Week 4 BIOREMEDIATION

1. Place the examples of biotechnology into the right column.

making cheese/yogurt antibiotics vaccines biodegradable plastics cloning making wine/beer genetically modified plants anthrax biofuels ricin

Food	Medicines	Eco-friendly products	Waste Disposal	Genetics	Biological Weapons

2. ACADEMIC VOCABULARY [1]

Read the text below and use the following words to fill in the gaps. There are 3 words that you will not need:

compounds environment specify involve involving source occurrence processes remove role process specific removing

Bioremediation is a process [1]_____ living microorganisms used to break down harmful chemical [2]_____ of contaminated soil or water in an [3]_____**.** Bioremediation can take place under aerobic or anaerobic conditions. Many microorganisms can survive with or without a [4]_____ of oxygen. In aerobic conditions, the microorganism can use oxygen from the atmosphere. In anaerobic conditions, the breakdown of soils occurs for a source of oxygen and the metals can play the [5]_____of oxygen. There are three types that [6] _____different [7] _____ such as biostimulation, bioaugmentation and intrinsic bioremediation. Biostimulation is the use of nutrients and oxygen (liquid or gas form) added to stimulate already existing bacteria. Bioaugmentation is when microorganisms are added to the contamination that target [8]_____ contaminants and intrinsic bioremediation takes place underground and is the use of the microorganisms to [9]_____ harmful substances from soil and water. Bioremediation is safe and does not cause a threat to the health of society because the microbes form in the soil and it is a natural [10]_____**.**

3. LISTENING: BAV 1[2]

Atlanta (January 20, 2004)

Investigators lead by Assistant Professor Frank Löffler in Georgia Tech's School of Civil and Environmental Engineering have isolated a bacterium they named BAV-1 that can be used to clean toxic sites and prevent cancer-causing substances from reaching drinking water supplies. Kirsti Ritalahti is reporting on the findings.

Listen and decide if the statements below are true or false:

1. To clean up an area, the bacteria have to change their behaviour.
2. The recently isolated organism is referred to as BAV 1.
3. The contaminating chemical accumulates in river water.
4. The meaning of "coccoide" is linked to a specific shape.
5. One micron refers to the length of the bacterium.
6. The decontamination process is based on oxygen supply.

In pairs, explain to each other the decontamination process mentioned in the listening exercise.

4. READING[3]

Matching words and definitions:

municipality	*an attraction or force between particles that causes them to combine*
improper	*to find a profitable or practical use for*
disposal	*of high price or value; expensive*
render	*a city, town, or other district with its own local government*
costly	*to cause to become; to make*
utilize	*not correct, unsuitable for the purpose or occasion*
affinity	*the act of getting rid of something, a means of destroying waste products*

Read the title and the introduction of the following piece of news.

Nature's Helpers: Using Microorganisms To Remove TCE Pollutants From Water
Feb. 27, 2008
In 2002, Bruce Rittmann, PhD, director of the Biodesign Institute's Center for Environmental Biotechnology, received a patent for an innovative way to use nature to lend society a hand. He invented a treatment system, called the membrane biofilm reactor (MBfR), which uses naturally occurring microorganisms to remove contaminants from water.

Before reading further, put the main ideas of individual parts of the text or paragraphs (A - G) in the order as you would expect them in the article.

A ***explaining what organisms are utilized in this technology***

B ***summarizing the significance of the discovery***

C ***introducing the new method and explaining its advantageous character***

D ***describing how the system works***

E ***describing the source and the effects of the contaminant***

F ***introducing the source of info***

G ***explaining the topicality of the problem***

1	2	3	4	5	6	7

Now read the article below. Match the main ideas from the previous exercise (A – G) and the paragraphs (1 – 7). Then compare the expected and real order of the paragraphs.

1	Now Rittmann and his research team recently published a paper in the journal Environmental Science & Technology for a new application that removes a contaminant that has made local headlines.
2	The chlorinated solvent trichloroethene (TCE) has been found to be an increasingly problematic contaminant in groundwater. The detection of TCE recently forced the shutdown of the water supply for the municipalities of Paradise Valley and Scottsdale.
3	TCE has been widely used as a cleaning agent and solvent for many military, commercial, and industrial applications. Its widespread use, along with its improper handling, storage, and disposal, has resulted in frequent detection of TCE in the groundwater. TCE has the potential to cause liver damage, malfunctions in the central nervous system and it is considered a likely human carcinogen.
4	Transforming the chlorinated solvent to a harmless product is the best way to eliminate the harmful effects of TCE. In the case of TCE, Mother Nature is the best helper. Scientists have discovered specialized microorganisms that can replace the chlorine in the chlorinated molecules with hydrogen, a process called reductive dechlorination. While other methods are possible, they are often more costly than reductive dechlorination on a large scale, and many do not transform TCE into a harmless end product.
5	In the paper, the Rittmann team utilized the MBfR and a naturally occurring group of microorganisms able to remove TCE from water. Surprisingly, these microorganisms, called ***dehalogenators***, have an affinity for chlorinated organics and can be found all throughout nature, even in clean water supplies, the soil, and groundwater. "These bacteria respire TCE, that is, they can use TCE like we use oxygen to breathe," said Krajmalnik-Brown, a member of the team. "They take in the TCE and they start removing the chlorines, step by step. In the ideal case, the dehalogenators remove all the chlorines, converting TCE to ethene, which is harmless."
6	Rittmann's MBfR works by delivering hydrogen gas to the bacteria through tiny hollow tubes submerged in water. In the right environment, the tubes become coated with a biofilm containing microorganisms. The system provides the microorganisms with hydrogen gas, which must be present for the microorganisms to change the chemical composition of a contaminant and render it harmless.
7	By assessing the MBfR community, they found the special dehalogenating bacteria that can take the hydrogen supplied by the MBfR and reduce TCE all the way to harmless ethene. Using the latest molecular techniques, they could not only identify the bacterial population to handle TCE, but also the genes within these populations that make enzymes that detoxify TCE to ethene.

Noun phrases

Noun phrases *(adjective + noun, noun+ prepositional phrase)* ***are frequently used in academic texts to express a large amount of information. They help to summarize information and are often basic units of a text.***

Complete the adjective+noun phrases with words from the text.

_____	team	_____	use	_____	dechlorination
_____	application	_____	handling	_____	end product
_____	solvent	_____	effects	_____	gas
_____	contaminant	_____	microorganisms	_____	bacteria

Sources: [1] **Based on a lesson plan by D. Dlabolová**

[2] "Helpful Organisms" by Kirsti Ritalahti **Available at** http://www.innovations.gatech.edu/bioremediation/avindex.php :

[3] **Available at** http://www.biodesign.asu.edu/news/natures-helpers-using-microorganisms-to-remove-toxins-from-water

(exercise adapted from a lesson plan by D. Dlabolová)