General Biology Lecture - 6

Kidney Dialysis Techniques Department

Prof . Dr. Younis A. Alkhafaj

Cell Division: Mitosis and Meiosis

Importance in Dialysis Field

1- Understanding cell regeneration in kidney tissues

2- Foundation for understanding some kidney disorders

3- Relevance to stem cell research and tissue repair

The Cell Cycle

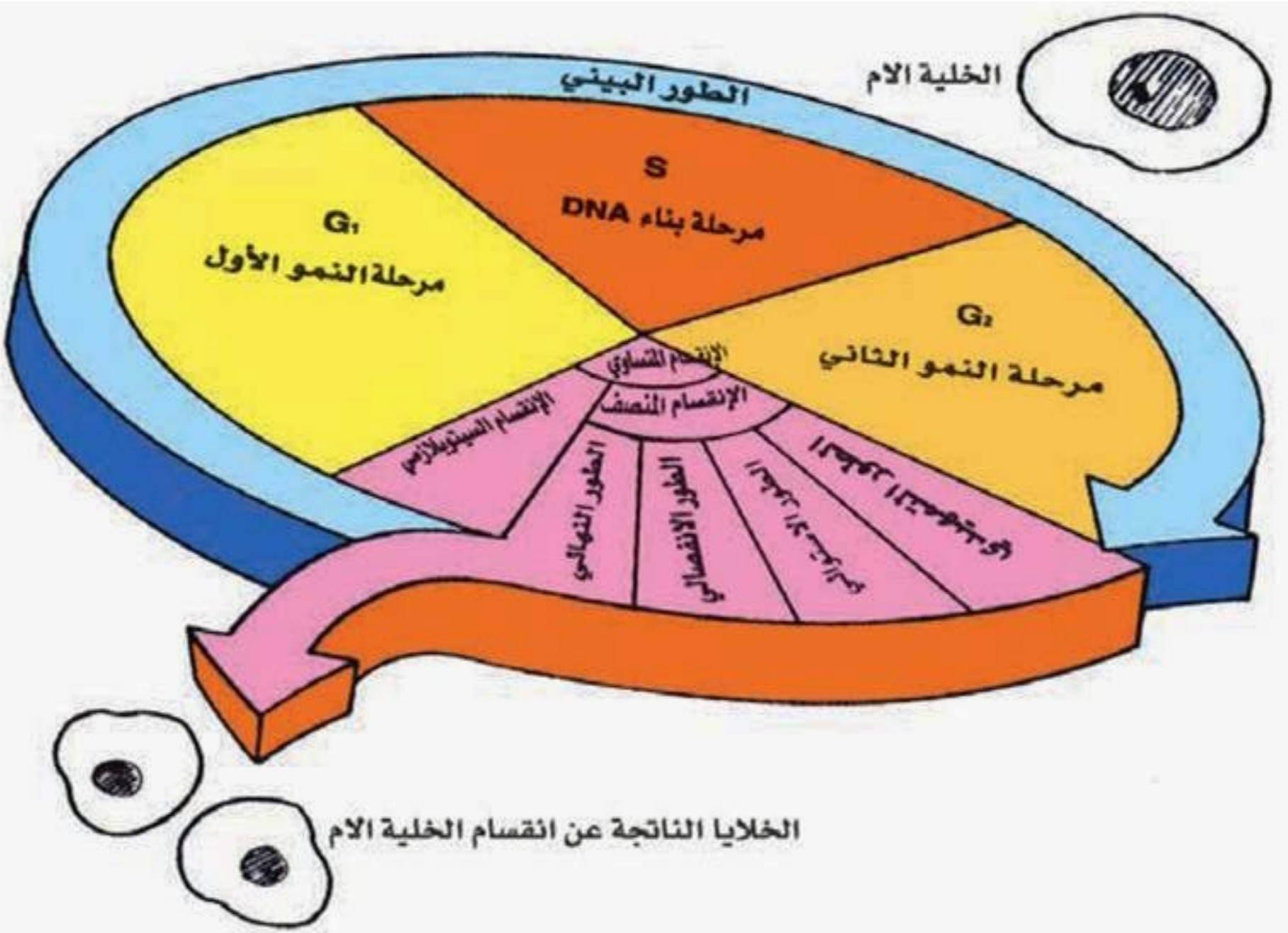
**Phases of the Cell Cycle:

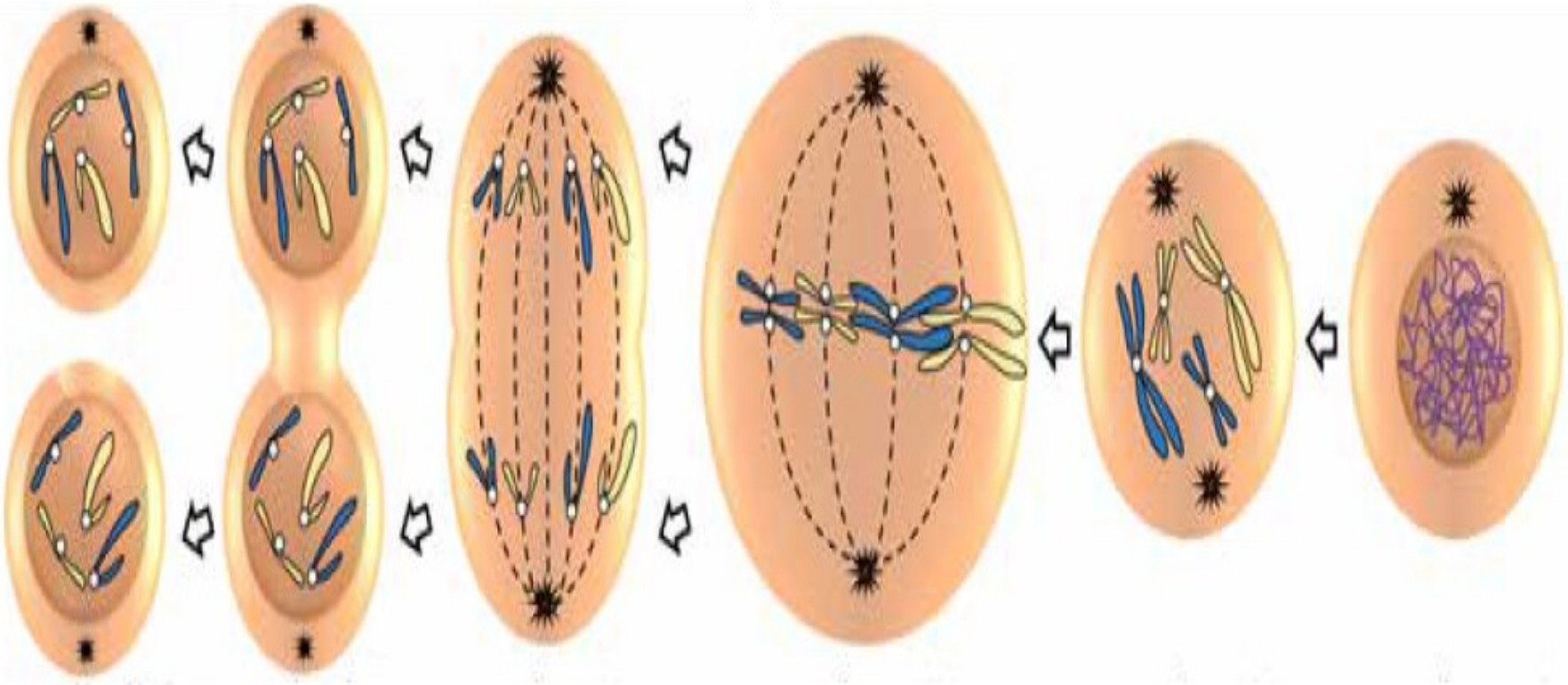
- Interphase:
  - G1 Phase: Cell growth and preparation
  - S Phase: DNA replication
  - G2 Phase: Final preparation for division
- M Phase:
  - Mitosis
  - Cytokinesis

Mitosis

Definition: Process of nuclear division resulting in two genetically identical daughter cells

Importance: Organism growth - Tissue repair - Asexual reproduction


الخلية الام
الطور البيني
S
مرحلة بناء DNA
G1
مرحلة النمو الأول
G2
مرحلة النمو الثاني
الإنقسام المتساوي
الإنقسام المنصف
الإنقسام السيتوبلازمي
الطور النهائي
الطور الانفصالي
الخلايا الناتجة عن انقسام الخلية الام



الطورُ التمهيديُّ

تستعدُّ فيهِ الخليةُ للانقسامِ، وتظهرُ الكروموسوماتُ بوضوحٍ.

الطورُ الاستوائيُّ

تصطفُّ الكروموسوماتُ في منتصفِ الخليةِ.

الطورُ الانفصاليُّ

تنفصلُ الكروماتيداتُ بعضُها عنْ بعضٍ باتجاهِ أقطابِ الخليةِ.

الطورُ النهائيُّ

ينقسمُ السيتوبلازمُ، وتنتجُ خليتانِ جديدتانِ.

Phases of Mitosis

1- Prophase: Chromosomes condense - Nucleolus disappears - Spindle formation begins

2- Metaphase: Chromosomes align at cell equator

3- Anaphase: Sister chromatids separate and move to opposite poles

4- Telophase: Chromosomes reach poles - Nucleoli begin to reform

5- Cytokinesis: Cytoplasm divides forming two separate cells

Characteristics of Mitosis

- **Produces two genetically identical cells**
- **Constant chromosome number (2n → 2n)**
- **Occurs in somatic cells**
- **Relatively shorter duration**

For growth and cell replacement

Meiosis

Definition: Cell division process producing gametes with half the chromosome number

Importance: Sexual reproduction - Genetic diversity

Phases of Meiosis

****Meiosis I:**

- **Prophase I: Chromosome pairing (crossing over)**
- **Metaphase I**
- **Anaphase I**
- **Telophase I**
- **Meiosis II:**
- **Similar to mitosis but without DNA replication**

Characteristics of Meiosis

- Produces 4 genetically non-identical cells
- Reduces chromosome number by half (2n → n)
- Occurs in germ cells
- Longer duration
- Genetic recombination (crossing over) in Prophase I

Purpose of Meiosis

1- Maintain constant chromosome number across generations

2- Generate genetic diversity through:

Crossing over

Random assortment of chromosomes

Produce gametes (sperm and egg cells)

Comparison Between Mitosis and Meiosis

Characteristic	Mitosis	Meiosis
Number of daughter cells	2	4
Chromosome number	Constant (2n → 2n)	Halved (2n → n)
Genetic identity	Identical	Different
Location	Somatic cells	Germ cells
Purpose	Growth and repair	Gamete production

Applications in Dialysis Field

1- Understanding kidney cell regeneration
2- Basis of genetic kidney disorders
3- Importance in stem cell research for kidney repair
4- Understanding some genetic causes of kidney failure

References

1- Cell biology textbooks

2- Specialized medical references

3- Credible scientific websites