Basis of Chromosome Analysis (Dicentric Analysis)

Chromosomes

Radiation

Chromosomes break and rejoin

DNA duplication

Normal chromosome duplication

Number of aberrations is proportional to dose absorbed

Radiation-induced chromosomal aberration
**Dicentric Chromosome Formation**

1. Radiation exposure
2. Breaks in two chromosomes
3. Fusion
4. DNA replication
5. Dicentric chromosome
6. Acentric fragment

**Centromere**
Scoring Dicentrics with New Technologies

Automated Cytogenetic Workstation

- Automated slide scanning stage.
- Digital Camera and Images
- 80 Slide Feeder

Digital images are used for scoring chromosomes aberrations (dicentrics).
Dicentric Chromosome Scoring Procedure

1. Write down the Cell ID located on the top of the slide.
2. Count and record the number of centromeres to make sure that the metaphase cell has 46 well spread chromosomes (range 45-48).
3. Look for, count, and record dicentric chromosomes - have two primary constrictions (centromeres).

Normal Dicentric

One X shaped structure

Fusion of two X shaped structures

= Centromere
4. Look for, count and record acentric fragments - fragments of DNA that do **NOT** have a centromere.
5. **Look for, count and record centric rings** - fragments of DNA in the shape of a circle with only a centromere present holding it together.
Dicentric Chromosome Shape

- Centromeres in the middle
- One centromere proximal and one in the center
- Both centromeres at the ends

Centromere
Chromosomes are well separated without any overlap
Centromeres are clearly visible with well separated chromosome arms
Anaphase cells with completely separated sister chromatids must be rejected from analysis
**Things to remember while scoring dicentric chromosomes**

Occasionally, chromosomes with three centromeres (tricentric) and four centromeres (quadricentric or tetra centric) are observed. A tricentric chromosome is scored as two dicentric chromosomes and a quadricentric chromosome is scored as three dicentric chromosomes.

For example, if one dicentric chromosome and one tricentric chromosome are found in a metaphase cell then the total number of dicentric chromosomes observed is 3.
Sample Chromosome Assays
**Pair-Share Dicentrics Activity:**

- Work with a partner to determine the cell ID, number of centromeres, number of dicentric chromosomes, number of centric rings, and number of acentric fragments for each of the chromosome assays given in the shared Google slide presentation named “Pair-Share Dicentrics Activity”.
- Record all data in the table provided. Each student must turn in his or her own data sheet.
- Each chromosome assay is worth 10 points. Total = 100 points.
Ticket Out the Door: 3-2-1 Activity

**Turn in as you leave class today!**

- List **THREE** objects found within a chromosome assay.
- What are **TWO** parts of a chromosome?
- Define **ONE** new term used today in class.