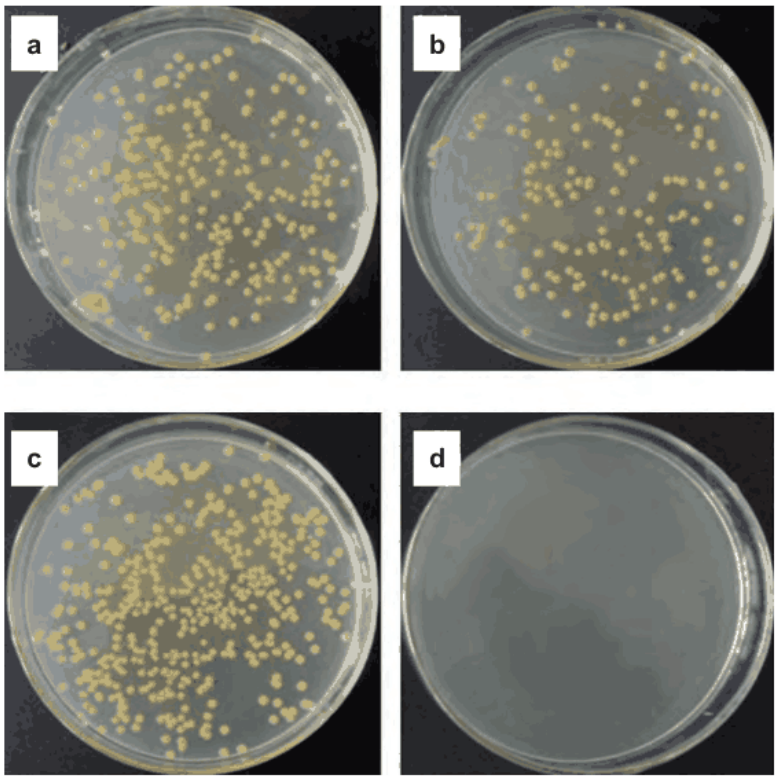
Antibiotics (Option A2): Eduqas A Level Biology Exam Questions by Topic

15 questions · 31 marks · about 37 minutes. Answer in the spaces, then check the mark schemes at the end.

Question 1 · A level Component 3 · June 2017 · Q7(c)(iii) · 2 marks

(iii) A sample of bacteria was removed from each zone of inhibition generated by the working antibiotics. These bacteria were then re-plated without the antibiotics and cultured.
The images below show the results for antibiotics **a** to **d**.



Conclude the mode of action of each of these antibiotics. Explain how you reached this conclusion. [2]

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Question 2 · information from earlier in the question

V. cholerae produces a protein referred to as CT (Cholera Toxin). **Image 7.3** shows the protein structure of CT. It has three sub units or polypeptides forming a protein complex or quaternary structure.

Antibiotics such as tetracycline may be used to treat cholera.

Tetracycline interferes with the synthesis of the CT protein as illustrated in **image 7.4**.

Image 7.3

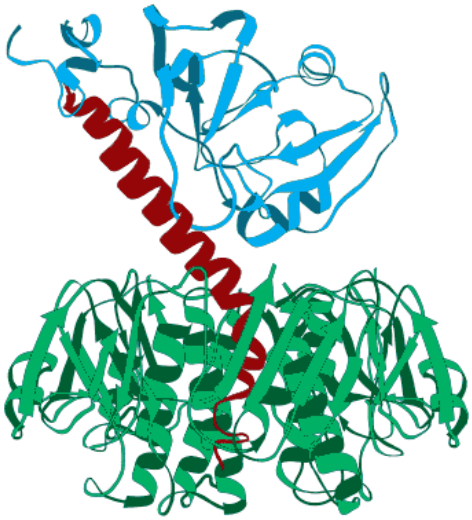
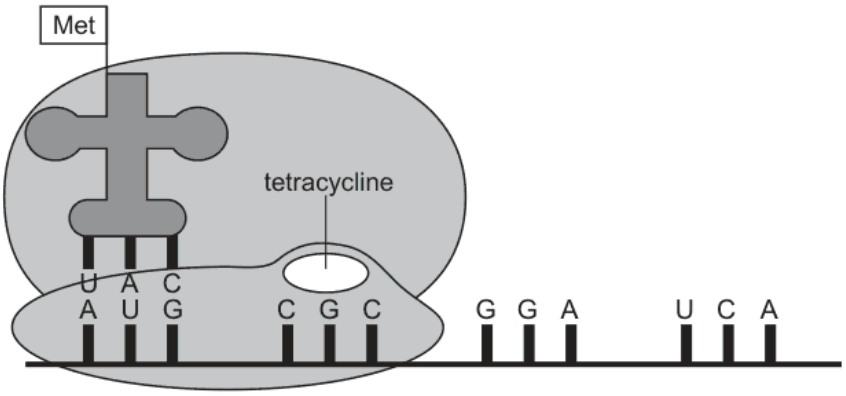


Image 7.4



Question 2 · A level Component 3 · Autumn 2021 · Q7(c)(iii) · 1 mark

(iii) The bacterium is not killed by this mechanism. State the name that describes the mode of action represented by this type of antibiotic. [1]

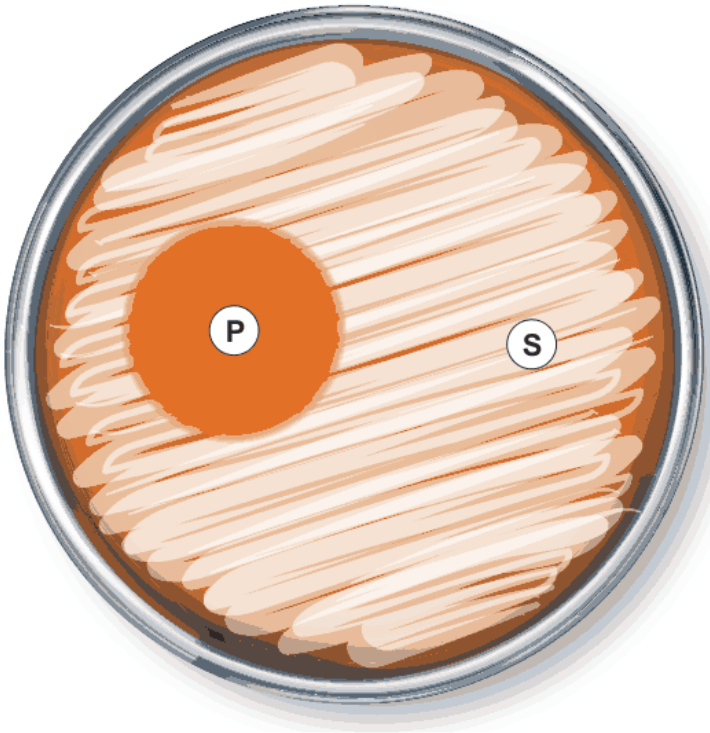
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The antibiotics penicillin and streptomycin are usually effective against *Streptococcus pyogenes*.

Bacteria from this patient were grown on an agar plate. Discs of filter paper saturated with either penicillin (disc **P**) or streptomycin (disc **S**) were placed onto the agar before incubation. The bacterial growth after incubation is indicated by the lighter areas in **Image 7.4**.

Image 7.4



(ii) Using the information in **Image 7.4**, explain why penicillin was selected to treat the patient. [2]

Questions, mark schemes and examiners' report extracts © WJEC CBAC Ltd (Eduqas).

Question 4 · A level Component 3 · Autumn 2020 · Q8(d)(i) · 2 marks

(d) Diphtheria is a potentially fatal bacterial disease caused by the Gram positive bacteria, *Corynebacteria diphtheria*.

Parts of South Africa have seen a rise in the number of cases of diphtheria due to a decrease in the number of children vaccinated.

Patients suffering from diphtheria are treated with antibiotics such as penicillin.

Penicillin inhibits an enzyme that is involved in the formation of the bacterial cell wall.

(i) Explain how inhibition of the enzyme described above causes bacterial cells to die. [2]

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Question 5 · A level Component 3 · Autumn 2020 · Q8(d)(ii) · 2 marks

(ii) Explain why penicillin is more effective against *Corynebacteria diphtheria* than it is against Gram negative bacteria. [2]

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Question 6 · A level Component 3 · June 2017 · Q7(b) · 3 marks

(b) *Pseudomonas aeruginosa* is a Gram-negative bacterium that can be easily spread by hands as a type of direct contact. *P. aeruginosa* infections can be treated with a bactericidal antibiotic called Colistin that binds to lipopolysaccharides and phospholipids in the outer cell layer of Gram-negative bacteria.

Using your knowledge of bacterial structure and antibiotics explain how penicillin acts and why it cannot be used to treat *P. aeruginosa*. [3]

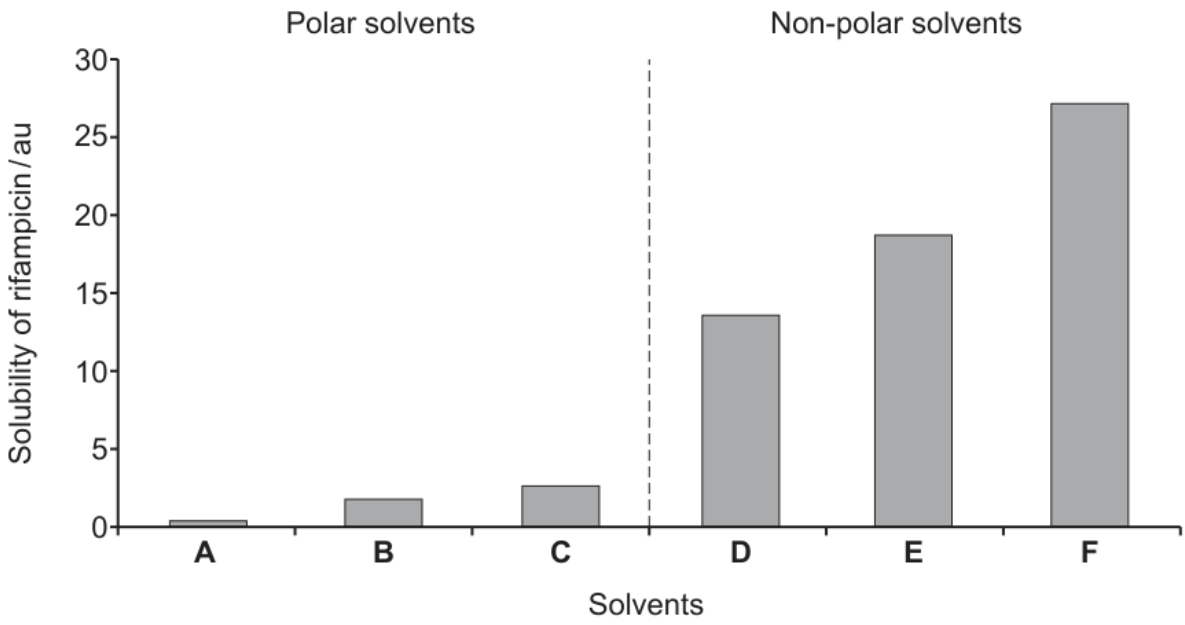
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(b) Although TB can be treated with antibiotics, many strains of the bacterium are resistant to antibiotics which are water soluble.

Rifampicin is one antibiotic which is effective against *Mycobacterium tuberculosis*. An investigation was carried out into the solubility of rifampicin in a range of different solvents. The solvents used in the investigation included three non-polar solvents and three polar solvents.

Graph 7.2 shows the results of the investigation.

Graph 7.2



All strains of *M. tuberculosis* have a thick, hydrophobic envelope surrounding the cell which prevents water soluble compounds from entering the cell.

(i) Use **Graph 7.2** to explain why rifampicin is effective against *M. tuberculosis*. [2]

Questions, mark schemes and examiners' report extracts © WJEC CBAC Ltd (Eduqas).

Question 8 · A level Component 3 · June 2024 · Q7(c)(ii) · 1 mark

(ii) Explain why penicillin would not be effective against malaria. [1]

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Question 9 · A level Component 3 · Autumn 2021 · Q7(c)(ii) · 3 marks

V. cholerae produces a protein referred to as CT (Cholera Toxin). **Image 7.3** shows the protein structure of CT. It has three sub units or polypeptides forming a protein complex or quaternary structure.

Antibiotics such as tetracycline may be used to treat cholera.

Tetracycline interferes with the synthesis of the CT protein as illustrated in **image 7.4**.

Image 7.3

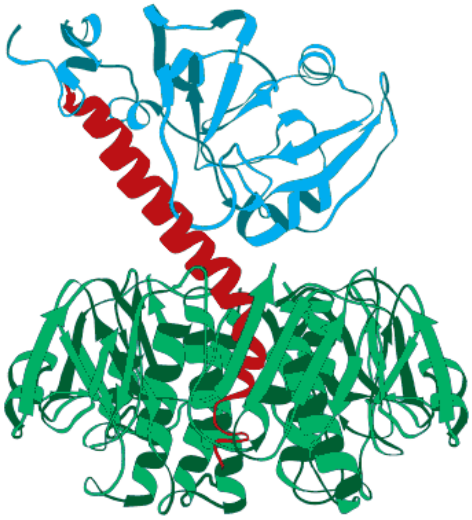
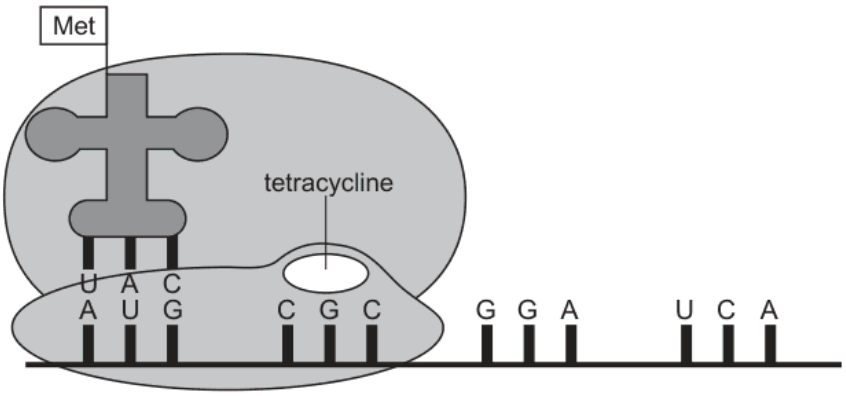


Image 7.4



(ii) Use **image 7.4** and your own knowledge to explain how tetracycline would prevent the synthesis of cholera toxin (CT). [3]

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Questions, mark schemes and examiners' report extracts © WJEC CBAC Ltd (Eduqas).

Question 10 · A level Component 3 · June 2018 · Q8(e)(ii) · 2 marks

(ii) Erythromycin can be bactericidal or bacteriostatic depending on the dose. It binds to the large ribosomal subunit in bacterial cells. Suggest how erythromycin may work to treat bacterial infection and why it does not affect the patient's cell metabolism. [2]

Question 11 · A level Component 3 · June 2025 · Q7(c)(i) · 1 mark

(c) Tetracycline is a broad-spectrum antibiotic. Some strains of *S. pyogenes* have become resistant to this antibiotic.

(i) Explain why tetracycline is effective against a wide range of bacterial species. [1]

Question 12 · A level Component 3 · June 2025 · Q7(c)(ii) · 3 marks

(ii) *S. pyogenes* is a Gram positive bacterium. Resistant strains of *S. pyogenes* survive due to one of two different mechanisms:

- A transmembrane protein which pumps tetracycline out of the cell as fast as it enters.
- A protein that protects the ribosome from the effects of tetracycline.

Use the information given to explain why *S. pyogenes* which are resistant to tetracycline can still be killed by penicillin. [3]

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Question 13 · A level Component 3 · June 2022 · Q7(c)(iii) · 2 marks

(iii) Explain why unnecessary overuse of antibiotics is likely to result in greater numbers of antibiotic resistant individuals in populations of bacteria. [2]

Question 14 · A level Component 3 · June 2025 · Q7(c)(iii) · 3 marks

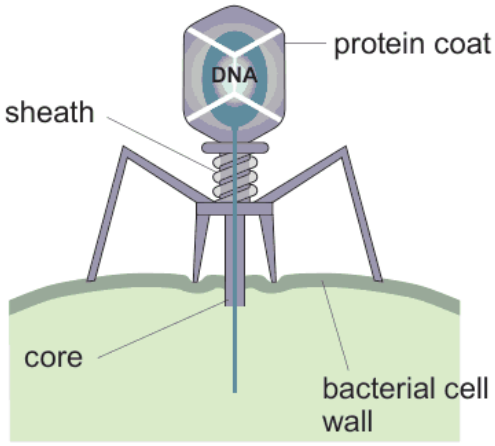
(iii) Scientists have concluded that resistance of *S. pyogenes* to tetracycline has become a problem due to the extensive use of this antibiotic.

Explain how the extensive use of this antibiotic might lead to an increased number of resistant strains of *S. pyogenes*. [3]

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(d) Bacteriophages are viruses which infect bacteria specifically. When they infect bacteria, they result in cell lysis. Bacteriophages are harmless to humans. A typical bacteriophage is shown in figure 8.5.

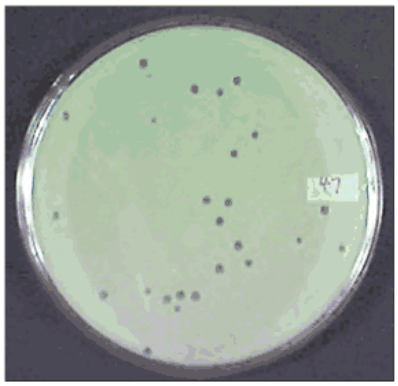
Figure 8.5



Bacteriophage therapy has been successful in trials against a range of bacterial infections, including chronic skin infections caused by bacteria such as MRSA. Their use in medicine to treat infectious disease in humans is called phage therapy.

Bacteriophages can be isolated from bacterial cultures and they can be grown on nutrient agar plates in a lawn of bacteria. Clear zones (plaques) appear on the plates as bacteria are lysed by the bacteriophages as shown in figure 8.6.
Each plaque is assumed to originate from a single bacteriophage.

Figure 8.6



The plate in figure 8.6 was prepared by mixing $0.02\,cm^3$ of a 10^{-5} dilution of bacteriophages with a bacterial culture and spreading it on an agar plate. This plate was incubated for 24 hours at 37 °C.

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Question 15 · A level Component 3 · June 2019 · Q8(d)(iv) · 2 marks

(iv) Using the information provided and your own knowledge, suggest **two** disadvantages of antibiotic use that could be overcome by phage therapy. [2]

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Mark schemes

Question 1 · A level Component 3 · June 2017 · Q7(c)(iii) · 2 marks

(iii)	A,B,C are bacteriostatic **and** D is bactericidal (1) Accept description of modes of action If bacteriostatic: there will be growth/ If bactericidal: no growth/ dead (1)	1	1	2

Question 2 · A level Component 3 · Autumn 2021 · Q7(c)(iii) · 1 mark

(iii)	Bacteriostatic	1	1

Question 3 · A level Component 3 · June 2022 · Q7(c)(ii) · 2 marks

	(ii)		(Penicillin) because there is a {clear area/ zone of inhibition} / bacteria have not grown around disc P/bacteria have grown around disc S. (1) {Streptoccocus/the bacteria} {are not resistant to penicillin/are resistant to streptomycin/ are killed by penicillin} (1)	1	1	2	2

Question 4 · A level Component 3 · Autumn 2020 · Q8(d)(i) · 2 marks

(d)	(i)	Cell walls weaker/fewer cross links between peptidoglycan molecules/do not develop correctly (1) Water uptake (by osmosis) causes cells to burst (1) (direction of water flow needs to be clear)	2	2

Question 5 · A level Component 3 · Autumn 2020 · Q8(d)(ii) · 2 marks

(ii)	gram negative cell wall has extra layer of lipopolysaccharide /other components/description (1) (Lipopolysaccharide layer of gram negative bacteria) protects cell wall/peptidoglycan (from antibiotic) (1)	1	1	2

Question 6 · A level Component 3 · June 2017 · Q7(b) · 3 marks

(b)	• Penicillin {inhibits/stops} the formation of cross linkages (between molecules of peptidoglycan) (1) NOT break cross linkages • {The wall is weakened / when osmotic changes occur} the cells lyse (1) • (Gram negative) cell walls have extra layers of lipopolysaccharide/ lipoprotein (1)	3	3

Questions, mark schemes and examiners' report extracts © WJEC CBAC Ltd (Eduqas).

Question 7 · A level Component 3 · June 2023 · Q7(b)(i) · 2 marks

(b)	(i)	Rifampicin {is not soluble / has low solubility} in water / Rifampicin is highly soluble in {organic / non-polar} solvents (1) Rif. Can pass through hydrophobic outer envelope to enter cell (1)			
	2	2		1	

Question 8 · A level Component 3 · June 2024 · Q7(c)(ii) · 1 mark

(ii)		**Any one (x1) from:** Penicillin disrupts cross-linkage formation in peptidoglycan (1) Malaria parasite is a {protoctist / eukaryote} (1) Plasmodium does not have a cell wall (1) Reject ref to Gram negative bacteria	1	1	

Question 9 · A level Component 3 · Autumn 2021 · Q7(c)(ii) · 3 marks

(ii)	**Any three (×1) from:** Tetracycline inhibits translation (by binding to (small/30s subunit of) ribosome) (1) tRNA anticodon cannot bind to mRNA codon (1) amino acid does not bond/ form a peptide bond with adjacent amino acid (eq). (1) (One of the) {CT/cholera toxin polypeptides/subunits/primary protein structures/amino acid chains} cannot form (1)	2	1	3

Question 10 · A level Component 3 · June 2018 · Q8(e)(ii) · 2 marks

	(ii)	{Inhibition of/ prevent/ stop} {protein synthesis/translation} (1) Humans have different ribosomes to bacteria (1)	1	1		2

Question 11 · A level Component 3 · June 2025 · Q7(c)(i) · 1 mark

(c)	(i)	(Tetracycline affects) protein synthesis/ inhibits translation/ blocks ribosome binding site (1)		1		1		

Questions, mark schemes and examiners' report extracts © WJEC CBAC Ltd (Eduqas).

Question 12 · A level Component 3 · June 2025 · Q7(c)(ii) · 3 marks

(ii)	**Any three (x1) from**: • Transmembrane protein {specific to tetracycline / will not remove penicillin} (1) • *S. pyogenes* has a thick peptidoglycan cell wall so will be affected by penicillin/ ORA (1) • Penicillin inhibits cross linkage formation in cell wall (1) • (so cell wall) weakened (1) • bacteria die due to osmotic lysis/ or description of (1)	3	3	

Question 13 · A level Component 3 · June 2022 · Q7(c)(iii) · 2 marks

	(iii)		**Any two (×1) from** Bacteria can obtain plasmids that carry an antibiotic resistance allele from other (resistant) bacteria (1) Random mutation of DNA/during DNA replication (produce antibiotic resistance allele) (1) Resistant bacteria have a selective advantage (only when antibiotics are present) (1)	1	1	2

Question 14 · A level Component 3 · June 2025 · Q7(c)(iii) · 3 marks

	(iii)	**Any three (x1) from**: • (Mutations result in) some bacteria in population having a resistance allele (1) • (Overuse of antibiotics) favours bacteria with the resistance allele / bacteria with allele are not killed/have a selective advantage} (1) • The allele is passed down to next generation / ref to transfer of plasmids (1) • Frequency of the allele increases in bacterial population (1)	3	3	

Question 15 · A level Component 3 · June 2019 · Q8(d)(iv) · 2 marks

(iv)	Any **two** (×1) from • Antibiotics are not specific/ Bacteriophage only infect specific bacteria (1) • antibiotics cause {side effects/ phages} / have no side effects/ no allergic reactions(1) • More chance of bacterial resistance with antibiotics/ Low chance of bacterial resistance to phage therapy (because bacteriophage can mutate as fast as bacteria). (1)	1	1	2

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