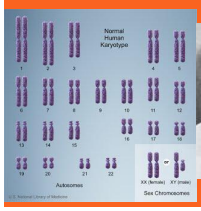
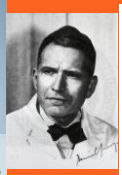
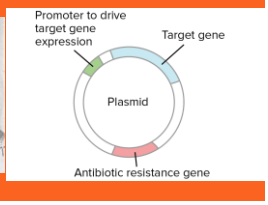
6.1 DNA and RNA Structure







ENDURING UNDERSTANDING

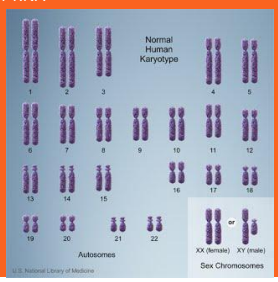
IST-1 Heritable information provides for continuity of life.

IST-1.K Describe the structures involved in passing hereditary information from one generation to the next.

- ❑ DNA, and in some cases RNA, is the primary source of heritable information.

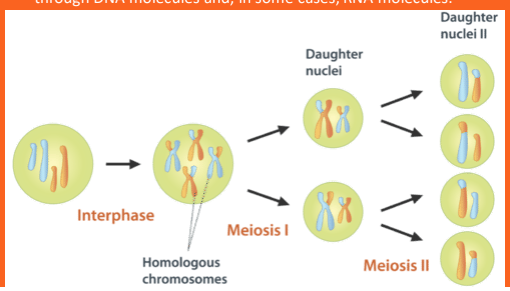
IST-1.K Describe the structures involved in passing hereditary information from one generation to the next.

- ❑ Genetic information is transmitted from one generation to the next through DNA or RNA



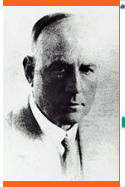
IST-1.K Describe the structures involved in passing hereditary information from one generation to the next.

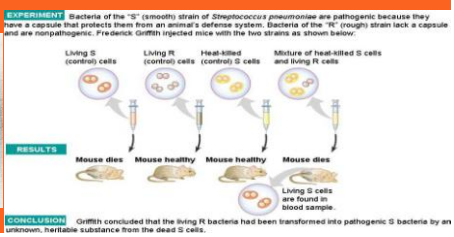
- Genetic information is stored in and passed to subsequent generations through DNA molecules and, in some cases, RNA molecules.



Frederick Griffith (1928)

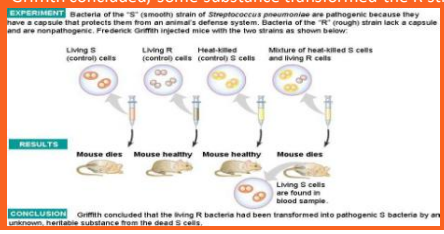
- DNA Can Transform Bacteria
- Conducted experiments with ***Streptococcus pneumoniae***
  - Injected mice with two strains: (S) strain and a (R) strain.
  - The S strain is virulent (mice died); it has a mucous capsule
  - The R strain is not virulent (mice lived); it has no capsule.





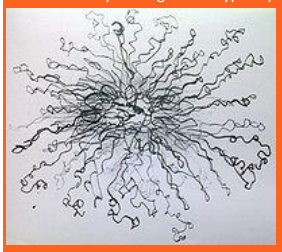
Frederick Griffith (1928)

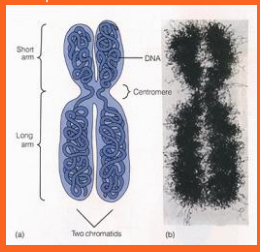
- He injected mice with heat-killed S strain bacteria; the mice lived.
- He injected mice with a mixture of heat-killed S strain and live R strain bacteria; the mice died and living S strain pneumococcus were recovered from their bodies.
- Griffith concluded, some substance transformed the R strain.



IST-1.K Describe the structures involved in passing hereditary information from one generation to the next.

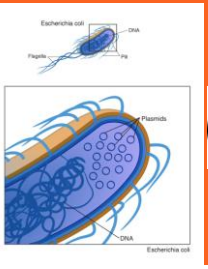
- Prokaryotic organisms typically have circular chromosomes, while eukaryotic organisms typically have multiple linear chromosomes.

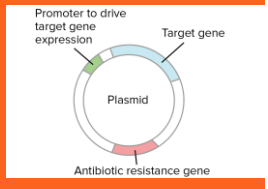




IST-1.K Describe the structures involved in passing hereditary information from one generation to the next.

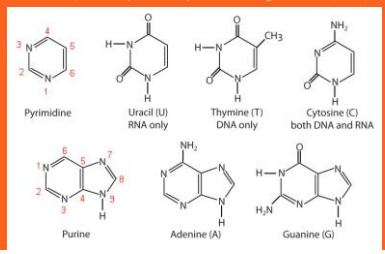
- ❑ Prokaryotes and eukaryotes can contain plasmids, which are small extra-chromosomal, double-stranded, circular DNA molecules.





IST-1.K Describe the structures involved in passing hereditary information from one generation to the next.

- ❑ DNA, and sometimes RNA, exhibits specific nucleotide base pairing that is conserved through evolution: adenine pairs with thymine or uracil (A-T or A-U) and cytosine pairs with guanine (C-G)



Erwin Chargaff (1947)

- Performed detailed analysis of base content of DNA.
- Purine bases
  - double-ring structure
  - adenine (A) and guanine (G).
- Pyrimidine bases
  - single-ring structure
  - Thymine (T) and cytosine (C)
- **Chargaff's Rules**:
  - The amount of A, T, G, and C in DNA varies from species to species.
  - In each species, the amount of A=T and G=C.

Table 11-1. Molar Properties of Bases* in DNAs from Various Sources

Organism	Tissue	Adenine	Thymine	Guanine	Cytosine
Escherichia coli (K12)	—	26.0	23.9	24.9	25.2
Diplococcus pneumoniae	—	29.8	31.6	20.5	18.0
Mycobacterium tuberculosis	—	15.1	14.6	34.9	35.4
Yeast	—	31.3	32.9	18.7	17.1
Paracentrotus lividus (sea urchin)	Sperm	32.8	32.1	17.7	18.4
Herring	Sperm	27.8	27.5	22.2	22.6
Rat	Bone marrow	28.6	28.4	21.4	21.5
Human	Thymus	30.9	29.4	19.9	19.8
Human	Liver	30.3	30.3	19.5	19.9
Human	Sperm	30.7	31.2	19.3	18.8

* Defined as moles of nitrogenous constituents per 100 g-atoms phosphate in hydrolysate.

Source: E. Chargaff and J. Davidson, eds., *The Nucleic Acids*. Academic Press, 1955.