 单层扁平上皮: simple squamous epithelium \rightarrow 单层立方上皮: simple cuboidal epithelium. HE stain. High magnification

2.2.4 单层立方上皮 Simple cuboidal epithelium

观察标本为肾切片，HE 染色。镜下可见大小不等的管腔，有纵切面、斜切面（Fig.2-3）和横切面（Fig.2-4）。单层立方上皮细胞为正方形，排列整齐，细胞间界限较清楚，细胞核呈圆形，位于细胞中央（Fig.2-3，2-4）。

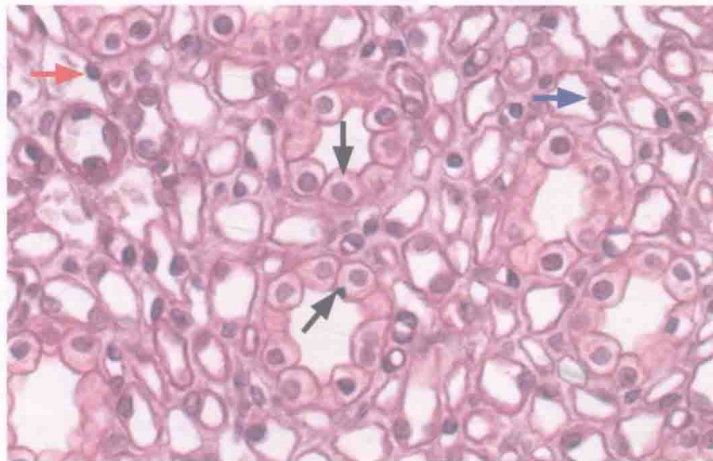


Fig.2-4 Section of kidney. \rightarrow 内皮: endothelium \blacktriangleup 单层扁平上皮: simple squamous epithelium \blacktriangledown 单层立方上皮: simple cuboidal epithelium. HE stain. High magnification

The observed specimen is the section of the kidney, HE stain. Under the microscope, there are many different size lumens which are longitudinal plane, oblique plane (Fig.2-3) and transverse plane (Fig.2-4) of section. Simple cuboidal epithelium consists of one layer of cells whose height roughly equals their width. Lateral cell borders are distinct and each cell has a round, central nucleus (Fig.2-3, 2-4).

2.2.5 单层柱状上皮 Simple columnar epithelium

观察标本之一为胆囊切片, HE 染色 (Fig.2-5)。先找到表面高低不平有皱褶的一面, 即为胆囊的内表面, 可见此面覆盖的一层上皮组织。上皮细胞呈长方形, 细胞间界限不清, 细胞核呈椭圆形, 位于细胞近基底部, 排列较紧密。观察标本之二为小肠切片, HE 染色 (Fig.2-6)。小肠的单层柱状上皮主要由柱状细胞 (columnar cell) 组成, 其间还可见杯状细胞 (goblet cell)。

One of the observed specimens is the section of gallbladder, HE stain. (Fig.2-5). The inner surface of gallbladder is lined with the simple columnar epithelium. The vertical section of the epithelium is formed of one layer of rectangle cells. Lateral cell borders are not distinct and the ovoid nucleus of cell is basally placed. The lumen of small intestine (Fig.2-6) is also lined with the simple columnar epithelium. Besides columnar cell, there are goblet cells in the simple columnar epithelium of inner lining of small intestine.



Fig.2-5 Section of gall bladder. ①单层柱状上皮: simple columnar epithelium ②结缔组织: connective tissue. HE stain. High magnification

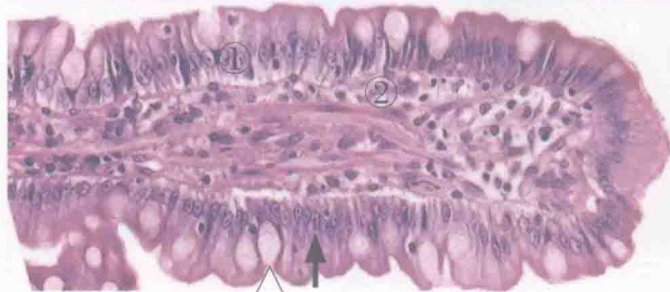


Fig.2-6 Section of small intestine. ①单层柱状上皮: simple columnar epithelium ②结缔组织: connective tissue ▲柱状细胞: columnar cell △杯状细胞: goblet cell. HE stain. High magnification

2.2.6 假复层纤毛柱状上皮 Pseudostratified ciliated columnar epithelium

观察标本为气管切片，HE 染色。先找到气管腔面的上皮部分，镜下可见上皮细胞之间界限不清，但根据细胞核位置和形态的不同，可将细胞分为四种类型：纤毛柱状细胞（ciliated columnar cell）、杯状细胞（goblet cell）、梭形细胞（fusiform cell）和锥形细胞（taper cell）（Fig.2-7）。

The observed specimen is the section of trachea, HE stain. The surface of the trachea is pseudostratified ciliated columnar epithelium. In this type of epithelium, lateral cell borders cannot be distincted. According to the different shapes and the places of nucleus, the epithelial cells are classified into four types, namely ciliated columnar cell, goblet cell, fusiform cell and taper cell.

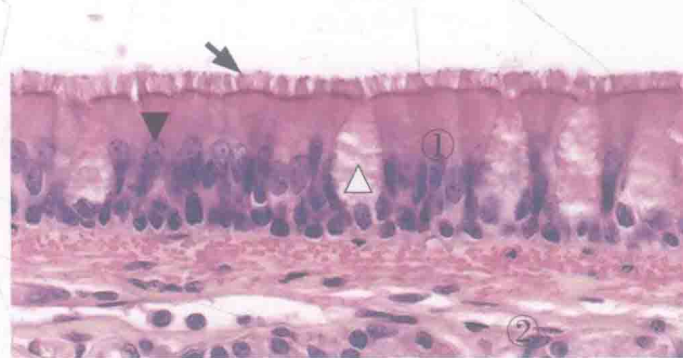


Fig.2-7 Section of trachea. ① 假复层纤毛柱状上皮: pseudostratified ciliated columnar epithelium ② 结缔组织: connective tissue ▲ 纤毛: cili ▼ 纤毛柱状细胞: ciliated columnar cell △ 杯状细胞: goblet cell. HE stain. High magnification

2.2.7 未角化的复层扁平上皮 Nonkeratinized stratified squamous epithelium

观察标本为食管切片，HE 染色。先找到食管腔面的上皮层，镜下可见上皮细胞排列成多层，细胞形态不一。由上皮基底面向腔面观察，可见如下几层形态特点各不相同的细胞层：基底层为一层矮柱状（short column）或立方形（cuboidal）细胞，排列整齐，细胞界限不清，核圆形，染色深；其上为数层多边形（polygon）细胞，细胞界限清楚，胞核圆形，位于细胞中央；再向上由数层梭形细胞组成，胞质渐显嗜酸性，胞核扁圆形，位于细胞中央；靠近腔面由数层扁平细胞组成，与梭形细胞层无明显分界，胞质嗜酸性较强，胞核逐渐变扁并呈固缩状态皮。上皮的基底面凸凹不平，借基底膜与深层组织相连接（Fig.2-8）。

The observed specimen is the section of esophagus, HE stain. The inner surface of esophagus is lined with nonkeratinized stratified skuamous epithelium, which is characterized by numerous cell layers that are different in size and shape. From the basement to outermost layer of the epithelium, several visible cell layers are different in morphology and characteristics. Cuboidal or low columnar basal cells are located at the base of the stratified epithelium. The border of cells is not distinct, and the cells with deep-dyed big nucleolus are regularly arranged. Cells in the intermediate layers of the epithelium are polygonal, with round central nuclei and more visible cell cytoplasm and membranes. Above the intermediate layers