BBC BITESIZE

Hello, I'm Dr Alex Lathbridge and this is Bitesize Biology.

This series is about infection and response. We're going to take a deep dive into infection and how the body responds to it.

To start things off, we're going to talk about communicable diseases, things like viruses, bacteria, fungi and, this might be new for you, protists.

But what about non-communicable diseases? Well we already did those in our series on the organisation of plants and animals. Maybe go back there and listen again if you're not quite sure what they are.

Communicable diseases are spread between humans, or between humans and animals. They're infectious, things like the flu virus and bacteria that cause food poisoning. Literally diseases that can be communicated from one to another.

The first thing you need to know is what a pathogen is, so grab a pen and write this down:

A pathogen is a microorganism that causes infectious, communicable diseases to plants and animals. Pathogens have really simple life cycles. They infect a host (that's the organism that pathogens live in or on), replicate or reproduce, and then move on to infect something else.

And the word pathogenic means that something can cause disease.

There are five ways pathogens can spread (or transmit) from one organism to another:

1. Droplets. Pathogens travel in the air as droplets that can be breathed in. Like when you sneeze, virus droplets can be sprayed into the air, that others can breathe in and be infected with.

2. Water. Pathogens exist in water, so drinking infected water or washing in it can transmit the pathogen. For example, cholera is spread by drinking water.

3. Direct contact. Pathogens can be spread when contact is made by two individuals. Basically touching another person. So things like shaking hands, or sexual contact.

4. Food. Improperly cooked or reheated food can contain pathogens.

5. Vectors. These are organisms that spread disease, but they don't get the disease themselves, like mosquitoes that spread malaria.

There are four different types of pathogens that we're going to discuss today: viruses, bacteria, fungi and protists.

We’re going to start with viruses.

A virus is a short length of DNA or RNA, enclosed inside a protein shell.

These things are so simple that scientists right now debate whether they fit in the category of "this is a living thing" or "no, this is some kind of un-alive microscopic machine."

For your exams, you’d say viruses are not alive. And remember, they are not cells.

This means that there are different strains of viruses but not different species, because they’re not alive.

So how do they work?

Viruses can only survive by infecting a living host, which could be any organism on earth. This means no life form is safe from infection by a virus.

Inside the host cell, the virus is replicated many times by the cells, thanks to the instructions contained in its DNA or RNA, and many copies are made. Basically the cell gets hijacked and turned into a mini-factory to replicate the virus as much as possible.

Let’s look at some real world examples: HIV and Measles.

HIV stands for Human Immunodefiency Virus. It’s transmitted by direct contact of bodily fluids, during unprotected sex or sharing needles. It attacks the patient’s immune system. If too many of the immune system cells are destroyed, the immune system can no longer cope with any infections or cancers.

You might have heard of AIDS. This isn’t a virus, it’s a condition: Acquired Immunodeficiency Syndrome. It’s caused by advanced and uncontrolled HIV infection and, at this stage, the immune system is severely weakened.

However, HIV can be controlled with anti-viral drugs, which stops the virus from replicating. A person can have HIV for many, many years with relatively few symptoms and without developing AIDS due to anti-viral drugs that exist today. And now there are drugs available that people without HIV can take to lower the risk of contracting the virus after possible exposure.

Measles is a very infectious virus, transmitted by droplets spread when an infected person sneezes or coughs. Measles lead to a rash and high temperature and can be serious or fatal if there are complications. Across the world, as many children as possible are given vaccines to protect against measles and to eradicate it from the population.

Next up, bacteria.

So first things first, bacteria are very useful. The bacterial cells inside us are like a hidden organ, helping us to do so many things like breaking down food.

But some bacteria are pathogenic.

These reproduce rapidly and produce toxins that can damage cells and tissue in the body.

Let's talk about a couple.

Gonorrhea is a sexually transmitted disease caused by bacteria, spread by direct contact when having unprotected sex. Gonorrhea makes urinating painful and causes the production of a thick discharge from genitals. Because Gonorrhea is a bacterium and not a virus, it can be treated with antibiotics and its spread can be reduced by contraceptives like condoms.

Now, salmonella is a bacteria that causes food poisoning, which you can get by eating contaminated food. It can cause stomach pain, vomiting and diarrhoea. To prevent salmonella, poultry are vaccinated against it, and just remember to always cook your food thoroughly.

That's viruses and bacteria done, next we're going to talk about fungi.

So fungi is a huge category and obviously, not all fungi are pathogenic. We eat mushrooms and use yeast to make bread and beer.

However, some fungi cause disease by penetrating human skin and the surface of plants.

For instance, athlete's foot is a rash caused by a fungus that lives in people's toes. You can get it in communal areas like swimming pools, by touching contaminated surfaces. Or you could get it if you share PE socks with someone infected with it. It is treated by anti-fungal medication.

In plants, rose black spot is caused by a fungus that leads to rose plants developing purple or black spots. It can spread through droplets in the air or in water. The leaves turn yellow and can drop off, so this reduces photosynthesis and therefore growth. It is treated by fungicides, which are chemicals that kill fungi.

And the fourth and final type of pathogen you need to know are protists.

Protists are single celled, eukaryotic organisms. They aren't animal cells, plant, fungi, or bacteria, they're their own thing.

Some protists are parasites that live on or inside organisms and cause them damage.

They often passed on to another organism by a vector, which is just a nice, sciencey way of saying: a carrier of disease that doesn't get infected. Because the pathogen wants to be able to reproduce, it makes sense that it doesn't harm the vector.

A good example of this is Malaria, a disease that causes fever, muscle weakness, and can be fatal. It's spread by mosquitos (so they're the vectors), and they carry the protist, and spread it when they feed on blood.

Mosquitos suck blood from an infected person which contains the Plasmodium protist. (You won't need to recall the name of this protist, but it's good to be familiar with it in case it pops up in your

exam!)

Scientists recently have come up with a vaccine for Malaria, but it only really works if it's given by the age of two. So it helps to stop people from being bitten by mosquitos in the first place. So people sleep under nets and wear insect repellent, and anti-malarial drugs can also help to treat infection.

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