普通高等教育“十一五”国家级规划教材

ENGLISH FOR BIOLOGY STUDENTS

生物专业英语

第 3 版

蒋悟生　编

高等教育出版社
HIGHER EDUCATION PRESS

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THIRD EDITION

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Shengwu Zhuanye Yingyu

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第 3 版前言

21 世纪是生命科学飞速发展的世纪, 新知识、新方法、新概念不断涌现。为了更好地学习和运用专业科学知识, 借鉴国内外的研究成果, 从事具有创新性的科学研究, 同时进行国际科技交流与合作, 编者根据高等教育大力培养创业和创新人才的需要, 编写这本教材, 奉献给广大读者。

本教材共 15 课, 1 ~ 10 课由课文 (Lesson)、课后练习 (Exercises)、拓展信息 (Additional Information)、阅读理解 (Reading Comprehension) 和阅读材料 (Reading Materials) 5 部分组成, 11 ~ 15 课由阅读材料 (Lesson) 和拓展信息 (Additional Information) 组成。书后附有练习答案和词汇表。教材涉及细胞生物学、遗传学、动物学、植物学、微生物学、生态学、分子生物学、物种起源与进化、环境科学、情报科学、论文写作等内容。

本教材的特点在于: ① 注重专业词汇的积累。目前大学生、研究生都具有大学英语四、六级的水平, 并已掌握了基本的英语语法, 但他们在阅读生物专业英文书刊时仍感到异常费力。分析其主要原因, 除了学生自身专业知识面较窄外, 更重要的是他们对专业词汇了解甚少。书刊中专业词汇重复率的高低直接影响到阅读理解的速度及阅读兴趣。因此, 编者在编写时注意文章中专业词汇的重复性。首先把课文中最初出现的重要的生物学词汇以黑体标注, 依次在注释中对词汇或短语加注国际音标, 并用中英文加以注释, 最后在书后附有词汇表, 便于学生自学。每课阅读材料中提供了与课文相应的内容和课后练习, 帮助学生巩固、加深对课文的理解和专业词汇的记忆。② 注重专业文献阅读、文献检索及论文写作能力的提高。阅读专业英文书刊的能力、科技文献检索能力及研究论文的写作能力是保证学生未来在各自研究领域成功地进行高水平科学研究的关键。本书在这些方面为读者提供了学习和实践环境。在补充材料和配套网站 (Companion Website) 内容的选择上, 编者有意挑选研究论文写作、投稿、文献检索与利用等方面的资料, 试图通过这些内容帮助学生掌握论文写作和文献检索知识。③ 选材具有实用性、可读性和趣味性。本书所选材料力图提高学生学习的兴趣, 帮助他们尽快掌握专业英语书刊的阅读技巧、了解文献检索及写作知识。④ 内容涉及面广, 难易适度。本教材力求反映现代生物学的发展趋势, 取材新颖。内容取材于国外原版教材、专业学术期刊、Internet 网上资源等。

本书第 3 版在前 2 版的基础上更新了部分较为陈旧的阅读材料。为了更好地帮助学生学习, 编者在与本书配套的网站上提供了许多教学资源网络链接, 以多种教学形式帮助读者有效利用 Web of Knowledge, Web of Science, Journal Citation Reports, Elsevier ScienceDirect, ProQuest 等国际重要文献数据库。这种网上自主性学习方式拓宽了大学生信息素养教育的领域, 有助于提高学生的自学能力。

加拿大国家科学院生物工程研究所生物信息学与系统生物学资深科学家、加拿大麦吉尔大学生物信息学中心教授王洪隆先生, San Francisco Edit (www.sfedit.net) 的 Paul Kretchmer 博士, Thomson Reuters 科技信息集团中国区总经理刘煜博士、产

品培训与技术支持经理张帆女士, ProQuest 公司北京代表处首席代表朱江先生、培训与市场主管姜雅琴女士以及其他同志给予本书热情的帮助, 编者在此向他们表示衷心感谢。同时, 在此对于给予本书提出各种建议和意见的同志一并表示感谢。本书参考文献 (References) 中列出本书选用资料的详细出处, 编者向他们表示最诚挚的谢意。

本书虽经作者努力, 但错误、缺点在所难免, 衷心希望广大读者批评指正。

蒋悟生

2009 年 12 月于天津

Contents

Lesson One

Inside the Living Cell: Structure and Function of Internal Cell Parts

1. Cytoplasm: The Dynamic, Mobile Factory

Most of the properties we associate with life are properties of the **cytoplasm**. Much of the mass of a cell consists of this semifluid substance, which is bounded on the outside by the plasma membrane. Organelles are suspended within it, supported by the filamentous network of the **cytoskeleton**. Dissolved in the cytoplasmic fluid are nutrients, ions, soluble proteins, and other materials needed for cell functioning.

2. The Nucleus: Information Central

The eukaryotic cell **nucleus** is the largest organelle and houses the genetic material (DNA) on **chromosomes**. (In prokaryotes the hereditary material is found in the **nucleoid**.) The nucleus also contains one or two organelles—the **nucleoli**—that play a role in cell division. A pore-perforated sac called the **nuclear envelope** separates the nucleus and its contents from the cytoplasm. Small molecules can pass through the nuclear envelope, but larger molecules such as mRNA and ribosomes must enter and exit via the pores.

3. Organelles: Specialized Work Units

All eukaryotic cells contain most of the various kinds of organelles, and each organelle performs a specialized function in the cell (Figure 1). Organelles described in this section include ribosomes, the endoplasmic reticulum, the Golgi complex, vacuoles, lysosomes, mitochondria, and the plastids of plant cells.

The number of ribosomes within a cell may range from a few hundred to many thousands. This quantity reflects the fact that ribosomes are the sites at which amino acids are assembled into proteins for export or for use in cell processes. A complete ribosome is composed of one larger and one smaller subunit. During protein synthesis the two subunits move along a strand of mRNA, "reading" the genetic sequence coded in it and translating that sequence into protein. Several ribosomes may become attached to a single mRNA strand; such a combination is called a **polysome**. Most cellular proteins are manufactured on ribosomes in the cytoplasm. Exportable proteins and membrane proteins are usually made in association with the endoplasmic reticulum.

The **endoplasmic reticulum**, a lacy array of membranous sacs, tubules, and vesicles, may be either rough (RER) or smooth (SER). Both types play roles in the synthesis and transport of proteins. The RER, which is studded with polysomes, also seems to be the source of the nuclear

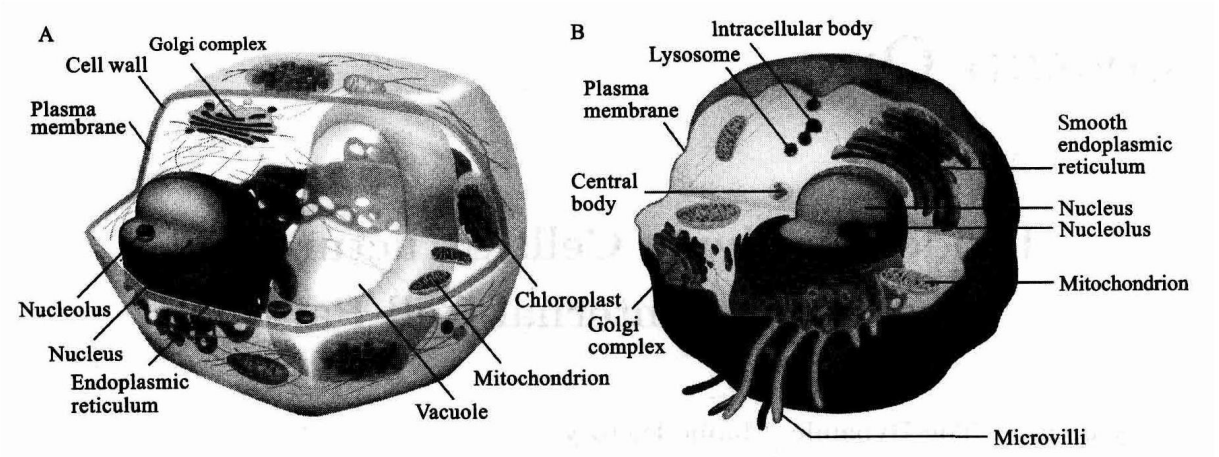

Figure 1 Plant cell (A) and animal cell (B).

envelope after a cell divides. SER lacks polysomes; it is active in the synthesis of fats and steroids and in the oxidation of toxic substances in the cell. Both types of endoplasmic reticulum serve as compartments within the cell where specific products can be isolated and subsequently shunted to particular areas in or outside the cell.

Transport vesicles may carry exportable molecules from the endoplasmic reticulum to another membranous organelle, the **Golgi complex**. Within the Golgi complex molecules are modified and packaged for export out of the cell or for delivery else where in the cytoplasm.

Vacuoles in cells appear to be hollow sacs but are actually filled with fluid and soluble molecules. The most prominent vacuoles appear in plant cells and serve as water reservoirs and storage sites for sugars and other molecules. Vacuoles in animal cells carry out **phagocytosis** (the intake of particulate matter) and **pinocytosis** (vacuolar drinking).

A subset of vacuoles is the organelles known as **lysosomes**, which contain digestive enzymes (packaged in lysosomes in the Golgi complex) that can break down most biological macromolecules. They act to digest food particles and to degrade damaged cell parts.

Mitochondria are the sites of energy-yielding chemical reactions in all cells. In addition, plant cells contain **plastids** that utilize light energy to manufacture carbohydrates in the process of photosynthesis. It is on the large surface area provided by the inner cristae of mitochondria that ATP-generating enzymes are located. Mitochondria are self-replicating, and probably they are the evolutionary descendants of what were once free-living prokaryotes.

There are two types of plastids: leucoplasts, which lack pigments and serve as storage sites for starch, proteins, and oils; and chromoplasts, which contain pigments. The most important chromoplasts are **chloroplasts**—organelles that contain the chlorophyll used in photosynthesis. The internal structure of chloroplasts includes stacks of membranes called *grana*, which are embedded, in a matrix called the **stroma**.

4. The Cytoskeleton

All eukaryotic cells have a cytoskeleton, which is a convoluted latticework of filaments and tubules that appears to fill all available space in the cell and provides support for various other organelles (Figure 2). A large portion of the cytoskeleton consists of threadlike **microfilaments** composed

mainly of the contractile protein **actin**. They are involved in many types of intracellular movements in plant and animal cells. A second protein, **myosin**, is involve in the contraction of muscle cells. Another main structural component of the cytoskeleton consists of **microtubules**, which are composed of the globular protein **tubulin** and together act as scaffolding that provides a stable cell shape. Cytoskeletal intermediate filaments appear to impart tensile strength to the cell cytoplasm. Mechanoenzymes such as myosin, **dynein**, and kinesin interact with the cytoskeletal filaments and tubules to generate forces that cause movements.

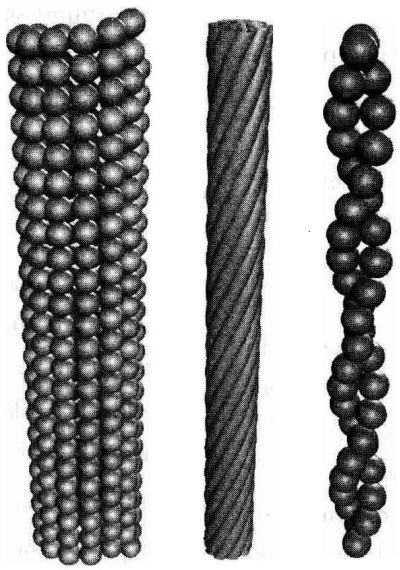

Figure 2 A comparison of the molecules that make up the cytoskeleton.

5. Cellular Movements

Although the cytoskeleton provides some stability to cells, its microtubules and filaments and their associated proteins enable cells to move by creeping or gliding. Such movements require a solid substrate to which the cell can adhere and can be guided by the geometry of the surface. Some cells also exhibit **chemotaxis**, the ability to move toward or away from the source of a diffusing chemical.

Certain eukaryotic cells can swim freely in liquid environments, propelled by whiplike **cilia** or **flagella**. Both cilia and flagella have the same internal structure: nine doublets (pairs of microtubules) are arranged in a ring and extend the length of the cilium or flagellum, and two more microtubules run down the center of the ring. Every cilium or flagellum grows only from the cell surface where a **basal body** is located. Movement is based on the activities of tiny dynein side arms that extend from one of the microtubules of each doublet.

Nutrients, proteins, and other materials within most plant cells are moved about via cytoplasmic streaming. The process occurs as myosin proteins attached to organelles push against microfilaments arrayed throughout the cell. Microsfilaments and microtubules are responsible for

almost all major cytoplasmic movements. During cell division, microtubules of the spindle—assembled from tubulin subunits near organelles called **centrioles**—move the chromosomes.

Glossary

actin['æktin] 肌动蛋白

A globular contractile protein. In muscle cells, actin interacts with another protein, myosin, to bring about contraction.

basal body ['beisl 'bɔdi] 基体

A body identical in structure to a centriole, found always at the base of a cilium or eukaryote flagellum.

centriole ['sentriəul] 中心粒

An organelle located close to the nucleus in most animal and lower plant cells but absent from prokaryotes and higher plants.

chemotaxis[ˌkeiməu'tæksis] 趋化性

A locomotory movement of an organism or cell in response to, and directed by, an external directional stimulus.

chloroplast ['klɔ(:)rəplæst] 叶绿体

A plastid in which photosynthesis is carried out. Chloroplasts occur in all photosynthetic organisms except photosynthetic bacteria and blue-green algae.

chromosome ['krəuməsəum] 染色体

A DNA-histone thread residing in the nucleus of a cell. Each chromosome possesses two telomeres and a centromere, and some contain a nucleolus organizer. RNA proteins are invariably associated with the chromosome.

cilia ['siliə] 纤毛

Numerous short, hairlike structures projecting from the cell surface that enable locomotion.

cytoplasm ['saitəplæzm] [细] 胞质

The living contents of a cell bounded externally by the plasmalemma, including an aqueous ground substance (hyaloplasm, cell sap, or cell matrix) containing organelles and various inclusions but excluding the nucleus and visible vacuoles.

cytoskeleton [ˌsaitəu'skelitən] 细胞骨架

Of eukaryotic cells, an internal "skeleton". Its microtubules and other components structurally support the cell, organize and move its internal components. The cytoskeleton also helps free-living cells move through their environment.

dynein ['daini:n] 动力蛋白

A group of at least four distinct proteins found in the flagella and microtubules of eukaryotic cells and possessing ATPase activity.

endoplasmic reticulum

[ˌendou'plæzmik ri'tikjuləm] 内质网

Folded membranes and tubes throughout the eukaryotic cell that provide a large surface upon which chemical activities take place.

flagella [flə'dʒelə] (单**flagellum** [flə'dʒeləm]) 鞭毛

Long, hairlike structures projecting from the cell surface that enable locomotion.

Golgi complex ['gɔldʒi 'kɔmpleks] 高尔基复合体

A stack of flattened, smooth, membranous sacs; the site of synthesis and packaging of certain molecules in eukaryotic cells.

lysosome ['laisəsəum] 溶酶体
A specialized organelle that holds a mixture of hydrolytic enzymes.

microfilament [ˌmaikrə'filəmənt] 微丝, 纤丝
Long, fiberlike structures made of protein and found in cells, often in close association with the microtubules; provide structural support and enable movement.

microtubule [ˌmaikrə'tju:bjul] 微管
Small, hollow tubes of protein that function throughout the cytoplasm to provide structural support and enable movement.

mitochondrion [ˌmaitə'kɔndriɔn] (复 **mitochondria** [ˌmaitə'kɔndriə]) 线粒体
A membranous organelle resembling a small bag with a larger bag inside that is folded back on itself; serves as the site of aerobic cellular respiration.

myosin ['maiəsin] 肌球蛋白
A protein that, with actin, constitutes the principal element of the contractile apparatus of muscle.

nuclear envelope ['nju:kliə 'envələup] 核膜, 核被膜
A double membrane (two lipid bilayers and associated proteins) that is the outermost portion of a cell nucleus.

nucleoid ['nju:kliɔid] 拟核, 类核, 核质体
The DNA-containing area of a prokaryote cell, analogous to the eukaryote nucleus but not membrane bounded.

nucleoli [nju:'kli:əlai] (单 **nucleolus** [nju:'kli:ələs]) 核仁
Nuclear structures composed of completed or partially completed ribosomes and the specific parts of chromosomes that contain the information for their construction.

nucleus ['nju:kliəs] (复 **nuclei** ['nju:kli,ai]) [细] 胞核, 神经核, 核
The organelle of the eukaryote cell that contains the chromosomes and hence ultimately controls cellular activity and inheritance through the activity of the genetic material, DNA.

phagocytosis [ˌfægəsai'təusis] 吞噬 [作用]
The process by which the cell wraps around a particle and engulfs it.

pinocytosis [ˌpainɔsai'təusis] 胞饮 [作用], 饮液作用
The process by which a cell engulfs some molecules dissolved in water.

plastid ['plæstid] 质体, 成形粒
An organelle present in all plants except bacteria, blue-green algae, and fungi; it is enclosed by two membranes (the envelope) and has various functions.

polysome ['pɔlisəum] 多核糖体, 多聚核糖体
Of protein synthesis, several ribosomes all translating the same messenger RNA molecule, one after the other.

ribosome ['raibəsəum] 核糖体, 核蛋白体
Small structures composed of two protein and ribonucleic acid subunits involved in the assembly of proteins from amino acids.

stroma ['strəumə] (复**stromata** ['strəumətə]) 子座, 基质
Region within a chloroplast that has no chlorophyll.

tubulin ['tju:bjulin] 微管蛋白
A protein that is the major constituent of microtubules.

vacuole ['vækjuəul] 液泡, 泡
Storage container within the cytoplasm of a cell having a surrounding membrane.

Exercises

I. Key Terms: Matching

Match each term on the left with the most appropriate description on the right.

1. polysome	a. protein synthesis
2. pinocytosis	b. baglike structure
3. exocytosis	c. power generator
4. plastid	d. where flagella grow
5. Golgi complex	e. toward or away from a chemical stimulus
6. flagella	f. engulfment
7. phagocytosis	g. RNA and ribosomes
8. lysosome	h. weblike
9. basal body	i. in plants only
10. chemotactic	j. control room
11. nucleus	k. expel
12. vacuole	l. vacant
13. ribosome	m. whiplike
14. cytoskeleton	n. cell drinking
15. mitochondrion	o. packaging

II. True or False

1. ____ The DNA of prokaryotic cells is concentrated in the nucleus.
2. ____ Ribosomes are derived from the nucleoli.
3. ____ Unlike other cell membranes, the nuclear envelope has no pores.
4. ____ The smooth endoplasmic reticulum is held in place by the cytoskeleton.
5. ____ Structural proteins are exportable.
6. ____ The nuclear envelope is produced by the rough endoplasmic reticulum.
7. ____ Most cellular proteins are manufactured on ribosomes.
8. ____ White blood cells work by phagocytosis.
9. ____ Prokaryotic cells have microbodies.
10. ____ Mitochondria are self-replicating.
11. ____ Pinocytosis describes the intake of fluid into a cell by a vacuole.
12. ____ Both prokaryotic and eukaryotic cells have a supporting cytoskeleton.
13. ____ Carotenoids are colorless molecules.
14. ____ Grana are surrounded by stomata.

III. Completion

1. Phagocytosis is a method of cell feeding that first requires that the food be _____.
2. The _____ packages some fifty hydrolytic enzymes in _____.

3. _____ are lysosome-like vesicles containing waste products. They are thought to be involved with cell _____.
4. Both _____ and _____ are thought to have arisen from endosymbiosis.
5. The cytoskeleton is composed of very fine _____, medium _____ and larger _____.
6. Creeping and gliding cell movements are usually _____-dependent.
7. _____ behavior is shown when a cell moves toward or away from a chemical substance.
8. Flagella grow from the cell surface only at the _____.

IV. Multiple Choice

Finish each of the following sentences by circling the letter of the correct response.

1. Most of the properties associated with processes of life are properties of _____.
   a. the nucleus
   b. DNA
   c. the cytoplasm
   d. endosymbionts
   e. none of the above
2. Ribosomes_____.
   a. are organelles involved in protein synthesis
   b. are the cell's main energy source
   c. are storage sites for starch
   d. are involved in the breakdown of proteins
   e. store genetic information in the form of DNA
3. Smooth endoplasmic reticulum (SER) _____.
   a. lacks ribosomes
   b. is active in fat and steroid synthesis
   c. is involved in the oxidation of toxins
   d. all of the above
   e. none of the above
4. Ribosomes are manufactured in _____.
   a. cytoplasm
   b. nucleoli
   c. mitochondria
   d. smooth endoplasmic reticulum
   e. rough endoplasmic reticulum
5. Lysosomes contain_____.
   a. hydrolytic enzymes
   b. genetic material
   c. stored fats
   d. proteins
   e. carbohydrates
6. The process of phagocytosis involves_____.
   a. vacuolar engulfing of particulate matter
   b. exocytosis
   c. intake of water by a cell's vacuole
   d. expulsion of particulate matter from a cell
   e. expulsion of water from a cell
7. Transformation of energy and storage of energy in the cell are the main function of _____.
   a. ribosomes
   b. microbodies
   c. contractile vacuoles
   d. mitochondria
   e. smooth endoplasmic reticulum
8. In the mitochondria, enzymes involved in ATP generation are _____.
   a. located within the matrix
   b. located on the cristae
   c. located on ribosomes in the matrix
   d. dispersed throughout the cristae and matrix
   e. associated with polysomes
9. Chromoplasts are a type of _____.
   a. pigment
   b. storage bin
   c. nutrient tank
   d. plastid
   e. none of the above
10. An mRNA molecule and its associated ribosomes make up_____.
   a. a multisome

b. a polysome
c. a lysosome
d. a monosome
e. none of the above

11. Leucoplasts are plastids that_____.
a. contain carotenoid
b. are involved in photosynthesis
c. serve as a storage site for starch, proteins, and oils
d. are responsible for plant pigmentation
e. are none of the above

12. Each individual cell is supported by a network of filaments and tubules known as_____.
a. cytoplasm
b. a vacuole
c. an endoplasmic reticulum
d. a cytoskeleton
e. a plasma membrane

13. In prokaryotic cells the DNA is _____.
a. found in the nucleus
b. organized into a number of discrete chromosomes
c. condensed into an unbounded area called the nucleoid
d. condensed into nucleoli
e. enclosed in a nuclear envelope

14. Amino acids are assembled into proteins in the cells _____.
a. in the nucleus
b. on ribosomes
c. in mitochondria
d. in lysosomes
e. in the Golgi complex

15. During protein synthesis a single mRNA molecule may be associated with several ribosomes to form _____.
a. a gene
b. a lysosome
c. a polysome
d. smooth endoplasmic reticulum
e. rough endoplasmic reticulum

16. Export proteins are proteins destined for export from the cell or for inclusion in cell membranes. The can be identified by_____.
a. their secondary structure
b. a sequence of amino acids known as signal peptide
c. their association with a polysome
d. all of the above
e. none of the above

17. Proteins synthesized on endoplasmic reticulum are modified_____.
a. in vacuoles
b. in the cell membrane
c. in the Golgi complex
d. in lysosomes
e. not at all after synthesis

18. An amoeba living in water whose tonicity is lower than that of its internal cytoplasm must deal with a constant influx of water into the cell. It expels this excess water by_____.
a. using excretory proteins
b. waterproofing its cell membrane with lipids
c. using a contractile vacuole
d. using phagocytosis
e. moving to an environment with lower tonicity

19. Hydrolytic enzymes in the cell digest food in the_____.
a. lysosome
b. Golgi complex
c. mitochondria
d. chloroplast
e. endoplasmic reticulum

20. An organelle isolated from an animal cell is found to contain large numbers of enzymes involved in energy transformation. This organelle is most likely to be_____.
a. a lysosome
b. a Golgi complex
c. a mitochondrion
d. a chloroplast
e. a leucoplast