

Activity n° 1: Let's have a look on Agar' Art! (**Axe 3:** Art et pouvoir)

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2. Choose one Petri dish and explain what it represents and why you chose it.

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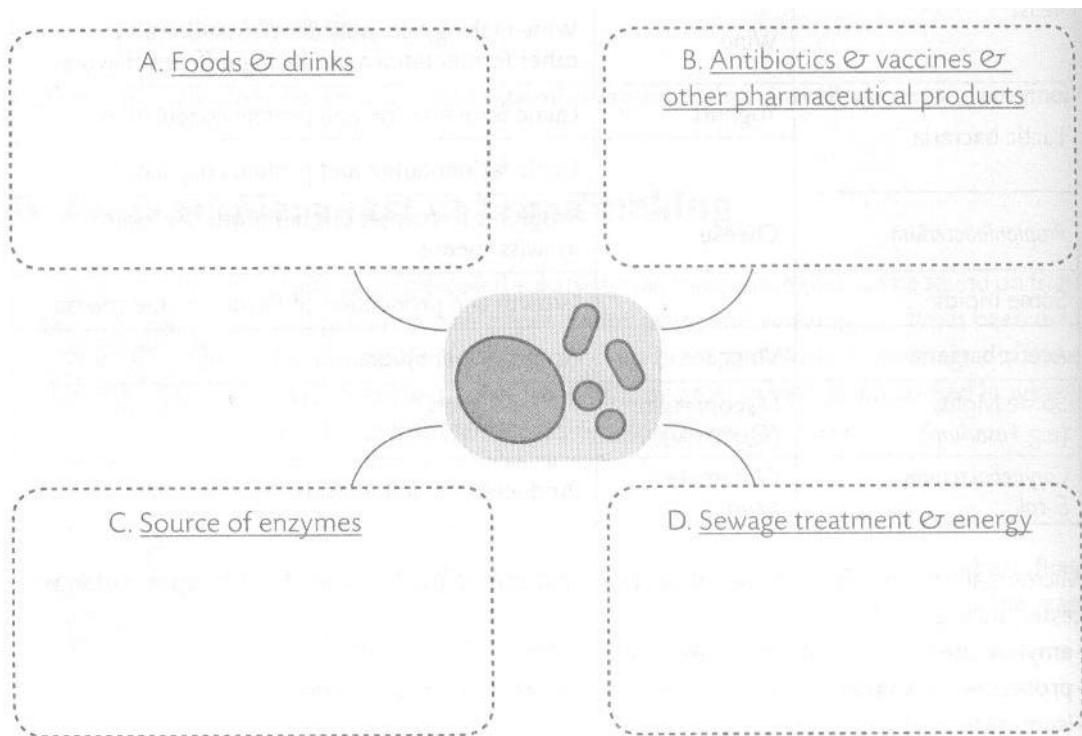
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Activity n° 2: Let's take a tour of "factory" microorganisms! (**Axe 8:** Territoire et mémoire)

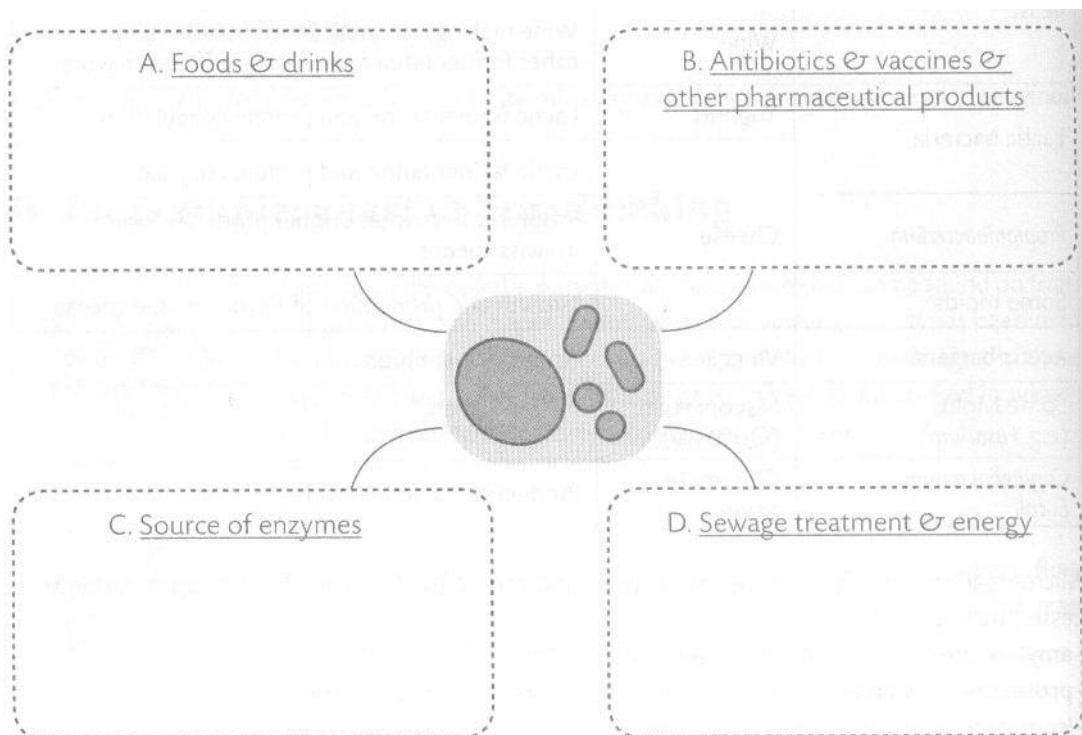
1. Complete the diagram below with examples of productions or use of microorganism.



2. Choose one country and explain how people use microorganisms in food (to make bread for example).

Activity n° 2: Let's take a tour of "factory" microorganisms! (**Axe 8:** Territoire et mémoire)

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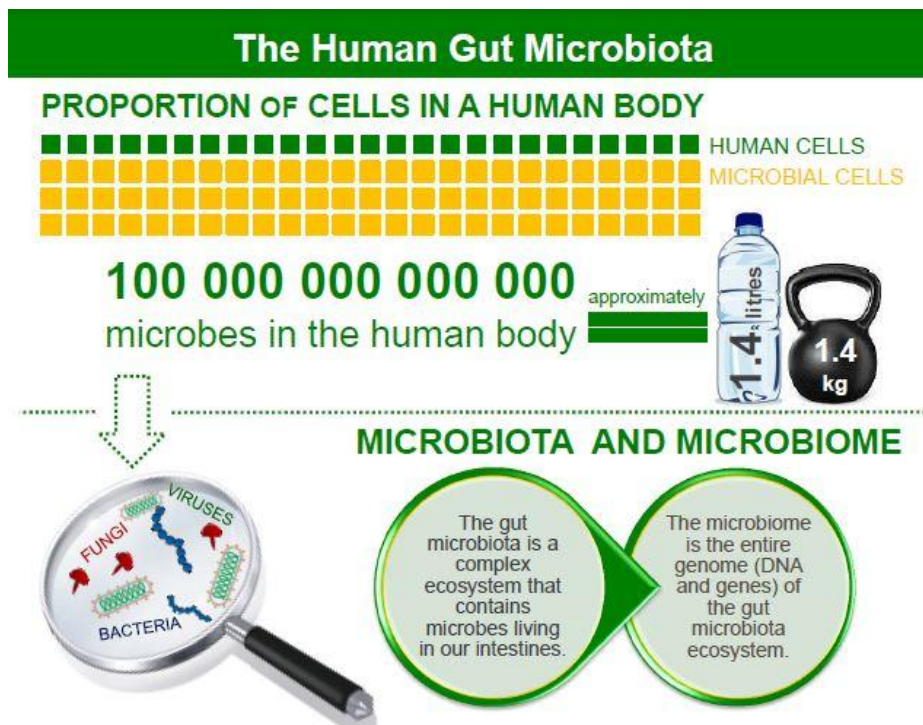
Activity n° 3: How our gut influences our health? (**Axe 6:** innovations scientifiques et responsabilité)

Peter, a 10 year old boy is convinced that bacteria ate quite badly for him. His sister, a student in STL biotechnologies will explain to him that he's wrong.

Using the documents, answer the questions.

1. What is gut microbiota?
2. Explain the role of gut microbiota in health and disease.
3. What are the factors influencing gut microbiota ? Give some advices to keep your gut microbiota healthy.

Document 1:



<http://www.mynewgut.eu/node/69>

Document 2:

<https://youtu.be/QE9QWFg-XNs>



Document 3:

8 surprising things that harm your gut bacteria.

Adapted from <https://www.healthline.com/nutrition/8-things-that-harm-gut-bacteria#section1>

The human gut is home to over 100 trillion bacteria, known as the "gut flora." Having a healthy gut flora is incredibly important for your overall health. Interestingly, many diet, lifestyle and other environmental factors can negatively affect your gut bacteria.

A diet lacking in a variety of different whole foods can result in a loss of gut flora diversity. This may have a number of negative health effects. Prebiotics are a type of fiber commonly found in fruits, vegetables and whole grains. They are important for increasing healthy gut bacteria like *Bifidobacterium*.

Generally speaking, alcohol consumption has a harmful effect on gut bacteria. However, the polyphenol content in red wine may have a protective effect on gut bacteria when consumed in moderation.

Antibiotics can affect the diversity and composition of the gut flora, even in cases of short-term use. This can have harmful effects on gut bacteria that may last for as long as two years.

Regular physical activity promotes the growth of beneficial gut bacteria, including *Bifidobacterium* and *Akkermansia*. These positive effects are not seen in individuals who are inactive.

Smoking has detrimental effects on nearly every organ in the body. Giving up smoking can improve gut health by increasing the diversity of the gut flora, and this can occur after only nine weeks.

The body has a 24-hour internal clock called the circadian rhythm. Sleep deprivation can disrupt the circadian rhythm, and this appears to have harmful effects on gut bacteria.

Excess stress has been shown to reduce gut flora diversity and alter gut flora profiles by increasing harmful bacteria like *Clostridium* and reducing beneficial bacteria like *Lactobacilli*.

Vocabulary:

Sleep deprivation: state of being without sleep

Activity n° 4: The mystery of the Pink Lake (**Axe 1:** identités et voyages)

Léa, a student in STL biotechnologies had the great chance to go to Australia during the last vacation. During this trip, she was able to admire the beauty of Lake Hillier, whose incredible pink color aroused her curiosity. When she returned home, Léa decided to conduct her investigation to unravel the mystery of Hillier Lake. She found the following video on internet :

Video link : <https://www.youtube.com/watch?v=cUfSn9utjMo>



Watch and listen carefully to this video and help Lea to unravel the mystery of Hillier Lake by answering the questions from exercises 1 and 2

Exercise 1 : translate the following words

Water bodies :

To mess with us :

Will impress you :

Delights your eye :

If you watch it from above :

Striking :

Sample :

A topic :

Salt crusts :

Exercise 2 : Fill in the boxes with a word that corresponds to the definitions or to a translation and then, thanks to the letters that are in the boxes n° 1 to n°16, write the secret word in the 16 boxes at the end of the exercise.

- 1 Previously what was salt done from this lake
- 2 Longueur
- 3 Name of pigments contained in the microalgae
- 4 Habite
- 5 Name of the discoverer of this lake
- 6 Usual color of water bodies
- 7 Name of this lake

8 Country where this lake is located

9 Bizareries

10 Travelling for distraction purposes

11 Largeur

12 Not dangerous to health

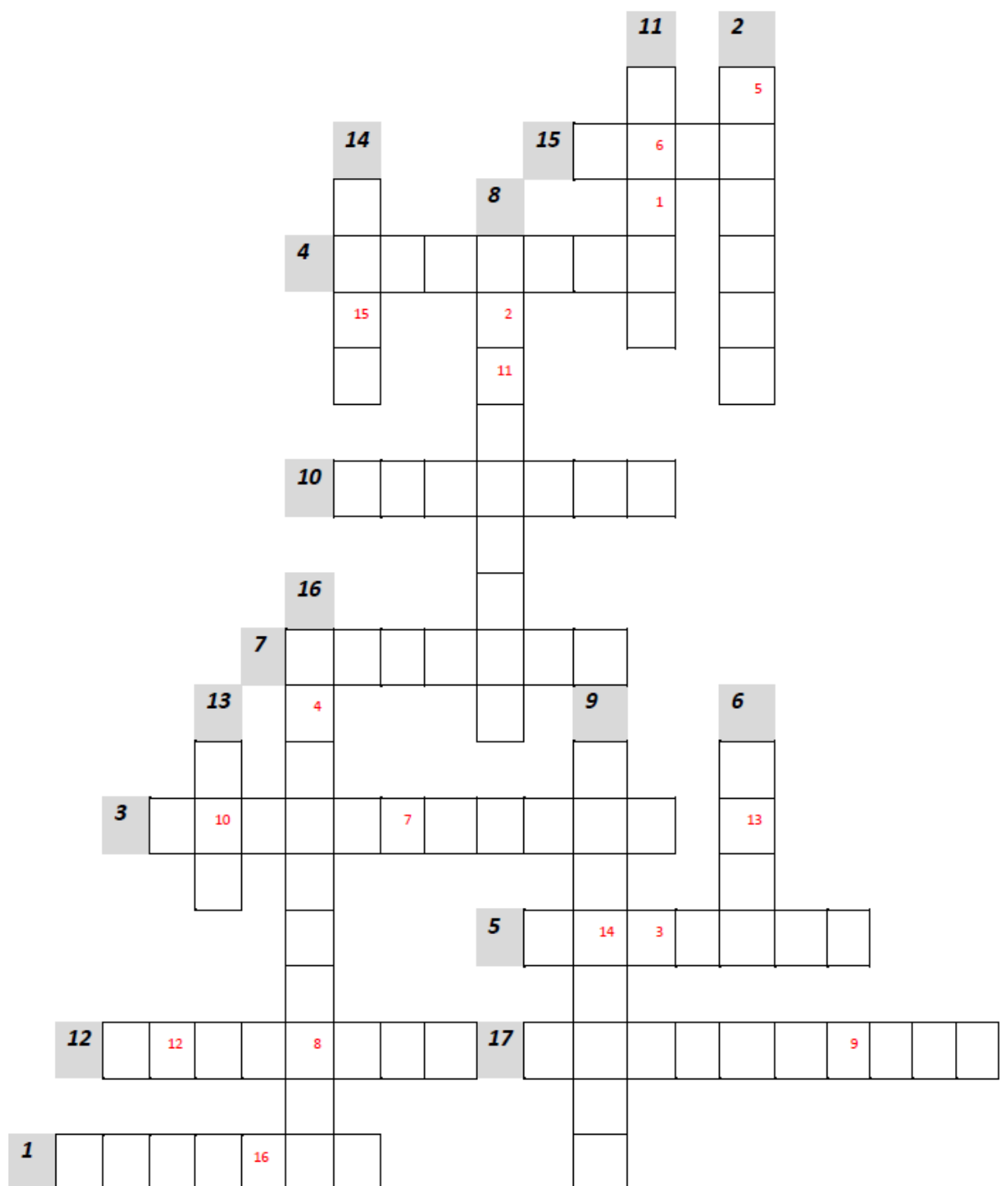
13 Carte

14 Color of this lake

15 Taille

16 Organism living in a very salty environment

17 Procaryote living in water and able to photosynthesis



1	2	3	4	5	6	7	8	9	10
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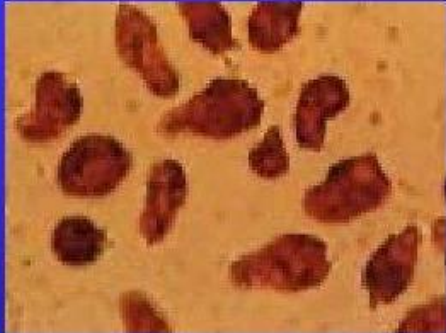
11	12	13	14	15	16
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Activity n° 5: Biotechnolgy applications of *Dunaliella salina* (**Axe 6:** innovations scientifiques et responsabilité)

Lea now knows that the pink colour of Hillier Lake is due to the presence of *Dunaliella salina*. Intrigued by this microalgae she doesn't know, she decides to meet an Ifremer engineer to learn more. The latter gives Lea 6 documents that will allow her to learn a lot about *Dunaliella salina*.

Document 1

Halophilic Algae



Dunaliella salina

- Photosynthetic flagellate
- Red because of high concentrations of beta-carotene
- On sensing high salinity, pumps out Na^+ ions and replaces with K^+ ions
- In high salt, will alter photosynthetic pathway to produce glycerol (water-soluble, nonionic substance which prevents dehydration) instead of starch

<https://slidetodoc.com/topics-types-of-extreme-environments-present-on-earth/>

Document 2 : *Dunaliella salina* is known for its antioxidant activity because of its ability to create large amount of carotenoids, it is used in cosmetics and dietary supplements. Few organisms can survive like *D. salina* does in high saline conditions. To survive, these organisms have high concentrations of β -carotene to protect against the intense light, and high concentrations of glycerol to provide protection against osmotic pressure. This offers an opportunity for commercial biological production of these substances.

https://en.wikipedia.org/wiki/Dunaliella_salina

Document 3 : The biofuels are receiving considerable attention as a substitute for petro diesel. For microalgae, biomass and lipid contents are key components for biodiesel production. This study was conducted to develop favorable culture conditions for *Dunaliella salina* to maximize its biomass and lipid accumulation.

<https://www.nature.com/articles/s41598-017-07540-x>

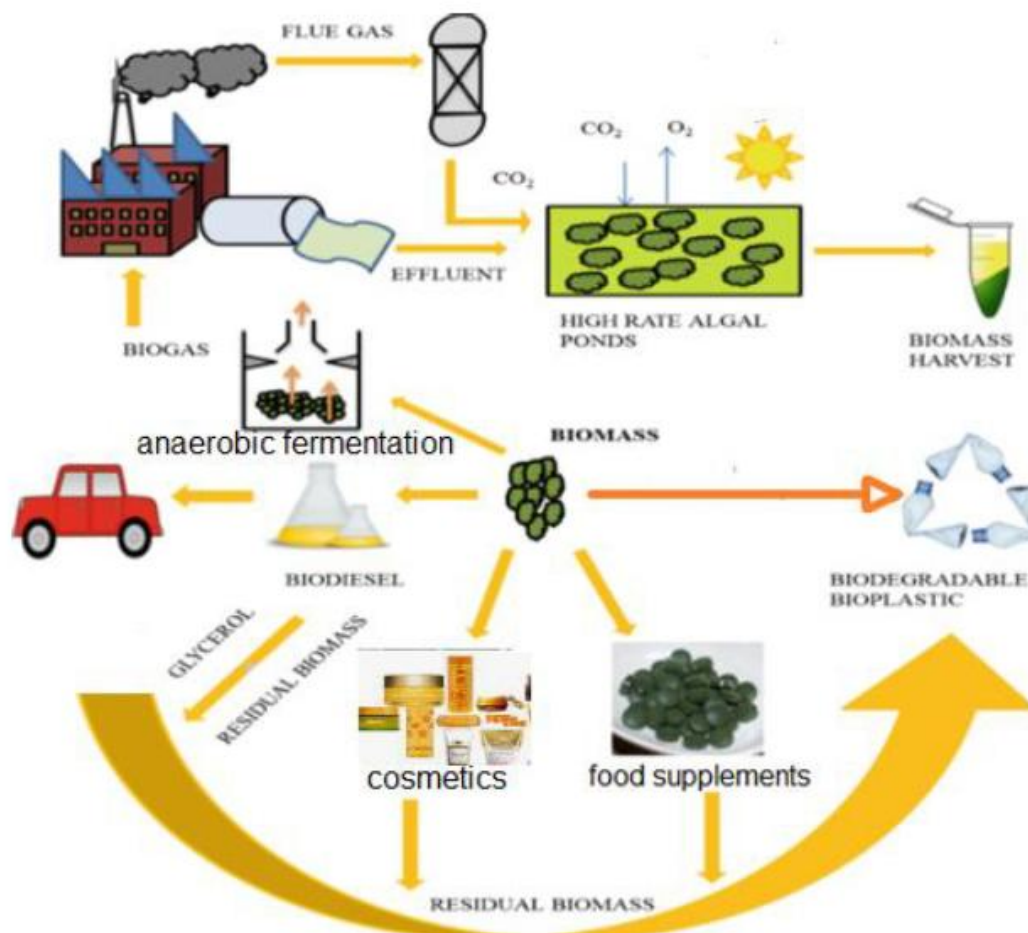
Document 4 : Polyhydroxyalkanoates (PHAs) are the biopolymer of choice if we look for a substitute of petroleum-based non-biodegradable plastics. Microbial production of PHAs as carbon reserves has been studied for decades and PHAs are gaining attention for a wide range of applications in various fields. Microalgae/cyanobacteria, being photoautotrophic, prove to have an edge over heterotrophic bacteria for PHAs bioproduction. They have minimal metabolic requirements, such as inorganic nutrients (CO_2 , N, P, etc.) and light, and they can survive under adverse environmental conditions.

<https://www.frontiersin.org/articles/10.3389/fbioe.2021.624885/full>

Document 5: *D. salina* as a microalgal biomass resource was employed for the production of biogas. This biogas production involves multiple steps of microbial reactions. Initially, organic compounds of biomass are converted to polymeric substances (polysaccharides, proteins...). Thus, this polymers should be hydrolyzed into small compounds, which are then converted into biogas (methane = CH_4) via anaerobic fermentation..

https://www.researchgate.net/publication/274962332_Dunaliella_salina_as_a_Microalgal_Biomass_for_Biogas_Production

Document 6 : Biotechnology applications of dunaliella salina



https://link.springer.com/chapter/10.1007/978-981-15-0169-2_11

By answering the questions from exercises 1 to 3, help Lea in her questioning

Exercise 1

Find in the document 1 the physiological characteristics of *D. salina* allowing it to live in hyper-salted environments

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Exercise 2.

Complete the following table using the documents 2 to 6

Name of the final bioproducts					
Molecule produced by <i>D. salina</i> used to manufacture bioproducts					

Lea has now understood all interests of *D. salina* in the fight against climate warming. Therefore she decides to pass on this information to a biofuel company. In writing exercise 3, helps Lea to write arguments to convince the company of the interest in launching this

Exercise 3 : Explain (in a few lines) using document 6 why the use of *D. salina* for manufacture of bioproducts is virtuous to the environment.

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