

**BIO 211:**

**ANATOMY & PHYSIOLOGY I**

1

Please wait 20 seconds  
before starting slide show.  
Mouse click or  
Arrow keys to navigate.  
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## **CHAPTER 03 and Lab**

# **Overview of the CELL CYCLE**

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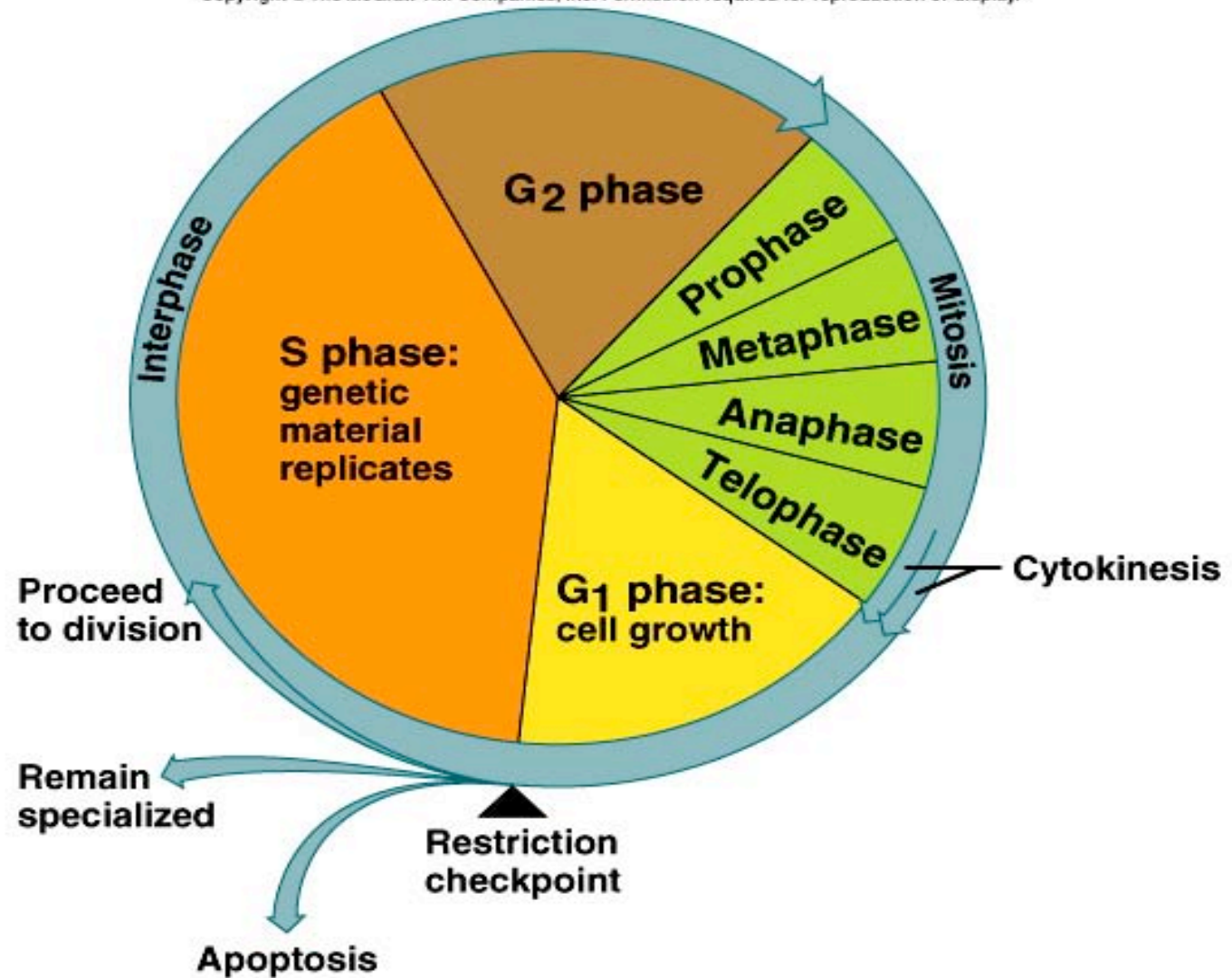
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# The Cell Cycle

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Series of changes a cell undergoes from the time it forms until the time it divides-



Stages:

**interphase**

**mitosis**

**cytoplasmic division**

**differentiation**

# The Cell Cycle

## A. The Cell Cycle

1. During the **first growth phase,  $G_1$** , (your text refers to G as "gap") the cell synthesizes new proteins and grows in size. At the end of this phase, **centrioles replicate**.
2. During the **S, or synthesis phase**, the cell undergoes **semiconservative replication of DNA**.
3.  **$G_2$ , the second growth phase**, is a **brief period** in which the **cell makes the enzymes needed for cell division**.  
 $G_1$ , S, and  $G_2$  are collectively known as **interphase**.
4. During the **M, or mitotic, phase**, the nucleus replicates its contents (**karyokinesis**).

# Interphase

- very active period
- cell grows
- cell maintains routine functions
- cell replicates genetic material to prepare for nuclear division
- cell synthesizes new organelles to prepare for cytoplasmic division
- Phases:
  - **G phases** – cell grows and synthesizes structures other than DNA
  - **S phase** – cell replicates DNA

# Mitosis

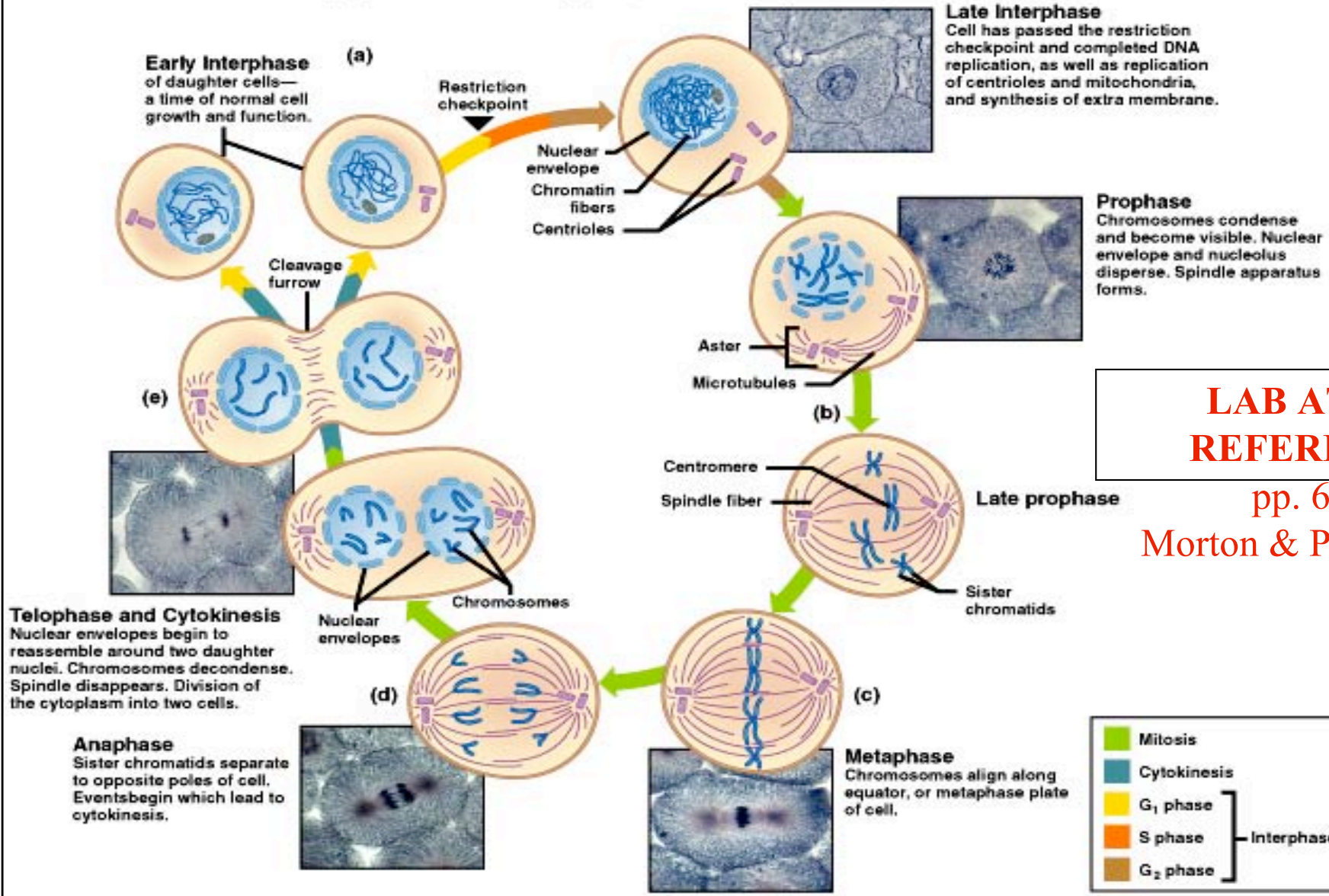
**LAB ATLAS  
REFERENCE:**

pp. 6 - 7  
Morton & Perry, 1998

- produces two daughter cells from an original cell
- nucleus divides – **karyonkinesis**
- cytoplasm divides – **cytokinesis**
- Stages:
  - **prophase** – chromosomes form;  
nuclear envelope disappears
  - **metaphase** – chromosomes align midway  
between centrioles
  - **anaphase** – chromosomes separate and  
move to centrioles
  - **telophase** – chromatin forms;  
nuclear envelope forms

# Mitosis

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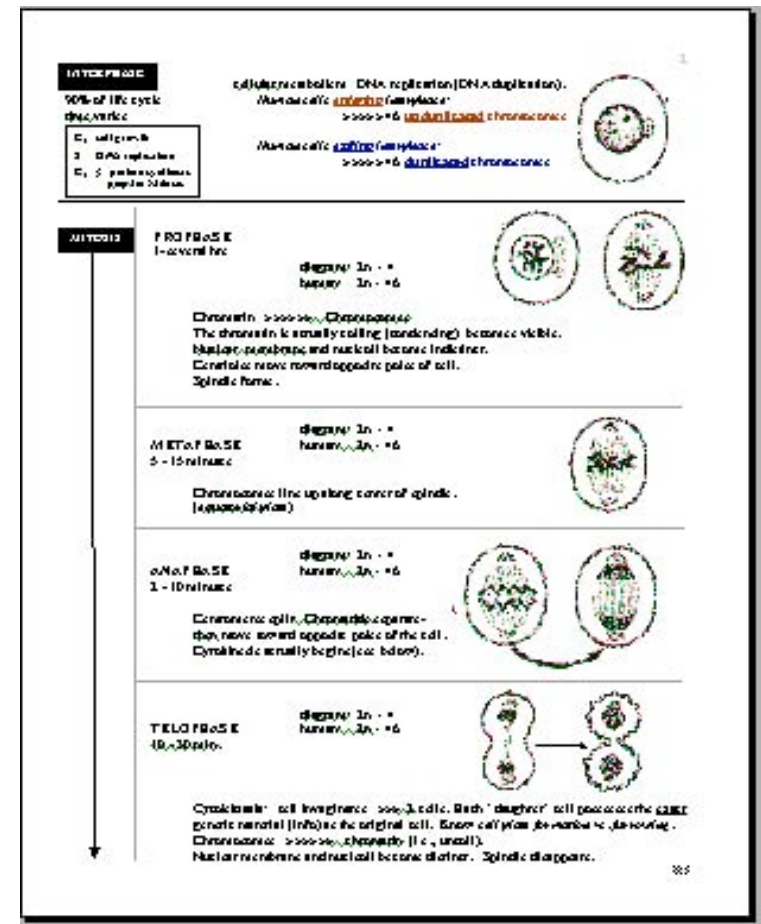
<span style="color: green;">■</span> Mitosis	} Interphase
<span style="color: teal;">■</span> Cytokinesis	
<span style="color: yellow;">■</span> G <sub>1</sub> phase	
<span style="color: orange;">■</span> S phase	
<span style="color: brown;">■</span> G <sub>2</sub> phase	

# Cytoplasmic Division

**(CYTOKINESIS)**

- **begins during anaphase**
- **continues through telophase**
- **contractile ring pinches cytoplasm in half (furling)**

Be sure to get the separate,  
 one-page  
**MITOSIS SKETCH**  
 at the end.





# Control of Cell Division

- **cell division capacities vary greatly among cell types**
  - skin and blood cells divide often
  - liver cells divide a specific number of times then cease
- **chromosome tips (telomeres) that shorten with each mitosis provide a mitotic clock**
- **cells divide to provide a more favorable surface area to volume relationship**
- **growth factors and hormones stimulate cell division**
  - hormones stimulate mitosis of smooth muscle cells in uterus
  - epidermal growth factor stimulates growth of new skin
- **contact inhibition**
- **tumors are the consequence of a loss of cell cycle control**

# Tumors

## Two types of tumors

- **benign** – usually remains localized
- **malignant** – invasive and can metastasize; cancerous

## Genes that cause cancer

- **oncogenes** – activate other genes that increase cell division
- **tumor suppressor gene** – normally regulate mitosis; if inactivated they will not regulate mitosis

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Normal cells  
(with hairlike cilia)

Cancer cells

# MITOSIS SKETCH

## INTERPHASE

90% of life cycle  
time varies

- G<sub>1</sub> cell growth
- S DNA replication
- G<sub>2</sub> ↑ protein synthesis  
prep for Mitosis

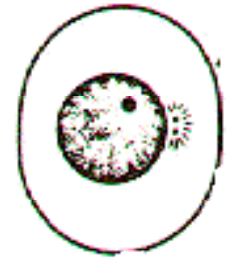
cellular metabolism; DNA replication (DNA duplication).

Human cells **entering** interphase:

>>>>> 46 **unduplicated** chromosomes

Human cells **exiting** interphase:

>>>>> 46 **duplicated** chromosomes

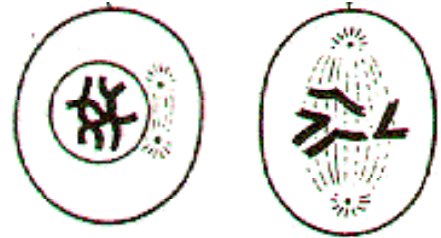


## MITOSIS

### PROPHASE

1 - several hrs

diagram: 2n = 4  
human: 2n = 46



Chromatin >>>>> Chromosomes

The chromatin is actually coiling (condensing); becomes visible.

Nuclear membrane and nucleoli become indistinct.

Centrioles move toward opposite poles of cell.

Spindle forms.

### METAPHASE

5 - 15 minutes

diagram: 2n = 4  
human: 2n = 46

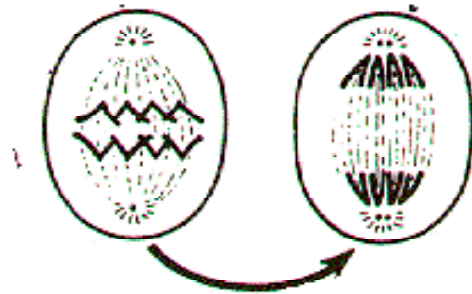


Chromosomes line up along center of spindle.  
(*equatorial plate*)

### ANAPHASE

2 - 10 minutes

diagram: 2n = 4  
human: 2n = 46

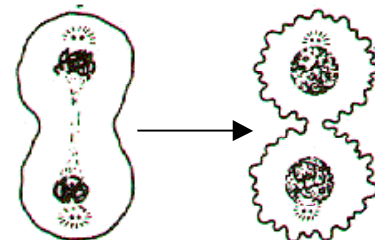


Centromeres split; Chromatids separate-  
then move toward opposite poles of the cell.  
Cytokinesis actually begins (see below).

### TELOPHASE

10 - 30 min.

diagram: 2n = 4  
human: 2n = 46



**Cytokinesis:** cell invaginates >>> 2 cells. Each “daughter” cell possesses the exact genetic material (info) as the original cell. Know *cell plate formation vs. furrowing*.

Chromosomes >>>>> chromatin (i.e., uncoil).

Nuclear membrane and nucleoli become distinct. Spindle disappears.