

CELL CYCLE

DR SUBHADRA ROY
SURENDRANATH COLLEGE

DEFINITION OF CELL CYCLE

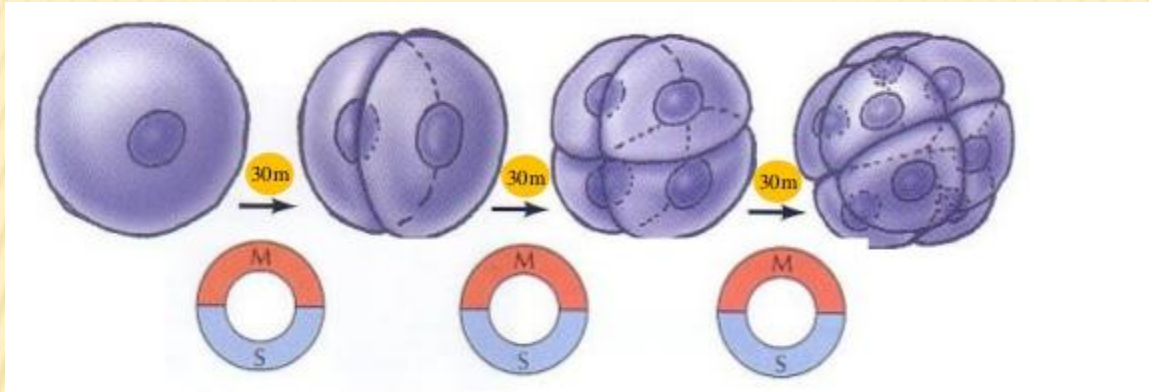
- ✘ Lodish and Baltimore
- ✘ ‘Ordered sequence of events in which a cell duplicates its chromosomes and divides into two.’

PHASES OF CELL CYCLE

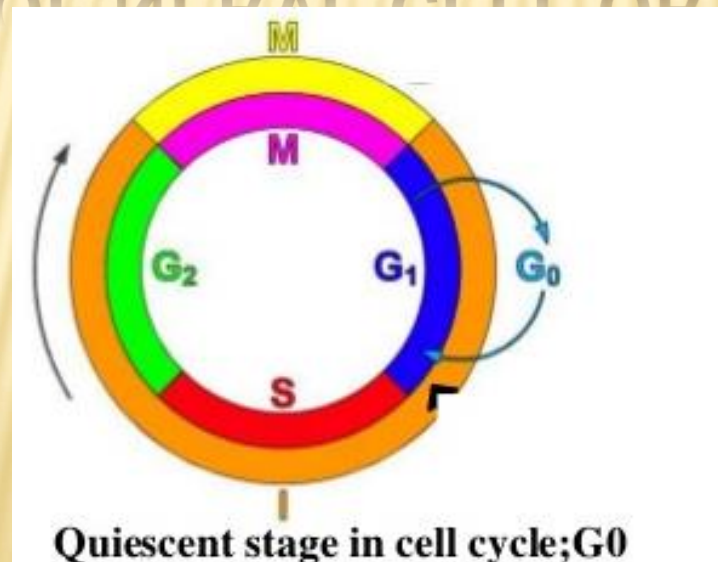
- ❖ G1
 - ❖ S
 - ❖ G2
 - ❖ M

 - ❖ G0
- Interphase
-
- ```
graph LR; G1 --- Interphase; S --- Interphase; G2 --- Interphase; M --- CellCycle[Cell Cycle]; G0 --- CellCycle;
```

# EMBRYONIC CELL CYCLE

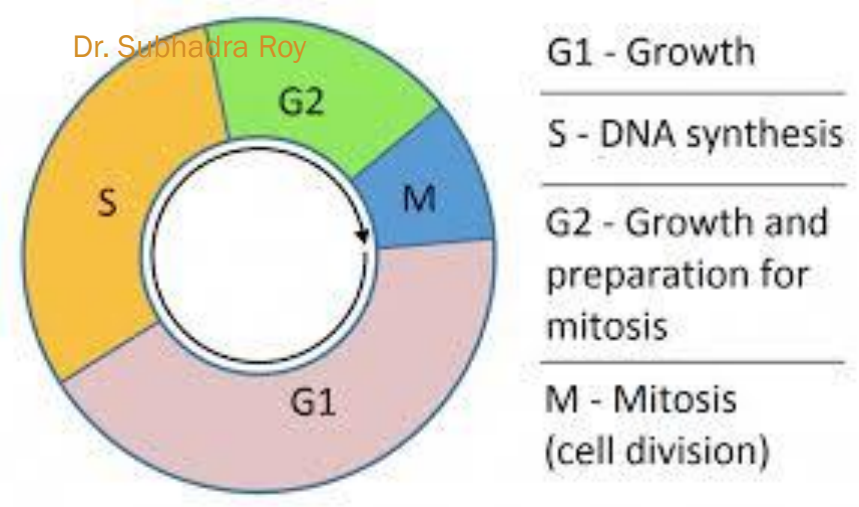


# CELL CYCLE OF NERVE CELL OR FIBROBLAST



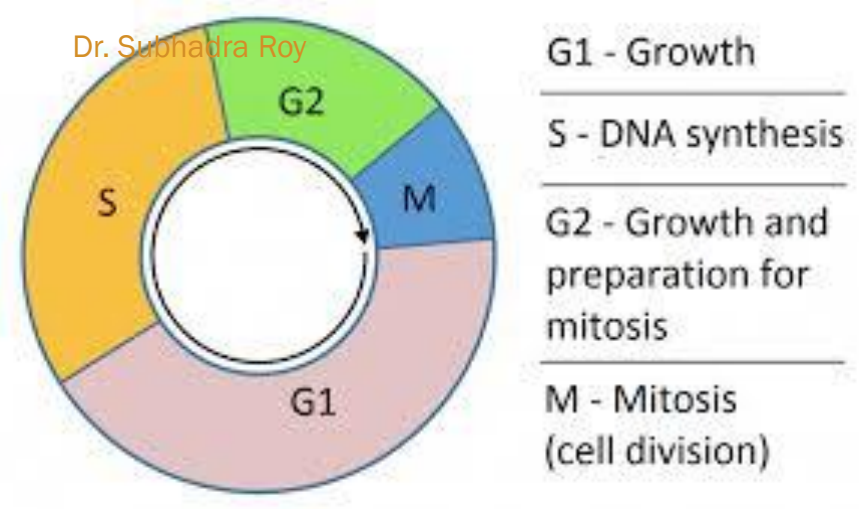
# PHASES OF CELL CYCLE IN BRIEF

## G1 PHASE



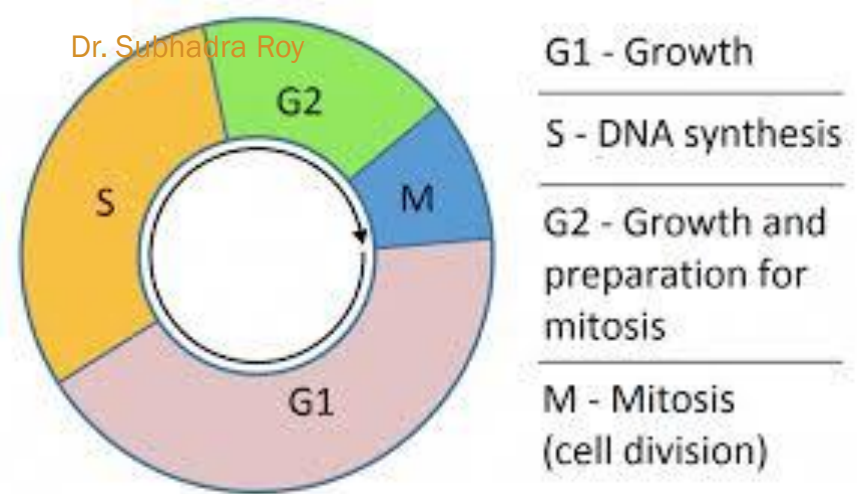
- ✘ Lies between M and S phase.
- ✘ Cell size increases.
- ✘ Synthesis and storing cytoplasm and cellular organelles.
- ✘ Chromatin network found.
- ✘ DNA content diploid.

# S PHASE



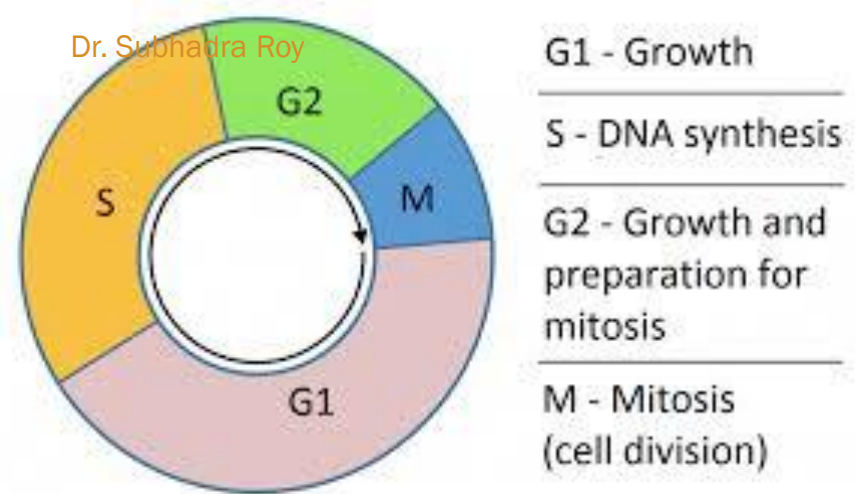
- ✘ Lies between G1 and G2 phases.
- ✘ DNA and histone synthesis occurs.
- ✘ Chromosome duplication occurs.

# G2 PHASE



- ✘ Lies between S and M phases.
- ✘ Shortest phase of interphase.
- ✘ Growth and intense cellular synthesis occurs.
- ✘ Synthesis of rRNA, mRNA and nucleolar RNA occurs.
- ✘ Nuclear volume increases.

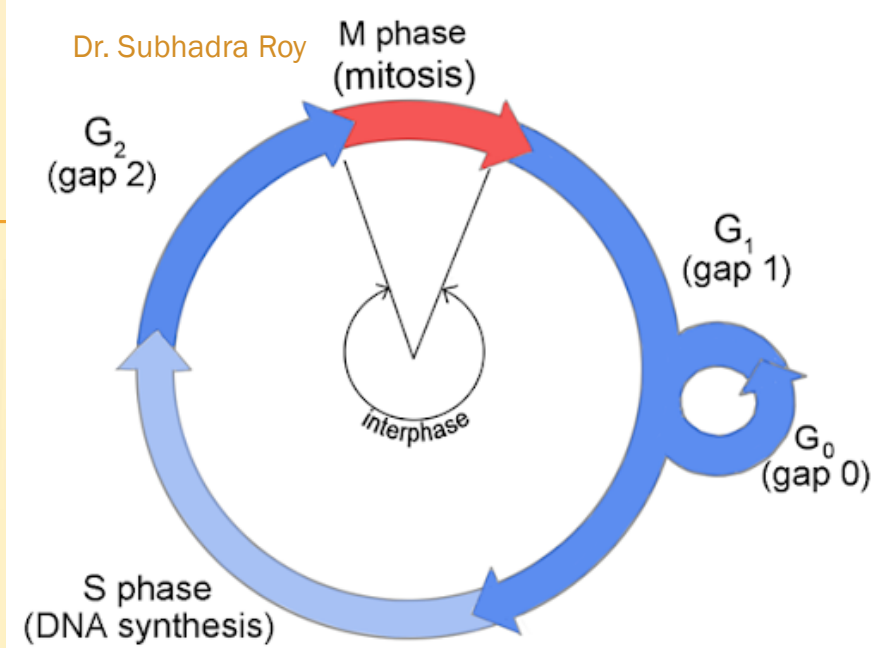
# M PHASE



- ✗ Dividing phase.
- ✗ Separation and distribution of chromatids to daughter cells.
- ✗ RNA and protein synthesis declines.
- ✗ Karyokinesis is followed by cytokinesis.
- ✗ Consists of
  - Prophase
  - Metaphase
  - Anaphase
  - Telophase

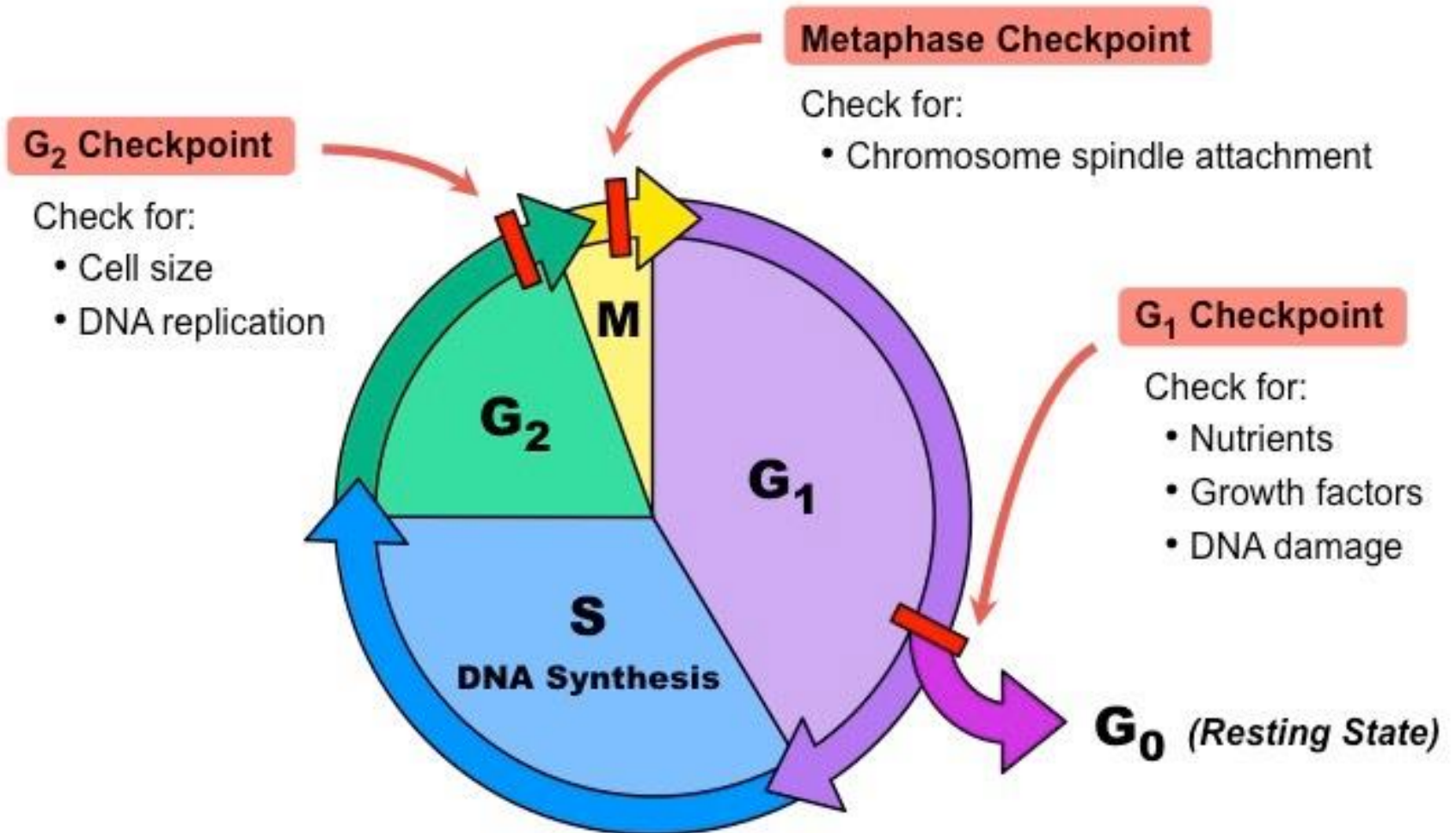
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# GO PHASE



- ✘ Known as Quiescent Phase.
- ✘ metabolically active and have reduced rates of protein synthesis.
- ✘ can be induced to divide again by proper stimulation

# CELL CYCLE REGULATION-CHECKPOINTS



# G1 CHECKPOINT

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- ✘ Known as START in budding yeast.
- ✘ Dependent on
  - Cell size
  - Nutrients availability
  - Mating factors
- ✘ Known as Restriction point in higher animals.
  - Growth factors

# G2 CHECKPOINT

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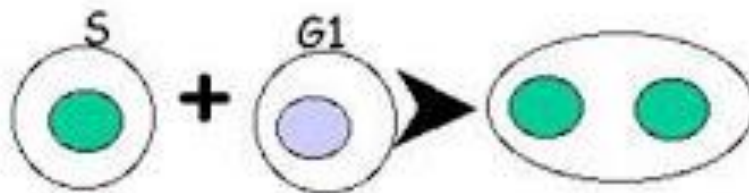
- ✘ Passage through this is regulated by
  - Unreplicated DNA
  - Damaged DNA
- ✘ In fission yeast, controlled by cell size and availability of nutrients.
- ✘ In vertebrate oocytes, controlled by hormonal stimulation.

# M CHECKPOINT

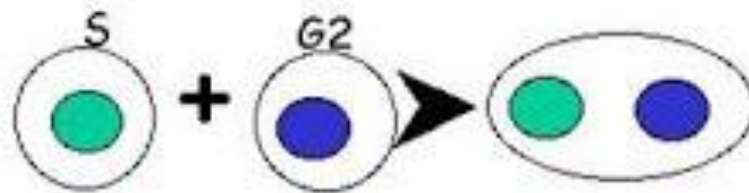
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- ✗ Occurs between metaphase and anaphase
- ✗ Controlled by
  - Proper chromosome alignment
  - Attachment of spindle fibers to chromatids

# Classic Experiment: Rao and Johnson Nuclear fusion



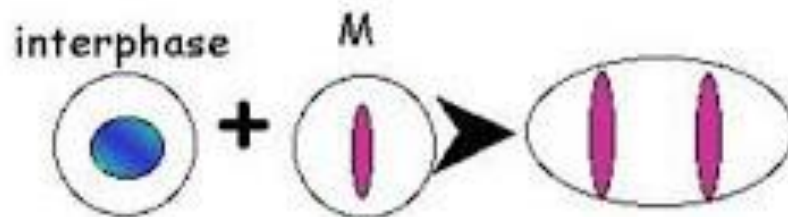
Conclusion: S phase nucleus  
Releases something that drives G1  
nucleus into S



Conclusion: G2 nucleus is resistant  
to S phase promoting factor

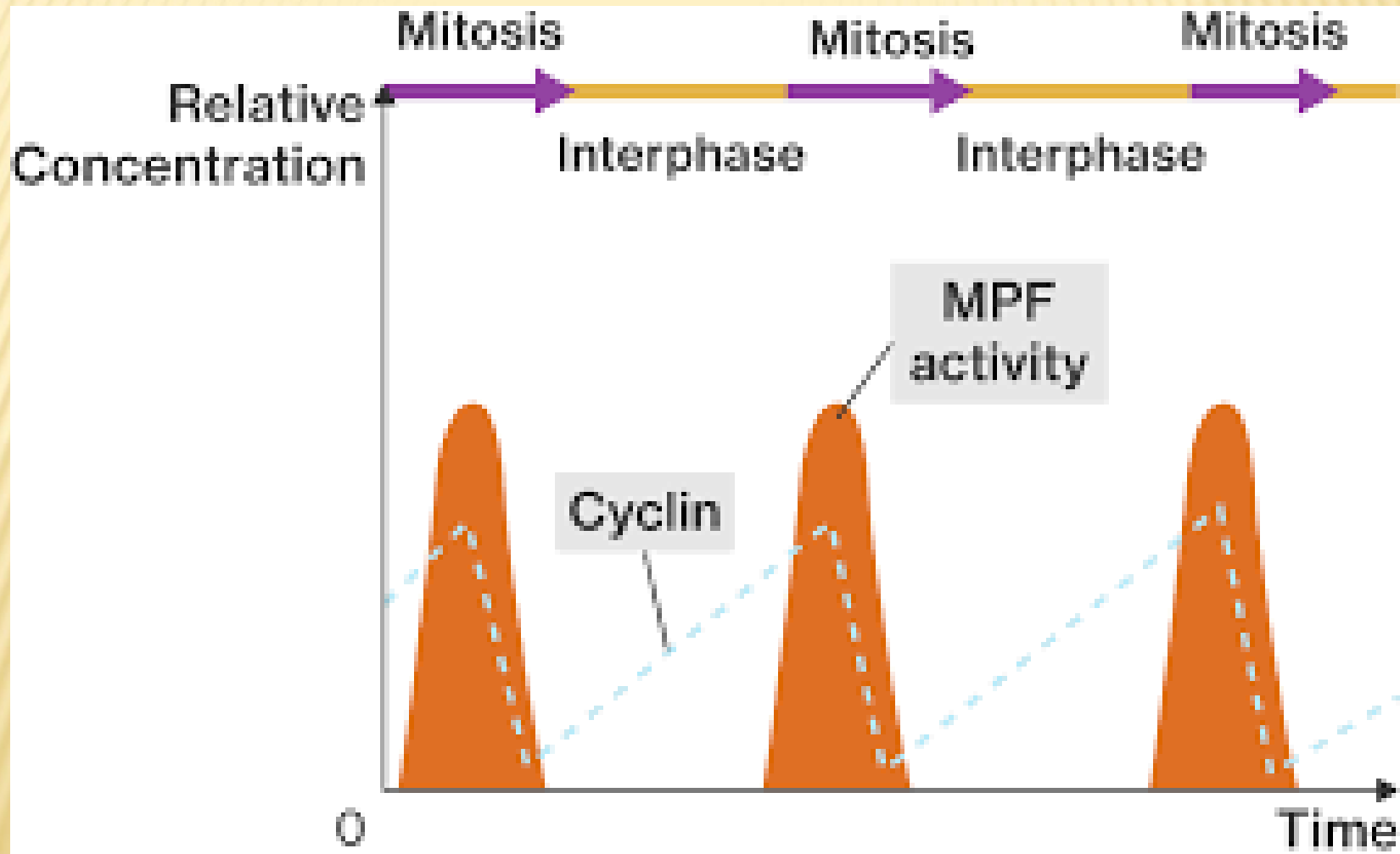


Conclusion: G1 and G2 do not  
influence each other



Conclusion: Mitotic nuclei release  
mitosis-promoting factor that  
affects all interphase nuclei

# MOLECULAR REGULATION OF CELL CYCLE

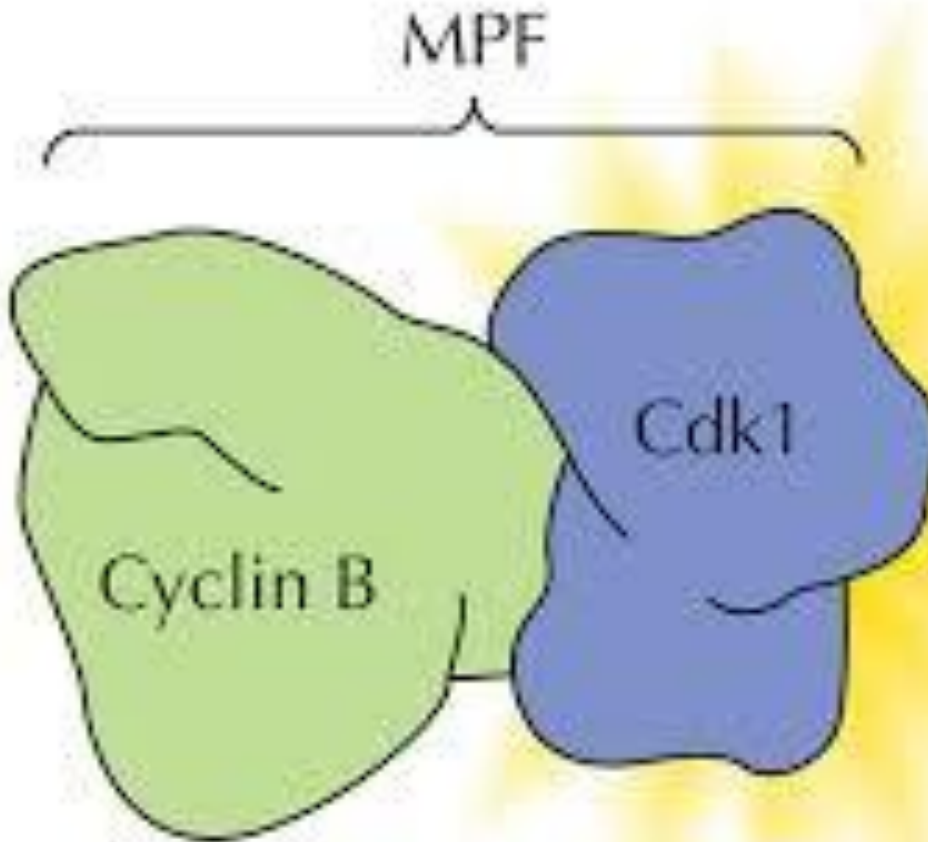


# DIFFERENT CYCLINS & CDKS

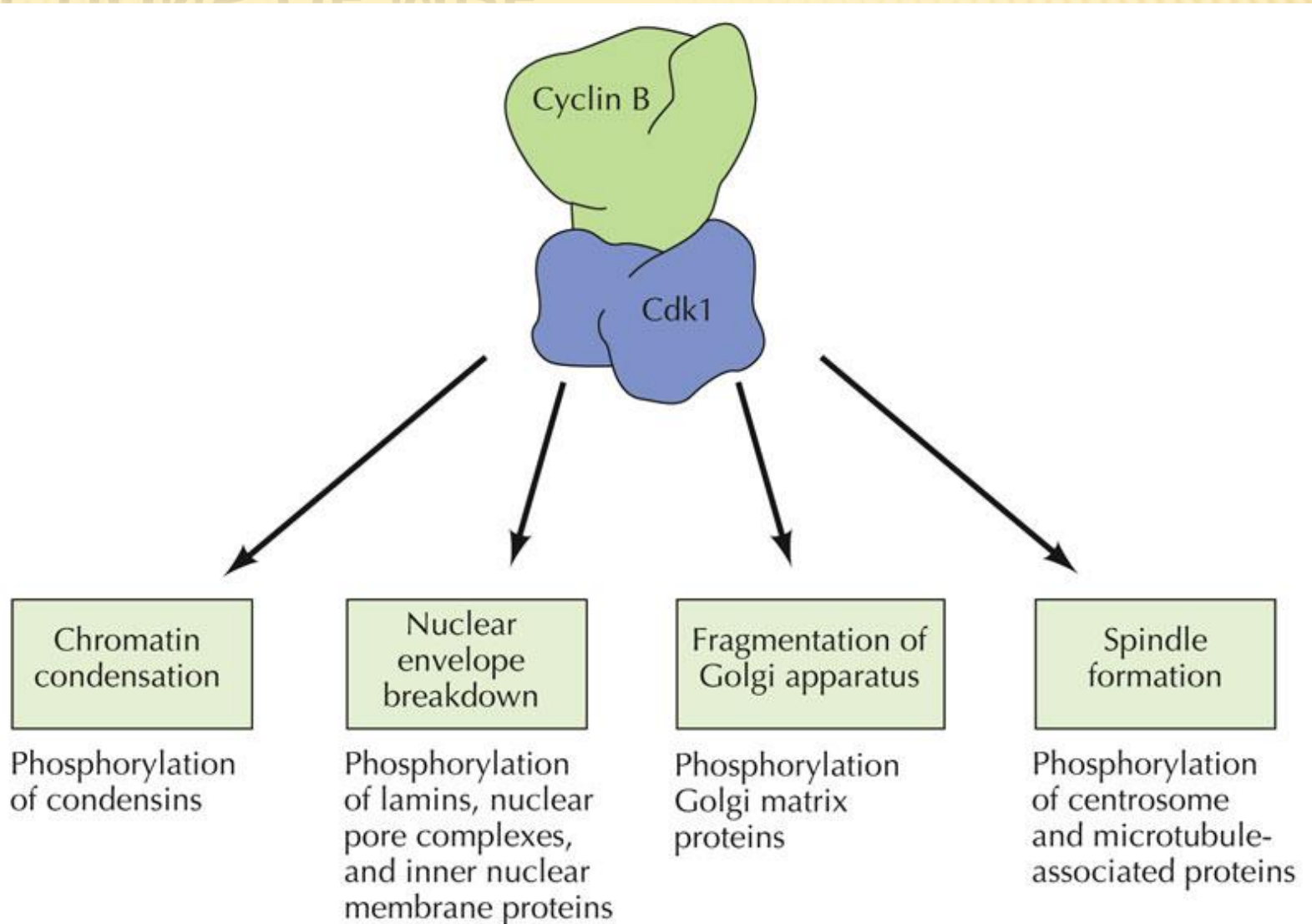
| CDKS | Cyclin        | Cell cycle            |
|------|---------------|-----------------------|
| CDK4 | Cyclin D1/2/3 | G1 phase              |
| CDK6 | Cyclin D1/2/3 | G1 phase              |
| CDK2 | Cyclin E      | G1/S phase transition |
| CDK2 | Cyclin A      | S phase               |
| CDK1 | Cyclin A      | G2/M phase transition |
| CDK1 | Cyclin B      | Mitosis               |

CDK, cyclin-dependent kinases; G1, pre-DNA synthesis; S, DNA synthesis; G2, pre-division

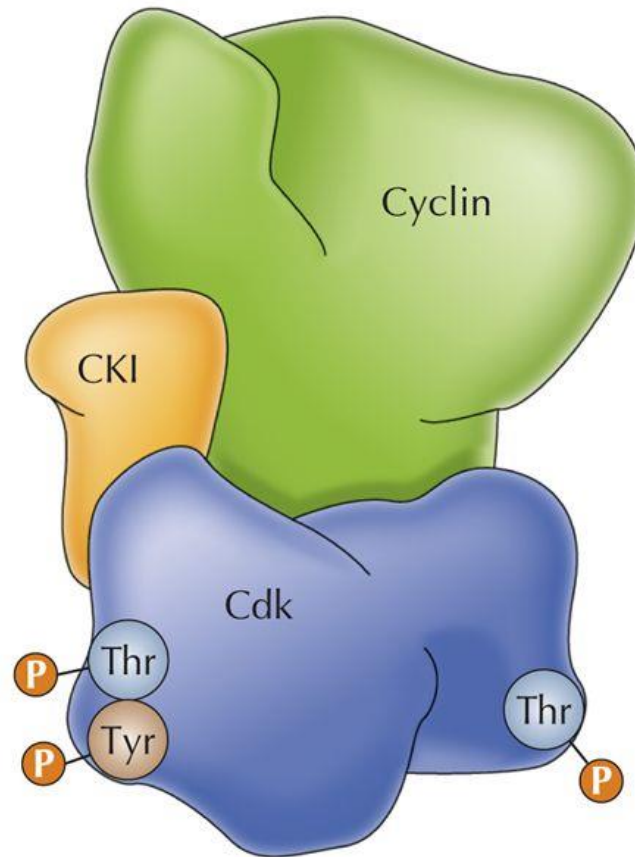
# MATURATION PROMOTING FACTOR (MPF)



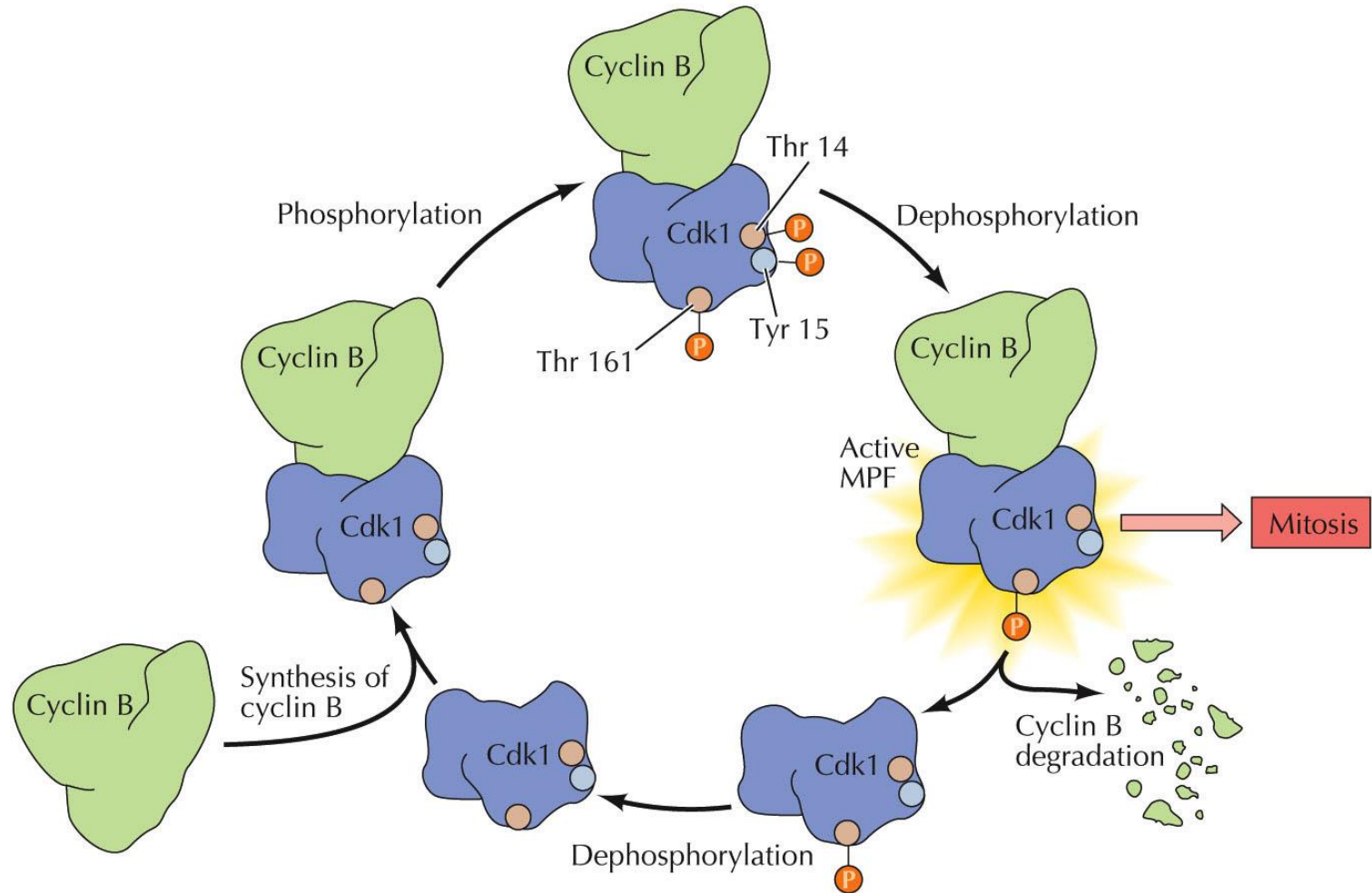
# FUNCTIONS OF MPF



# SITES OF PHOSPHORYLATION OF MPF



# REGULATION OF MPF



**THANK YOU**