Chromosomal abnormalities

Prof. Dr. Hatice Ilgın Ruhi
Medical Genetics

Development ofMethodologies for Cytogenetics

- 1950-1960s → Chromosome preparations

  Example: Chromosome number determined to be 46 (1956), Ph^1: t(9;22) → 1960

- 1970s → Giemsa chromosome banding

  Example: *RB1* geni → 13q14 (1976)

- 1980s → FISH

  Example: İnterphase FISH for rapid detection of DS (1994)

- 2000s → Array CGH

  Example: identification of CHARGE syndrome gene (2004)

Morphologically chromosomes

- Centromere
- Telomere
- Sister chromatids
- Short arms: p (=petite)
- Long arms: q (= grande)

İncidence of Chromosome Abnormalities

- Spermatozoa → 10%
- Mature oocytes → 25%
- Spontaneous miscarriage → 50%
- Morphologically normal embryos → 20%
- Stillborn infants → 5%
- Birth → 0.5-1%

Chromosome Abnormalities

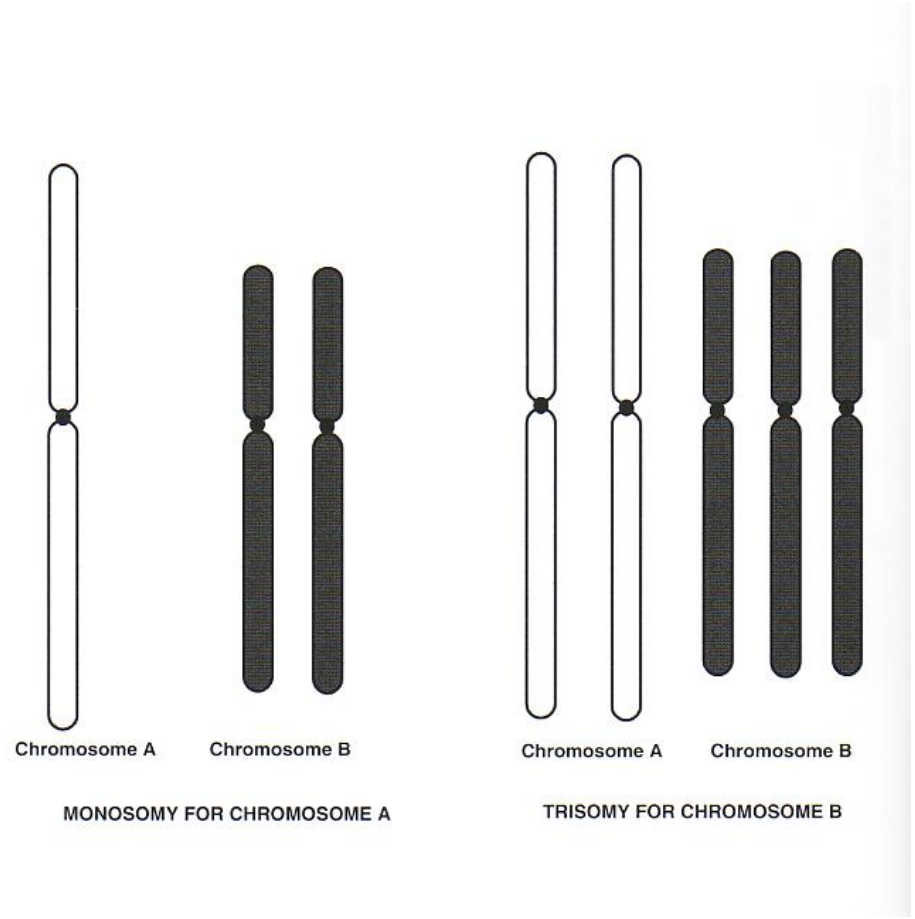
- Numerical (heteroploid)
  - Euploid: triploidy, tetraploidy, polyploidy…
  - Aneuploid: monosomy, trisomy
- Structural: translocations, deletions, duplications, insertions, invertions, rings..
- Different cell lines (mixoploidy)
  - Mosaicism
  - Chimerism

Euploidy

- Dispermy (fertilization of an egg by two sperm)
- Result from failure of one of the meiotic divisions (fertilization of a diploid egg or sperm)

Aneuploidy

- Nondisjunction
  - Maternal; meiosis I, II
  - Paternal; meiosis I, II
  - postzygotic



Abnormalities of Chromosome Structure

- Balanced: Genom has the normal complement of chromosomal material.
- Unbalanced: There is additional or missing genomic material (partial trisomy, partial monosomy).

Structural rearangement result from chromosomal breakage, recombination or exchange…

Unbalanced Rearrangements

- Deletions
- Duplications
- Isochromosomes
- Dicentric chromosomes
- Ring chromosomes
- Marker chromosomes

Balanced Rearrangements

- Translocations
- Invertions
- Insertions

Indications for chromosome analysis

- Congenital anomalies
- Problems of early growth and development
- Stillbirth and neonatal death
- Fertility problems
- Family history
- Neoplasia
- A higher risk for chromosome abnormality in fetuses (prenatal diagnosis)

Further reading

- Thompson&Thompson, Genetics in Medicine, eighth ed. 2016.
- Emery's Elements of Medical Genetics, 15th ed. 2017.