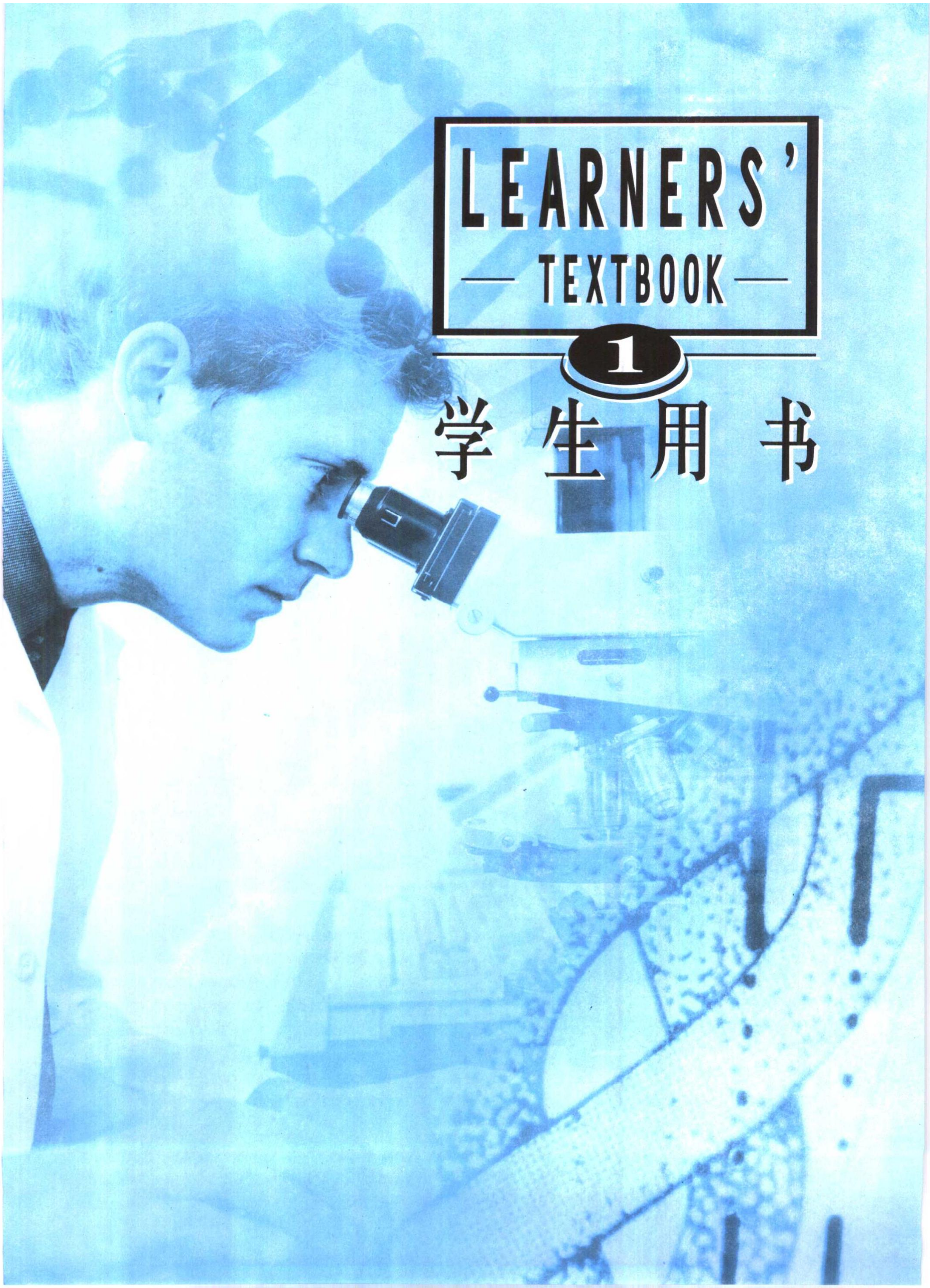
LEARNERS' TEXTBOOK

1

学生用书



Unit 1 Cell

Part I
Reading and Comprehension

The Chemical Components of a Cell

1. Cell Chemistry Is Based on Carbon Compounds

A living cell is composed of a restricted set of elements, four of which (C, H, N, and O) make up nearly 99% of its weight. This composition differs markedly from that of the earth's crust and is evidence of a distinctive type of chemistry.

What is this special chemistry, and how did it evolve?

The most abundant substance of a living cell is water. It accounts for about 70% of a cell's weight, and most intracellular reactions occur in an aqueous environment. Life on this planet began in the ocean, and the conditions in that primeval environment put a permanent stamp on the chemistry of living things. All organisms have been designed around the special properties of water, such as its polar character, its ability to form hydrogenbonds, and its high surface tension. Water will completely surround polar molecules, for example, while tending to push nonpolar molecules together into larger assemblies.

If we disregard water, nearly all of the molecules in a cell are carbon compounds, which are the subject matter of organic chemistry. Carbon is outstanding among all the elements on earth for its ability to form large molecules; silicon is a poor second. The carbon atom, because of its small size and four outer-shell electrons, can form four strong covalent bonds with other atoms. Most important, it can join to other carbon atoms to form chains and rings and thereby generate large and complex molecules with no obvious upper limit to their size. The other abundant atoms in the cell (H, N, and O) are also small and able to make very strong covalent bonds.

A typical covalent bond in a biological molecule has an energy of 15 to 170 kcal / mole, depending on the atoms involved. Since the average thermal energy at body temperature is only 0.6 kcal / mole, even an unusually energetic collision with another molecule will leave a covalent bond intact. Specific catalysts, however, can rapidly break or rearrange covalent bonds. Biology is made possible by the combination of the stability of covalent bonds under physiological conditions and the ability of biological catalysts (called enzymes) to break and rearrange these bonds in a controlled way in selected molecules.

In principle, the simple rules of covalent bonding between carbon and other elements permit an infinitely large number of compounds. Although the number of different carbon compounds in a cell is very large, it is only a tiny subset of what is theoretically possible. In some cases we can point to good reasons why this compound or that performs a given biological function; more often it seems that the actual "choice" was one among many reasonable alternatives and therefore something of an accident. Once established in an ancient cell, certain chemical themes and patterns of reaction were preserved, with variations, during billions of years of cellular evolution. Apparently, the development of new classes of compounds was only rarely necessary or useful.

2. Cells Use Four Basic Types of Small Molecules

Certain simple combinations of atoms—such as the methyl ($-CH_3$), hydroxyl ($-OH$), carboxyl ($-COOH$), and amino ($-NH_2$) groups—recur repeatedly in biological molecules. Each such group has distinct chemical and physical properties that influence the behavior of whatever molecule the group occurs in.

The atomic weights of H, C, N, and O are 1, 12, 14, and 16 respectively. The small organic molecules of the cell have molecular weights in the range 100 to 1000 and contain up to 30 or so carbon atoms. They are usually found free in solution, where some of them form a pool of intermediates from which large polymers called macromolecules are made. They are also essential intermediates in the chemical reactions that transform energy derived from food into usable forms.

The small molecules amount to about one-tenth of the total organic matter in a cell, and (at a rough estimate) only on the order of a thousand different kinds are present (Table 1-1). All biological molecules are synthesized from and broken down to the same simple compounds. Both synthesis and breakdown occur through sequences of chemical changes that are limited in scope and follow definite rules. As a consequence, the compounds in a cell are chemically related and can be classified into a small number of distinct families. Since the macromolecules in a cell are assembled from these small molecules, they belong to corresponding families.

Broadly speaking, cells contain just four major families of small organic molecules: the simple sugars, the fatty acids, the amino acids and the nucleotides. Each of these families contains many different members with common chemical features. Although some cellular compounds do not fit into these categories, the four families, especially the macromolecules made from them, account for a surprisingly large fraction of the mass of every cell. (Table 1-1)

Sugars Are Food Molecules of the Cell.

The simplest sugars—the monosaccharides—are compounds with the general formula $(CH_2O)_n$, where n is an integer from 3 through 7. As shown in study, sugars can exist in

	Percent of Total Cell Weight	Number of Types of Each Molecule
Water	70	1
Inorganic ions	1	20
Sugars and precursors	1	250
Amino acids and precursors	0.4	100
Nucleotides and precursors	0.4	100
Fatty acids and precursors	1	50
Other small molecules	0.2	~ 300
Macromolecules (proteins, nucleic acids, and polysaccharides)	26	~ 3000

Table 1-1 The Approximate Chemical Composition of a Bacterial Cell.

either a ring or an open-chain form. Because each monosaccharide has several free hydroxyl groups that can form a link to another monosaccharide (or to some other compounds), the number of possible polysaccharide structures is extremely large. It is very difficult to determine the structure of any particular polysaccharide because one needs to determine the sites of linkage between each sugar unit and its neighbors. With present methods, for instance, it takes longer to determine the arrangement of half a dozen linked sugars (those in a glycoprotein, for example) than to determine the nucleotide sequence of a DNA molecule containing many thousands of nucleotides (where each unit is joined to the next in exactly the same way).

Fatty Acids Are Components of Cell Membranes.

Fatty acids are a valuable source of food since they can be broken down to produce more than twice as much usable energy as glucose. But the most important function of fatty acids is in the construction of cell membranes. These thin, impermeable sheets that enclose all cells and surround their internal organelles are composed largely of phospholipids, which are small molecules that resemble triglycerides in that they are 15
constructed mostly from fatty acids and glycerol.

Amino Acids Are the Subunits of Proteins.

Although there are many different possible amino acids, only 20 are common in proteins, each with a different side chain attached to the α-carbon atom. The same 20 amino acids occur over and over again in all proteins, including those made by bacteria, 20
plants, and animals. Although the choice of these particular 20 amino acids probably occurred by chance in the course of evolution, the chemical versatility they provide is vitally important.

Nucleotides Are the Subunits of DNA and RNA.

There are two main types of nucleic acids, differing in the type of sugar that forms the polymeric backbone. Those based on the sugar ribose are known as ribonucleic acids (or RNA), and contain the four bases A (adenine), U (uracil), G (guanine) and C (cytosine). Those based on deoxyribose are known as deoxyribonucleic acids, or DNA, and contain the four bases A, T (thymine), G and C. The sequence of bases in a DNA or RNA polymer represents the genetic information of the living cell.

(1199 words)

From *Molecular Biology of Cells* by B. Alberts

Words and Expressions

intracellular	/ˌintrəˈseljulə/	*adj.*	细胞内的
aqueous	/ˈeikwiəs/	*adj.*	水的，水性的
covalent	/kəuˈveilənt/	*adj.*	共有原子价的，共价的
thermal	/ˈθəːməl/	*adj.*	热的
catalyst	/ˈkætəlist/	*n.*	催化剂
enzyme	/ˈenzaim/	*n.*	酶
subset	/ˈsʌbset/	*n.*	子集
methyl	/ˈmeθil/	*n.*	甲基
hydroxyl	/haiˈdrɔksil/	*n.*	羟(基)，氢氧基
carboxyl	/kɑːˈbɔksil/	*n.*	羧基
amino	/əˈmiːnəu/	*adj.*	氨基的
polymer	/ˈpɔlimə/	*n.*	聚合物(体)
nucleotide	/ˈnjuːkliətaid/	*n.*	核苷酸
monosaccharide	/ˌmɔnəuˈsækəraid/	*n.*	单糖
integer	/ˈintidʒə/	*n.*	整数(体)
polysaccharide	/pɔliˈsækəraid/	*n.*	多糖
membrane	/ˈmembrein/	*n.*	膜
glucose	/ˈgluːkəus/	*n.*	葡萄糖
impermeable	/imˈpəːmjəbl/	*adj.*	不渗透性的
organelle	/ˌɔːgəˈnel/	*n.*	细胞器，小器官
phospholipid	/ˌfɔsfəuˈlipid/	*n.*	磷脂
triglyceride	/traiˈglisəraid/	*n.*	甘油三酸酯
glycerol	/ˈglisərɔl/	*n.*	甘油
ribose	/ˈraibəus/	*n.*	核糖
ribonucleic acid			核糖核酸

adenine	/ˈædəniːn/	*n.*	腺嘌呤
uracil	/ˈjuərəsil/	*n.*	尿嘧啶
guanine	/ˈgwɑːniːn/	*n.*	鸟嘌呤
cytosine	/ˈsaitəsiːn/	*n.*	胞嘧啶
deoxyribonucleic acid			脱氧核糖核酸
thymine	/ˈθaimiːn/	*n.*	胸腺嘧啶

阅读技巧 1
阅读速度检测方法

如何用最短的时间、最快的速度获取最丰富的信息，并对这些信息进行最有效的筛选，取得最佳效果，产生最好效应？对这些问题的圆满回答是：提高阅读速度，增强理解能力，改善记忆方式。

在进行系统的阅读技巧学习之前，首先应该对现阶段自身的阅读速度有所了解。具体检测方法是：用所读文章单词数除以阅读所用的时间，算出每分钟能阅读多少单词的阅读速度（WPM）。

阅读速度计算公式：每分钟单词数(WPM) $= \frac{\text{所读单词数}}{\text{时间}}$

阅读能力参考表：

读者水平	阅读速度(WPM)	理解程度
差	10 ～ 100	30% ～ 50%
平　　均	200 ～ 240	50% ～ 70%
专业人员	400	70% ～ 80%
百里挑一	800 ～ 1000	80% 以上
千里挑一	1000 以上	80% 以上

Exercises

I Choose the best answer for each of the following Statements.

1. The special properties of water are ________.
   A. polar character　　B. high surface tension
   C. ability to form hydrogen bonds　　D. all of the above

2. The carbon atom can form four strong covalent bonds with other atoms since
   A. it accounts for about 70% of a cell's weight
   B. it is small in size and has four outer-shell electrons
   C. it surrounds polar molecules
   D. it is composed of an unlimited set of elements
3. Covalent bonds can be quickly broken and rearranged by ______.
   A. selected molecules　　B. different carbon compounds
   C. established choice　　D. specific catalysts
4. Which compound is not synthesized in a cell?
   A. lipids　　B. polysaccharides　　C. amino acids　　D. nucleic acids
5. The atomic weights of O, N, C and H are ______.
   A. 16, 14, 12 and 1　　B. 14, 12, 1 and 16
   C. 1, 12, 14 and 16　　D. 12, 16, 1 and 14
6. As we know, cells contain just four major families of ______.
   A. living organisms　　B. different atoms
   C. small organic molecules　　D. simple sugars
7. Four of a restricted set of elements, ______, make up nearly 99% of a living cell's weight.
   A. H, N, T and A　　B. C, H, N and O
   C. O, A, G and H　　D. N, H, T and C
8. The subject matter of organic chemistry is ______.
   A. thermal energy　　B. covalent bonds
   C. biological catalysts　　D. carbon compounds
9. From Table 1-1 in this passage, we can see that ______.
   A. macromolecules add up to 26% of a cell's weight
   B. inorganic ions come to the second place in percent of total cell weight
   C. amino acids and precursors are the least ones according to the information provided
   D. other small molecules account for 1% of a cell's weight
10. Which of the following statements is NOT true?
   A. The most important function of fatty acids is in the formation of cell membranes.
   B. A typical covalent bond in a biological molecule has a higher energy than body temperature.
   C. Nucleotides play a central part in energy transfer and also are the subunits from which the informational macromolecules, RNA and DNA, are made.
   D. Not all of the organisms have polar character and the ability to form hydrogen bonds.

Answer the following questions.

1. Why do we say the most abundant substance of a living cell is water?
2. What is the most important function of carbon atom?
3. Why the number of possible polysaccharide structure is very large?
4. How many major families of small organic molecules do cells contain? What are their functions?
5. What is RNA? What is DNA?

Part II

Reading and Practice

Passage 1

A Modern View of Cell Structure

1. Advances in Electron Microscopy Reveal the Commonality of structures within Eukaryotic Cells

Throughout the 1930s and early 1940s, while geneticists were seeking the identity of the gene and biochemists were finding enzymes and interpreting the cell's chemistry, relatively little attention was paid to the organization of the higher structures within the cell. The light microscope imposed a great physical limitation on inquiry into cell structure. Resolution of the best light microscopes is dictated by the average wavelength of visible light; objects less than 500 nm in diameter could not be resolved from one another. In that era only the larger intracellular structures—the nuclei, nucleoli and chloroplasts in plant cells and mitochondria in animal and plant cells — had been identified with ordinary microscopes. The electron microscope lifted a veil from the eyes of biologists. Even in its early forms, its practical resolving power was 1 ~ 5 nm; its theoretical resolving power is 10 times higher (0.1 ~ 0.5 nm). A world of structure never before observed was suddenly displayed, and a striking fact emerged: all eukaryotic cells have certain cell structures in common.

2. Biochemical Activities Can Be Assigned to Specific Subcellular Structures

By the end of 1950s, the fundamental observations made independently by geneticists, biochemists and structural cell biologists were ready to be stitched together into a coherent pattern that would become the design for molecular cell biology. Two different experimental approaches provided key contributions.

First, a correlation between cell structure and biochemical activity was achieved by breaking open plant and animal cells and separating, or fractionating, the broken cell extracts. Each fraction was studied under the electron microscope and through biochemical assays. Much of the early electron-microscopic identification of cell structures and biochemical characterization of cell fractions was the work of Albert Claude and his associates Christian de Duve, George Palade and Keith Porter. The current sophisticated picture of cell structure and function is very largely due to their research.

3. The Activity of Genes Is Highly Regulated by the Protein Products of Other Genes

The second experimental approach that had a great unifying effect was genetic analysis. The work of Beadle, Tatum, Lederberg, and others in the 1940s and early 1950s had made it clear that genes encode proteins, but the means by which gene activity was controlled was still unclear. Yet it was widely supposed that the differences between cells having the same genes were due to differences in the activities of those genes. Two French scientists, Francois Jacob and Jacques Monod, proposed that the protein products of certain genes regulate the activities of other genes. This principle finally unified the diverse approaches to the subject that we now call molecular cell biology. The concept of the cell had evolved a long way from its original characterization as a simple unit of living matter: the cell had become an organism in which the controlled and integrated actions of genes produce specific sets of proteins that build characteristic structures and carry out characteristic enzymatic activities.

4. The Molecular Approach Is Applied to Eukaryotic Cells

Soon after Jacob and Monod presented their findings on regulatory genes in1961, three significant advances occurred: (1) proof that messenger RNA (mRNA) carries information from DNA to the protein-synthesizing machinery; (2) the discovery of the genetic code, by which information is stored in the nucleic acid, and (3) the discovery that proteins are translated by transfer RNA (tRNA) and ribosomes (small nucleoprotein machinery granules first discovered by electron microscopy).

Much of the research that contributed to these achievements was done by biochemists and molecular geneticists working with *E. coli*. However, two developments in the 1960s led an ever-increasing number of workers into the study of mammalian cells: (1) the successful culturing of mammalian cells in vitro, particularly by such pioneers as Harry Eagle, who perfected the first defined growth medium, and Theodore Puck, who led the way in culturing single mammalian cells, and (2) the emergence of animal virology as a quantitative science, notably through the work of Renato Dulbecco and his students.

Although many aspects of protein and nucleic acid synthesis and of cell growth and cell function were elucidated in the 1960s and early 1970s, a lack of detailed genetic information about higher organism impeded progress. Since the late 1970s, however, new techniques have revolutionized the study of DNA and the genes that it embodies. The DNA from any organism can be cut into reproducible pieces with site-specific endonucleases called restriction enzymes; the pieces can then be linked to bacterial vectors (DNA viruses or plasmids capable of independent growth) and introduced into bacterial hosts. In this way, almost any DNA segment from any organism can be isolated and produced in any amount simply by culturing the bacteria. These procedures are collectively referred to as gene cloning or recombinant DNA technology. Rapid DNA sequencing techniques were worked out. Suddenly, biologists were ushered into a new era: instead of just counting chromosome or identifying gene mutations and mapping genes imprecisely by means of breeding experiments, they could now obtain the exact DNA sequence of individual genes and thus their exact location and coding capacity.

Not only has the isolation of particular DNA segments and their sequencing become commonplace, but molecular biologists can now introduce specific mutations at will; altered genes can be reintroduced into cells or even into the germline of organisms, so that the function of individual genes can be studied in particular cells. These fantastic strides forward, combined with the ever-improving methods for examining cells and their components, both biochemically and structurally, have aroused great optimism about the success of future research. We are standing on the brink of the formerly unthinkable achievement of knowing the DNA sequence of the entire human genome. Surely few problems in molecular cell biology, even finding the cause for cancer or determining the molecular basis of differentiation and development, will remain unsolved much longer.

(981 words)

From *Molecular Cell Biology* by H. Lodish

Words and Expressions

microscopy	/maiˈkrɔskəpi/	*n.*	显微镜检查
eukaryotic	/ˌjuːkæriˈɔtik/	*adj.*	真核的（=eucaryotic）
resolution	/ˌrezəˈljuːʃən/	*n.*	分辨
nucleoli	/njuːˈkliːəlai/	*n.*	核仁
chloroplast	/ˈklɔ(ː)rəplæst/	*n.*	叶绿体
mitochondria	/ˌmaitəˈkɔndriə/	*n.*	线粒体
veil	/veil/	*n.*	幕，遮蔽物
correlation	/ˌkɔriˈleiʃən/	*n.*	相关，联系
assay	/ˈəsei/	*n.*	测定，鉴定，分析，试验

ribosome	/ˈraibəˌsəum/	*n.*	核糖体
granule	/ˈgrænjuːl/	*n.*	粒剂，颗粒
E. coli	/ˈiːkəuli/	*n.*	大肠杆菌
in vitro	/inˈvaitrəu/		在试管内，在活体内
virology	/vaiəˈrɔlədʒi/	*n.*	病毒学
elucidate	/iˈljuːsideit/	*v.*	阐明
endonuclease	/ˌendəuˈnjuːklieis/	*n.*	内切核酶酸，核酸内切酶
vector	/ˈvektə/	*n.*	载体，媒介物
plasmid	/ˈplæzmid/	*n.*	质粒
usher	/ˈʌʃə/	*v.*	引导，展示
chromosome	/ˈkrəuməsəum/	*n.*	染色体
mutation	/mjuːˈteiʃən/	*n.*	突变
stride	/straid/	*n.*	大步，阔步
genome	/ˈdʒiːnəum/	*n.*	基因组，染色体组
differentiation	/ˌdifərenʃiˈeiʃən/	*n.*	分化（作用）；鉴别，区别；歧化

Passage 2

From Single Cells to Multicellular Organisms

Single-cell organisms, such as bacteria and protozoa, have been so successful in adapting to variety of different environments that they comprise more than half of the total biomass on earth. Unlike animals, many of these unicellular organisms can synthesize all of the substances they need from a few simple nutrients, and some of them **divide more than once every hour. What, then, was the selective advantage that led to the** evolution of multicellular organisms?

A short answer is that by collaboration and by division of labor it becomes possible to exploit resources that no single cell could utilize so well. This principle, applying at first to simple associations of cells, has been taken to an extreme in the multicellular organisms we **see today. Multicellularity enables a plant, for example, to become physically large;** to have roots in the ground, where one set of cells can take up water and nutrients; and to have leaves in the air, where another set of cells can efficiently capture radiant energy from the sun. Specialized cells in the stem of the plant form channels for transporting water and nutrients between the roots and the leaves. Yet another set of specialized cells forms a layer of epidermis to prevent water loss and to provide a protected internal environment. The plant as a whole does not compete directly with unicellular organisms for its ecological niche; It has found a radically different way to survive and propagate.

As different animals and plants appeared, they changed the environment in which further evolution occurred. Survival in a jungle calls for different talents than survival in the open sea. Innovations in movement, sensory detection, communication, social organization—all enabled eucaryotic organisms to compete, propagate, and survive in ever more complex ways.

1. Single Cells Can Associate to Form Colonies

It seems likely that an early step in the evolution of multicellular organisms was the association of unicellular organisms to form colonies. The simplest way of achieving this is for daughter cells to remain together after each cell division, even some procaryotic cells show such social behavior in a primitive form. Myxobacteria, for example, live in the soil and feed on insoluble organic molecules that they break down by secreting degradative enzymes. They stay together in loose colonies in which the digestive enzymes secreted by individual cells are pooled, thus increasing the efficiency of feeding (the "wolf-pack" effect). These cells indeed represent a peak of social sophistication among procaryotes, for when food supplies are exhausted, the cells aggregate tightly together and form a multicellular fruiting body, within which the bacteria differentiate into spores that can survive even in extremely hostile conditions. When conditions are more favorable, the spores in a fruiting body germinate to produce a new swarm of bacteria.

Green algae (not to be confused with the procaryotic "blue-green algae" or Cyanobacteria) are eucaryotes that exist as unicellular, colonial, or multicellular forms. Different species of green algae can be arranged in order of complexity, illustrating the kind of progression that probably occurred in the evolution of higher plants and animals. Unicellular green algae, such as Chlamydomonas, resemble flagellated protozoa except that they possess chloroplasts, which enable them to carry out photosynthesis. In closely related genera, groups of flagellated cells live in colonies held together by a matrix of extracellular molecules secreted by the cells themselves. The simplest species have the form of a concave disc made of 4, 8, 16 or 32 cells. Their flagella beat independently, but since they are all oriented in the same direction, they are able to propel the colony through the water. Each cell is equivalent to every other, and each can divide to give rise to an entirely new colony. Larger colonies are found in other genera, the most spectacular being Volvox, some of whose species have as many as 50,000 or more cells linked together to form a hollow sphere. In Volvox the individual cells forming a colony are connected by fine cytoplasmic bridges so that the beating of their flagella is coordinated to propel the entire colony along like a ball. Within the Volvox colony there is some division of labor among cells, with a small number of cells being specialized for reproduction and serving as precursors of new colonies. The other cells are so dependent on one another that they cannot live in isolation, and the organism dies if the colony is disrupted.

2. The Cells of a Higher Organism Become Specialized and Cooperated

In some ways Volvox is more like a multicellular organism than a simple colony. All of its flagella beat in synchrony as it spins through the water, and the colony is structurally and functionally polarized and can swim toward a distant source of light. The reproductive cells are usually confined to one end of the colony, where they divide to form new miniature colonies, which are initially sheltered inside the parent sphere. Thus, in a primitive way, Volvox displays the two essential features of all multicellular organisms: its cells become specialized, and they cooperate. By specialization and cooperation the cells combine to form a coordinated single organism with more capabilities than any of its component parts.

Organized patterns of cell differentiation occur even in some procaryotes. For example, many kinds of cyanobacteria remain together after cell division, forming filamentous chains that can be as much as a meter in length. At regular intervals along the filament, individual cells take on a distinctive character and become able to incorporate atmospheric nitrogen into organic molecules. These few specialized cells perform nitrogen fixation for their neighbors and share the products with them. But eucaryotic cells appear to be very much better at this sort of organized division of labor; they, and not procaryotes, are the living units from which all the more complex multicellular organisms are constructed.

3. Multicellular Organization Depends on Cohesion Between Cells

To form a multicellular organism, the cells must be somehow bound together, and eucaryotes have evolved a number of different ways to satisfy this need. In Volvox, as noted above, the cells do not separate entirely at cell division but remain connected by cytoplasmic bridges. In higher plants the cells not only remain connected cytoplasmic bridges (called plasmodesmata), they are also imprisoned in a rigid honeycomb of chambers walled with cellulose that the cells themselves have secreted (cell walls).

The cells of most animals do not have rigid walls, and cytoplasmic bridges are unusual. Instead, the cells are bound together by a relatively loose meshwork of large extracellular organic molecules (called the extracellular matrix) and by adhesions between their plasma membranes. Very often, side-to-side attachments between the cells hold them together to form a multicellular sheet, or epithelium.

Summary

The evolution of large multicellular organisms depended on the ability of eucaryotic cells to express their hereditary information in many different ways and to function cooperatively in a single collective. In animals one of the earliest developments was probably the formation of epithelial cell sheets, which separate the internal space of the body from the exterior. In addition to epithelial cells, primitive differentiated cell types would have included nerve cells, muscle cells, and connective tissue cells, all of which can be found in very simple present-day animals. The evolution of higher animals and plants depended on production of an increasing number of specialized cell types and more sophisticated methods of coordination among them, reflecting an increasingly elaborate system of controls over gene expression in the individual component cells. 5

(1253 words)

From *Molecular Biology of the Cells* by B. Alberts

Words and Expressions

protozoa	/ˌprəutəuˈzəuə/	*n.*	(单数 protozoon)原生动物,原虫
biomass	/ˈbaiəumæs/	*n.*	生物质,生物量
epidermis	/ˌepiˈdəːmis/	*n.*	表皮
niche	/nitʃ;niːtʃ/	*n.*	龛,龛影;小境
propagate	/ˈprɔpəgeit/	*v.*	传播,繁殖
procaryotic	/ˌprɔkæriˈɔtik/	*adj.*	原核的
myxobacteria	/ˌmiksəubækˈtiəriə/	*n.*	黏杆菌
degradative	/ˌdigrəˈdeitiv/	*adj.*	降解的
aggregate	/ˈægrigit/	*v.*	集合,聚集
germinate	/ˈdʒəːmineit/	*v.*	使生长, 发育
algae	/ˈældʒiː/	*n.*	(复数)藻类
Cyanobacteria	/ˌsaiənəbækˈtiəriə/	*n.*	蓝藻目,蓝细菌
Chlamydomonas	/ˌklæmidəˈməunəs/	*n.*	衣滴虫属:双鞭毛分离原虫
flagellated	/ˈflædʒəleitid/	*adj.*	生有鞭毛的
genera	/ˈdʒenərə/	*n.*	属(分类)
concave	/ˈkɔnkeiv/	*adj.*	凹的,凹面的
Volvox	/ˈvɔlvɔks/	*n.*	团藻虫
cytoplasmic	/ˌsaitəuˈplæzmik/	*adj.*	(细)胞质的,细胞浆的
propel	/prəˈpel/	*v.*	推进、驱使
precursor	/priˈkəːsə/	*n.*	先质,前体(产物母体)
synchrony	/ˈsinkrəni/	*n.*	同步、同时性
filamentous	/ˌfiləˈmentəs/	*adj.*	丝状的,丝性的
plasmodesmata	/ˌplæzməˈdezmətə/	*n.*	(=plasmodesma)胞间连丝
cellulose	/ˈseljuləus/	*n.*	纤维素
meshwork	/ˈmeʃwəːk/	*n.*	网络,网状组织
matrix	/ˈmeitriks/	*n.*	基质,母质
adhesion	/ədˈhiːʒən/	*n.*	黏着物, 粘连
epithelium	/ˌepiˈθiːljəm/	*n.*	上皮,上皮细胞

Exercises

I Fill in the blanks with the verbs from the text. The first letter of the verb has been given.

1. In that era only the larger intracellular structures had been i______ with ordinary microscopes.
2. The work of many researchers had made it clear that genes e______ proteins.
3. Proteins are t______ by transfer RNA and ribosomes.
4. Altered genes can be r______ into cells or even into the germline of organisms.
5. Single-cell organisms c______ more than half of the total biomass on earth.
6. When food supplies are exhausted, the cells a______ tightly together and form a multicellular fruiting body.
7. Many unicellular organisms can s______ all of the substances they need from a few simple nutrients.
8. Individual cells become able to i______ atmospheric nitrogen into organic molecules.
9. The reproductive cells are usually c______ to one end of the colony.
10. To form a multicellular organism, the cells must be somehow b______ together.

II Translate the following expressions into English.

1. 真核细胞
2. 实际分辨率
3. 遗传分析
4. 分子细胞生物学
5. 基因编码
6. DNA 重组技术
7. 多细胞有机体
8. 表皮层
9. 降解酶
10. 胞质桥

III Fill in the blanks of the following sentences with appropriate prepositions.

1. Two classes ______ nucleic acids are found ______ cells: DNA and RNA.
2. Water serves ______ the medium ______ which most biochemical reactions occur in living cells.
3. Amino acids differ from each other ______ the content of the R group attached ______ this alpha carbon.
4. Other types ______ microscopy emerged that could manipulate the light path ______ cells so as to reveal different images.
5. Detergent experiments also showed that some proteins were more localized ______ the surface and thus easily washed off ______.

IV Read the following passage carefully and then fill in each blank with one suitable word or expression selected from the list.

function	against	release	designed to	determines
with	bind	substitute	for	from
maintain	where	degree	which	such as

A protein's structure *1* ______ what functions it is most suited *2* ______. For example, the structure of hemoglobin allows it to *3* ______ oxygen efficiently in the lungs and then *4* ______ oxygen in the tissues *5* ______ it is needed. Enzymes are proteins *6* ______ catalyze specific biochemical reactions. They are equipped *7* ______ binding sites for their substrates and for the cofactors *8* ______ enable them to function. Immunoglobulins are proteins which defend *9* ______ invading pathogens. Other proteins *10* ______ actin serves as structural proteins that establish and *11* ______ the cellular architecture. The *12* ______ of structural specialization of any protein bars it *13* ______ performing the *14* ______ of an unrelated protein. For example, actin cannot be a *15* ______ for hemoglobin.

V Complete the following definitions.

1. differentiation: Process by which a cell undergoes a change to an overtly ______.
2. genome: Total genetic information carried by ______.
3. cellulose: Structural polysaccharide consisting of ______. It provides tensile strength in ______.
4. protein: The major ______ of cells. A linear polymer of amino acids linked together by ______.
5. gene: Region of DNA that controls a discrete hereditary characteristic, usually corresponding to ______.
6. reaction: ______, any process in which the arrangement of atoms into molecules ______.
7. vector: In cell biology, ______ (virus or plasmid) used to transmit genetic material to ______.
8. enzyme: Protein that catalyzes ______.
9. mutation: ______ in the nucleotide sequence of a chromosome.
10. in vitro: Term used by biochemists to describe a process taking place in ______. Also used by cell biologists to refer to ______ (in vitro), as opposed to ______ (in vivo).