

# CAIE Biology A-level

## Topic 10: Infectious Disease

### Flashcards

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Define the term “infectious disease”.



Define the term “infectious disease”.

A disease caused by a pathogen which can be transmitted.



Define the term “non-infectious disease”.  
Give two examples.



Define the term “non-infectious disease”. Give two examples.

A disease that cannot be transmitted by direct contact between individuals, e.g. sickle cell anaemia or lung cancer.



State the binomial name and pathogen type for cholera.



State the binomial name and pathogen type for cholera.

- *Vibrio cholerae*
- Bacterium



State the binomial names and pathogen type for malaria.





State the binomial names and pathogen type for malaria.

- *Plasmodium ovale*
- *Plasmodium falciparum*
- *Plasmodium malariae*
- *Plasmodium vivax*
- Protoctist



State the binomial names and pathogen type for tuberculosis.



State the binomial names and pathogen type for tuberculosis.

- *Mycobacterium tuberculosis*
- *Mycobacterium bovis*
- Bacterium



State the pathogen type for HIV/AIDS.



State the pathogen type for HIV/AIDS.

Virus



# What does HIV stand for?



State the pathogen type for HIV/AIDS.

Human immunodeficiency virus



# What does AIDS stand for?





What does AIDS stand for?

Acquired immunodeficiency syndrome



\*State the genus names and pathogen type for smallpox and measles.

\*2019-2021 syllabus



\*State the genus names and pathogen type for smallpox and measles.

- Both viruses
- Smallpox - *Variola*
- Measles - *Morbillivirus*

\*2019-2021 syllabus



# What causes HIV/AIDS?



# What causes HIV/AIDS?

1. HIV virus is transmitted by direct contact with blood, semen, rectal fluids, vaginal fluids and breast milk
2. Attachment proteins bind to complementary CD4 receptor on  $T_H$  cells
3. HIV particles replicate inside  $T_H$  cells, killing or damaging them
4. AIDS develops when there are too few  $T_H$  cells for the immune system to function



# How is HIV/AIDS treated?



## How is HIV/AIDS treated?

Taking a combination of antiretroviral drugs prevents HIV replication. Post exposure prophylaxis (PEP) can prevent infection after exposure.



# What causes tuberculosis (TB)?





# What causes tuberculosis (TB)?

1. Transmitted by droplet infection (inhalation)
2. Trigger inflammatory response by infecting phagocytes in lungs
3. Infected phagocytes are sealed in waxy-coated tubercles so bacteria remain dormant. Primary TB has no symptoms
4. If another factor weakens immune system, bacteria become active. Secondary TB destroys lung tissue



Outline the primary treatment of TB.



Outline the symptoms and primary treatment of TB.

Patients take a combination of antibiotics for several months.



# How is cholera transmitted?



## How is cholera transmitted?

- Fecal/oral transmission.
- Ingesting contaminated food or water



# How is cholera treated?



## How is cholera treated?

- Rehydration (fluid and electrolytes)
- Antibiotics



# How is measles transmitted?





# How is measles transmitted?

Droplet infection from coughing or sneezing.



Why may the incidence and prevalence of communicable diseases change over time?



# Why may the incidence and prevalence of communicable diseases change over time?

- Development of **vaccines**
- Development of **treatments**, e.g. antibiotics
- Random mutations cause **antigen variability** in pathogens. Memory cells no longer complementary
- Random mutations result in **treatment-resistant strains**



# How can the spread of HIV be prevented?



# How can the spread of HIV be prevented?

- Take PEP
- Multi-drug treatment (HIV difficult to control due to high antigen variability)
- Use clean needles
- Screen blood donations to ensure they are not HIV positive (ethically important not to outsource cheap blood e.g. from prison donations)
- Education
- Use of condoms



# How can the spread of TB be prevented?



## How can the spread of TB be prevented?

- Combination of drugs and vaccinations (expensive)
- Cover mouth & nose when coughing/ sneezing
- Quarantine (socially isolating)
- Improved sanitation



# How can the transmission of measles be prevented?





# How can the transmission of measles be prevented?

- Vaccinate population (expensive)
- Education on nutrition (vitamin A deficiency increases susceptibility)
- Education on sanitation for infants



# How can the transmission of cholera be prevented?



# How can the transmission of cholera be prevented?

- Education on water sanitation i.e. don't drink untreated water
- Education on contamination of water supply e.g. sewage



Outline the mode of transmission and infection of the *Plasmodium spp.* parasite.



Outline the mode of transmission and infection of the *Plasmodium spp.* parasite.

- Female mosquito acts as vector when it transfers saliva to another organism during feeding
- Parasite reproduces asexually in red blood cells in liver, causing lysis



# How is endemic malaria controlled?



# How is endemic malaria controlled?

- **Preventing mosquito bites** - mosquito nets, insect repellent
- **Controlling mosquito numbers** - pesticides, chemical treatment of standing water and sewage, introduction of predators for mosquitoes
- **Drug treatment**



Consider the biological, social and economic factors of preventing infectious disease.





# Consider the biological, social and economic factors of preventing infectious disease.

- Diseases generally spread faster in **densely populated** and **poorly sanitized** areas
- Countries with **healthcare systems** and good **education** often have less disease. People educated on how to prevent the spread of disease and can access treatments and vaccines
- **Social stigma** - some countries may see diseases (e.g. HIV) as socially stigmatising. People may avoid seeking treatment for risk of social fallout
- **Patronage of developed countries** - vaccination programmes from developed nations considered suspicious. Programmes used in the past to sample DNA without the consent of indigenous people



Describe and explain the global distribution of malaria, TB and HIV/AIDS.



# Describe and explain the global patterns of malaria, TB and HIV/AIDS.

- **Malaria** - generally in tropical countries (warm temperatures required for survival of plasmodium). Such countries tend to lack education and healthcare. Malaria is uncontrolled and there is a lack of or no education regarding prevention methods.
- **TB** - common in developing countries where people live in cramped, poorly sanitised conditions (proximity essential for TB transmission). Treatment and education in prevention are rare.
- **HIV/AIDS** - common in developing nations. Lack of access to education in prevention. Lack of access to healthcare means many people go undiagnosed and untreated.



How does penicillin act as an antibiotic?  
Name its type and mode of action.



How does penicillin act as an antibiotic? Name its type and mode of action.

**Penicillin** inhibits the synthesis of the peptidoglycan wall in bacteria, preventing new cell walls forming. The cell bursts.

This class of antibiotic is **bactericidal**. They work by preventing cell wall synthesis or disrupting protein synthesis.



# Why do antibiotics have no effect on viruses?



# Why do antibiotics have no effect on viruses?

Antibiotics work by targeting machinery found in bacteria (prokaryotic cells). Viruses do not have this machinery  $\therefore$  antibiotics have no effect on viruses.



Why is it important antibiotics do not affect eukaryotes?





Why is it important antibiotics do not affect eukaryotes?

Humans (host) are eukaryotic. If antibiotics affected eukaryotic cells they could potentially kill the recipient.



# How does antibiotic resistance occur?



# How does antibiotic resistance occur?

- **Spontaneous mutation** of bacterial **plasmids** can occur which may lead to improved tolerance to an antibiotic. These cells are able to survive long enough to divide, increasing the prevalence of the mutation and making the population more resistant to a particular antibiotic.
- Resistance can be spread '**horizontally**' – the movement of genetic material between unicellular and/or multicellular organisms (**conjugation**) other than by the 'vertical' transmission of DNA from parent to offspring via reproduction.



# How can we mitigate bacterial resistance?



# How can we mitigate bacterial resistance?

- Complete the course of antibiotics to ensure the bacterial infection is eliminated
- Do not overuse antibiotics
- Do not use antibiotics in animal feed
- Reduce contamination in hospitals
- Aseptic techniques in hospitals
- Isolation of infected patients
- Emphasis on hygiene
- Reduce use of antibacterial hand gel – removes non-pathogenic bacteria, allowing pathogenic bacteria to survive.

