Babs1202 Summery Notes

Contents:

Lecture 2: Eukaryotic Cell Structure 28/7

Note that the word prokaryote is no longer used to describe bacteria and archaea, they are two different and seperate domains of life.

What is life?
A state that distinguishes organisms from non-living objects, such as non-live, and dead organisms.
Life is a complex network of chemical reactions

Characteristics of life

1. Reproduction
2. Growth and development
3. Metabolise
4. Respond to stimuli (environmental changes)
5. Posses chemicals of life
6. Contains cells

1. Reproduction

Sexual: Two cells from different organisms unite to form the first two cells of a new organism (meiosis then grows by mitosis)
Asexual: A single organism reproducing without the aid of another (eg bacteria undergoes binary fission)

2. Growth and Development

Development: Change in form during an organising lifetime
Growth: Increase in size during an organising lifetime

3. Metabolise

The set of chemical reaction that happen in living organisms to maintain life. These processes low organisms to grow and reproduce, maintain structures and respond to their environments.

a. Catabolism (breaks down organic matter not smaller molecules to capture energy)
b. Anabolism (uses energy to construct components of life)

e.g… The metabolism of food into usable ATP energy

Energy can be gained differently depending on whether the organism is…

a. Autotrophic - produces energy themselves
    - Plants obtain energy through photosynthesis (converting complex organic chemicals into simple inorganic chemicals using light energy)
    - There are other inorganic chemical reactions organisms may use
b. Hetrotrophic - need to obtain energy through food
    - Requires organic substances to get its chemical energy (ATP after metabolism)

4. Respond to stimuli (environmental changes)

Organisms need to be able to respond to changes in their environment.

5. Posses the chemicals of life

Carbohydrates (saccharides)

- most abundant of the four major biomolecules
- Chemically, they are simple organic compounds, with monosaccharides as the basic unit
    - These monosaccharides are linked together to form polysaccharides or oligosaccharides
    - There is almost limitless combinations
- They are used for storage and transport of energy, as well as structural components

Lecture 9: Brewing 25/8

Beer can have many appearances, varying in colour from light golden brown to quite dark. It can be cloudy due to residual yeast, or protein haze, when it is a wheat beer. The characteristic bitterness is from the hops. It is mostly a carbonated drink, that comes from carbon oxide, which is produced at the same time as the alcohol fermentation.

By volume, huge amounts are being produced across the glove, but there are decreases in some areas, while other areas are quickly increasing in production and consumption.

Beer ingredients

- Water
- Hops — herb/flower that gives flavour (bitterness) and aroma (only grows in high altitudes)
- Malt — Modified form of grain that is a fermentable sugar that gives colour and flavour
- Adjunct — Some country will add extra fermentable sugar
- Yeast — An organism that will convert malt sugars into alcohol (ethanol) and esters which contribute to the flavour. There are both top and bottom fermenting strains of saccharomyces.

Biotechnology in Brewing

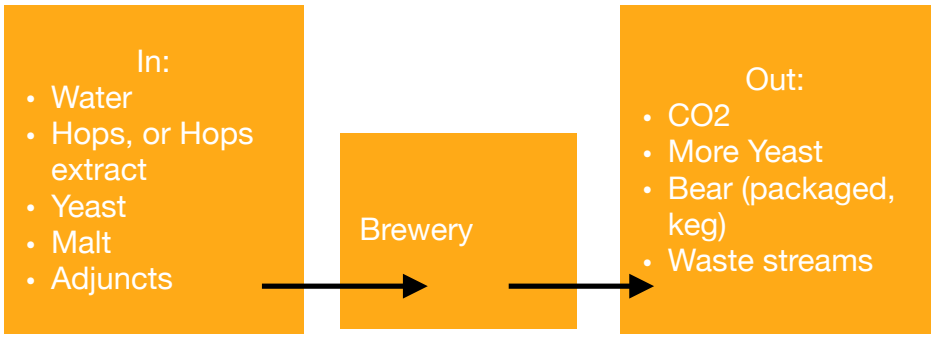
- Enzyme reactions that catalyse hydrolysis (breakdown), have two main functions:
  - To break down unfermentable starch into fermentable glucose (and maltose)
  - To break down proteins in grains to smaller peptides, which provides amino nutrition to the yeast during fermentation.

- Protein denaturation (occurs in the boiling step just before fermentation)
  - Boiling of wort denatures protein, causing them to become insoluble and capable pop removal.
  - Wort: unfermented beer, hence liquid extracted from the mashing process during the brewing of beer. Wort contains the sugars that will be fermented by the brewing yeast to produce alcohol.
- Yeast cell growth in fermenters on malt sugars in the fermentation process
  - Hence cell growth to give the product of ethanol

The inputs and output of the process

The yeast used as an input is chosen for its tolerance of alcohol as well as the flavour profiles it will give the beer.

For every mole of ethanol we produce a mole of carbon dioxide. As this is food grade (clean) CO2, It can be used to make carbonated beverages, or in labs, etc.
More yeast is also produced (called brewery yeast) and is sold and made into products like Vegemite.



Babs1202 Summery Notes

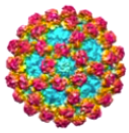
Lecture 15: Medical Virology and Gastroenteritis 22/9

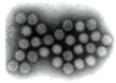
Lecture outline
- Molecular epidemiological study –viral surveillance
- Norovirus viral load and genotypic diversity in wastewater
- Can wastewater results correlate with clinical results and if so – Can we use sewage for infectious disease surveillance?

FOCUS ON STATS

Virus'

Have two structures either helical like a worm, or icosahedral (20 sided shape with 12 corners). They cannot be seen under a light microscope, but need an electron microscope.





Gastroenteritis

Worldwide, 2 billion cases of acute gastroenteritis and 1.9 million deaths occur each year in children under 5 years. Hence, its one of the highest killing infectious diseases, particularly in children in developing countries.
- Norovirus costs >$60 billion in global societal costs
- Symptoms include vomiting, diarrhoea, fever, malesie
- There is usually one episode per person per year in Australia (very common)
- Has three aetiological agents: parasites, bacteria and viruses

Acute Gastroenteritis

Inflamation of the stomach and intestine resulting in vomiting, diarrhoea, fever, abdominal pain and cramps. It effects all age groups, but children and elderly suffer the most.
In 2004, the estimated cases of gastroenteritis worldwide was over 4.6 billion, but has now dropped to 1.8 billion. This drop can be attributed to better sewage systems and sanitation, allowing for a decrease in bacteria and viruses.

The diagram shows how gastroenteritis is a leading disease that causes child mortality.

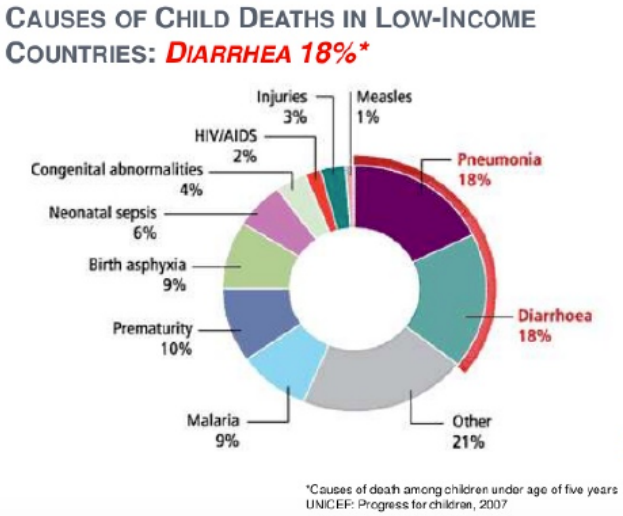
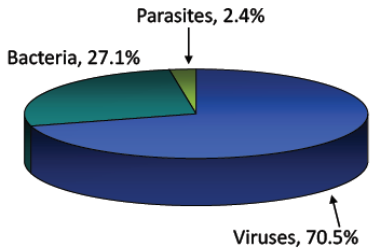


Diagram below shows that virus' are the most common cause, with the norovirus the main one.

The gastro viruses

In Australia, 70% of gastro is caused by viruses.
25nm to 300nm is a common size range for most viruses
Common putative viral agents in humans are:
1. Norovirus
2. Rotavirus (gone down massively since 2006, due to a vaccine)
3. Adenovirus (40/41)
4. Astrovirus
5. Sapovirus



The **norovirus** is estimated to cause 95% of non-bacterial gastroenteritis in developing countries, and is highly infections and environmentally stable. We often see outbreaks of this virus, in nursing homes, hospitals, cruise ships, childcare and military camps.

Norovirus transmission

Transmits from person to person, most common route being via faecal - oral route. Consumption of contaminated food or drink and poor food handling can carry the disease, as can aerosols.

Lecture 18: Bioinformatics and microbial genomes 11/10

Learning outcomes:
- An appreciation of the role of computational methods in biotechnology
- An appreciation of the utility of mathematics in understanding living systems

We live in dangerous times, with floods, explosions, natural disasters, and infectious disease outbreaks. This all relates to the field of bioinformatics.

Major advances in molecular biology and genomic technologies has required knowledge in computers and mathematics to analyse, organise and store data.

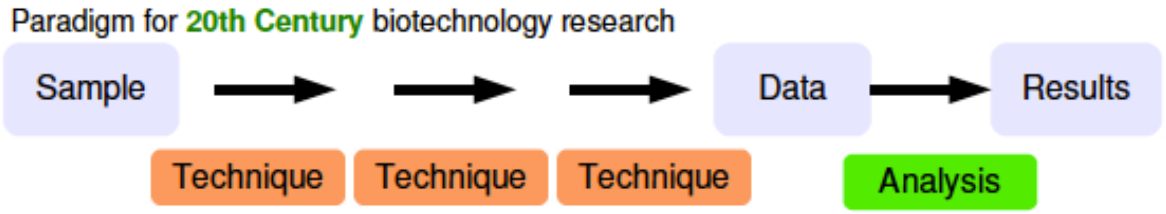
Big data is increasing important, and hence more people are needed with deep analytical skills.

Molecular epidemiology is a field where they look at molecular data, such as genetic variation, to see how disease spread. Big data can be used here to help find answers.

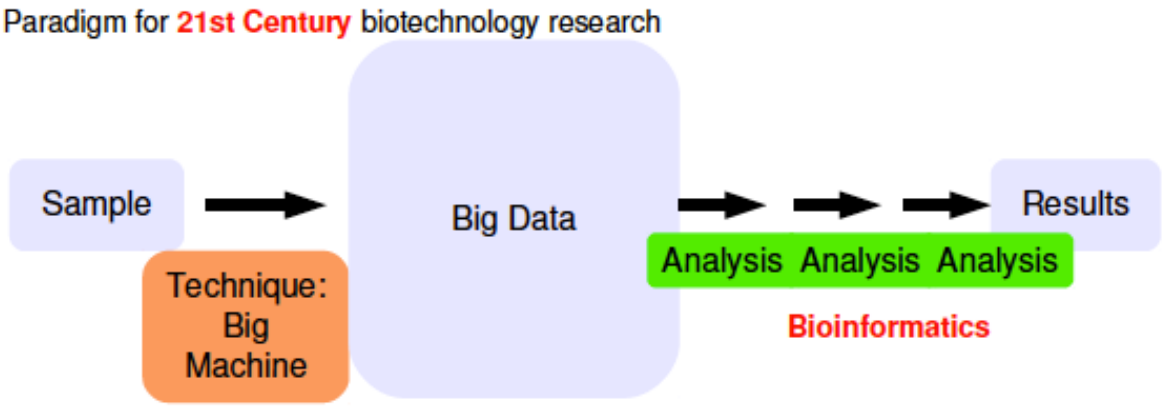
Climate change is another area where big data will be used, as we start to get more and more data collected from satellites, for example.

Hence, solving 21st century problem will increasingly require analysis of large data sets.

Comparing methods of research in molecular biology



It took much longer to get information, such as genetic information, as there were many techniques that had long process. Once data was acquired, simple analysis could be used to get information as their was so little data to begin with. Most of the process was hence dominated by collecting the data.



Now, processes are automated, and data can be easily be collected with powerful machines. This provides a lot of data, which takes longer to organise and analyse. As there is so much data, there is many more questions you can raise and many more ways of making sense of it. This is bioinformatics.