Lecture 1

Microbes (living microscopic organism) can
-cause disease
-destroy pharmaceutical products
-manufacture pharmaceutical products

Microbes
-eukaryotes
-prokaryotes
-viruses and prions (no cellular structure)

Eukaryotes	Prokaryotes
Larger than 10µm	1-10 µm
Complex	Simple
Mitosis	No mitosis
Nuclear membrane	No nuclear membrane

Facts
-microbes grow everywhere
-humans and animals can't survive without microbes

Lecture 2

• Nutrients & electron acceptors used by microbes

Nutrients needed from a lot to little: C,N,P,S, major metal, minor metal

Nutritional type	Carbon source	Energy source	Macro-organism equivalent
Heterotroph	Organic compounds	Organic compounds	Animals & microbes
Photoautotroph	CO_2	Light	Plants & microbes
Chemoautotroph	CO_2	Inorganic compounds	Microbes

Possible electron acceptors: SO_4^{2-}, NO_3^-, O_2, organic carbon, Fe^{3+} etc.

• Different types of growth media, and their use

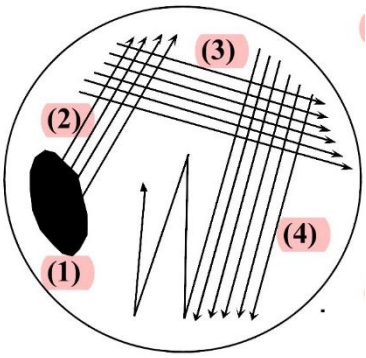
-Liquid media: broth, contains nutrients required for growth, shaken to mix cells, nutrients, oxygen, homogeneous, grow large number of microbes
-Solid media: agar plates, contains nutrients, solidified with agar, for growing colonies of microbes
theory: a single colony arises from a single cell, heterogeneous, grow small number of microbes
-General purpose media: allows growth of many microbial types
-Selective media: favours growth of one microbial type
-Differential media: to differentiate different microbes using colour
-Complex: ingredients derived from organisms, exact composition unknown
-Defined: ingredients are pure compounds

• Importance and limitations of pure cultures

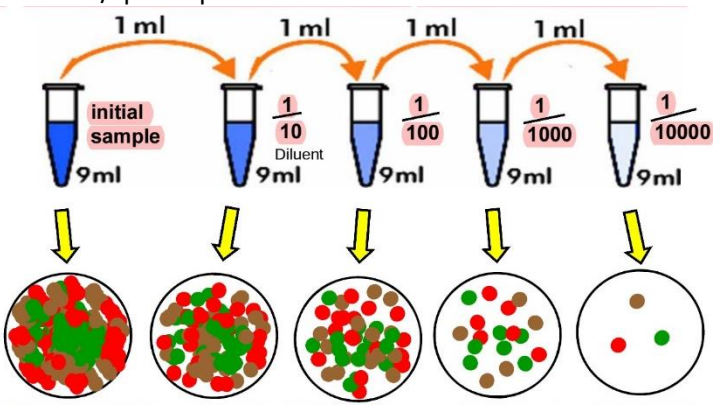
Pure culture: contain only a single species, allows microbial identity and function
Limitations
- Many microbial types cannot be isolated in pure culture
- Pure cultures are not representative of microbial diversity
-Pure cultures behave differently to microbial mixtures
-Microbial interactions can only be tested in mixtures

• Methods of obtaining pure cultures

-Streak plate



-Dilution/spread plate

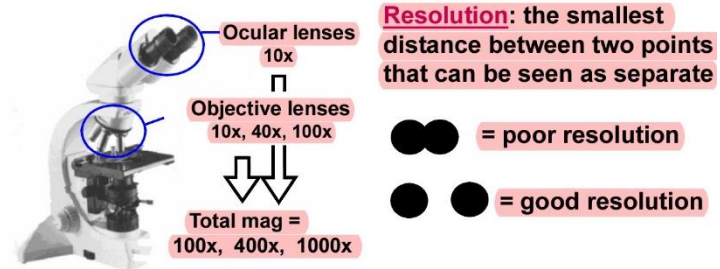


• Aseptic technique – what is it, why use it?

Aseptic technique-technique to prevent contamination (through sterile equipment, clean work environment and careful handling,) to protect us, culture and environment

• Some common microscopy and staining techniques

• **Total magnification = mag. (objective) x mag. (ocular)**



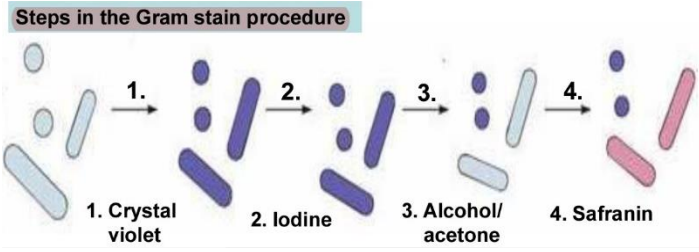
Objective lens

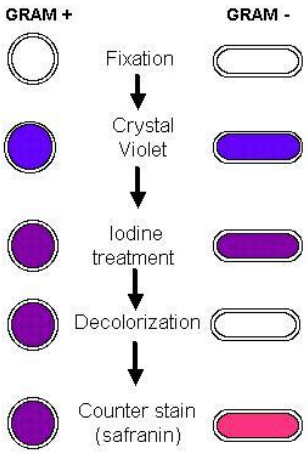
-10x: finding cells

-40x: examination of larger microbial cells: fungi, algae, protists

-100x: examination of smaller microbial cells: bacteria.

Microbes are killed by heat or chemical before stained





Extra

Phase-contrast microscopy
-Allows visualisation of live, unfixed, unstained samples
Electron microscopy: SEM (Scanning electron microscopy) and TEM (transmission electron microscopy) use electrons to view samples
-for viruses with small wavelength

Lecture 3

Why the HIV/AIDS, malaria, tuberculosis and influenza are major problems

AIDS

AIDS known as acquired immune deficiency syndrome is cause by a retrovirus called HIV (human immunodeficiency virus). The virus comes in two forms, HIV-1 and HIV-2 which is related to SIV (Simian immunodeficiency virus) from monkeys and chimpanzee, however it only seems to have effects on human. The first cases of HIV erupted in USA in the 1981 and is spread through the exchange of fluids via needles and exchange of sex. Therefore, to be infected HIV must get into the bloodstream through exchange of bodily fluid such as saliva and semen to get past the barrier of skin. When the virus enters the body, the protein in its virus membrane binds to a receptor protein CD4+ on the host membrane (set of immune cells) and reduces the number of CD4+ cells. This leads to fusion and the contents of the virion membrane move into the cell. Then the reverse transcriptase uses the single stranded RNA to make double stranded DNA which is transferred into the nucleus and incorporated in the host genome. Once infected, the patient may take years to develop the symptom and stays infected for life. Effective cure of AIDS currently is related to reducing the number of actively replicating virus, not eradicating the disease and prolong life expectancies

Malaria

Malaria is caused by Plasmodium vivax which is a single cell eukaryote –protist. It is transmitted through mosquitoes and is curable with appropriate drugs. Plasmodium vivax infects the liver and blood cells and is very persistent. The problem with malaria is that people can be infected multiple times and the lack of vaccine makes malaria hard to control. Its current success is due to its ability to reinfect after a cure and the development of drug resistance by plasmodium and insecticide resistance by mosquitoes, makes local elimination expensive.

Tuberculosis

Tuberculosis is caused by a chronic bacterial infection; it is an airborne disease usually transmitted only after prolonged exposure to someone with active disease. It normally infects the lungs but may infect other organs. Due to its complex impermeable cell wall, it has a slow growth making it hard to detect in early infections due to its ability to enter a latent state causing it to be introduced to the country by travellers. The infected area is often surrounded by host cells and the bacteria cease growing but survives in tubercles and could be detected by x-ray. It is fatal to patients with AIDS and may re-emerge when the organism develops drug resistance. It is a big problem for those that lives in poor living conditions and lack of health care, but vaccines are developed and works well.

Influenza

Influenza is caused by the flu virus which infects the respiratory tract and can be life threatening. It normally kills frail old aged elders over the age of 65. It works by entering the host cell and replicating its viral genome. The problem with influenza is that it mutates easily (antigenic shift dur to re-assortment of segment of HA and NA segment) and the mutations accumulate each year and over time lead to enormous variation and each time the host respond with new antibodies as it does not recognise the mutated virus, this is called antigenic drift and re-infection may occur. Vaccines are made in hen's eggs and takes month to accumulate enough.