

**Ministry of Higher Education and Scientific Research**  
**Al-Mustaqbal university**  
**Intelligent of Medical Systems Department**

**Bioinformatics/Practical**  
**Lecture (2)**  
**Chromosomes Classification**

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## Chromosomes classification

Human somatic chromosomes (autosomes) (number=22) are classified according to the following criteria:

- 1- Length.
- 2- Position of centromere.
- 3- Pattern of banding.

### 1-Chromosomal classification according to Length.

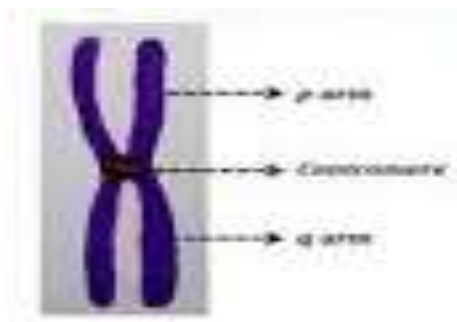
Human somatic chromosomes were divided according to the length into seven (7) groups designated by the letters from (A to G). The sex chromosomes (XY) in which X chromosome were placed with C group, whereas Y chromosome were placed in G group because these chromosomes have the same length with these groups.

Group A (1-3), group B (4-5), C (6-12 +X), D (13-15), E (16-18), F (19-20), G (21-22 + Y).

### 2-Chromosomal classification according to Position of centromere

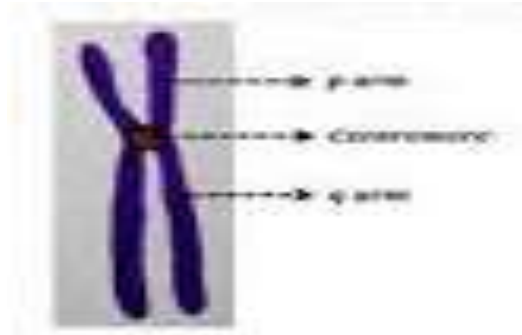
#### a. Metacentric Chromosomes

Metacentric chromosomes have the centromere in the center, such that both sections are of equal length. Human chromosome 1 and 3 are metacentric.



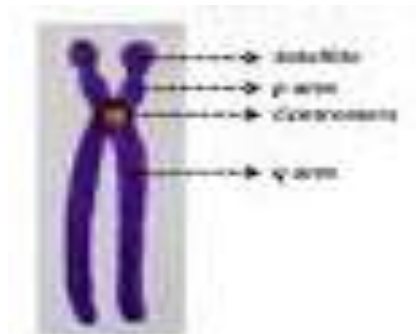
#### b. Submetacentric Chromosomes

Submetacentric chromosomes have the centromere slightly offset from the center leading to a slight asymmetry in the length of the two sections. Human chromosomes 4 through 12 are submetacentric.



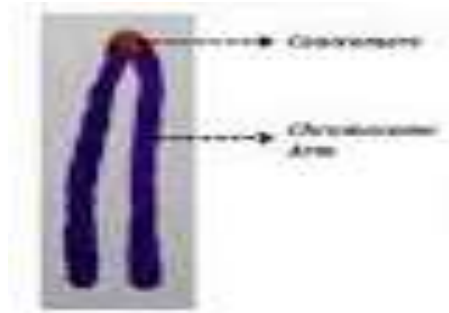
### c. Acrocentric Chromosomes

Acrocentric chromosomes have a centromere which is severely offset from the center leading to one very long and one very short section. Human chromosomes 13,15, 21, and 22 are acrocentric.



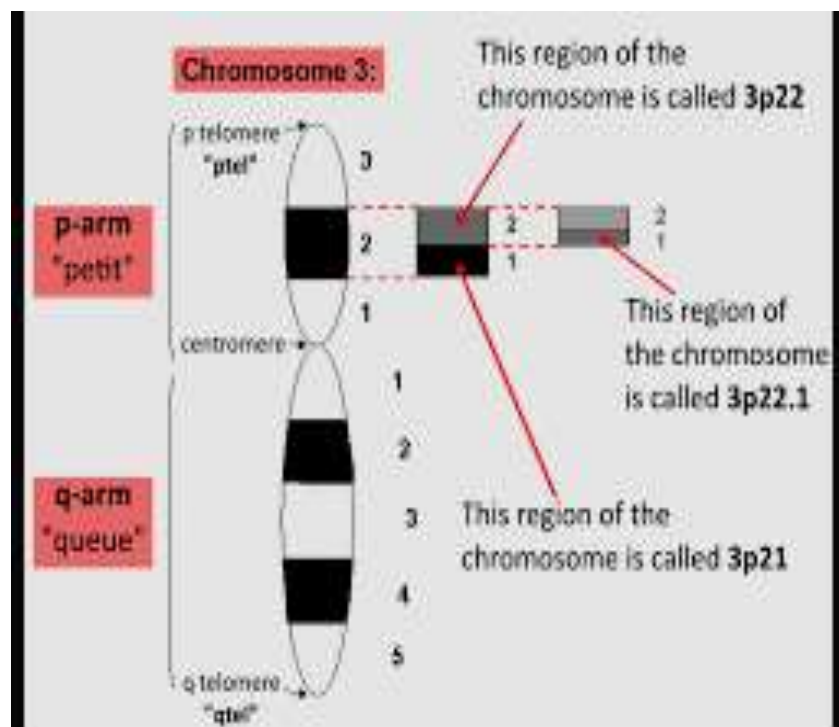
### d. Telocentric Chromosomes

Telocentric chromosomes have the centromere at the very end of the chromosome. Humans do not possess telocentric chromosomes but they are found in other species such as mice.



### 3-Chromosomal classification according to banding pattern.

Each chromosome were divided by centromere into short arm (p) and long arm (q), and each arm were divided into regions and this region were subdivided into visible bands and sub-bands.



**Ex: 1p 3.4.2**

The Answer:

This band present in chromosome 1, region-3, band-4, sub-band-2.

In order to describe the increased or decreased chromosomal numbers the symbols (+ or –) were used :

**Ex: 47, XX +21**

The answer:

This pattern represents the chromosomal pattern for female has an increased in chromosome 21.

**Ex: 47,XXY**

The answer: male has an increased in sex chromosome X.

To describe the increased or decreased length of chromosomes :

**Ex: 46,XY,1q+**

The answer: represents male has an increased in long arm of chromosome 1.

**Ex: 47,XY+14p+**

The answer: represent male has 47 chromosome, has increased chromosome is 14, with increased in short arm.