

TITLE: B3 Infection and Response

Unit Overview

In this topic students learn about **infectious diseases, the pathogens that cause them, and how the human body protects itself against infection**. Students will explore how diseases spread, how the immune system responds to pathogens, how vaccines and medicines help prevent and treat disease, and how scientists develop and test new drugs to ensure they are safe and effective. As part of this topic, students will use scientific evidence to explain disease prevention, evaluate medical treatments and understand the importance of public health.

Prior Learning (KS3)

Students have learnt previously about cells, tissues, organs and reproduction. This has involved:

- Describing cells as the fundamental units of living organisms.
- Comparing the structures and functions of plant, animal and bacterial cells.
- Explaining how specialised cells are adapted for particular functions.
- Understanding that bacteria are living microorganisms and that some bacteria are useful to humans.
- Describing human and plant reproduction, including fertilisation, growth and development.
- Explaining how multicellular organisms are organised into tissues, organs and organ systems.
- Using scientific evidence to explain how living organisms grow, reproduce and respond to their environment.

This prior learning provides the foundation for understanding how pathogens cause disease, how the body defends itself against infection, and how medicines, vaccines and modern drug development help prevent and treat disease.

Future Learning (KS5)

At A Level Biology, students will build on their knowledge of **pathogens, immunity and disease prevention** by studying the structure and function of bacteria, viruses and other microorganisms in much greater detail. Students will investigate how pathogens interact with host organisms and how immune responses are coordinated at the cellular and molecular level.

Students will develop a deeper understanding of the **immune system**, including the role of different white blood cells, antigens, antibodies and memory cells in defending the body against disease. Students will learn how vaccination leads to immunity and how vaccination programmes can influence disease transmission within populations.

Students will also study the mechanisms of **antibiotic action and antibiotic resistance**, exploring the challenges these present for modern medicine. In addition, students will examine the development and testing of new medicines, including the analysis of clinical trial data, experimental design and the evaluation of scientific evidence.

Throughout A Level Biology, students will apply statistical analysis, data interpretation and scientific reasoning to investigate infectious diseases, evaluate treatments and explain how advances in microbiology, immunology and medicine contribute to improving human health.

Misconceptions

B3.01 Communicable Diseases

- Not all microorganisms are harmful.
- A pathogen and a disease are not the same thing.
- Diseases can spread in different ways, not just by direct contact.

B3.02 Pathogens and Diseases

- Bacteria, viruses, fungi and protists are all different types of pathogen.
- Antibiotics do not kill viruses.
- Mosquitoes carry malaria rather than causing it.

B3.03 Fighting Diseases

- White blood cells have different roles.
- Antibodies and antitoxins are not the same thing.
- The immune system works continuously, not only when you feel ill.

B3.04 Vaccines

- Vaccines prevent disease rather than cure it.
- Vaccines do not contain fully active pathogens.
- Vaccination helps protect both individuals and populations.

B3.05 Drugs

- Antibiotics only work against bacterial infections.
- Painkillers reduce symptoms but do not kill pathogens.
- Antibiotic resistance develops in bacteria, not people.

B3.06 Developing Drugs

- New drugs must be tested before use.
- Placebos are important for fair testing.
- A drug can be effective without being completely safe.

Topic-Wide Misconceptions

- Infection and disease are not the same thing.
- The immune system cannot prevent every disease.
- Scientific conclusions should be based on evidence rather than opinion.

Practical Requisitions

Mastery (HPA)

Students explain and justify biological ideas using evidence from scientific research, experimental data and real-world examples. They apply their knowledge of pathogens, disease transmission, immunity and medical treatments to unfamiliar situations, making links between cause and effect in biological systems.

Students analyse how different pathogens infect organisms, evaluate the effectiveness of vaccination programmes and medical treatments, and explain how the immune system protects the body from disease. They use scientific evidence to compare disease prevention strategies, assess the impact of antibiotic resistance and evaluate the reliability of drug-testing procedures.

Students interpret information from investigations and case studies, identify patterns in evidence and construct balanced scientific arguments about disease control, vaccination and the development of new medicines. They use accurate scientific vocabulary to communicate complex biological ideas clearly and effectively.

B1.01 Cells – Eukaryotes and Prokaryotes		HPA Challenge	Skills	EEF Recommendations
Learning Objectives	- Explain what a pathogen is and how pathogens are spread - Explain how the spread of diseases can be reduced or prevented	Analyse how different pathogens spread between organisms.	Working Scientifically WS 1.1 (Development of Scientific Thinking) Understand the relationship between pathogens, disease transmission and prevention. WS 3.6 (Explain using Evidence) Explain how diseases spread using biological knowledge. WS 3.7 (Evaluation) Evaluate strategies to reduce disease transmission. WS 4.1 (Scientific Vocabulary) Use terms such as pathogen, communicable, transmission and infection accurately.	EEF 4 (Memory): Retrieve prior learning about cells and microorganisms. EEF 3 (Modelling): Model routes of transmission and infection cycles. EEF 6 (Language): Explicit teaching of disease-related vocabulary. EEF 7 (Feedback): Feedback used to improve biological explanations and evaluation.
Do Now (5 mins)	Purpose Retrieve prior learning about cells and microorganisms. Suggested Structure (teacher adapts) - What is a microorganism? - Name one type of living cell. - What is bacteria? Diamond (Challenge) - Why do some microorganisms make us ill while others do not? Teacher Uses Responses To - Assess understanding of bacteria as living organisms. - Address misconceptions about germs and disease. - Prepare pupils for pathogens.	Apply knowledge of transmission routes to explain how infectious diseases can spread rapidly through populations. Evaluate methods used to reduce the spread of communicable diseases.	Maths Skills 1c (Classification) Categorise pathogens and transmission routes. 2c (Patterns and Relationships) Identify relationships between behaviour and disease spread.	
Hook / Intro (5 mins)	Introduce Key Idea “Why can one person with a cold lead to several more people becoming ill?” Suggested Strategy Present a simple classroom scenario: One pupil returns to school with a contagious illness. Ask: - How might the illness spread? - Could everyone become infected? - What factors influence the spread? Pedagogical Rationale Provides an accessible context for understanding transmission and communicable disease.			
Direct Teaching: Cell Structure (10 – 15 mins)	Content: Communicable Diseases Introduce: Communicable Disease			

	• A disease that can be spread between organisms. Pathogen • A microorganism that causes disease. Introduce pathogen groups: • Bacteria • Viruses • Fungi • Protists How Pathogens Cause Disease Explain: • Pathogens enter the body. • They reproduce. • They damage tissues directly or produce toxins. • Illness develops. Methods of Transmission Introduce: Airborne Transmission Examples: • Coughing • Sneezing Direct Contact Examples: • Touching infected people • Bodily fluids Contaminated Food or Water Examples: • Food poisoning Vectors Examples: • Mosquitoes spreading malaria Reducing Disease Spread Examples: • Hand washing • Good food hygiene			
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	• Covering coughs and sneezes • Isolation of infected individuals • Vaccination Key Idea The spread of disease can often be reduced by interrupting transmission. Teacher Modelling (EEF 3) Model pathway: Pathogen → Transmission → Infection → Disease Model explanation: “A virus can leave one person through coughing and enter another person through inhalation, causing infection.” Check for Understanding (Hinge Point) • What is a pathogen? • Name one communicable disease. • How can disease spread through the air? • How does handwashing reduce disease transmission? Mini whiteboards / cold calling			
Guided Practice (10 mins)	Task Type Supported classification and explanation. Pupils • Match pathogens to definitions. • Match diseases to transmission routes. • Explain how transmission occurs in simple scenarios. Teacher Role • Model first examples. • Reinforce scientific vocabulary. • Address misconceptions immediately.			
Main Task (20 mins)	Core Task Pupils: • Explain what pathogens are. • Describe methods of disease transmission. • Explain how disease spread can be reduced. • Apply knowledge to real-life scenarios.			

	Suggested Activities • Transmission route matching • Disease spread case studies • Pathogen classification • Extended explanation question Teacher Flexibility Teachers select format based on class need: • Scenario cards • Flow diagrams • Information sorting task • Structured written responses Success Criteria • Define pathogen correctly. • Explain how pathogens spread. • Describe methods of disease prevention. • Apply scientific understanding to real-life examples. • Use scientific vocabulary accurately. Adaptation Prompts If pupils struggle • Provide pathogen definitions. • Use visual transmission diagrams. • Provide sentence starters. If secure • Compare different transmission routes. • Evaluate prevention methods. • Apply learning to unfamiliar diseases.			
Support / Diamond (challenge)	Support • Vocabulary mat. • Transmission flow diagrams. • Pathogen classification sheet. Example sentence starters: “A pathogen is _____.” “This disease spreads by _____.” “The spread can be reduced by _____.” Diamond (Challenge)			

	• Explain why some diseases spread more rapidly than others. • Evaluate which prevention strategy is most effective in different situations. • Analyse how population density affects disease transmission.			
Common misconceptions	• All microorganisms cause disease. • Bacteria and viruses are the same thing. • Antibiotics cure viral infections. • Diseases spread only through direct contact. • Good hygiene completely prevents infection.			
Assessment (5 mins)	Formative and Summary Quick Check Options • Define pathogen. • Explain one route of transmission. • Suggest a method of disease prevention. • Classify examples of pathogens. Diagnostic Focus Can pupils: • Explain what pathogens are? • Describe transmission routes? • Explain prevention strategies? • Use scientific vocabulary accurately?			
Exit ticket (5 mins)	Purpose Inform planning for B3.02 Bacterial, Viral, Fungal and Protist Diseases Example Questions • What is a pathogen? • Name one transmission route. • Give one way to reduce the spread of disease. Teacher uses responses to identify misconceptions before studying specific diseases.			
Adaptive teaching	• Retrieval links cells and microorganisms to disease. • Hinge questions identify misconceptions early. • Real-world examples support understanding. • Vocabulary is explicitly taught and revisited.			

	• Challenge develops analysis and evaluation. • Exit ticket informs the next lesson.			
British Values	Rule of Law - Students understand the importance of following public health guidance and infection-control measures. Individual Liberty - Students make informed decisions about behaviours that reduce personal disease risk.			
Teacher Notes for MTP adaptations				

B3.02 Bacterial, Vural, Fungal and Protist Diseases		HPA Challenge	Skills	EEF Recommendations
Leaning Objectives	- Explain how pathogenic bacteria and viruses cause damage in the body - Describe salmonella food poisoning and gonorrhoea as examples of bacterial pathogens - Describe measles, HIV and tobacco mosaic virus as examples of viral pathogens - Describe the signs, transmission and treatment of rose black spot infection in plants as an example of a fungal pathogen - Describe the symptoms, transmission and control of malaria, including the role of the mosquito vector, as an example of a protist pathogen	Analyse how different types of pathogens cause disease in animals and plants. Apply knowledge of transmission routes to explain how specific diseases spread. Evaluate methods used to prevent and control bacterial, viral, fungal and protist diseases.	Working Scientifically WS 1.1 (Development of Scientific Thinking) Understand how different pathogens affect living organisms. WS 3.5 (Interpret Data) Compare symptoms, transmission routes and treatments for different diseases. WS 3.6 (Explain using Evidence) Explain disease processes using biological knowledge. WS 3.7 (Evaluation) Evaluate methods used to control disease. WS 4.1 (Scientific Vocabulary) Use terms such as pathogen, bacteria, virus, fungus, protist and vector accurately. Maths Skills 1c (Classification) Classify pathogens and diseases. 2c (Patterns and Relationships) Identify links	EEF 4 (Memory): Retrieve prior learning about communicable diseases and pathogens. EEF 3 (Modelling): Model how to compare different diseases and identify patterns. EEF 6 (Language): Explicit teaching of scientific disease vocabulary. EEF 7 (Feedback): Feedback used to improve explanations and comparisons.
Do Now (5 mins)	Purpose Retrieve prior learning about pathogens, disease transmission and disease prevention. Suggested Structure (teacher adapts) - What is a pathogen? - Name one way communicable diseases can spread. - Give one way disease spread can be reduced. Diamond (Challenge) - Are all pathogens the same? Explain your thinking. Teacher Uses Responses To - Assess understanding of communicable diseases. - Identify misconceptions about microorganisms. - Introduce the idea that different pathogens cause disease in different ways.			
Hook / Intro (5 mins)	Introduce Key Idea "Not all diseases are caused by the same type of pathogen." Suggested Strategy Display images or headlines relating to: - Measles - Malaria - Salmonella food poisoning - Rose black spot Ask:			

	- Are these all caused by the same type of microorganism? - Why might different diseases require different treatments? Pedagogical Rationale Builds curiosity and introduces pathogen diversity.		between pathogens, symptoms and transmission routes.	
Direct Teaching: Cell Structure (10 – 15 mins)	Content: Types of Pathogen Introduce four groups: Bacteria - Single-celled microorganisms. - Reproduce rapidly. - Can produce toxins that damage tissues. Examples: - Salmonella - Gonorrhoea Viruses - Smaller than bacteria. - Reproduce inside living cells. - Cause damage by destroying cells. Examples: - Measles - HIV - Tobacco Mosaic Virus (TMV) Fungi - Some fungal pathogens infect plants. - Spread through spores. Example: - Rose Black Spot Protists - Single-celled organisms. - Some are parasites. Example: - Malaria Disease Examples Salmonella			

	• Spread by contaminated food. • Causes fever, stomach cramps and vomiting. • Controlled through food hygiene and poultry vaccination. Gonorrhoea • Sexually transmitted bacterial disease. • Can be treated with antibiotics. • Antibiotic resistance is becoming a problem. Measles • Viral disease spread through droplets. • Causes fever and skin rash. • Can lead to serious complications. • Prevented through vaccination. HIV • Attacks the immune system. • Can develop into AIDS if untreated. • Spread through bodily fluids. Tobacco Mosaic Virus (TMV) • Plant virus. • Causes leaf discolouration. • Reduces photosynthesis and growth. Rose Black Spot • Fungal plant disease. • Produces black/purple spots on leaves. • Reduces photosynthesis. • Controlled by fungicides and destroying infected leaves. Malaria • Protist disease. • Spread by mosquitoes. • Mosquito acts as a vector. • Common in some tropical regions. Key Idea Different pathogens: • Cause disease in different ways. • Spread using different transmission routes. • Require different control measures. Teacher Modelling (EEF 3)			
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	Model classification: <table><tr><th>Disease</th><th>Pathogen Type</th></tr><tr><td>Measles</td><td>Virus</td></tr><tr><td>Salmonella</td><td>Bacterium</td></tr><tr><td>Malaria</td><td>Protist</td></tr><tr><td>Rose Black Spot</td><td>Fungus</td></tr></table> Model explanation: “Malaria spreads through a mosquito vector, whereas measles spreads through droplets in the air.” Check for Understanding (Hinge Point) • What is a bacterium? • How do viruses cause disease? • Which disease is caused by a protist? • What is a vector? • Why is TMV harmful to plants? Mini whiteboards / cold calling	Disease	Pathogen Type	Measles	Virus	Salmonella	Bacterium	Malaria	Protist	Rose Black Spot	Fungus			
Disease	Pathogen Type													
Measles	Virus													
Salmonella	Bacterium													
Malaria	Protist													
Rose Black Spot	Fungus													
Guided Practice (10 mins)	Task Type Supported classification and comparison. Pupils • Sort diseases by pathogen type. • Match diseases to symptoms and transmission methods. • Compare control strategies. Teacher Role • Model first examples. • Reinforce scientific terminology. • Address misconceptions immediately.													
Main Task (20 mins)	Core Task Pupils: • Compare bacterial, viral, fungal and protist diseases. • Describe symptoms, transmission and treatment. • Explain how pathogens cause disease. • Apply knowledge to unfamiliar disease scenarios. Suggested Activities • Disease comparison table													

	• Pathogen card sort • Transmission pathway matching • Structured explanation questions Teacher Flexibility Teachers select format based on class need: • Comparison matrix • Carousel activity • Information cards • GCSE-style application questions Success Criteria • Correctly identify pathogen types. • Describe disease symptoms and transmission. • Explain how pathogens cause harm. • Compare control methods. • Use scientific vocabulary accurately. Adaptation Prompts If pupils struggle • Provide pathogen summaries. • Use structured comparison tables. • Highlight key information. If secure • Compare disease control strategies. • Analyse similarities and differences between diseases. • Explain why different pathogens require different treatments.			
Support / Diamond (challenge)	Support • Pathogen fact sheets. • Vocabulary mat. • Comparison framework. Example sentence starters: “This disease is caused by a _____.” “The disease spreads through _____.” Diamond (Challenge) • Explain why antibiotics are effective against some diseases but not others. • Compare disease-control strategies used in			

	- plants and animals. - Evaluate which pathogen type presents the greatest challenge to public health.			
Common misconceptions	- All microorganisms are harmful. - Bacteria and viruses are the same thing. - Antibiotics kill viruses. - HIV and AIDS are the same thing. - Malaria is caused by a virus. - Plant diseases cannot affect food production.			
Assessment (5 mins)	Formative and Summary Quick Check Options - Classify a disease by pathogen type. - Identify a transmission route. - Explain how a pathogen causes disease. - Compare bacterial and viral infections. Diagnostic Focus Can pupils: - Identify pathogen types? - Describe how diseases spread? - Explain treatment and prevention methods? - Use scientific vocabulary accurately?			
Exit ticket (5 mins)	Purpose Inform planning for B3.03 Fighting Diseases Example Questions - Name four types of pathogen. - Why are antibiotics not used to treat viral diseases? - What is a vector? Teacher uses responses to identify misconceptions before moving on to the body's defence systems.			
Adaptive teaching	- Retrieval strengthens understanding of pathogens and transmission. - Hinge questions identify misconceptions about treatment and disease types. - Comparison tasks reduce cognitive load. - Vocabulary is explicitly taught and revisited. - Challenge develops evaluation and application skills. - Exit ticket informs planning for immunity and			

	body defences.			
British Values	Tolerance - Students recognise that infectious diseases affect people, plants and communities in different ways around the world. Mutual Respect - Students discuss communicable diseases sensitively and respectfully, recognising their impact on individuals and society.			
Teacher Notes for MTP adaptations				

B3.03 Fighting Diseases		HPA CHALLENGE	Skills	EEF Recommendations
Learning Objectives	- Use a light microscope to observe plant and animal cells - Produce clear, labelled biological drawings from microscope observations - Explain how to use a light microscope safely and effectively as part of Required Practical 1	Analyse how the body's defence systems work together to reduce the risk of infection. Apply knowledge of the immune system to explain how the body responds to unfamiliar pathogens. Evaluate which defence mechanisms are most important in preventing disease.	Working Scientifically WS 1.1 (Development of Scientific Thinking) Understand how biological systems work together to protect organisms from disease. WS 3.6 (Explain using Evidence) Explain immune responses using scientific knowledge. WS 3.7 (Evaluation) Evaluate the effectiveness of different defence mechanisms. WS 4.1 (Scientific Vocabulary) Use terms such as pathogen, immune system, phagocytosis, antibody and antitoxin accurately. Maths Skills 1c (Classification) Categorise physical and chemical defence mechanisms. 2c (Patterns and Relationships) Identify relationships between pathogens and immune responses.	EEF 4 (Memory): Retrieve prior learning about pathogens and communicable diseases. EEF 3 (Modelling): Model how pathogens enter the body and how the immune system responds. EEF 6 (Language): Explicit teaching of specialist immune-system vocabulary. EEF 7 (Feedback): Feedback used to improve explanations of immune responses.
Do Now (5 mins)	Purpose Retrieve prior learning about pathogens and communicable diseases. Suggested Structure (teacher adapts) - What is a pathogen? - Name one bacterial disease. - Name one viral disease. Diamond (Challenge) - Why do most pathogens fail to make us ill? Teacher Uses Responses To - Assess understanding of pathogens. - Identify misconceptions about infection. - Introduce the body's defence mechanisms.			
Hook / Intro (5 mins)	Introduce Key Idea "Your body is constantly surrounded by pathogens, yet you are not always ill. Why?" Suggested Strategy Ask pupils: - How many surfaces have you touched today? - How many people have you been near today? - Why do you not become ill every day? Gather ideas before introducing the body's defence systems. Pedagogical Rationale Highlights the effectiveness of the body's natural barriers and creates curiosity about immunity.			
Direct Teaching: Cell Structure (10 – 15 mins)	Content: First Line of Defence Introduce: The body has several barriers that reduce the chance of			

	infection. Skin Function: • Forms a physical barrier. • Prevents pathogens entering the body. Nose Function: • Produces mucus that traps pathogens. Trachea and Bronchi Function: • Produce mucus. • Contain cilia which move mucus away from the lungs. Stomach Function: • Produces hydrochloric acid. • Kills many pathogens swallowed with food. Key Idea The body tries to prevent pathogens entering before an infection can develop. Content: The Immune System If pathogens enter the body: • The immune system responds. • White blood cells help destroy pathogens. White Blood Cells Phagocytosis White blood cells surround and digest pathogens. Introduce: Phagocytosis • The process of engulfing and destroying pathogens. Antibodies White blood cells can produce antibodies. Function: • Recognise specific pathogens. • Help destroy them.			
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	Antitoxins White blood cells can produce antitoxins. Function: • Neutralise toxins released by bacteria. Key Idea Different white blood cells perform different roles in fighting disease. Teacher Modelling (EEF 3) Model sequence: Pathogen enters body → Immune system activated → White blood cells respond → Pathogen destroyed Model explanation: “If bacteria enter a cut in the skin, white blood cells can recognise the pathogen and destroy it through phagocytosis.” Check for Understanding (Hinge Point) • What is the role of the skin? • What does mucus do? • What is phagocytosis? • What is the role of an antibody? • What is an antitoxin? Mini whiteboards / cold calling			
Guided Practice (10 mins)	Task Type Supported identification and explanation. Pupils • Match defence mechanisms to functions. • Sequence the immune response. • Label diagrams showing pathogen defence. Teacher Role • Model first examples. • Reinforce scientific vocabulary. • Correct misconceptions immediately.			
Main Task (20 mins)	Core Task Pupils: • Describe the body's first-line defences. • Explain the role of white blood cells.			

	• Compare different defence mechanisms. • Explain how the immune system destroys pathogens. Suggested Activities • Defence mechanism matching task • Immune response flow chart • Comparison table • GCSE-style explanation questions Teacher Flexibility Teachers select format based on class need: • Card sort activity • Annotated diagrams • Flow-chart construction • Structured written explanations Success Criteria • Describe physical and chemical barriers. • Explain the role of the immune system. • Describe how white blood cells destroy pathogens. • Use scientific vocabulary accurately. • Explain the sequence of immune responses. Adaptation Prompts If pupils struggle • Provide labelled diagrams. • Use sentence starters. • Provide vocabulary mats. If secure • Compare different immune responses. • Explain why multiple defence systems are needed. • Analyse how pathogens might overcome barriers.			
Support / Diamond (challenge)	Support • Defence mechanism fact sheet. • Labelled immune-system diagrams. • Vocabulary mat. Example sentence starters: “The skin protects the body because _____.”			

	“White blood cells destroy pathogens by _____.” Diamond (Challenge) - Evaluate which defence mechanism is most important. - Explain why antibodies are specific to particular pathogens. - Analyse how different defences work together to prevent disease.			
Common misconceptions	- White blood cells kill every pathogen in the same way. - The immune system only works when a person is ill. - Antibodies and antitoxins are the same thing. - Mucus causes illness rather than helping prevent it. - Skin is the only defence against infection.			
Assessment (5 mins)	Formative and Summary Quick Check Options - Define phagocytosis. - State one function of the skin. - Explain the role of antibodies. - Explain the role of antitoxins. Diagnostic Focus Can pupils: - Identify defence mechanisms? - Explain how white blood cells respond? - Use key vocabulary accurately? - Link structure and function appropriately?			
Exit ticket (5 mins)	Purpose Inform planning for B3.04 Vaccines Example Questions - What is phagocytosis? - How does the skin help prevent disease? - What do antibodies do? Teacher uses responses to identify misconceptions before introducing vaccination and immunity.			
Adaptive teaching	Retrieval strengthens understanding of			

	• pathogens and disease transmission. • Hinge questions identify misconceptions about immunity. • Visual models support understanding of invisible biological processes. • Vocabulary is explicitly taught and revisited. • Challenge develops explanation and evaluation skills. • Exit ticket informs planning for vaccination.			
British Values	Rule of Law - Students understand the importance of following health guidance and protective behaviours that reduce the risk of infection. Individual Liberty - Students recognise how personal choices can influence health and disease prevention.			
Teacher Notes for MTP adaptations				

B3.04 Vaccines		HPA Challenge	Skills	EEF Recommendations
Learning Objectives	- Describe how vaccination works - Explain how vaccination helps protect individuals from disease - Explain how vaccination can reduce the spread of disease through populations	Analyse how vaccination prepares the immune system to respond to pathogens. Apply knowledge of immunity to explain how vaccination reduces the spread of disease within a population. Evaluate the benefits and limitations of vaccination programmes using scientific evidence.	Working Scientifically WS 1.1 (Development of Scientific Thinking) Understand how scientific evidence has led to the development of vaccination. WS 3.5 (Interpret Data) Interpret information about vaccination and disease prevalence. WS 3.6 (Explain using Evidence) Explain immunity and vaccination using scientific knowledge. WS 3.7 (Evaluation) Evaluate vaccination as a disease-prevention strategy. WS 4.1 (Scientific Vocabulary) Use terms such as vaccination, immunity, pathogen, antibody and immune response accurately. Maths Skills 1c (Comparisons) Compare disease rates before and after vaccination. 2c (Patterns and	EEF 4 (Memory): Retrieve prior learning about pathogens, white blood cells and antibodies. EEF 3 (Modelling): Model how vaccination stimulates an immune response. EEF 6 (Language): Explicit teaching of vaccination and immunity vocabulary. EEF 7 (Feedback): Feedback used to improve explanations and evaluation.
Do Now (5 mins)	Purpose Retrieve prior learning about pathogens, antibodies and the immune system. Suggested Structure (teacher adapts) - What is a pathogen? - What is the role of white blood cells? - What do antibodies do? Diamond (Challenge) - Why do people usually not get the same disease repeatedly? Teacher Uses Responses To - Assess understanding of the immune response. - Identify misconceptions about immunity. - Prepare pupils for vaccination.			
Hook / Intro (5 mins)	Introduce Key Idea “How can your body learn to fight a disease before you have ever had it?” Suggested Strategy Present two scenarios: - A vaccinated individual exposed to measles. - An unvaccinated individual exposed to measles. Ask: - Who is more likely to become ill? - Why? - How can the body protect itself before infection? Pedagogical Rationale Creates curiosity and establishes vaccination as a preventative strategy rather than a treatment.			

Direct Teaching: Cell Structure (10 – 15 mins)	Content: Vaccination Introduce: Vaccination • A method of stimulating the immune system against a particular disease. Explain: Vaccines contain: • Dead pathogens • Inactive pathogens • Harmless parts of pathogens These cannot usually cause disease but can trigger an immune response. How Vaccination Works 1. Vaccine enters the body. 2. White blood cells recognise the pathogen. 3. Antibodies are produced. 4. Memory cells remain. 5. If exposed again, antibodies are produced rapidly. Key Idea Vaccination allows the immune system to respond much more quickly during future infections. This reduces: • Illness severity • Disease transmission • Risk of outbreaks Vaccination at Population Level Introduce: If a large proportion of a population is vaccinated: • Fewer people become infected. • Disease spreads more slowly. • Vulnerable individuals receive indirect protection. Teacher Modelling (EEF 3) Model the sequence: Vaccination → Antibody production → memory cells produced → Future exposure → Rapid response		Relationships) Identify relationships between vaccination rates and disease spread.	
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	Model explanation: “The vaccine trains the immune system so that future infections can be dealt with rapidly before serious illness develops.” Check for Understanding (Hinge Point) • What is a vaccine? • Why does vaccination work? • What happens after a vaccinated person encounters a pathogen? • Why can vaccination reduce disease spread? Mini whiteboards / cold calling			
Guided Practice (10 mins)	Task Type Supported sequencing and explanation. Pupils • Sequence stages of vaccination. • Match keywords to definitions. • Explain how vaccines produce immunity. Teacher Role • Model first examples. • Reinforce scientific vocabulary. • Correct misconceptions immediately.			
Main Task (20 mins)	Core Task Pupils: • Explain how vaccination works. • Describe the role of antibodies and memory cells. • Explain how vaccination helps individuals and populations. • Evaluate the importance of vaccination programmes. Suggested Activities • Vaccination flow chart • Immunity sequencing task • Population immunity case study • Structured evaluation question Teacher Flexibility Teachers select format based on class need: • Flow-diagram completion			

	• Scenario cards • Information analysis task • Extended written response Success Criteria • Describe how vaccination works. • Explain the immune response. • Explain how immunity develops. • Describe benefits at both individual and population level. • Use scientific vocabulary accurately. Adaptation Prompts If pupils struggle • Provide vaccination sequence cards. • Use labelled flow diagrams. • Provide sentence starters. If secure • Evaluate the effectiveness of vaccination programmes. • Explain why vaccination protects vulnerable groups. • Apply learning to unfamiliar disease examples.			
Support / Diamond (challenge)	Support • Vaccination flow chart. • Keyword sheet. • Sequencing scaffold. Example sentence starters: “Vaccination works because _____.” “Antibodies are important because _____.” “Vaccination helps populations because _____.” Diamond (Challenge) • Evaluate the benefits and limitations of vaccination programmes. • Explain why high vaccination rates are important. • Analyse how disease outbreaks can occur when vaccination rates fall.			

Common misconceptions	• Vaccines cure diseases. • Vaccines contain fully active pathogens. • Vaccination provides protection immediately. • Antibiotics and vaccines perform the same function. • Vaccination only protects the vaccinated individual.			
Assessment (5 mins)	Formative and Summary Quick Check Options • Define vaccination. • Explain the role of antibodies. • Explain how vaccination provides immunity. • Describe one benefit of vaccination. Diagnostic Focus Can pupils: • Explain how vaccines work? • Describe the role of memory cells? • Link vaccination to disease prevention? • Use scientific vocabulary accurately?			
Exit ticket (5 mins)	Purpose Inform planning for B3.05 Drugs Example Questions • What is vaccination? • Why are memory cells important? • How can vaccination reduce the spread of disease? Teacher uses responses to identify misconceptions before introducing medicines and treatments.			
Adaptive teaching	• Retrieval strengthens understanding of immunity and white blood cells. • Hinge questions identify misconceptions about vaccines. • Visual models support understanding of immune responses. • Vocabulary is explicitly taught and revisited. • Challenge develops evaluation and evidence-based reasoning. • Exit ticket informs progression to antibiotics and medicines.			

British Values	Democracy - Students evaluate scientific evidence and discuss how vaccination programmes benefit populations. Tolerance - Students recognise that different viewpoints may exist and learn to evaluate claims using evidence.
Teacher Notes for MTP adaptations	

B3.05 Drugs		HPA Challenge	Skills	EEF Recommendations
Learning Objectives	- Explain how antibiotics and painkillers are used to treat disease, including their limitations - Describe how sources for drugs have changed over time and give some examples	Analyse the differences between antibiotics and painkillers and explain why they are used for different purposes.	Working Scientifically WS 1.1 (Development of Scientific Thinking) Understand how scientific discoveries have transformed medicine. WS 3.5 (Interpret Data) Interpret information about antibiotic resistance and drug effectiveness. WS 3.6 (Explain using Evidence) Explain how drugs work and why some have limitations. WS 3.7 (Evaluation) Evaluate the benefits and risks associated with different treatments. WS 4.1 (Scientific Vocabulary) Use terms such as antibiotic, resistance, painkiller, aspirin and penicillin accurately. Maths Skills 1c (Comparisons) Compare different types of drugs and treatments. 2c (Patterns and	EEF 4 (Memory): Retrieve prior learning about bacterial and viral pathogens and the immune system. EEF 3 (Modelling): Model comparisons between antibiotics and painkillers and how to construct balanced evaluations. EEF 6 (Language): Explicit teaching of medical and treatment-related vocabulary. EEF 7 (Feedback): Feedback used to improve scientific explanations and evaluations.
Do Now (5 mins)	Purpose Retrieve prior learning about pathogens, disease and vaccination. Suggested Structure (teacher adapts) - What is a bacterial pathogen? - What is a viral pathogen? - Why are vaccines used? Diamond (Challenge) - If your body already has an immune system, why might medicines still be needed? Teacher Uses Responses To - Assess understanding of disease. - Identify misconceptions about treatment. - Prepare pupils for learning about medicines.	Apply knowledge of antibiotic resistance to explain why some bacterial diseases are becoming harder to treat. Evaluate the importance of discovering new drugs and the challenges associated with antibiotic resistance.		
Hook / Intro (5 mins)	Introduce Key Idea “Have you ever taken medicine when you were ill? Did it actually kill the pathogen?” Suggested Strategy Display common medicines: - Paracetamol - Ibuprofen - Antibiotics Ask: - Do all medicines work in the same way? - Which medicines actually kill pathogens? - Which medicines only reduce symptoms? Pedagogical Rationale Challenges the common misconception that all medicines cure disease.			
Direct Teaching: Cell Structure (10 – 15 mins)	Content: Antibiotics Introduce: Antibiotics			

	- Medicines that kill bacteria or prevent them reproducing. - Used to treat bacterial diseases. Example: Penicillin - One of the first antibiotics discovered. - Originally developed from a mould. Key Idea Antibiotics only work against bacteria. They do not work against viruses because viruses reproduce inside body cells. Antibiotic Resistance Explain: - Some bacteria are resistant to antibiotics. - Resistant bacteria survive and reproduce. - Resistant strains become more common over time. Introduce: Resistance - The ability of bacteria to survive treatment by antibiotics. Content: Painkillers Introduce: Painkillers - Reduce symptoms such as pain. - Do not destroy pathogens. Examples: - Aspirin - Paracetamol - Ibuprofen Key Idea Painkillers help patients feel better but do not cure the infection itself. Sources of Drugs Introduce: Historically many medicines came from plants and microorganisms.		Relationships) Identify trends in antibiotic resistance.	
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	Examples: Aspirin - Originally developed from chemicals found in willow bark. Digitalis - Derived from foxglove plants. - Used to treat some heart conditions. Penicillin - Derived from mould. Modern Drug Discovery Today drugs may be discovered by: - Studying natural products. - Screening chemicals. - Scientific research and development. Teacher Modelling (EEF 3) Model comparison: <table><tr><th>Antibiotic</th><th>Painkiller</th></tr><tr><td>Kills bacteria</td><td>Relieves symptoms</td></tr><tr><td>Treats bacterial infections</td><td>Does not kill pathogens</td></tr><tr><td>Can become less effective due to resistance</td><td>No effect on antibiotic resistance</td></tr></table> Model explanation: “Antibiotics are useful against bacterial diseases, but they are ineffective against viral infections because viruses live inside body cells.” Check for Understanding (Hinge Point) - What is an antibiotic? - Why do antibiotics not work against viruses? - What is antibiotic resistance? - What do painkillers do? - Name one medicine that came from a natural source. Mini whiteboards / cold calling	Antibiotic	Painkiller	Kills bacteria	Relieves symptoms	Treats bacterial infections	Does not kill pathogens	Can become less effective due to resistance	No effect on antibiotic resistance			
Antibiotic	Painkiller											
Kills bacteria	Relieves symptoms											
Treats bacterial infections	Does not kill pathogens											
Can become less effective due to resistance	No effect on antibiotic resistance											
Guided Practice (10 mins)	Task Type Supported comparison and explanation. Pupils Classify medicines by type.											

	• Match examples to sources. • Compare antibiotics and painkillers. Teacher Role • Model first examples. • Reinforce scientific vocabulary. • Correct misconceptions immediately.			
Main Task (20 mins)	Core Task Pupils: • Explain how antibiotics and painkillers are used. • Compare their roles in disease treatment. • Explain the problem of antibiotic resistance. • Describe how drug sources have changed over time. Suggested Activities • Drug comparison table. • Resistance case study. • Medicine source card sort. • Structured evaluation task. Teacher Flexibility Teachers select format based on class need: • Information carousel. • Comparison tables. • Scenario-based application questions. • Extended written responses. Success Criteria • Explain how antibiotics work. • Explain how painkillers work. • Describe antibiotic resistance. • Describe natural and modern drug sources. • Use scientific vocabulary accurately. Adaptation Prompts If pupils struggle • Provide comparison frameworks. • Highlight key features of each drug type. • Use sentence stems. If secure • Explain why resistance develops. • Compare the impact of different medicines.			

	Evaluate the need for discovering new antibiotics.			
Support / Diamond (challenge)	Support - Drug comparison sheet. - Vocabulary mat. - Structured explanation scaffold. Example sentence starters: “Antibiotics are used because _____.” “Painkillers help by _____.” “Resistance occurs when _____.” Diamond (Challenge) - Evaluate why antibiotic resistance is a global concern. - Explain why discovering new antibiotics is important. - Analyse the advantages of drugs from natural and synthetic sources.			
Common misconceptions	- Antibiotics kill viruses. - Painkillers cure infections. - Resistance develops in people rather than bacteria. - Stronger antibiotics always work better. - All medicines come from laboratories.			
Assessment (5 mins)	Formative and Summary Quick Check Options - Define antibiotic. - Define resistance. - Explain why antibiotics do not treat viral diseases. - State one source of a medicine. Diagnostic Focus Can pupils: - Distinguish between antibiotics and painkillers? - Explain resistance? - Describe sources of medicines? - Use scientific vocabulary accurately?			

Exit ticket (5 mins)	Purpose Inform planning for B3.06 Developing Drugs Example Questions • Why do antibiotics not treat viral diseases? • What is antibiotic resistance? • Give one example of a medicine from a natural source. Teacher uses responses to identify misconceptions before introducing drug testing and development.			
Adaptive teaching	• Retrieval strengthens understanding of pathogens and immunity. • Hinge questions identify misconceptions about medicines. • Comparisons reduce cognitive load and improve understanding. • Explicit vocabulary instruction supports scientific literacy. • Challenge develops evaluation and analytical thinking. • Exit ticket informs progression into drug development.			
British Values	Individual Liberty - Students understand how informed choices about medicine use can affect personal and public health. Tolerance - Students recognise that different treatments may affect individuals differently and that medical decisions should be evidence-based.			
Teacher Notes for MTP adaptations				

B3.06 Developing Drugs		HPA Challenge	Skills	EEF Recommendations
Learning Objectives	- Describe how new drugs are tested through pre-clinical testing and clinical trials - Explain the purpose of double-blind trials and placebos - Evaluate how scientists determine whether a	Analyse why rigorous testing is required before new drugs can be approved for use.	Working Scientifically WS 1.1 (Development of Scientific Thinking) Understand how scientific	EEF 4 (Memory): Retrieve prior learning about medicines, pathogens and treatments. EEF 3 (Modelling): Model the

Do Now (5 mins)	drug is safe and effective Purpose Retrieve prior learning about antibiotics, painkillers and drug development. Suggested Structure (teacher adapts) - What is an antibiotic? - What is a painkiller? - Why is antibiotic resistance a problem? Diamond (Challenge) - Why shouldn't a new medicine be given to patients immediately after it has been discovered? Teacher Uses Responses To - Assess understanding of medicines. - Identify misconceptions about drug safety. - Prepare pupils for the idea of drug testing.	Apply evidence from clinical trials to determine whether a drug should be considered successful. Evaluate the strengths and limitations of different stages of drug testing.	evidence informs medical decisions. WS 2.2 (Experimental Skills and Strategies) Understand how variables are controlled during testing. WS 3.5 (Interpret Data) Analyse evidence from clinical trials and investigations. WS 3.7 (Evaluation) Evaluate the reliability and validity of trial results. WS 4.1 (Scientific Vocabulary) Use terms such as toxicity, efficacy, clinical trial, placebo and double-blind accurately. Maths Skills 1c (Comparisons) Compare outcomes from different treatments. 2c (Patterns and Relationships) Identify trends in trial data. 4a (Interpretation) Interpret results from investigations and clinical studies.	stages of drug testing and interpretation of trial results. EEF 6 (Language): Explicit teaching of specialist scientific and medical terminology. EEF 7 (Feedback): Feedback used to improve evaluation and evidence-based reasoning.
Hook / Intro (5 mins)	Introduce Key Idea "Would you take a medicine that had never been tested?" Suggested Strategy Present a scenario: Scientists believe they have discovered a new drug that may treat a serious disease. Ask: - Should doctors begin using it immediately? - What could go wrong? - How would scientists know if it works? Pedagogical Rationale Creates a clear need for evidence-based testing and links to real-world medicine.			
Direct Teaching: Cell Structure (10 – 15 mins)	Content: Why New Drugs Must Be Tested Explain: Scientists need to know: - Is the drug safe? - Does the drug work?			

	• What is the correct dose? Stage 1: Pre-Clinical Testing Explain: New drugs are first tested: • On cells and tissues. • Then on animals. Scientists investigate: Toxicity • Does the drug cause harm? Efficacy • Does the drug work? Dose • What quantity of the drug is effective? Stage 2: Clinical Trials Once pre-clinical testing is successful: The drug is tested on humans. Healthy Volunteers Initially: • Small doses. • Check for side effects. Patients Later: • Larger groups. • Determine effectiveness. Double-Blind Trials Explain: In a double-blind trial: • Patients do not know whether they have received the drug. • Doctors do not know who has received the drug. This reduces bias. Placebos Introduce: Placebo			
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	• A treatment that looks like the drug but contains no active ingredient. Used to compare results fairly. Key Idea Scientists require reliable evidence before a drug can be approved. Teacher Modelling (EEF 3) Model a drug testing sequence: Discovery → Pre-clinical testing → Clinical trial → Approval Model explanation: “A placebo allows scientists to compare whether improvements are caused by the drug itself or by other factors.” Check for Understanding (Hinge Point) • What is toxicity? • What is efficacy? • Why are placebos used? • What is a double-blind trial? • Why are clinical trials important? Mini whiteboards / cold calling			
Guided Practice (10 mins)	Task Type Supported sequencing and evaluation. Pupils • Match testing stages to descriptions. • Sequence the drug testing process. • Match key terms to definitions. Teacher Role • Model first examples. • Reinforce scientific vocabulary. • Correct misconceptions immediately.			
Main Task (20 mins)	Core Task Pupils: • Describe the stages of drug testing. • Explain why drugs must be tested.			

	• Explain the role of placebos and double-blind trials. • Evaluate the reliability of clinical trials. Suggested Activities • Flow-chart completion • Clinical trial sorting activity • Drug testing comparison table • Extended evaluation question Teacher Flexibility Teachers select format based on class need: • Sequencing cards • Case-study analysis • Structured notes • GCSE-style application questions Success Criteria • Describe pre-clinical testing. • Describe clinical trials. • Explain the purpose of placebos. • Explain the purpose of double-blind trials. • Evaluate evidence from drug testing. • Use scientific vocabulary accurately. Adaptation Prompts If pupils struggle • Provide a drug-testing flowchart. • Use keyword matching activities. • Provide sentence starters. If secure • Analyse clinical trial scenarios. • Evaluate strengths and weaknesses of testing methods. • Explain why scientific evidence is important when approving drugs.			
Support / Diamond (challenge)	Support • Drug testing flow diagram. • Vocabulary mat. • Sequencing scaffold. Example sentence starters: “A placebo is used because _____.”			

	“Clinical trials are important because _____.” “Scientists test drugs to determine _____.” Diamond (Challenge) - Evaluate which stage of drug testing is most important. - Analyse why double-blind trials increase reliability. - Explain the ethical challenges involved in testing new medicines.			
Common misconceptions	- Drugs only need to be tested once. - Placebos are fake treatments with no scientific value. - Double-blind trials are designed to hide information permanently. - A successful drug automatically has no side effects. - If a drug works for one person it will work for everyone.			
Assessment (5 mins)	Formative and Summary Quick Check Options - Define toxicity. - Define efficacy. - Explain the role of a placebo. - Explain why double-blind trials are used. Diagnostic Focus Can pupils: - Describe drug testing stages? - Explain placebos and double-blind trials? - Evaluate evidence from clinical trials? - Use scientific vocabulary accurately?			
Exit ticket (5 mins)	Purpose Review and consolidate the entire B3 Infection and Response topic. Example Questions - What is a placebo? - Why are drugs tested before use? - Why are double-blind trials important?			

	Teacher uses responses to identify areas requiring retrieval and revision.			
Adaptive teaching	• Retrieval links medicines to disease treatment. • Hinge questions identify misconceptions about testing and evidence. • Flow diagrams reduce cognitive load. • Vocabulary is explicitly taught and revisited. • Challenge develops evaluation and evidence-based judgement. • Exit ticket informs future retrieval activities and end-of-unit revision.			
British Values	Rule of Law - Students understand why strict testing procedures, regulations and ethical guidelines must be followed before medicines can be approved. Democracy - Students evaluate evidence from clinical trials before reaching conclusions about effectiveness. Mutual Respect - Students recognise the importance of fairness, ethics and participant welfare during scientific testing.			
Teacher Notes for MTP adaptations				