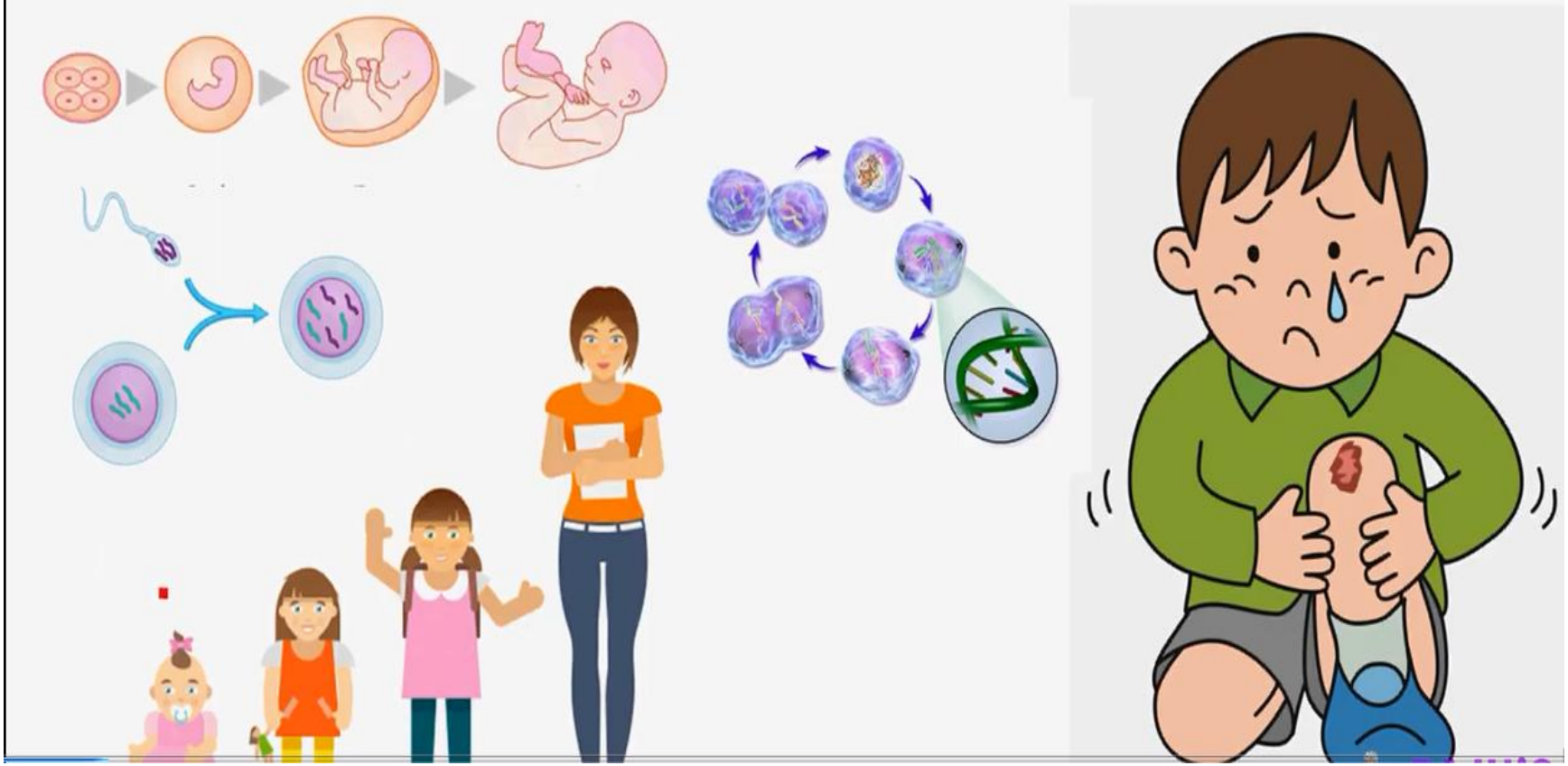
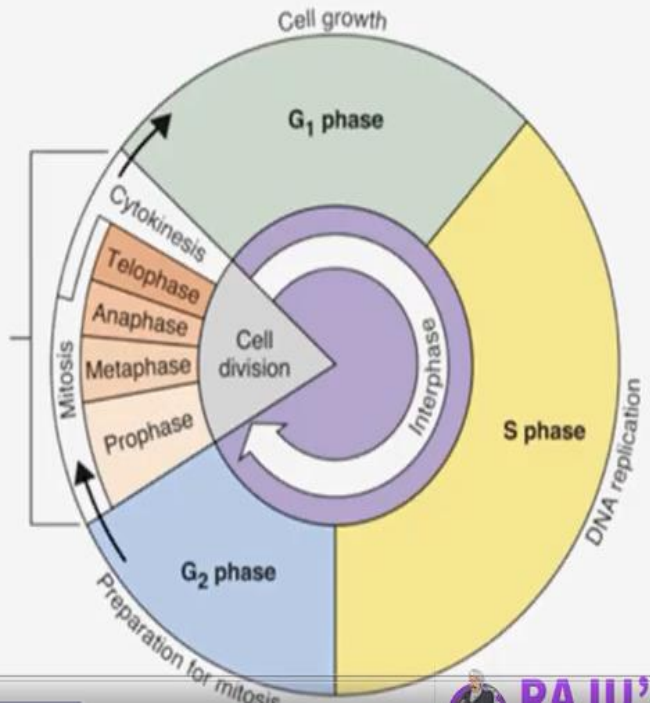
Cell Cycle and Cell Division

INTRODUCTION



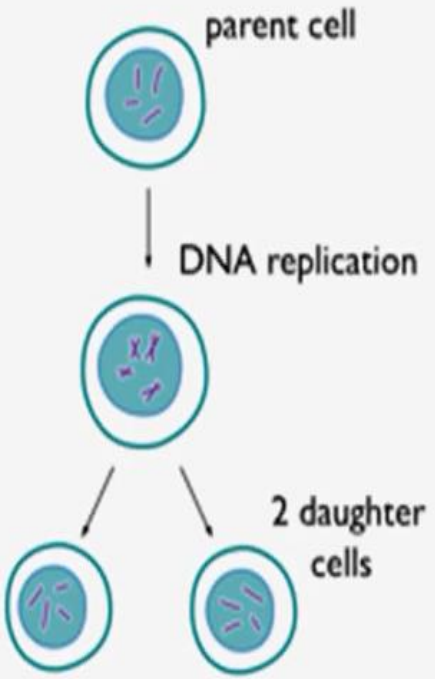
WHAT IS CELL CYCLE?

- Cell cycle is series of events involving cell growth and cell division



WHAT IS CELL DIVISION?

- Production of daughter cell from parent cell is known as cell division
- Cell division occurs as part of cell cycle

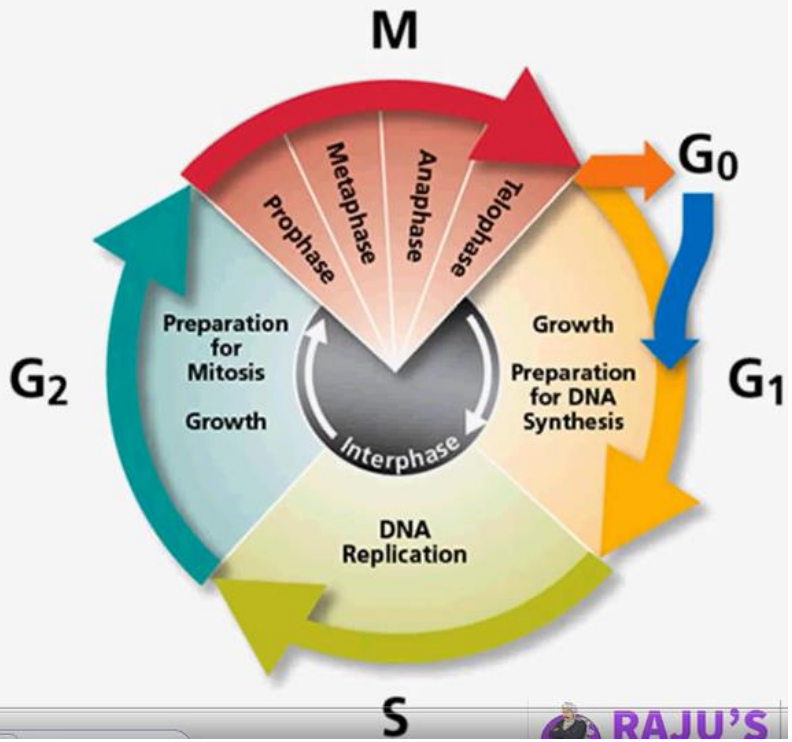


TYPES OF CELL DIVISION

- Amitosis
- Mitosis
- Meiosis

CELL CYCLE

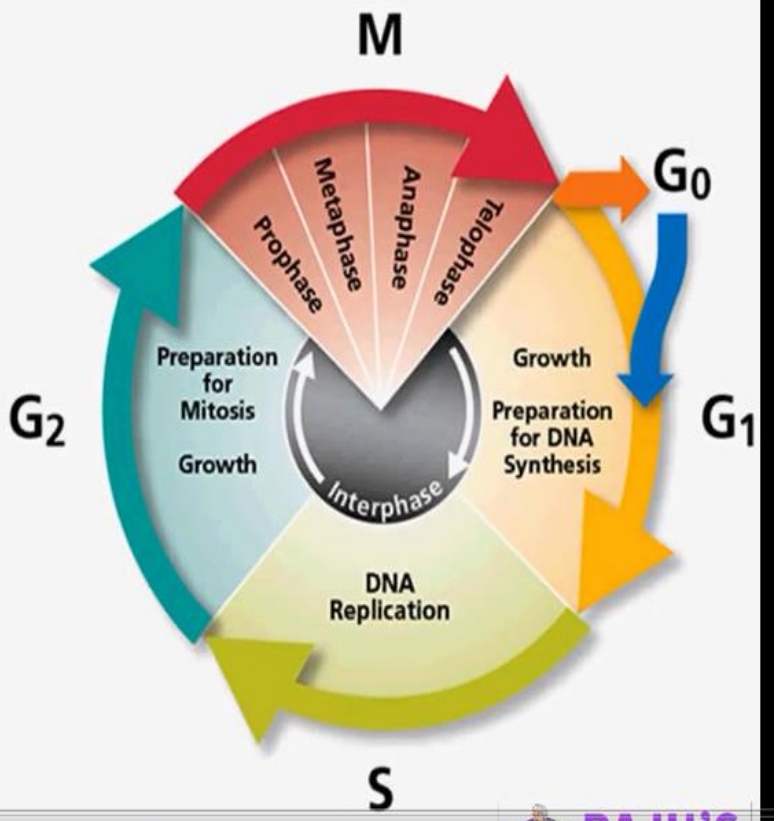
- Discovered by Prevost and Dumas (1824)
- Cell cycle is series of events that take place in cell, resulting in the duplication of DNA and division of cytoplasm and organelles to produce two daughter cells
- Cell cycle is divided broadly into 2 phases
  1. Interphase
  2. M phase



CELL CYCLE

1. INTERPHASE

- Interphase is most active phase
- It Takes more than 95% time of the cell cycle
- Series of metabolic changes occurs during interphase
- This changes are not visible under microscope, so termed as resting phase
- The I phase is further divided into G1, S, and G2 phase



CELL CYCLE

G1 phase

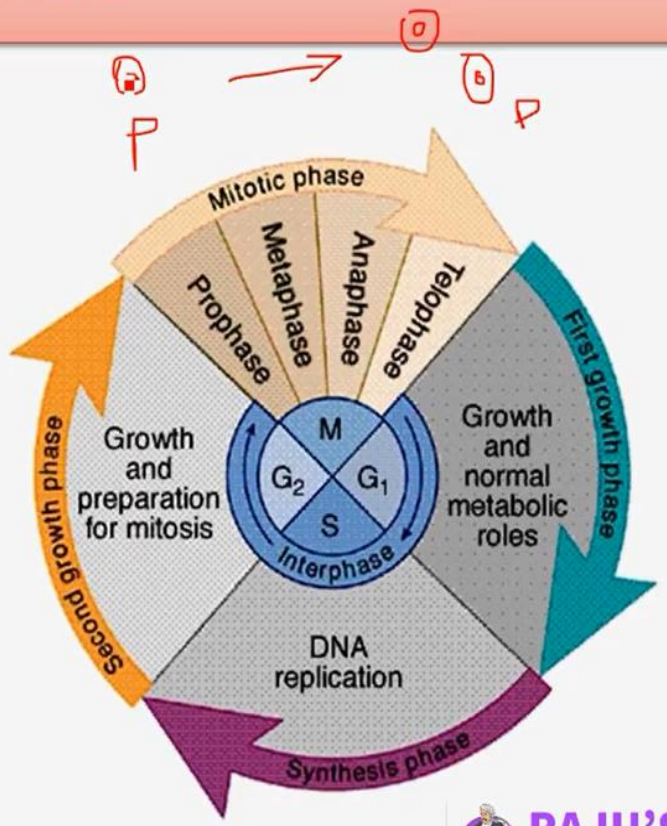
- Synthesis of enzymes, RNA, amino acids, ATP and nucleotides occur
- Raw materials synthesis for S phase
- Size of cell is increased

S Phase

- DNA replication occurs
- Synthesis of histone protein takes place
- DNA doubles but chromosome number remains same
- If animal cell centriole also duplicates

G2 phase

- Cell prepares itself for division
- Synthesis of proteins and RNA takes place
- ATP synthesis occurs



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CELL CYCLE

2. M Phase

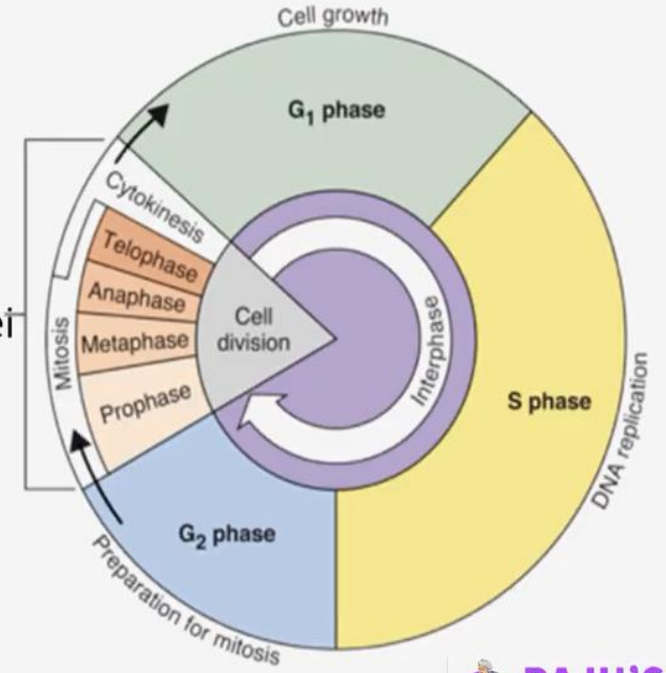
- Cell division occurs in M phase
- This phase has a short duration
- M phase is composed of two process

i) Karyokinesis

- Division of nucleus into two daughter nuclei
- Four sub stages
  - ✓ Prophase
  - ✓ Metaphase
  - ✓ Anaphase
  - ✓ Telophase

ii) Cytokinesis

- Division of cytoplasm resulting in two daughter cells



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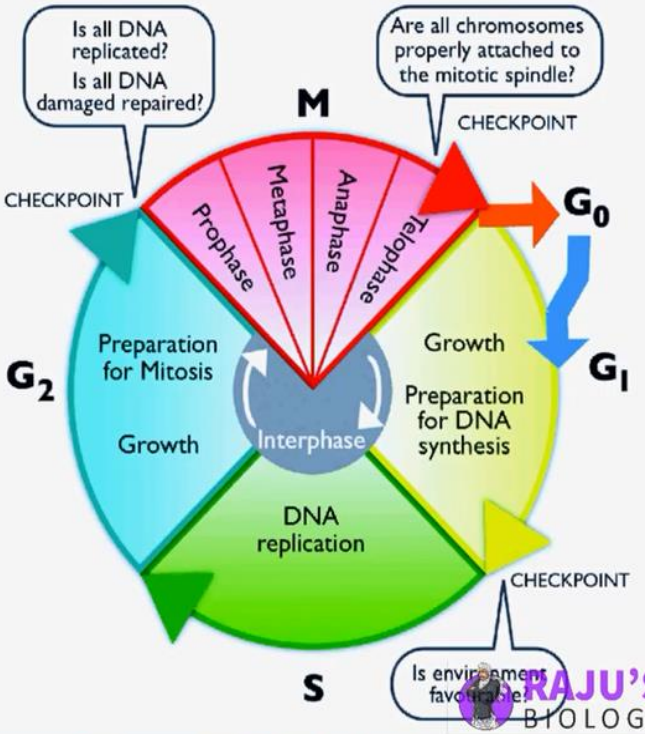
CELL CYCLE CHECKPOINTS

- Cell cycle checkpoints are control mechanisms in cell cycle which ensure its proper progression
- Three most important checkpoints
  - ✓ G1 Checkpoint
  - ✓ G2 Checkpoint
  - ✓ M checkpoint

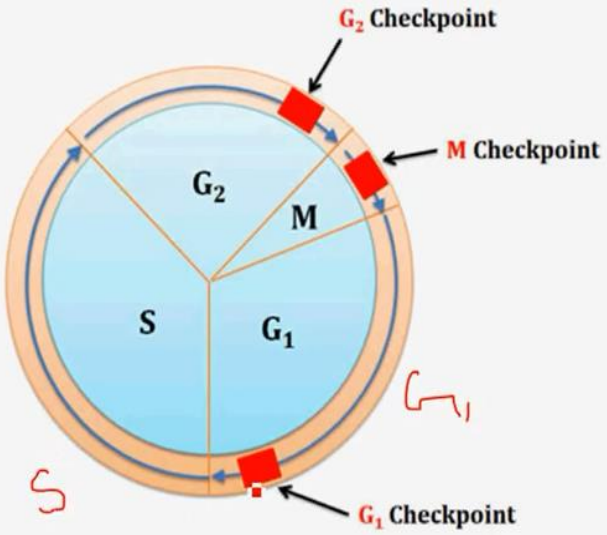


CELL CYCLE CHECKPOINTS

G1 CHECKPOINT

- This checkpoint checks internal and external conditions are right for division
  - ✓ Check cell size
  - ✓ Check Enzyme, Protein and ATP are synthesized
  - ✓ Check DNA damage or not
- If a cell doesn't get it may leave the cell cycle and enter a resting state called G0 phase

DNA is ok?
Enough resource for DNA replication?
Build enough proteins?
Is environment is ok?



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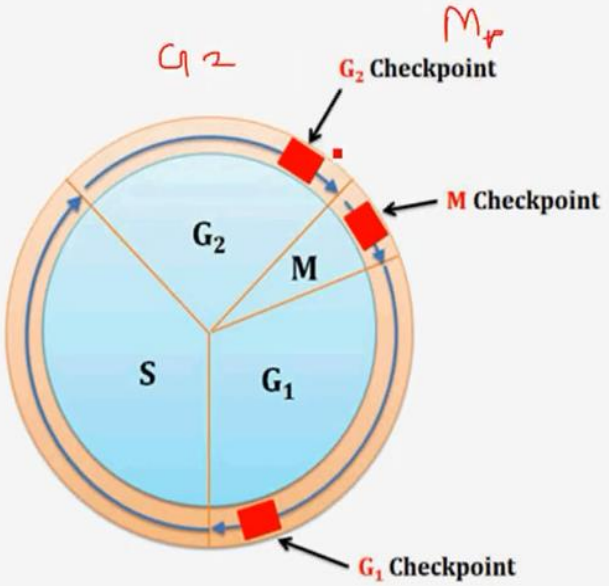
CELL CYCLE CHECKPOINTS

G2 CHECKPOINT

- ✓ DNA replication completeness
- ✓ Check DNA completely copied or not
- ✓ Check Enzyme, Protein and ATP are synthesized

- ➢ If errors or damage are detected
- ➢ Cell will pause at G2 checkpoint to allow for repairs
- ➢ If the damage is irreparable, the cell may undergo apoptosis

DNA correctly replicated?
DNA replication is complete?
Build enough protein?



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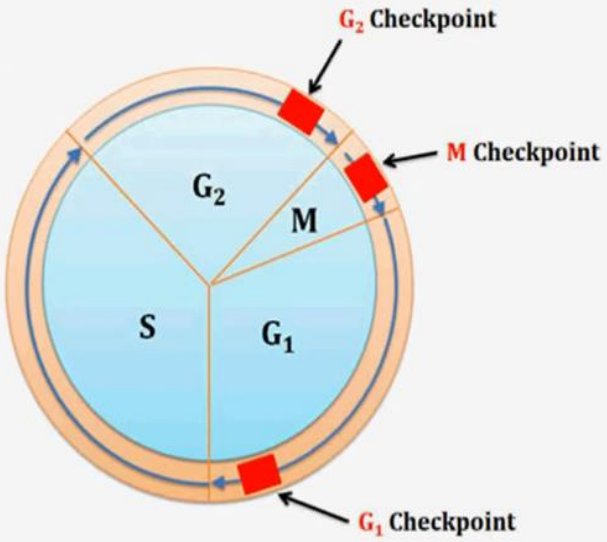
CELL CYCLE CHECKPOINTS

M CHECKPOINT

- M checkpoint is also known as the spindle checkpoint
- Chromosome attachment to spindle at metaphase plate
- If chromosome is misplaced, the cell will pause mitosis, allowing time for spindle to capture the stray chromosome

Spindle fibres properly formed?
Chromosomes correctly oriented?
All chromosomes attached to spindle fibres?



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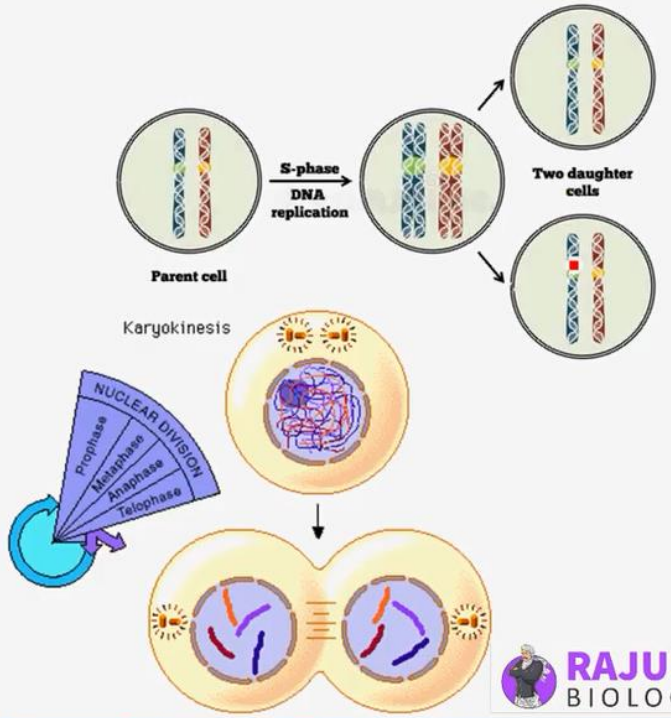
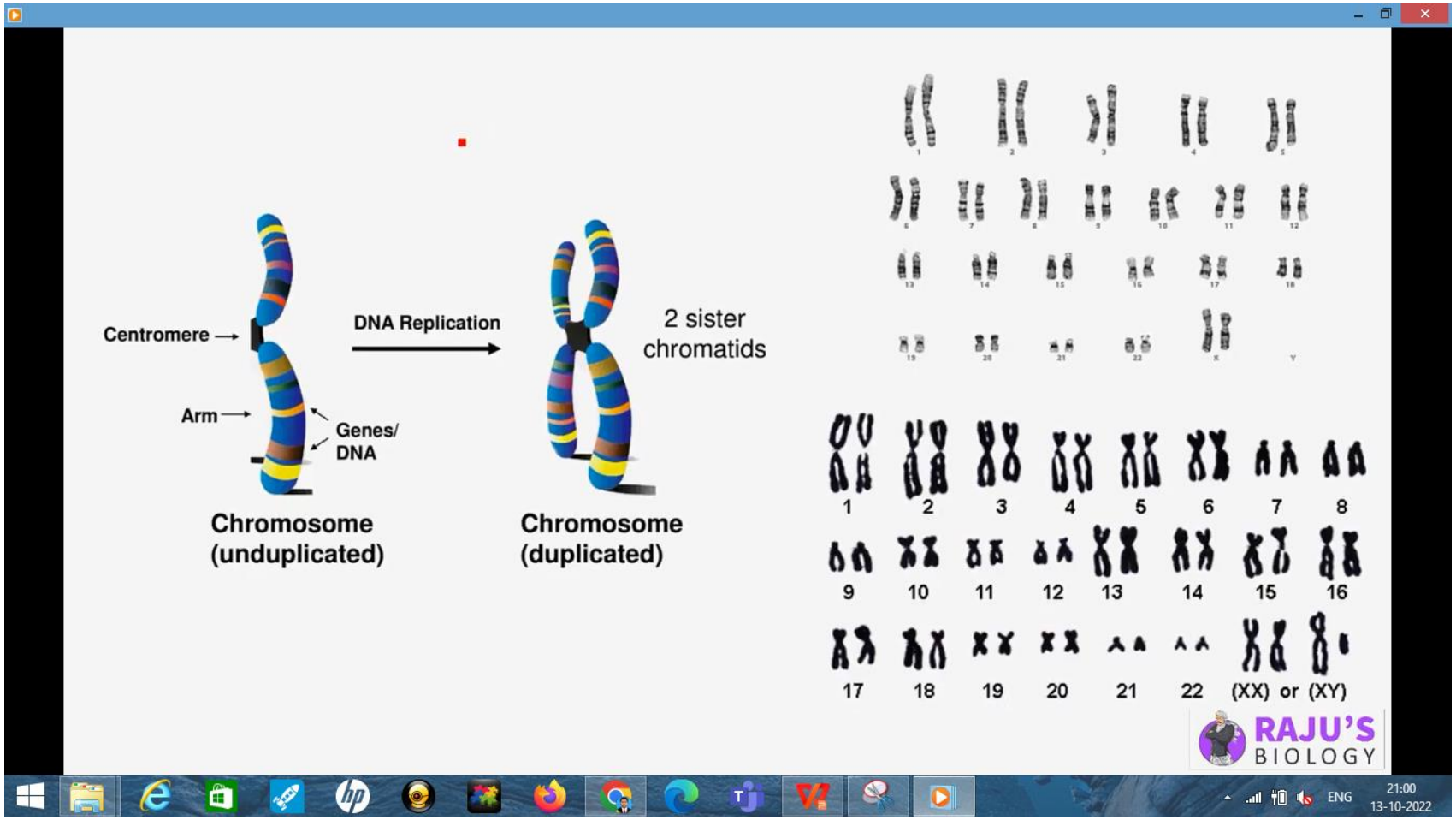
CELL DIVISION: MITOSIS

- Mitosis is called as equational division
- No change in number of chromosomes in parent cell & daughter cell
- Two major processes occur during M Phase: Karyokinesis and Cytoinesis

Karyokinesis

- Nucleus division is occurs
- Chromosomes are also separated
- This phase consists of 4 stages
  - ✓ Prophase
  - ✓ Metaphase
  - ✓ Anaphase
  - ✓ Telophase




Centromere
Arm
Genes/
DNA
DNA Replication
2 sister
chromatids
Chromosome
(unduplicated)
Chromosome
(duplicated)
1
2
3
4
5
6
7
8
9
10
11
12
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21
22
(XX) or (XY)
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BIOLOGY

THANK U