B1.1.2 How our bodies defend themselves against infectious diseases

Microorganisms which cause disease are called pathogens. There are 3 major types of pathogens including; bacteria, virus and fungi.

- Bacteria are microscopic organisms. They come in many shapes and sizes, but even the largest are only 10 micrometres long - 10 millionths of a metre. Bacteria are **living cells** and, in favourable conditions, can multiply rapidly. Once inside the body, they release poisons or toxins that make us feel ill. Diseases caused by bacteria include: food poisoning, cholera and typhoid.
- Viruses are many times smaller than bacteria. They are among the smallest organisms known and consist of a fragment of genetic material inside a protective protein coat. Viruses can only reproduce **inside host cells**, and they damage the cell when they do this. A virus can get inside a cell and, once there, take over and make hundreds of thousands of copies of itself. Eventually the virus copies fill the whole host cell and burst it open. The viruses are then passed out in the bloodstream, the airways, or by other routes. Diseases caused by viruses include: influenza – flu, colds and measles

Bacteria and viruses cause disease because once they're inside your body they rapidly reproduce. Bacteria simply split into two. However they often produce toxins which basically poison your body- sometimes they directly damage your cells. Viruses take over the cells of your body as they reproduce, damaging and destroying them. They very rarely produce toxins.

White blood cells are very useful at defending the body from pathogens- their defence includes

- Ingesting pathogens
- Producing antibodies, which destroy particular bacteria or viruses
- Producing antitoxins, which counteract the toxins released by pathogens

When your immune system detects pathogens, white blood cells are produced to wipe out the pathogen and prevent illness. White blood cells often produce antibodies which locate a pathogen and try to connect to it. Only a certain type of antibody will fit onto the right antigen of a pathogen. Many antibodies will have to be tested until one fits, which causes it to connect onto the pathogen it pulls it apart, killing it. Once this antibody has been produced before, your body's memory cells remember what antibody destroys what pathogen, and if it returns in the future it can easily be killed (quickly).

This is like what happens with vaccinations… Either dead or inactive pathogens are injected into your body, which is viewed as a threat to your body- despite not being able to cause harm. Anyway this triggers your immune response to invading pathogens. Then your white blood cells spend time figuring out the right antibody to fit onto the pathogens antigen and this correct antibody is remembered by your memory cell. You now are immune to this pathogen, as if it returns your body can quickly destroy it. E.g. MMR vaccine (mumps, measles, rubella).

Semmelweiss- When he was a doctor, many women who gave birth in hospital died a few days later. They died from childbed fever but no one knew what caused it. Semmelweiss

B1.4 Interdependence and Adaption

Organisms are well adapted to survive in their normal environment. Population size depends on a variety of factors including competition, predation, disease and human influences. Changes in the environment may affect the distribution and behaviour of organisms.

B1.4.1 Adaptions

Organisms live in different habitats need different adaptations. Animals and plants may have specific features that adapt them to their environment. To survive and reproduce, organisms require a supply of materials from their surroundings and from the other living organisms there.

Competition

There is competition with-in an ecosystem to determine which species survive and can reproduce or those that die. Habitats have limited amounts of the resources needed by living organisms and organisms can only survive if they can get enough of these resources, so they must compete for resources with other organisms.

Plants compete for:

- Light
- Water
- Space
- Nutrients

Animals compete for:

- Food
- Territory
- Mates

Some organisms aren't capable to survive in these conditions and instead adapt to survive in the most extreme conditions on Earth- these are called Extremophiles. They may be tolerant to; high salt levels, high temperatures and high pressures.

Animals and plants may be adapted for survival in the conditions where they normally live, eg deserts, the Arctic.

Animals may be adapted for survival in dry and arctic environments by means of:

■ changes to surface area

■ thickness of insulating coat

■ amount of body fat

■ camouflage

B1.7 Genetic Variation and its control

B1.7.1 Why Organisms are Different

The genetic information passed from parent to offspring is contained in genes carried by chromosomes in the nucleus. Sexual reproduction produces offspring that resemble their parents, but are not identical to them, due to passing on characteristics in the genes from gametes.

Chromosomes, found in the cell nucleus, contain many genes. A gene is a section of DNA, which carries coding for a particular protein. Different genes control the development of different characteristics of an organism. Many genes are needed to carry all the genetic information for a whole organism. Each cell has 23 pairs of chromosomes.

Differences in characteristics may be due to genetic factors, environmental factors of both.

B1.7.2 Reproduction

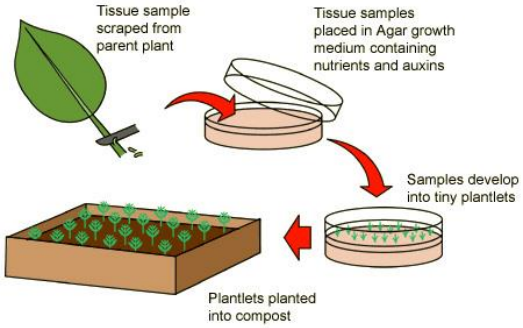
There are two forms of reproduction:

- Sexual- This is the fusion of gametes, causing the offspring to have shared characteristics from each parent. The mixture of the genetic information from two parents leads to variety in the offspring
- Asexual- This involves 1 parent and there is no fusion of gametes. There is no mixing of genetic information and so no genetic variation in the offspring. These genetically identical individuals are known as clones.

Cuttings- The simplest way to clone a plant involves taking a *cutting*. A branch from the parent plant is cut off, its lower leaves removed and the stem planted in damp compost. Plant hormones are often used to encourage new roots to develop. The cutting is usually covered in a clear plastic bag at this stage to keep it moist and warm. After a few weeks, new roots develop and a new plant is produced which is identical to the original. The method is easy.

Cloning

There are 3 main ways of cloning: tissue culture, embryo transplants and adult cell cloning.



Tissue Culture: Another way of cloning plants is by tissue culture, which works not with cuttings but with tiny pieces from the parent plant. Sterile agar jelly with plant hormones and lots of nutrients is needed. This makes tissue culture more expensive and difficult to do than taking cuttings. However you can produce many more identical plants.