爱上科学
Science

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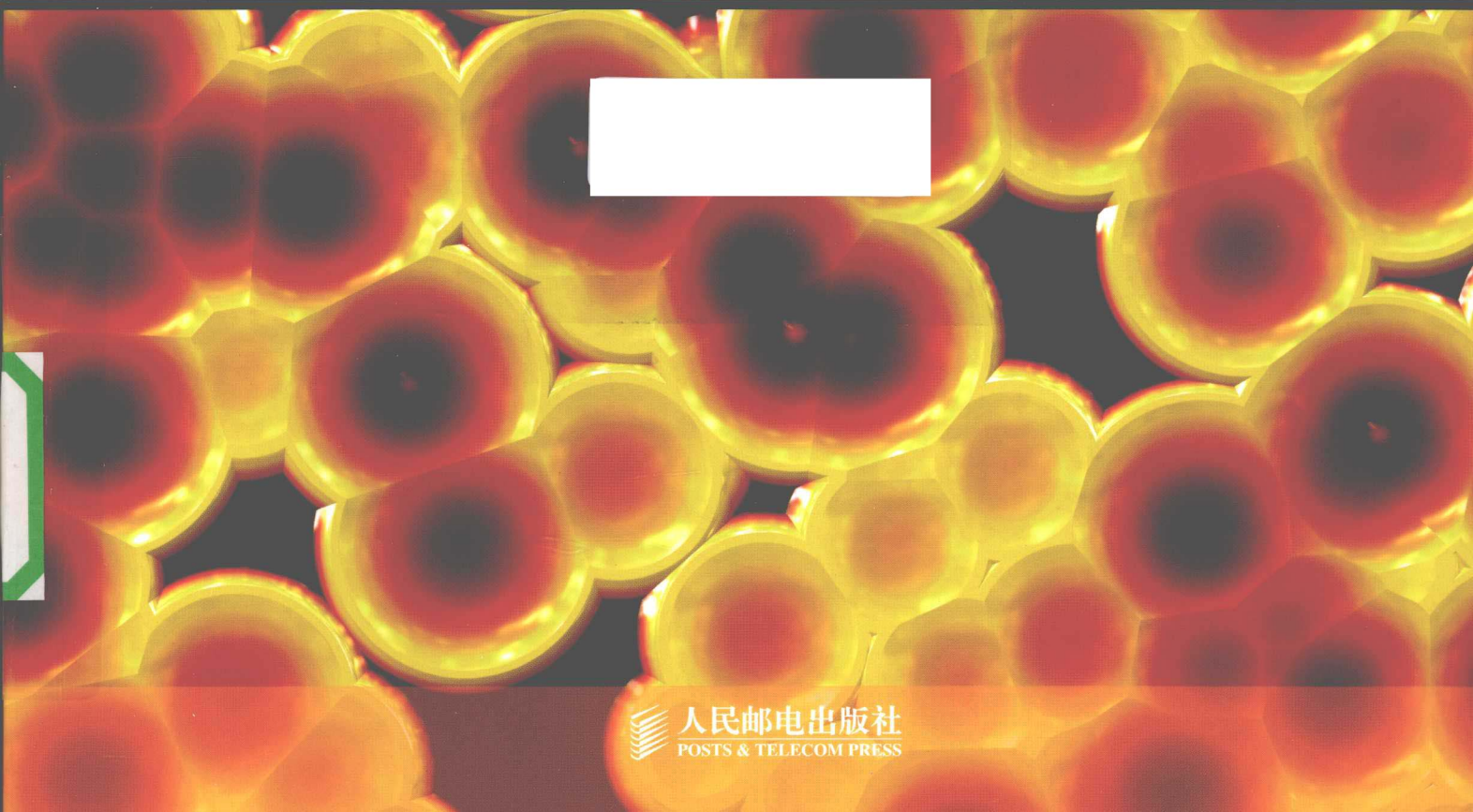
爱上科学

INTRODUCING • 生物系列
BIOLOGY

植物与微生物

PLANTS AND MICROORGANISMS 双语版

[英] Sarah Eason 编
臧越鹏 译
梁彤 审



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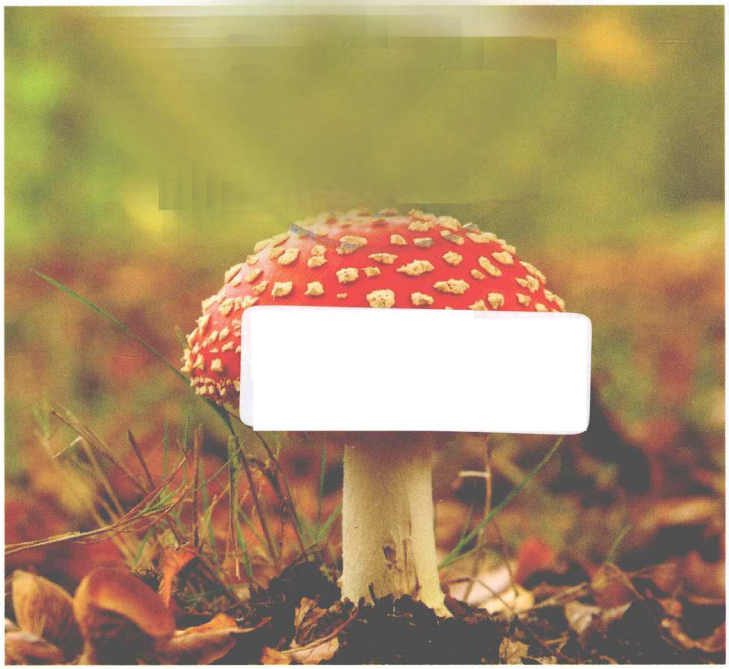

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内容提要

《爱上科学》系列科普丛书为读者全面地讲述了科学知识和原理，以通俗的文字、生动的图表为特色，每本书介绍一个或几个主题。从日常生活中有趣的现象出发，引导和培养读者学习的兴趣，扩宽读者的视野，同时还可以帮助读者学习英语词汇、练习英语阅读。丛书涵盖物理、化学、生物、科技与发明这4个系列。适合对科学知识感兴趣的广大科普爱好者阅读。

本书是生物系列中的一本。生物系列主要阐释生命科学的基本概念，并探讨有关生物学的现代思想的各个方面，包括植物学、微生物学、动物与人类、遗传学、细胞生物学以及生命形式等。

有些“小东西”会导致我们生病，为什么我们看不见它们？而植物又是什么？这本书将介绍什么是细菌、病毒、微生物与疾病、植物、藻类等，为读者生动有趣地讲述一个我们用肉眼看不到的微观世界，同时概括了植物类的相关知识。书中含有“科学词汇”栏目，提取每章重点知识词汇。同时还有“试一试”栏目，包含丰富有趣的家庭小实验，有助于提高大家的动手能力。

丛书编委会

丛书序

这是一个科技新时代，我们曾经认为遥不可及的科学，时刻围绕在我们身边。你是否曾经怀疑过所谓的“2012，世界末日”，或者好奇过在地下高速飞驰的地铁，抑或每天都在关注着PM2.5……这说明科学已然走进了你的生活。学习科学，分享科学，爱上科学，让我们共同聆听来自科学的声音。

《爱上科学》系列科普丛书是一套引进版系列科普丛书，译自英国大型出版商棕熊图书（BROWN BEAR BOOKS）有限公司出版的著名系列科普图书《Facts At Your Fingertips》，其独特的科学解读视角、生动的科普画面、优美的图文设计，得到了欧洲读者的青睐，尤其是得到了欧洲青少年的极大欢迎。本丛书为读者全面地讲述了各个领域的基础科学知识和基本事实，以精彩的主题、通俗的文字、生动的画面为特色，从我们身边的素材和现象出发，激发和培养读者学习的兴趣。

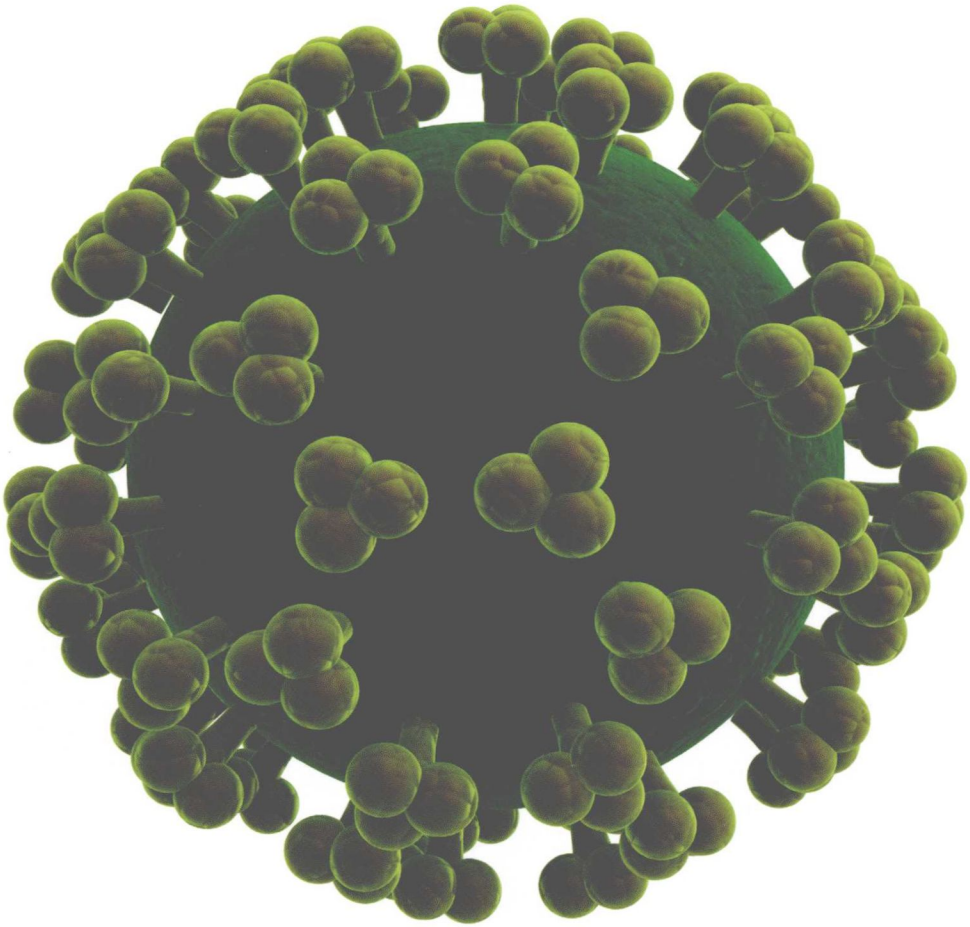
丛书涵盖物理、化学、生物、科技与发明四大系列。物理系列阐释和说明了物理学知识及其发展史，包含对物理学发展史许多重大的物理发现以及著名的物理学家的介绍。化学系列主要阐释现代化学的基本概念，涵盖化学反应、有机化学、生物化学、金属、非金属、分子、原子、物态等多方面内容。生物系列主要阐释生命科学的基本概念，并探讨有关生物学的各个方面，包括植物学、微生物学、动物和人类、遗传学、细胞生物学以及生命形式等。科技与发明系列主要介绍各种科技成果以及相关发明，覆盖多个领域，包括建筑、交通、医学、军事、能源以及航空航天等，指导读者认知和学习各种科学技术，拓宽视野，引发思考，提升创新能力以及发明意识。

本丛书还具有中英双语的独特设计，让读者在阅读中文时，能对照性地阅读英语原文，为他们提高科学领域的英文阅读能力以及扩展科学类英语词汇量提供了很好的帮助。

丛书中还有“试一试”栏目，该栏目包含了丰富有趣的家庭小实验，为大家在生活实践中验证科学知识提供了更多的选择。

学无止境，让我们一起爱上科学！

目录 CONTENT



Microorganisms matter. Although we cannot see microorganisms without using a microscope, billions of them live all around us—on land, sea, and even deep underground.

Microorganisms live in all extremes, from near-boiling volcanic springs to frozen polar ice, and from high mountain peaks to ocean trenches. They also live on and in all plants and animals. Microorganisms are often simple life-forms, but they are essential to life on Earth. The main types of microorganisms are bacteria and **protists**. Bacteria are single-celled organisms. People often think of them as dangerous and disease-causing, but most are not harmful. Many types of bacteria break down dead organic matter, including food inside peoples ' intestines, or guts.

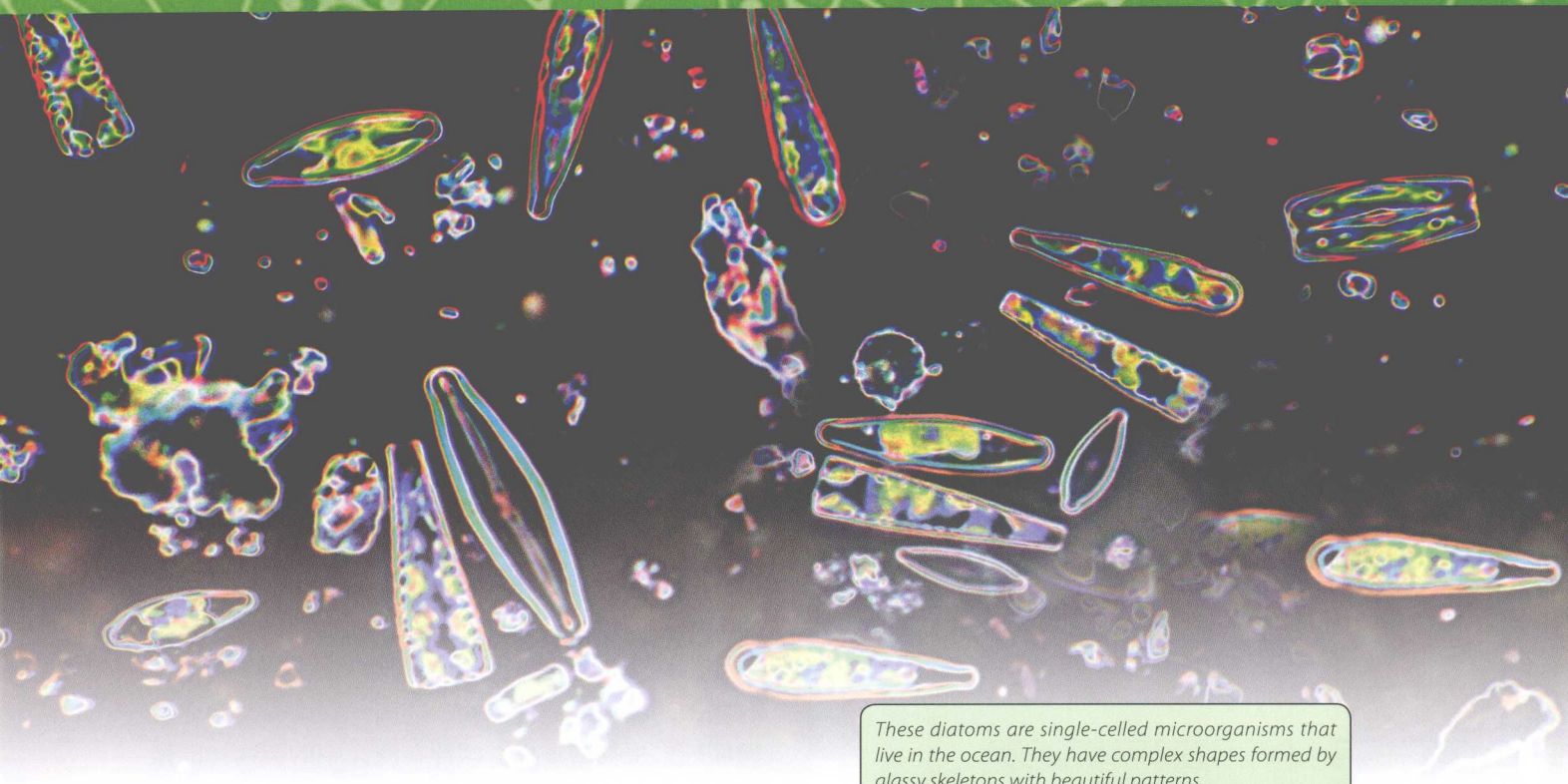
Protists include green **algae**, amoebas, slime molds, and many types of plankton (floating organisms). The group is very diverse and includes many organisms that are related only distantly. Some protists move around like tiny animals. Others seem more like plants. Yet others are plantlike and animal-like at various stages in their life.

Importance of microorganisms

Some microorganisms cause terrible diseases such as tuberculosis and AIDS. Yet overall, we cannot do without them. They are vital to Earth's ecosystems, and life would be impossible without them.

Microorganisms are too small to see with the naked eye, so it is not always obvious how important they are. They play many different roles. Some microorganisms make their own food like plants. Others hunt prey like animals, while yet others rot down and recycle dead material. Plantlike microorganisms that float in the oceans are particularly important. Just like true plants, they

Bacteria in the air have caused these lemons to rot. The visible signs of mold on the surface of the lemons are the fruiting bodies of a parasitic fungus growing inside them.



These diatoms are single-celled microorganisms that live in the ocean. They have complex shapes formed by glassy skeletons with beautiful patterns.

use the energy in sunlight to turn water and carbon dioxide from the air into food and oxygen by **photosynthesis**. These microorganisms are eaten by others and form the base of a food chain that leads to fish, whales, and even people. Many single-celled protists are plantlike. Plantlike protists are often called algae, or microalgae if they are single-celled. Not all the microorganisms called algae are related.

Microorganisms and people

Bread, wine, and cheese are all made with help from microorganisms. Industrial uses for microorganisms, or biotechnology, include the manufacture of drugs, solvents (dissolving liquids), and some types of plastics. Other uses include the spreading of insect-attacking proteins to control pests and using biological methods to clean up pollution.

Much of the knowledge gained in the fields of biochemistry, genetics, and molecular biology has come from studying bacteria and viruses. So too have many of the techniques used in genetic engineering.

SCIENCE WORDS

- **algae** Plantlike, often single-celled, organisms.
- **photosynthesis** The conversion of water and carbon dioxide into sugars in plants, using the energy of sunlight.
- **protist** A single-celled organism with a nucleus and other organelles.

微生物至关重要。虽然我们不借助显微镜看不到微生物，但是亿万计的微生物就生活在我们周围——在陆地上、海洋里，甚至在地层深处。

微生物可以生活在各种极端的条件下——从接近沸腾的火山泉里到极地冰层中，从高山之巅到深邃的海沟中。它们还会出现在所有动植物的身上和体内。通常，微生物的生命形式很简单，但是它们对地球的生物却很重要。微生物主要可以分为细菌和**原生生物**两种类型。细菌是单细胞生物。人们通常认为它们很危险并且会使人生病，其实大部分细菌是无害的。许多种细菌参与降解无生命的有机物质，包括人类肠道或内脏里的食物。

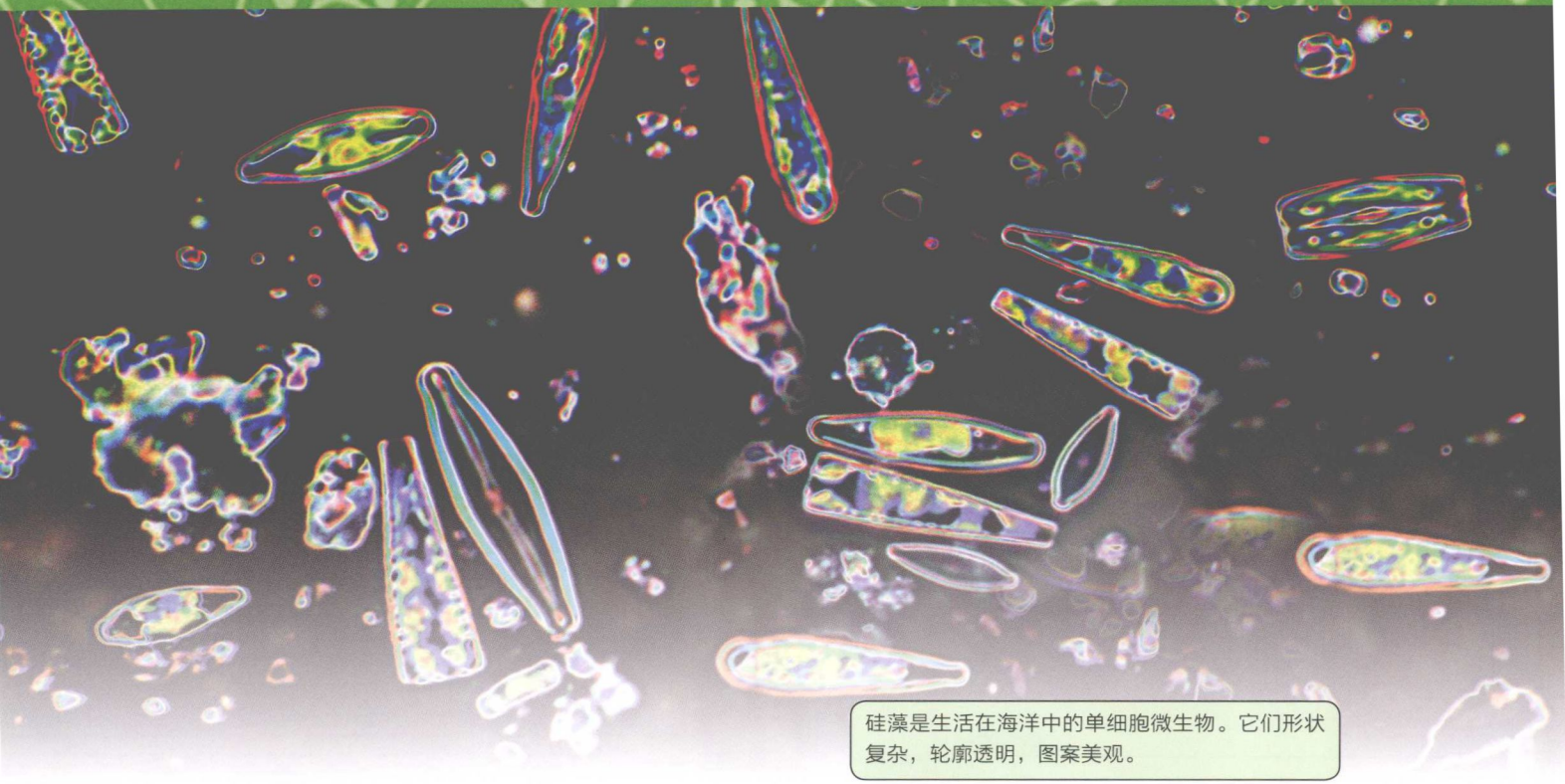
原生生物包括绿**藻**、变形虫、黏菌，以及许多种浮游生物（漂浮生长的生命体）。原生生物种类繁多，并且许多种类间差异很大。有些原生生物可以自由移动就像微小的动物，有的更像植物，还有一些在它们整个生命过程中的不同阶段有时像动物有时又像植物。

微生物的重要性

有些微生物会引发严重的疾病，比如肺结核和艾滋病。但总地来说，我们离不开微生物。它们对地球的生态系统非常重要，生命离开它们是不能存在的。

微生物非常小，小到肉眼不能看到它们，所以我们不是总能观察到它们有多重要。它们有不同的功能。有些微生物可以像植物那样自己产生食物，有些像动物一样捕食猎物，还有一些则参与腐化及循环死亡生物的过程。漂浮在海洋中的植物样的微

空气中的细菌使得这些柠檬腐烂。柠檬表面上的霉变印记警示着其体内已有寄生的真菌。



硅藻是生活在海洋中的单细胞微生物。它们形状复杂，轮廓透明，图案美观。

生物尤其重要。就像真正的植物那样，它们利用阳光中的能量通过**光合作用**将水和空气中的二氧化碳转化成食物和氧气。这些微生物会被其他生物吃掉并且形成食物链的最底层，该食物链还包括鱼、鲸鱼，甚至是人类。大部分单细胞原生生物是像植物的。植物样的原生生物通常称为藻类，如果是单细胞的话就称之为微藻。不是所有称为藻类的微生物都这么命名。

微生物和人类

面包、红酒及奶酪都是在微生物的帮助下制作出来的。微生物在工业或者生物技术产业中的用途主要包括生产药物、溶剂（用于溶解的液体）及某些种类的塑料。其他的用途还包括通过传播灭虫蛋白来控制寄生虫，以及通过生物学途径来清理污染。

生物化学、遗传学以及分子生物学等领域的许多知识都来源于对细菌以及病毒的研究。同样的，还有很多技术应用在遗传工程中。

科学词汇

- **藻：**类似植物，通常为单细胞的生命体。
- **光合作用：**植物利用太阳光的能量将水和二氧化碳转化成糖的过程。
- **原生生物：**一种单细胞生命体，通常具有一个细胞核和其他一些细胞器。

BACTERIA

Some bacteria cause diseases, but most perform vital or useful functions—in the digestive systems of animals and also in the recycling of nitrogen.

There are more bacteria living on Earth than any other life-form. They live in air, water, soil, and plants and animals. Evidence that bacteria may have been the first organisms on Earth comes from the fact that some bacteria live in harsh environments that are probably similar to the conditions present on Earth when life first began.

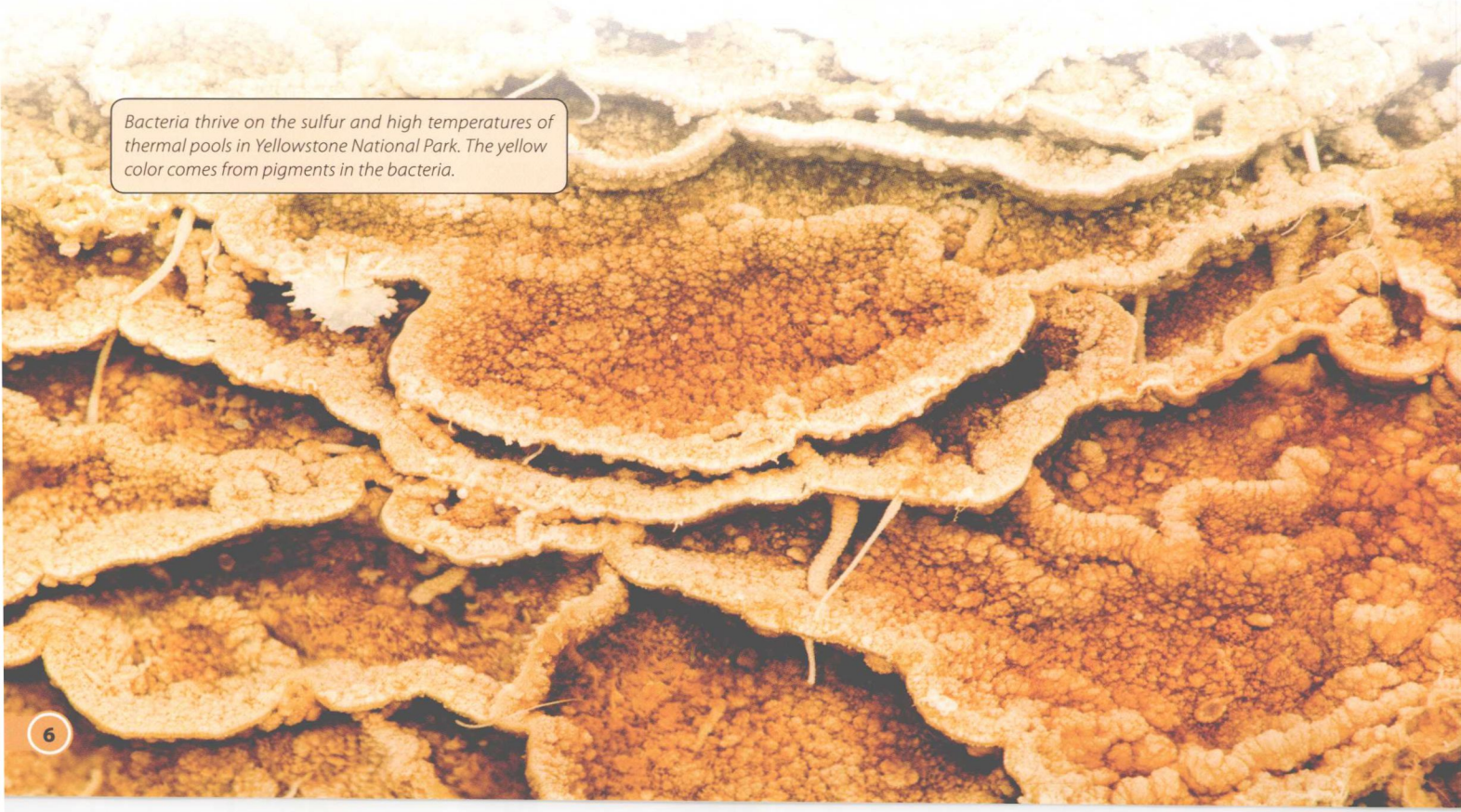
People usually think of bacteria as disease-causing germs. However, the bacteria that cause diseases such as cholera, tuberculosis, and the sexually transmitted infection gonorrhea make up just a tiny portion of the bacterial world.

We depend on bacteria for many important functions in life, including maintaining Earth's atmosphere as well as breaking down decaying matter and releasing the nutrients they contain back into the environment. They also digest food in the gut of animals.

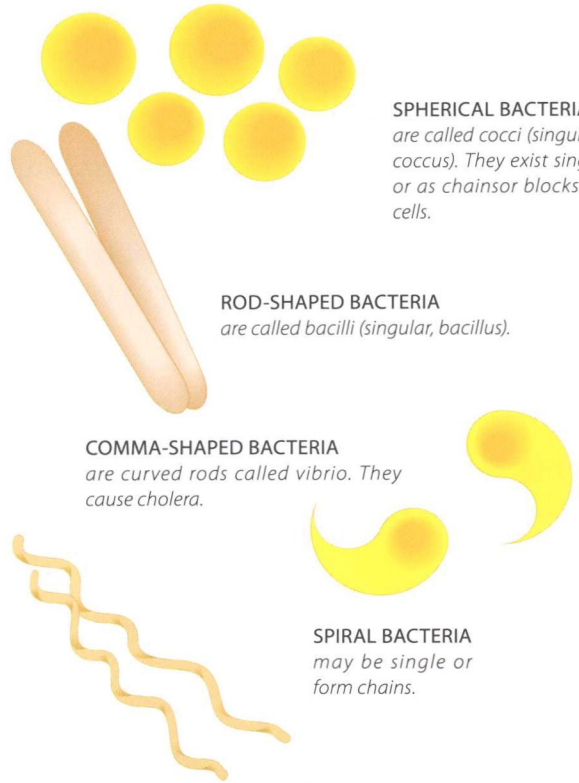
Recycling Earth's nitrogen is another important bacterial activity. Plants need nitrogen to grow properly. Soil bacteria make nitrogen available to plants by changing nitrogen gas from the air into **nitrates** or nitrites in a process called nitrogen fixation.

Size

Bacteria are among the smallest organisms on Earth. A human body has billions of cells, but each **bacterium** (plural, bacteria) is just one cell. A bacterium may be just a few nanometers long



Bacteria thrive on the sulfur and high temperatures of thermal pools in Yellowstone National Park. The yellow color comes from pigments in the bacteria.



Bacteria come in many different shapes and sizes, but the three most common are rods, spheres, and spirals.

(a nanometer is 1 millionth of a millimeter) or as large as 0.75 mm in length. Bacteriologists (scientists who study bacteria) view bacteria through microscopes because they are too small to be seen with the naked eye. Bacteria are always single-celled, but some types join up and form filaments or threads. These threads may be visible to the naked eye. Even in bacteria that live in groups the contents of each cell remain separate.

A typical bacterial cell is much simpler than an animal or plant cell and is usually more than 100 times smaller. However, there are some exceptions: The relatively huge bacterium

BACTERIA GROOPS

Bacteria are divided into two main groups. The two groups are the eubacteria and the archaebacteria. The eubacteria are the older group. Scientists are unsure exactly when the archaebacteria split from the eubacteria. This major division may have taken place as long as 3 billion years ago, or it may have been much more recent; some scientists think the split took place around 850 million years ago. The two main bacteria groups are further separated into several major divisions.

Epulopiscium fischelsoni is 0.5 mm long; it can just about be seen with the naked eye. This bacterium lives in the gut of the surgeon fish, where it feeds on the fish 's digested food.

Classification

Not long after bacteria appeared about 3.5 billion years ago, they split into two groups, archaebacteria and eubacteria. The groups are very different in terms of their structure and metabolism (the way in which they carry out their life processes). The name *archaebacteria* is misleading since eubacteria are more ancient than archaebacteria (*archae* means old). Scientists have studied eubacteria—which include most of the known species of bacteria—much more thoroughly than archaebacteria.

To date, scientists have recognized about 5,000 different types of bacteria on Earth. However, this is just the tip of the iceberg and there may be many millions more types of bacteria that have not yet been discovered. Bacteria exist in a variety of different shapes. Their shapes include rods, spheres, spirals, and commas. Scientists mostly classify bacteria by genetic characteristics (characteristics that are inherited from previous generations) and by how the bacteria get their energy.

一些细菌会引发疾病，但大多数细菌都行使着重要或有用的功能——在动物的消化系统中，也在氮的循环过程中。

地球上细菌的数量比任何其他的生命形式都要多。它们生活在空气中、水中、土壤中及动植物体内。有证据表明细菌或许是地球上最先出现的生命体，得出这一结论是因为有些细菌可以生活在严酷的环境中，而这种环境恰恰与生命起源时地球的环境相似。

人们通常认为细菌就是致病的病菌。但是，具有致病性的细菌，如引起霍乱、肺结核及性接触传染的淋病等的细菌，只占细菌世界的很小的一部分。我们生命的很多重要功能都依赖于细菌，包括维持地球大气的稳定及降解衰败的物质，从而将其中包含的营养物质重新释放到环境当中。它们还可以帮助消化动物内脏中的食物。

促进地球上的氮元素再循环是细菌的另一项重要的活动。植物需要氮元素来帮助其生长。土壤中的细菌通过将空气中的氮气转化成**硝酸盐**或者亚硝酸盐等，可以被植物利用的氮元素的过程，称为固氮。

大小

细菌是地球上最小的生命体之一。人类的身体通常含有上亿的细胞，但是**细菌**仅仅具有一个

细菌可以在美国黄石国家公园的高温并且含有硫磺的温泉中生存。黄色来源于细菌体内的色素。

细菌具有不同的形状和大小，但是3种最常见的分别是杆状、球状和螺旋状。

细胞。细菌或许仅有几纳米长（1纳米=1 × 10^{-6}毫米），或许可以大到0.75毫米长。细菌学家（研究细菌的科学家）只有通过显微镜才能观察到细菌，因为它们实在太小，小到肉眼无法看到。细菌通常是单细胞生物，但是有些种类的细菌可以结合在一起形成纤维状。这些纤维是有可能通过肉眼观察到的。但即使是在成群生长的细菌的内部，单个细胞仍然保持分离状态。

典型的细菌细胞比动物细胞或者植物细胞要简单得多，而且通常都会比它们小100倍。但是也有一些例外：一种相对巨大的细菌费氏刺骨鱼菌有0.5毫米长，可以通过肉眼看到。这种细菌生活在颊纹鼻鱼的内脏中，以鱼消化后的食物为生。

细菌菌群

细菌主要可以分成两大菌群。分别是真细菌以及古细菌。真细菌是最原始的一个菌群。科学家们还不清楚古细菌具体是在什么时候从真细菌中分离出来的。这一主要的分离有可能发生在30亿年前，或者更近一些；有些科学家认为分离事件发生在8亿5千万年前左右。这两大菌群又被进一步分成若干主要的门。

分类

在35亿年前细菌出现后不久，它们便分离进化成了两类，分别是真细菌和古细菌。这两大类细菌在结构和代谢（进行生命活动的生物学过程）上存在着很大的区别。古细菌的名字很容易造成误解，因为实际上真细菌比古细菌更加古老。科学家们对真细菌（包括大多数的已知种类）的研究比对古细菌的研究更加透彻。

迄今为止，科学家在地球上已经发现了5 000种不同的细菌。但这仅仅是冰山一角，可能还会有数以百万种细菌还没有被发现。细菌具有各种各样不同的形状，包括杆状、球状、螺旋状以及逗号状。大多数情况下，科学家们会通过细菌的遗传学特征（从上一代遗传下来的特征）以及它们获取能量的方式对细菌进行分类。

Archaebacteria

Archaebacteria often live in environments that few other organisms can exploit. These habitats include salty places, inhabited by halophile (which means "salt-loving") bacteria, hot places, inhabited by thermophile ("heat-loving") bacteria, or environments that are low in oxygen such as the sand or mud of swamps, marshes, and estuaries. These are anaerobic (oxygen-hating) bacteria. People use anaerobic bacteria to decompose sewage and other waste. Similar types of bacteria live in the guts of animals, including people, where they break down food.

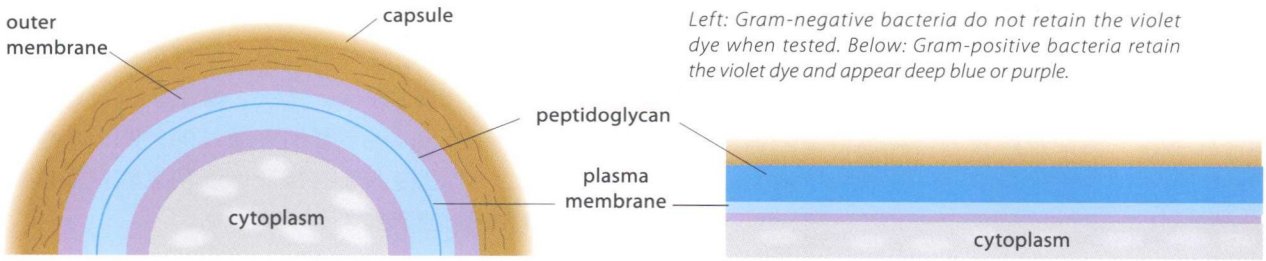
Halophiles live in very salty environments, such as the Great Salt Lake in Utah. The bacteria contain high levels of pigments (coloring) and are purple or red. Extreme thermophiles live in very hot places, such as deep-ocean hydrothermal vents. *Sulfolobus* is a thermophile bacterium that lives in hot sulfur springs in Yellowstone National Park. It gets energy by breaking down sulfur compounds.

BACTERIA AND FOOD PRODUCTION

Bacteria are used widely in the food industry to ferment foods or alter their properties, making them more flavorsome, digestible, or merely to improve their texture. Fermentation is a natural chemical process in which microorganisms, such as bacteria and yeast (a fungus), get their energy by breaking down sugars to form alcohol and carbon dioxide gas in an oxygen-free environment. Dairy products, bread, vinegar, and pickled vegetables are some of the foods we enjoy every day thanks to bacteria. Milk is fermented to cheese, yogurt, and sour cream by the lactic acid-producing bacteria *Lactobacillus*, *Leuconostoc*, and *Streptococcus*. The bacteria change the taste and texture of the products and even help them keep better: Some cheeses can be stored for months at room temperature.

THE GRAM STAIN

Bacteria are identified using a staining technique called the **Gram stain**, named after its developer Danish physician Hans Christian Gram (1853–1938). Gram-positive bacteria stain purple when exposed to the Gram stain. Gram-negative bacteria are not stained by the purple dye. The Gram stain reacts to differences in the structure of the bacterial cell surface. Bacteria with an outer layer that contains a chemical called peptidoglycan are Gram-positive. The peptidoglycan turns purple when exposed to the stain. Gram-negative bacteria have less peptidoglycan and a further outer embrane that keeps out the stain. Gram-negative bacteria can resist **antibiotics** (drugs that kill bacteria) thanks to the extra outer membrane.



Left: Gram-negative bacteria do not retain the violet dye when tested. Below: Gram-positive bacteria retain the violet dye and appear deep blue or purple.