

Microbial Genetics

- Understanding the genetics of microbes is important for a number of reasons:
 - **Producing microbial strains with desirable characteristics**
 - **Producing medicines to fight against resistant microorganisms**
- Bacterial DNA, unlike human DNA, is circular and contains a much lower number of base pairs.
 - ***E. coli*** for example contains **~4 million base pairs**
 - **Human DNA** contains **~3 billion base pairs**
- There are a few distinct differences between microbial DNA and human DNA:

Microbial	Human
Small genome (Mbp)	Very large genomes (Bbp)
Gene density is high (>90% are exons)	Gene density is low (~25% are genes, only 1% are exons)
Exons are short (~1kbp)	Genes can span >30kbp
Operons with promoters upstream of exon	Genes have ~3 transcripts
Fewer non-coding RNA's	Promotor regions are distinct from the gene
Single circular chromosome	Multiple linear chromosomes
Chromosomes condensed in the nucleoid	Chromosomes condensed in nucleus via histones

- Microorganisms contain operons, clusters of genes
 - **Their mRNA is synthesised in one place** and is **under the control of a single promoter**
 - One example is the lac operon
- The size of bacterial chromosomes range from 0.6Mbp to over 10
 - **The smallest bacterial genome belongs to *Mycoplasma genitalium* with a genome of 0.58Mbp**
 - This is not free living
 - **The largest currently belongs to *Saccharomyces cerevisiae* with 8.7Mbp**
 - This is free living and has genes dedicated to the biosynthesis and transport of nutrients etc.
- Because microorganisms divide at a very fast rate, they must replicate their DNA very fast
 - More will be spoken on DNA replication in BIOM 1006 – Dr Sherwood
 - There are **2 components to control the initiation of replication**:
 - **A replicator sequence**
 - This is a specific set of DNA that tells the initiator protein where to start
 - **The initiator protein**
 - This recognises the replicator sequence and start the unzipping of the DNA adjacent to the sequence
 - Another three components are needed during the reactions:
 - **A plentiful supply of nucleotides**
 - **DNA helicase**
 - **DNA polymerase**
 - When the DNA stops replicating, the two circular strands must be cut apart from each other
 - This is done via the enzyme **topoisomerase**