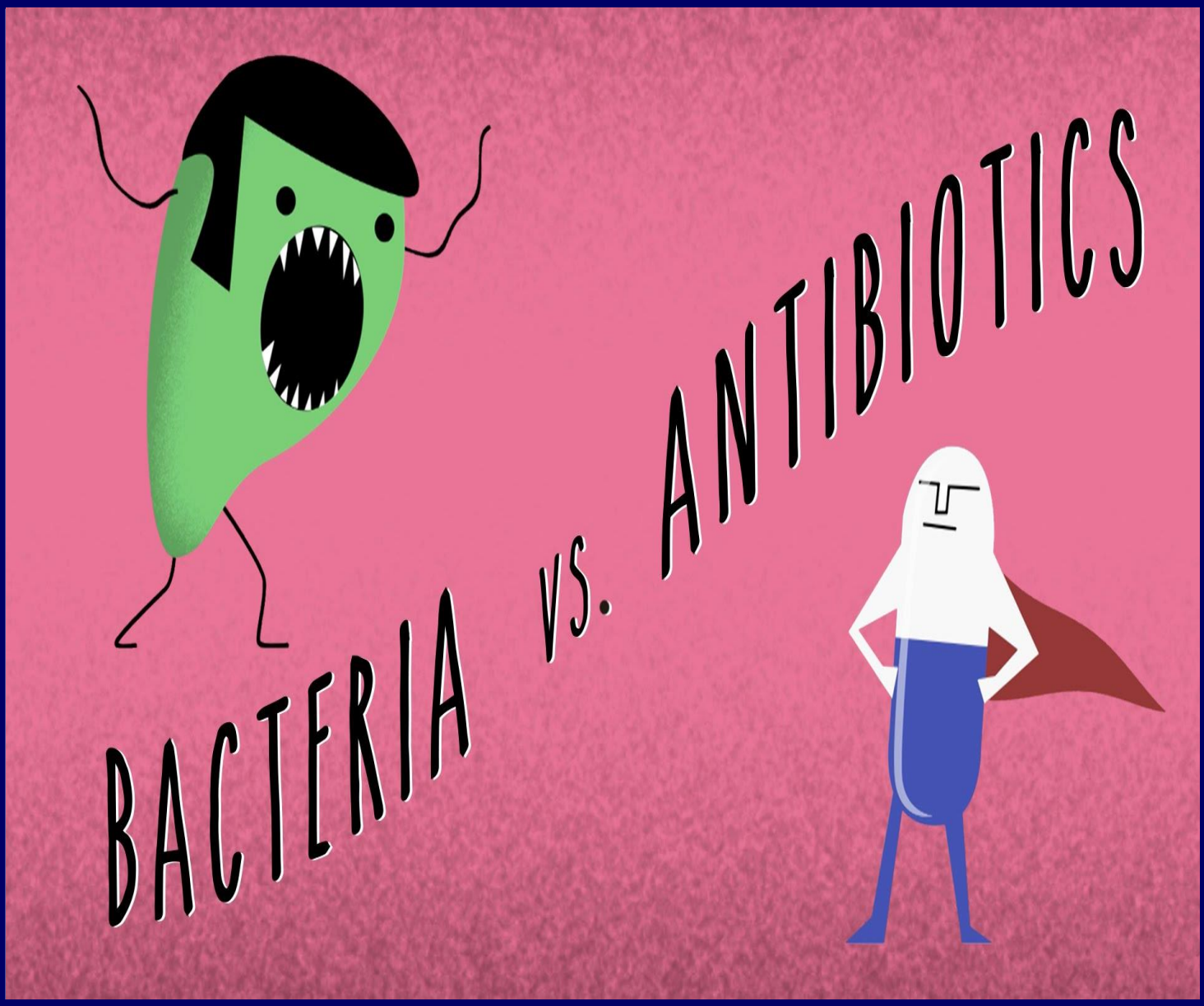
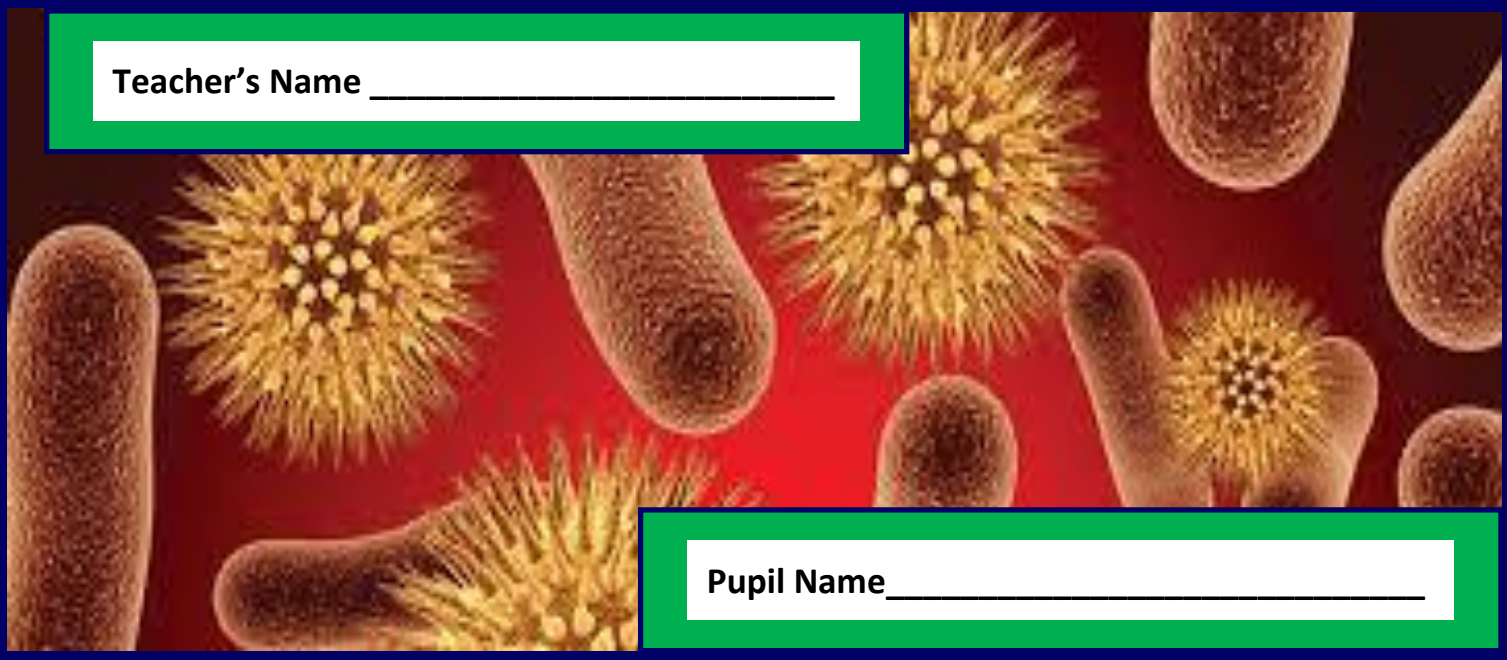


The **Scholars** Programme

How do we combat antibiotic resistance?

Key Stage 4 Programme – Spring 2017

Teacher's Name _____



Pupil Name_____

Timetable and Assignment Submission

Timetable – Tutorials

Tutorial	Date	Time	Location
1			
2			
3			
4			
5			
6			

Assignment Submission – Lateness and Plagiarism

Lateness	
Submission after 4.00pm on	10 marks deducted
Plagiarism	
Some plagiarism	10 marks deducted
Moderate plagiarism	20 marks deducted
Extreme plagiarism	Automatic fail

The Einstein Programme – Spring 2017 – Pupil Feedback Report

Grade	Marks	What this means
1st	70+	Performing to an excellent standard at first year undergraduate level
2:1	60-69	Performing to a good standard at first year undergraduate level
2:2	50-59	Performing to an excellent standard at current key stage
3rd	40-49	Performing to a good standard at current key stage
Working towards a pass	0-39	Performing below a good standard at current key stage
Did not submit	DNS	No assignment received by The Brilliant Club

Lateness	
Any lateness	10 marks deducted
Plagiarism	
Some plagiarism	10 marks deducted
Moderate plagiarism	20 marks deducted
Extreme plagiarism	Automatic fail

Name of Teacher			
Title of Assignment			
Name of Pupil			
ORIGINAL MARK / 100		**FINAL MARK / 100**	
DEDUCTED MARKS		**FINAL GRADE**	

If marks have been deducted (e.g. late submission, plagiarism) the teacher should give an explanation in this section:

Learning Feedback Comment 1 - *Communication*	
What you did in relation to this Key Learning Priority	**How you could improve in the future**
Learning Feedback Comment 2 – *Language*	
What you did in relation to this Key Learning Priority	**How you could improve in the future**
Learning Feedback Comment 3 – *Research Skills*	
What you did in relation to this Key Learning Priority	**How you could improve in the future**
Learning Feedback Comment 4 – *Critical Thinking*	
What you did in relation to this Key Learning Priority	**How you could improve in the future**
Resilience Comment	
How you showed learning resilience during the course	**How you could build learning resilience in the future**

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- Tutorial 1 Homework Page 11

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- Tutorial 2 Homework Page 20

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- Tutorial 4 Homework Page 34

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Course Rationale

Antibiotic resistance has come to the forefront of health and society over the past 5 years, with scientists and doctors worried about the lack of new drugs and an increasing number of resistant infections appearing in hospitals.

As an example, the death rate for patients with serious infections caused by common resistant bacteria treated in hospitals can be about twice that of patients with infections caused by the same non-resistant bacteria. For example, people with MRSA (methicillin-resistant *Staphylococcus aureus*, another common source of severe infections in the community and in hospitals) are estimated to be 64% more likely to die than people with a non-resistant form of the infection.

But where did this problem begin? How did resistance develop and how are scientists trying to tackle this problem? This course aims to understand how resistances to antibiotics have developed and how we might begin to fight back against these “Superbugs”.

Our tutorials will focus on understanding bacteria as organisms and how we currently fight infection using traditional antibiotics. We will then move our interest towards how resistance has developed, and how we are trying to combat this. Tutorials 3 and 4 will look at solutions currently being trialled or investigated, including new discovery methods and the use of the predatory bacterium *Bdellovibrio* (the focus of my research) as an alternative therapy. The final tutorial will act as a discussion forum about our final assignment and any ideas you have for new schemes to help combat any further development of resistance.

The final assignment entitled "Will we ever beat antibiotic resistance?" will ask you to describe the problems humans face in the face of antibiotic resistance and to use the analytical skills you have developed through the course to put forward a logical answer. Marking will be based partly on your final conclusion, but will mainly focus on the understanding of the course.

The overarching aim of the course is the widen your knowledge on the topic of bacteria, to understand the difficulties Doctors are currently facing, and to start to look at the exciting new experiments scientists are designing to find new solutions to antibiotic resistance.

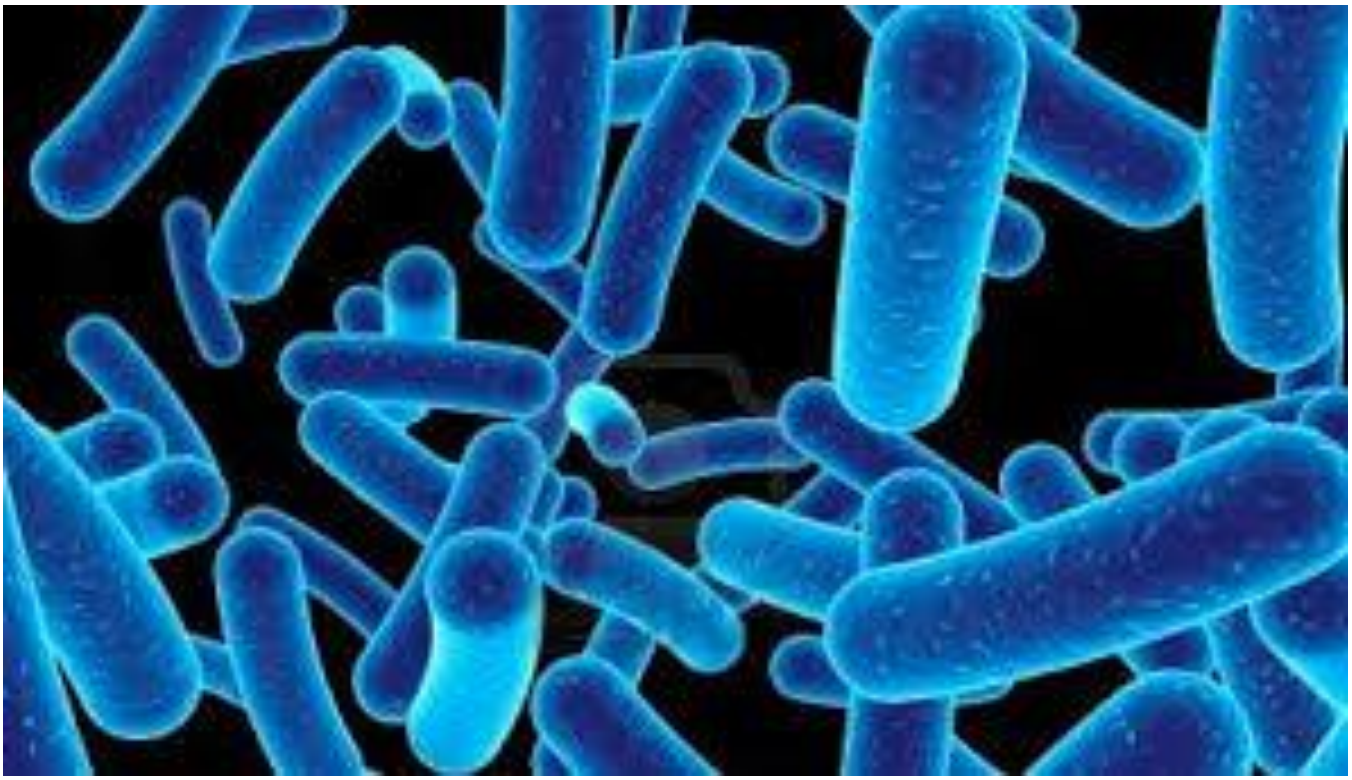
Mark Scheme

Key Skill	1st	2.2
Communication	- Almost perfect spelling, punctuation and grammar. - Writing is clear, logically organised and of an appropriate style i.e. written in third person. - Self-drawn diagram to explain a process or system with a detailed caption - Complex ideas will be explained clearly e.g. vertical gene transmission.	- Writing is sometimes poorly organised with a lack of logical structure. - The spelling, punctuation and grammar are weak in places. - Inconsistent use of style which results in an unclear essay. - Diagram either missing or not detailed enough.
Language	- Uses appropriate new and scientific terms correctly and effectively, including correct use of acronyms such as Antimicrobial Resistance (AMR). - Use of new scientific terms shows understanding of ideas. - Vocabulary from extra reading used.	- Scientific terms used incorrectly at times. - Can use simple new vocabulary easily but struggles with acronyms.
Research Skills	- All the outside sources are correctly referenced in the agreed format (explained on page 40). - 10 or more sources used - Uses a range of sources; e.g. Youtube videos, scientific papers, healthcare websites - Own research is included; sources of information go beyond those suggested by teacher.	- Sources are sometimes referenced correctly. - Less than 6 sources used - Unreliable sources used e.g. Wikipedia. - Opinion in the conclusion does not agree with the information in the essay.
Critical Thinking	- Use of papers and websites is logical: it is well explained how each piece of extra reading links back to the assignment question. - Conclusion is based on the facts in the essay with **personal** opinions based on further reading.	- The reasons for using particular websites or papers are not clear (i.e. extra reading does not match the point you re making)

Glossary of Keywords

Word	Definition	In a sentence…
Antibiotic Resistance		
Organelle		
Synthesise		
Gene		
Target		
Inhibitor		
Unculturable		
Prey		
Bdellovibrio		

Tutorial 1 – Marvellous Microbes



Today's Key Question(s):

- What are bacteria?
- How are bacteria structured?
- How do antibiotics work?
- What are genes?

What is the Purpose of Tutorial 1?

- To understand how bacteria survive and their internal structure
- To understand what a gene is and why they are important to bacteria
- To understand how antibiotics can target specific parts of bacteria

Activity 1

- **Use the cards to pair the names of organelles with their functions**
- **Fill in the missing parts of the table in your handbook**

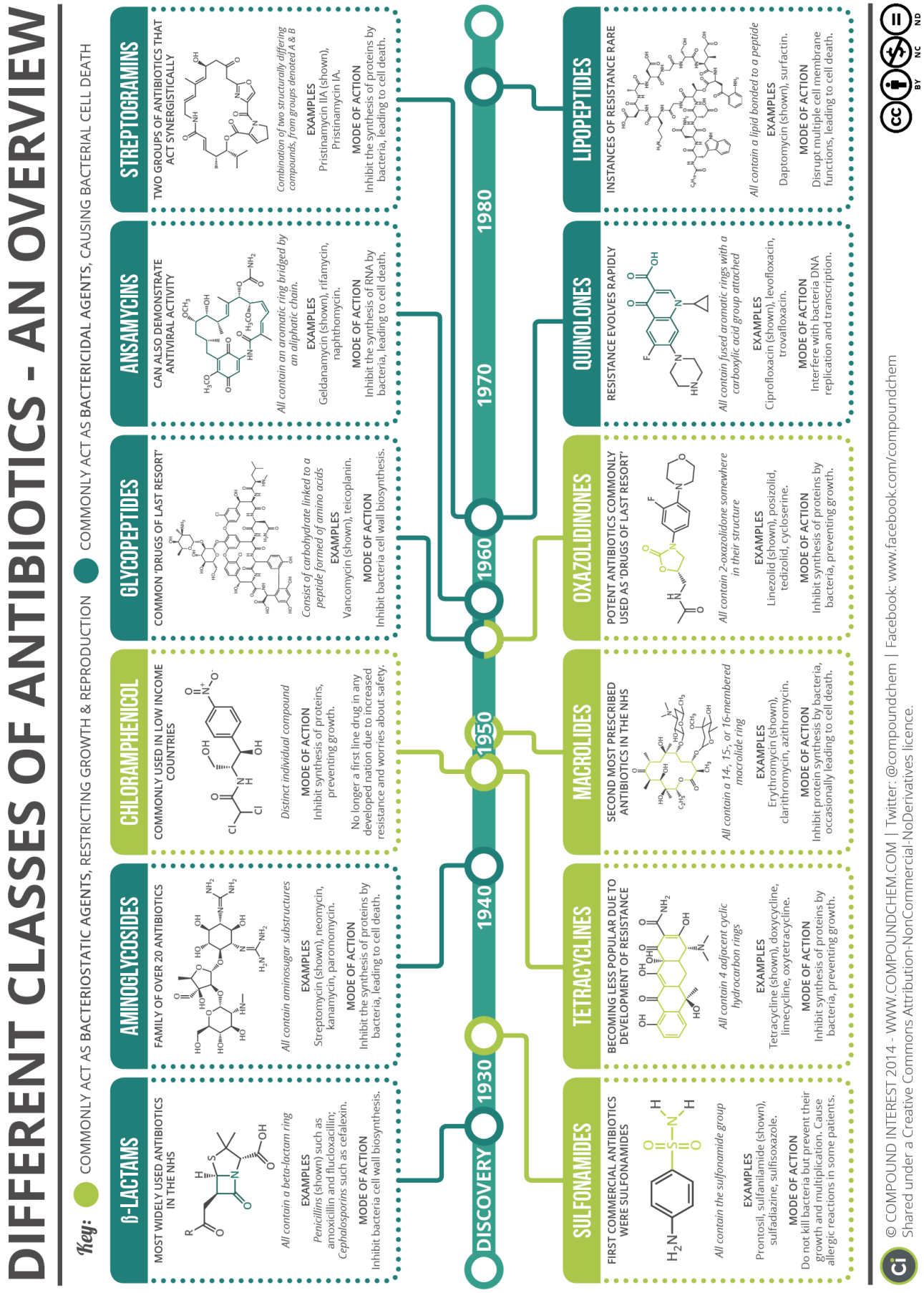
Name	Description/Function
Organelle	
	Protects all the components inside the cell
Cell wall	
	Separates the inside of the cell from the outside of the cell
Cytoplasm	
Nucleoid	
	A small circular DNA molecule that is separate from the rest of a cell's DNA
Pili	
	The protein builders or protein "synthesisers" in the cell.
Flagellum	

Activity 2

Discussion Point: What organelles of bacteria might be good "targets" for antibiotics i.e. what organelles are key for bacteria survival?

Activity 3

Read the picture about antibiotics and list three organelles that drugs can target



Activity 4

Discussion point: What is a gene?

_____

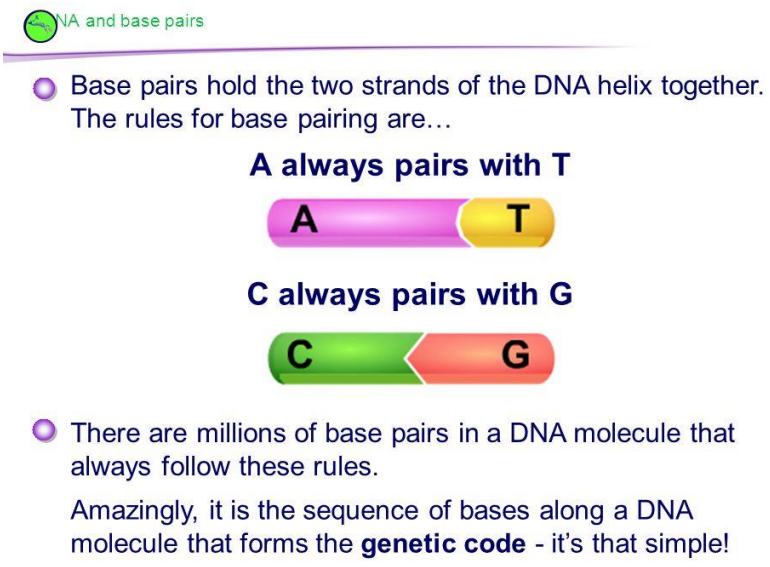
_____

_____

_____

DNA

- **A gene is made up of DNA. Each DNA molecule consists of two twisted strands of bases that form a shape called a double helix.**
- **The double helix of DNA has to be held together so that the structure is stable and the cell can copy itself accurately.**

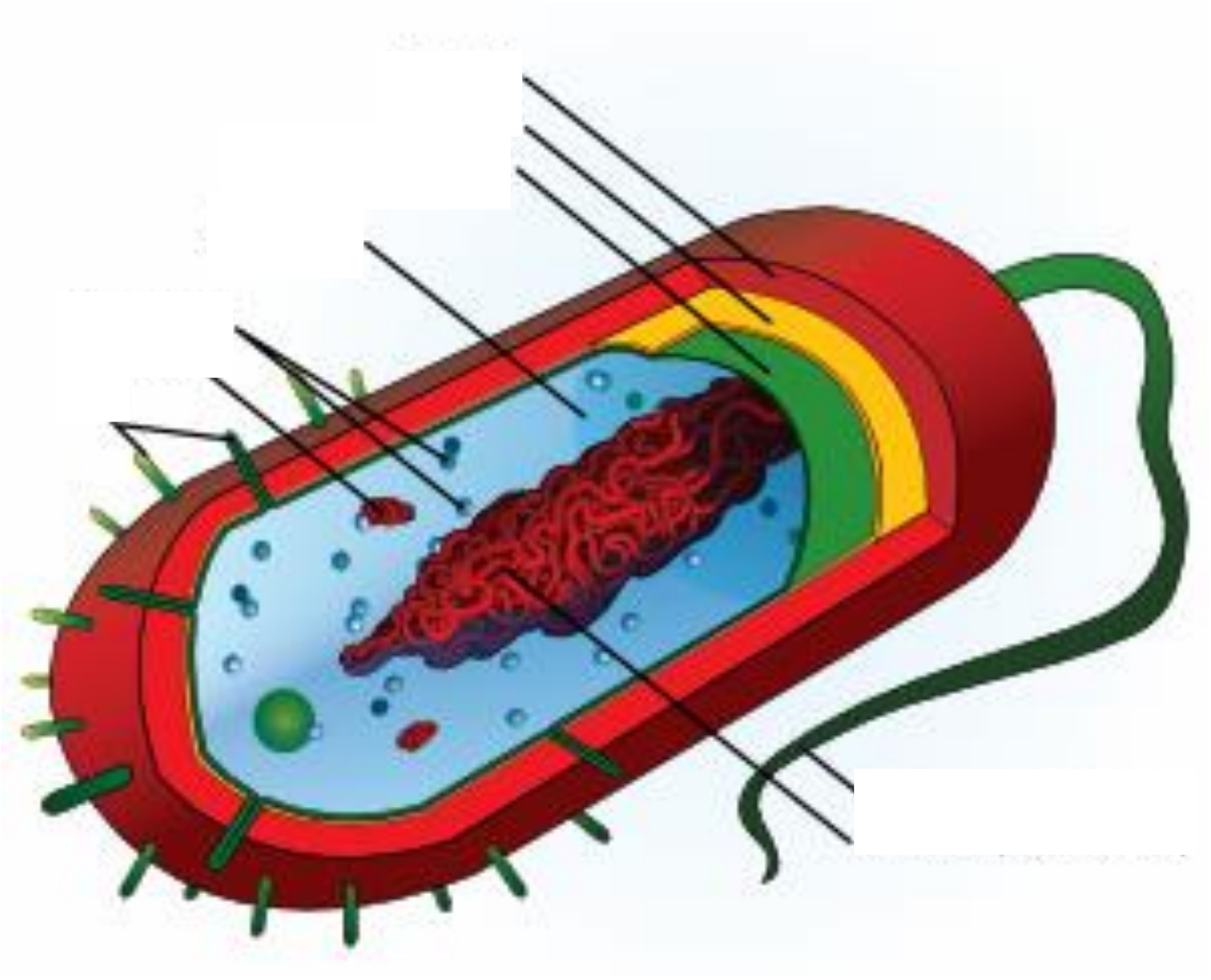


Write the complementary (matching) base pairs for this piece of DNA

A T G T A A C T C G A T C C A G G G T C C A T C G A A T C T T A A G G G C C G A T A T C

Consolidate

1. **Label the diagram below:**



2. **Choose one bacterial organelle and explain why this is important for bacterial survival.**

_____

_____

_____

_____

_____

_____

_____

_____

3. **What is the difference between a Bacteriostatic antibiotic and a Bactericidal antibiotic?**

_____

_____

_____

_____

_____

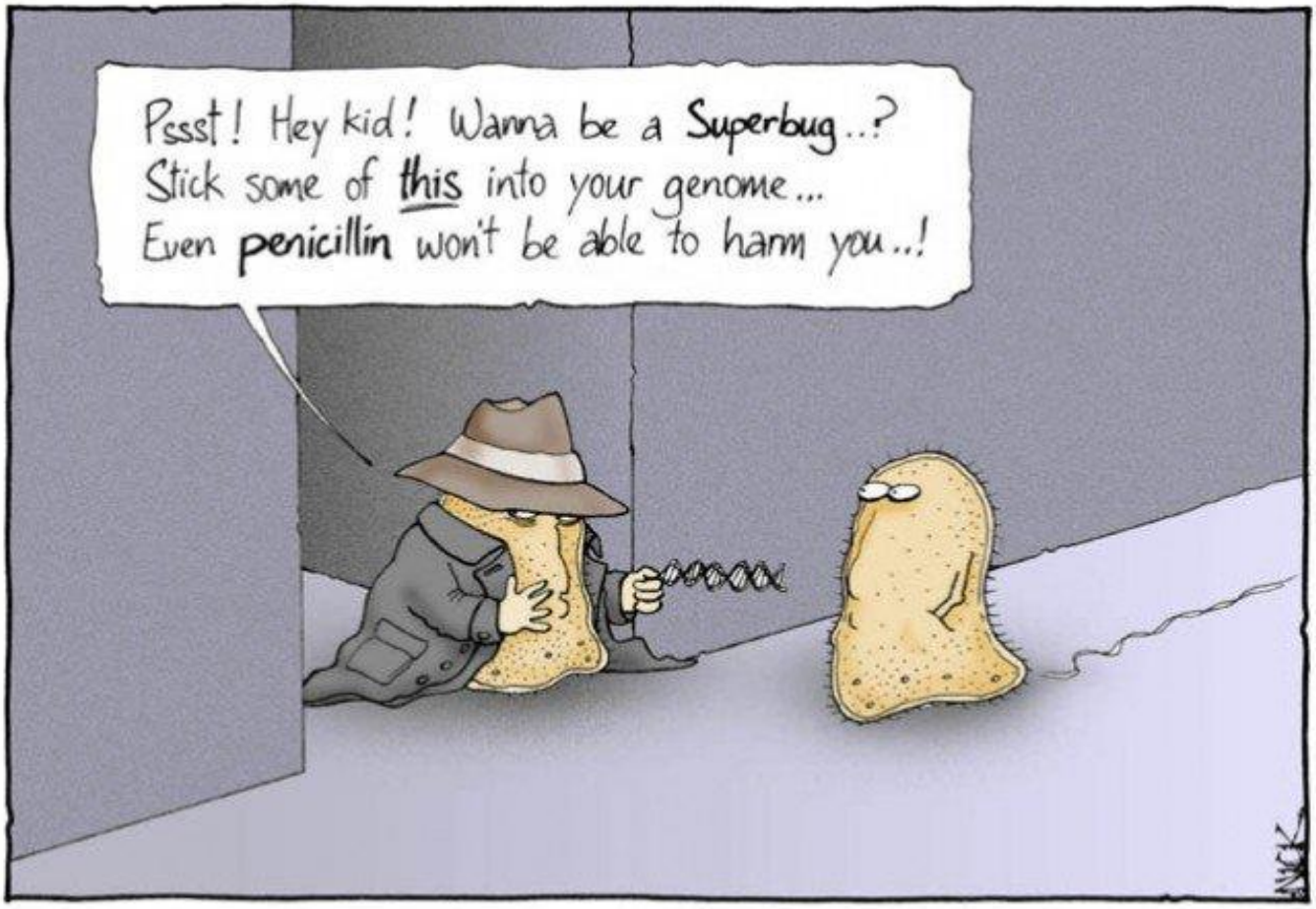
_____

_____

_____

Notes

Tutorial 2 – What is antibiotic resistance?



It was on a short-cut through the hospital kitchens that Albert was first approached by a member of the Antibiotic Resistance.

Today's Key Question(s):

- What does the term "antibiotic resistance" mean?
- How do bacteria become resistant to antibiotics?

What is the Purpose of Tutorial 2?

- To understand what resistance means
- To understand how bacteria exchange DNA
- To understand how resistance develops
- To understand why antibiotic resistance is important

Activity 1: Quickfire Recap!

Activity 2: Read the case study below and highlight any unfamiliar words

Case Study: MRSA

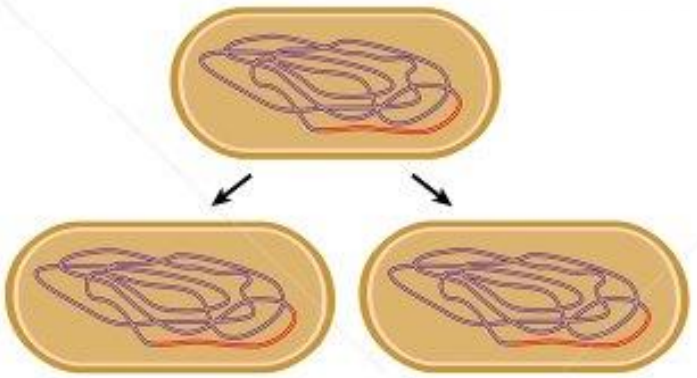
MRSA (methicillin-resistant *Staphylococcus aureus*) now contributes to more US deaths than does HIV. MRSA is resistant not only to the antibiotic methicillin, but also to whole other suites of our drugs, making it very difficult to treat and, occasionally, deadly. Modern strains of MRSA did not, however, show up out of the blue. In the early 1940s, when penicillin was first used to treat bacterial infections, penicillin-resistant strains of *S. aureus* were unknown — but by the 1950s, they were common in hospitals. Methicillin was introduced in 1961 to treat these resistant strains, and within one year, doctors had encountered methicillin-resistant *S. aureus*. Today, we have strains of MRSA that simultaneously resist a laundry list of different antibiotics, including vancomycin — often considered our last line of antibacterial defence.

How did *S. aureus* morph from a minor skin infection to a terror? When the media report on MRSA and other drug resistant pathogens, they often say that such pathogens have recently "emerged" — that they've "developed" resistance or "learned" to evade our drugs. In fact, it's more accurate to say that these bugs have evolved resistance.

Bacteria are great evolvers for many reasons. For example, their short generation times and large population sizes boost the rate at which they can evolve. Here's a quick explanation:

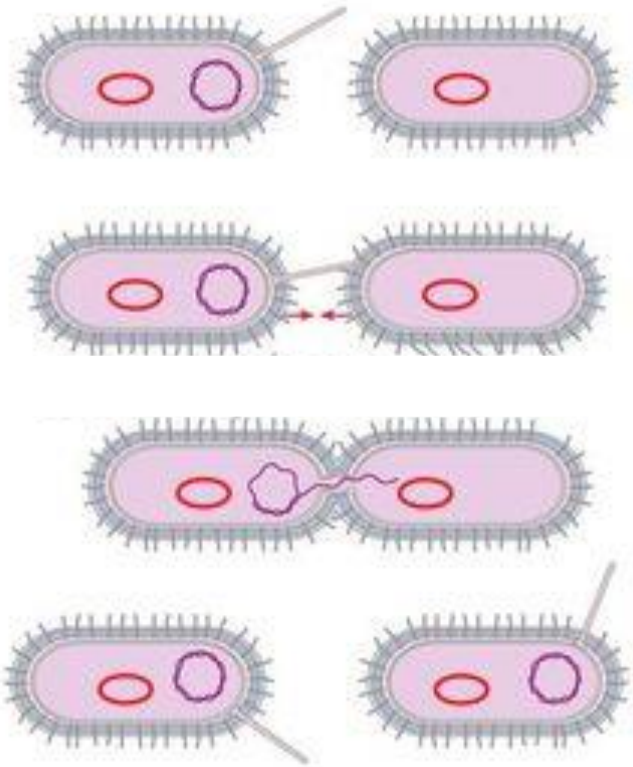
- **Evolution with vertical transmission.** New gene variants arise in a population through random mutation — that is, one individual experiences a genetic mutation and if that mutation increases the individual's ability to survive and reproduce, it is favoured by natural selection.

  Mutant gene variants are passed from parent to offspring, and advantageous mutations spread through future generations in that way. Over time, additional beneficial mutations that build on the first may occur and begin to spread in the population, allowing more complex traits to evolve as mutations accumulate. This standard picture of evolution is at work in all organisms — whether they are humans that eventually evolve the ability to digest milk or a plant species that adapts to the presence of heavy metals in its environment. The same mechanism also works on bacteria. In fact, biologists have observed the MRSA strain infecting a single patient evolving through random mutation and selection. The patient was being treated with vancomycin, and slowly, over the course of a few months and 35 separate mutations, the bacteria evolved into a vancomycin-resistant MRSA strain.



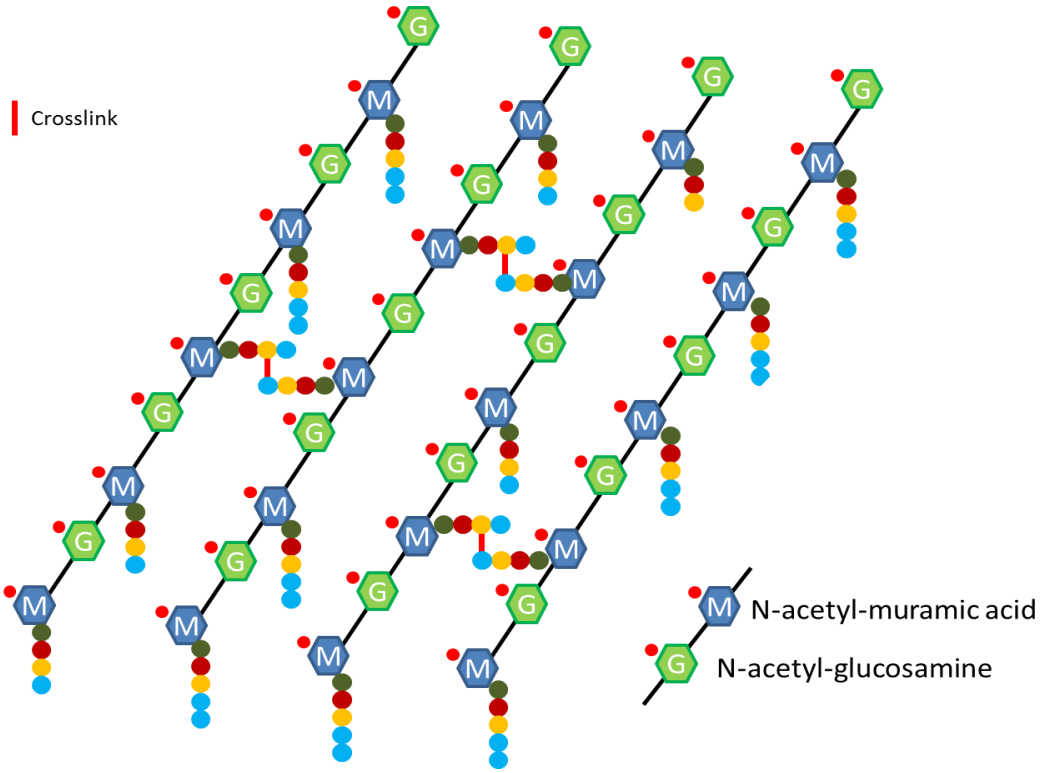
- **Evolution with horizontal transfer.** So bacteria acquire genetic variation through random mutation, but, unlike humans, they also regularly get new gene variants through the process of horizontal transfer — that is, they can pass DNA back and forth to one another directly.

  For example, bacterial genes can be incorporated into plasmids, which can be "injected" into other bacteria. The receiving bacterium may even incorporate some of the new DNA from the plasmid into its own genome and pass those genetic sequences on to its descendants. Importantly, bacteria do not have to be closely related to share DNA. Horizontal transfer can occur across even distantly related species — which would be a bit like you picking up the family pet and winding up with a few cat genes in your genome. In terms of evolution, this means that bacteria do not have to rely on random mutation to produce a beneficial gene variant. One species might pick up an advantageous gene from another species, and the process of natural selection could begin to act right away, spreading the new variant through future generations.



Activity 3: Discuss the two methods of resistance development with your partner. Which do you think is most dangerous in a hospital?

Penicillin – how have bacteria developed resistance?

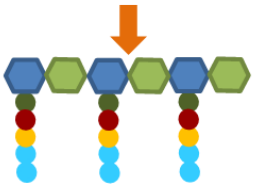


Cell wall Building

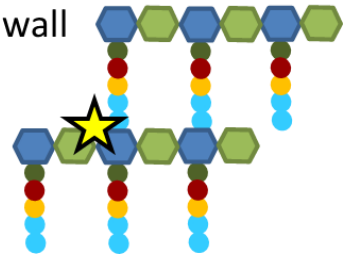
NAM has "peptide stem" added to it

NAG is joined to NAM

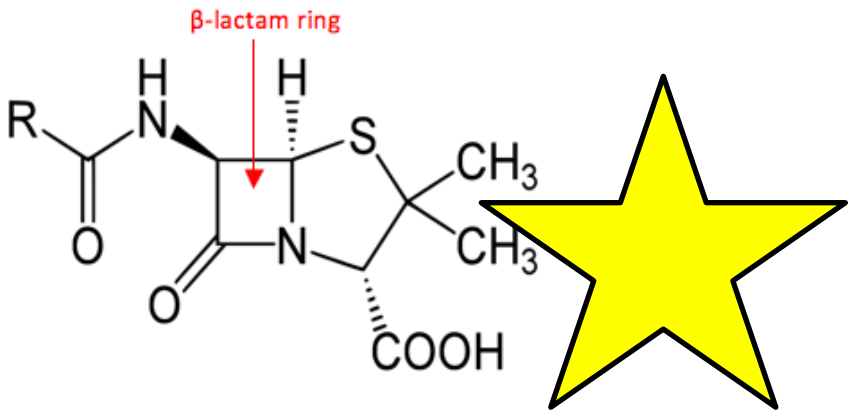
The NAG-NAM is added into the "linear" strand of the wall

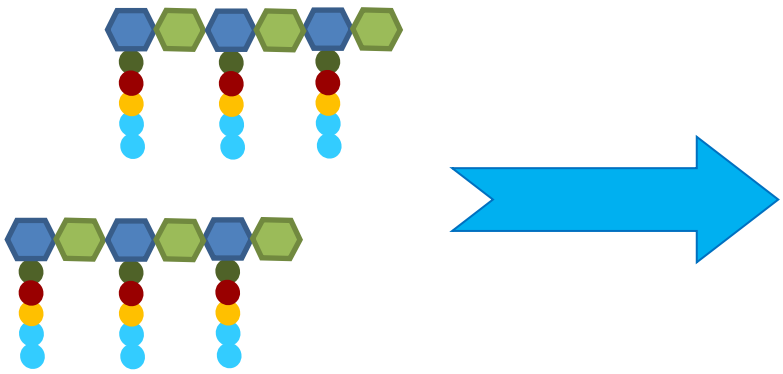


The "peptide stem" is linked to a NAM in the next strand of the wall by an enzyme



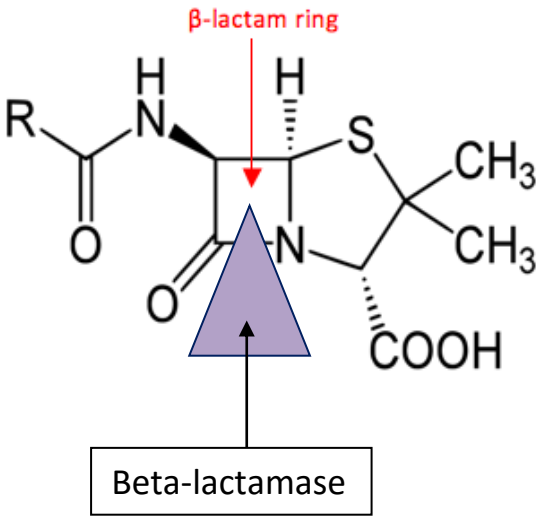
Penicillin Structure





The wall cannot link and has lots of gaps in it.
The bacteria is not stable anymore and cannot grow

How have bacteria fought back?



Some bacteria already had a gene, which makes a **beta-lactamase**: this attacks the beta-lactam ring in penicillin. This stops the penicillin binding to the cross-linking wall enzyme, and stops the antibiotic from killing the bacteria. This is called a RESISTANCE gene.

Consolidate

Use the space below to draw a "Superbacterium"

- **Name your superbug!**
- **Give your superbug three resistance genes**
- **State which three resistance genes you have chosen**
- **Explain why you have chosen these resistances e.g. will the gene save the bacteria from more than one antibiotic?**

Notes

Tutorial 3 – How are scientists looking for new drugs?

Today's Key Question(s):

- What methods are scientists using to build new drugs?
- How are completely new drugs being found in the environment?

What is the Purpose of Tutorial 3?

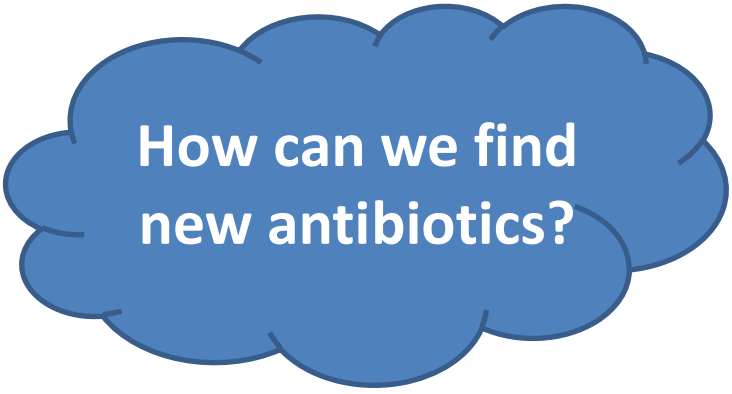
- To understand how scientists can "synthesise" new medications
- To become familiar with the drug Teixobactin
- To understand the new discovery method designed to find new antibiotic compounds in the environment

Activity 1: How would you go about making a new antibiotic?

Fill in the spider diagram below with your ideas.

Share your ideas with your partner and then we will discuss these together.

Afterwards, use a different colour to add to your diagram with the methods scientists are using in laboratories.



Drug Design

MENU nature.com Search Login / Sign up

Structure-based drug design

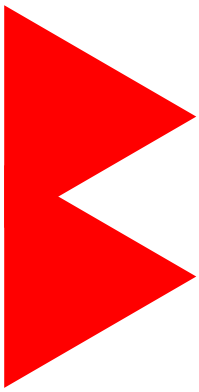
Atom RSS Feed

Structure-based drug design is the design and optimization of a chemical structure with the goal of identifying a compound suitable for clinical testing – a drug candidate. It is based on knowledge of the drug's three-dimensional structure and how its shape and charge cause it to interact with its biological target, ultimately eliciting a medical effect.

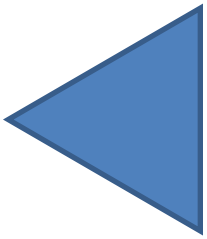
Structure-based drug design uses the scientist's knowledge of how their target molecule looks i.e. the shape of a protein. This information is used to understand exactly how that target could be inhibited.

Example

If one of our targets looks like this:



Then scientists can design a drug to block its shape and activity that looks like this:



Draw a drug that would be able to block this target:

Why do you think scientists use this method to find new drugs?

How do you think these drugs work?

_____

_____

_____

_____

_____

_____

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_____

_____

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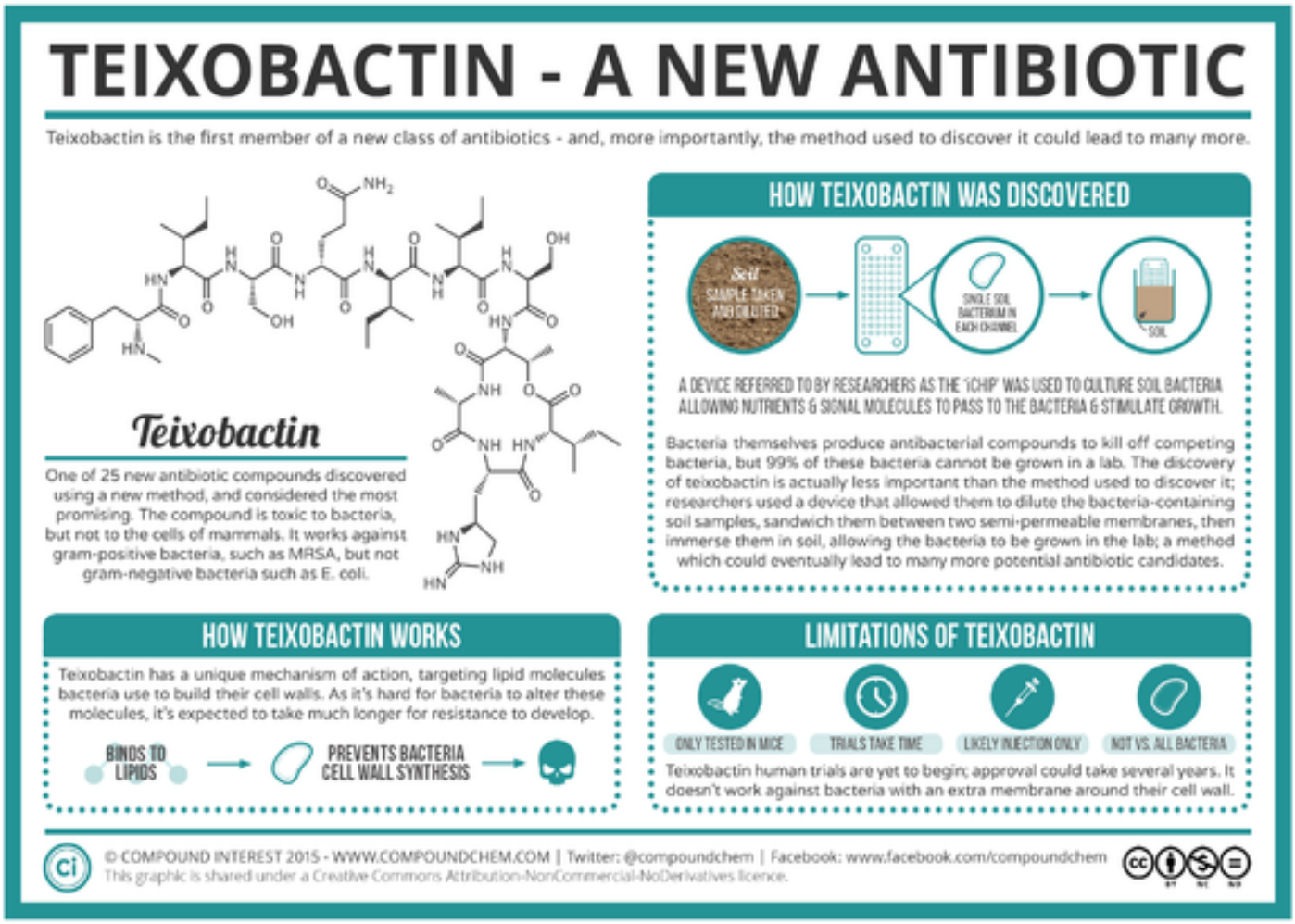
_____

_____

Activity 2: What's the biggest problem facing scientists trying to design new drugs? Use the cards on your tables and rank them in a Diamond 9.



Activity 3: Read the extract above and answer the questions about Teixobactin below:

1. **What was the name of the method used to find Teixobactin?**

_____

2. **What organelle does Teixobactin target?**

_____

3. **Why do researchers think it will be hard for bacteria to develop resistance against this drug?**

_____

4. **Name two of the limitations of this drug?**

_____

_____

Unculturable bacteria

We are grossly ignorant of bacterial life on earth. Environmental microbiologists estimate that less than 2% of bacteria can be cultured in the laboratory. In the mouth we do rather better, with about 50% of the oral microflora being culturable. For other body sites, the figure is unknown but is likely to be similar to that found in the mouth or higher. For example, the colonic microflora is suspected to be predominantly unculturable. It is therefore likely on numerical grounds alone that unculturable and therefore uncharacterized organisms are responsible for several oral and other human infections. A known instance is syphilis, caused by the spirochaete *Treponema pallidum*, which remains unculturable today.

- Wade (2002) Unculturable bacteria—the uncharacterized organisms that cause oral infections. *J R Soc Med*, 95(2): 81–83.

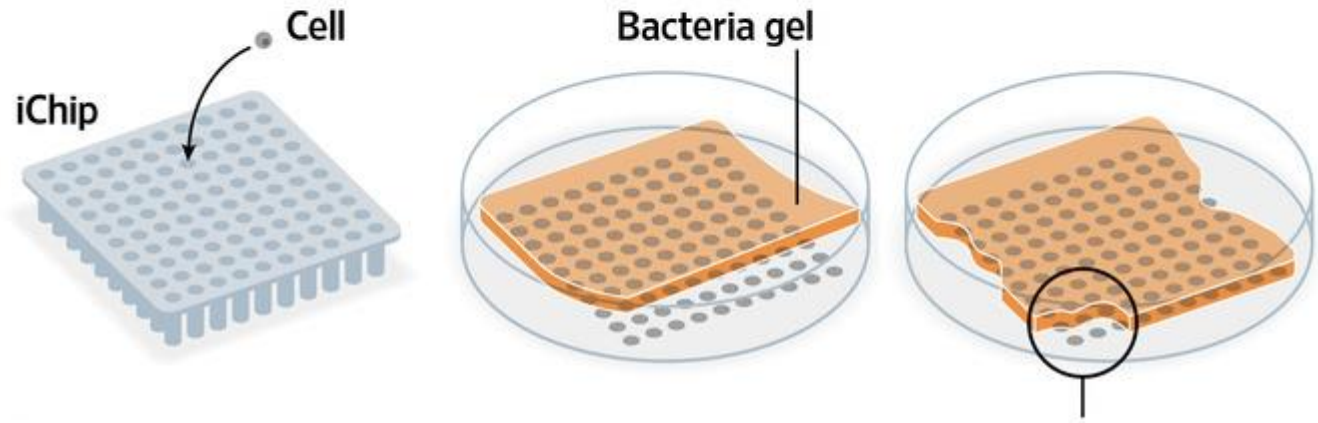
It is estimated that over 98% of bacteria on earth cannot be grown in a laboratory. This might be because the environment is wrong, the other bacteria or organisms they are used to growing with are not present, or simply because we do not know how to start trying!

Many of our current antibiotics and other drugs come from microorganisms. For example Penicillin is produced by a mould called *Penicillium*, and it is used by the mould to kill off any bacteria in the area so the mould can have all the water and nutrients for its own growth. Therefore humans exploit this killing system already at work in the microbe world, to treat infections caused by bacteria. But if we cannot grow these bacteria, how can we find out if they have any life-saving drugs?

The iChip

Drug Quest

A new technique lets researchers identify antibiotic treatments from bacteria that are notoriously hard to cultivate in the lab.



The chambers of a tiny device are each filled with a cell from a different bacterium and the device is placed in soil to allow the bacteria to grow.

The bacteria are then placed in a Petri dish and covered by a gel containing the target bacteria—Staph aureus.

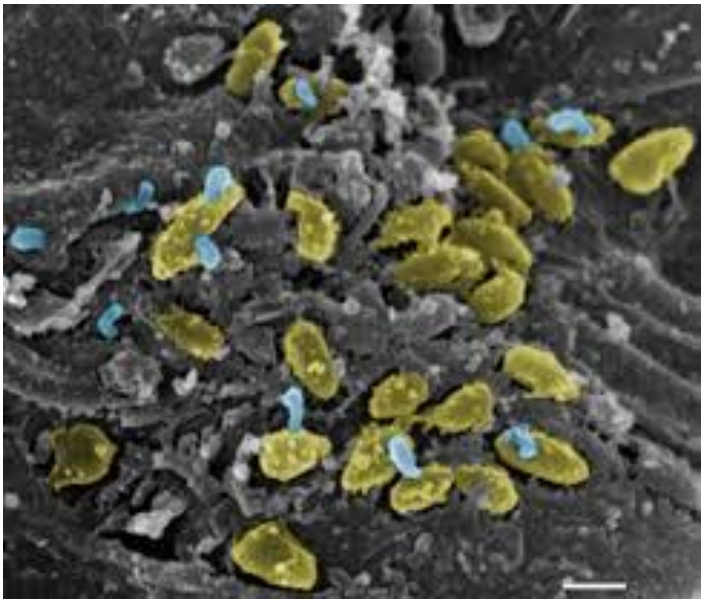
If there's no growth over a particular bacteria colony, then that colony contains bacteria that are releasing a potential antibiotic.

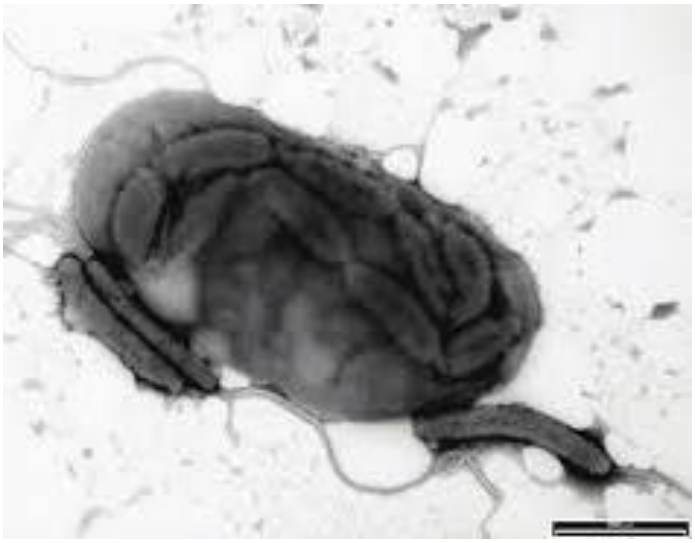
Source: Nature

The Wall Street Journal

Notes

Tutorial 4 – Predator! Bdellovibrio bacteriovorus





Today's Key Question(s):

- What are *Bdellovibrio*?
- How do they kill other bacteria?
- How can we use these bacteria instead of antibiotic medicines?

What is the Purpose of Tutorial 4?

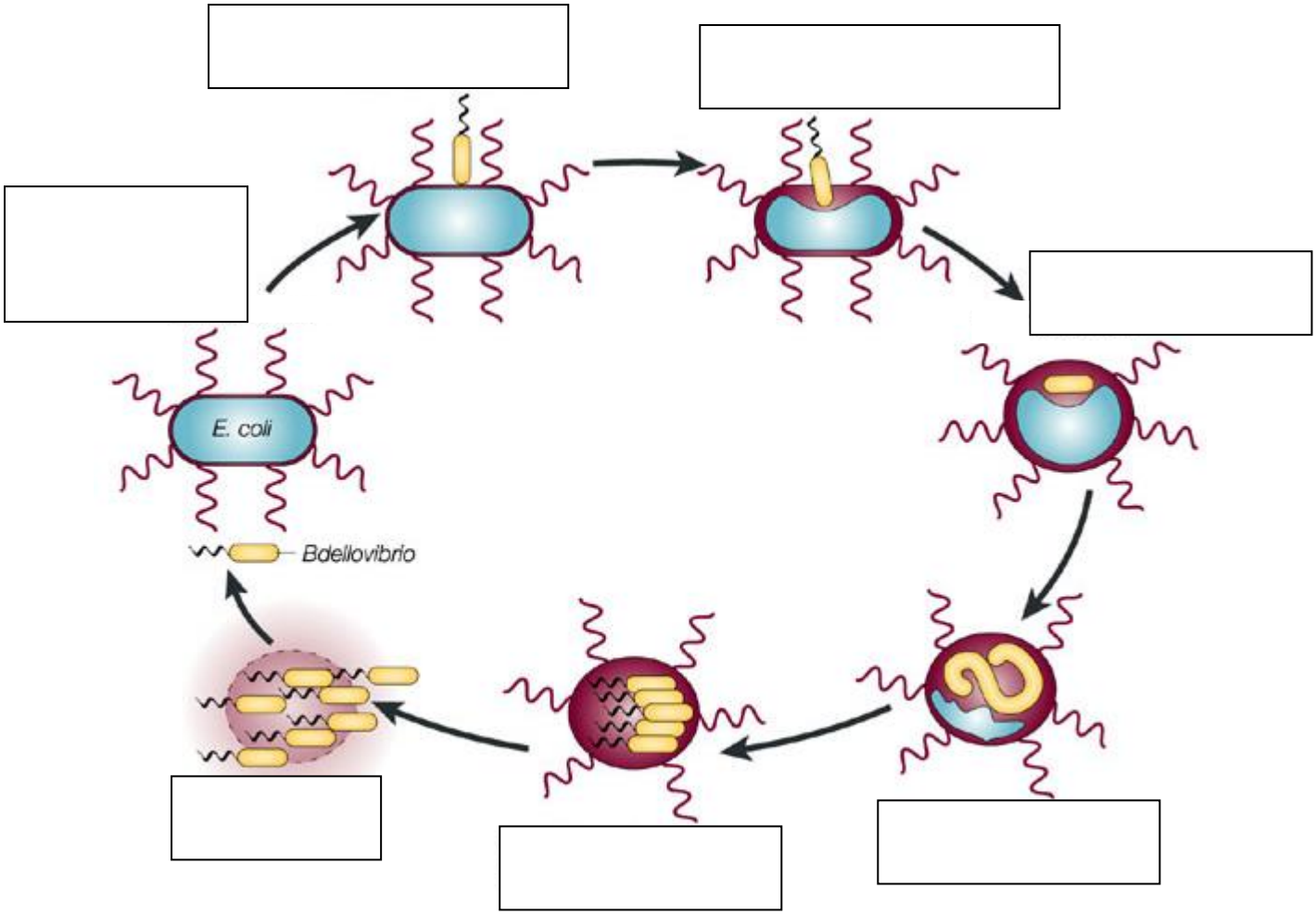
- To understand what *Bdellovibrio* are
- To understand how *Bdellovibrio* kill other bacteria
- To understand why this bacterium is useful against antibiotic-resistant bacteria

Activity 1: Recall from last week

Activity 2: Memory Challenge!

Activity 3:

Label the diagram of the life cycle below.



Why do <u>you</u> think that Bdellovibrio might be a good alternative to an antibiotic drug?

_____

_____

_____

_____

_____

Activity 4:

Read the extract from the paper below and write three things the scientists found out from this study.

Highlight any words you do not understand and we will discuss these.

Underline the "prey" bacteria and the "predator" bacteria in different colours

RESEARCH ARTICLE | OPEN ACCESS

Bdellovibrio bacteriovorus HD100 guards against *Pseudomonas tolaasii* brown-blotch lesions on the surface of post-harvest *Agaricus bisporus* supermarket mushrooms

Emma B Saxon, Robert W Jackson, Shobita Bhumbra, Tim Smith and R Elizabeth Sockett

BMC Microbiology 2014 **14**:163 | **DOI:** 10.1186/1471-2180-14-163 © Saxon et al.; licensee BioMed Central Ltd. 2014

Received: 21 February 2014 | **Accepted:** 12 June 2014 | **Published:** 20 June 2014

We showed that *B. bacteriovorus* HD100 is a predator of *P. tolaasii in vitro* and *in vivo* (*in funga*), suppressing population growth of the strain over a 24-hour period where *B. bacteriovorus* HD100 were added to pathogen on post-harvest mushrooms. *P. tolaasii* is a difficult pathogen to control in mushroom grow-houses due to its ability to persist in nutrient-poor soils and the ease with which it spreads through mushroom compost, through flagellar swimming, and via the hands of pickers during the manual harvesting process. Furthermore, commensal bacterial species in the mushroom casing soil play a key role in mushroom growth initiation, and therefore any treatment to prevent or treat *P. tolaasii* infection must not result in a completely sterile growth environment, which may result from broad antibiotic or antiseptic treatment. Thus it is beneficial to explore post-harvest anti- *P. tolaasii* treatments, such as this study with *B. bacteriovorus.*

Our images confirmed that *B. bacteriovorus* HD100 survived on the supermarket mushroom surfaces after 48 hours, and was therefore unaffected by any pre-treatment of those mushrooms for commercial purposes to promote growth and extend shelf-life in the film-covered plastic trays they were sold in. *B. bacteriovorus* is therefore a viable treatment for bacterial diseases of mushrooms, such as brown blotch disease. Previous studies of mushroom infections have found that a 'threshold' number of *P. tolaasii* cells are required for the initiation of infection. We found that when *B. bacteriovorus* HD100 was applied to the surface of commercially grown mushrooms before or after inoculation with *P. tolaasii*, both the intensity of the brown blotch symptoms of disease and the number of *P. tolaasii* present on the mushroom surface were significantly reduced. Our images also showed that *B. bacteriovorus* HD100 attached to, invaded and killed *P. tolaasii* cells by forming bdelloplasts on the pileus surface, when added both before or after *P. tolaasii* inoculation thus, reduction in *P. tolaasii* numbers and

disease symptoms was due to predatory activity by *B. bacteriovorus* HD100. As the consumer preference is for white, clean-looking mushrooms with minimal surface damage, the reduction in brown blotch tissue damage by *B. bacteriovorus* application could increase the yield and possibly the shelf life of high-quality, marketable mushrooms. This study investigated the survival of *B. bacteriovorus* HD100 and its predatory activity against *P. tolaasii* on the surface of post-harvest mushrooms up to 48 hours, sufficient time for brown blotch disease to develop on untreated mushrooms. Thus studies over longer time points, covering time from transportation to the sell-by date, would need to be investigated, in future work, if *Bdellovibrio* was to be applied as a treatment to extend shelf-life.

As host-dependent *Bdellovibrio* require prey cells to survive, the post-harvest treatment could also be self-limiting, as *Bdellovibrio* would die once *P. tolaasii* prey had been eradicated; further studies could quantify this. Furthermore, these *in vitro* and *in vivo* predation studies suggest that *B. bacteriovorus* may be able to survive the action of the toxins produced by *P. tolaasii* and other members of the *Pseudomonas* genus, which cause the damage to the mushroom pileus. This suggests that *Bdellovibrio* species may be effective against other crop pathogenic bacterial species, even if they produce biologically active secreted compounds. This could be followed up with studies of the pure compounds themselves versus *B. bacteriovorus.*

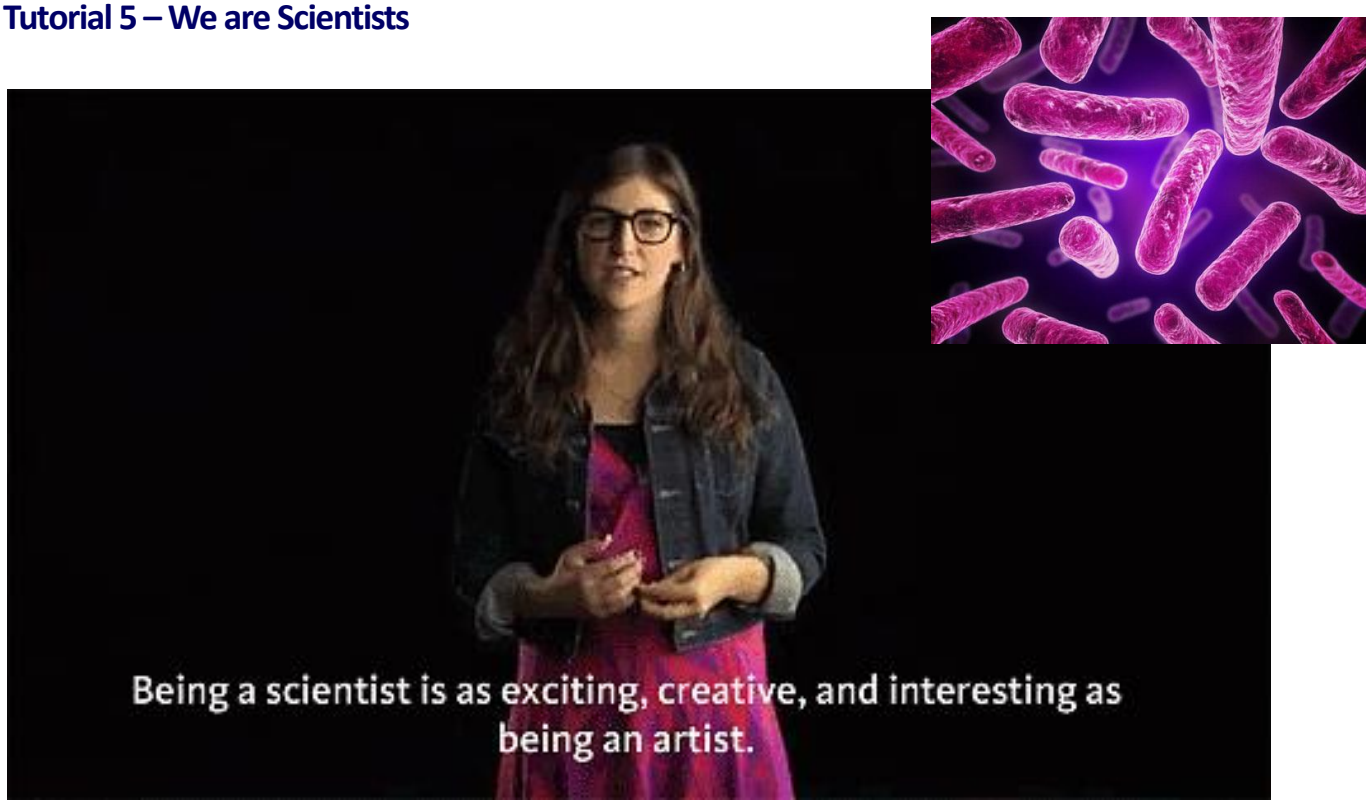
The scientists discovered:

-
-
-

Write a paragraph explaining how *Bdellovibrio* kill other bacteria. Use the life cycle as your basis and remember to use the words "prey" and "predator".

Notes

Tutorial 5 – We are Scientists



Today's Key Question(s):

- What do we know?
- What do we need to revise?
- What is the final assignment?

What is the Purpose of Tutorial 5?

- To ensure everyone understands what antibiotic resistance is
- To understand how University marking of essays works
- To understand the purpose of the final assignment and how to achieve good marks

Activity 1

Watch Amy Farrah Fowler!
Share homework findings – how do you feel about writing your final assignment?

Activity 2

Quick fire Quiz – Healthcare statistics and Revision

Activity 3

Understanding the Mark Scheme and how to get top marks!

Today's Homework is:

- Final Assignment

The Deadline is:

4pm

Notes

Final Assignment

Please write a maximum of **2000** words on the topic of:

Will we ever beat antibiotic resistance?

Use the outline below to structure your answer.
Try to include diagrams: these can be based on ones we have used or any you find in your reading.

Introduction (200-400 words)

- What is antibiotic resistance?
- What are the effects of antibiotic-resistant bacteria on humans?

Background Knowledge (400-800 words)

- How has antibiotic resistance developed?
- Give an example of an antibiotic and explain how bacteria have evolved to become resistant to this drug

Argument (400-800 words)

- How are scientists trying to tackle antibiotic resistance?
- What alternatives exist to new drugs?
- Are there any other methods you can think of that scientists could use to attack resistant bacteria?

Conclusion (200-300 words)

- Explain why antibiotic-resistant bacteria are dangerous to the public
- Give your opinion on the question: do you think we will beat antibiotic resistance and why?

Bibliography

- Reference the material you have used as we discussed in the final tutorial

Tutorial 6 – Feedback

What is the Purpose of Tutorial 6?

- Reflect on skills learned on the programme with a view to encouraging resilience
- Receive feedback on final assignment

What are the key questions?

- What strengths have I demonstrated in my work and what areas of development are there left for me to address?
- What steps do I need to take to improve my academic output?

Activity 1 – Marking your own

Using the mark scheme, identify three things you did well and three things you could improve.

What went well?

1.

2.

3.

What could be improved?

1.

2.

3.

Activity 2 – Responding to feedback

Read through your feedback sheet and highlight on your assignment where you received positive feedback (one colour) and areas for improvement (different colour). You might find it helpful to annotate this with a brief comment or two.

Activity 3 – Looking Forwards: Think, Pair Share

1. Think about how you can use this feedback in your future school work.
2. Talk to your partner about how you both plan to make changes to your school work in the future as result of this feedback
3. Share your ideas as a group.

Appendix 1 – Referencing correctly

When you get to university, you will need to include references in the assignments that you write, so we would like you to start getting into the habit of referencing in your Brilliant Club assignment. This is really important, because it will help you to avoid plagiarism. Plagiarism is when you take someone else's work or ideas and pass them off as your own. Whether plagiarism is deliberate or accidental, the consequences can be severe. In order to avoid losing marks in your final assignment, or even failing, you must be careful to reference your sources correctly.

What is a reference?

A reference is just a note in your assignment which says if you have referred to or been influenced by another source such as book, website or article. For example, if you use the internet to research a particular subject, and you want to include a specific piece of information from this website, you will need to reference it.

Why should I reference?

Referencing is important in your work for the following reasons:

- It gives credit to the authors of any sources you have referred to or been influenced by.
- It supports the arguments you make in your assignments.
- It demonstrates the variety of sources you have used.
- It helps to prevent you losing marks, or failing, due to plagiarism.

When should I use a reference?

You should use a reference when you:

- Quote directly from another source.
- Summarise or rephrase another piece of work.
- Include a specific statistic or fact from a source.

How do I reference?

There are a number of different ways of referencing, and these often vary depending on what subject you are studying. The most important to thing is to be consistent. This means that you need to stick to the same system throughout your whole assignment. Here is a basic system of referencing that you can use, which consists of the following two parts:

A marker in your assignment: After you have used a reference in your assignment (you have read something and included it in your work as a quote, or re-written it your own words) you should mark this is in your text with a number, e.g. [1]. The next time you use a reference you should use the next number, e.g. [2].

Bibliography: This is just a list of the references you have used in your assignment. In the bibliography, you list your references by the numbers you have used, and include as much information as you have about the reference. The list below gives what should be included for different sources.

Websites – Author (if possible), title of the web page, website address, [date you accessed it, in square brackets].

E.g. Dan Snow, 'How did so many soldiers survive the trenches?', http://www.bbc.co.uk/guides/z3kgjxs#zg2dtfr [11 July 2014].

Books – Author, date published, title of book (in italics), pages where the information came from.

E.g. S. Dubner and S. Levitt, (2006) *Freakonomics*, 7-9.

Articles – Author, 'title of the article' (with quotation marks), *where the article comes from* (newspaper, journal etc.), date of the article.

E.g. Marv Kennedy, 'The lights to go out across the UK to mark First World War's centenary', *Guardian*, 10 July 2014.