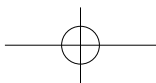
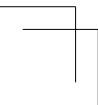
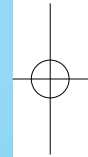
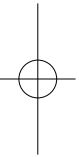
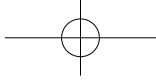
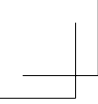


CONTENTS

UNIT 1	Biomaterial shaping tomorrow	1
UNIT 2	Engineering solutions for health	15
UNIT 3	Chemistry in health care	29
UNIT 4	Silent cells, digital oaths	43
UNIT 5	The sociomedical tapestry	57
UNIT 6	Critical minds, healing hands	71



UNIT

1

Biomaterial shaping tomorrow



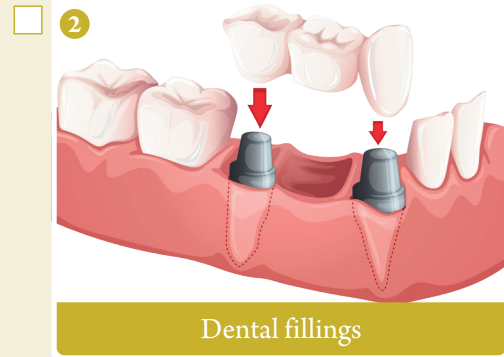
Learning objectives

After learning this unit, you will be able to:

- understand the types and roles of biomaterials;
- use clarification strategies while speaking;
- recognize problem-solution patterns while listening;
- make a presentation on 4D printing.

Opening up

1 Match the following pictures related to medical items with their corresponding materials.



A. Hard plastic or metal
C. Metal or ceramic

B. Polymer material
D. Cloth

2 Work in pairs and discuss how these materials help our bodies.

Viewing and speaking

Pre-viewing

Think about a time when someone you know broke a bone, such as an arm or a leg. What can be used to help it heal – a plaster cast, a metal pin, or something else?

Viewing

New words and expressions

osteoporosis /ˌɒstiəʊpəˈrəʊsɪs/ *n.* 骨质疏松症

fracture /ˈfræktʃə/ *n.* 骨折

cranial /ˈkreɪniəl/ *a.* 头骨的

tendon /ˈtendən/ *n.* 肌腱

stent /stent/ *n.* 支架

clogged /ˈkɒlɡd/ *a.* 堵塞的

implant /ˈɪmplɑːnt/ *n.* 植入物

resin /ˈrezɪn/ *n.* 树脂

degradation /ˌdeɪgrəˈdeɪʃən/ *n.* 降解

elasticity /ˌɪlæˈstɪsɪti/ *n.* 弹性

filament /ˈfɪləmənt/ *n.* 丝状物

individualized /ˌɪndɪˈvɪdʒʊəlaɪzd/ *a.* 个性化的;
切合个人需要的

- 1 How do Evonik's biomaterials help patients with bone fractures? Watch the video and finish the outline.

The story of Evonik's biomaterials

- **The problem:** Fractures caused by osteoporosis can be painful for patients and experts are working to find new 1) _____ for millions of patients with bone diseases.
- **The advantages:** The new materials developed by Evonik are lightweight, help to increase bone 2) _____, and can be completely 3) _____ by the body, so no second surgery is needed.
- **Different uses:** They are used for the 4) _____ of injuries in various parts of the body.
- **The future:** Evonik is also using 5) _____ printing to make implants that are perfect for each patient.

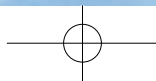


2 Watch the video again and decide whether each of the following statements is true (T) or false (F).

- 1. An osteoporotic fracture occurs every thirteen seconds.
- 2. The polymers can be used in devices that reconstruct shoulder tendons.
- 3. The application of these polymers extends beyond bone repair to include cardiovascular medical devices.
- 4. VESTAKEEP is the material chosen when an implant needs to be removed after healing.
- 5. Patient-specific implants created by 3D printers are already a common solution that surgeons use today.

3 Work in pairs and discuss the following question.

The video highlights the advantages of absorbable polymers over traditional metal implants. However, every new technology may have its own limitations or challenges. Based on your understanding, what could be some potential disadvantages or challenges of using these absorbable polymer implants? (e.g., from the perspective of cost, accessibility, surgeon training, etc.)



Listening and speaking

News

New words and expressions

replacement /rɪ'pleɪsmənt/ *n.* 置换; 替换

hydrogel /'haɪdrədʒel/ *n.* 水凝胶

- 1 Listen to a piece of news and match each biomaterial with its corresponding medical application.**

Biomaterial

1. Strong metal
2. Special plastic
3. Ceramic material
4. Natural material from an animal
5. Hydrogel bandage

Medical application

- A. is used to make artificial blood vessels.
- B. is used for dental implants.
- C. can stop serious bleeding very quickly.
- D. is used for bone repair in most hip replacement surgeries.
- E. helps wounds heal faster.

- 2 Work in pairs and discuss the following question.**

According to the news, scientists are improving biomaterials to make them safer, longer-lasting, and “self-healing” so that they work better with the human body. How can such “self-healing” materials help treat patients more effectively in the future?

Conversation

New words and expressions

antimicrobial /ˌæntɪmɑː'krəʊbiəl/

a. 抗微生物的

collagen /'kɒlədʒən/ *n.* 胶原蛋白

scaffold /'skæfəʊld/ *n.* 支架; 脚手架

biosensor /'baɪəʊ'sensə/ *n.* 生物传感器

inflammatory /ɪn'flæmətəri/ *a.* 炎症的

diabetic ulcer /,daɪə'betɪk 'ʌlsə/ 糖尿病溃疡

1 Listen to a conversation and choose the best answer to each question you hear.

- A. They are made of stronger fabric. B. They are more expensive to produce.
C. They actively help the body heal. D. They can change color to show infection.
- A. To make the bandage stick better. B. To fight germs and prevent infection.
C. To help build new tissue faster. D. To measure the pH level of the wound.
- A. By destroying harmful bacteria around the wound.
B. By creating a structure that supports the growth of new cells.
C. By monitoring chemical changes in the wound fluid.
D. By communicating directly with a health-care professional.
- A. The wound is completely healed. B. The collagen framework disappears.
C. The bandage is taken off. D. Possible signs of infection are detected.
- A. Because they can detect problems at an early stage.
B. Because they are the most affordable option.
C. Because they use natural ingredients.
D. Because they don't need to be replaced.

2 Listen again and decide whether each of the following statements is true (T) or false (F).

1. The antimicrobial function of smart bandages is mainly achieved through copper particles.
2. Collagen is a type of synthetic plastic material.
3. Biosensors in smart bandages can measure pH levels to assess wound health.
4. Inflammatory activity levels can be monitored through changes in wound temperature.
5. Smart bandages represent a shift from merely covering a wound to actively managing the healing process.

3 Work in pairs and discuss the following questions.

If smart bandages can monitor wounds so well, will patients still need to visit their doctors as often? Is this a good change for health care?

Speaking skill

Using clarification strategies

This skill focuses on employing targeted questioning techniques to enhance comprehension in academic dialogs, particularly valuable when discussing specialized topics like biomedical science. The approach involves three practical techniques.

First, seek direct clarification by asking specific questions about technical terms. For example, when Dr. Chen mentions that smart bandages are “bioactive,” Alex follows up with “How do they work with the body?” to better understand the concept of bioactive materials. Second, use progressive questioning to move from general to specific inquiry. Alex demonstrates this by moving from the general request, “Can you tell me something about ‘smart bandages?’” to a specific inquiry about the mechanism. Third, confirm your understanding by rephrasing key ideas. Alex does this when he checks his grasp of the alert system by asking, “So the doctor gets an early warning?”

Implement these strategies using the 3C Method: Clarify unclear technical aspects, confirm your understanding of biomedical mechanisms, and connect new information to existing health knowledge.

These clarification strategies transform passive listening into active learning, making technical conversations about medical innovations more productive while enhancing both speaking and listening skills in scientific contexts.

Work in pairs and role-play the situation.

At a biomedical technology exhibition, a researcher (Student A), is tasked with explaining a new device such as a smart bandage to a visitor (Student B), who has a non-science background. Student A must clearly describe the device’s operation and benefits, while Student B should ask clarifying questions to ensure a deep and comprehensive understanding of the technology.

Passage

Passage 1

New words and expressions

gel /dʒel/ *n.* 凝胶

nutrient /'nju:triənt/ *n.* 营养物质

mechanical /mɪ'kænikəl/

a. 力学的; 物理(结构)的

cellular /'seljʊlə/ *a.* 细胞的

secrete /sɪ'kri:t/ *v.* (身体或植物器官) 分泌

extracellular matrix /,ɛkstrə'seljʊlə 'mertriks/
细胞外基质

graft /gra:ft/ *n.* 移植物

cartilage /'kɑ:tɪlɪdʒ/ *n.* 软骨

1 Listen to a passage and finish the summary.

Bioprinting is an innovative technology that creates living tissues using a special material called 1) _____, which contains living cells and essential nutrients. The printing process starts with a digital model based on a patient's own 2) _____. This model guides the printer to build structures layer by layer, creating temporary supports known as 3) _____. Over time, the living cells begin to 4) _____ and form functional units. They produce their own natural support system, allowing the artificial structure to safely 5) _____. This method could greatly reduce 6) _____ for organ transplants and improve treatment 7) _____ for patients worldwide.

2 Listen again and choose the best answer to each question you hear.

- A. They stop communicating with each other.

B. They secrete support materials to form a natural matrix.

C. They become harder and turn into plastic.

D. They are immediately ready for transplant.
- A. It is widely available in all hospitals.

B. It has replaced traditional transplant methods.

C. It is only used for printing simple tissues.

D. It remains mainly experimental.
- A. A new layer of metal.

B. A patient's natural extracellular matrix.

C. A permanent plastic structure.

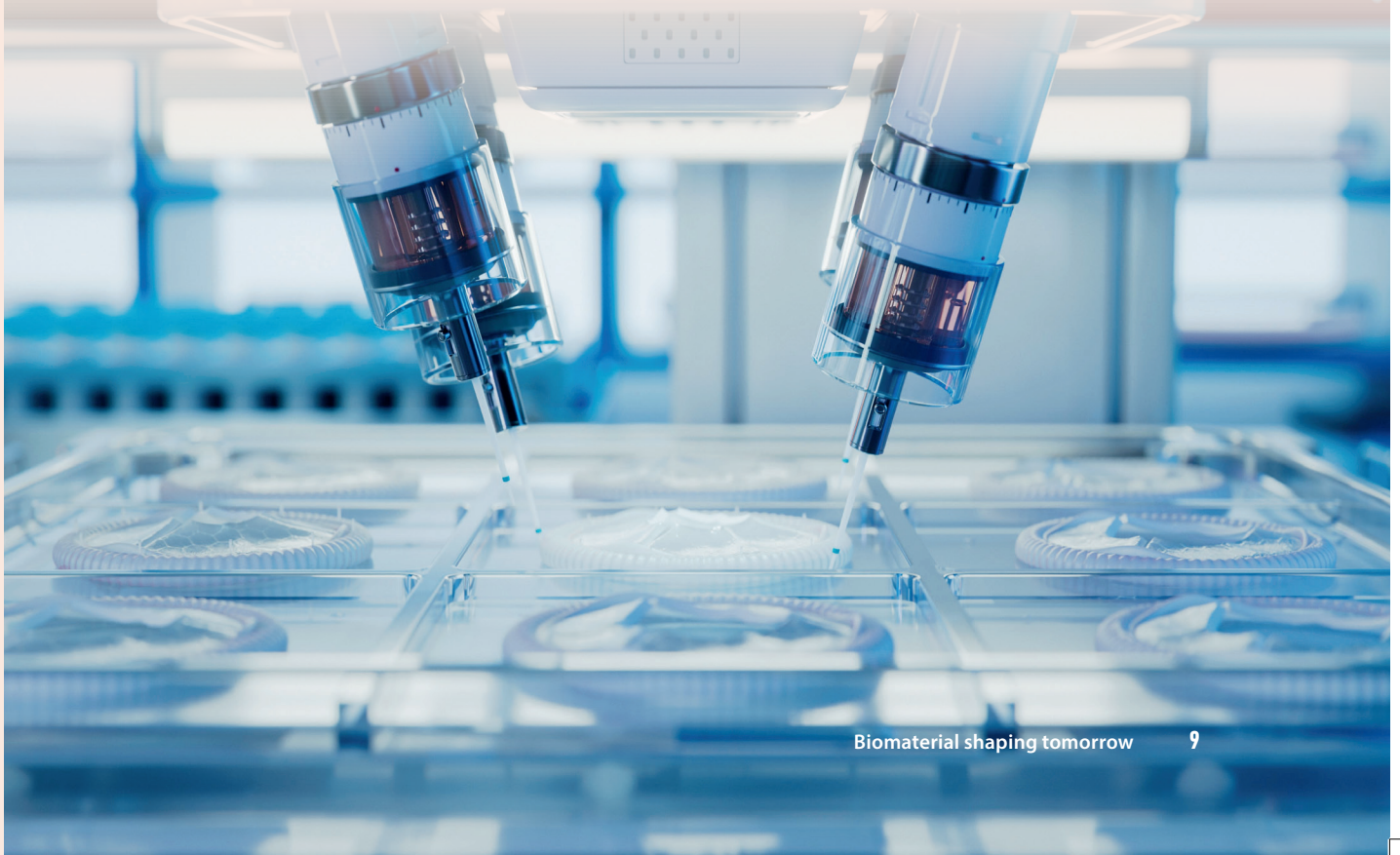
D. Additional bio-ink injections.



4.
 - A. Printing full human brains.
 - B. Creating artificial metal limbs.
 - C. Printing skin grafts and cartilage.
 - D. Replacing all bone fractures with plastic.

3 Work in pairs and discuss the following question.

Imagine your school is planning to install a 3D bioprinter in the science lab. What would be more valuable for students: printing accurate organ models to study anatomy, or printing living tissues to understand cell behavior? Choose one position and explain your reasons.





Passage 2

New words and expressions

shape memory polymer 形状记忆聚合物

insertion /ɪn'sɜːʃən/ *n.* 嵌入

minimally invasive surgery 微创手术

coating /'kəʊtɪŋ/ *n.* 涂层

1 Listen to a passage and finish the summary.

Smart materials are bringing important changes to medical treatments. These special materials can 1) _____ their original shape after being deformed. They respond to specific 2) _____ like body heat. This allows medical devices to be inserted through small openings in a(n) 3) _____ state. Once inside the body, these devices 4) _____ to provide support. The technology causes 5) _____ to the body and helps patients recover more quickly. Scientists are improving these materials with special 6) _____ that can release medicine.

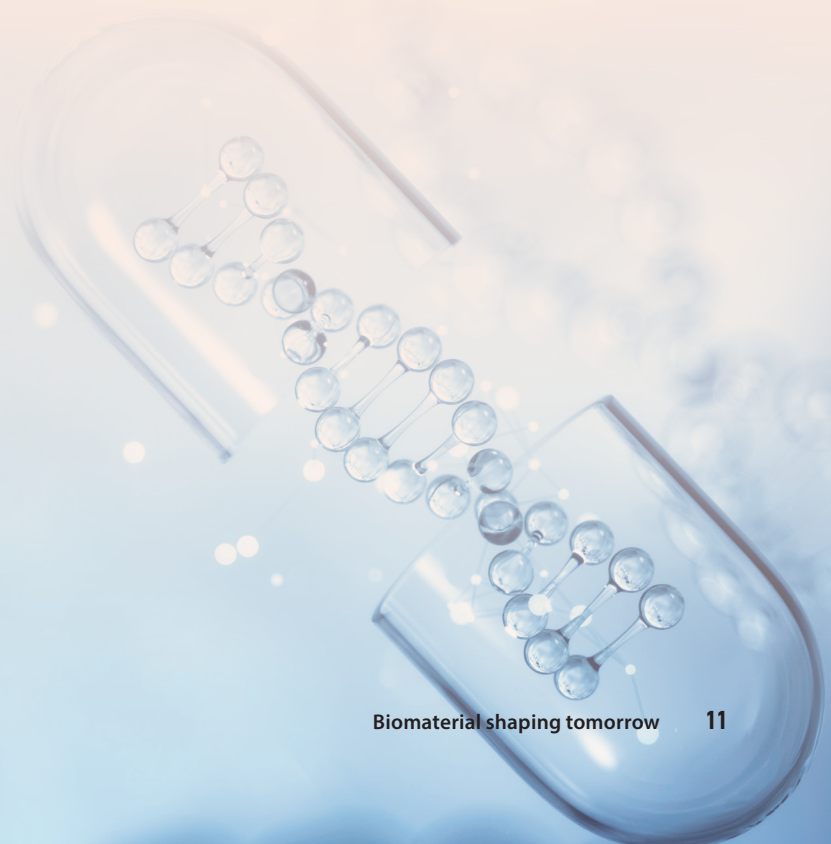
2 Listen again and decide whether each of the following statements is true (T) or false (F).

- 1. These smart materials are primarily made from refined traditional metals.
- 2. The shape-changing process of these materials can be triggered by light signals as well as heat.
- 3. Bone repair devices made from these materials require open surgery for implantation.
- 4. Scientists are improving the materials so they can transform into their intended shapes with greater precision.
- 5. Patients using devices made from these materials typically require longer hospital stays than those using traditional implants.



3 Work in pairs and discuss the following questions.

We know biomaterials can be used for many things. Some, like special wound-care bandages, are important for health. Others, like materials for cosmetic dentistry (to make teeth look perfect), are mainly for appearance. How can scientists and companies balance creating biomaterials for addressing serious medical problems (like treating diseases) and for enhancing the quality of life (like making perfect teeth)? Why is this balance crucial?





Listening skill



Recognizing problem-solution patterns

Mastering the problem-solution pattern is about understanding the logical connections between ideas. The goal is to follow the speaker's line of reasoning, tracing the path from a challenge to its proposed solution. To effectively follow a problem-solution pattern, the essential task is to track the speaker's logic. This process involves two critical steps: first, understanding how the problem is framed; and second, recognizing how the proposed solution directly addresses it.

1. Identifying the specific problem and its implications

A well-constructed argument not only states a problem but also explains its significance. For example, in the video, the problem is not simply that many fractures occur. It is specifically framed around the drawbacks of existing solutions: metal implants require a second surgery for removal, which is described as an "unpleasant" and "inevitable" burden. This clarifies that the core issue extends beyond the fracture itself to include the limitations of current treatments.

2. Connecting the solution's features directly to the problem's drawbacks

The proposed solution should function as a direct response to the limitations previously outlined. Continuing the example, the video introduces polymers with the key feature of being "completely absorbed by the body, reducing the need for removal surgery." This is not an isolated technical detail but a direct counter to the "unpleasant secondary surgery" mentioned earlier. Similarly, the solution of 3D-printed, patient-specific implants addresses the problem of surgeons having to "select the most appropriate implant from a number of standard sizes."

By focusing on this logical connection – how the solution is designed to resolve the specific problem – listeners can move beyond memorizing details to understanding the speaker's argument.

Medical terms

Complete the sentences with the words in the box. You may not use any of the words more than once. Change the form if necessary.

fracture stent biosensor hydrogel antimicrobial
inflammatory cellular coating

1. The development of a new medical _____ allows doctors to monitor a patient's blood sugar levels in real time without drawing blood.
2. Older people are more likely to suffer from bone _____ if they fall.
3. The doctor explained that the redness and swelling were signs of a(n) _____ response to the infection.
4. To improve its compatibility with the human body, the metal implant received a protective polymer _____ that prevents adverse reactions.
5. The new biomaterial supports _____ regeneration by providing an ideal environment for cell growth and multiplication.
6. After the heart attack, a(n) _____ was placed in the blocked blood vessel to keep it open and restore blood flow.
7. This advanced burn treatment is made from a special _____ that can keep the injury moist and absorb excess fluid, promoting faster healing.
8. The new wound dressing is made from a(n) _____ fabric that actively fights infection.

Medical insights

4D printing in biomedical engineering

4D printing represents the next evolution of 3D printing technology, where printed objects can change their shape or properties over time when exposed to specific environmental signals. This advanced manufacturing approach uses smart materials that respond to environmental triggers such as temperature, moisture, or light.

In biomedical applications, 4D printing enables the creation of dynamic medical devices and implants that can self-assemble or adapt within the body. For instance, researchers are developing cardiovascular stents that expand to their proper size upon contact with blood, and orthopedic implants that modify their stiffness to match healing bone tissue. Another promising application is in creating drug delivery systems that release medication in response to specific biological signals. This technology offers significant advantages in minimally invasive procedures, as devices can be implanted in a compact form and then expand into their functional shape inside the body, reducing surgical complexity and improving patient outcomes.



Make a presentation on 4D printing.

Imagine you are going to introduce 4D printing technology to an audience of freshmen. In simple terms, explain the core concept of 4D printing, describe what makes it different from 3D printing, and provide one example of its potential medical application.