Penicillin

9-1 GCSE

www.stchistory.com

The Ultimate Magic Bullet

Can you remember….

- 1) what is a magic bullet?
- 2) what was the first magic bullet?
- 3)what year was it found?
- 4) what disease did it combat?
- 5) what was the second magic bullet?
- 6)what year?
- 7) what disease did it combat?

Which common medicine…

- Saved 15% of the lives of soldiers during World War Two
- Was so valuable at the beginning that the urine from patients being treated with it would be collected so it could be extracted and reused
- Has saved millions of lives worldwide
- Is the most common medicine to be allergic to (about 1 in 10 people are allergic to it)

What is Penicillin?

- Penicillin does not cure illnesses, it stops infections. It is an antibiotic, meaning **it kills bacteria**, and that's it!
- Therefore, it helps to kill of almost any bacterial infection, for example: pneumonia, meningitis, erysipelas, scarlet fever, diphtheria, blood poisoning, syphilis, gangrene, strep throat, gonorrhoea……….

What can you INFER from these two pictures?

Alexander Fleming

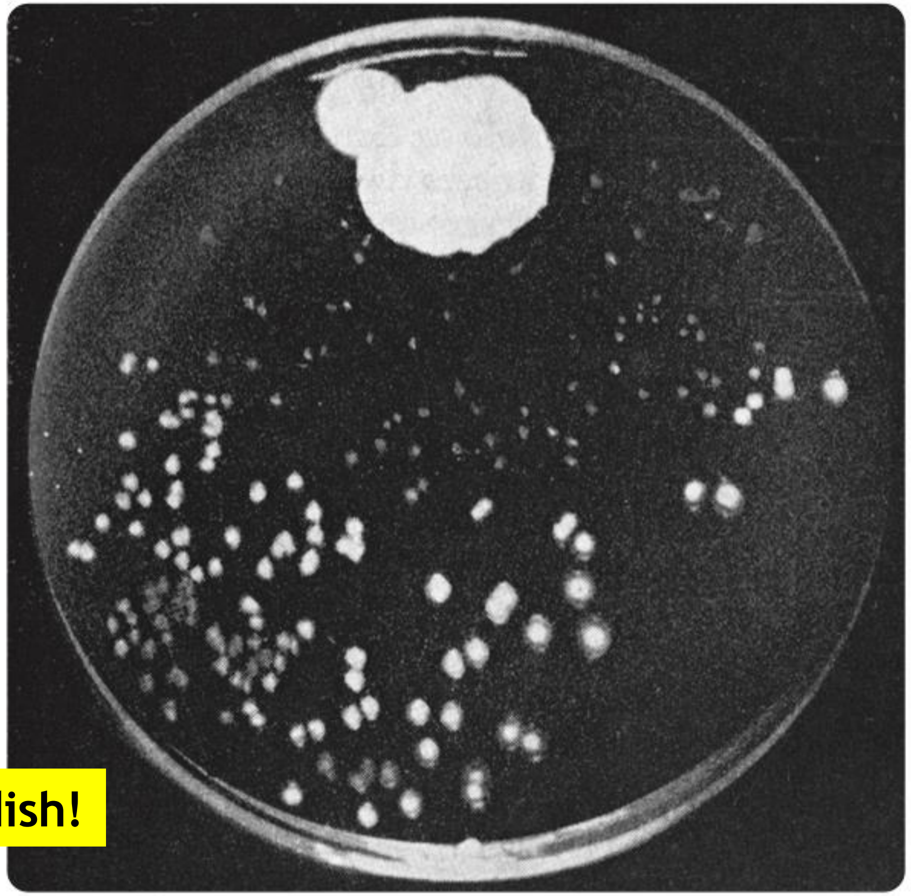
Fleming is said to have become interested in finding a cure for infections after seeing how many soldiers died of it during WWI.

He rediscovered penicillin after some bacteria flew into his lab and onto a petri dish he'd left out when he went on holiday.

He was known to be careless and messy when researching / Produced papers. He noticed that the mould was killing the bacteria around it.

Fleming published his findings, but most scientists at this time were looking for chemical cures. He thought it became ineffective when mixed with blood so not help with humans!

Fleming had to give up on penicillin as he couldn't afford the research.



The actual dish!

Fleming's main problem…

Summarise Fleming's main problems into 30 words

- Few paid attention to his article. It was difficult to grow the mould and even more difficult to isolate the antibiotic. He believed that because it doesn't stay in the body for longer than 4 hours, it wouldn't be very good and when he tested it in ineffective, he gave up! blood and it became
- Nearly 10 years later Florey & Chain found this article in c1939 and began work on mass production.

Penicillin Key Dates:

- 1872 Penicillin discovered by Lister, uses it once and never again
- 1928 Alexander Fleming rediscovered penicillin's powers
- 1929 Fleming published articles on penicillin
- 1939 Howard Florey and Ernst Chain start to research penicillin
- 1940 Successful tests on mice
- February 1941 First test of penicillin on humans
- 1942 US pharmaceutical companies begin mass production
- 1944 Used widely to treat soldiers on D Day landings
- 1945 Chemical structure of penicillin identified
- 1957 Chemical copy made allowing scientists to change it / modify a synthetic version to target different diseases

WW2

The real heroes?

Florey and Chain

Used money from the American and British governments to fund their research. Started after Pearl Harbor. Although the British Government offered them £25 due to the war effort.

Proved penicillin worked.

Eventually produced enough penicillin to treat all the wounded at D-Day.

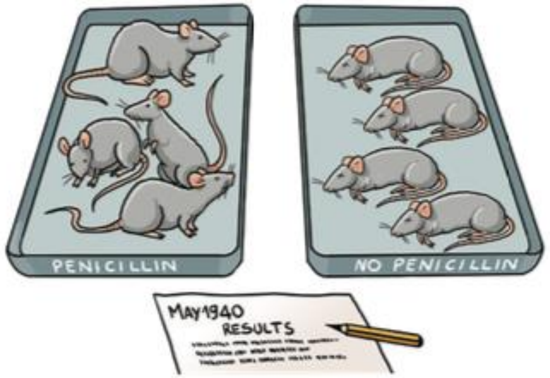
How Florey and Chain continued Fleming's work on penicillin

1. In 1929, Alexander Fleming publishes his work on penicillin in the medical journal *The Lancet*.

2. Ten years later Florey and Chain read Fleming's paper and decide to continue his work on penicillin.

3. Chain finds a way to purify penicillin using milk bottles, a dog bath and a pump. It was important to find the specific compound that caused bacteria to shrink.

4. The team test the effects of penicillin on mice. Eight are injected with a deadly bacterium. Four of them receive penicillin and survive. Florey remarks that the results look 'quite promising'.



(5) A 41-year-old policeman called Albert Alexander is scratched by a rose thorn and the wound becomes infected. He becomes the first human involved in a trial for penicillin.

(6) Although the patient is recovering, the team run out of penicillin. Without it, Alexander's infection returns. He dies in February 1941.

(7) Florey realises that more penicillin is needed to run more effective trials. He travels to the USA to get more support and funding.

(8) Once trials are shown to be successful, Florey receives funding from American **pharmaceutical companies** – big companies that manufacture medicines and drugs. In 1944, he sets up production on a large scale in an old warehouse in New York, so penicillin can be mass-produced.

Summary

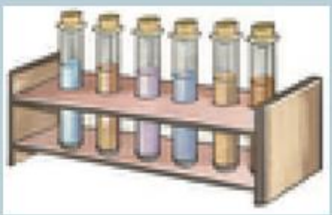
1 Scientists Florey and Chain were researching antibiotics when they came across Fleming's work. They decided to test the mould further.

2 In 1940 they tested their penicillin on infected mice. It seemed to work but they didn't have enough of the drug to completely cure them.

3 They would need a lot more mould for human tests. They started to experiment with different growing containers – milk churns, bed pans and even a bath tub!

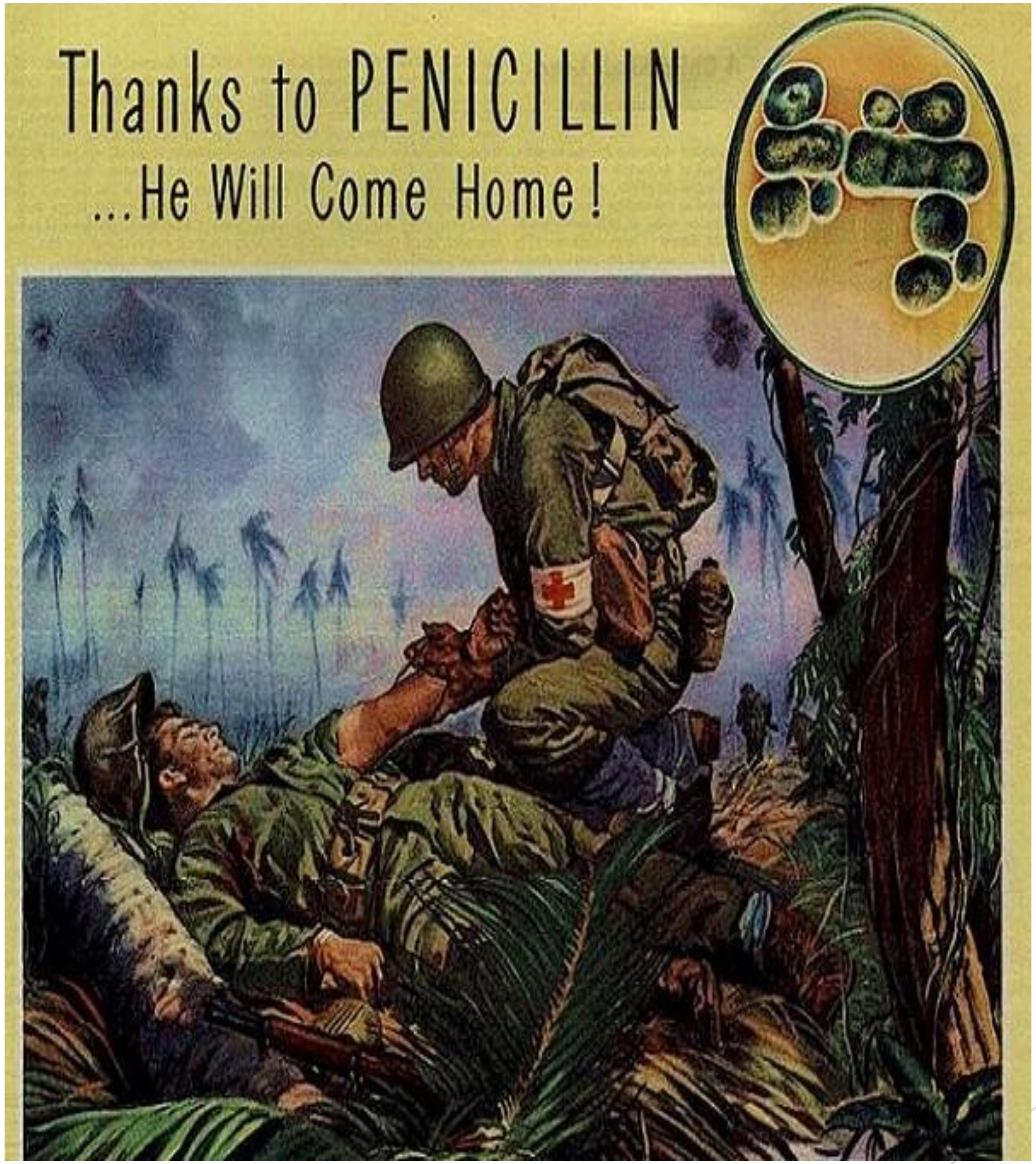
4 In 1941 they had the opportunity to try their penicillin on a human – a policeman who had developed blood poisoning from a scratch.

5 When given penicillin, the policeman started to get better. But the drug ran out. He became worse, and eventually died.



6 Despite this first failure, Florey and Chain had proved that penicillin could be used to treat and possibly cure infections in humans.

World War II



Factors

A

Alexander Fleming discovered penicillin when he noticed that his staphylococcus bacteria were being killed by *Penicillium* mould. After Florey and Chain continued work on penicillin in the early 1940s, they managed to purify pencillin and test it successfully on animals and humans. It was Florey who travelled to the USA, in 1941, to secure more money for penicillin's mass production. In 1945, Fleming, Florey and Chain were all awarded a Nobel Prize.

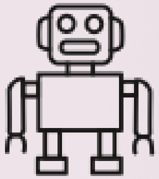
B

In 1939, the British government gave Florey's team just £25 to research penicillin. When the USA joined the war in 1941, the US government was much more supportive. It realised the life-saving potential of this 'wonder drug' and gave $80 million to four big companies to mass-produce penicillin.

Factors

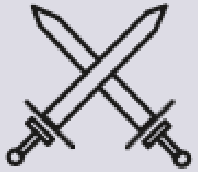
C

Without modern laboratories and large pharmaceutical companies it would have been impossible to mass-produce penicillin. In 1941, a company called Pfizer built an enormous factory in New York. They had realised that they would never have enough penicillin mould if it was only grown on the surface of a liquid. They built huge fermentation tanks and pumped them full of liquid citric acid. This allowed penicillin to be produced throughout the liquid in much larger quantities.



D

Without the huge numbers of US casualties in the Second World War it is unlikely that the USA would have been so keen to mass-produce penicillin. In 1943, there was only enough for penicillin to treat 1,000 patients. By 1944 (and before the planned invasion of Normandy), there was enough to treat 250,000 soldiers.



Factors enabling the development of penicillin

Institutions. The US government agreed to fund Florey's research for five years. This enabled him to develop methods to mass produce the drug.

Technology. The development of new ways of mass-producing and storing penicillin made the drug available in large quantities.

Individuals. Florey and Chain built on the work of Fleming. All three were looking for a chemical treatment for disease and illness.

Main factors

Attitudes in society. The need to find a treatment for wound infections became important during the Second World War.

Science. Scientists were able to observe how penicillin attacked staphylococcus* bacteria. This enabled them to modify it to attack other types of bacteria.

Copy this factors diagram for development of penicillin – which is most important?

Mass Production: Factors

- Florey & Chain proved that penicillin was effective but could not mass produce it. They needed a large-scale factory where it could be grown and extracted.
- Florey approached British pharmaceutical companies for assistance but this was during WW2 and they were too preoccupied with the war effort.
- However, in 1941, USA had not yet joined the war and Florey managed to convince US companies to mass produce penicillin, they were soon funded by the US government.

What does this 'joke' suggest?

"PENICILLIN IS CALLED A 'WONDER DRUG' BECAUSE ANY TIME THE DOCTOR WONDERS WHAT YOU'VE GOT, THAT'S WHAT YOU GET."

BBC Summary video

- https://www.youtube.com/watch?v=N2-7UQWrYPY&list=PLcvEcrsF_9zJ8AqMTFZycm46Ks4DdSaLM&index=9

Summary

- Alexander Fleming discovered penicillin by accident in 1928. His research went unnoticed until 1938, when it was developed by Howard Florey and Ernst Chain.
- Florey and Chain were able to create a usable drug from the mould, which they tested on mice and then a human being. However, it was very difficult to mass produce.
- When the Second World War broke out, Florey was able to get money from the US government to mass produce the drug.
- Penicillin is effective against a wide range of illnesses.

Checkpoint

Strengthen

S1 Describe how Fleming discovered penicillin.

S2 How did Florey and Chain test penicillin when they isolated it?

S3 Describe how penicillin has been used since the Second World War.

Challenge

C1 With a partner, discuss the roles played by Fleming, Florey and Chain in the discovery and development of penicillin. Was it the right decision to award them the Nobel Prize jointly?

You could also discuss the answer to C1 in groups. Your teacher can give you some hints.