

UNIT 2

MICROBIAL BIOTECHNOLOGY

2.1. Write three examples of microorganisms and compare the ideas with your partner.

2.2. Check if you understand the meanings of the words in the box.

prokaryotic • to sequence • genome • provisionally • indispensable
• to constitute • to establish • complement • insecticide • sample

2.3. Read the text and decide which word or phrase a), b) or c) fits best each space 1–8.

Microorganisms, whether cultured or represented only in _____ (1) DNA samples, constitute the natural resource base of microbial biotechnology. Numerous prokaryotic and _____ (2) genomes have been completely sequenced and the functions of many genes established. For a newly sequenced prokaryotic genome, functions for over 60% of the open reading frames can be provisionally _____ (3) by sequence homology with genes of known function. _____ (4) of the ecology, genetics, physiology, and metabolism of thousands of prokaryotes and fungi provides an indispensable complement to the sequence database.

This is an era of explosive _____ (5) of analysis and manipulation of microbial genomes as well as of invention of many new, _____ (6) ways in which both microorganisms and their genetic endowment are utilized. Microbial biotechnology is riding the crest of the wave of genomics. The umbrella of microbial biotechnology covers many scientific activities, ranging from production of _____ (7) human hormones to that of microbial insecticides, from mineral _____ (8) to bioremediation of toxic wastes.

(adapted from *Microbial Biotechnology: Fundamentals of Applied Microbiology*)

- | | | | |
|----|--------------------|------------------|----------------|
| 1. | a) environmentally | b) environmental | c) environment |
| 2. | a) fungal | b) fungi | c) fungous |
| 3. | a) sign | b) assigned | c) assigning |
| 4. | a) Knowing | b) Knowledgeable | c) Knowledge |
| 5. | a) growth | b) grow | c) growment |
| 6. | a) creating | b) creative | c) creativity |

7. a) combination b) recombination c) recombinant
 8. a) leaches b) leaching c) leachment

2.4. Find the words or phrases in exercise 2.3 which mean the following.

- 1) to be very successful for a limited period of time
- 2) something that you have from birth, often a quality
- 3) to grow microorganisms
- 4) important or useful/ impossible to manage without
- 5) a thing that contributes extra features to something else



[7]



[8]



2.5. Can you think of how microbial biotechnology helps agricultural industry? Discuss the question with a partner.

2.6. Fill the gaps in the sentences with provided words.

control • exploiting • plants • transfer • genes

1. _____ can be incorporated into crop plants.
2. It is now possible to _____ foreign genes into plant cells.
3. Transgenic plants are generated by _____ a plasmid vector.
4. Foreign DNA can be introduced into _____.
5. Microorganisms can be manipulated to _____ insect pests and fungal disease.

2.7. Read the text to check if your ideas in exercise 2.5 were correct and find the sentences from exercise 2.6 to check your answers.

Agriculture

Methods dependent on microbial biotechnology greatly increase the diversity of genes that can be incorporated into crop plants and dramatically shorten the time required for the production of new varieties of plants. It is now possible to transfer foreign genes into plant

cells. Transgenic plants that are viable and fertile can be regenerated from these transformed cells, and the genes that have been introduced into these transgenic plants are as stable as other genes in the plant nuclei and show a normal pattern of inheritance. Transgenic plants are most commonly generated by exploiting a plasmid vector carried by a bacterium *Agrobacterium tumefaciens*. Foreign DNA carrying from one to 50 genes can be introduced into plants in this manner, with the donor DNA originating from different plant species, animal cells, or microorganisms.

Higher plants have genes whose expression shows precise temporal and spatial regulation in various parts of plants – for example, leaves, floral organs, and seeds that appear at specific times during plant development and/or at specific locations, or whose expression is regulated by light. Other plant genes respond to different stimuli, such as plant hormones, nutrients, lack of oxygen (anaerobiosis), heat shock, and wounding. It is therefore possible to insert the control sequence(s) from such genes into transgenic plants to confine the expression of foreign genes to specific organelles or tissues and to determine the initiation and duration of such expression. Microorganisms that live on or within plants can be manipulated to control insect pests and fungal disease or to establish new symbioses, such as those between nitrogen-fixing bacteria and plants.

(adapted from *Microbial Biotechnology: Fundamentals of Applied Microbiology*)

2.8. Read the text above again and answer the following questions.

1. What are the benefits of applying microbial biotechnology into agriculture?
2. How are transgenic plants generated?
3. What is the purpose of manipulating microorganisms which live on or within plants?

2.9. Rearrange letters to make words from the text about Agriculture. Try to explain their meanings in English. Compare your answers with the partner.

1. E F E R L I T _____
2. T E X O I P L _____
3. H R T I N I E C A N E _____
4. U T I N R E N T _____
5. Y S B O E I S M S _____
6. G Y E O X N _____

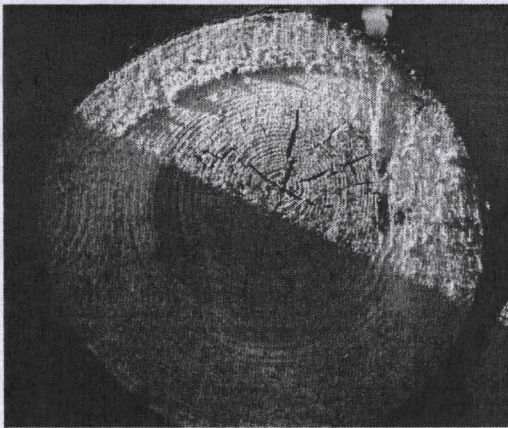
2.10. Put the words from exercise 2.9 into correct sentences. Sometimes the meaning of the words can be slightly different from the one in the reading text.

1. The soil on our neighbour's field has proven to be quite _____.
2. She began her own business with the _____ she got from her grandfather.
3. My grandfather was too shy to _____ his talent, which was a great pity.
4. Higher amounts of dissolved _____ are found in freshwater.
5. They absorb many useful _____ in order to grow well.
6. In the ocean we can find various examples of _____ among marine animals.

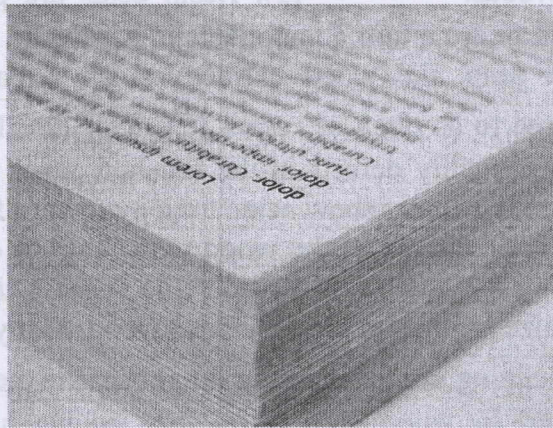
2.11. Match the words 1–10 from column A with the words a–j from column B according to what you hear.

- | A | B |
|-------------------|----------------|
| 1) genetic | a) countries |
| 2) environmental | b) modified |
| 3) chemical | c) engineering |
| 4) pharmaceutical | d) tolerant |
| 5) genetically | e) concerns |
| 6) developing | f) food |
| 7) insect- | g) agents |
| 8) herbicide- | h) conditions |
| 9) conventional | i) treatments |
| 10) economic | j) resistant |

2.12. Write your own sentences including the following pairs of words from the previous exercise.



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[10]

2.13. How do you think microbial biotechnology can improve paper manufacturing?

2.14. Match the vocabulary with the provided definitions.

- | | |
|--------------|-------------------------------------------------------------------------|
| 1) pulp mill | a) a chemical that is used to dissolve another substance |
| 2) effluent | b) living or growing in water |
| 3) aquatic | c) liquid waste |
| 4) solvent | d) to change the colour of something |
| 5) softwood | e) a thick sticky substance that is produced by some trees |
| 6) hardwood | f) a thin piece of wood separated by chopping or cutting |
| 7) resin | g) a thick black sticky substance |
| 8) to stain | h) a manufacturing facility that converts wood chips into a thick fibre |
| 9) chip | i) strong heavy wood |
| 10) pitch | j) wood from evergreen trees |

2.15. Read the text. Four sentences have been removed from the text. Put the sentences a–d into the gaps 1–4.

- a) To avoid this problem, a commercial fungal product, Cartapip, utilizes an ‘albino’ strain of *Ophiostoma piliferum*
- b) Moreover, the effluent biotoxicity was reduced 11- to 14-fold compared with untreated controls
- c) These compounds, called wood extractives, consist mainly of triglycerides, fatty acids, diterpenoid resin acids, sterols, waxes, and sterol esters
- d) These colloidal particles form deposits in the pulp and in the machinery

Fungal removal of pitch in paper pulp manufacturing

In the paper manufacturing industry, treatment of wood with certain white rot fungi to degrade certain wood extractives before pulping substantially decreases the toxicity of pulp mill effluent toward aquatic organisms. Compounds that are extractable from wood with organic solvents make up between 1.5% and 5.5% of the dry weight of softwoods and hardwoods. _____ (1). Resin acids are present in most softwoods but are generally absent or are minor components in hardwood species. During wood pulping and refining of paper pulp, the wood extractives are released, forming colloidal particles commonly referred to as *pitch* or *resin*. _____ (2). These deposits can cause mill shutdowns and various quality defects in the finished paper products. Moreover, the resin constituents in pulp mill effluent show acute toxicity toward fish and aquatic organisms.

Pretreatment of the wood with fungi to degrade some of the wood extractives before pulping has met with considerable success. *Basidiomycete* fungi and *Ophiostoma* species colonize living and recently dead wood. Many of the species in this genus are referred to as sap-staining or blue-staining fungi because they stain colonized wood. _____ (3). When applied to wood chip piles, this fungus has been particularly effective in degrading triglycerides and fatty acids in both softwoods and hardwoods, but only partially effective in the removal of other pitch-forming compounds (sterols, sterol esters, and waxes) or the biotoxic resin acids. After four weeks of treatment at a moisture level of 70% on a wet wood weight basis at 27°C, *O. piliferum* produced up to a 50% reduction in the pitch content of softwoods, with less than a 5% loss of woody mass. _____ (4).

(adapted from *Microbial Biotechnology: Fundamentals of Applied Microbiology*)

2.16. Read the text once again and answer the following questions.

1. In what way is penetrating wood with fungi beneficial for the environment?
2. Can resin acids be detected in softwoods?
3. When are wood extractives released?
4. What are harmful effects of the deposit on the paper production?

2.17. At a paper manufacturing company you work for, your supervisor asks you to prepare a short presentation of fungal removal of pitch in paper pulp manufacturing. Present the benefits of this process.

GLOSSARY

aquatic – wodny	nucleus (nuclei) – jądro, jądra
chip – wiór	pitch – smoła
complement – uzupełnienie	pretreatment – obróbka wstępna
confine – ograniczyć	prokaryotic – prokariotyczny
crop plant – roślina uprawna	provisionally – prowizorycznie
deposit – odkład, osad	pulp – zmiążdżyć, rozetrzeć na miazgę
effluent – ścieki	pulp mill – ścieralnia
exploit – wykorzystywać	recombinant – rekombinowany
fertile – żyzny	refine – oczyszczać
fungus, fungi – grzyb, grzyby	resin – żywica
genetic endowment – wyposażenie genetyczne	softwood – drewno miękkie
hardwood – drewno twarde	solvent – rozpuszczalnik
indispensable – niezbędny	stain – poplamieć
inheritance – dziedzictwo, spadek	to ride the crest of the wave – być na fali sukcesu
insecticide – preparat przeciw owadom	transgenic plant – roślina transgeniczna
leaching – traktowanie zasadą	viable – realny