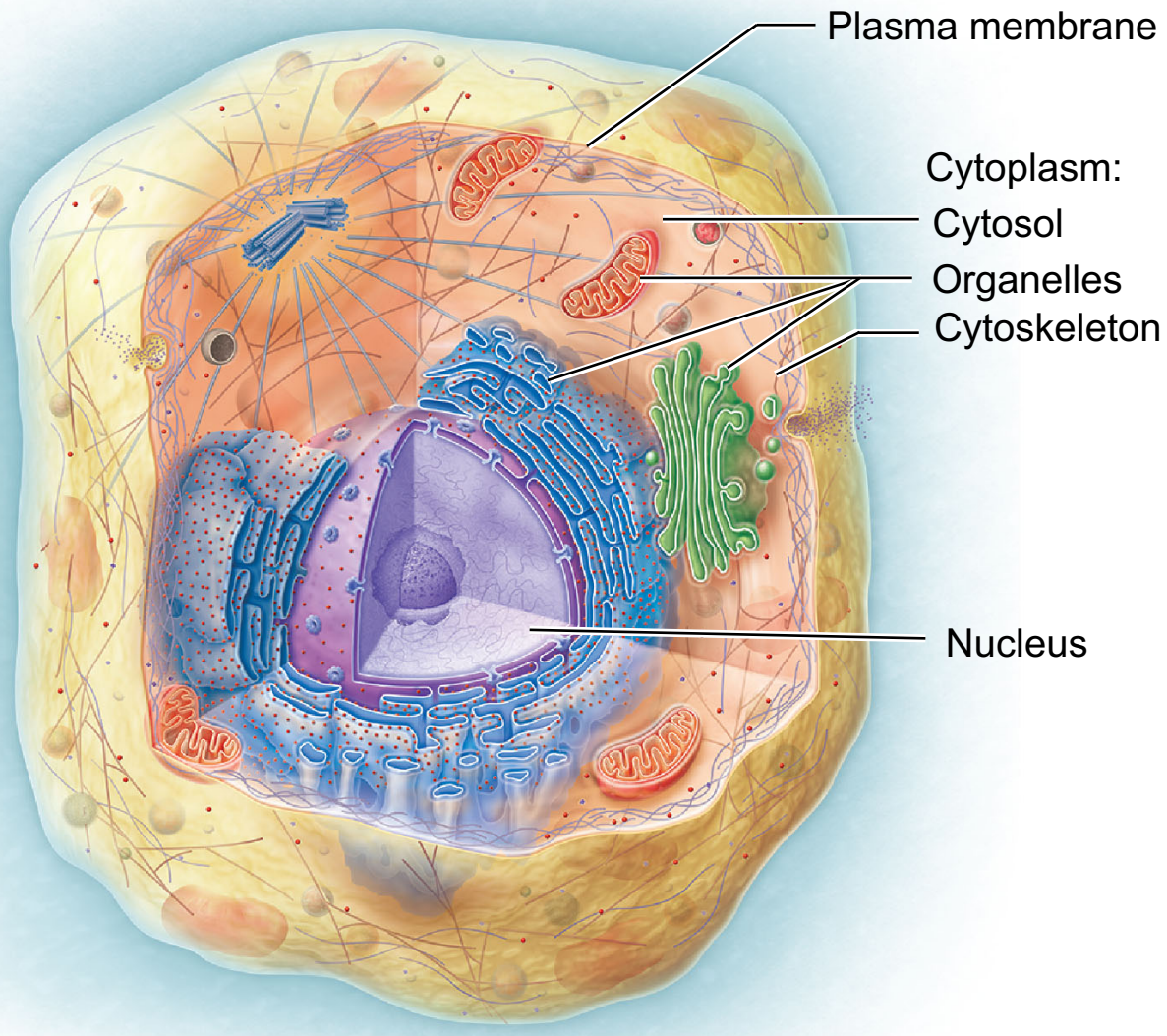
TEAS Biology review workshop
May 17th
3-5pm

Organelles, mitosis, meiosis, DNA replication, chromosomes, genes, Punnett square, inheritance of traits

Figure 3.1 The basic components of a generalized cell.



Chapter Opener 3 Computer-generated image: The series of events from cell formation to cell division, shown here, is called the cell cycle.

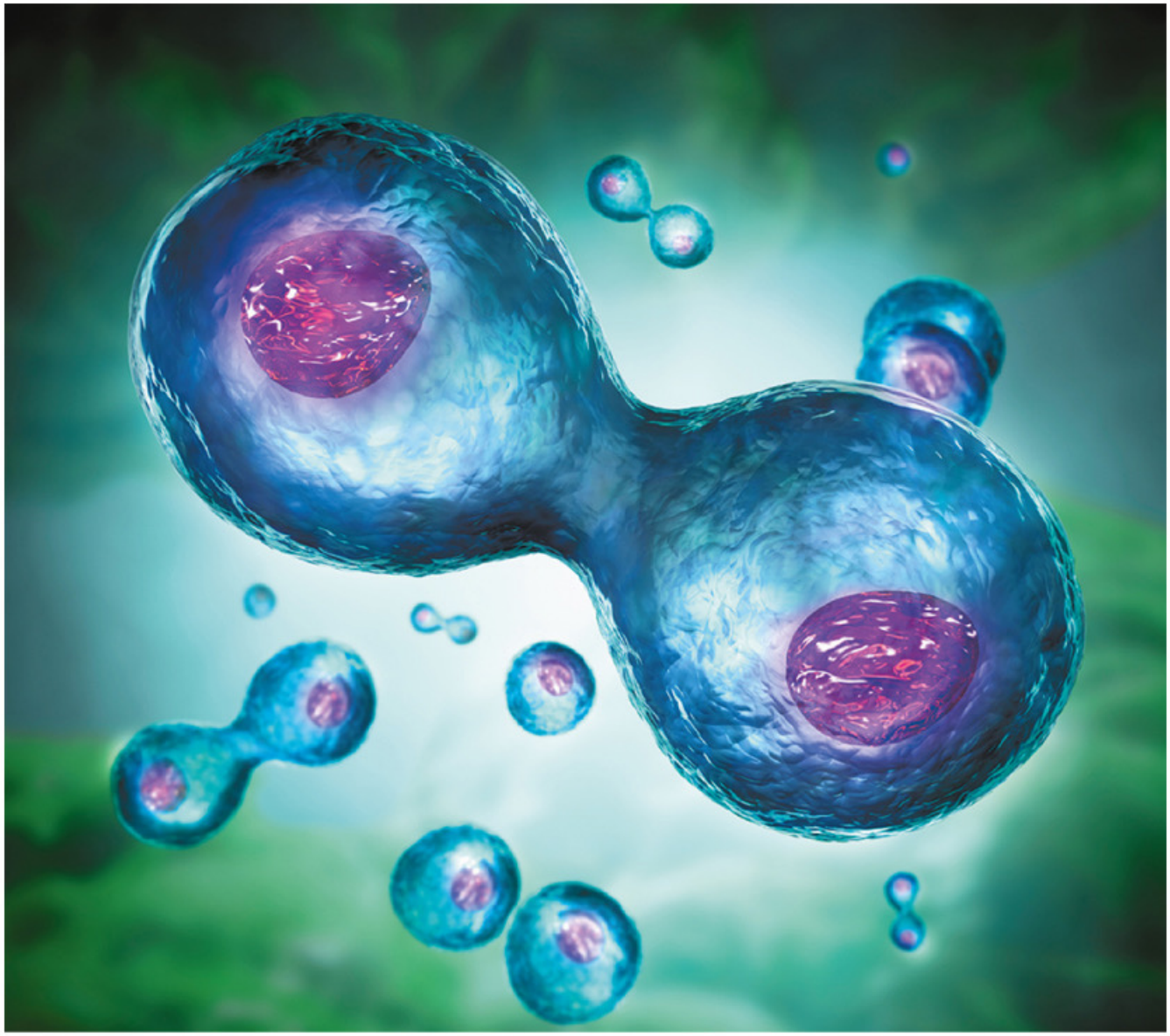
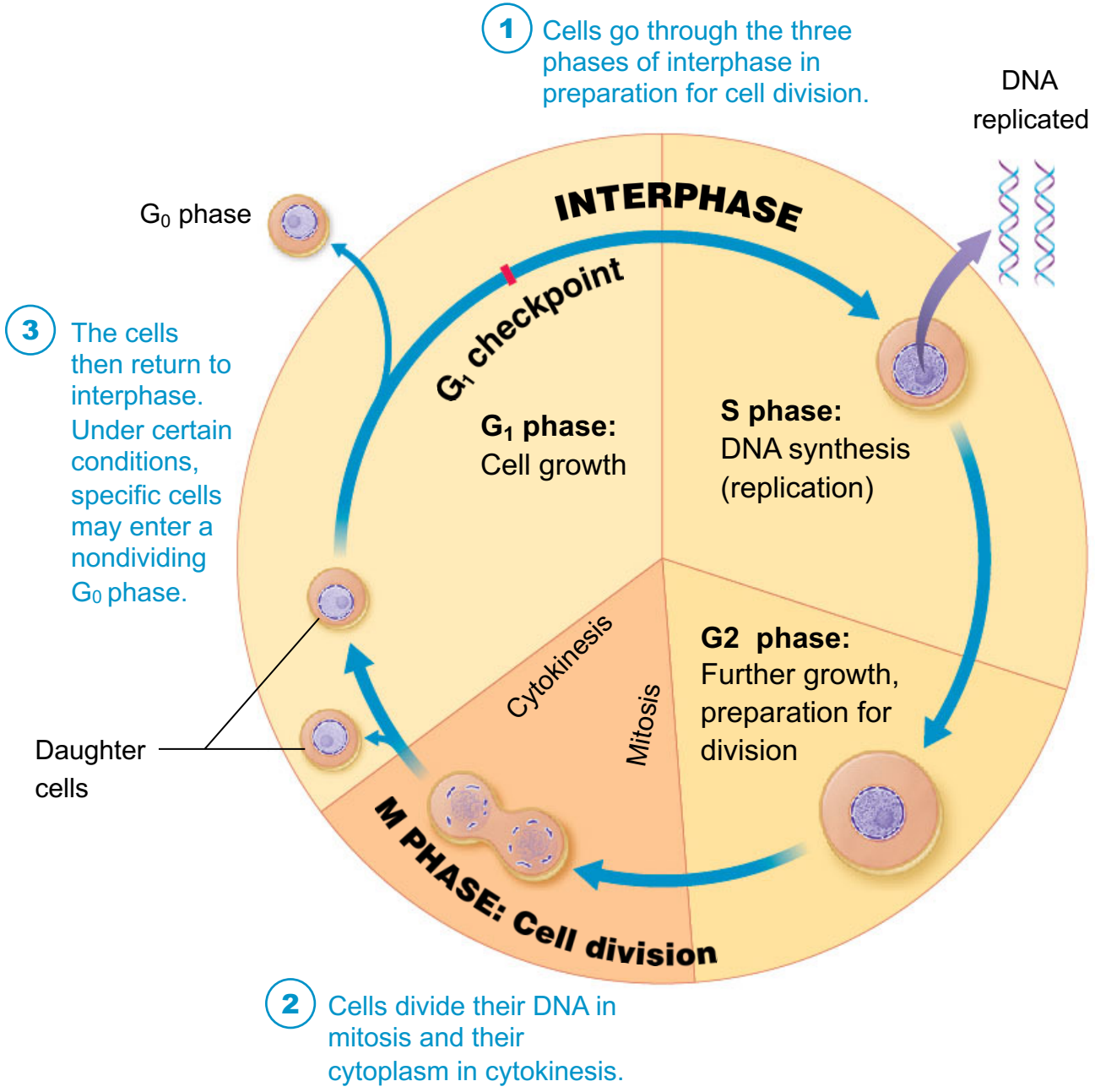
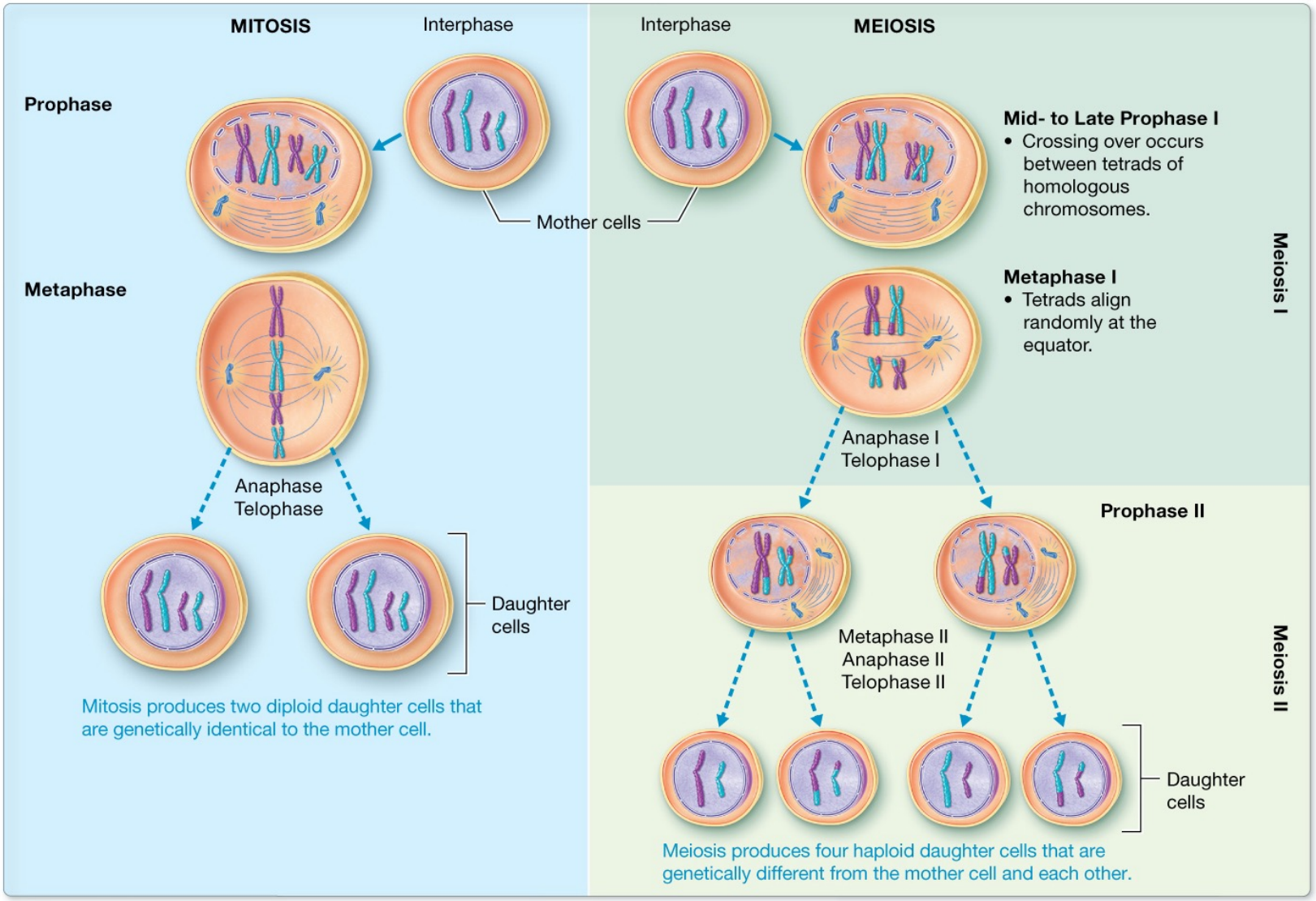


Figure 3.33 The cell cycle.





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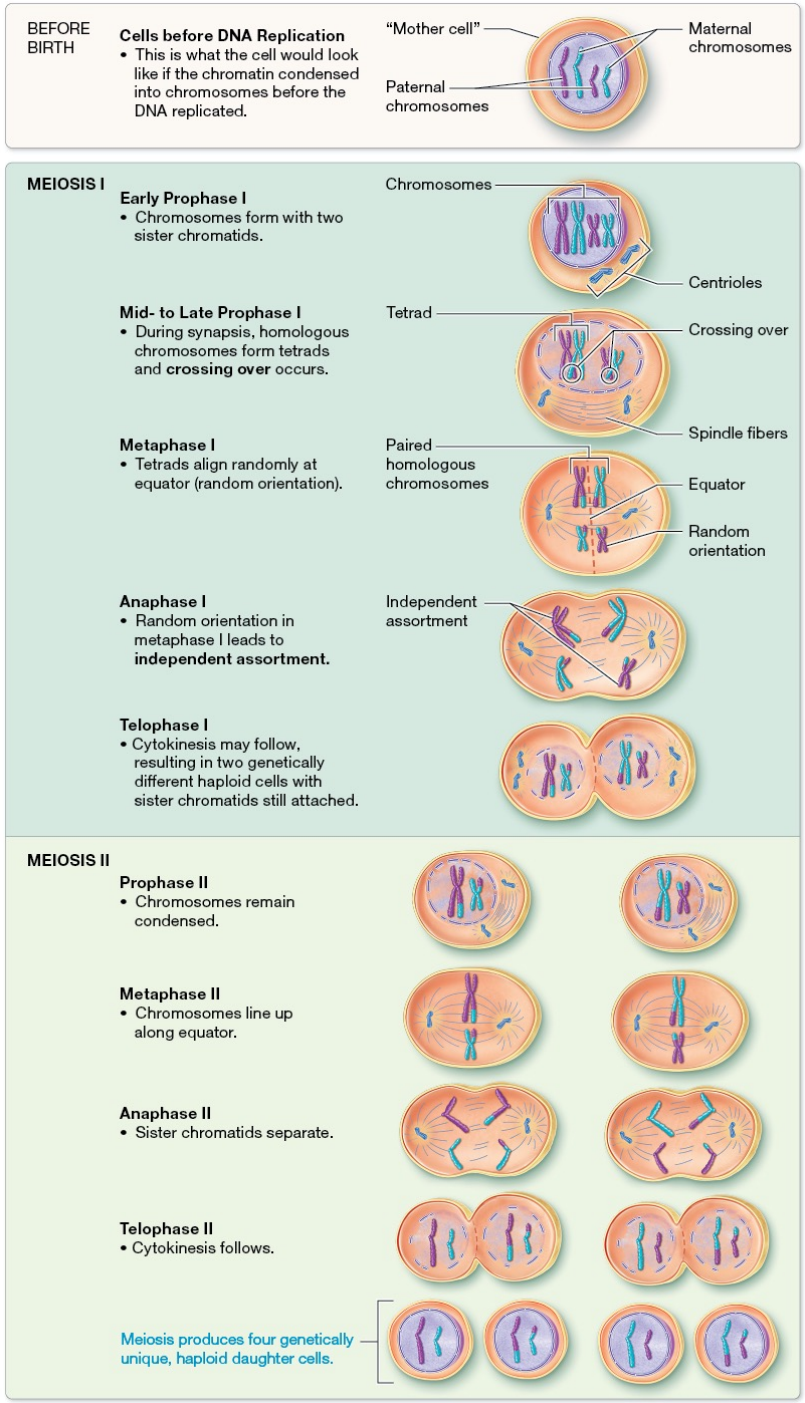

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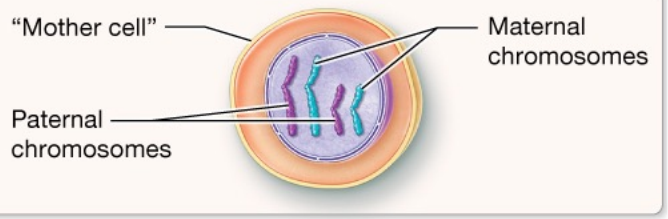
BEFORE BIRTH

Cells before DNA Replication

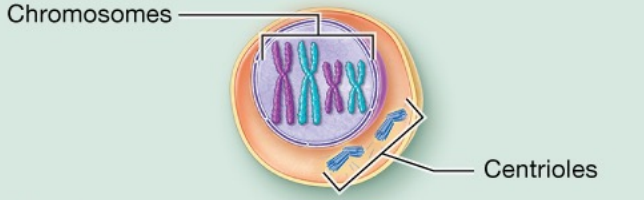
- This is what the cell would look like if the chromatin condensed into chromosomes before the DNA replicated.



MEIOSIS I

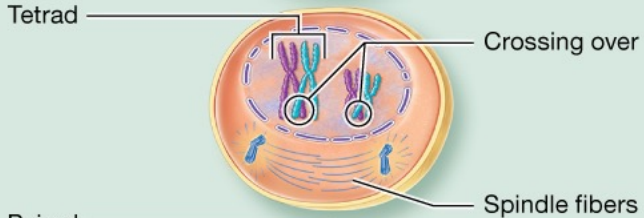
Early Prophase I

- Chromosomes form with two sister chromatids.



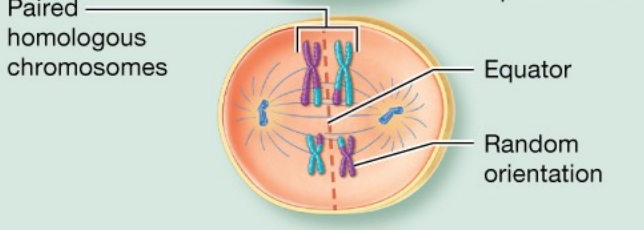
Mid- to Late Prophase I

- During synapsis, homologous chromosomes form tetrads and **crossing over** occurs.



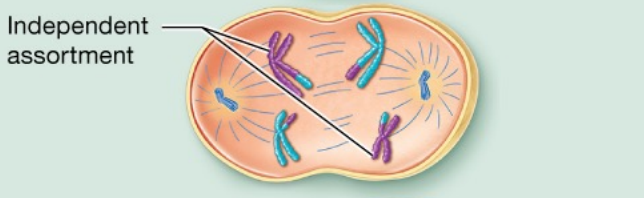
Metaphase I

- Tetrads align randomly at equator (random orientation).



Anaphase I

- Random orientation in metaphase I leads to **independent assortment.**



Telophase I

- Cytokinesis may follow, resulting in two genetically different haploid cells with sister chromatids still attached.

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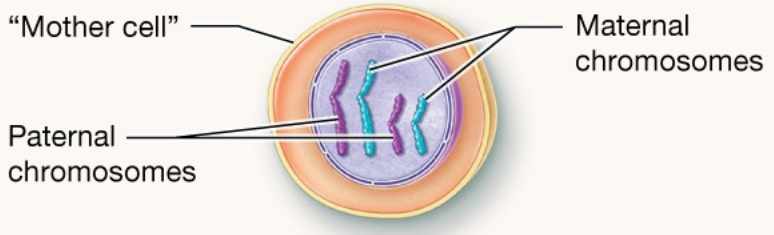
BEFORE BIRTH

Cells before DNA Replication

- This is what the cell would look like if the chromatin condensed into chromosomes before the DNA replicated.



MEIOSIS II

Prophase II

- Chromosomes remain condensed.

Metaphase II

- Chromosomes line up along equator.

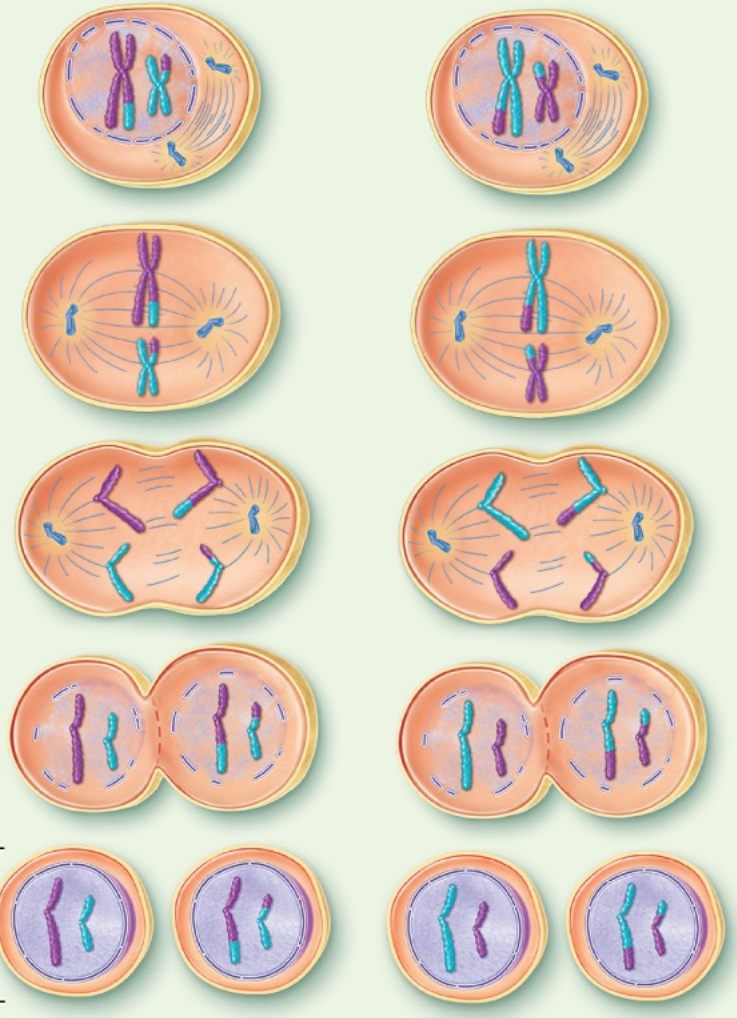
Anaphase II

- Sister chromatids separate.

Telophase II

- Cytokinesis follows.

Meiosis produces four genetically unique, haploid daughter cells.



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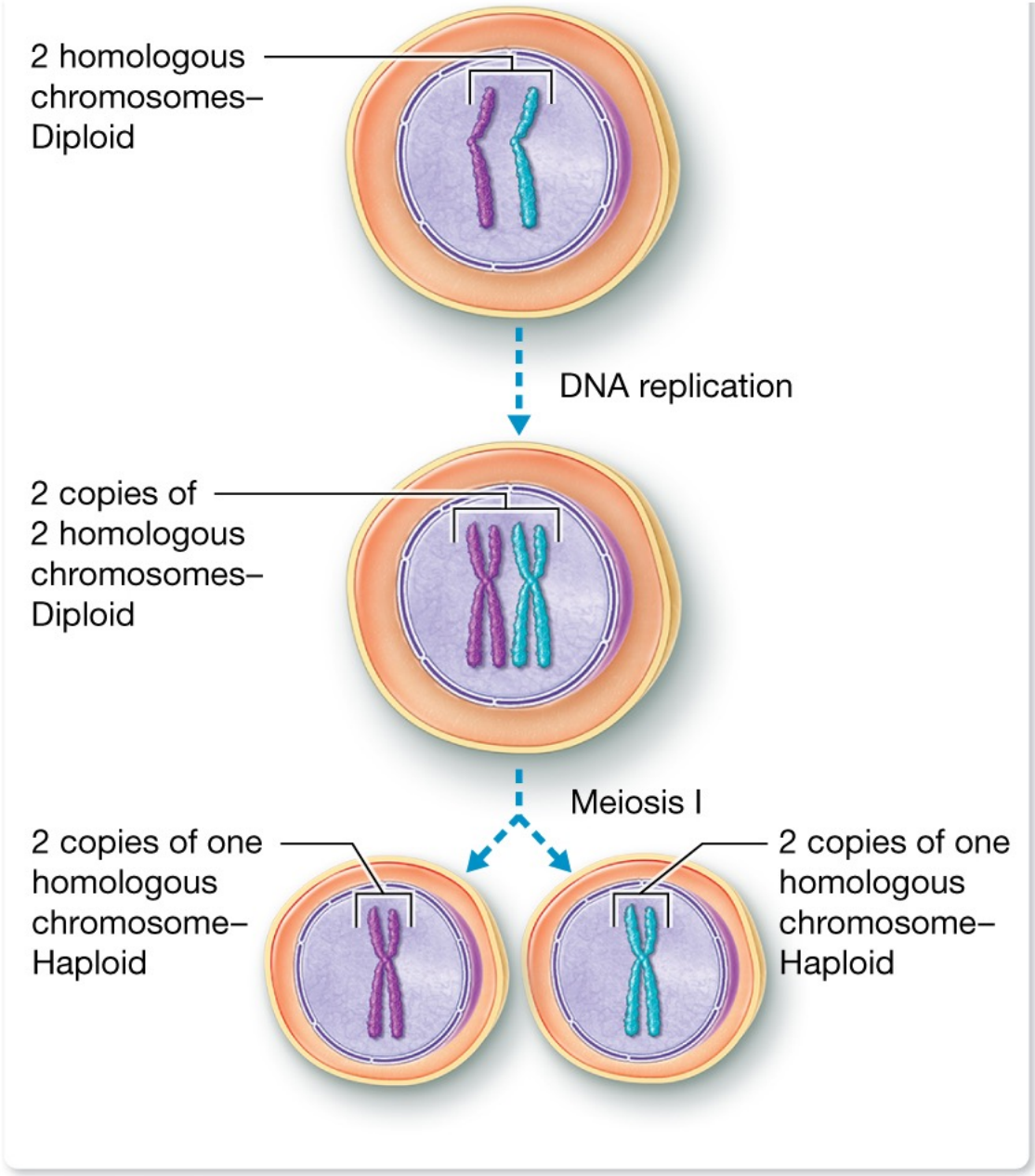

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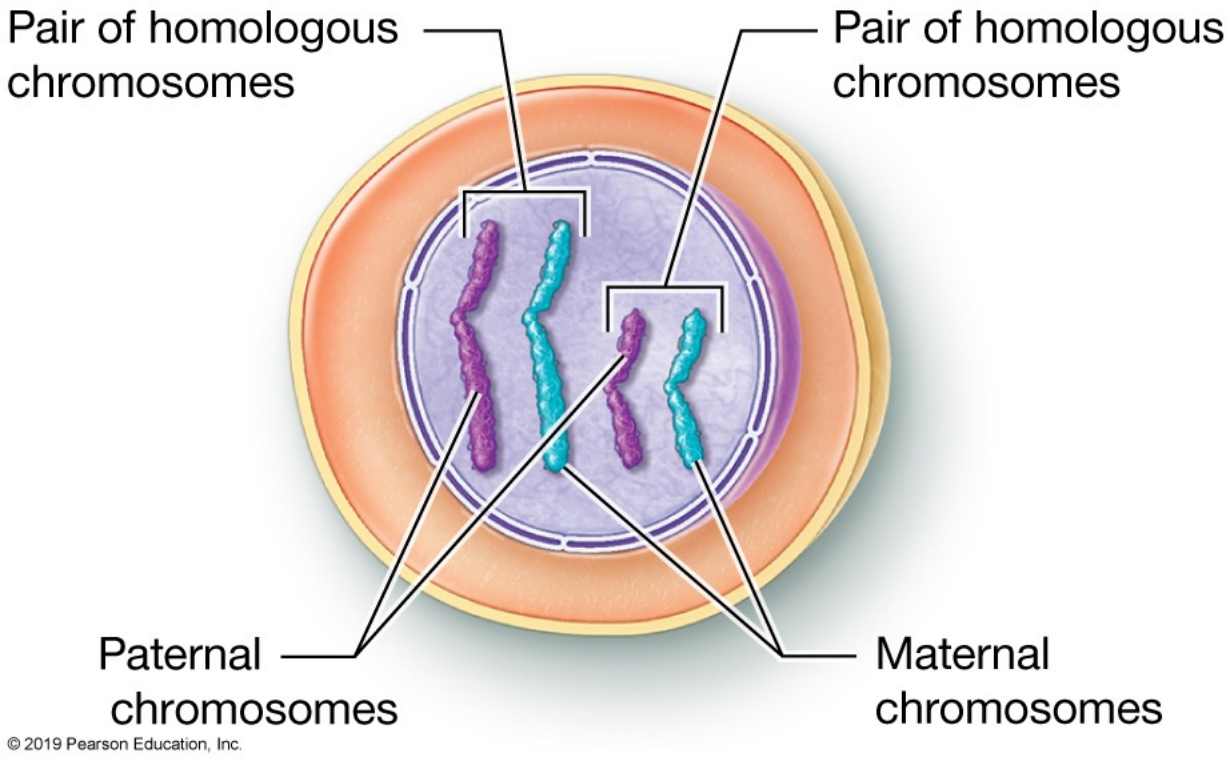

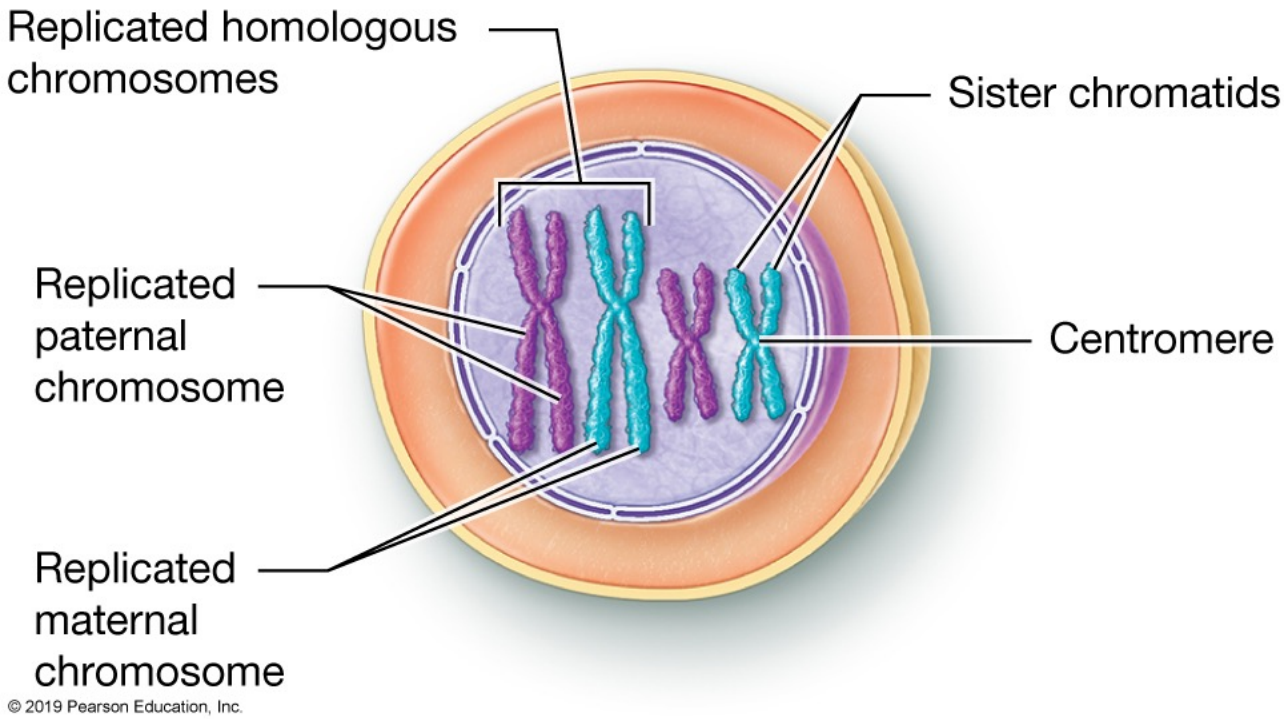

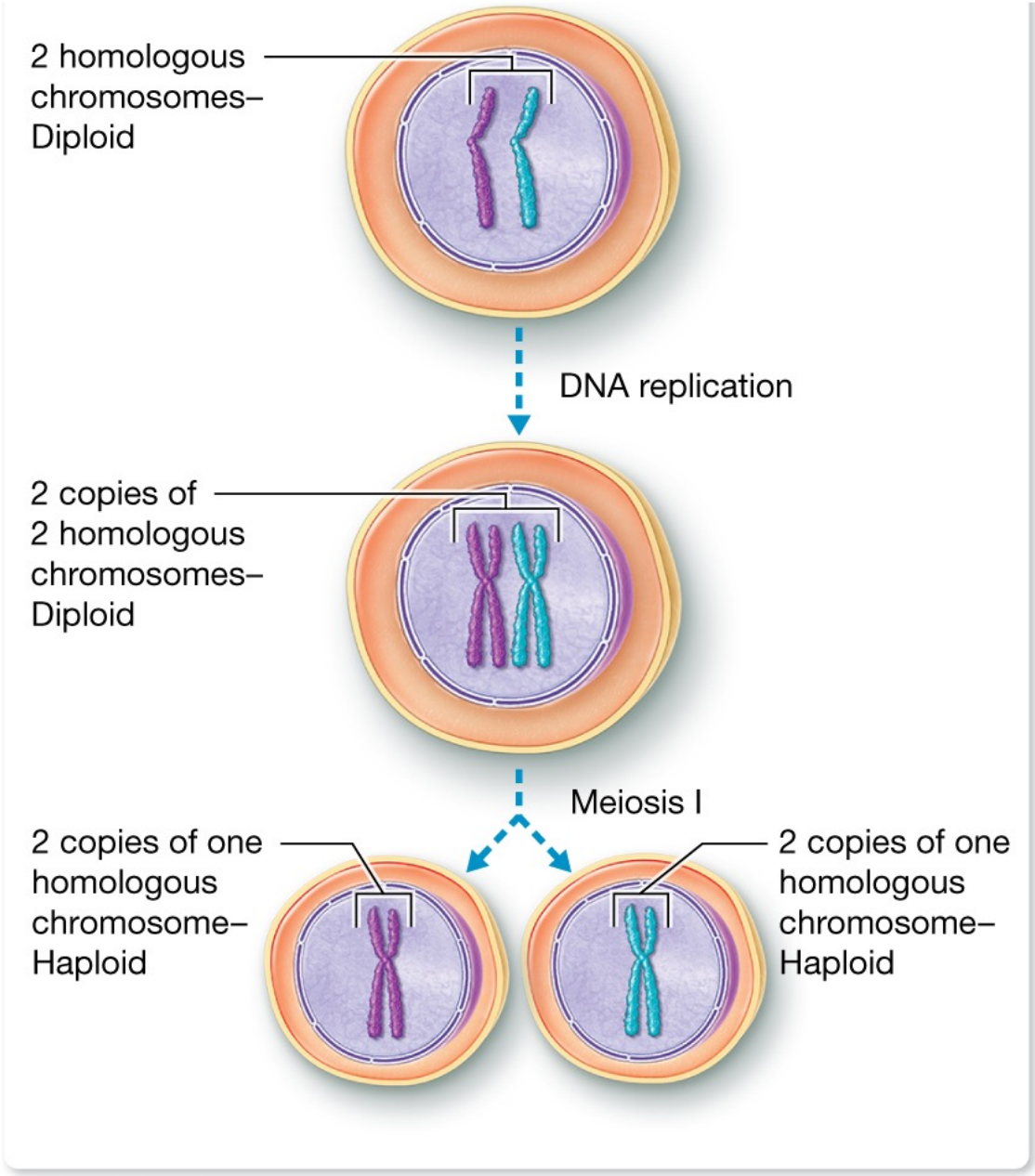

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Figure 3.5 Functions of membrane proteins.

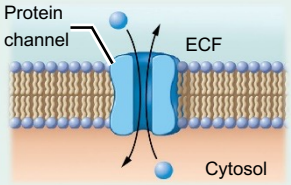
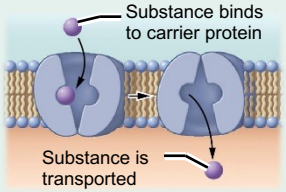
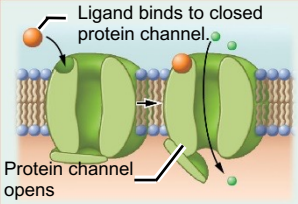
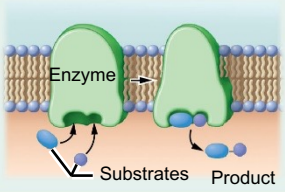
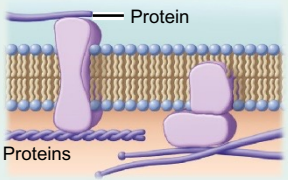
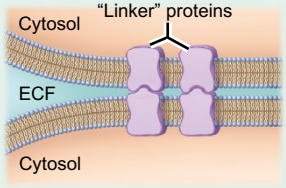
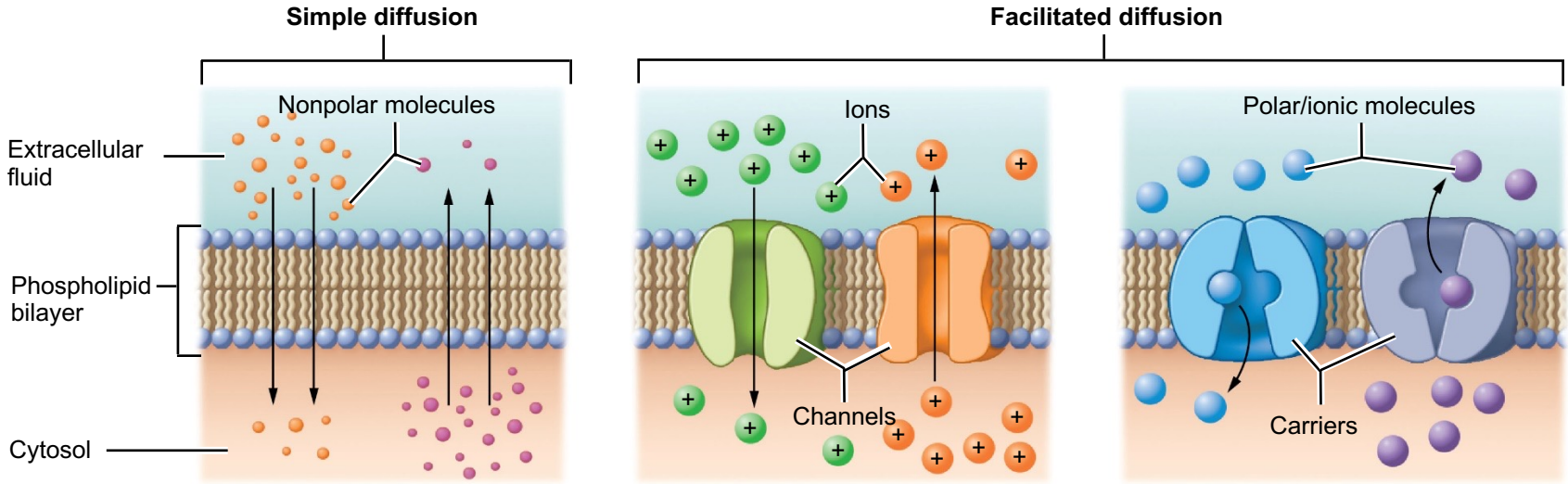
FUNCTION	STRUCTURE
Channels: Membrane proteins act as channels through which substances pass to enter or exit the cell.	
Carriers: Membrane proteins bind and transport substances into or out of the cell.	
Receptors: Membrane proteins act as receptors, binding to a ligand to trigger a change in the membrane protein or the cell.	
Enzymes: Membrane proteins act as enzymes, catalyzing chemical reactions.	
Structural support: Membrane proteins bind other proteins in the ECF and/or cytosol, supporting the cell.	
Linking adjacent cells: Membrane proteins link adjacent cells in a tissue together.	

Figure 3.7 Passive transport: simple and facilitated diffusion.

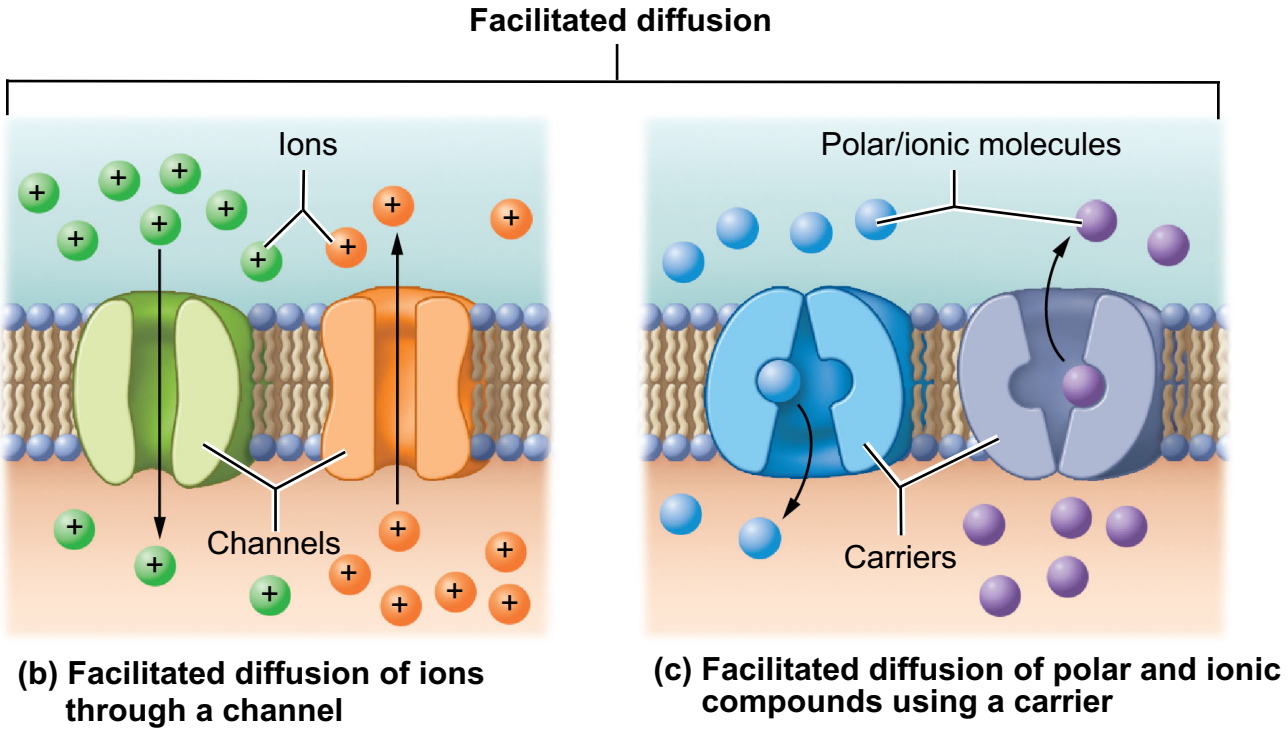


(a) Simple diffusion of nonpolar molecules through the phospholipid bilayer

(b) Facilitated diffusion of ions through a channel

(c) Facilitated diffusion of polar and ionic compounds using a carrier

Figure 3.7bc Passive transport: simple and facilitated diffusion.



(b) Facilitated diffusion of ions through a channel

(c) Facilitated diffusion of polar and ionic compounds using a carrier

Figure 3.8 Passive transport: osmosis.

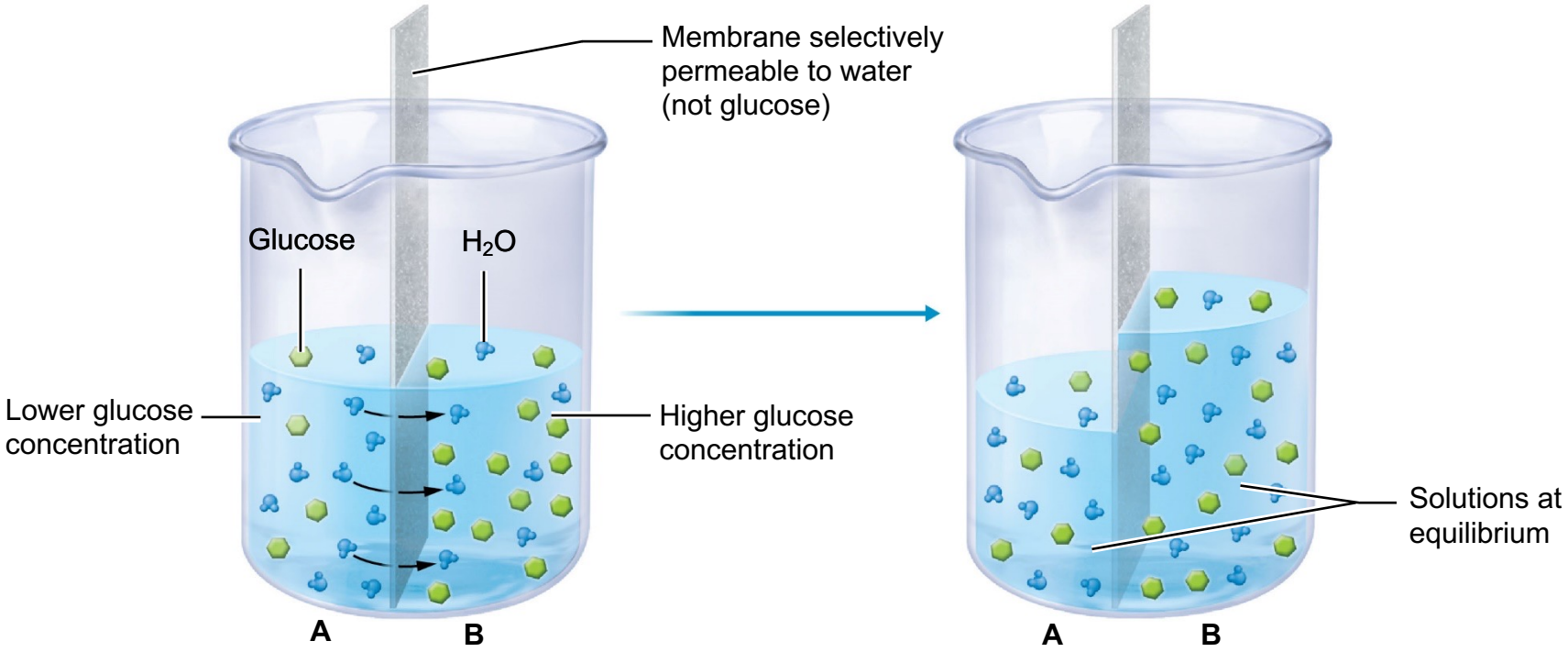


Figure 3.9 Tonicity: effects of isotonic, hypertonic, and hypotonic solutions on cell volume.

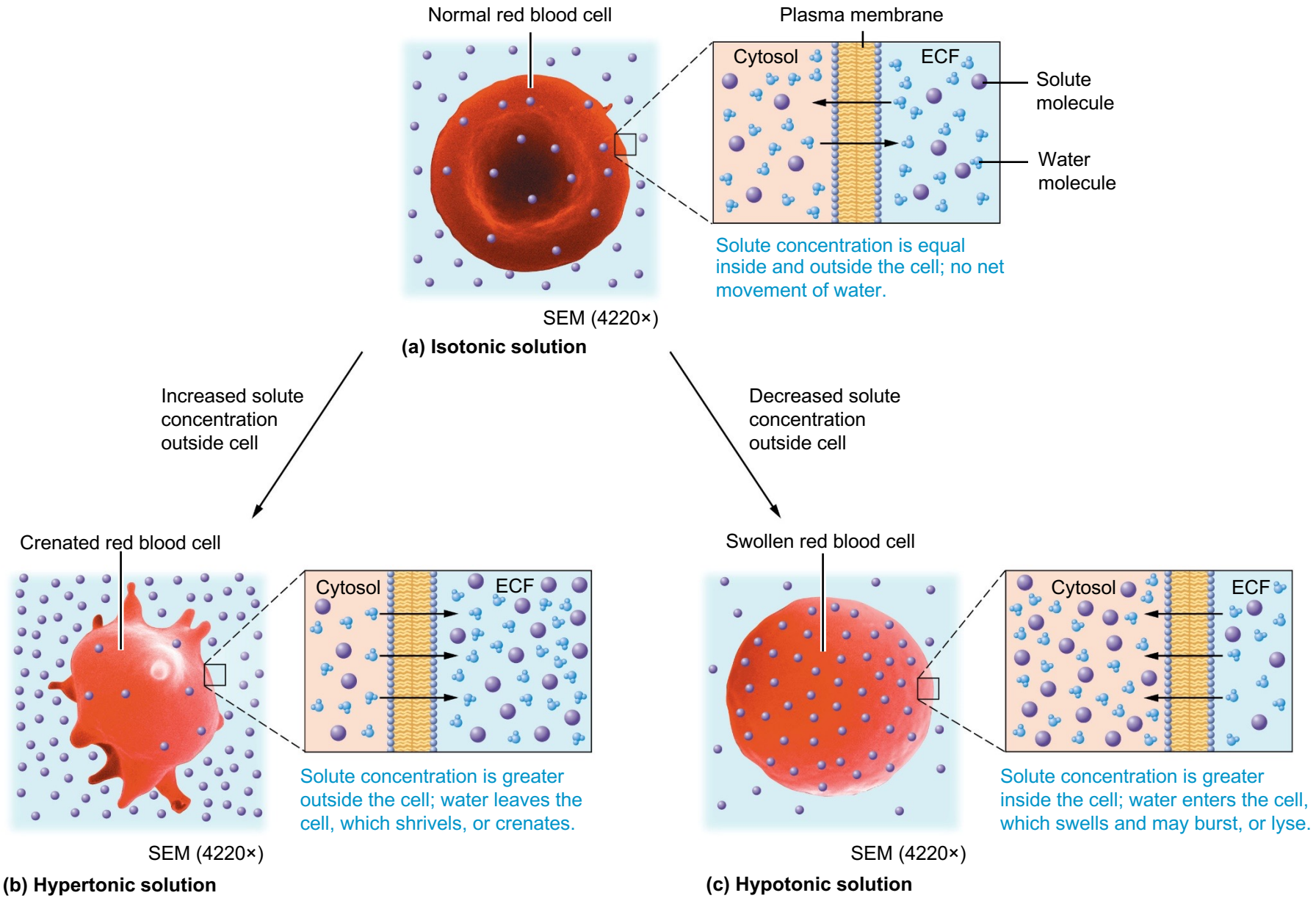


Table 3.1-1 Plasma Membrane Transport

Table 3.1 Plasma Membrane Transport

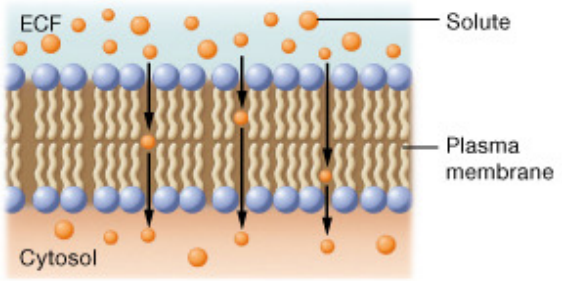
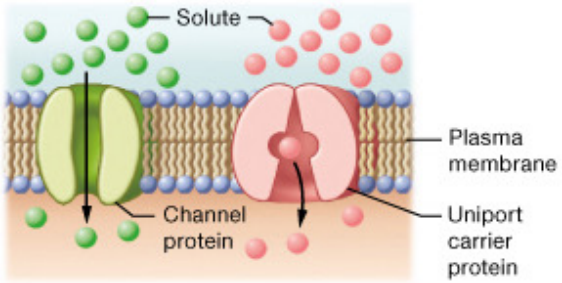
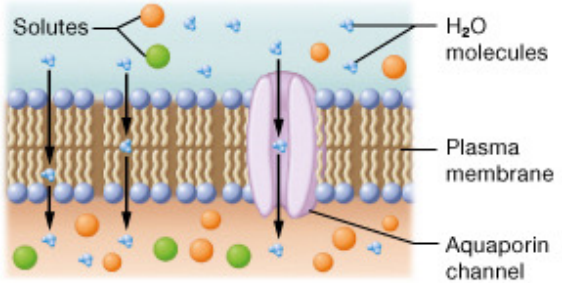
Type of Transport	Definition	Example(s)
Passive		
Simple Diffusion 	Movement of solute with its concentration gradient through the plasma membrane unaided by a transport protein; energy source is the solute's own kinetic energy (see Figure 3.7a).	• Oxygen • Carbon dioxide • Lipids
Facilitated Diffusion 	Movement of solute with its concentration gradient with the help of a carrier or channel protein; energy source is the solute's own kinetic energy (see Figure 3.7b and c).	• Sodium ions • Potassium ions • Calcium ions • Glucose • Amino acids
Osmosis 	Movement of solvent (water) from a solution of lower solute concentration to one of higher solute concentration through a selectively permeable membrane (see Figure 3.8).	• Water absorption from the intestinal lining • Water reabsorption from the kidneys • Water movement between the ECF and blood vessels

Table 3.1-2 Plasma Membrane Transport

Table 3.1 Plasma Membrane Transport *(continued)*

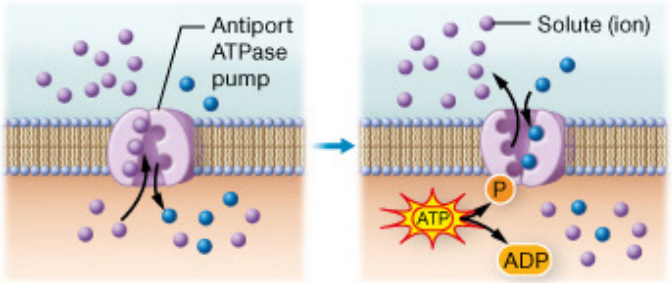
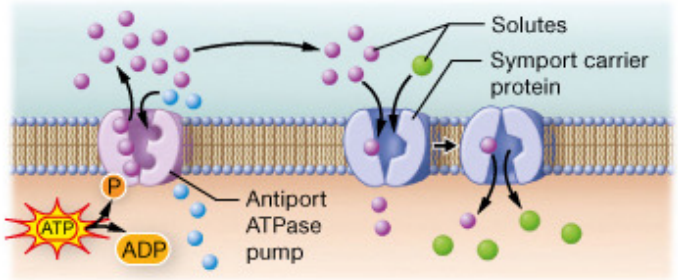
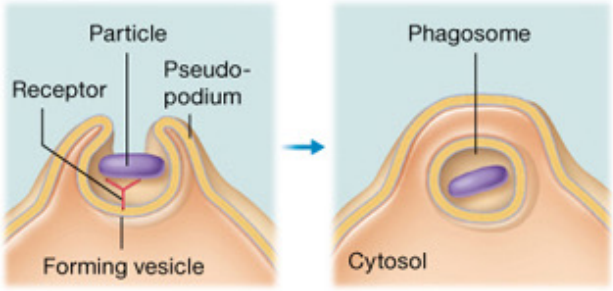
Type of Transport	Definition	Example(s)
Active		
Primary Active Transport 	Movement of solute against its concentration gradient using ATP (see Figure 3.10).	Na^+/K^+ ATPase antiporter pump removes 3 Na^+ from the cytosol and brings 2 K^+ into the cytosol against the concentration gradient.
Secondary Active Transport 	An ATPase pump drives a solute out of (or into) the cell against its concentration gradient. Movement of this solute with its concentration gradient back into the cell is used to power the transport of another solute against its concentration gradient (see Figure 3.11).	Symporters use sodium ion gradient to bring glucose, chloride ions, and bicarbonate ions into the cell.
Phagocytosis 	"Cell eating"; bringing large molecules or particles into the cell via a phagosome; ATP required (see Figure 3.12).	Ingestion of bacteria and cell debris by phagocytes

Table 3.1-3 Plasma Membrane Transport

Table 3.1 Plasma Membrane Transport *(continued)*

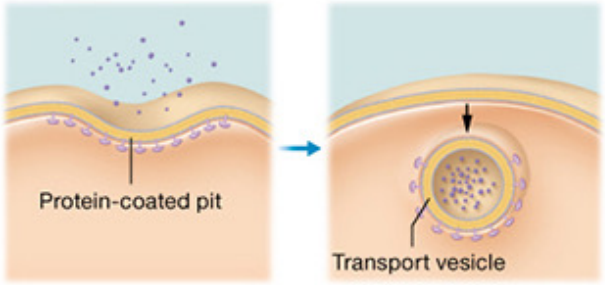
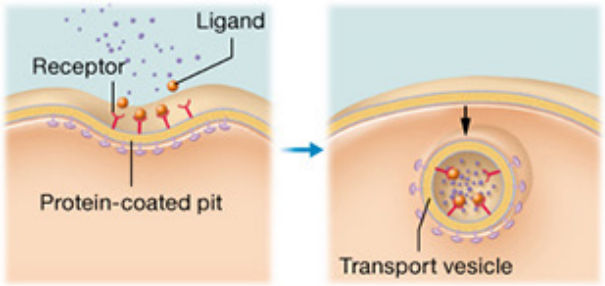
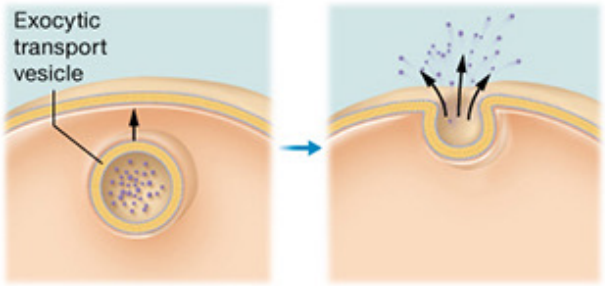
Type of Transport	Definition	Example(s)
Pinocytosis 	"Cell drinking"; bringing substances in the ECF into the cell via a transport vesicle formed from a protein-coated pit; ATP required (see Figure 3.13a).	Nutrient transport
Receptor-Mediated Endocytosis 	Bringing a specific substance into a transport vesicle using receptors on the plasma membrane; ATP required (see Figure 3.13b).	Cholesterol, iron, and hormone transport
Exocytosis 	Release of a substance from the cell via an exocytic transport vesicle; ATP required (see Figure 3.14).	• Secretion of hormones, neurotransmitters, and enzymes • Release of proteins and glycoproteins into the ECF • Adding components to the plasma membrane

Figure 3.15 The cell and its organelles.

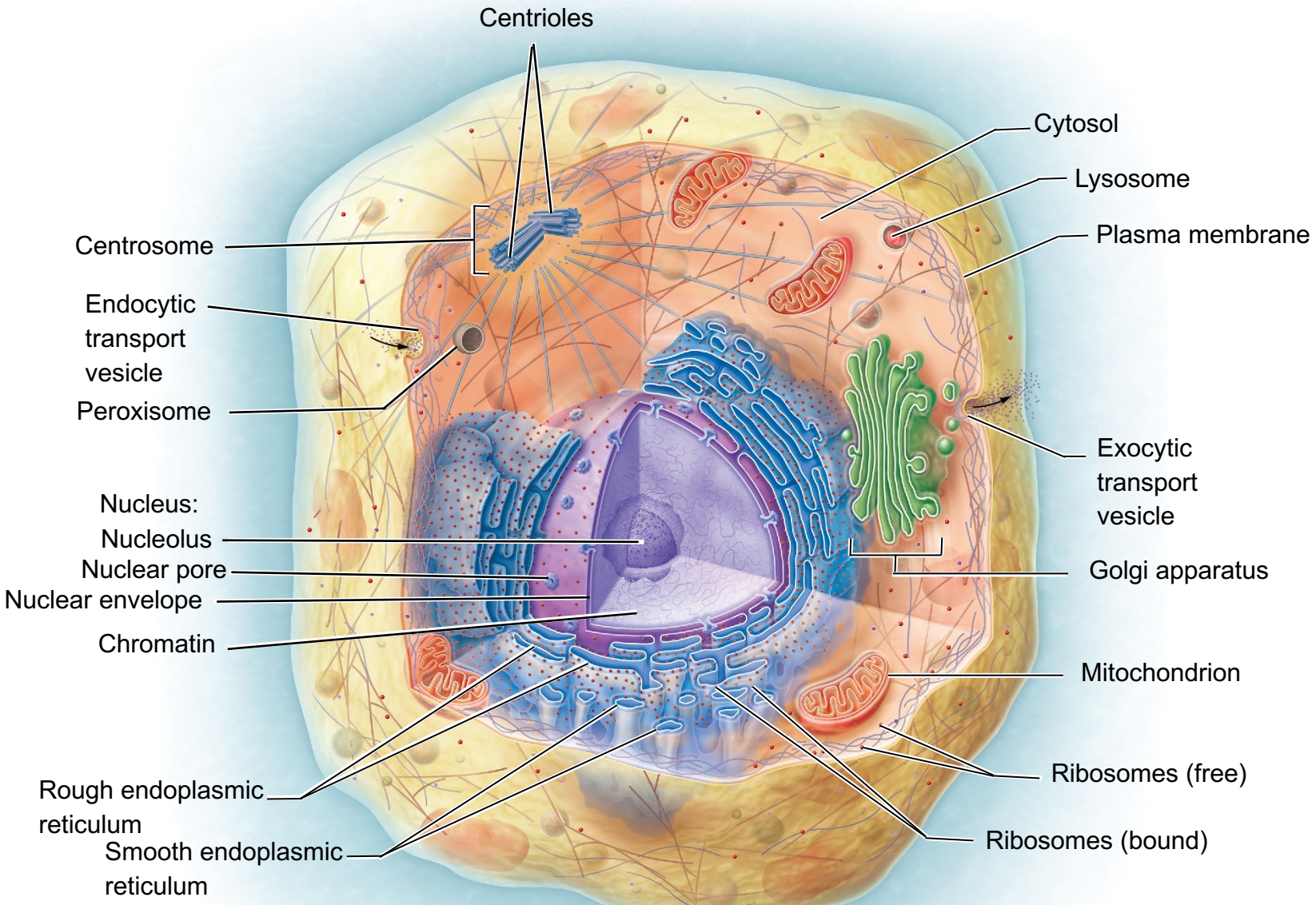


Figure 3.16 Structure of the mitochondrion.

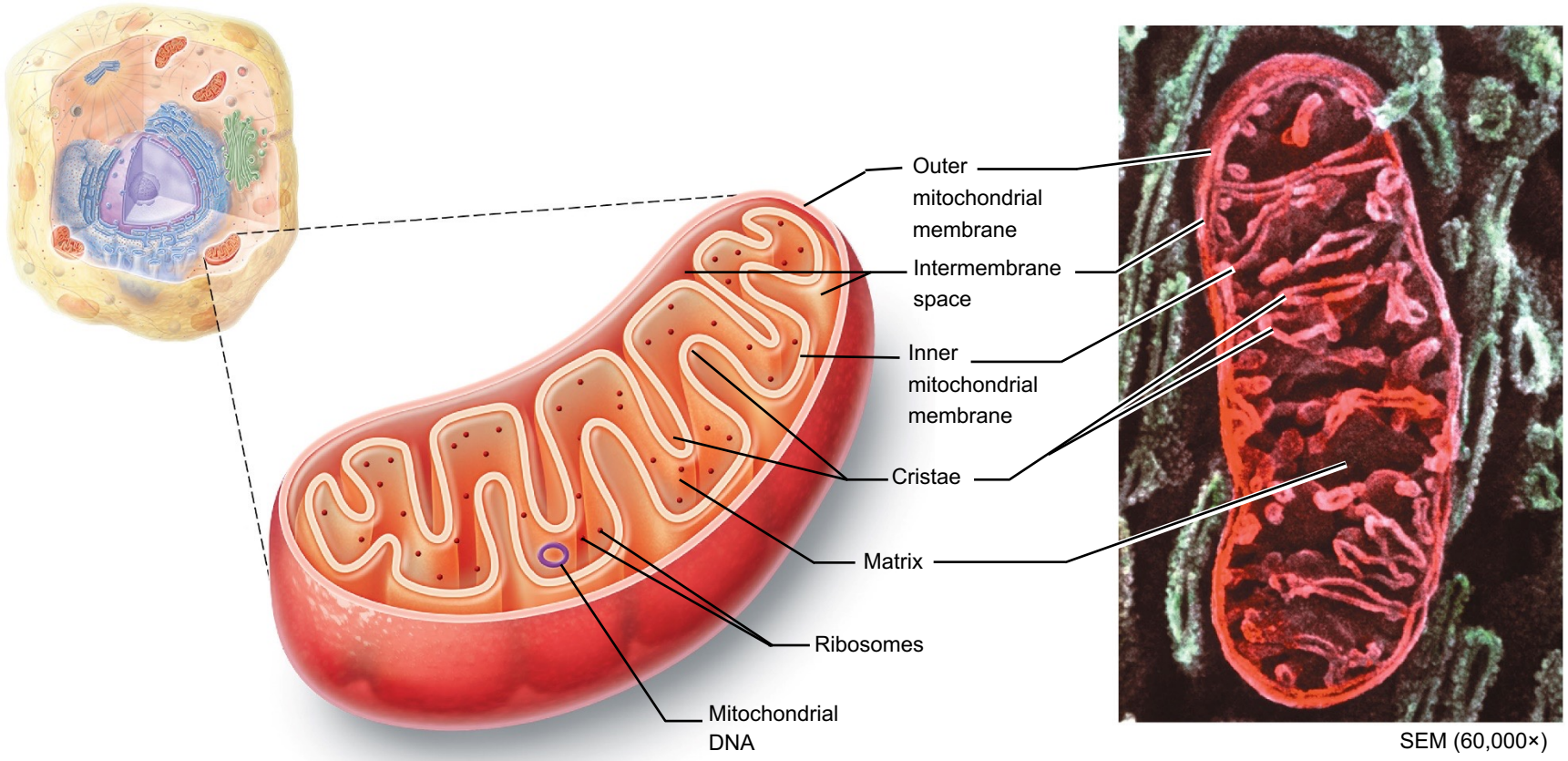


Figure 3.17 Function of the mitochondrion.

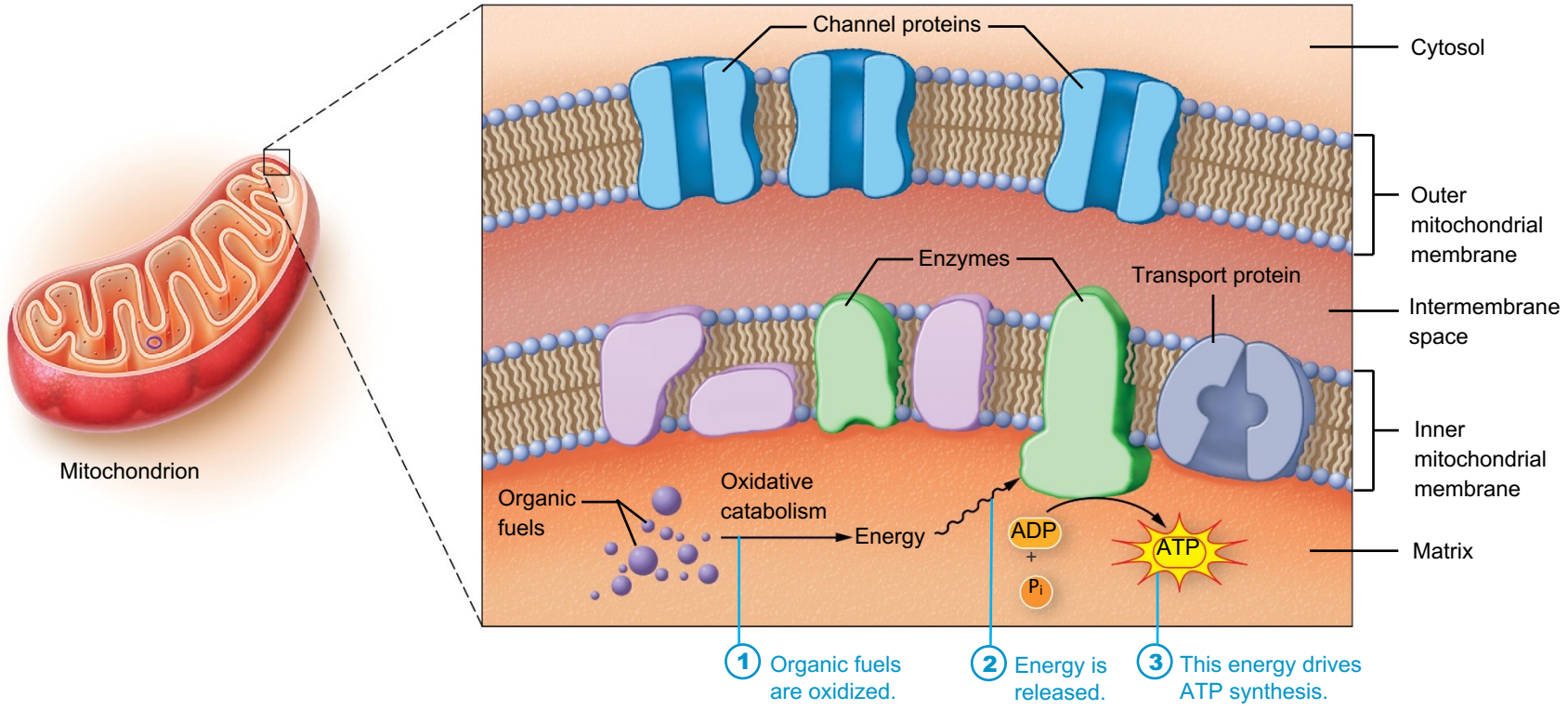


Figure 3.19 The endoplasmic reticulum.

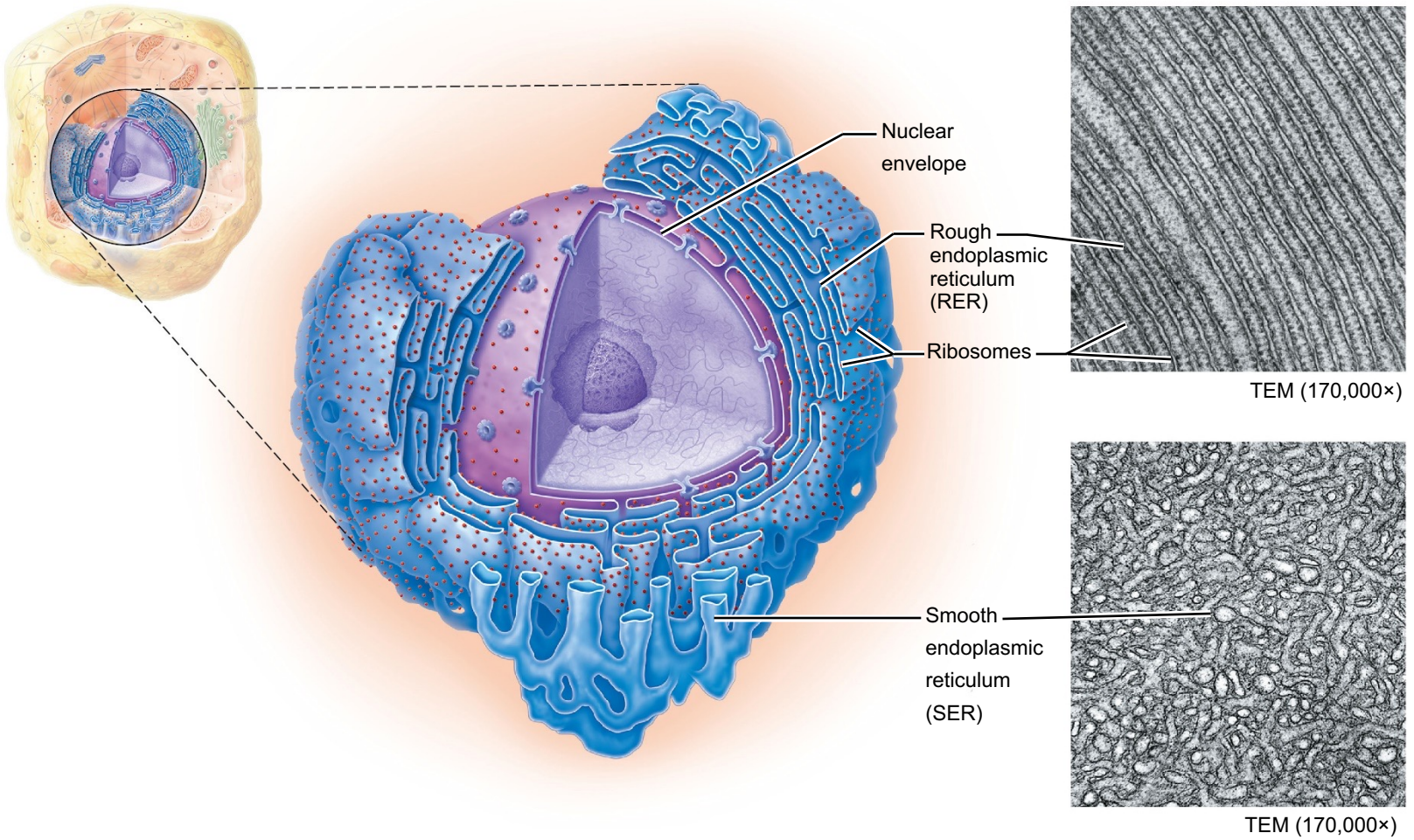


Figure 3.21 Function of the endomembrane system.

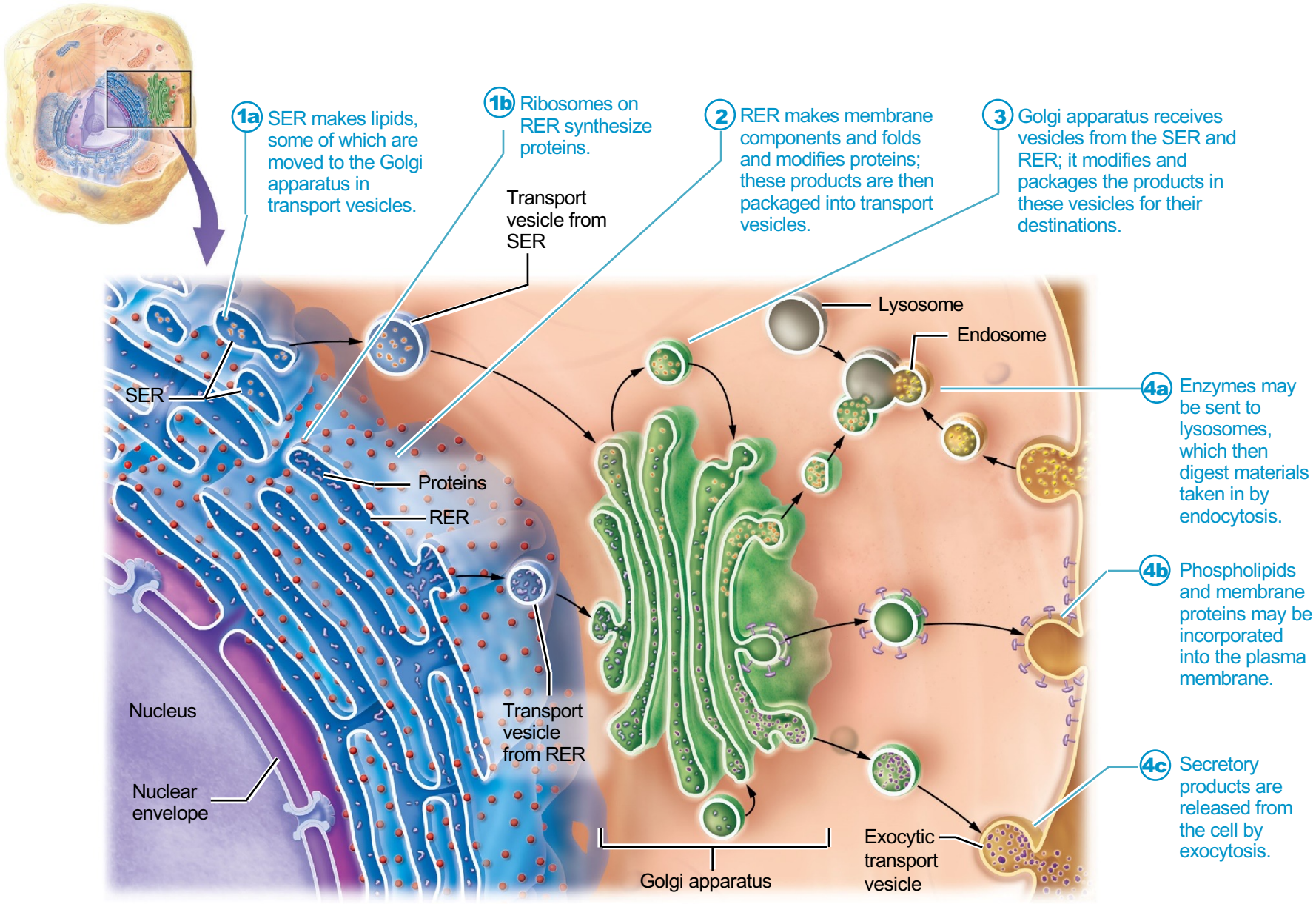


Table 3.2-1 Cytoplasmic Organelles

Table 3.2 Cytoplasmic Organelles

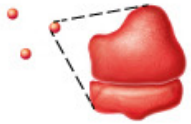
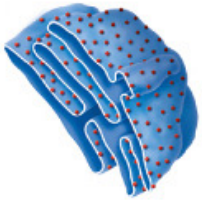
Organelle	Structure	Function
Mitochondrion 	Double membrane; inner membrane folded into cristae; has own DNA and ribosomes (see Figures 3.16 and 3.17).	• Synthesizes the majority of the cell's ATP
Peroxisome 	Membrane-enclosed; similar to large vesicle.	• Detoxifies certain chemicals through oxidation reactions • Metabolizes fatty acids • Synthesizes certain phospholipids
Ribosome 	Two subunits made of proteins and rRNA; not membrane-enclosed (see Figure 3.18).	• Synthesizes proteins
Rough Endoplasmic Reticulum (RER) 	Series of saclike membranes enclosing the ER lumen; surface studded with ribosomes (see Figure 3.19).	• Modifies and folds proteins made by the ribosomes • Manufactures and assembles most components of the plasma membrane

Table 3.2-2 Cytoplasmic Organelles

Table 3.2 Cytoplasmic Organelles *(continued)*

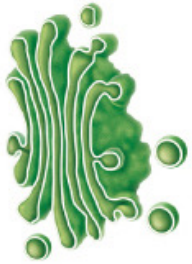
Organelle	Structure	Function
Smooth Endoplasmic Reticulum (SER) 	Series of tubular membranes enclosing the ER lumen; surface does not contain ribosomes (see Figure 3.19).	• Stores calcium ions and synthesizes lipids • Detoxifies certain substances
Golgi Apparatus 	Stack of flattened, membrane-enclosed sacs (see Figure 3.20).	• Sorts, modifies, and packages proteins and other products made by the ER
Lysosome 	Membrane-enclosed structure with digestive enzymes; similar to a large vesicle.	• Digests damaged organelles and products brought into the cell by endocytosis • Recycles damaged organelles

Table 3.3 Cytoskeletal Filaments

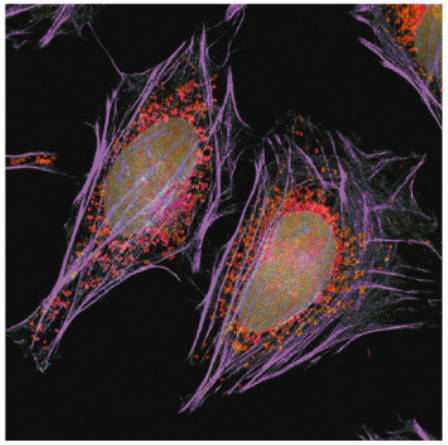
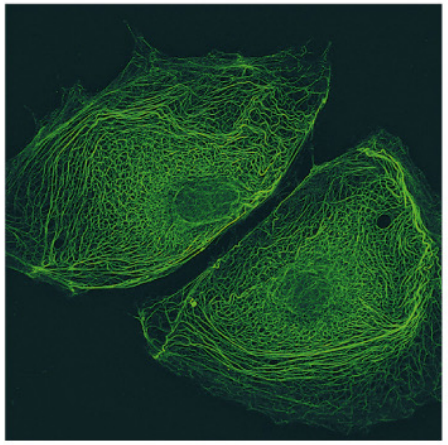
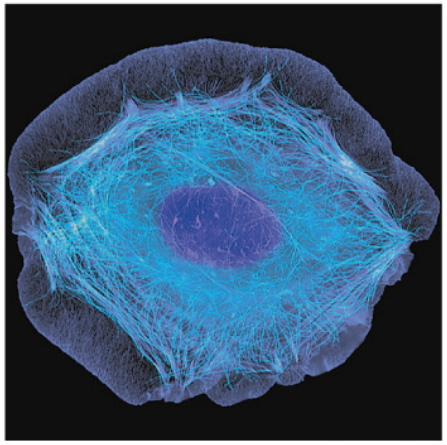
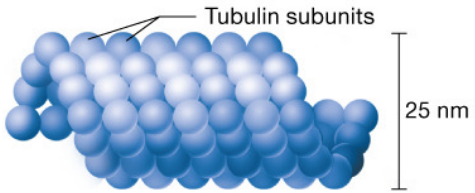
Property	Actin Filaments	Intermediate Filaments	Microtubules
Location in cell	 LM (1270×)	 LM (1200×)	 LM (1420×)
Structure			
Functions	• Support the plasma membrane • Form the core of microvilli • Involved in cell motion (e.g., phagocyte "crawling") and cell division	• Form the framework of the cell • Support the shape and size of the nucleus • Provide cell strength • Help the cell and tissue to with - stand mechanical stresses	• Support the cell • Maintain the position of organelles • Associate with motor proteins that move vesicles and organelles throughout the cell • Form the core of cilia and flagella

Table 3.4 Cilia and Flagella

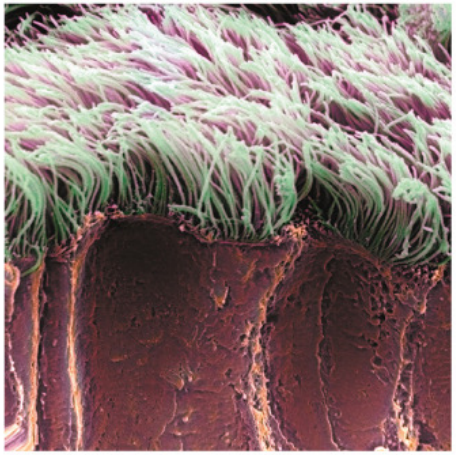
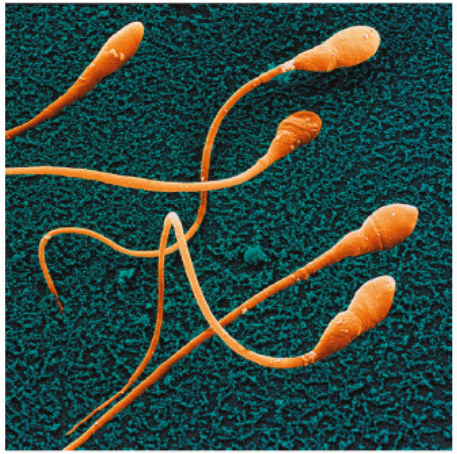
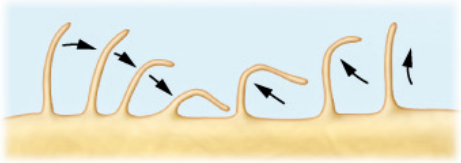
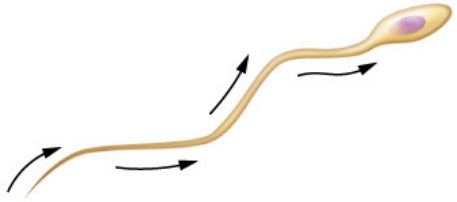
Property	Cilia	Flagella
Location in body	Cells lining the respiratory tract and the female reproductive tract  SEM (5000×)	Sperm cell  SEM (1525×)
Structure	Short, hairlike extensions from the cell; contain an internal ring of nine microtubule pairs surrounding a central microtubule core	Single, long extension from the cell; same internal structure as cilia
Function	Coordinated beating motion sweeps substances past the cell. 	Whiplike motion propels the cell through liquid. 

Figure 3.27 Chromatin and chromosomes.

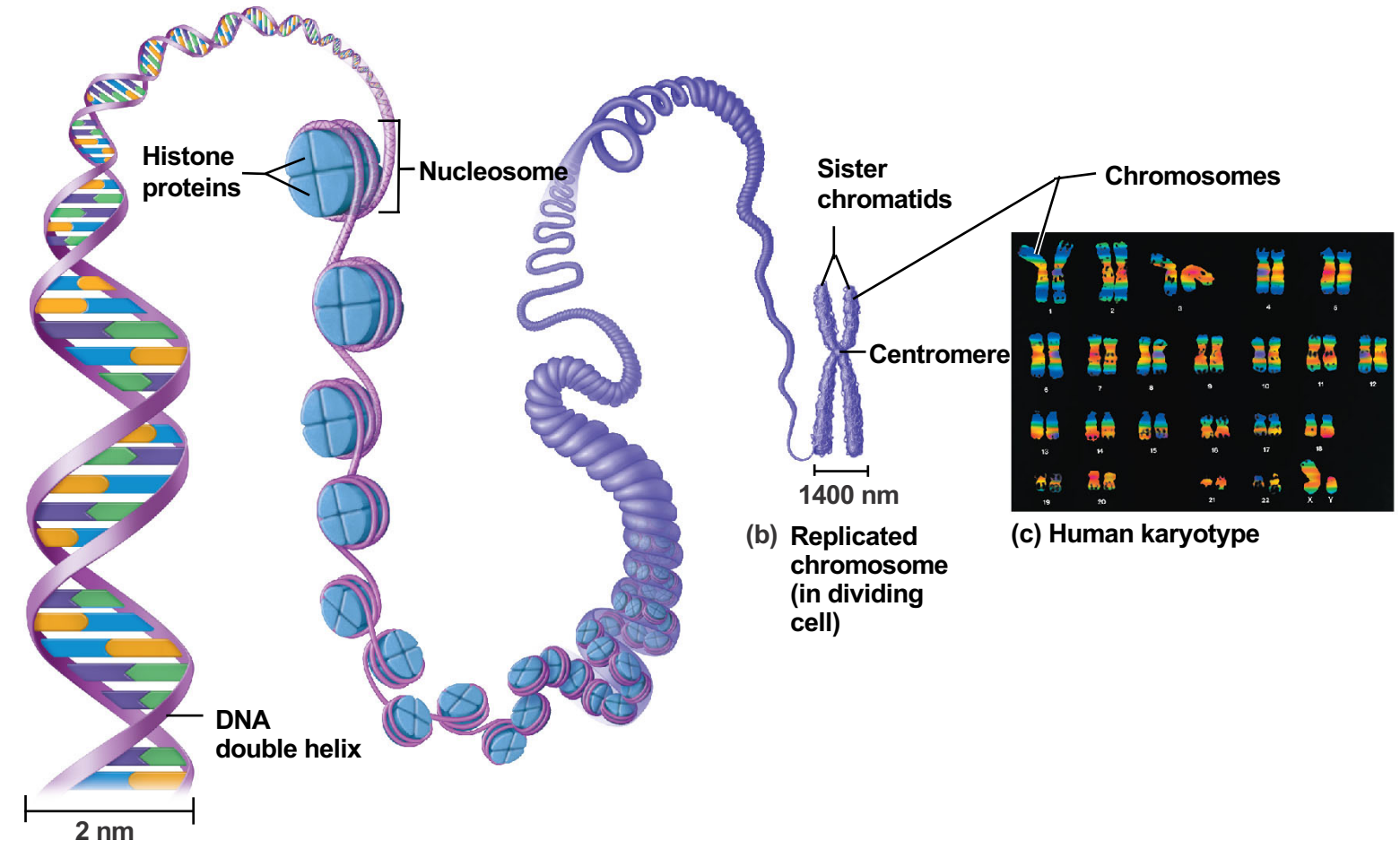


Figure 3.27 Chromatin and chromosomes.

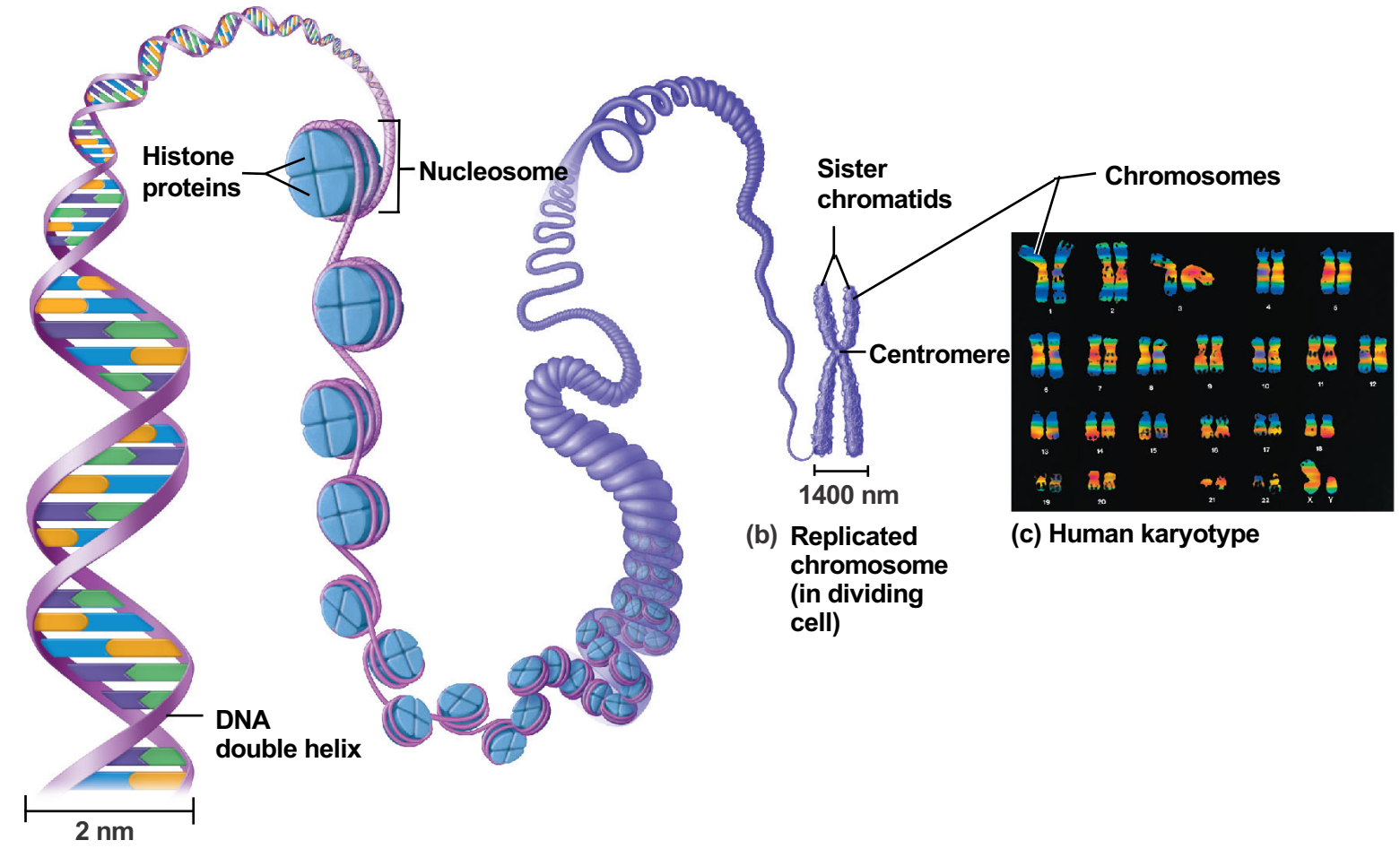
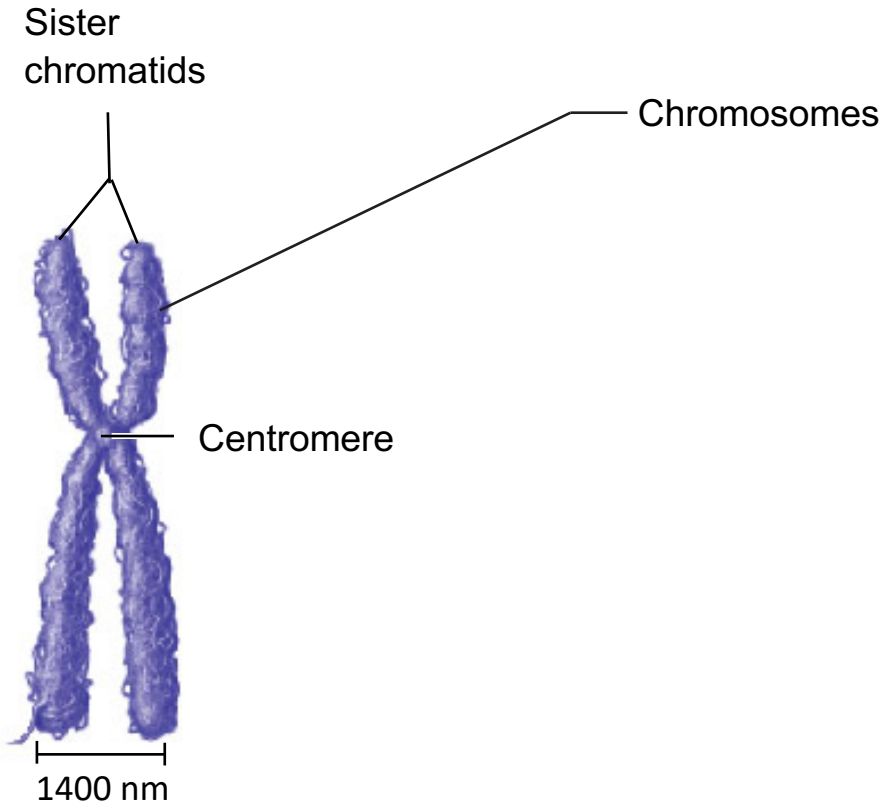
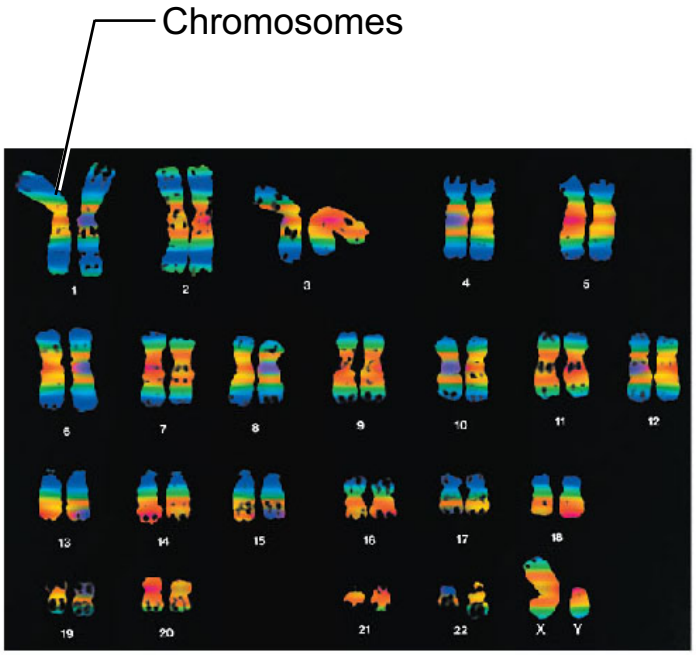


Figure 3.27b Chromatin and chromosomes.



(b) Replicated chromosome (in dividing cell)

Figure 3.27c Chromatin and chromosomes.



(c) Human karyotype

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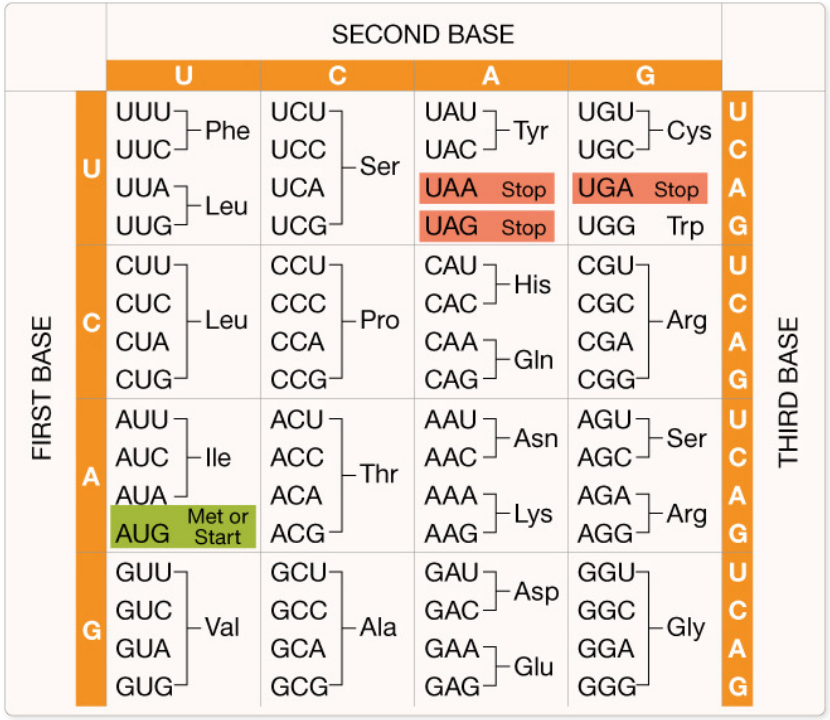
Figure 3.28 The genetic code.



Key:

Abbreviation	Amino acid	Abbreviation	Amino acid
Ala	Alanine	Leu	Leucine
Arg	Arginine	Lys	Lysine
Asn	Asparagine	Met	Methionine
Asp	Aspartic acid	Phe	Phenylalanine
Cys	Cysteine	Pro	Proline
Glu	Glutamic acid	Ser	Serine
Gln	Glutamine	Thr	Threonine
Gly	Glycine	Trp	Tryptophan
His	Histidine	Tyr	Tyrosine
Ile	Isoleucine	Val	Valine

Figure 3.28-1 The genetic code.

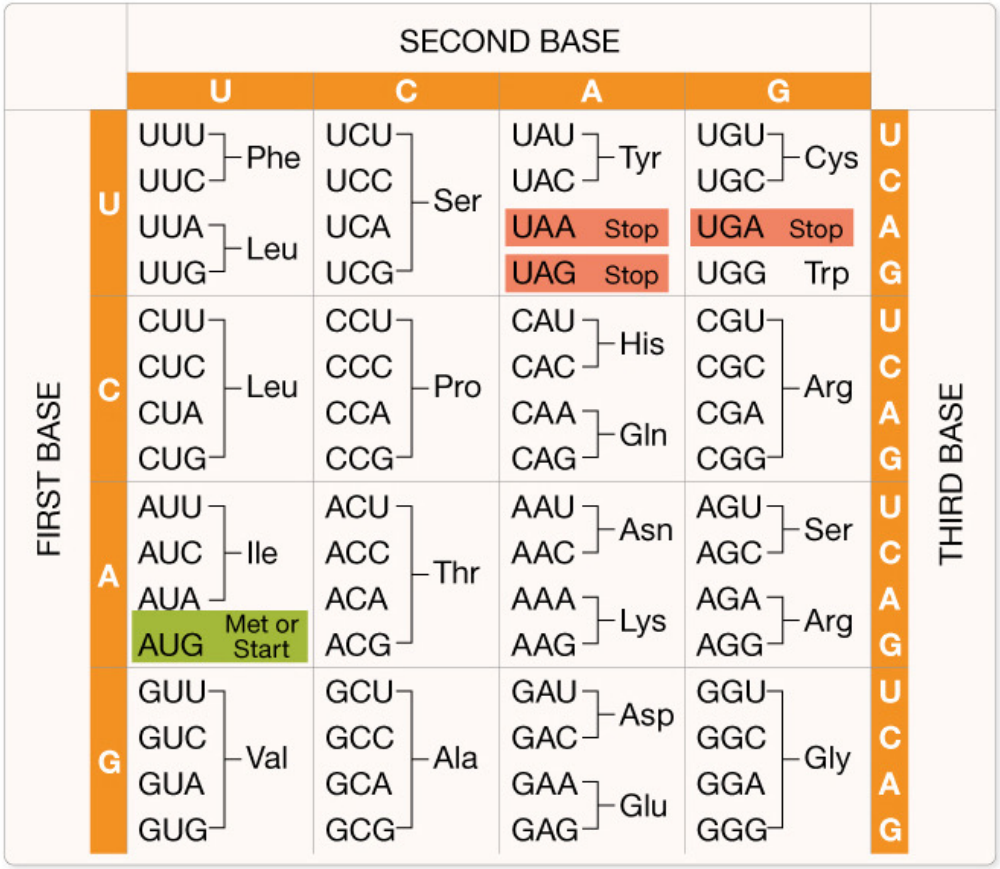
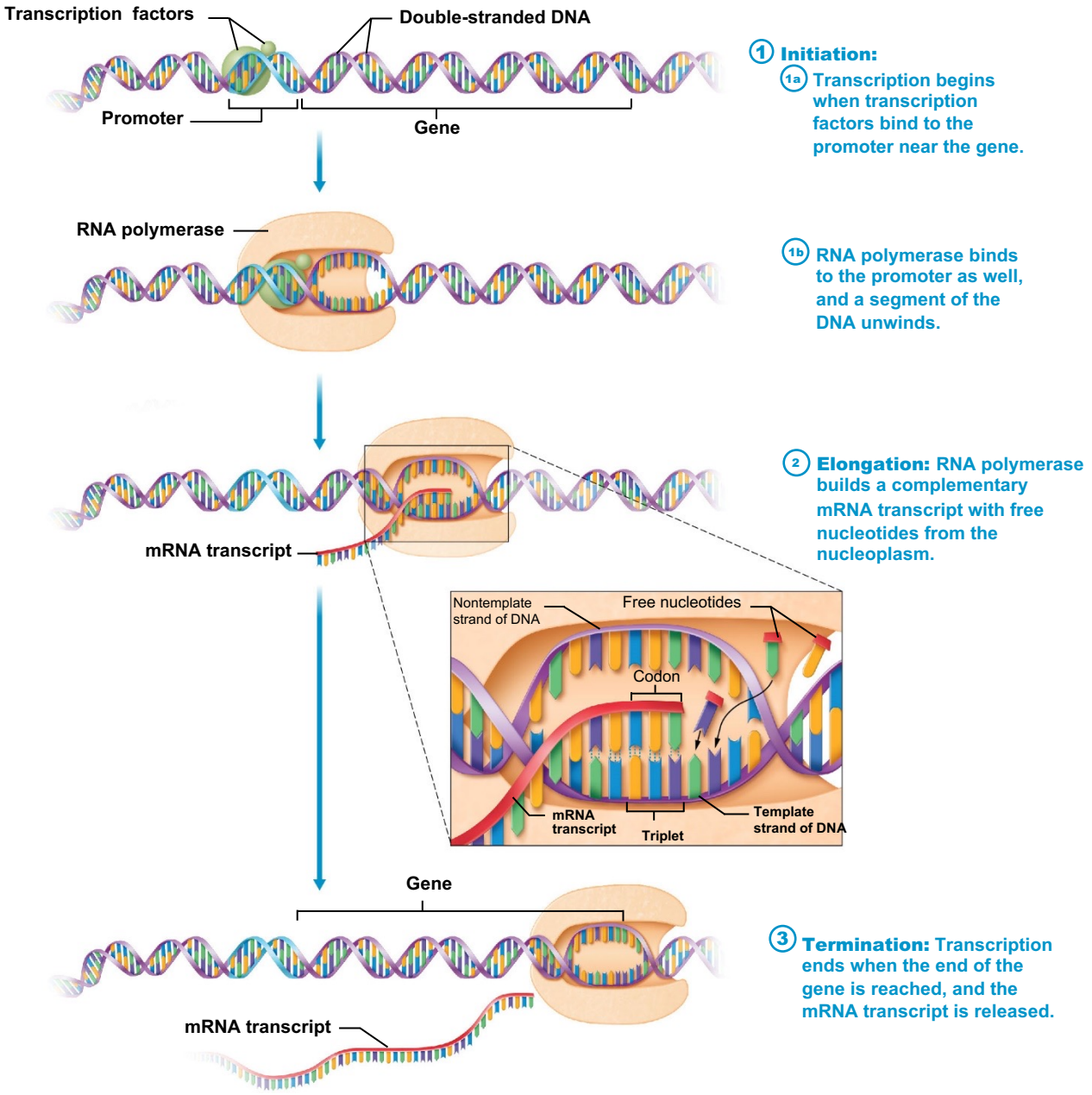


Figure 3.28-2 The genetic code.

Key:

Abbreviation	Amino acid	Abbreviation	Amino acid
Ala	Alanine	Leu	Leucine
Arg	Arginine	Lys	Lysine
Asn	Asparagine	Met	Methionine
Asp	Aspartic acid	Phe	Phenylalanine
Cys	Cysteine	Pro	Proline
Glu	Glutamic acid	Ser	Serine
Gln	Glutamine	Thr	Threonine
Gly	Glycine	Trp	Tryptophan
His	Histidine	Tyr	Tyrosine
Ile	Isoleucine	Val	Valine

Figure 3.29 Transcription.



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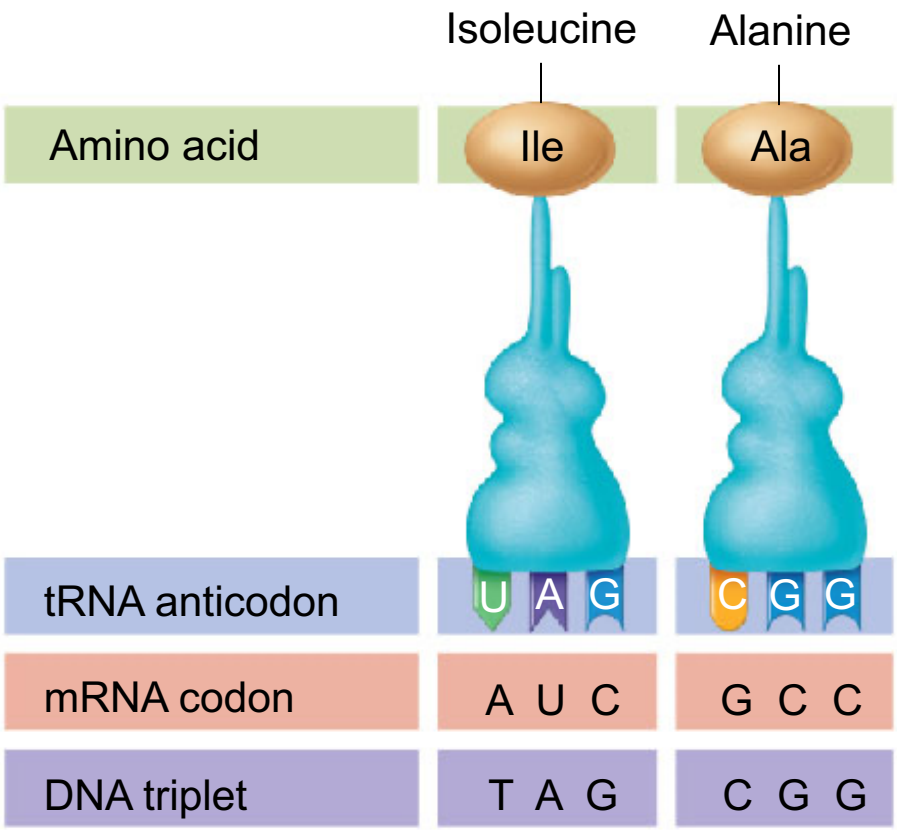


Unnumbered Figure 3.7_page 107

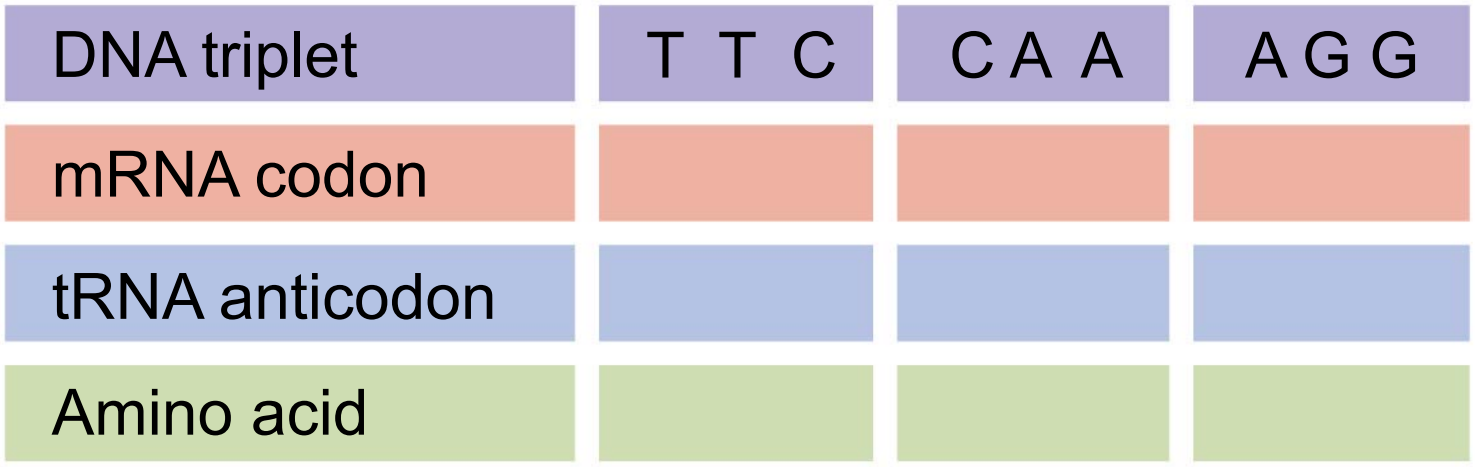
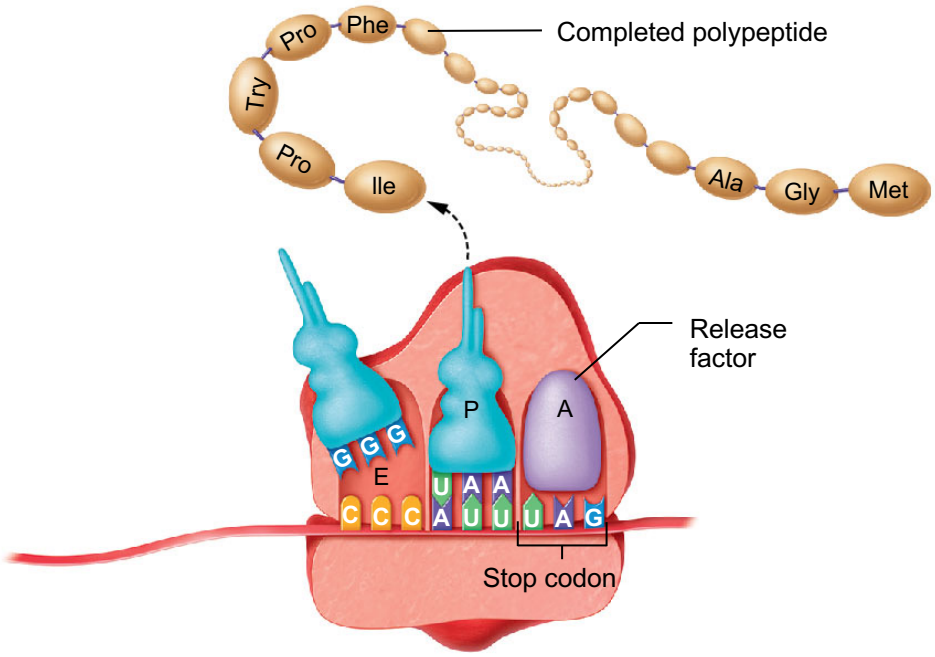


Figure 3.31b-2 Translation.



③ **Termination:** Translation ends when the ribosome reaches the stop codon and the completed polypeptide is released.

Figure 3.32 Protein Synthesis

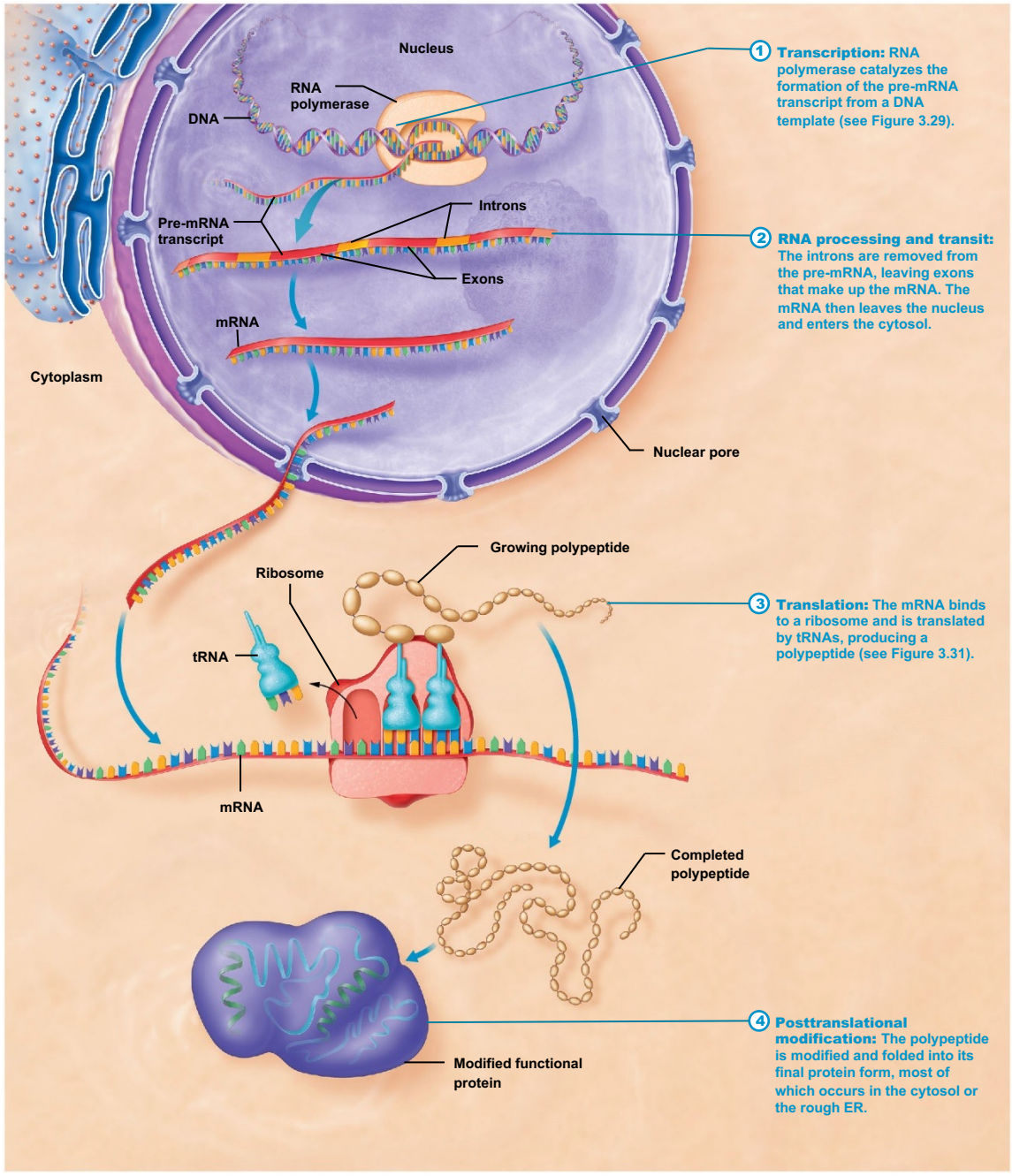


Figure 3.32-1 Protein Synthesis

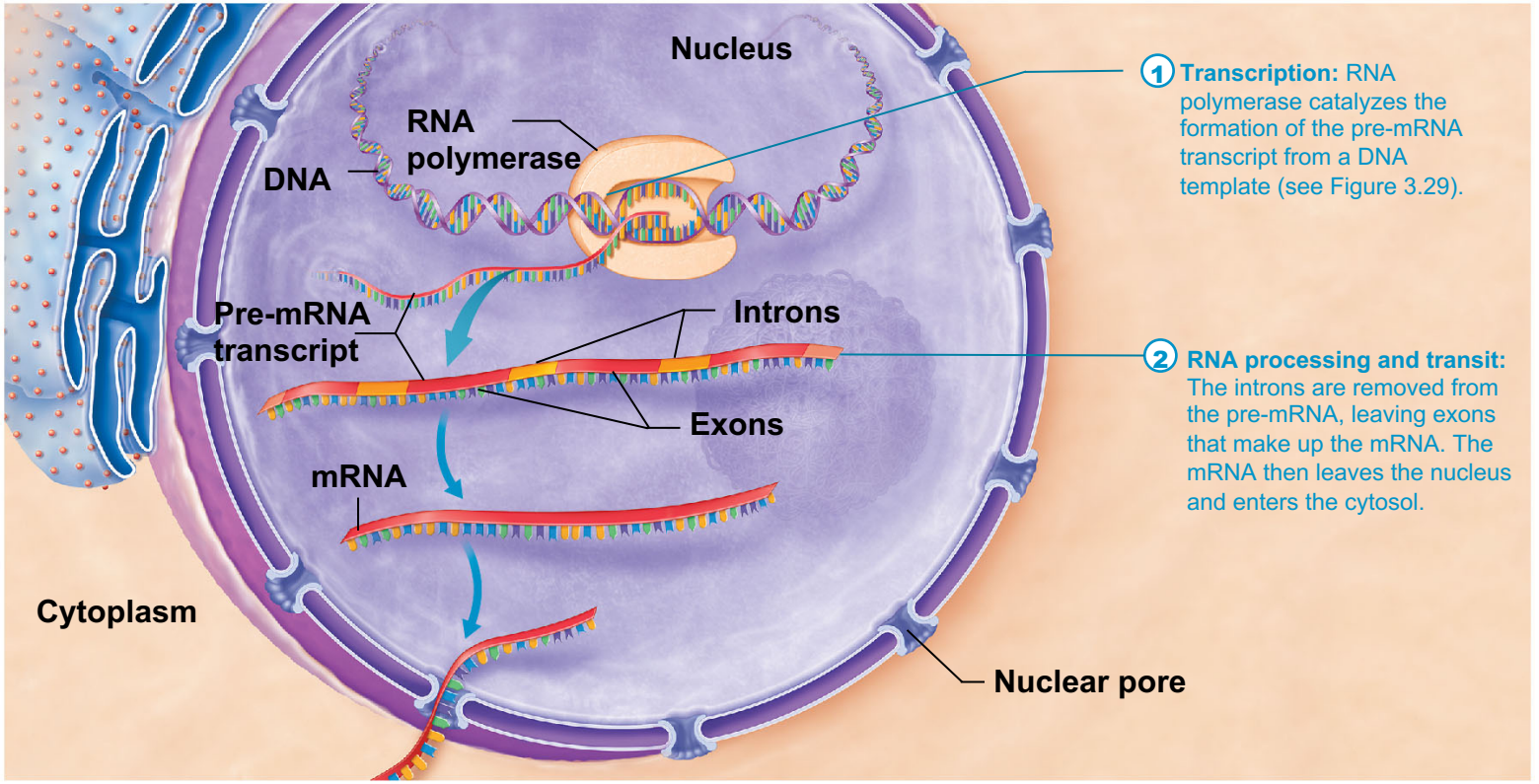


Figure 3.32-3 Protein Synthesis

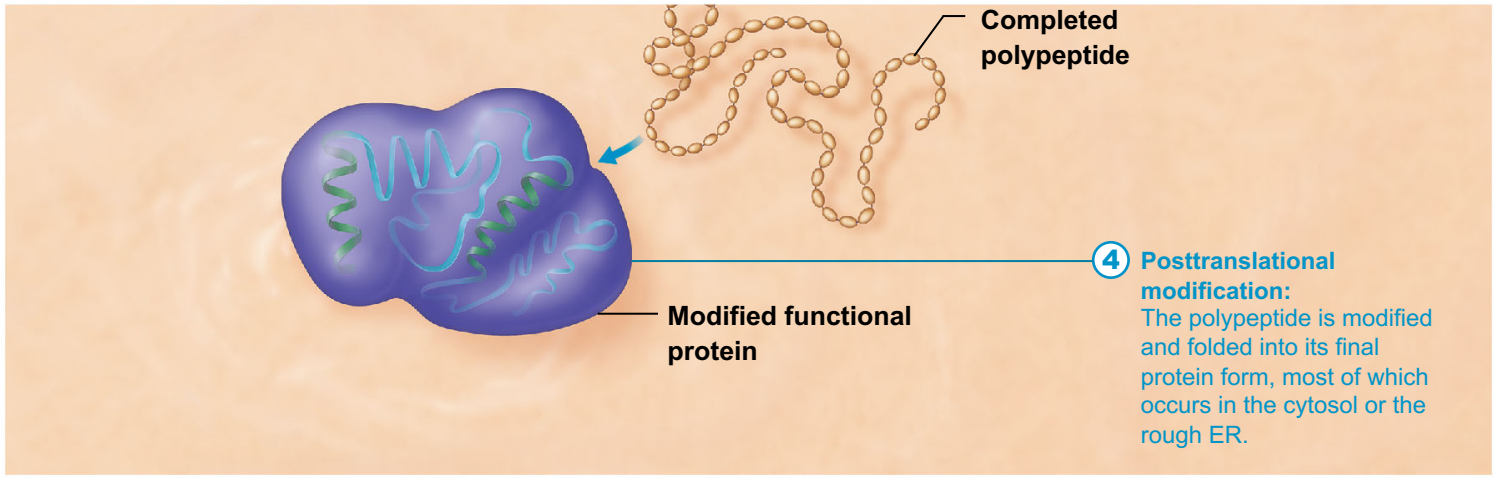


Figure 3.33 The cell cycle.

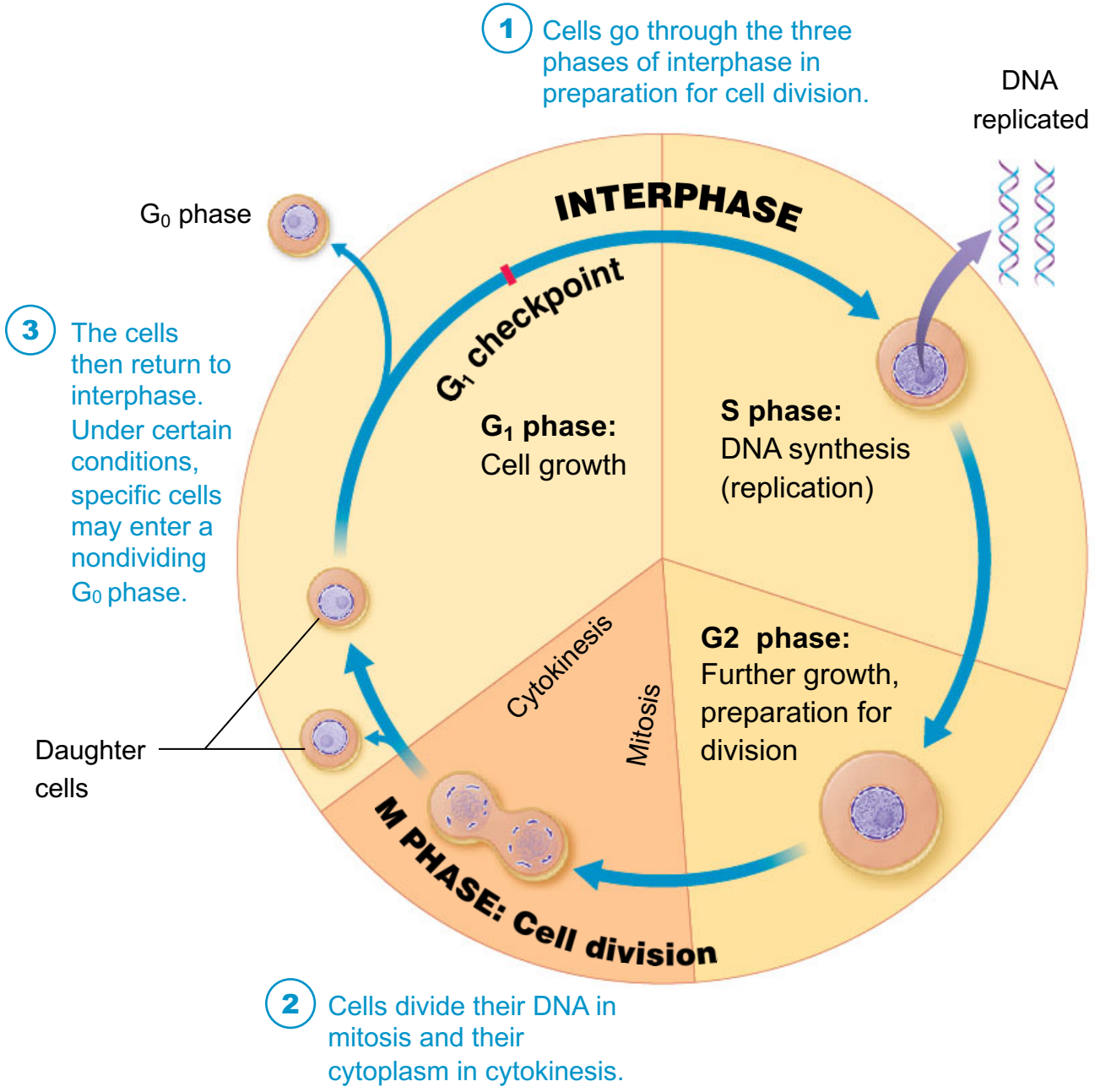


Figure 3.35a Interphase, mitosis, and cytokinesis.

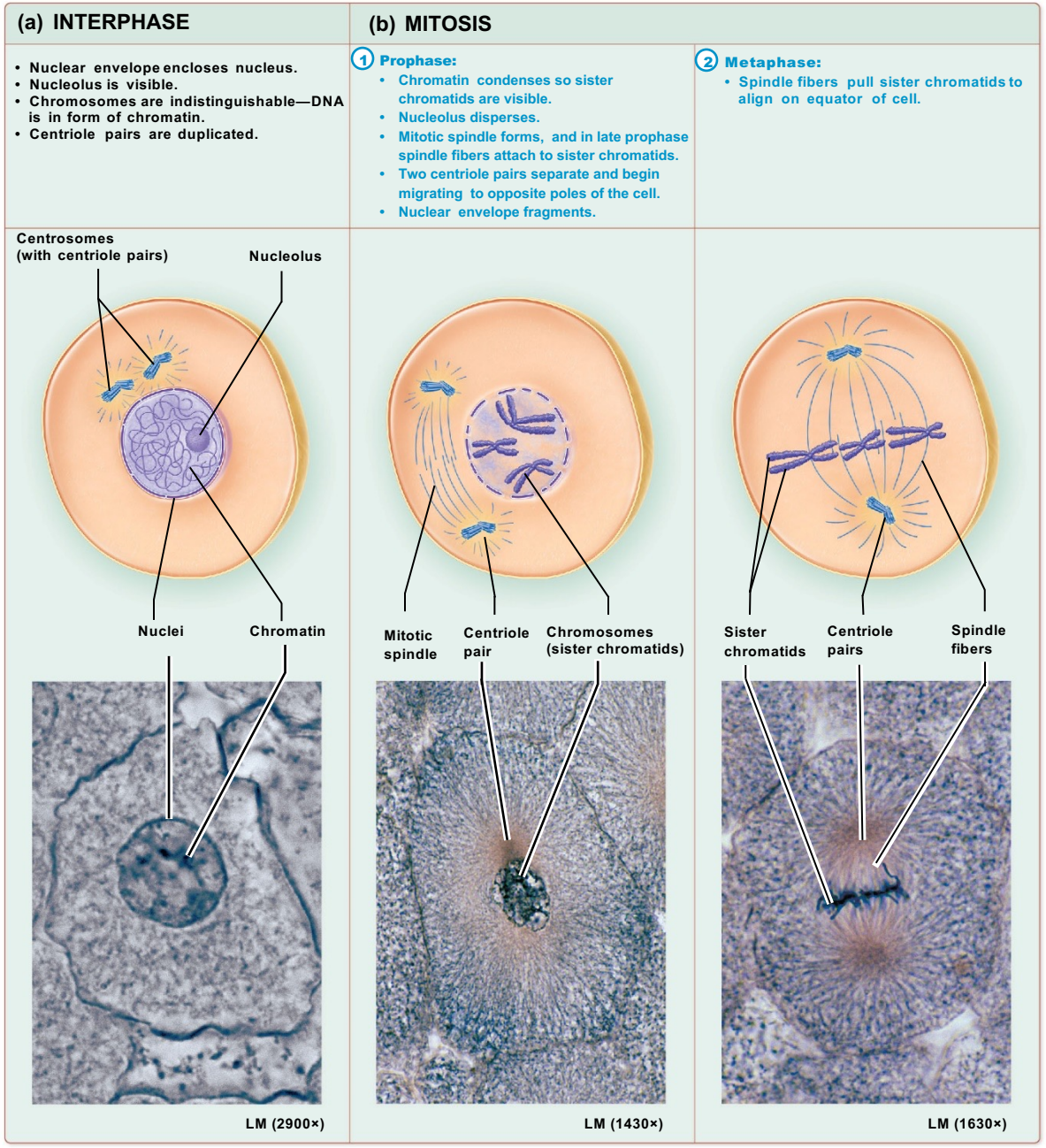


Figure 3.35b Interphase, mitosis, and cytokinesis.

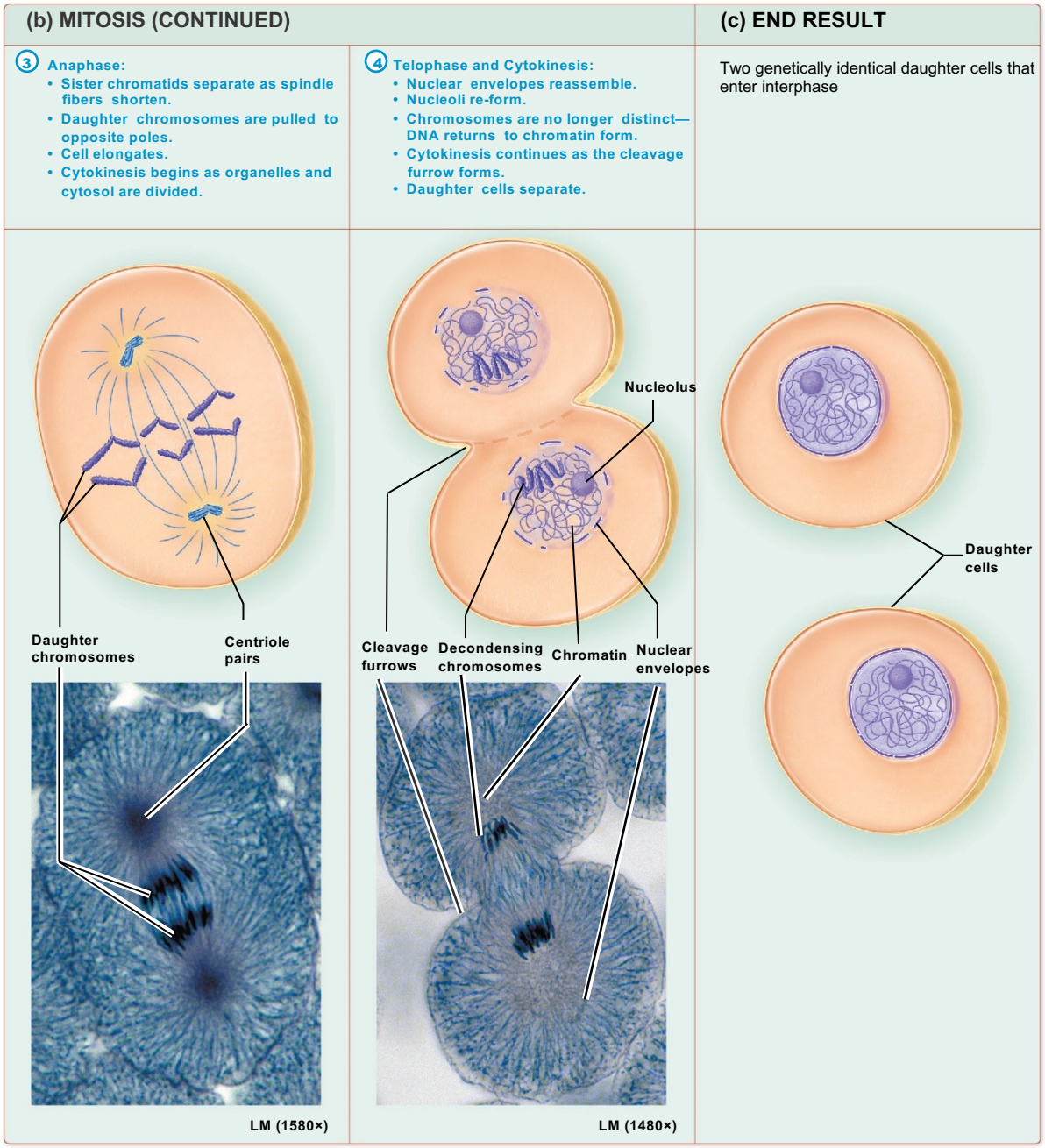
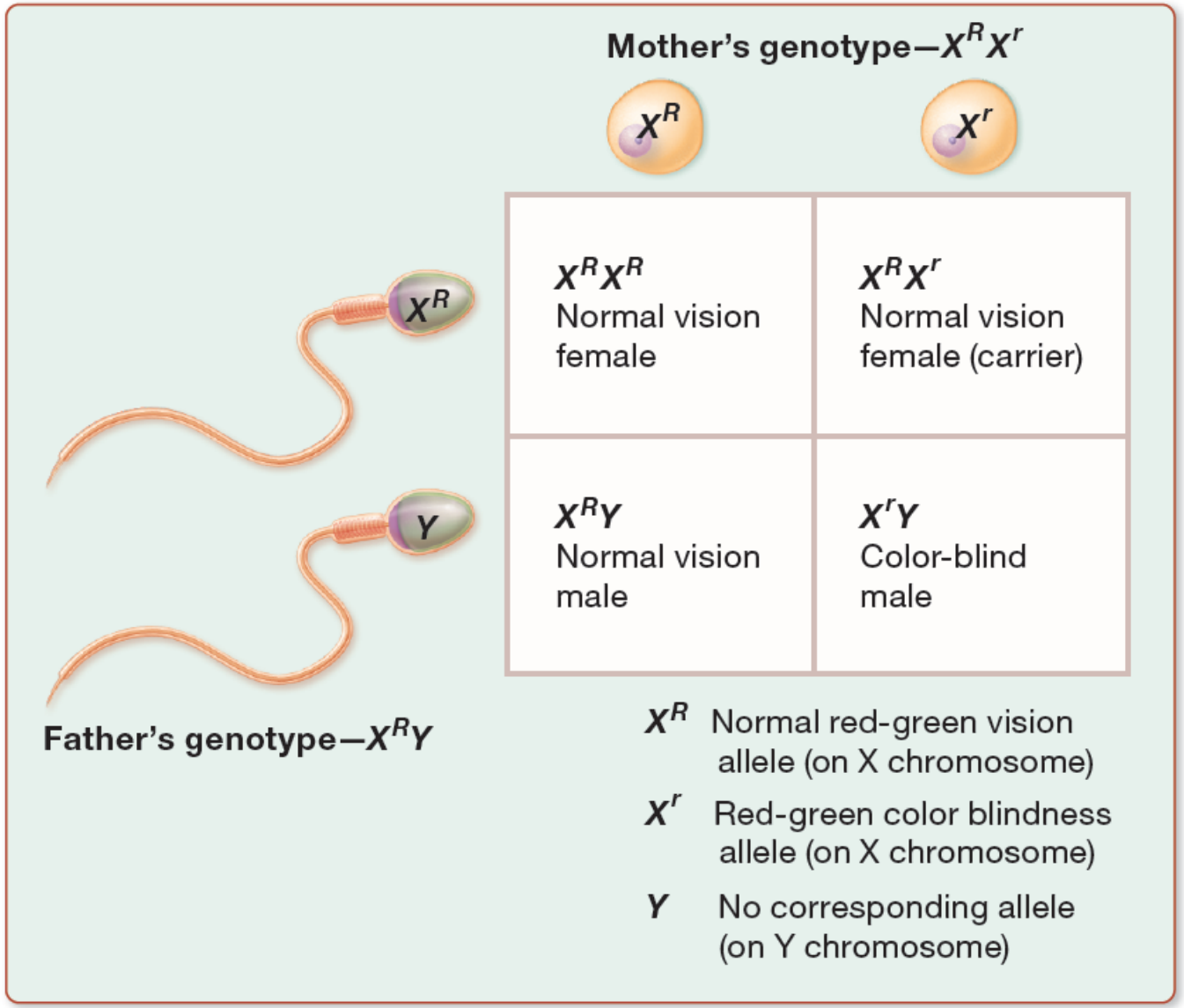
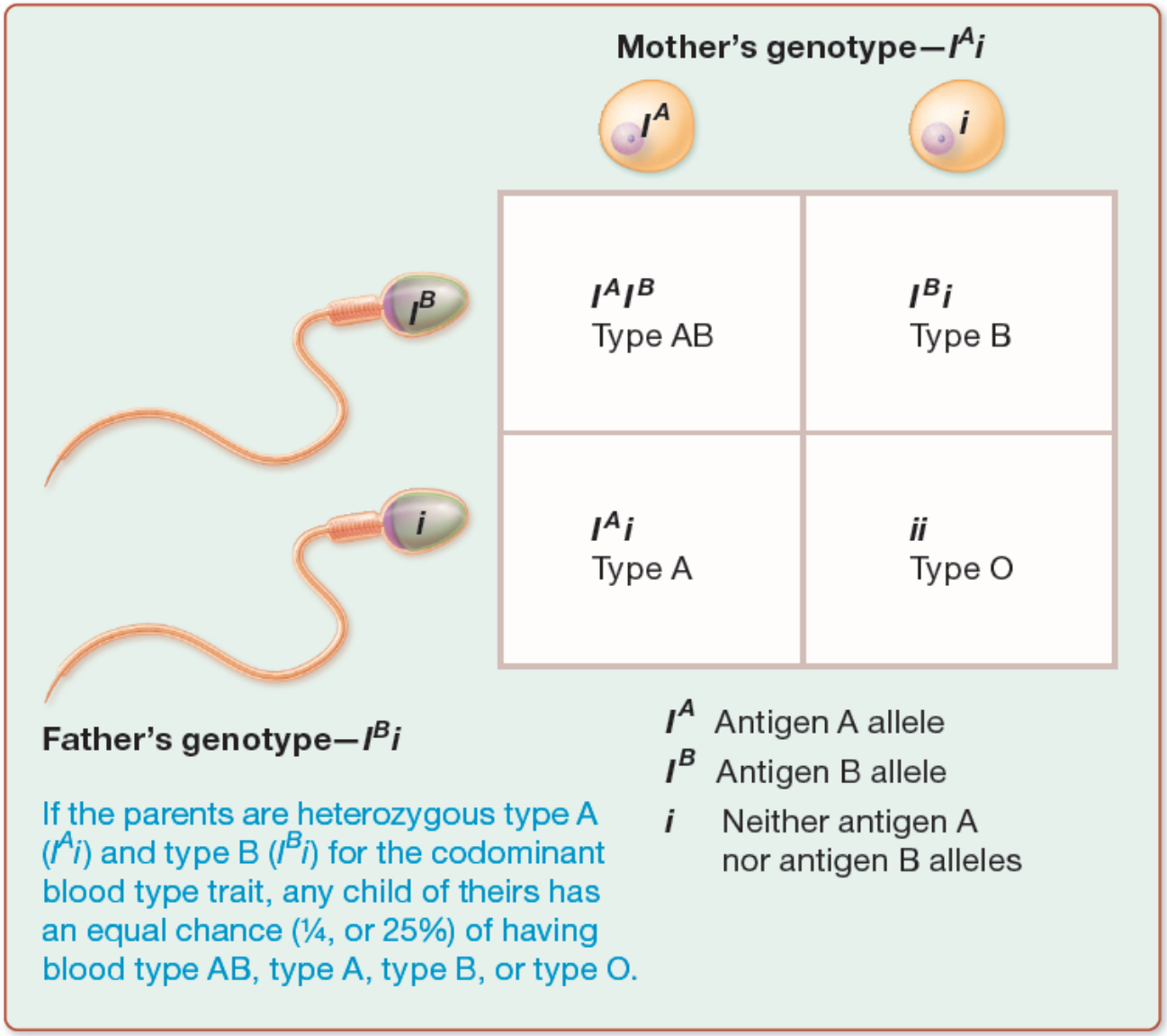


Figure 27.19b Possible offspring with multiple-allele traits and X-linked traits.



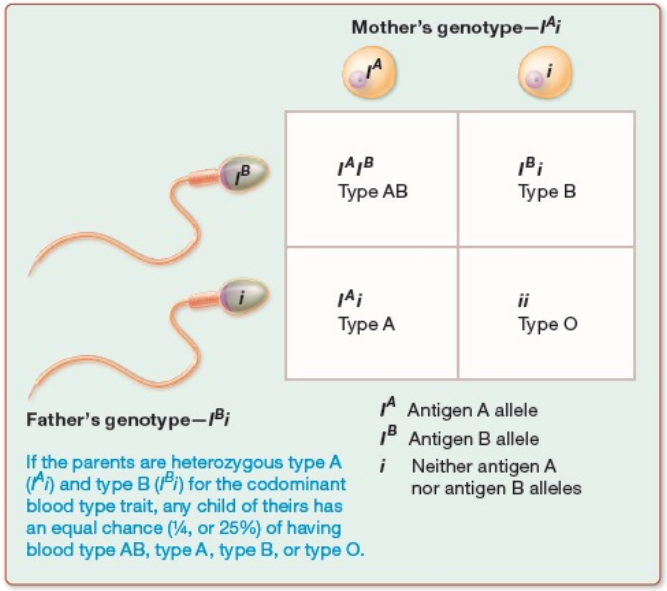
(b) Possible offspring with X-linked trait: red-green color blindness

Figure 27.19a Possible offspring with multiple-allele traits and X-linked traits.

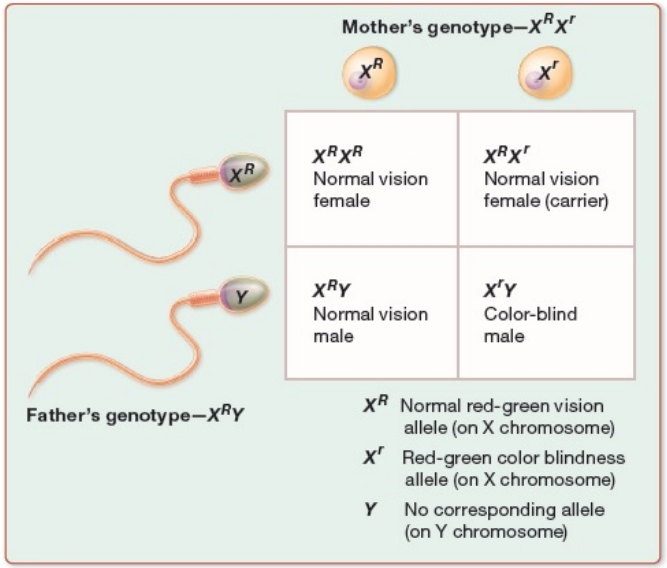


(a) Possible offspring with a multiple-allele trait: blood type

Figure 27.19 Possible offspring with multiple-allele traits and X-linked traits.



(a) Possible offspring with a multiple-allele trait: blood type



(b) Possible offspring with X-linked trait: red-green color blindness

Figure 27.18 Possible offspring with an incomplete dominant trait: sickle-cell anemia.

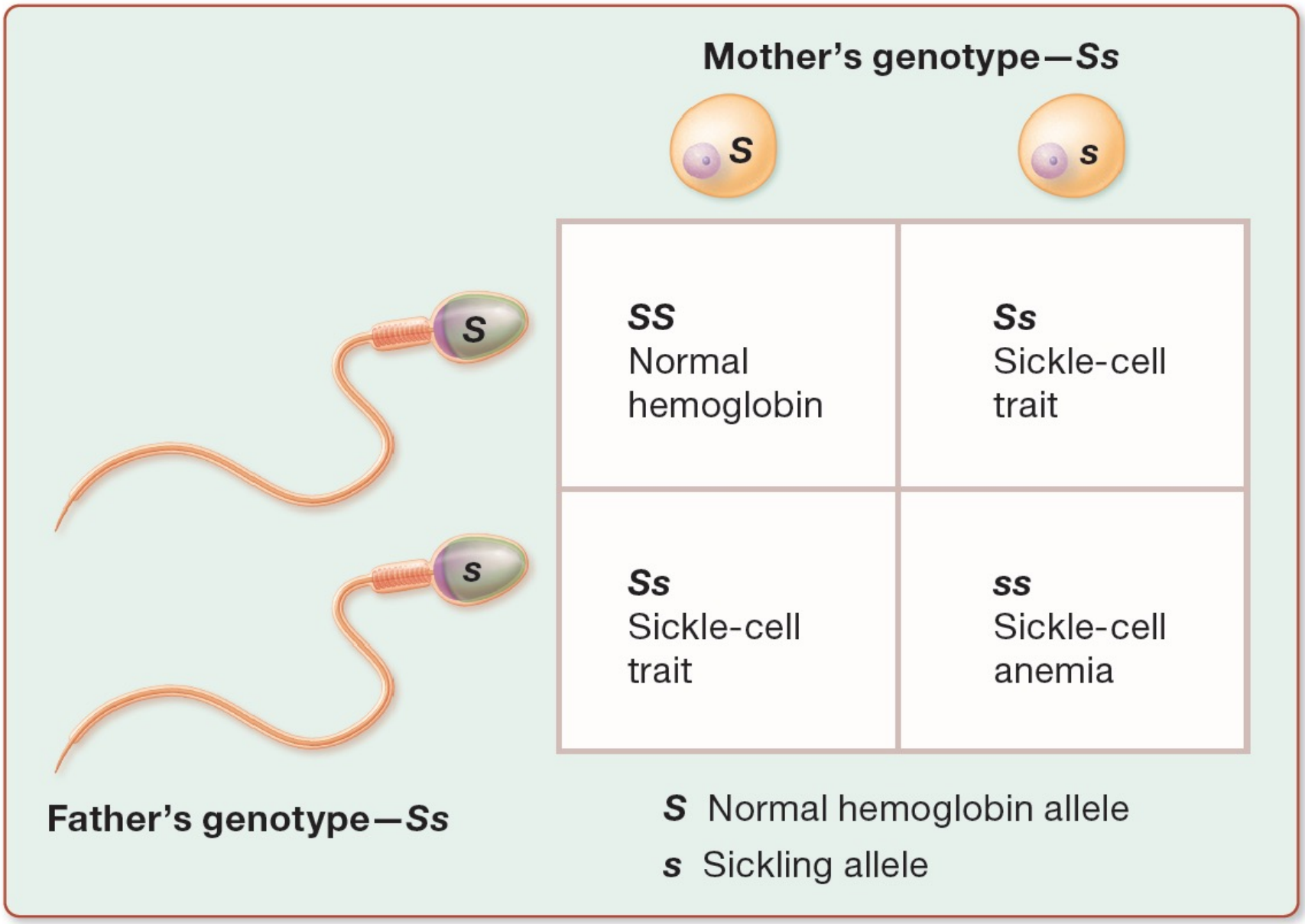


Figure 27.17 Possible offspring with a dominant-recessive trait: dimples.