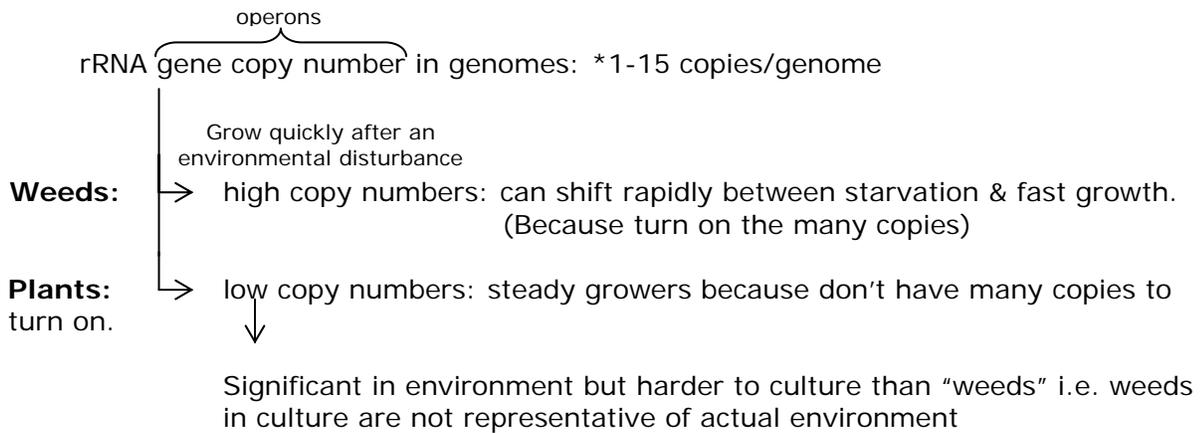


1.89, Environmental Microbiology
 Prof. Martin Polz
Lecture 4



*CFU = Colony Forming Units

Genetic Elements

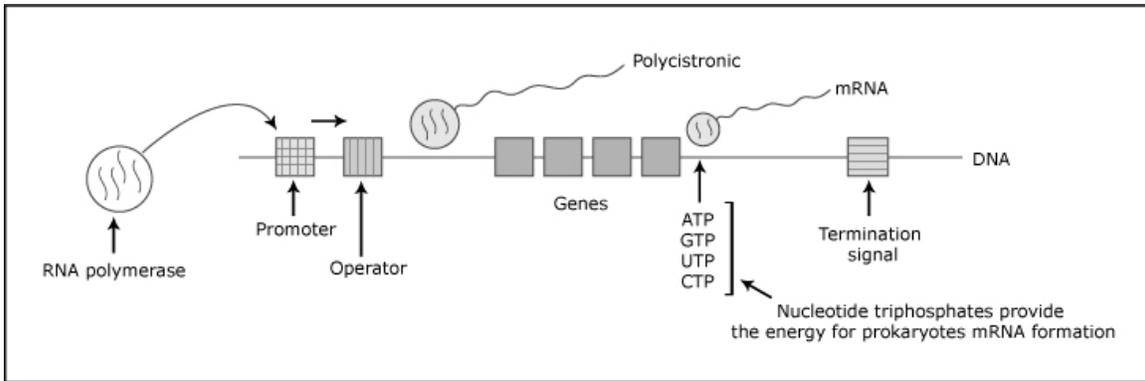
Types	Prokaryotes	Eukaryotes
- Plasmids	+	(+, rare)
- Chromosome	+	+
- Mitochondria, Chloroplast	-	+
- Viruses (infect)	+	+
- Transposable elements	+	+

Chromosomes

Prokaryotes	Eukaryotes
- Single (up to 3)	- Multiple
- haploid (1 copy)	- di → polyploid
- circular (some linear)	- linear
- supercoiled	- coiled around histones
- small & efficiently organized ~ 4.7 Mb ~ 3,000 genes	- large & redundant ~ 40,000 genes (3,000 Mb) ↙ Old, other organism's DNA
	(lots of noncoding DNA)

Organization in Prokaryotes

Usually genes of related function are often linked in one transcriptional unit = OPERON



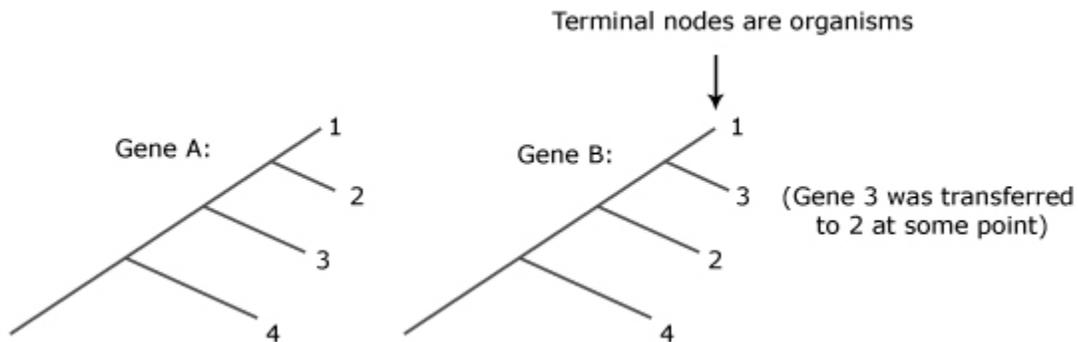
Polycistronic mRNA: Operon is transcribed as continuous mRNA; made by RNA polymerase as it moves along the DNA (genes)

Related functions (operons) are often clustered on the chromosome

- Ecological consequences: rapid turning on of pathways
- Evolutionary consequences: transfer of pathways between unrelated organisms is possible among prokaryotes. This leads to high plasticity in the genome of prokaryotes. → "Mosaic structure"

Evidence for gene transfer:

- gene phylogenies:



- GC (Guanine Cytosine) - content among regions of genome may differ
 - ↳ can reflect DNA transfer between organisms with different GC content in their DNA

Plasmids

Accessory genetic elements. i.e. they are not essential under all conditions.

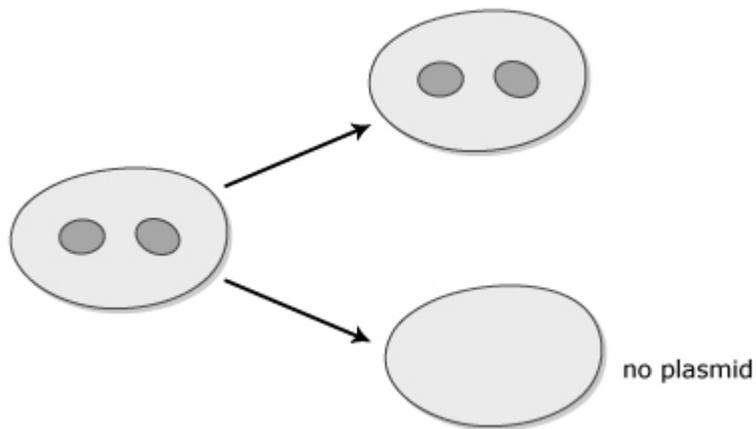
Properties

- o Double-stranded,
- o 1-200 Kbp long,
- o Usually circular,

- Extrachromosomal,
- Self-replicating (have own ORI of replication),
- Small plasmids can have multiple copies (up to 300); large plasmids can have a single or few copies.

Functions

- Carry toxin genes, pili (attachment) or adhesin genes, R-factors (resistance) to antibiotics, toxins, & heavy metals.
- Catabolic genes (biodegradation) for aromatic hydrocarbons.
- Siderophores (Fe scavenging)
- Random allocation of plasmids to daughter cells:



(antibiotics provide selective pressure for plasmids with antibiotic R-factor to propagate in environment)