GCSE 9-1 Biology Revision Topic 5 – health, disease and the development of medicine (paper 1)

Key definitions – must learn – link up

Pathogen	An enzyme in tears, saliva and mucus that is antibacterial
Health	A protein produced by B lymphocytes, binds to specific antigens to destroy it
Communicable disease	A cell made on fusing a plasma cell with a myeloma cell
Non communicable disease	Techniques to prevent unwanted micro organisms entering
Antibody	Pathway in virus lifecycle where virus genetic material is inserted into host cell DNA for replication each time cell divides
Antigen	A disease that is not spread from person to person or animal to animal
Lytic pathway	Destroys micro organisms on surfaces, not used internally in body
Lysogenic pathway	Making an individual immune , for example by vaccinating
Lysozyme	A tumour cell that keeps dividing by mitosis
Immunisation	Drug that kills bacteria or prevents their replication by binary fission
Aseptic technique	A complete state of physical, social and mental wellbeing
Hybridoma	Protein on surface of cell that white blood cells recognise
Myeloma	Pathway in virus lifecycle on entering cell to produce more virus causing lysis when viruses released from cell
Antibiotic	Disease causing micro organism, includes viruses, fungi, bacteria and protoctista
Antiseptic	A disease that can be spread directly from person to person

You must be able to link the disease to pathogen type, how transmitted and symptoms for cholera, HIV, malaria, TB, ebola, ash die back, stomach ulcers, chlamydia (see your notes)

You have a **first line of defence** to protect you from pathogens entering your body and into the blood where they will cause an infection, *state which are* ***chemical or physical barriers***:

- Skin – too thick for most pathogens to get through
- Hydrochloric acid in the stomach - kills ingested micro organisms
- Lysozyme in tears, mucus and saliva – kills bacteria by breaking down cell walls
- Ear wax – protects ears
- Nasal hair – traps inhaled pathogens
- Ciliated epithelial cells in the trachea – waft mucus away from the lungs to the throat, where it is swallowed and enters the stomach
- Mucus in trachea – traps pathogens

Once pathogens have entered the body there are different categories of drugs which you might be able to take to kill the pathogen:
Antibacterials kill _____
Antifungals kill _____
Antivirals kill _____
Antiseptics kill _____ on_____ of bodies

Antiseptic use eg in hand washes, hand rubs are used to decrease transmission of infections (including ones that are resistant or sensitive to antibiotics if a bacterial infection) by killing the pathogens on the surface of the skin, this prevents further spread to other people and can reduce the incidence of disease eg MRSA spread in hospitals.

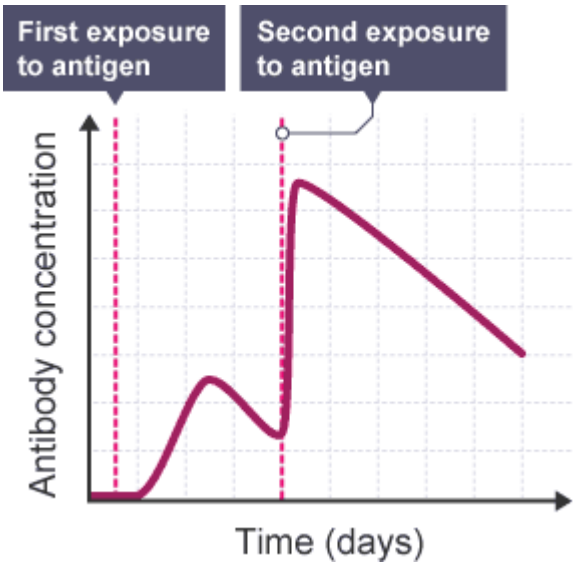
So if bacteria enter your body evading the _____ line of defence (eg skin), an infection can develop rapidly.

On the surface of pathogens there are _____, (mainly made of protein) which the immune system detects as being foreign, triggering a response

The immune response to a pathogen when an infection arises

This is due to _____ blood cells:

- Phagocytes do _____ and digest pathogens using _____. They are not specific to 1 pathogen .
- B Lymphocytes produce _____ which kill pathogens and are _____ to one antigen.
- When a B lymphocyte encounters and binds to its specific _____ for the first time, it divides by _____ to produce plasma cells which produce the _____ and also _____ cells that can last a lifetime. This is known as the _____ immune response. These cells are important in case the person encounters the pathogen again which will trigger the _____ immune response.



In the secondary immune response the antibody levels are _____

The response is _____

The antibodies last for _____

The individual will have no or fewer symptoms from the infection, due to being immune by having the _____ cells

Vaccination – involves giving a vaccine (injecting or given orally) to individuals, contains _____of the pathogen, or weakened or dead _____ that will protect against the specific disease for many years. This is by the generation of a primary immune response so that the individual has _____ cells to the specific pathogen so if they encounter the pathogen their response will be the _____ immune response, limiting symptoms and ill health.

Person is injected with the dead pathogen/antigen/weakened pathogen which is harmless

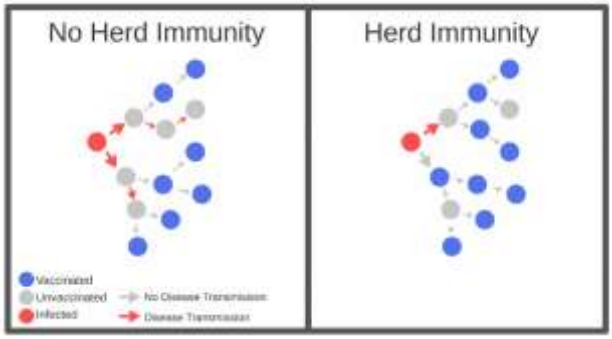
↓

antigen triggers B lymphocyte to produce antibodies and memory cells

↓

memory cells will respond quickly to pathogen if person becomes infected later on

Vaccination and herd immunity – explain using the diagram:



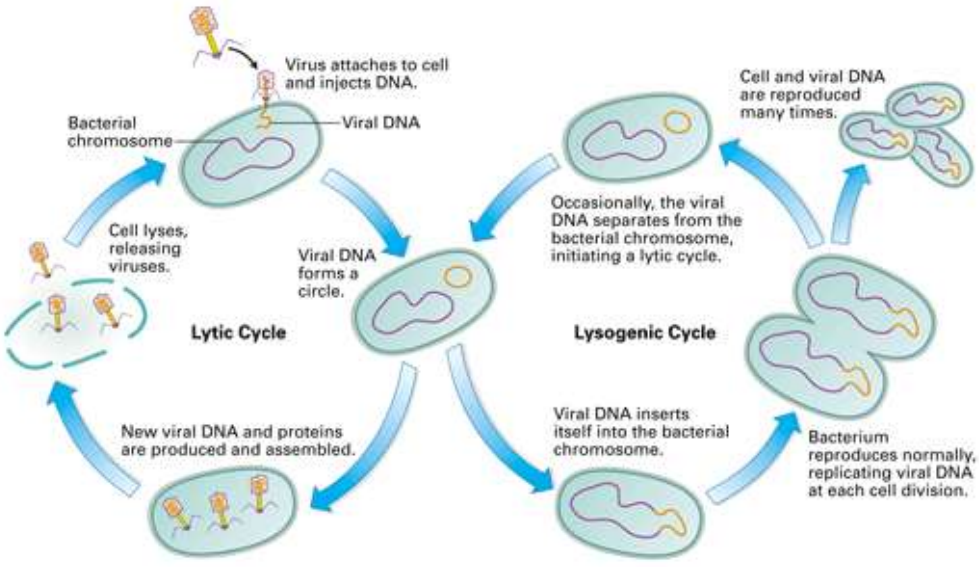
Plus points of vaccination	Minus points of vaccination

Viruses eg HIV, Ebola

What is a virus coat made of?

What is the genetic content of a virus?

Can viruses replicate on their own?



Viruses replicate using the lytic or lysogenic pathway, some viruses can change between the pathways

You must be able to compare and contrast the 2 cycles

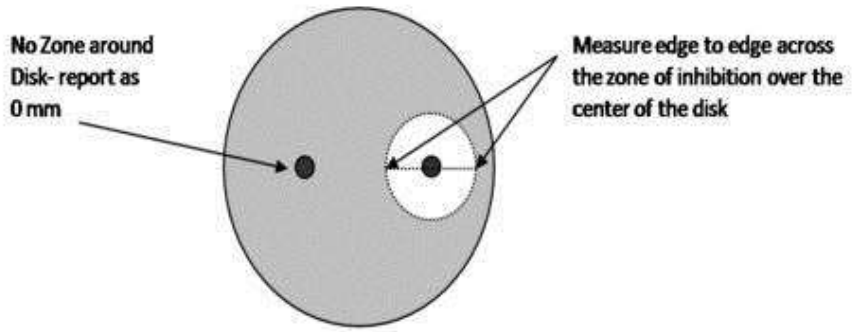
Ways to prevent HIV transmission (consider between adults and mother to fetus/baby)

Ways to prevent chlamydia transmission (consider between adults and mother to fetus/baby)

Core practical: how to determine the effect of antibiotics/antiseptic/plant product on bacteria

Study effect by placing antibiotic disc, antiseptic or plant product on a _____ which is placed on a bacterial culture evenly spread on _____ in a _____ dish, incubated for 24-48 hours. Then you measure the diameter of the clear zone (where no bacterial growth occurs due to the chemical killing the bacteria) around the disc, from this calculate the _____ using πr^2.

By calculating this you can compare how effective the chemical is. The larger the cross sectional area = _____ effective, the smaller the cross sectional area = _____ effective



What processes in bacteria do antibiotics stop to kill them?

What would you use as a control in the experiment?

1. Calculate the cross sectional area of a clear diameter zone of 15mm with no bacteria around an antibiotic A
2. Antibiotic B has a clear diameter zone of 18mm, calculate the cross sectional area

3. Which is the more effective antibiotic?

Aseptic technique = any technique to reduce the chance of contaminating cultures (or cells/tissues) with unwanted microorganisms from the air or surfaces

1. How can you sterilise petri dishes and agar?

2. What do you do when opening the petri dish lid?

3. How can you create a more sterile atmosphere when opening petri dish lids?

4. What will you use to place discs onto agar?

5. What do you do to petri dish lid and base when incubating?

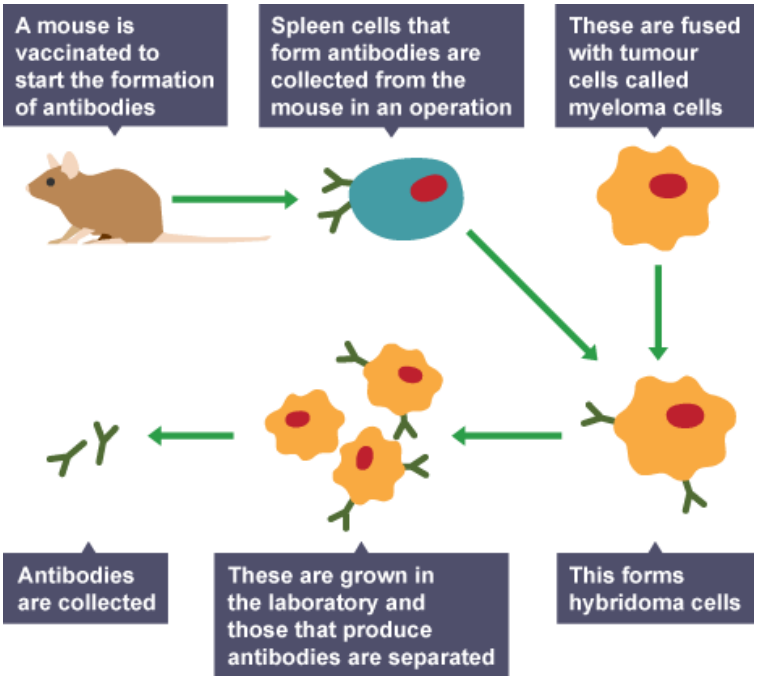
6. What do you wear to protect yourself when working with bacteria?

7. What is done to all used equipment eg loops, pipettes, spreaders after use?

Drug testing - any drug before being given a license so it can be prescribed undergoes extensive testing, place the events in the right order for developing a new antibiotic (could be any other drug too):

	Test compounds on animals to check effect on whole body eg mice
	Test compounds on large number of people with the disease that the drug is going to be used to treat, to work out correct dose and side effects in large number of different people
	Screening of new potential compounds to see if they kill bacteria
	Test compounds on healthy volunteers to check it is not toxic and side effects are few. clinical testing
	Test compounds on cultures of cells and tissues in tissue culture in the lab to see if cells are damaged (side effects) pre clinical testing

Monoclonal antibodies – for human use



What is the mouse injected with?

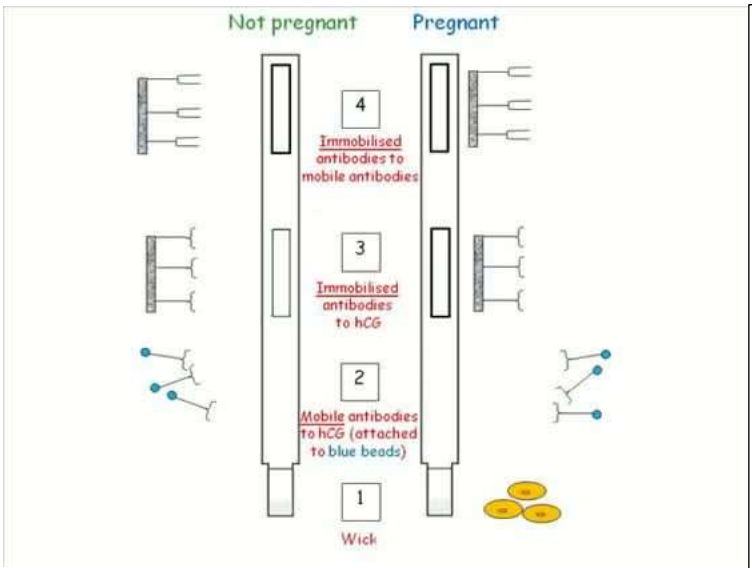
What cells produce the monoclonal antibodies?

Monoclonal antibodies are identical copies of antibodies specific to an antigen that have been made in laboratories. They need to be made in large numbers to use commercially, eg:

- pregnancy testing
- locating blood clots and cancer cells via antigens, antibody has radioactive marker attached so can be seen with a scanner
- treatment of diseases such as cancer (instead of drug and radiotherapy that have more whole body side effects as they kill cancer and normal body cells), as drug attached to antibody to deliver to tumour cells only

Pregnancy testing using monoclonal antibodies

The placenta produces the hormone _____ (human Chorionic Gonadotropin)



Point 1 – urine moves up the strip

Point 2 – HCG in urine binds to monoclonal antibody to HCG that is not fixed to strip and has a blue bead attached, so the 2 bound together move up the strip

Point 3 – another monoclonal antibody that is fixed to the strip binds to the HCG antibody complex and it can't move further, blue dye can now be seen as line

Point 4 – to show test works, further monoclonal antibody specific to the mobile monoclonal antibodies with blue dye bind and blue band seen

Can produce monoclonal antibodies to any antigen eg to test for chlamydia in urine. If you get an exam question on this apply same principles as above

Eg to test for chlamydia what antigen is injected into the mouse?

Plants – defence against diseases and drugs from plants

1. What do plants have on upper surface of leaves for protection from pathogens?

Is this a chemical or physical barrier?

2. What do trees have on their outer surface as protection?
3. What can fungi produce to penetrate through waxy cuticles, bark and cellulose cell walls?

Insects and pests can penetrate through these physical barriers, so some plants have **chemical defence mechanisms** eg poisons which they release on being attacked. Some release insect repellent chemicals eg aphids are deterred by a chemical released from wild potato plants

4. What is a greenfly feeding on when it inserts its mouthpart into phloem vessels?

Drugs from plants – some of the chemicals plants produce to protect themselves against pest attack and pathogens are useful to humans. Match the plant to its drug and use

Taxol	Juice from leaves of aloe plant	Anti malarial drug
Aspirin	Cinchona tree	Anti cancer drug
Quinine	Pacific yew tree bark	Wound healing
Aloe vera	Willow tree bark and leaves	Treat pain and a high temperature

Diagnosing plant diseases – important to diagnose and treat plant diseases (if possible) to increase food security. How is this done?:

1. By visible symptoms (can use a drones) eg too little water, low mineral ions, disease. Look for colour, blotching of leaves, change in growth
2. Look for where the damaged crops = distribution analysis eg 1 area only (?pathogen), , widespread area (? Drought, flood, wind spread)
3. Specific test eg culture fungus or bacteria from plants on agar using aseptic technique (to avoid contamination), DNA analysis, soil testing

Non communicable diseases - Ensure you look at notes on:

Deficiency diseases due to malnutrition eg scurvy, anaemia, obesity, liver disease (due to excess alcohol - cirrhosis)

Cardiovascular diseases – causes and how treated (drugs, surgery through stents, dietary changes)

Calculating BMI and waist to hip ratios to determine obesity

Smoking and disease – atherosclerosis

Past paper long answer questions

Additional sample B1 q5 – this would now include your wider range of diseases

*(d) Describe how different pathogens are spread within human populations.

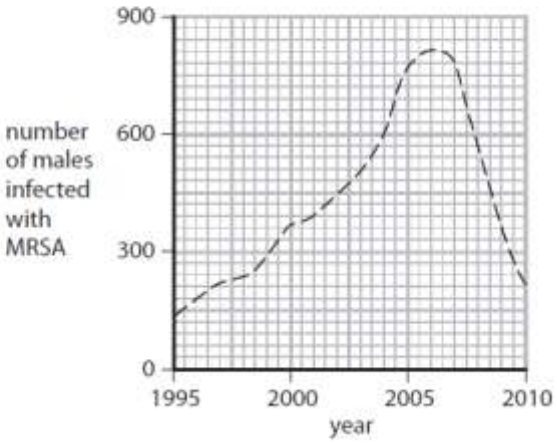
(6)

B1 June 2014B3 june 2017 q5

Q6

*(d) Hospitals have introduced programmes to reduce MRSA infections in patients because antibiotics have become less effective.

The graph shows the number of males infected with MRSA during their stay in hospital.



A programme of intensive use of antiseptics in hospitals has been used since 2005.

Use the information given and your own scientific knowledge to explain the trends shown in the graph [6]

B3 june 2016 q4

(b) Blood clots can be detected using monoclonal antibodies.

(i) Describe how monoclonal antibodies are produced.

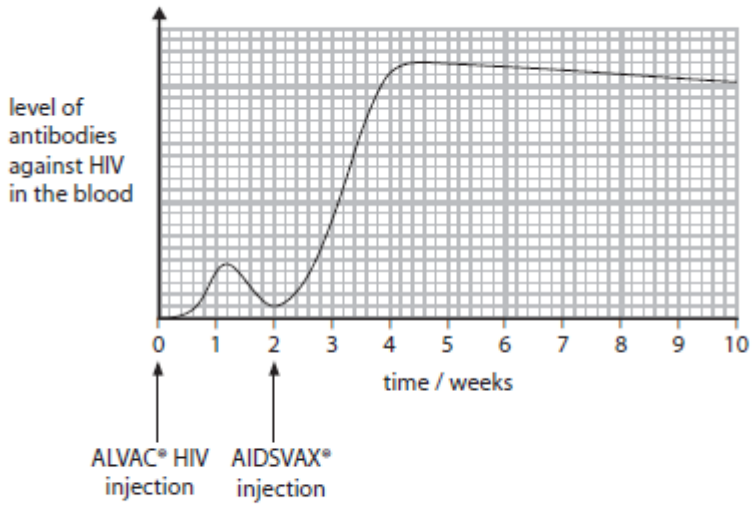
(4)

(ii) Describe how monoclonal antibodies can be used to detect blood clots.

(2)

B3 june 2017 q5

*(b) The level of antibodies against HIV in the blood of an immunised volunteer was measured during the clinical trial.



Explain the effect of this immunisation on the level of antibodies against HIV in the blood.

(6)