

**For issue on or after: 13 March 2026**

**A Level Biology B (Advancing Biology)**

**H422/02 Scientific literacy in biology**

**Advance Notice Article**

**To prepare candidates for the examination taken on  
Friday 12 June 2026 – Morning**



### INSTRUCTIONS

- **Before** the exam, read this article carefully and study the content of the learning outcomes for A Level Biology B (Advancing Biology).
- You can ask your teacher for advice and discuss this article with others in your class.
- You can investigate the topic of this article yourself using any resources available to you.
- Do **not** take this copy of the article or any notes into the exam.

### INFORMATION

- A clean copy of this article will be given to you with the question paper.
- In the exam you will answer questions on this article. The questions are worth 20–25 marks.
- This document has **4** pages.

### ADVICE

- In the exam you won't have time to read this article in full but you should refer to it in your answers.

## THE RISE AND FALL OF ANTIBIOTICS

Antibiotic-producing microorganisms have been used for thousands of years to treat and prevent disease. For example, mouldy bread was used to treat open wounds over 2000 years ago. However, the development of anti-infective drugs and the concept of chemotherapy began in the early 20th century. This is widely accredited to Paul Ehrlich; he developed the arsenic-based drug salvarsan to kill the bacterium that causes syphilis. Bacterial resistance to salvarsan had emerged by 1930, and it is no longer in clinical use.

Sulfonamide drugs were also developed in the early 20th century and were the first effective broad-spectrum antimicrobials. They are still in use today, although some resistance emerged soon after their first use.

Sulfonamides were largely superseded by the discovery of penicillin by Alexander Fleming in 1928. Although Fleming made the initial discovery, the successful use of penicillin was only possible because of the work of Howard Florey and his colleagues in Oxford. Another Oxford scientist, Dorothy Hodgkin, determined the beta-lactam structure of penicillin. This was important because it enabled the development of semi-synthetic derivatives to bypass penicillin resistance.

Antibiotic resistance has become a global health challenge, although it is not a recent phenomenon. The ancient and continuing evolution of antibiotic resistance has been driven by competition for resources between microorganisms. Many of these microorganisms produce secondary metabolites that are similar in structure to the antibiotics that are used today as pharmaceuticals. However, the evolution of resistance has been accelerated by the increased presence of antibiotics in the environment and by horizontal transfer of resistance genes between different bacterial species.

As antibiotic resistance has become an increasing problem, doctors have begun to question whether traditional prescribing practices are contributing to the spread of resistance. The conventional wisdom has been that antibiotic therapy aims to eradicate every last bacterium so that no resistant bacteria remain. However, this is not based on evidence.

Treatment of persistent infections such as tuberculosis requires extended antibiotic treatment for many months. This has been responsible, in part, for the widespread belief in the need for 7- or 14-day treatments for common bacterial infections. However, it is also well known that increased use of antibiotics leads to increased development of resistant strains.

Since 2008 there have been numerous clinical trials comparing the effectiveness of shorter duration and longer duration treatment regimes. For example, pneumonia may be treated for 3–5 days (short course) rather than 5–14 days (long course). While many trials have shown that shorter treatment durations are as effective as longer treatments, this has not always been the case. For example, treatment of infection in prosthetic joints (such as hip or knee replacements) was less effective with a 6-week course than with a 12-week course.

### Further reading

Antibiotics: past, present and future: Matthew I Hutchings, Andrew W Truman and Barrie Wilkinson. *Current Opinion in Microbiology* (2019) 51:72–80.

<https://doi.org/10.1016/j.mib.2019.10.008>

The Shorter Is Better movement: past, present, future: Brad Spellberg and Louis B Rice. *Clinical Microbiology and Infection* (2023) 29:141–142.

<https://doi.org/10.1016/j.cmi.2022.04.005>



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