Cytogenetics

What is Cytogenetics?

- Cytogenetics is the study of the structure of chromosome material.

- Chromosomes are genetic structures of cells containing DNA and therefore they:

* carry inherited traits

* carry the organization of the cell life

* heredity-one paternal and one maternal

In this course we will study

- **Structure of Chromosome**
- **Morphology of Chromosome**
- **Size of Chromosome**
- **Shape of Chromosome**
- **Number of Chromosome**
- **Types of Chromosomes**
- **Chromosome nomenclature**
- **Karyotype**
- **cell division and Chromosome**
- **Abnormalities of Chromosome**

Cytogenetics

- Today, the study of chromosomes–both in the research lab and in clinical settings–is called **cytogenetics**.
- There are two major tools used in cytogenetics today.

- **The first is the karyotype** which is literally a picture of the stained chromosomes that can be viewed under the light (or fluorescent) microscope.
- **The second is** a procedure called **fluorescent in situ hybridization or FISH** that is used to detect chromosomal microdeletions, i.e., deletions that are too small to see under a light microscope.

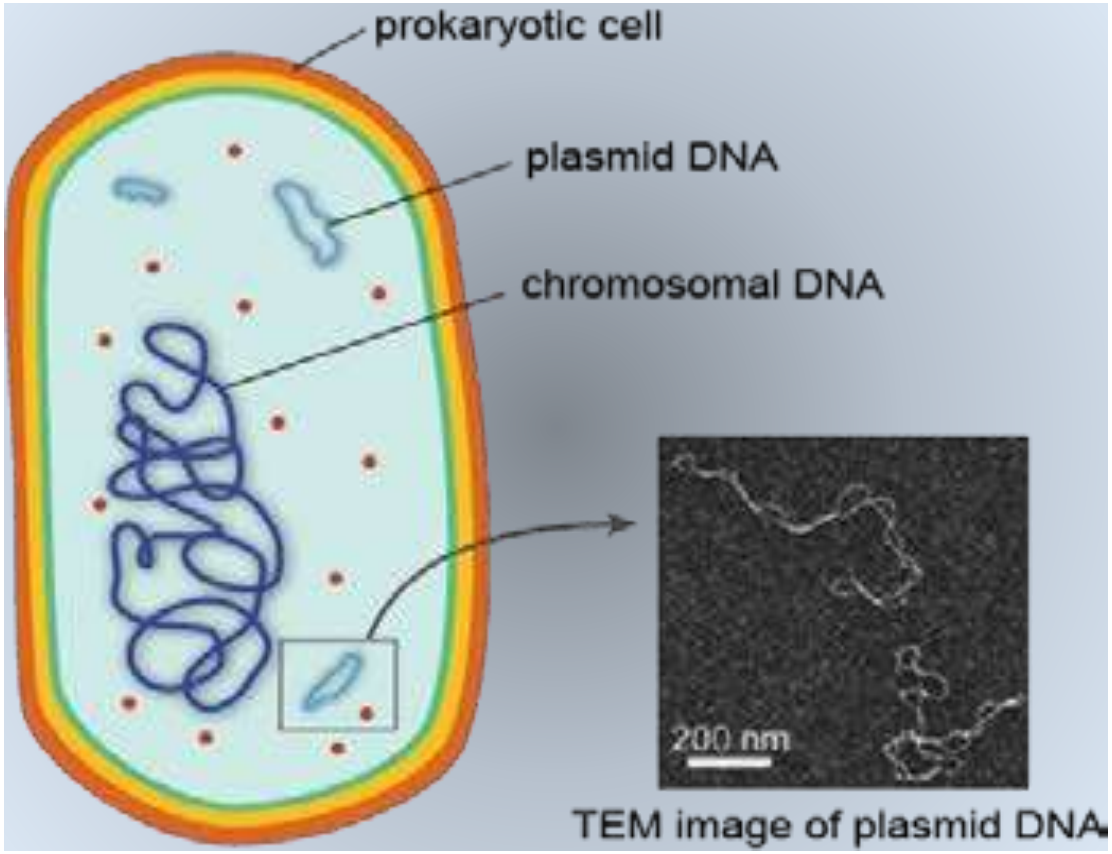
Genetic material in a cell

- All cells have the capability to give rise to new cells and the encoded information in a living cell is passed from one generation to another. The information encoding material is the genetic or **hereditary material** of the cell.

• Prokaryotic genetic material:

- The prokaryotic (bacterial) genetic material is usually concentrated in a specific clear region of the cytoplasm called **nucleiod**.
- The bacterial chromosome is **a single, circular, double stranded DNA molecule mostly** attached to the plasma membrane at one point.
- **It does not contain any histone protein.**

- Besides the chromosomal DNA many bacteria may also carry extra chromosomal genetic elements in the form of small, circular and closed DNA molecules, **called plasmids.**
- They generally remain floated in the cytoplasm and bear different genes based on which they have been studied.
- Some of the different types of plasmids are **F plasmids, R plasmids, virulent plasmids, metabolic plasmids etc.**



Bacterial genetic material

- In addition to the large chromosome, many bacteria have additional DNA molecules called **plasmids (or episomes.)**
- **Plasmids** are separate DNA molecules that contain a **replication origin** which allows them to multiply independently of the host chromosome.

- **Plasmids** range in size from 1 kbp (Kilo base pair) (1000 bp) to 100 kbp, and **these DNA molecules encode genetic systems for specialized functions.** Some plasmids make extracellular appendages that allow bacteria to infect and colonize sensitive eukaryotic hosts.

Plasmids often carry genes that confer on bacteria the ability to survive in the presence of antibiotics such as tetracycline, kanamycin and penicillin.

Many **plasmids** also contain genes that promote DNA transfer so that plasmid genes can move into other bacterial species.

- **Plasmid** transfer has caused the emergence of bacterial pathogens that are resistant to most of the useful antibiotics in medicine, with notable examples including multidrug-resistant strains of Staphylococcus and Myco- bacterium tuberculosis.

- **Virus genetic material:**

- The chromosomal material of viruses is DNA or RNA which adopts different structures. It is circular when packaged inside the virus particle.

• Eukaryotic genetic material:

- A Eukaryotic cell has genetic material in the form **of genomic DNA enclosed within the nucleus.** Genes or the hereditary units are **located on the chromosomes which exist as** chromatin network in the non dividing cell/interphase.

Questions