

## Microbiology 1 300833

### Lecture 1

- **Microbiology:** microscope, microorganisms, germs, microbes, antibiotic resistance, superbugs, viruses are microorganisms as well. There is a virus that has people concerned there was an outbreak of Ebola in Africa about a year ago. Is there a micro-organism that you can eat? There are microorganisms everywhere so you are eating them. Mushrooms are fungi. Yoghurt – microbes, why do we make yoghurt? The bacteria that we put in yoghurt are good for our gut health, the microbes store the dairy for longer. We can store our dairy for longer because of the microbes.
- **What is this unit about?** Microbes are important in recycling nutrients, they are important in the food industry, we can use microbes to make antibiotics. They are important in industry as well as health and disease. We will talk about all of these factors in this unit. Enumeration means counting them. You should have a background on the organisms to biodiversity.
- **Textbook:** Microbiology 2<sup>nd</sup> Edition Wessner, there are required readings from this textbook every week, the textbook is required, you can purchase from the Wiley website (this is an e-text) or you can buy it from the bookstore. You get the textbook and extras. Wiley Plus has Orion which has a lot of extra material that comes with it, there are quizzes, and you can highlight and take notes in your textbook.
- **vUWS:** there is a practicals link in the learning resources and there are videos of the practical techniques. Once part of the practical component is your ability to do all of these techniques that are shown. Preparing for your practical exam you can go to these videos. There is also a work, health and safety video for you to view under the quizzes. If you have not done the quiz you won't be able to access the lab.
- **Type of microbial cells:** in general prokaryotes don't have a nucleus and eukaryotic cells do. They contain mitochondria, they have a lot going on inside their cells.
- **The importance of microorganisms:** they are the most popular and diverse group of organisms and they are found everywhere on the planet, they are everywhere and are doing many jobs in the environment. They are releasing oxygen into the atmosphere. They can be a source of nutrients. They can produce oxygen, they benefit society by the production of food. The human microbiome project is about all of the organisms living in and on your body. Researchers are interested in how these help your body and what they are doing there. They sample all of the spots in your body, there are 10 times more microbial cells on your body than human cells, so are you really a human or a microbe? There are about 1000 different kinds of bacteria on a person. They can compare parent

and child and their microbe file will not be the same, some scientists also think that you can use microbes as a personal file. The microbiome starts at birth as the baby passes through the vaginal microbiome, somehow there is a process so that the baby gets exposed to the right bacteria that it needs. Then babies are micro magnets. Your bodies are learning what are the good and the bad microbes, your body is learning about these microbes and where they are supposed to be and how they are benefitting you. If you got rid of the bacteria in your body you could lose kilograms. Sometimes if the microbes in your gut are out of whack this can affect your brain and your behaviour. There is so much to know and learn about these. There are genetic signatures of disease. Stools are mostly microbial biomass.

- **Microbes and diseases:** microbes are healthy and are looking after you. But the things that stand out are the things that cause disease, infectious disease and how they change over time. Today we are lucky in western countries because the number of deaths have significantly decreased. There are a number of reasons that are economic, people in Africa don't have access to the medicines that we do. And there are insects that only live and cause Malaria in Africa.
- **How do we know microbes exist:** How do you know that microbes existed? Because you don't see them, how did scientists figure this out? Antony van Leeuwenhoek created the first lens that could see microbes, he then drew what he saw through the lens. Once we knew they were there, there was an interest in how they grew and some people feel that they spontaneously regenerated.
- **The conflict over spontaneous generation:** There was this idea that microbes spontaneously generated, the idea that living organisms can arise from decomposing matter. Redi showed that maggots came from fly eggs. Louis Paster in the 1800s became interested in where microbes come from. He placed a nutrient solution into a flask and created a curved neck to not allow anything to fall in. Even though they were exposed to air there was no growth to micro-organisms. He then said it did not spontaneously generate from the froth it had to come from the air
- **The scientific method:** one of the major components of this course is the scientific method, Paster led to the development of the scientific method, you are a scientist and you ask a question about something that you are interested in and he had a hypothesis. Based on your results you can accept, reject, or modify the hypothesis. You do the observation, you get the result and you either repeat it and accept it into a theory or a law. You are going to design your own experiment in the prac. You will be taught how to get the skills, take the information and apply it to try to solve this question. You will figure out how to design the experiment. What is your control? Usually you need to repeat the

experiment and consider the variables. You don't put the negative and positive control at 2 different temperatures, you have to think about volume etc. You will work with your group and submit in class and explain what your experimental plan and how it is going to work out. You will take the materials that you need and you will write a list, and you conduct the experiment, you do it twice, you conduct the results and you write a report, you write the report as an individual. You need to make sure that you are getting in there and collecting results. All of the details to the assignment are in the learning guide, as you go through the labs you will get an idea of what you are up against, you will be working in a group on a lab bench.

- ***The role of microorganisms in disease:*** how do we know that the illnesses that we get are caused by these little things that we can't see? It was not immediately obvious and not all diseases are caused by infectious things. How do we differentiate what are caused by microorganisms and which aren't? They used to think that infectious diseases were caused by supernatural diseases. Robert Koch discovered the link between infectious diseases and microorganisms – established the relationship between bacillus anthracis and anthrax. Basically you take the infected person and the microorganism has to be present in every case of the disease but absent from healthy organisms. In this case there is a patient with tuberculosis, you have to be able to culture the organism in a pure culture, at this time there were no agar plates. How can you grow a pure culture when there are no agar plates? One individual species on the agar plate. You will learn in the lab how to obtain a pure culture, you have to get the microorganism growing on its own, you take the colonies off the agar and inject into a healthy host. Then the same microorganisms must be isolated again from the diseases host. This is a process that he developed with his teacher that is still used today.
- ***Limitations to Koch's postulates:*** a virus needs a cell to grow inside of, it can't grow on its own. You can grow some viruses in cell cultures. Some diseases are human diseases but don't give the disease in animals. There was an Australian scientist – how could they prove that stomach ulcers are caused? He inoculated himself with the disease to try to complete the postulates. Other diseases, if they don't cause disease in an animal this is a problem. You can genetically modify the organism in each case.
- ***The development of techniques for studying microbial pathogens:*** his work was seminal to this field – in the field of microbial diseases