In 1892, one year old Maggie Wade was badly scalded by boiling soup. Her family lived in a village where people believed in the healing powers of a local woman, Mrs. Brundish. Maggie's parents called Mrs. Brundish to **charm** the fire out of the little girl, repeating healing words and passing her hands over the injuries. Maggie's parents believed some good was done but she died the next day.

1. Is this to do with: PREVENTION, CAUSE, TREATMENT, CARE?
2. What does this tell us?
3. What is unusual or surprising about this source?

21/10/2020

Modern Medicine – Treatment: Magic Bullets and Penicillin

What is a “Magic Bullet”?

A **magic bullet** is a drug that targets and kills specific germs, while leaving other cells and bacteria untouched.

They are incredibly useful because of how specific and targeted they are.

There are three important “magic bullets” that we should know about:

Magic Bullets

Cut out and organise the tiles into chronological order

After I have checked them, glue them into your book.

CHALLENGE: Reduce each of these boxes to no more than **THREE KEY WORDS** for each box.

Robert Koch found a way of staining bacteria to identify them. In 1880 **Paul Ehrlich**, a member of his team, decided to take this idea further.

Scientists further researched Prontosil and discovered it worked by stopping bacteria from multiplying in the body, allowing the body's immune system to kill it. They called these types of drugs "antibiotics".

Ehrlich thought that a chemical compound could be used not just to stain the bacteria causing an infection, but which would **kill** the bacteria and leave everything else healthy. Ehrlich said this would be like a **Magic Bullet**. The chemical would 'shoot' the infection, not the patient

In 1932 scientist Gerhard Domagk discovered a red dye called **Prontosil** that killed bacterial infections in mice. His own daughter was sick with a blood infection and she became his first human test subject, luckily Prontosil cured her.

In the medieval times some chemicals were used to treat diseases. **Syphilis** was an STD that was often cured using **mercury**. However, although the mercury killed the disease it also was incredibly poisonous to everything else it touched. Henry VIII may have died from mercury poisoning used to treat his syphilis.

A Japanese scientist named Hata was interested in Ehrlich's work and in 1909 he re-tested all of the compounds. He realised that Ehrlich had made a mistake and that the 606th compound actually worked! He named it **Salvarsan 606**. This was the first real "Magic Bullet"

Scientists began to look for other antibiotics that worked in the same way. In 1939 they developed **MB 693**, a drug that was used to cure **Winston Churchill** of Pneumonia during the Second World War.

He began testing for chemical compounds that could cure **syphilis**, a dangerous STD. By 1907 he had tested over 600 compounds before giving up.

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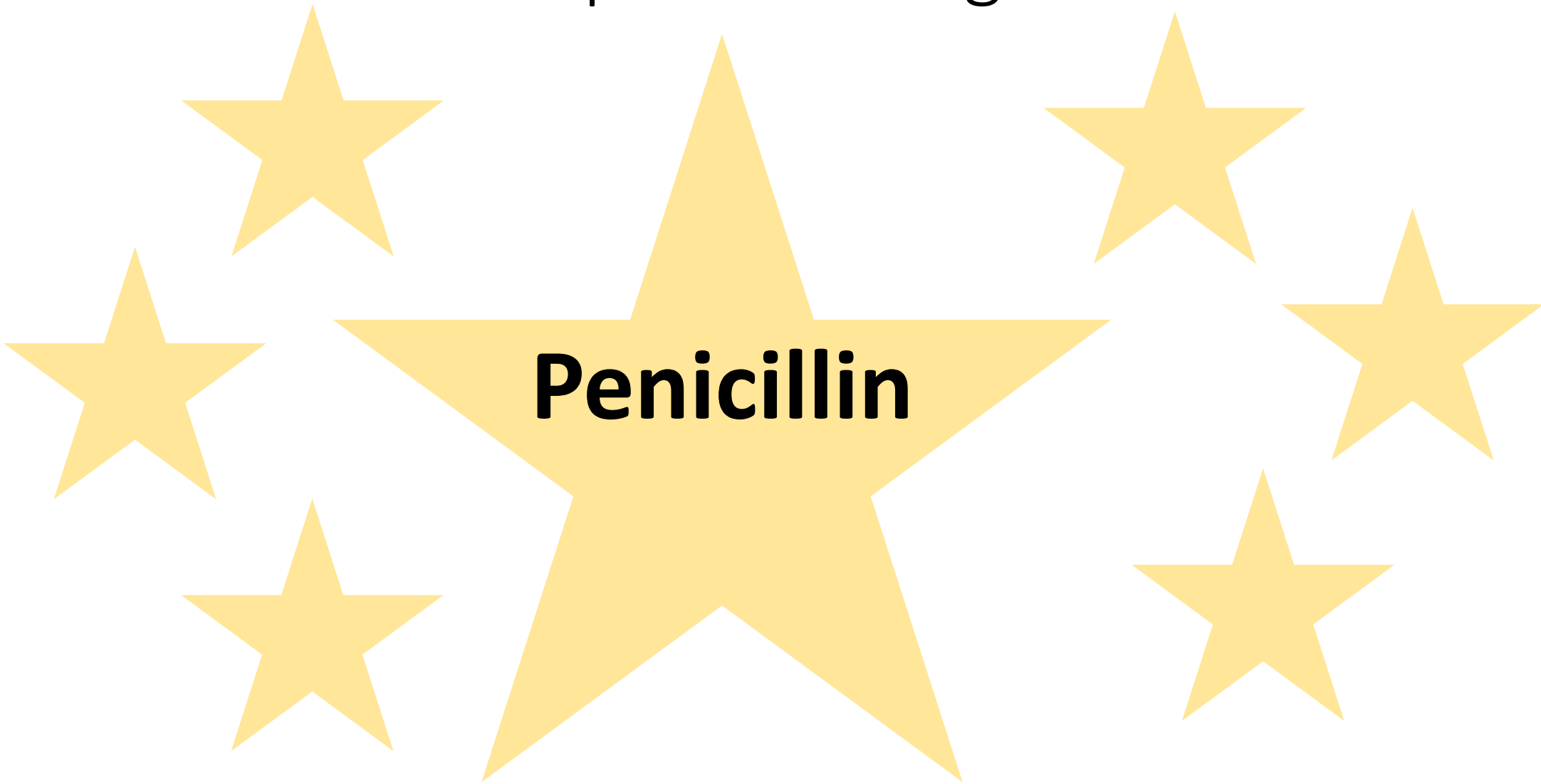
Summary –
Answer these questions in full sentences in your book

1. What is a “Magic Bullet”?
2. Who came up with the idea of Magic Bullets?
3. What was Salvarsan 606 intended to treat?
4. Why was it called 606?
5. What did Prontosil kill?
6. What Magic Bullet was used to treat Churchill of pneumonia during WW2?

But the most important Magic Bullet of all…



What do these two pictures suggest about Penicillin?

What is Penicillin?

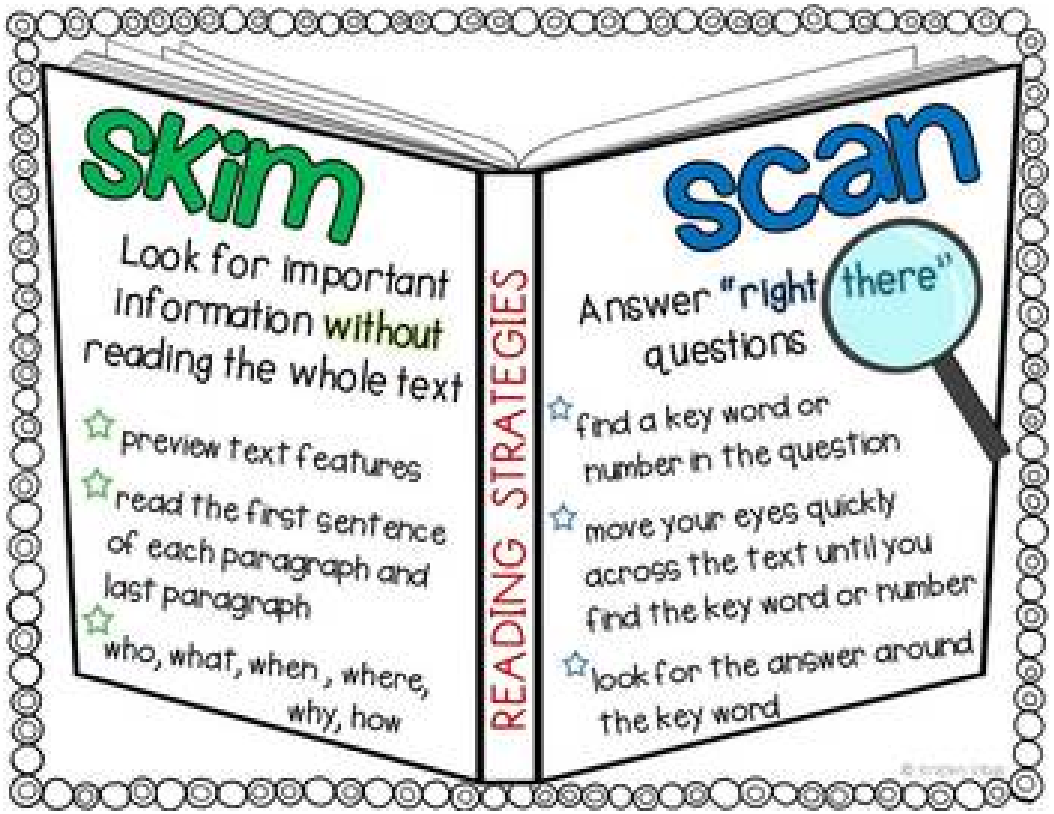
- Penicillin does not cure illnesses, it stops infections. It is an **antibiotic**, meaning it kills bacteria, and that's it.
- Its great, because it is **not toxic** to humans, but it is **very toxic** to bacteria. So, we take it, nothing happens to us, but any bacteria that happen to be infecting our bodies will soon be killed off.
- Therefore, it helps to kill of almost any **bacterial infection**, for example: pneumonia, meningitis, scarlet fever, diphtheria, blood poisoning, syphilis, gangrene, strep throat, gonorrhoea and more.
- **Alexander Fleming** is often credited with the discovery of penicillin but that may not be completely accurate.

Your Task

Use the information sheets to fill out your worksheet.

EXTENSION: Use a highlighter to identify key dates and key individuals.

CHALLENGE: What enormous danger do we face regarding penicillin today?



Summary – The impact of science and technology on medicine

Science:

As with diagnosis, the way we _____ diseases now is almost unrecognisable from the way that people treated them before 1900. This is largely due to huge _____ in science and technology.

Scientists have developed medicines that pinpoint and treat _____ diseases. Even if we can't cure some diseases, like cancer, we have developed ways to help patients _____ their illness. Scientists are now able to identify the specific cause of most diseases because they know what to look for – e.g. a microbe, a tumour, an unusual ____.

Improved scientific understanding has led to better testing and development of _____. This has improved over the 20th century. In the 1960s the drug thalidomide was given to pregnant women to cure sickness, but because it was _____ through testing it wasn't noticed that the drug caused birth defects. Now it takes several years for a drug to be trialled, this slows down progress but ensures drugs are _____ for everybody.

MISSING WORDS:
treatments / specific / safe / treat / manage / rushed / advances / gene

Technology:

New technology has helped us create and supply many new drugs. Match the technology to the benefit:

Mass production of pills	Allows a precise dose of medicine to be safely introduced directly into the blood stream.
The development of capsules	Young people suffering from diabetes are able to get relief without needing injections.
Hypodermic needles	This has made the supply and distribution of important medicine much easier.
Insulin pumps	These dissolve in the stomach to release the drug, making taking drugs much easier.

CHALLENGE: Why has progress in the 20th Century been so rapid? Use specific examples in your answer.

GCSE Focus:
“Alexander Fleming deserves full credit for the discovery of penicillin? How far do you agree?

Write a paragraph that either agrees or disagrees with this statement.

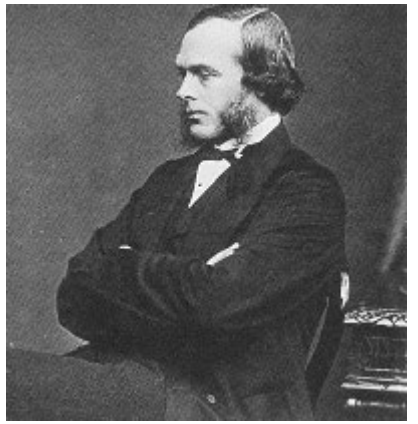
“It can be argued that Alexander Fleming deserves full credit for discovering penicillin. He… As a consequence… Therefore… Another reason… This also led to… As a result…”

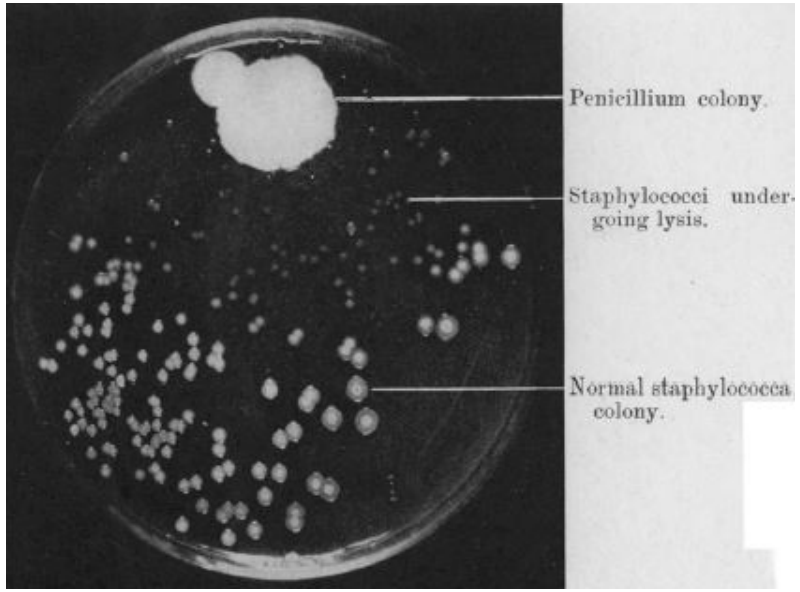
“It can also be argued that other individuals were far more significant, for example… This caused… Consequently,… Furthermore another key piece of evidence is…. This also shows their significance because…”

BONUS: Write a second paragraph that considers the other side of the argument.

Stage 1: Discovery

- Penicillin is a natural substance, meaning that it was discovered, not invented.
- Penicillin is made from a mould called *penicillium*. When fruit/cheese goes bad mould grows on it. In the 1870s, **Joseph Lister** noticed that mould of bacteria called penicillin killed other bacteria.
- **In 1871 Lister successfully treated a nurse** with an infected wound with penicillin, but did not leave any notes on the case and apparently **did not continue his research** in this area.





Stage 2: Re-discovery!

- Alexander Fleming was known to be careless and messy, he often left samples of bacteria in petri dishes open on his desk.
- In 1928 some mould flew through the open window of his office and landed in a petri dish, he noticed that it had killed the bacteria.
- He needed to find a way to turn the mould juice into drugs. However, Fleming did not have the facilities or the support to develop and test his idea. No one would give him money or specialist help.
- He wrote up his findings and published articles in the ***British Journal of Experimental Pathology*** in 1929 & did no more about his discovery. Nothing else happened for 10 years.

Stage 3: Florey and Chain

In ***1938*** two scientists and their team began looking at germ killing substances, they came across Flemings articles on penicillin. They set out to make pure penicillin from mould juice. They succeeded in making small quantities of pure penicillin in powder form.

In ***1940*** they gave eight mice a bacterial infection. Four mice were given penicillin to treat them and the other four were not. The ones who were given penicillin survived and the other mice died.

However, Florey and Chain's team did not have the resources to manufacture large amounts of pure penicillin. They grew the mould in milk bottles, milk churns, bed pans and a dog bath.

Oct 1941: Penicillin is used on a human patient with success: they used penicillin on Albert Alexander a policeman suffering with blood poisoning. He began to recover after receiving penicillin only to die shortly after supplies of the drug ran out.

Howard Florey (left) and Ernst Chain.

Stage 4: Small Scale Production

The curative (curing) properties of penicillin were now obvious, but mass producing the drug for use remained a problem.

Only large chemical companies had the resources to do so. By this time Britain was deeply engaged in the Second World War and its chemical industry was too busy producing weapons and explosives to become involved in the manufacture of penicillin.

But thousands of men were dying at war…

Florey realised that penicillin would cure the deep infections caused by war wounds. He visited the USA (who did not join WWII until 1941 – 3 years after it started in 1939) to try to persuade American chemical firms to invest in the mass production of penicillin. He was unsuccessful.

American companies started growing penicillin in beer vats. After 1 year they only had enough to treat 10 people! It was a very slow process and not enough money was put into it initially.

Stage 5: Mass Production

In **December 1941** after the attack on Pearl Harbour, the USA enters the Second World War.

In **1942** the US government funded 21 pharmaceutical companies to begin mass producing penicillin.

1943: Mass production began. Britain then also started mass producing the drug in this year. Penicillin first used by British army in North Africa.

June 1944: Enough penicillin is available to treat all the casualties of D-Day.

1945: The US Army uses 2 million doses of penicillin every month. It saves 1/6 of all wounded men from infections.

Stage 6: Impact

- In **1945**, Fleming, Florey and Chain were jointly awarded the **Nobel Prize for Medicine** for their work on penicillin.
- **1957** chemist **John Sheehan** creates a chemical copy of penicillin allowing the drug to be changed to target different diseases.
- By the **1960s** it was no longer seen as a wonder drug, it was just an ordinary everyday treatment.

- Scientists could then look for other moulds that could be used to fight bacterial infections. This effective treatment led to more confidence in doctors and more people seeking/wanting treatment when ill.

- However more recently bacteria has mutated to become resistant to antibiotics/penicillin – scientists are now working hard to develop new forms of antibiotics to kill bacteria.