

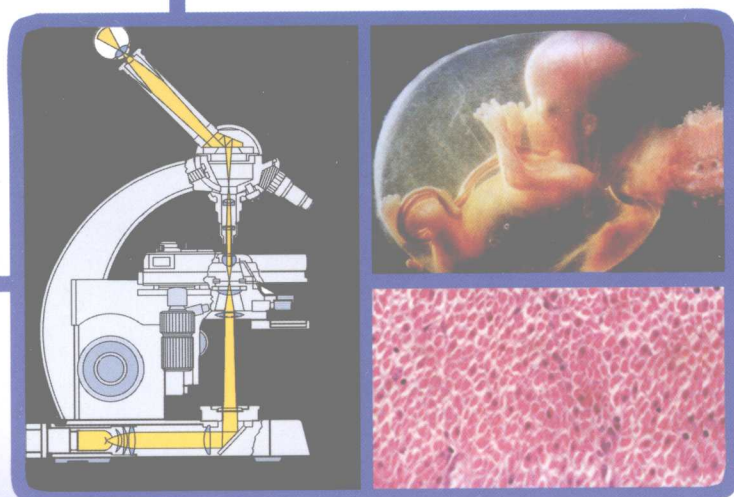
普通高等教育“十一五”国家级规划教材配套教材
全国高等医药院校教材

描述组织学与胚胎学

——实验指导与彩色图谱

(双语版)

高英茂 武玉玲 主编



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主 编 高英茂 武玉玲

副主编 吴 梅 翟新梅 张圣明

编 者 (以姓氏笔画为序)

王占友 刘 凯 刘晓萍 吴 梅

汪 涛 宋天保 张圣明 武玉玲

高英茂 湛宏鸣 管英俊 翟新梅

科 学 出 版 社

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内 容 简 介

本书实用性强、应用面广、文字简明、图文并茂,紧密结合实验教学的需要,不求“全、深”,只求“简明、实用”。无论文字描述还是图例图注,都是中英两种文字,且中英文严格对照。这样,学生在学习专业知识的同时,也学到了专业英语。对于外国留学生来说,使用更方便,在学习专业知识的同时,也学习了专业中文。在各章之末,还增加了中英对照的复习题,便于学生全面复习、重点掌握。全书共 21 章,中英文版面字数约 15 万,彩色图片 195 幅,大部分为实验课上常用的组织切片彩色显微图像,实用性很强。

本书适合医学院校本科生、长学制学生、研究生及外国留学生使用。

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前 言

作为一本实验教学的简明教材,本书中文版已于2000年7月首次出版,至今已有7年。本书出版以来,深受读者欢迎。文字简明、重点突出,彩色图版、清晰逼真,课上课下、使用方便,这是读者对本书的普遍赞誉。但也有读者提出,书内英文注释太少,不利于双语教学,更不便于留学生应用。针对读者的这些反应,我们进行了修订。在本版中,坚持了实用性强、应用面广、文字简明、图文并茂的原则,紧密结合实验教学的需要,不求“全、深”,只求“简明、实用”。同时将修订版改为中英文对照的双语版。无论文字描述还是图例、图注,都是中英两种文字,且中英文严格对照。这样,学生在学习专业知识的同时,也学到了专业英语。对于外国留学生来说,使用更方便,在学习专业知识的同时,也学习了专业中文。在 chapters 之末,还增加了中英对照的复习题,便于学生全面复习、重点掌握。全书共有21章,中英文版面字数约15万,彩色图片195幅,大部分为实验课上常用的组织切片彩色显微照像,实用性很强。

本书在编写过程中得到了十余所院校和科学出版社的支持,在此表示衷心的感谢。在本书的编写过程中,尽管我们全体作者尽心尽力,力求编出一本精品实验教材,但编写中英文严格对照的实验教材,对于我们来说还是个尝试,难免有所疏漏,敬请读者批评指正。

高英茂 武玉玲

2007年7月15日

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图版

第一章

组织学绪论

INTRODUCTION TO HISTOLOGY

一、普通光学显微镜和显微镜观察技术 Conventional Light Microscope and Microscopy

普通光学显微镜由机械部和光学部组成(图 1-1)。光学部包含 3 个透镜系统,即聚光镜、物镜和目镜。聚光镜有会聚光线的作用,可产生一个光锥投射到物体上,以便观察。物镜可放大物体并将物体的成像投射向目镜。目镜进一步放大物像并将放大的物像投射到观察者的视网膜上。显微镜的总放大倍数是物镜放大倍数与目镜放大倍数的乘积。

载物台是一个带孔的扁平台板,通过台板上的孔光线可投射到组织切片上。载物台位于聚光镜的上方,贴有组织切片的载玻片固定在载物台上。可以通过调节载物台去移动载玻片,从而能观察到整个切片。

调焦钮包括粗调和细调,可通过调节而将物像聚焦在交点上。在低倍镜下可用粗调钮,而在高倍镜下则用细调钮。

The conventional light microscope is composed of mechanical and optical parts (Fig. 1-1). The optical components consist of 3 systems of lenses: condenser, objective, and ocular lens. The condenser collects and focuses light, producing a cone of light that illuminates the object to be observed. The objective lenses enlarge and project the illuminated image of the object in the direction of the ocular lens. The ocular lens further magnifies this image and projects it onto the viewer's retina. The total magnification is obtained by multiplying the magnifying power of the objective and ocular lenses.

The specimen stage is a flat platform with an aperture through which the light can pass onto the tissue section. It lies above the condenser and can hold the glass slide bearing the tissue section. The stage position adjustment can be used to move the slide to allow viewing of the whole slide.

The focus adjustment knobs include coarse and fine focus controls, and can be used to bring the image into focus. At lower magnification the coarse focus adjustment knob should be used, and at higher magnification the fine knob should be used.

光学显微镜应该正确使用和细心使用。学生使用时,最好先用肉眼观察标本,以便确认标本的形态和一般结构。目镜可用作手持放大镜,在显微镜观察前用此检测标本。通过肉眼和目镜粗略观察,可以对观察物体的主要结构有一个基本概念。当将载玻片放在载物台上时,要确认是否盖玻片向上,否则,在用高倍镜观察时会压碎切片,而且焦点永远不能落在观察的标本上。通过转动载物台调节钮,将标本移动到载物台孔的中心,打开光源,将物镜盘旋转至低倍物镜处,将聚光镜升至其最高水平并将光圈开至最大。对于学生来说,对焦是关键。应用粗调节钮将载物台慢慢升高,直到标本与物镜靠得最近,眼睛要仔细盯着这一过

程。然后,眼睛看着目镜,上下调节细调节钮,直到完全聚焦。

在使用显微镜时,学生必须高度重视以下几点:操作要认真仔细,不可产生拆装显微镜任何一个部件的念头。当镜头需要清洁时,必须用专门的擦镜纸,千万不可用普通纸或手指去擦磨。在观察组织标本时,必须首先用低倍镜,然后再用高倍镜。

The light microscope should be used correctly and carefully. It is better for students to examine the specimen with naked eye to determine the shape and general structure of the object. The eyepiece may be used as a hand magnifier to examine the object before observing under light microscope. This scanning will obtain a general idea about the major structure of the object. When the slide is put on the stage, make sure it is coverslip up, otherwise the high power objective lens will crush the slide, and the focus can never be made on the object. Move the object in center of the stage aperture by turning the stage position adjustment knob, switch on the lamp, rotate the nosepiece swing in the low power objective into the position with a click, raise the condenser to its highest position and turn its aperture diaphragm to fully open. It is the key point for students to focus the image. Raise the stage by rotating the coarse knob slowly to bring the specimen close to the objective, at the same time keep watching carefully by naked eye. Look into the eyepieces and rotate the fine adjustment knob back and forth to focus exactly.

When the microscope is used the students must pay great attention to the following: Handle the microscope gently and carefully, never attempt to dismantle any parts of the microscope. When the lenses need to clean, the special lens tissue should be used, never use rough paper or finger. When a tissue specimen is observed, the low power lens must be first used, and then the higher power lens is used.

二、组织切片的制备 Preparation of Histologic Section

观察组织最普通、常用的方法是光学显微镜组织学切片的制作。在光镜下,观察组织结构需要有光束通过组织标本。由于组织和器官通常都太厚,光线不能通过,因而需要将其切成薄而透明的薄片。理想的显微镜观察的组织标本应该保持活体时的结构和分子构成。

The most common methods used in the study of tissues is the preparation of histologic sections used in light microscopy. Under the light microscope, tissues are examined via a light beam that is transmitted through the tissue. Since tissues and organs are usually too thick for light to pass through them, they must be sectioned to be thin, translucent. The ideal microscope tissue preparation should be preserved so that the tissue on the slide has the same structure and molecular composition as it had in the body.

(一) 固定 Fixation

如果要制作长期不变的组织切片,就必须将组织固定。为了避免组织被细胞内的酶消化(即自溶)或被细菌所分解,保持组织结构和分子构成不变,在将小块组织从活体取出之后应尽快进行适时适当的处理,这种处理就是固定。固定常用化学方法,较少应用物理方法。在化学固定中,通常是将组织浸入固定剂中。由于固定剂有时需要完全进入组织中,因而组织通常需要切成小块,然后再固定,从而有利于固定液的穿透和保证组织的保存。固定剂的血管灌注也可应用。由于在灌注固定中固定剂通过血管很快达到组织,因而固定效果得以很大提高。

用作常规光镜观察的最好固定剂之一是4%的缓冲等渗甲醛液。固定过程的化学过程很复杂,并非都已阐明。已知甲醛、吴二醛和其他广泛应用的固定剂是通过与组织蛋白中的氨基($-\text{NH}_2$)发生反应而发挥固定作用。在戊二醛固定中,其固定作用由于其二醛与蛋白形成横联的特点而得以加强。

If a permanent section is desired, tissues must be fixed. To avoid tissue digestion by enzymes present within the cells (autolysis) or by bacteria and to preserve the structure and molecular composition, pieces of organs should be promptly and adequately treated before or as soon as possible after removal from the animal's body. This treatment—fixation—can be done by chemical or, less frequently, physical methods. In chemical fixation, the tissues are usually immersed in solutions of stabilizing or cross-linking agents called fixatives. Because the fixative needs some time to fully diffuse into the tissues, the tissues are usually cut into small fragments before fixation to facilitate the penetration of the fixative and to guarantee preservation of the tissue. Intravascular perfusion of fixatives can be used. Because the fixative in this case rapidly reaches the tissues through the blood vessels, fixation is greatly improved.

One of the best fixatives for routine light microscopy is a buffered isotonic solution of 4% formaldehyde. The chemistry of the process involved in fixation is complex and not always well understood. Formaldehyde and glutaraldehyde, another widely used fixative, are known to react with the amine groups ($-\text{NH}_2$) of tissue proteins. In the case of glutaraldehyde, the fixing action is reinforced by virtue of its being a dialdehyde, which can cross-link proteins.

(二) 包埋 Embedding

组织通常包埋在固体包埋剂中以利于切片。为了用切片机切出薄的切片,组织必须在固定后浸入包埋剂,这样会使组织具有足够的硬度。包埋剂包括石蜡和塑性树脂。石蜡常规用于光镜标本的包埋,树脂可用于光镜和电镜标本的包埋。

石蜡包埋过程通常有两个主要步骤:脱水和透明。用乙醇和水的梯度系列混合液将组织块中的水分除去(通常从70%~100%的梯度乙醇溶液)。然后再用与包埋剂相溶的溶剂将乙醇置换出来。在石蜡包埋中,溶剂常用二甲苯。当组织内渗入溶剂时,组织通常会变得透明。组织内一旦充满了溶剂,温箱内液体的石蜡就会进入组织之中,此时温箱内的温度为58~60.8℃。高温使溶剂挥发,组织内留下的空隙便被石蜡填充。当从温箱中取出后,组织及其浸入其中的石蜡便凝固变硬。

Tissues are usually embedded in a solid medium to facilitate sectioning. To obtain thin sections with the microtome, tissues must be infiltrated after fixation with embedding substances that impart a rigid consistency to the tissue. Embedding materials include paraffin and plastic resins. Paraffin is used routinely for light microscopy; resins are used for both light and electron microscopy.

The process of paraffin embedding, or tissue impregnation, is ordinarily preceded by two main steps: dehydration and clearing. The water is first extracted from the fragments to be embedded by bathing them successively in a graded series of mixtures of ethanol and water (usually from 70% to 100% ethanol). The ethanol is then replaced with a solvent miscible with the embedding medium. In paraffin embedding, the solvent used is usually xylene. As the tissues are infiltrated with the solvent, they generally become transparent (clearing). Once the tissue is impregnated with the solvent, it is placed in melted paraffin in the oven, typically at 58–60.8°C. The heat causes the solvent to evaporate, and the spaces within the tissues become filled with paraffin. The tissue together with its impregnating paraffin gets hard after being taken out of the oven.

含有组织的硬包埋块放在切片机上(图 1-2),用切片刀将其切成 $1\sim 10\mu\text{m}$ 的薄片。要记住 $1\mu\text{m}=0.001\text{mm}=10^{-6}\text{m}$; $1\text{nm}=0.001\mu\text{m}=10^{-6}\text{mm}=10^{-9}\text{m}$ 。将切下的薄片放在水面上,然后将其转放到载玻片上待染色。

快速冷冻切片是一种完全不同的组织切片制作方法。在冷冻切片中,应用物理性的冷冻方法固定组织,而不是化学固定,此时组织变硬以备切片。冷冻切片机已经用于切制冷冻组织。由于这种方法可以快速制备组织切片而不需经过上面所说的长时间的包埋手续,因而常规用于医院外科标本的研究。冷冻切片也用于敏感酶或小分子物质的组织化学研究,因为冷冻不会灭活大多数酶。由于组织在浸泡于二甲苯这样的溶剂中时组织中的脂肪会被溶解失散,因而在研究这类化合物时也常利用冷冻切片。

The hard blocks containing the tissues are then taken to a microtome (Fig. 1-2) and are sectioned by the microtome's steel to a thickness of $1\sim 10\mu\text{m}$. Remember that 1 micrometer ($1\mu\text{m}$) = $0.001\text{mm}=10^{-6}\text{m}$; 1 nanometer (1nm) = $0.001\mu\text{m}=10^{-6}\text{mm}=10^{-9}\text{m}$. The sections are floated on water and transferred to glass slides to be stained.

A completely different way to prepare tissue sections is to submit the tissues to rapid freezing. In this process, the tissues are fixed by freezing (physically, not chemically) and at the same time become hard and thus ready to be sectioned. A freezing microtome—the cryostat has been devised to section the frozen tissues. Because this method allows the rapid preparation of sections without going through the long embedding procedure described above, it is routinely used in hospitals to study specimens during surgical procedures. Freezing of tissues is also effective in the histochemical study of very sensitive enzymes or small molecules, since freezing does not inactivate most enzymes. Because immersion of tissues in solvents such as xylene dissolves the tissue lipids, the use of frozen sections is advised when these compounds are to be studied.

(三) 染色 Staining

为了显微镜观察,大多数切片必须染色。除少数例外,多数组织都是无色的,因而光镜不能观察这样一些未染色的组织。所以,组织染色的方法的应用不仅可以使不同的组织成分明确可见,而且可以显示这些构成成分的特性。染料染色组织成分有一定的选择性。这些染料的大多数都偏向于酸性或碱性化合物并有与组织中可电离基团形成盐键的趋势。更容易被碱性染料染色的组织成分称嗜碱性,更容易被酸性染料染色的组织成分称嗜酸性。

甲苯胺蓝和亚甲蓝是典型的碱性染料。苏木精是典型的碱性染料,这就是说,该染料能够使组织中的嗜碱性成分着色。主要组织成分之所以能够与碱性染料起反应,是因为其组成中有酸性成分,如核酸、糖胺多糖、酸性糖蛋白等。酸性染料如橘黄 G、伊红、酸性复红等可以使组织中的嗜酸性成分着色,如线粒体、分泌颗粒、糖原等。

在所有染料中,联合应用苏木精和伊红染色,即 H. E 染色最为普遍。苏木精可使细胞核和其他酸性结构,如胞质内富含 RNA 的蛋白质、透明软骨基质等染成蓝色,相反,伊红可使细胞质和胶原等染成粉红色。

To be studied in the microscope most sections must be stained. With few exceptions, most tissues are colorless, so observing them unstained in the light microscope is useless. Methods of staining tissues have therefore been devised that not only make the various tissue components conspicuous but also permit distinctions to be made between them. The dyes stain tissue components more or less selectively. Most of these dyes behave like acidic or basic compounds and have a tendency to form electrostatic (salt) linkages with ionizable radicals of the tissues. Tissue components that stain more readily with basic dyes are termed basophilic; those with an affinity for acid dyes are termed acidophilic.

Examples of basic dyes are toluidine blue and methylene blue. Hematoxylin behaves like a basic dye, that is, it stains the basophilic tissue components. The main tissue components that ionize and react with basic dyes do so because of acids in their composition (nucleic acids, glycosaminoglycans, and acid glycoproteins). Acid dyes (eg, orange G, eosin, acid fuchsin) stain the acidophilic components of tissues such as mitochondria, secretory granules, and collagen.

Of all dyes, the combination of hematoxylin and eosin (H. E) is the most commonly used. Hematoxylin stains the cell nucleus and other acidic structures (such as RNA-rich portions of the cytoplasm and the matrix of hyaline cartilage) blue. In contrast, eosin stains the cytoplasm and collagen pink.

(高英茂 Gao Yingmao)

第二章 上皮组织 EPITHELIAL TISSUE

(一) 内容提要 Synopsis

1. 上皮组织的特点 细胞呈层或成束排列,多位于体表或器官表面;细胞有极性,有基底端和游离端之别;细胞排列紧密,细胞间质少;神经末梢丰富,但无血管。

2. 上皮组织的生理功能 防卫,分泌,吸收,感觉等。

3. 上皮组织的分类 根据上皮组织的主要功能进行分类;常见的上皮组织有被覆上皮、腺上皮和感觉上皮。

4. 被覆上皮的分类 根据细胞层数和细胞形态,被覆上皮通常分为单层扁平、单层立方、单层柱状、假复层纤毛柱状上皮;复层扁平、复层立方、复层柱状、变移上皮。复层扁平上皮中又有角化和非角化两种。

1. Features of epithelium Cells arrange in sheets or bundle; often sitting on surfaces of body and organs; having polarity with a basal pole and free pole; closely arranging with a few intercellular substance; no blood vessel but rich in nerve endings.

2. Functions of epithelium Protection, secretion, absorption, sensation etc.

3. Classification of epithelium The epithelium is classified depending on their chief functions. The common types are covering epithelium, glandular epithelium and sensory epithelium.

4. Classification of covering epithelium According to the number of cell layer and the shape of the cells, the covering epithelium is commonly classified into simple squamous epithelium, simple cuboidal epithelium, simple columnar epithelium, pseudostratified ciliated columnar epithelium, stratified squamous epithelium, stratified columnar epithelium and transitional epithelium.

5. 上皮细胞表面的特化结构 在上皮细胞的游离面上,有细胞衣、微绒毛和纤毛;在上皮细胞的侧面上,有紧密连接、中间连接、缝管连接和桥粒;在上皮细胞的基底面上,有基膜、半桥粒和质膜内褶。

6. 腺上皮和腺体 具有分泌功能的上皮称腺上皮,以腺上皮为主构成的器官称腺体。腺体有单细胞腺和多细胞腺;有外分泌腺和内分泌腺;有浆液腺、黏液腺和混合腺。多细胞的外分泌腺最常见,由分泌部和导管部构成。腺细胞的分泌方式有:全浆分泌、顶浆分泌和局浆分泌。

5. Specializations on surface of epithelial cell On the free surface of the epithelial cell there are cell coat, microvillus and cilium; on the lateral surface there are tight junction; intermediate junction, gap junction and desmosome; on the basal surface there are basement membrane, hemidesmosome and plasma membrane infolding.

6. Glandular epithelium and glands The epithelium having secretory function is called glandular epithelium, and the organ composed mainly of glandular epithelium is called gland. The glands have several types; unicellular and multicellular glands, exocrine and endocrine glands, serous and

mucous glands, and mixed gland. The multicellular exocrine gland is frequently seen, and it usually consists of secretory portion and duct. The glandular cells have three secretory patterns: holocrine, apocrine and merocrine.

(二) 实验目的 Objectives

- (1) 理解上皮组织的结构特点。
- (2) 在光镜下辨认各种被覆上皮。
- (3) 在光镜下或在图片上辨认不同类型的腺细胞和腺体。
- (4) 在电镜照片或图谱上,辨认上皮细胞表面的各种特化结构。
- (5) 熟悉各种上皮组织的功能特性,并理解其功能与其结构的相关性。

- (1) Understand the structural characteristics of epithelium.
- (2) Recognize each type of covering epithelium under light microscope.
- (3) Recognize different types of glandular cells and glands under light microscope or in atlas.
- (4) Recognize the specializations on surface of epithelial cells in electron microscope or atlas.
- (5) Know the functional capabilities of each epithelial tissue type and relate them to tissue structure.

(三) 实验内容 Contents

1. 单层扁平上皮——内皮(图 2-1) 该片取材于兔, H. E 染色, 高倍镜观可见一纵切的小血管, 其管壁很薄, 腔面有一层扁平细胞纵形排列, 即内皮。其细胞核深染, 呈长梭形, 略凸向管腔, 深蓝紫色, 胞质很少, 呈红色。管腔内有若干红色无核的红细胞。

2. 单层扁平上皮——间皮, 侧面观(图 2-2) 该片取材于动物, H. E 染色。高倍镜观可见单层扁平上皮覆盖在疏松结缔组织的表面, 上皮细胞均呈扁平形, 很薄, 核染色深。

3. 单层扁平上皮——间皮, 表面观(图 2-3) 该片取自猫腹膜, 银染, 苏木精复染。高倍镜观可见上皮细胞呈不规则的多边形, 细胞间质很少, 着色深。细胞核呈圆形或椭圆形, 位于细胞中央, 呈紫蓝色。

4. 单层立方上皮(图 2-4) 该片取自动物的肾小管, H. E 染色。高倍镜观可见小管由单层立方上皮构成, 上皮细胞呈立方形, 细胞界线清楚, 胞质染色淡, 核圆形, 较大, 呈紫蓝色, 位居细胞中央。

5. 单层柱状上皮(图 2-5) 该片取自动物胆囊, H. E 染色。高倍镜观可见上皮细胞呈高柱状, 细胞排列紧密, 细胞界线清楚, 胞质染成粉红色, 细胞核呈椭圆形, 位于细胞近基部, 染色紫蓝。

1. Simple squamous epithelium—endothelium (Fig. 2-1) This tissue section is taken from rabbit, H. E Stain, high magnification. A small blood vessel in longitudinal section can be observed. A layer of simple squamous epithelium lines the lumen of the blood vessel. This type of simple squamous epithelium is also called endothelium. The nuclei of the endothelial cells are stained deeply in blue, being long spindle in shape, there a few cytoplasm in red color present, some red blood cells occur in the lumen of the vessel.

2. Simple squamous epithelium—mesothelium—lateral view (Fig. 2-2) This tissue section is

taken from animal, H. E Stain, high magnification. A layer of simple squamous epithelium covering loose connective tissue is observed, the epithelial cells and their nuclei are flattened and very thin, the nuclei are stained deeply.

3. Simple squamous epithelium—mesothelium—surface view (Fig. 2-3) This section is taken from cat peritoneum, Silver Stain and restain with hematoxylin, high magnification. The epithelial cells are irregularly polygonal, the intercellular substance in between the cells is very little and stained deeply by silver. The nuclei are round or oval and stained palely by hematoxylin in purplish blue color, located in center of cell.

4. Simple cuboidal epithelium (Fig. 2-4) This section is taken from renal tubule of animal, H. E Stain, high magnification. On this section you can observe: the tubule consists of simple cuboidal epithelium, the cell is cuboidal, the boundary between the cells is clear, the cytoplasm is palely stained, the nucleus is round, relatively bigger, stained in purple color, and located in the center of cell.

5. Simple columnar epithelium (Fig. 2-5) This tissue section is taken from gallbladder of animal, H. E Stain, high magnification. From this section you can observe: the epithelial cell appears high columnar, the cells are arranged closely, the boundary between adjacent cells is clear, the cytoplasm is stained in pink color, the nucleus is elliptical, located near basal portion of cell, stained in purplish blue color.

6. Simple columnar epithelium (Fig. 2-6) This section is taken from small intestine of animal, special stain, high magnification. On this section you can observe: the epithelial cell is high columnar, the cells are closely arranged, and a goblet cell present in between them. On the free surface of the epithelium there is a striated border formed by numerous microvilli, stained in fresh red color. The nucleus of the columnar is elliptical, located near basal portion of the cell, stained in purple blue color. The goblet cell has a big top portion and a thin basal portion, its nucleus appears triangular, stained in deep purple blue color.

6. 单层柱状上皮(图 2-6) 该片取自动物小肠,特染。高倍镜观可见细胞呈高柱状,细胞排列紧密,并有一杯状细胞。上皮游离面上有密集的微绒毛形成的纹状缘,呈鲜红色。细胞核呈椭圆形,位于细胞基底部,染成紫蓝色。杯状细胞顶端大,底部细,染成深紫蓝色,核呈三角形,位于细胞底部。

7. 假复层纤毛柱状上皮(图 2-7) 该片取自动物气管,H. E 染色。高倍镜观见上皮较厚,游离面上有染成粉红色的纤毛,细胞排列紧密,界线不清,细胞核呈圆形或椭圆形,位于不同平面上。

8. 假复层纤毛柱状上皮(图 2-8) 特殊染色,高倍镜观。该片取自动物气管,特殊染色以显示基膜。可见这类上皮的基膜比其他类型的上皮明显厚。

9. 复层扁平上皮(图 2-9) H. E 染色,高倍镜观。该切片取自动物食管,可见上皮很厚,由多层细胞构成。基底层的一层细胞呈立方形或矮柱状,核圆或椭圆形,位于细胞中心,染色深。中间有数层细胞,呈多边形,胞体大,界线清楚,核圆形,位于细胞中央。表层有 3~4 层扁平细胞,染色淡,核呈扁的椭圆形,细胞界线清楚。上皮基底部呈波纹状,高低不平。

10. 变移上皮(图 2-10) H. E 染色,高倍镜观。该切片取自动物膀胱,可见上皮由 7~8 层细胞构成,表面细胞较大,呈立方形或圆形并突向腔中,细胞顶端胞质致密,核圆形,有的细胞为双核。基底层细胞为低柱状,排列紧密,染色深,界线不清,核椭圆形。中间有数层细胞,细胞呈梭形,界线清楚,核呈椭圆形。

11. 腺上皮(图 2-11) H. E 染色,高倍镜观。该切片取自动物下颌下腺,可见浆液性和黏液性腺泡。前者由浆液性腺细胞构成,后者由黏液性腺细胞构成。浆液性腺细胞呈锥

体形,核圆形,位于细胞基底部,细胞质染成红色。黏液性腺细胞也呈锥体形,核扁,位于细胞基底部,靠近基膜。胞质染成蓝紫色,呈泡沫状。

7. Pseudostratified ciliated columnar epithelium (Fig. 2-7) This section is taken from trachea of animal, H. E Stain, high magnification. From this section the epithelium is relatively thicker, on the free surface present cilia stained in pink color, the cells are closely arranged, having no clear boundary. Some nuclei are round and some are oval. As the nuclei are located in different level, the epithelium looks like striated epithelium.

8. Pseudostratified ciliated columnar epithelium (Fig. 2-8) special stain, high magnification. This tissue section is taken from trachea of animal, stained with special method, showing specially basement membrane. On this section you can observe the basement membrane of such epithelium is much thicker than another type of epithelium.

9. Stratified squamous epithelium (Fig. 2-9) H. E Stain, high magnification. This section is taken from esophagus of animal. On this section, you can observe: the epithelium is rather thick and consists of many layers of cells. The cells in the basal layer are cuboidal or low columnar, the nuclei are round or oval located in the center of cell, stained deeply. There are several layers of cells in the middle portion of the epithelium, the cell appears to be polygonal, having a bigger body and a clear boundary, the nucleus is round, located in the center of the cell. There are 3~4 layers of cells in the super part of the epithelium, the cell is flattened and stained palely, the nucleus is flattened elliptical, the boundary between adjacent cells is clear.

10. Transitional epithelium (Fig. 2-10) H. E Stain, high magnification. This section is taken from urinary bladder of animal. From this section you can see: there are 7~8 layers of cells in this type of epithelium, the superficial cells are relatively bigger, appearing cuboidal or rounded and bulge into the lumen, some cells have double nuclei. The cells in basal layer are low columnar, closely arranged, deeply staining, no clear boundary between cells. There are several layers of cells in the middle portion, the cells are fusiform, having clear boundary and a elliptical nucleus.

11. Glandular epithelium (Fig. 2-11) H. E Stain, high magnification. This section is taken from submandibular gland of animal. In this specimen, you can observe the serous and mucous alveoli, which are composed of serous cells and mucous cells respectively. The serous cell is also pyramidal in shape, the nucleus is round and basally located, the cytoplasm is stained red. The mucous cell is pyramidal in shape, the nucleus is flattened, located near the base of the cell, the cytoplasm is stained purplish blue and presents foamy appearance.

(四) 复习题 Questions for review

- (1) 试述上皮组织的特点和分类
- (2) 试述被覆上皮的种类和各类上皮的形态结构特点。
- (3) 试述腺体的分类和多细胞外分泌腺的构成。
- (4) 试述各种特殊结构的结构和功能。

- (1) Describe the features and classifications of epithelium.
- (2) Describe the types of covering epithelium and the structural features of each type.
- (3) Describe the classifications of gland and the construction of the multicellular exocrine gland.
- (4) Describe the structure and functions of the specializations on the surface of each type of epithelial cell.

第三章

固有结缔组织 CONNECTIVE TISSUE PROPER

(一) 内容提要 Synopsis

1. 结缔组织的结构特点和分类 结缔组织由不同种类的细胞和大量细胞间质构成。细胞间质包括纤维和基质。根据细胞和细胞间质的不同组合,广义的结缔组织分为下列不同类型:固有结缔组织、软骨组织和骨组织、血液。狭义的结缔组织仅指固有结缔组织而言,包括疏松结缔组织、致密结缔组织、脂肪组织和网状组织。

2. 结缔组织的主要功能 连接、填充、支持、营养、修复、保护等。

3. 疏松结缔组织的构成

(1) 细胞:成纤维细胞、脂肪细胞、未分化的间充质细胞、巨噬细胞、浆细胞、肥大细胞、白细胞。

(2) 纤维:胶原纤维、弹性纤维、网状纤维。

(3) 基质:水、无机盐、大分子物质。

1. Structural features and classification of connective tissue Connective tissue consists of variety of cells and much intercellular substance, which includes fibers and ground substance. Based on the various combinations of cells and intercellular substance, in wide sense, connective tissues can be classified as follows: connective tissue proper, cartilage and bone, and blood. In narrow sense, connective tissue refers to connective tissue proper, which includes loose connective tissue, dense connective tissue, adipose tissue and reticular tissue.

2. Main functions of connective tissue Connection, filling, supporting, nutrition providing, repairing, protection and etc.

3. Composition of loose connective tissue

(1) Cells: fibroblast, fat cell, undifferentiated mesenchymal cell, macrophage, plasma cell, mast cell, and leukocyte.

(2) Fibers: collagenous fiber, elastic fiber, and reticular fiber.

(3) Ground substance: water, inorganic salts, macromolecules.

(二) 实验目的 Objectives

(1) 掌握结缔组织的结构特点、分类及分布。

(2) 掌握疏松结缔组织各种细胞成分的结构特点和功能。

(3) 掌握疏松结缔组织的纤维和基质的结构及功能。

(4) 了解致密结缔组织、脂肪组织和网状组织的基本结构。

- (1) Master the structural features, classification and distribution of connective tissue.
- (2) Master the structural features and functions of each type of cells in loose connective tissue.
- (3) Master the structures and functions of fibers and ground substance in loose connective tissue.
- (4) Understand the structures of dense connective tissue, adipose tissue and reticular tissue.

(三) 实验内容 Contents

1. 疏松结缔组织铺片(图 3-1,图 3-2) 台盼蓝腹腔注射后的肠系膜整装片,特殊染色。

(1) 巨噬细胞:呈卵圆形或不规则形。细胞轮廓清晰,胞质内可见蓝色台盼蓝颗粒。图 3-2 显示巨噬细胞有细长的突起,深蓝色胞质颗粒和清晰的细胞核。

(2) 成纤维细胞:除巨噬细胞外,切片上所见到的细胞大多数为成纤维细胞。细胞轮廓不清楚,细胞核清晰可见。

(3) 胶原纤维:呈粉红色的宽带状结构,相互交织成网状。

(4) 弹性纤维:比胶原纤维细,染成棕褐色,有分支且交织成网。

2. 疏松结缔组织切片(图 3-3) 食管黏膜下层,H. E 染色。

粉红色不规则排列的纤维束为胶原纤维。胶原纤维间可见许多椭圆形细胞核。它们多为成纤维细胞核,胞质和细胞轮廓不明显。

3. 浆细胞(图 3-4) 皮肤肉芽组织,H. E 染色。

肉芽组织成于愈合伤口的表面,由新生毛细血管和结缔组织构成,富含成纤维细胞、巨噬细胞和浆细胞。

图 3-4 显示的大多数轮廓清晰的圆形或椭圆形细胞为浆细胞。细胞核成圆形,偏心存在。染色质在细胞核外周部聚集成簇使细胞核成轮辐状。浆细胞胞质呈嗜碱性,核旁胞质内常见一淡染区。

1. Stretch preparation of loose connective tissue (Fig. 3-1, Fig. 3-2) Whole mount of mesentery after trypan blue intraperitoneal injection, special stain.

(1) Macrophages: They are oval or irregular shaped cells with distinct outlines and trypan blue granules in the cytoplasm. Fig. 3-2 shows a macrophage with processes, dark blue granules in red cytoplasm and a distinct nucleus.

(2) Fibroblasts: Except the macrophages, most of the cells belong to fibroblasts. They do not appear distinct cell outlines and nuclei can be clearly seen.

(3) Collagenous fibers: They appear pink belt-like structure and arranged in networks.

(4) Elastic fibers: They are thinner than collagenous fibers, purple-brown in color, branched and arranged in networks.

2. Section of loose connective tissue (Fig. 3-3) The submucosa of esophagus, H. E. stain.

The pink irregular arranged bundles are of collagenous fibers. In between the fibers, many oval nuclei can be observed. Most of them belong to fibroblasts, many of which do not appear distinct cytoplasm and cell outlines.

3. Plasma cells (Fig. 3-4) Granulation tissue of skin, H. E. stain.

Granulation tissue is formed on the surface of a healing wound. It consists of new capillaries and connective tissue containing fibroblasts, macrophages, and plasma cells.

In Fig. 3-4, most of the round or oval cells with distinct outlines are plasma cells. The nuclei

are round and decentrally located. The chromatin form clumps near the periphery of nuclei thus given the nuclei resemblance to cart-wheels. The cytoplasm is basophilic, and a small weak stained region near the nucleus usually can be observed.

4. 致密结缔组织,肌腱(图 3-5) 肌腱纵切面, H. E 染色。

大量粉红色胶原纤维束平行排列。腱细胞位于纤维束间,腱细胞核成扁椭圆形;胞质不明显。

5. 脂肪组织(图 3-6) 手指皮下组织, H. E 染色。

脂肪组织主要由脂肪细胞构成。脂肪细胞常被结缔组织分隔成小叶。由于制片过程中有机溶剂将脂肪溶解,故脂肪细胞成空泡状。细胞质均分布于细胞周缘,细胞核位于细胞一侧。

6. 网状纤维(图 3-7) 人淋巴结,银染。

网状纤维呈细黑线状结构,有分支并连接成网。纤维间深染的细胞核为淋巴细胞。

4. Dense connective tissue, tendon (Fig. 3-5) Longitudinal section of a tendon, H. E stain.

Numerous pink collagen fiber bundles arrange parallel to each other. Tendon cells are present in the intervals between the bundles. The nuclei of tendon cells are flat-oval and the cytoplasm of them are not distinct.

5. Adipose tissue (Fig. 3-6) Subcutaneous tissue of finger, H. E stain.

Adipose tissue is made up mainly of fat cells. Fat cells are usually separated by connective tissue to form distinct lobules. Fat cells appear empty due to the fat is dissolved during preparation of the section with organic solvent. The cytoplasm of each cell is peripherally distributed, and the nucleus is flat and lies to one side of the cell.

6. Reticular fibers (Fig. 3-7) Human lymph node, silver stain.

Reticular fibers are seen as thin black lines, which are branched and arranged in networks. Most of the dark stained nuclei, in between the fibers, belong to nuclei of lymphocytes.

(四) 复习题 Questions for review

- (1) 结缔组织是如何分类的?
- (2) 疏松结缔组织是如何构成的?
- (3) 描述巨噬细胞、成纤维细胞、浆细胞和肥大细胞的结构特点和生理功能?

(1) How is the connective tissue classified?

(2) How is the loose connective tissue composed of?

(3) Describe the structural features and the physiological functions of macrophage, fibroblast, plasma cell and mast cell.

(王占友 Wang Zhanyou)