

Cytogenetics

1st Lecture

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Introduction

In 1839 Schleiden and Schwann -
apply the cell theory. This theory
stated that all organisms are
composed from cells. In this
manner they stated that cell is the
functional part of organisms.

- 1855-1878 Mitosis and meiosis -
were described.

-- Walther Flemming, an Austrian cytologist and professor of anatomy, who published the first illustrations of human chromosomes in 1882.

-- Flemming also referred to the stainable portion of the nucleus as chromatin and first used the term mitosis.

-- In 1888, Waldeyer introduced the word chromosome, from the Greek words for “colored body”

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--After the “rediscovery” of Mendelian inheritance in 1900, Sutton (and, independently at around the same time, Boveri) formally developed a “chromosome theory of inheritance” .

-- *Sutton combined the disciplines of cytology and genetics when he referred to the study of chromosomes as cytogenetics.*

Chromosome theory of inheritance

The chromosomal theory of inheritance is : the idea that genes, the units of heredity, are physical in nature and are found in the chromosomes. The theory arose at the turn of the twentieth century, and became one of the cornerstones of the modern understanding of genetics.

Genome complexity

- *E. coli* .. **4.6 million** base pairs, encoding **4,400** genes.
- Human.. **3 billion** base pairs encoding **30,000 to 40,000** genes (estimated), taking up 3% of the sequence.
- **The rest includes regulator regions and large stretches of repetitive sequence of unknown function.**

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Genomes and Evolution

Haemophilus influenzae 1,830,135

Helicobacter pylori 1,667,867

Bacillus subtilis 4,214,814

Mycoplasma genitalium 580,073

Archaeoglobus fulgidus 2,178,400

Eukaryotes

Saccharomyces cerevisiae 12,069,313

Caenorhabditis elegans 97,000,000

Drosophila melanogaster 180,000,000

Arabidopsis thaliana 115,500,000

Homo sapiens 3,200,000,000

Mus domesticus 3,000,000,000

Genome and Chromosomes

- Ascaris 2	Culex 6	Drosophila 8
Musca 12	Allium 16	Bee 16
Corn 20	Chinese hamster 22	
Tomato 24	Frog 26	yeast 36
Cat 38	Wheat 42	Human 46
Chimpanzee 48	Tobacco 48	Amoeba 50
Horse 64	Dog 78	Chicken 78

Nucleus and Chromatin

Nucleus

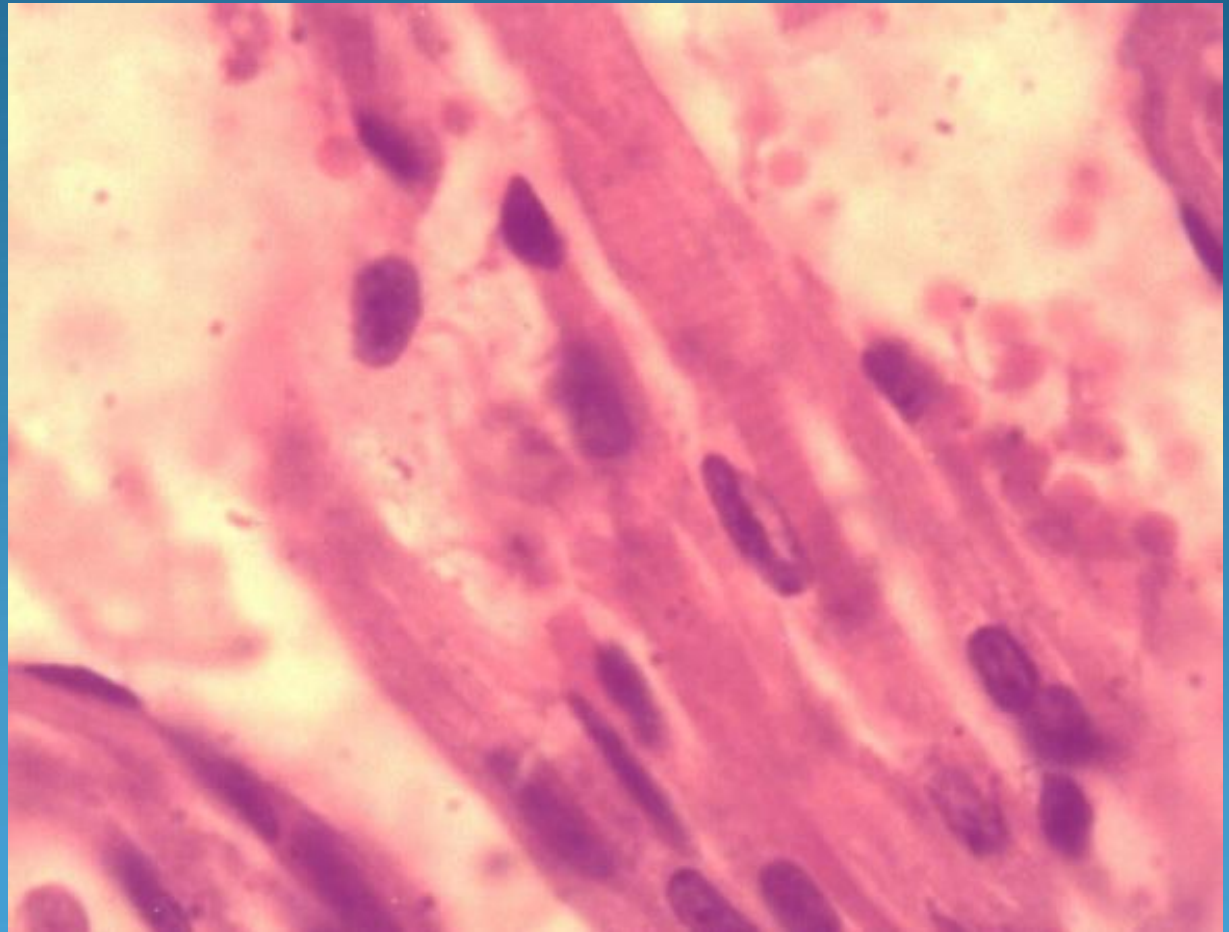
Location

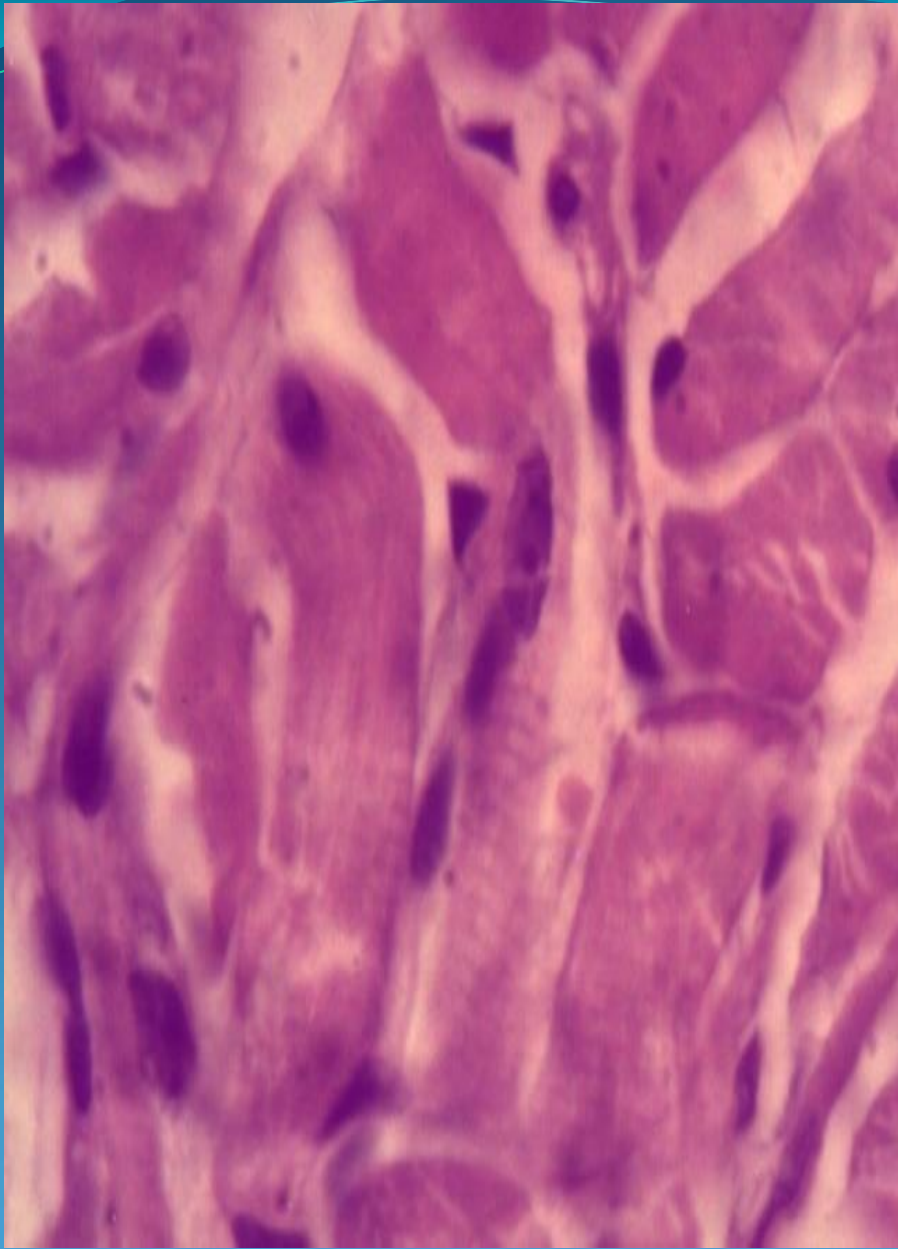
Shapes

Numbers

Nucleoli

Function





Chromatin

-- DNA

-- Proteins-Histones

B+ & Non Histons A-

-- Chromatin Net

Types :

- Euchromatin

DNA + RNA ?

- Heterochromatin ... DNA ?



Cell activity and Chromatin types:

-- Active cell with more Euchromatin and less Heterochromatin.

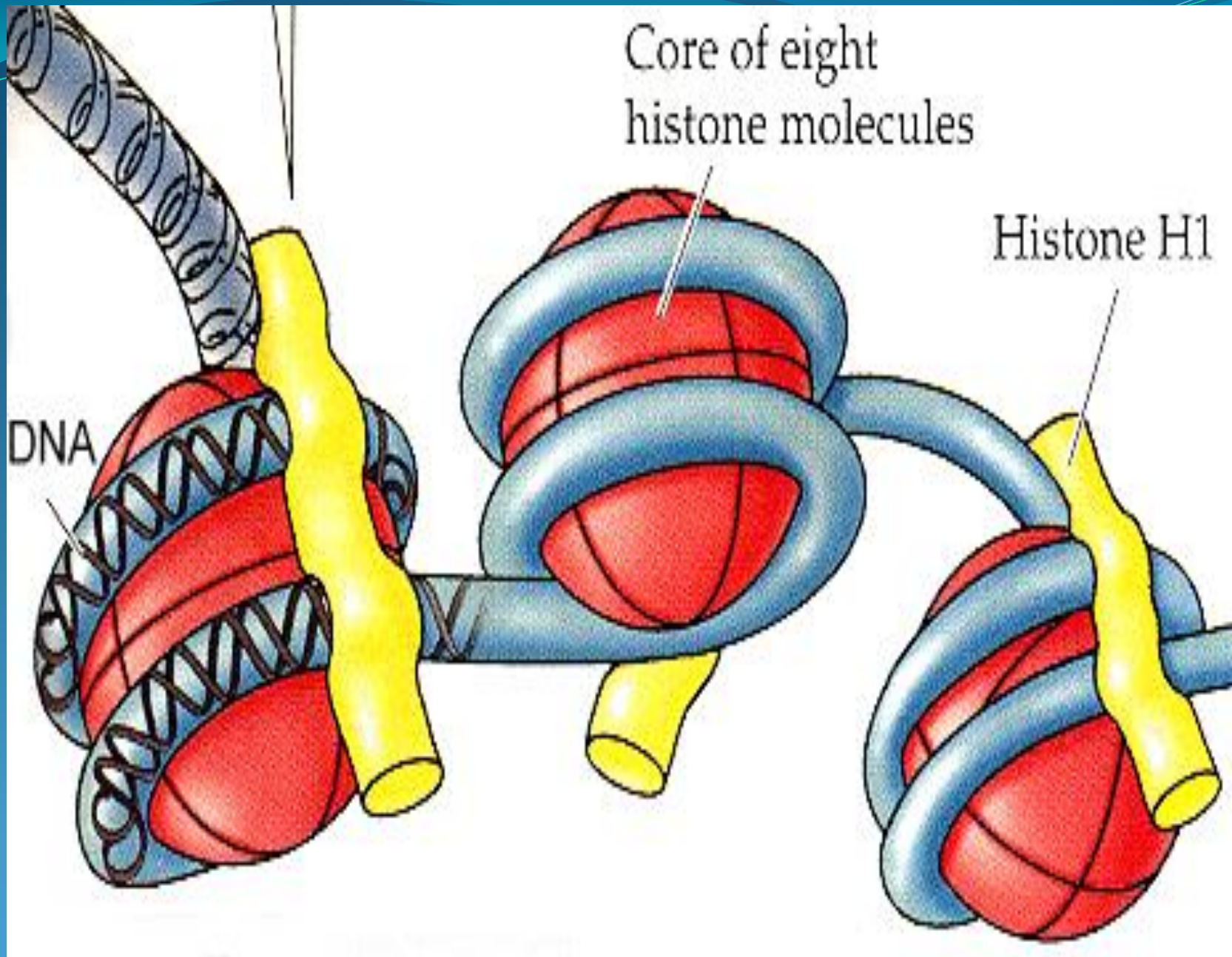
-- Active lymphocytes with 60% (+PHA) Heterochromatin and Non active with 90% Heterochromatin.

Molecular Structure of Chromatin:

-- Nucleosome is the unit of chromatin

-- Structure of Nucleosome DNA + Histones

Core= H2a + H2b + H3 + H4 ... H1 ..9 molecules



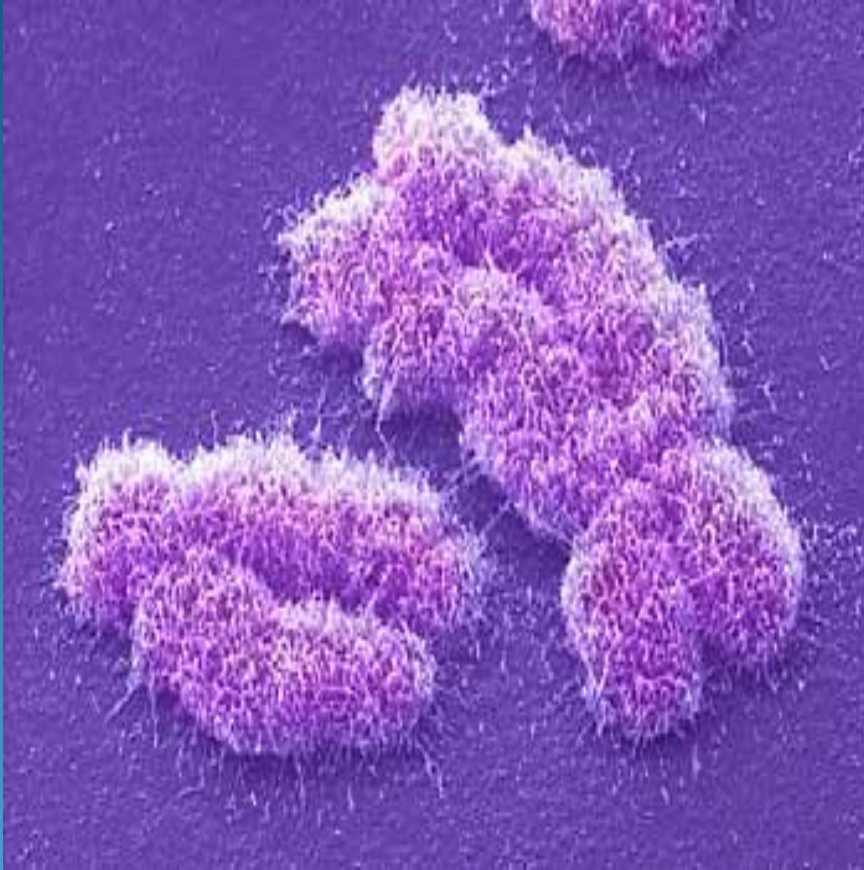
Core of eight histone molecules

Histone H1

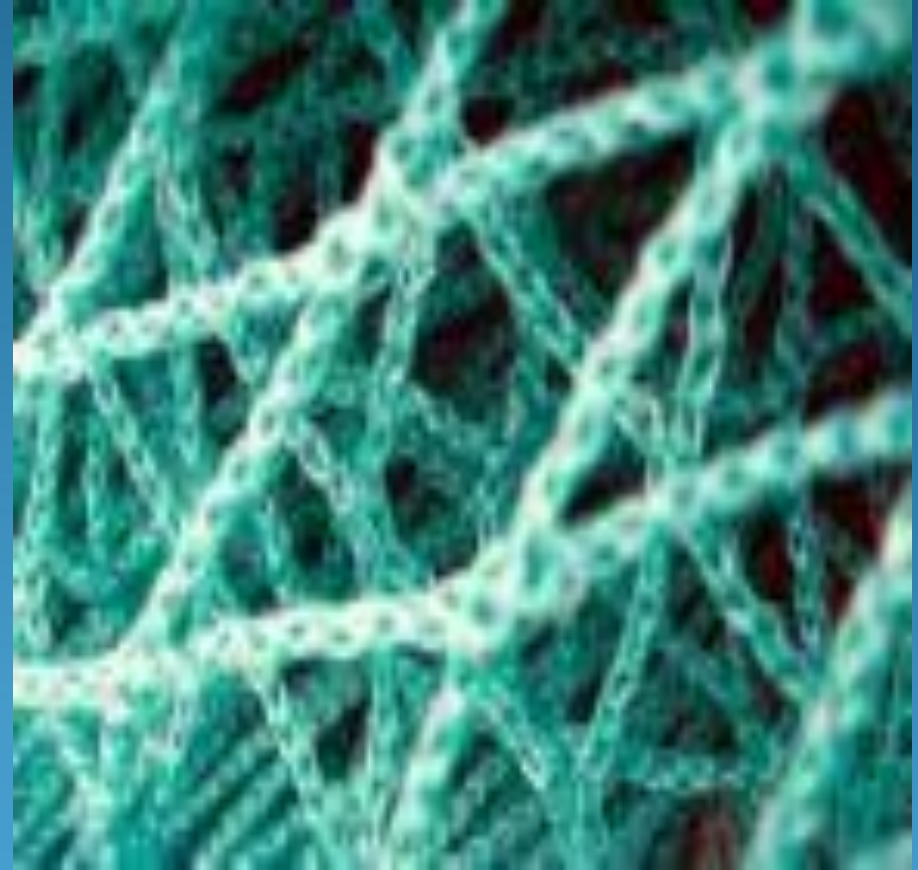
DNA

Chromatin and Chromosomes

-- Chromatin Net = Chromosomes



Metaphase



Interphase

Chromatin and Chromosomes



Thank you for listening



