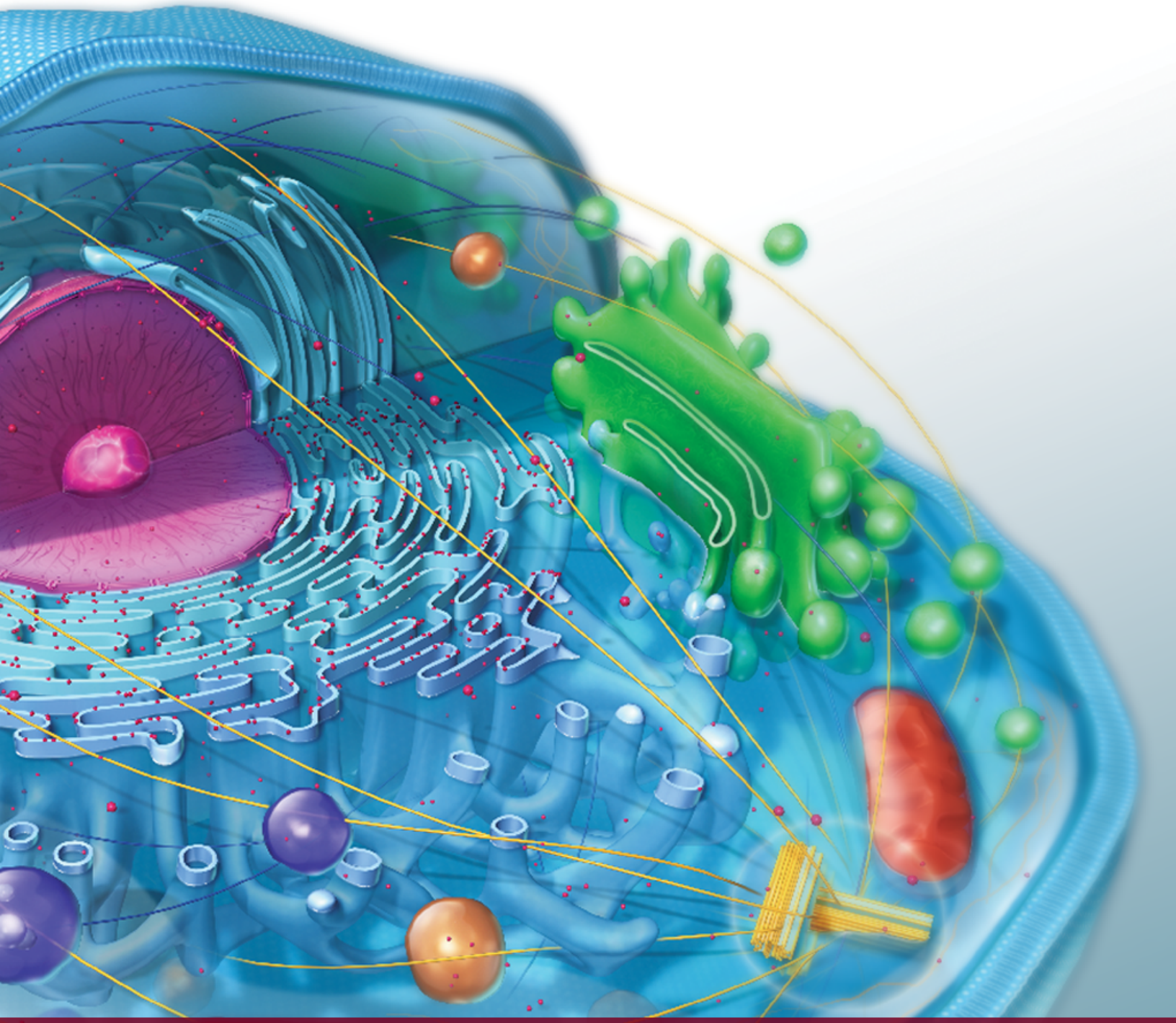

VISIBLE BODY®

Cells: Structure and Function

A cells and tissues lab activity using Visible Body Suite

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PRE-LAB EXERCISES

Open Visible Body Suite. From the main menu, choose Anatomy & Physiology and select 1. Cells and Tissue.

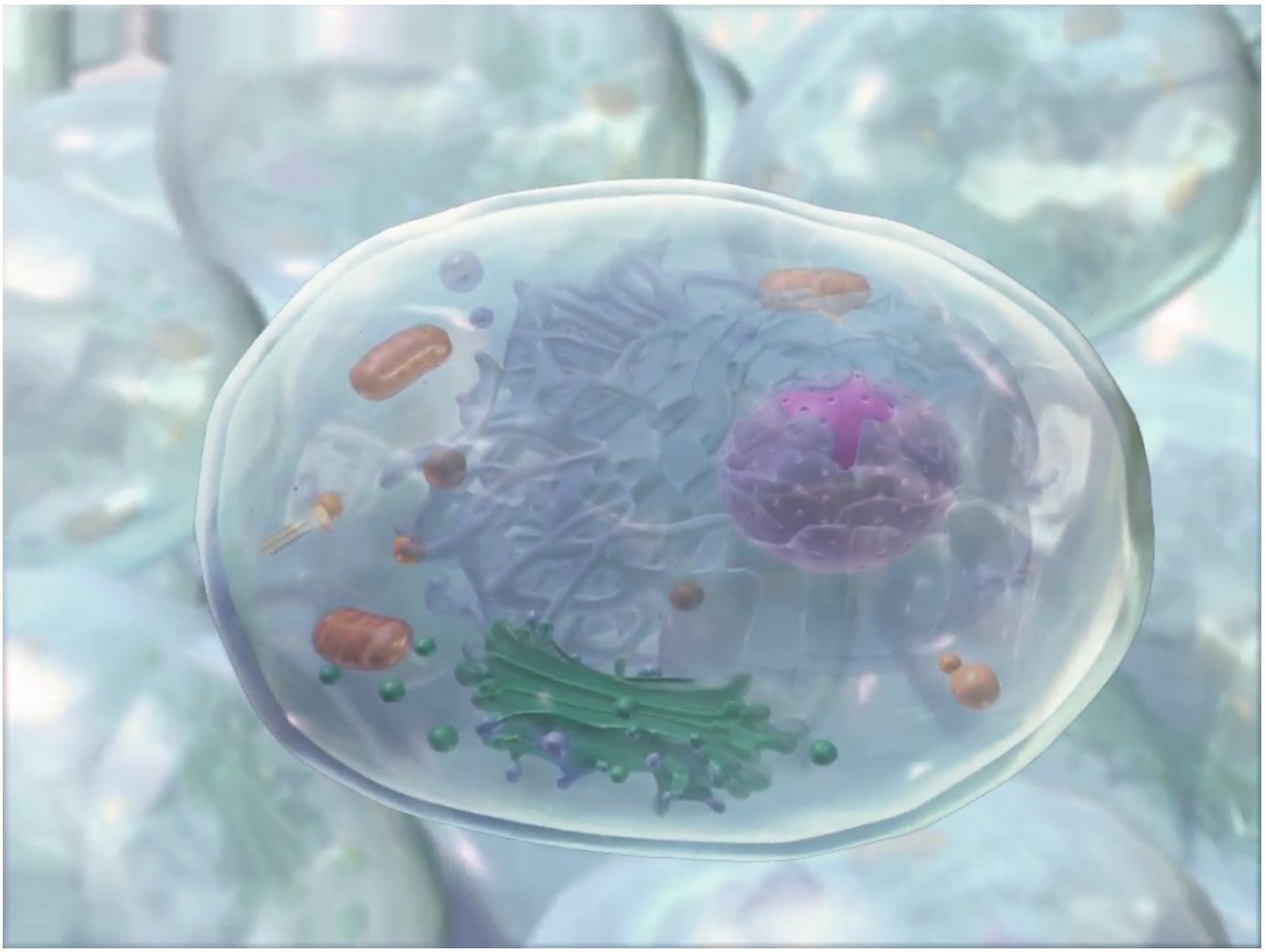
Use the modules to guide your exploration of the structure and function of cells. Be sure to use the book icon to learn more about the cellular features that you are exploring.

You are responsible for the identification of **all bold terms** and all answers to the questions.

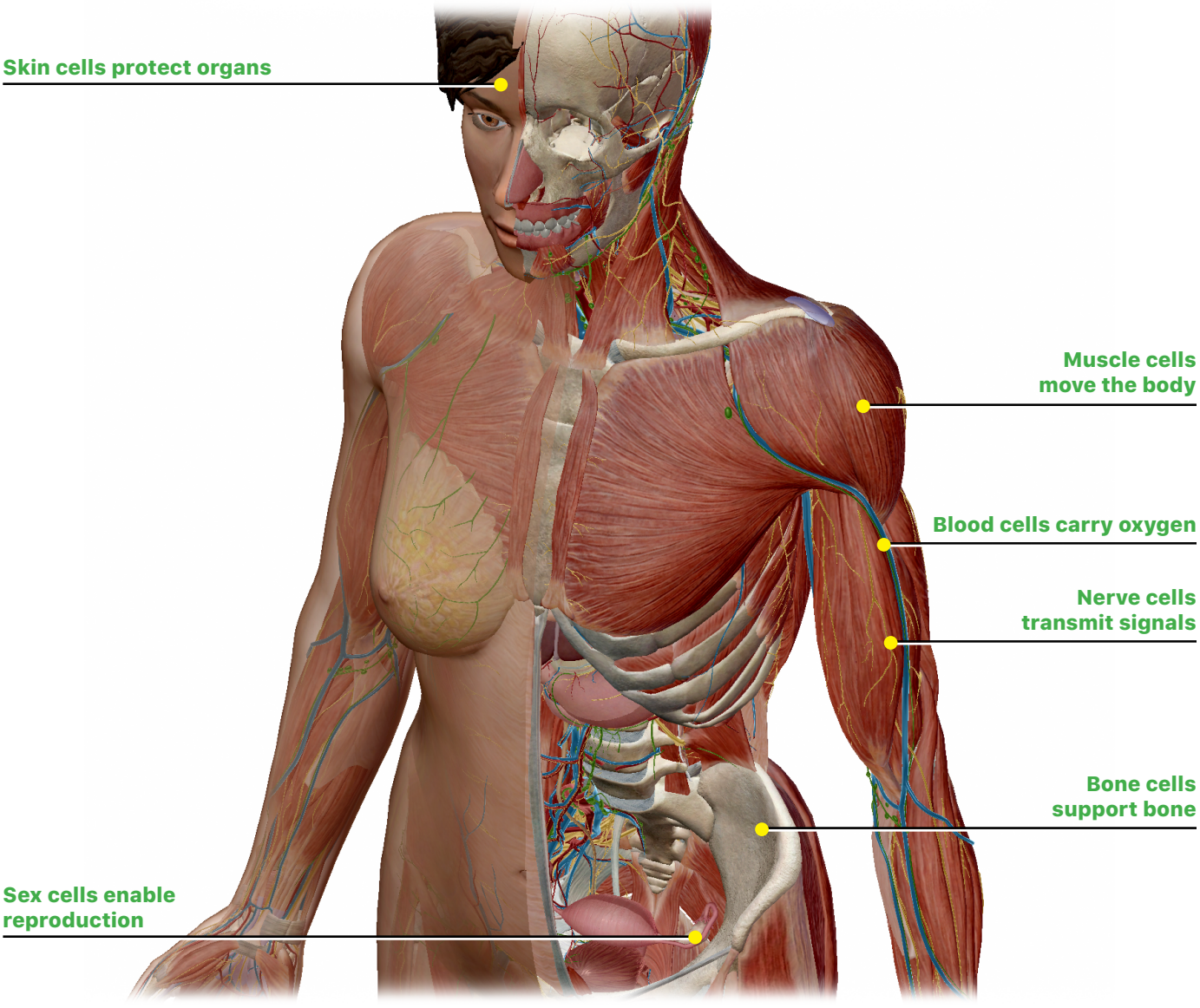
A. Cell Functions & Types

Watch the video in Module 1.1 Types of Cells, explore the 3D anatomical view in Module 1.2 Cell Functions, examine the illustration in Module 1.3 Cell Types, and then answer the following questions.

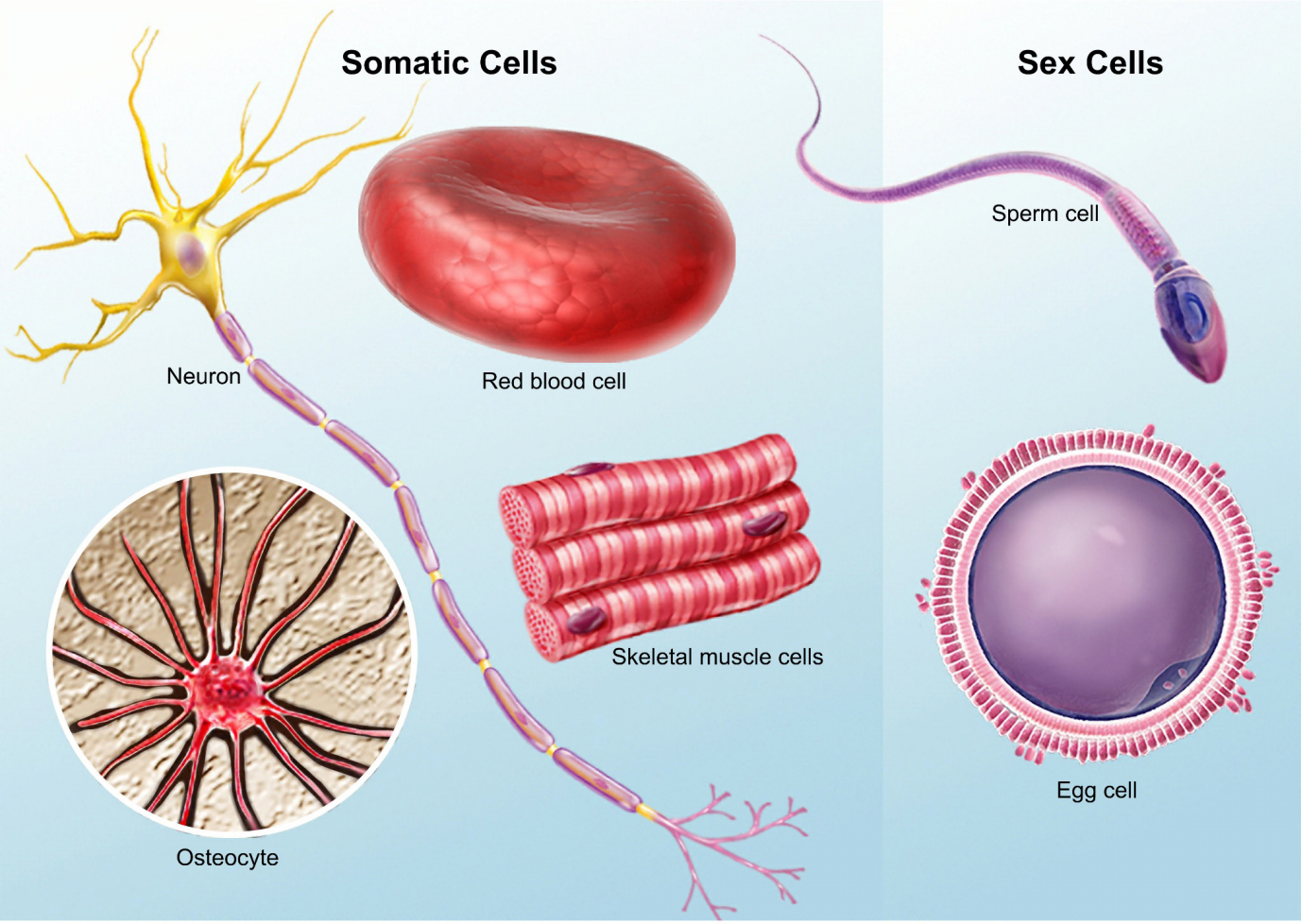
Module 1.1 Types of Cells



Module 1.2 Cell Functions



Module 1.3 Cell Types



1. All living things are composed of one or more cells. Adult humans are composed of trillions of cells that have a stunning array of forms and functions. How many different types of cells are there in the human body?

2. What are six examples of human cell types and their essential functions?

Example	Essential function

3. In Module 1.3 Cell Types, examine the illustrations of six specific cells: **a neuron, red blood cell, osteocyte, skeletal muscle cell, sperm cell,** and **egg cell**.

a. What observations can you make on how these cells are similar?

b. What observations can you make on how these cells are different?

c. What is a difference between a **somatic cell** and a **sex cell**?

4. Think about a living organism (e.g. bacterium, fern, fruit fly, or mouse) and consider what characteristics it has that make it alive. What do all living things require and what do they do? Because all living things are composed of one or more cells, cells share some of these characteristics. Write down some characteristics of living things.

Keep these characteristics in mind as you learn about organelles and metabolism in the following in-lab exercises.

IN-LAB EXERCISES

Use the following modules in the VB Suite app to guide your exploration of cellular structures and their functions. Be sure to select the book icon under the structure name to read information specific to that structure.

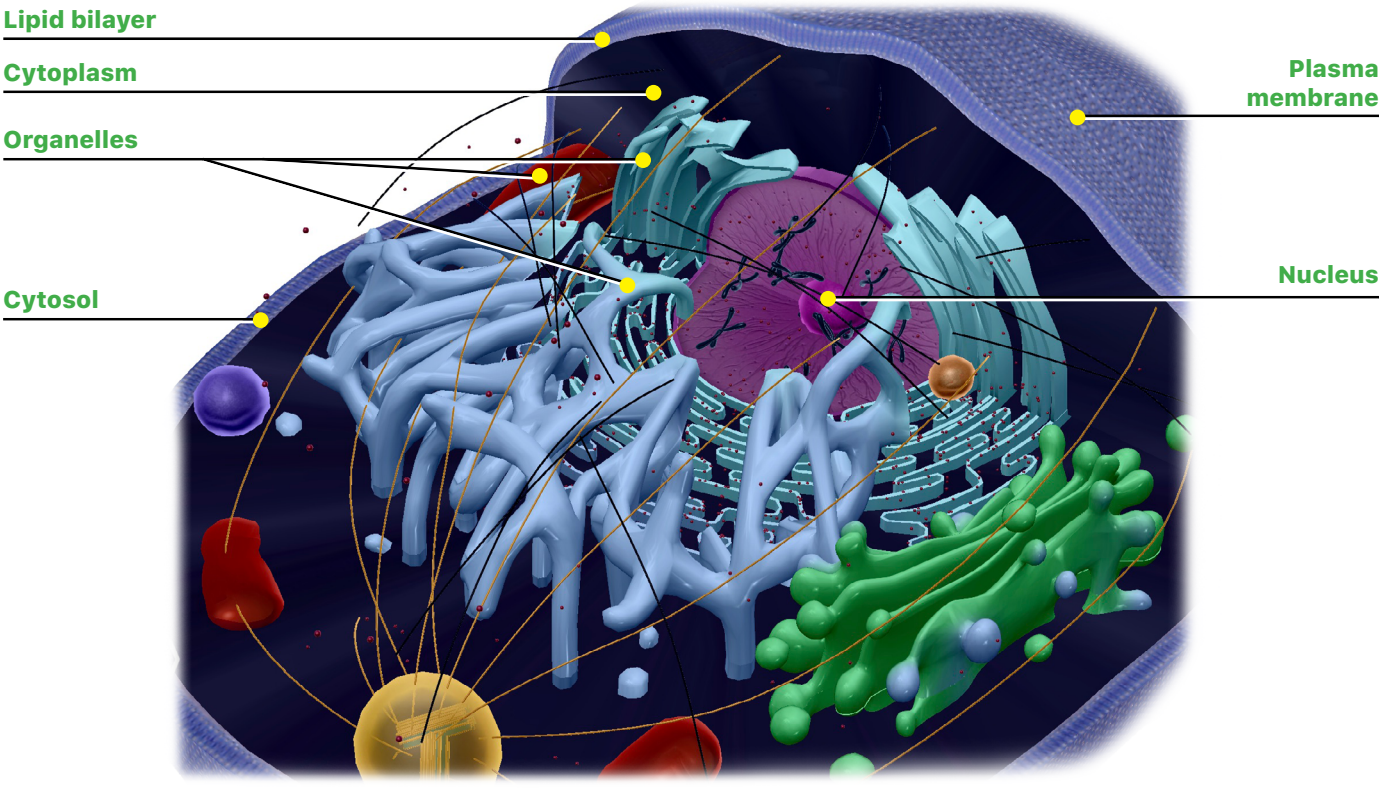
You are responsible for the identification of **all bold terms** and all answers to the questions.

Go to the Cells and Tissue unit and scroll to 2. Cell Structure and Function.

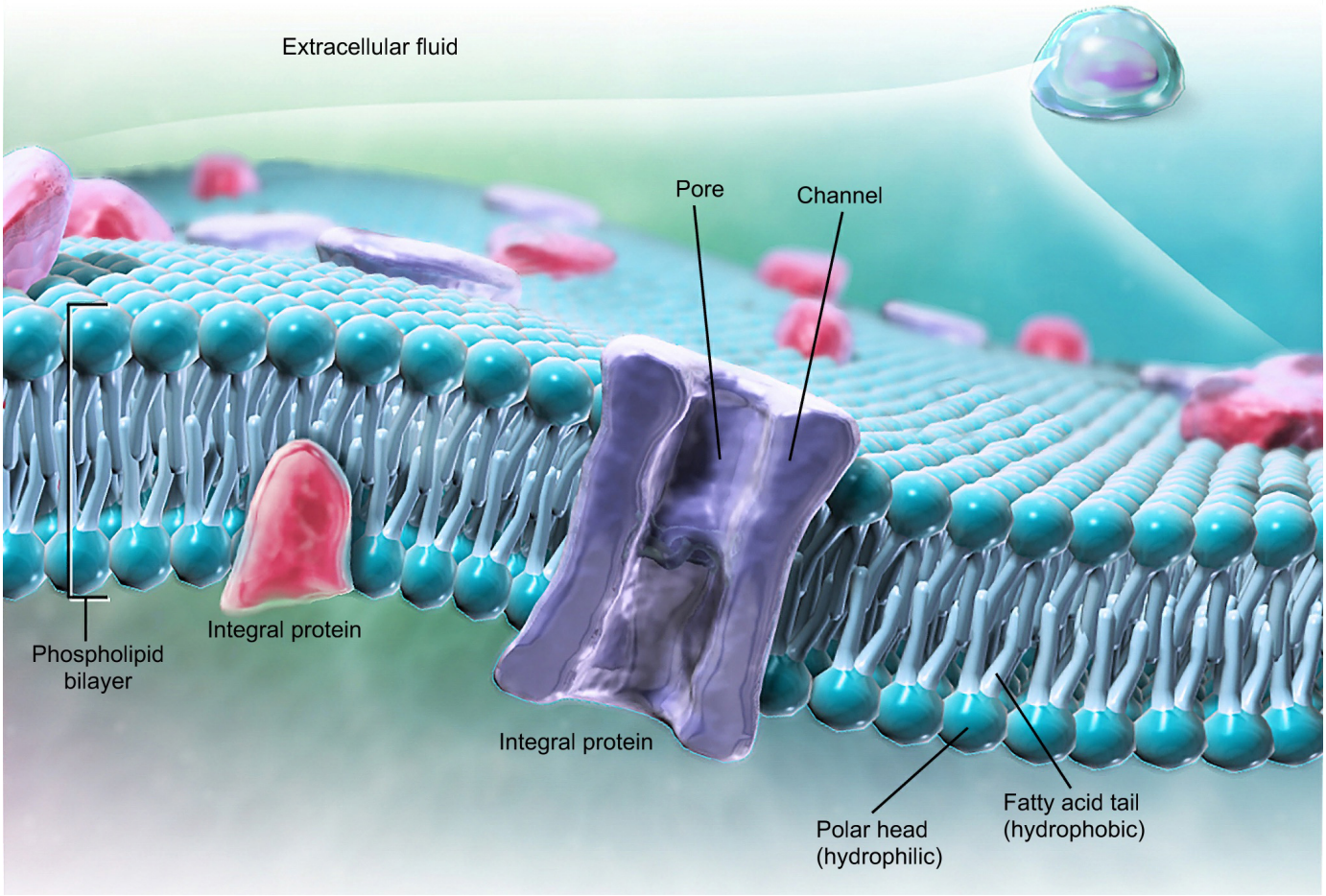
A. Cell Parts and the Plasma Membrane

Explore the 3D anatomical views in Modules 2.1 Parts of a Cell and 2.2 Plasma Membrane and examine the illustration in Module 2.3 Structure of the Plasma Membrane to learn about three major cellular structures. Use these modules to answer the following questions.

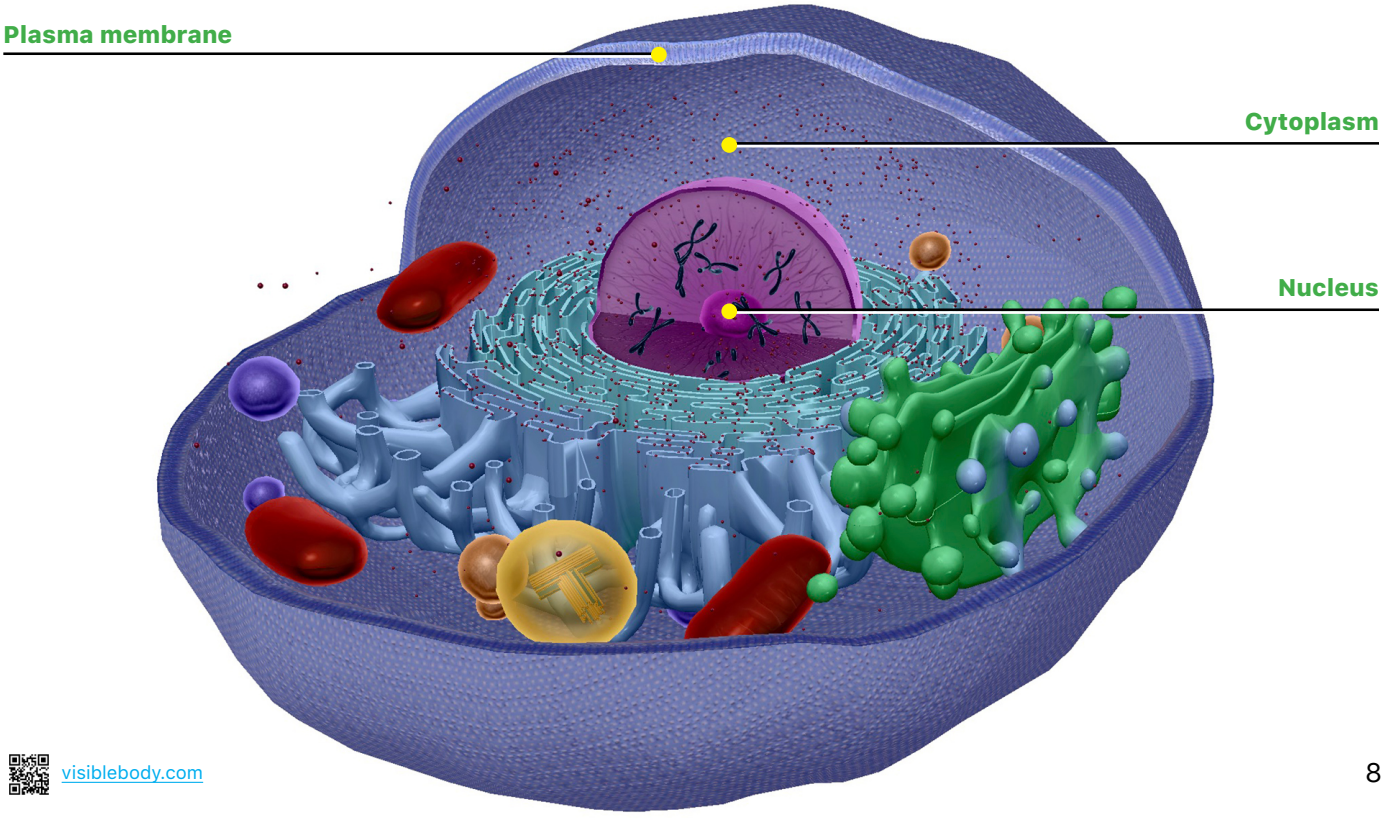
Modules 2.1 Parts of a Cell and 2.2 Plasma Membrane



Module 2.3 Structure of the Plasma Membrane



1. In the following diagram, label the major cellular structures: **the nucleus, cytoplasm**, and **plasma membrane**.



2. Although most cells have the three structures labeled in the previous diagram, there are some rare exceptions. What is an example of a type of cell that is missing one of these structures, and what structure is it?

3. The outer membrane of a cell (plasma membrane) and all the membranes found within a cell are built largely of **phospholipids** that are organized in a bilayer. For your reference, a simplified diagram of a phospholipid is provided below. In the following space, carefully draw a phospholipid bilayer that contains approximately twelve phospholipids. Then, label a hydrophilic **phospholipid polar head** and a hydrophobic **phospholipid fatty acid tail**. Finally, draw and label some membrane **proteins**.

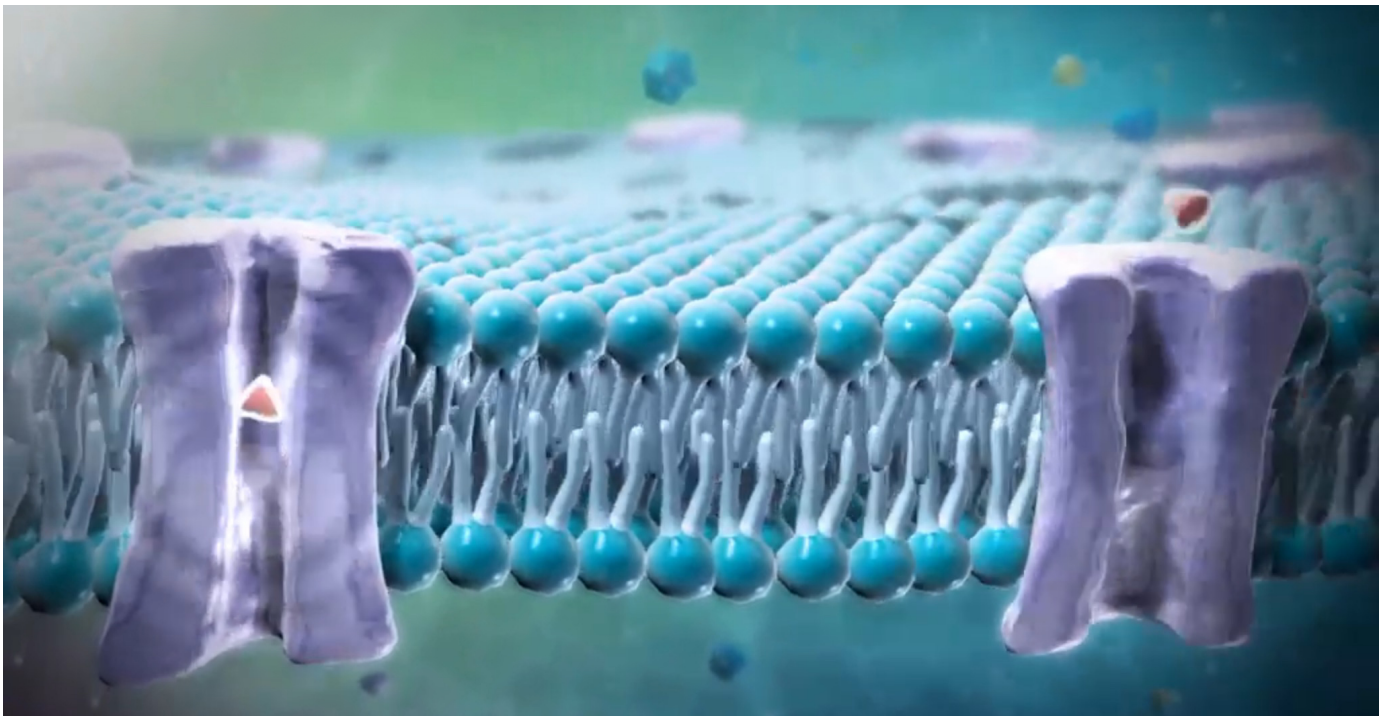
4. Phospholipids in an aqeous (water) solution may spontaneously form bilayers. Why will they spontaneously form these structures?

5. Proteins are found in and around a lipid bilayer. What are some functions of these proteins?

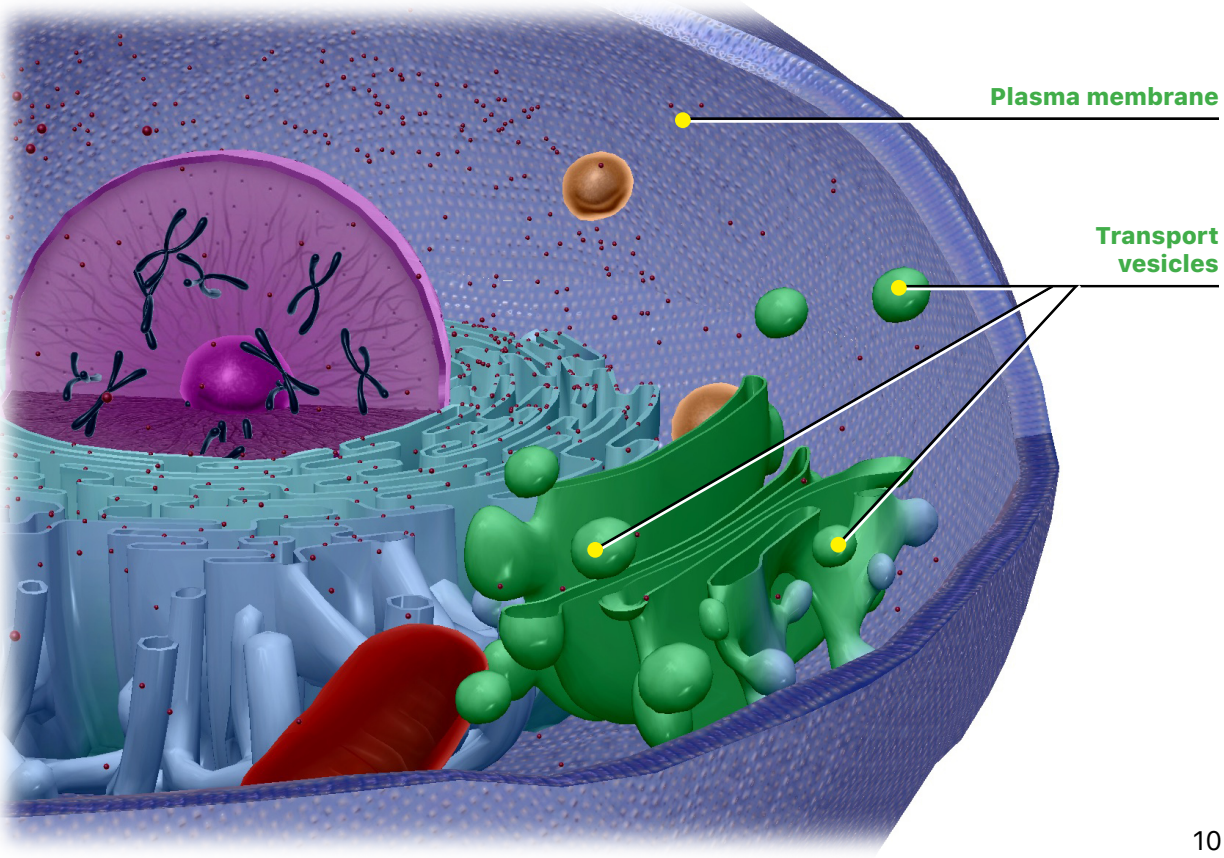
B. Transport and Osmosis

Watch the video in Module 2.4 Cell Transport, explore the 3D anatomical view in Module 2.5 Transport Vesicles, and examine the illustration in Module 2.6 Osmosis to learn about principles of cellular transport. Use these modules to answer the following questions.

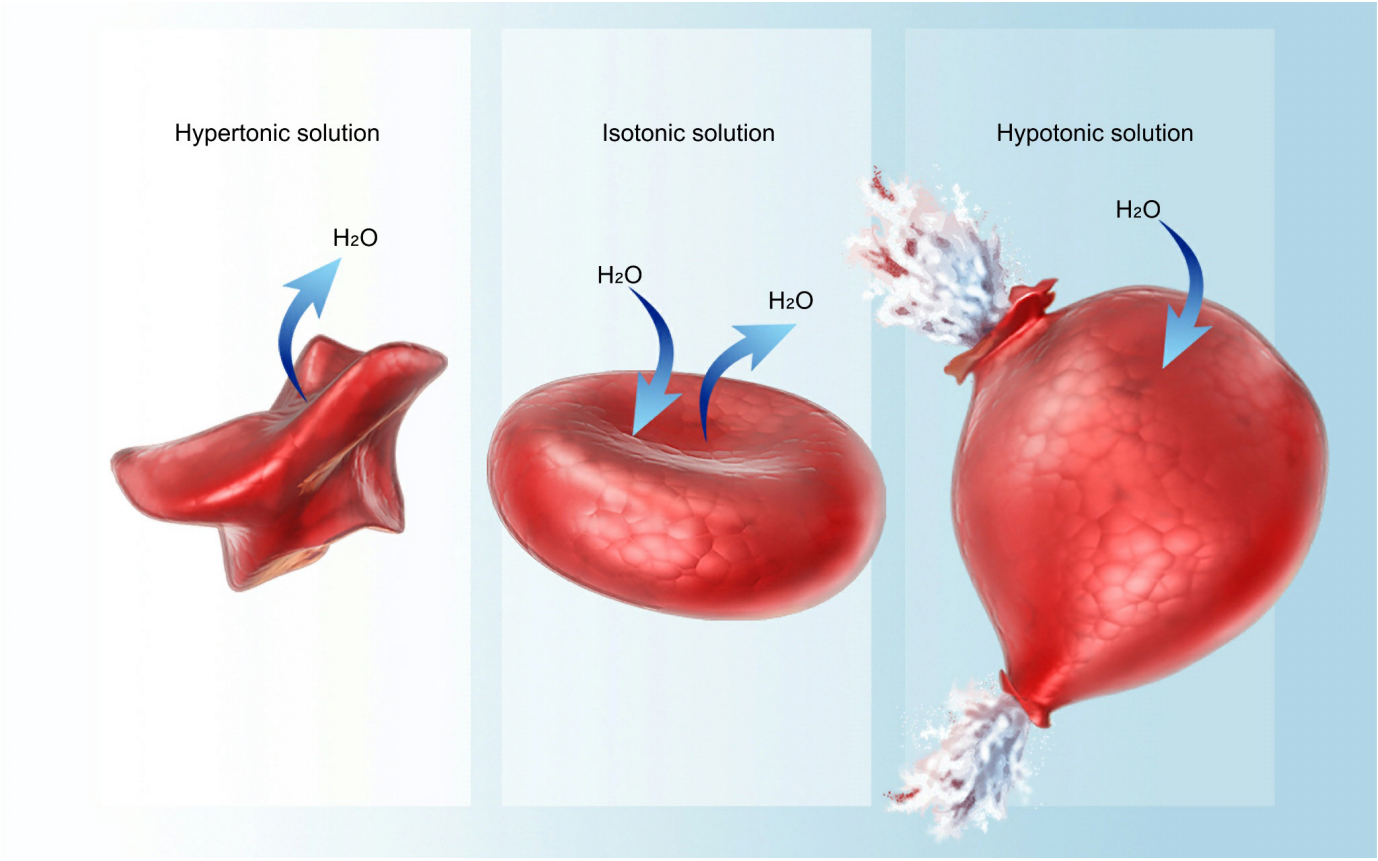
Module 2.4 Cell Transport



Module 2.5 Transport Vesicles



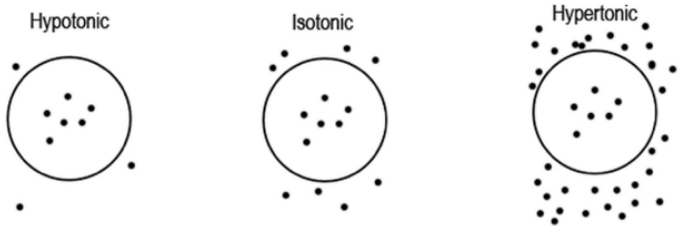
Module 2.6 Osmosis



1. Moving substances from an area of low concentration to an area of high concentration is not energetically favorable. How do cells move substances that are of low concentration on one side of a cell membrane to the other side, where they are relatively high?

2. Some substances are transported within the cell, or across membranes, within membranous sacs. What are these structures called?

3. In the following illustration, draw an arrow to show the direction of osmosis. The large circles represent cells and the black dots represent molecules of solute, or the substance dissolved in water. Is water flowing into or out of each type of cell? Note: In one context, water will not move into or out of the cell.



C. Cellular Organelles and Their Functions

Explore the 3D anatomical views in the following modules that identify cellular organelles and describe their function: 2.7 Organelles, 2.8 Cytoskeleton and Centrosome, 2.9 Endoplasmic Reticulum, 2.10 Golgi Complex, 2.11 Lysosomes and Peroxisomes, and 2.12 Nucleus, 2.13 Mitochondria and 2.14 Ribosomes. Use these modules to answer the following questions.

For each of the following functions, identify the type of organelle that performs it.

A. **Cytoskeleton**

B. **Centrosome**

C. **Rough endoplasmic reticulum**

D. **Smooth endoplasmic reticulum**

E. **Golgi complex**

F. **Peroxisome**

G. **Lysosome**

H. **Nucleus**

I. **Nucleolus**

J. **Ribosome**

K. **Mitochondrion (pl. mitochondria)**

1. A relatively small organelle that contains enzymes that oxidize organic substances _____

2. Composed of RNA and protein, this organelle synthesizes proteins _____

3. An organelle that uses oxygen to produce ATP _____

4. A network of protein filaments that extend throughout the cytoplasm _____

5. A large organelle that contains genomic DNA _____

6. Found in the nucleus, this organelle contains DNA, RNA, and protein _____

7. An organelle that contains centrioles, which are composed of microtubules, and pericentriolar material with protein complexes that play a critical role during cell division _____

8. A relatively small organelle that contains hydrolases that break down worn out parts of the cell _____

9. A membranous organelle that modifies proteins and packages them in transport vesicles _____

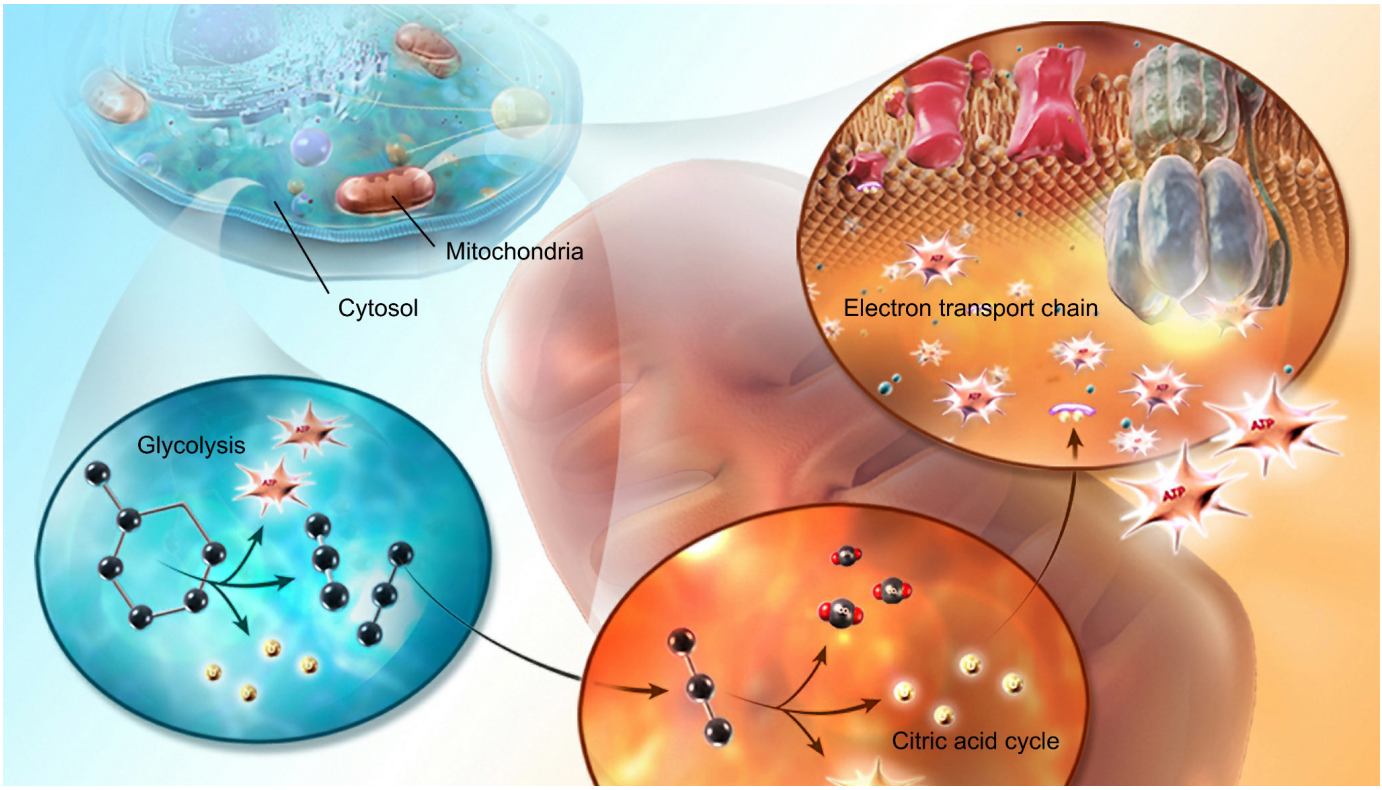
10. A network of tubules that synthesize and transport materials needed for cellular growth and other functions _____

11. A membranous organelle that is covered in ribosomes _____

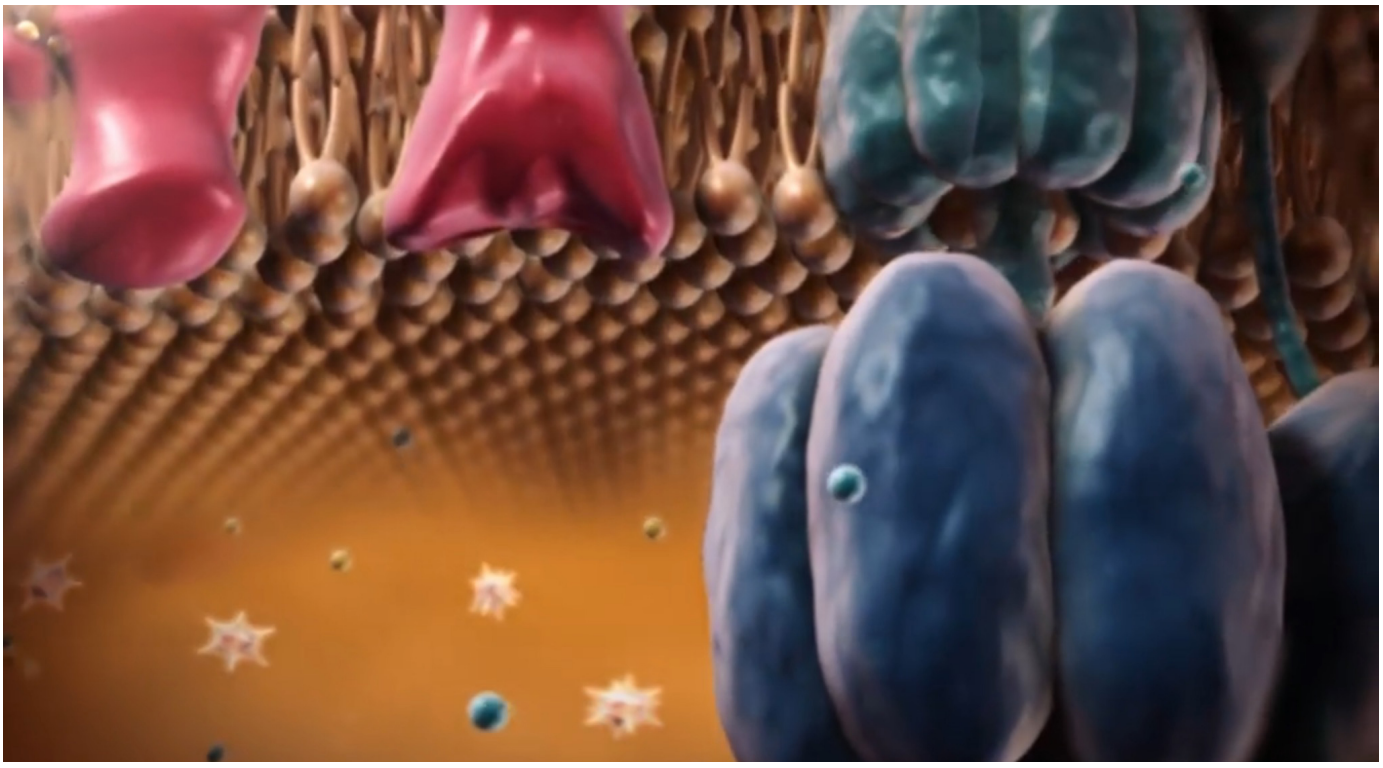
D. Cellular Respiration

Examine the illustration in Module 2.15 Cellular Respiration Definition, watch the video in Module 2.16 Cellular Respiration, and then answer the following questions on cellular respiration.

Module 2.15 Cellular Respiration Definition



Module 2.16 Cellular Respiration



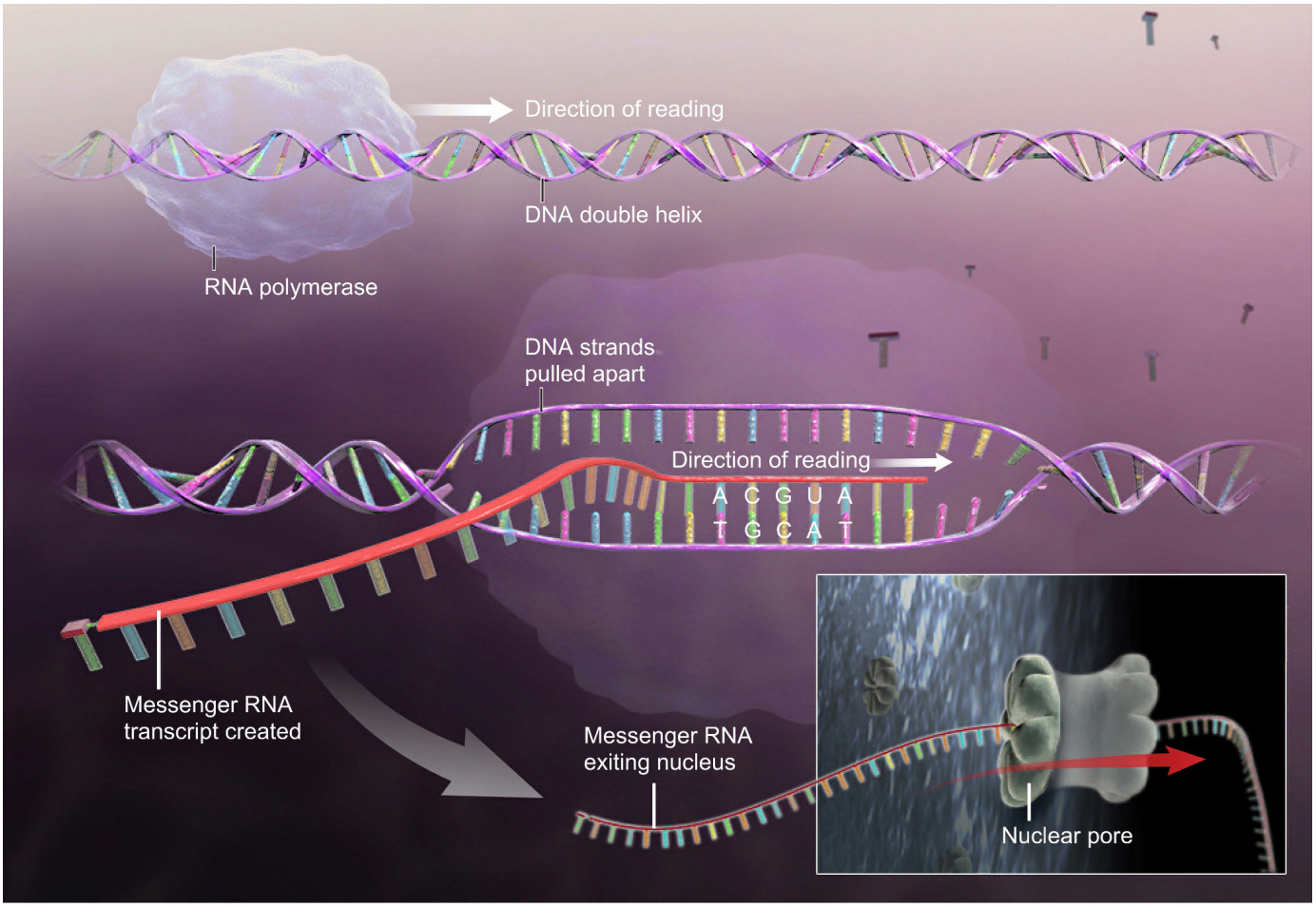
1. What are the three steps of **cellular respiration** and where do they occur?

2. When all three steps of cellular respiration occur, how many **ATP** molecules can be produced for each molecule of glucose?

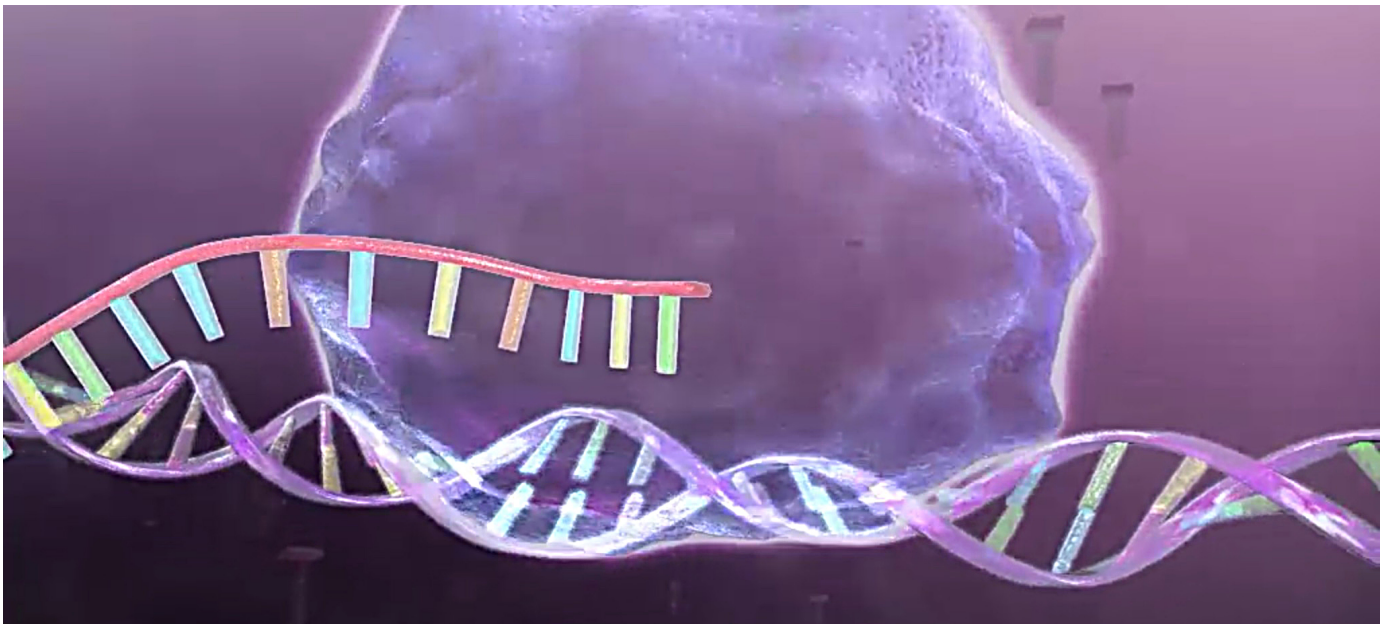
E. Transcription

Examine the illustration in Module 2.19 Transcription Definition, watch the video in Module 2.20 Transcription, and then answer the following questions on transcription.

Module 2.19 Transcription Definition



Module 2.20 Transcription



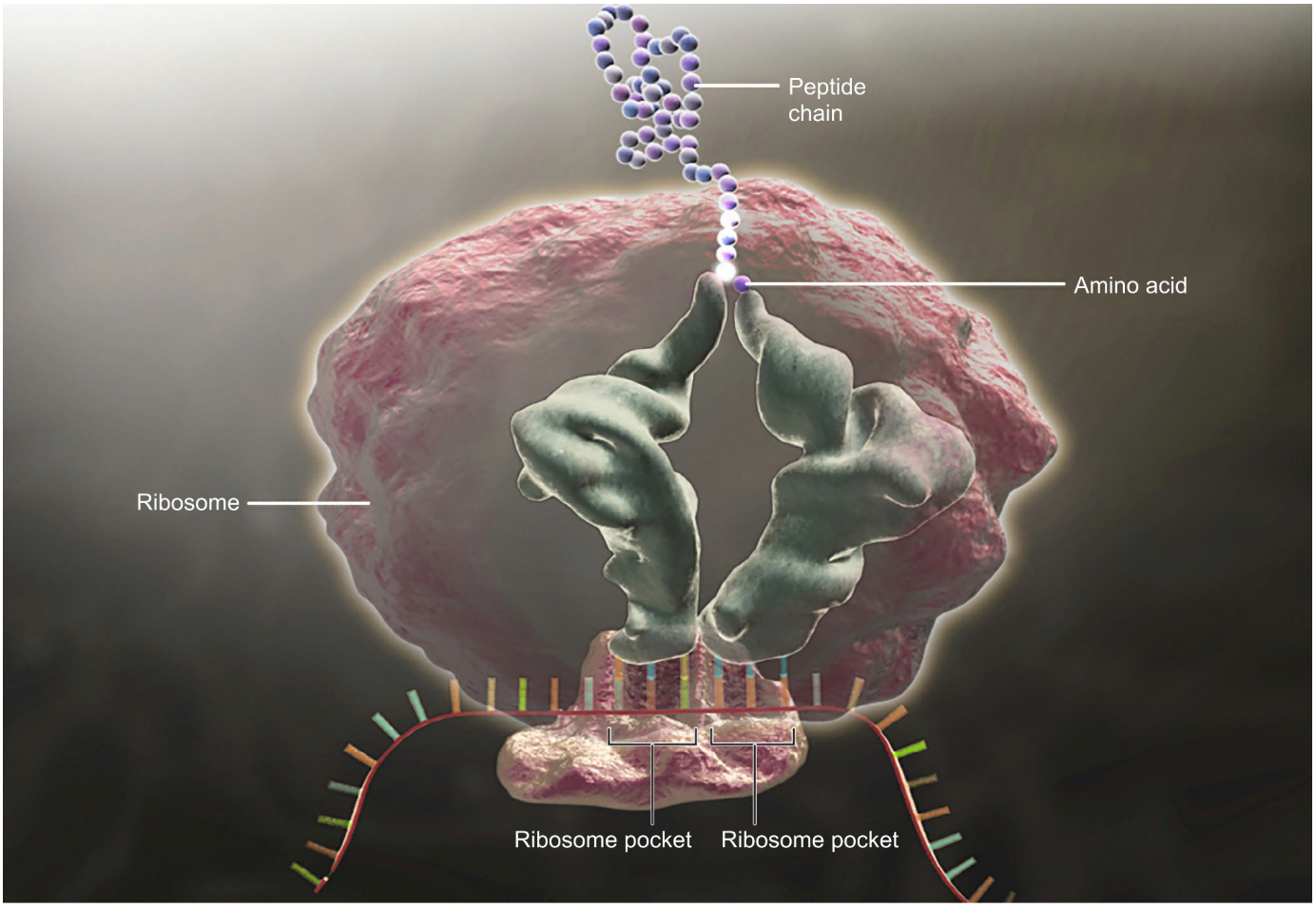
1. What is messenger RNA (**mRNA**)?

2. Where does mRNA get transported, so that it may be used to synthesize protein?

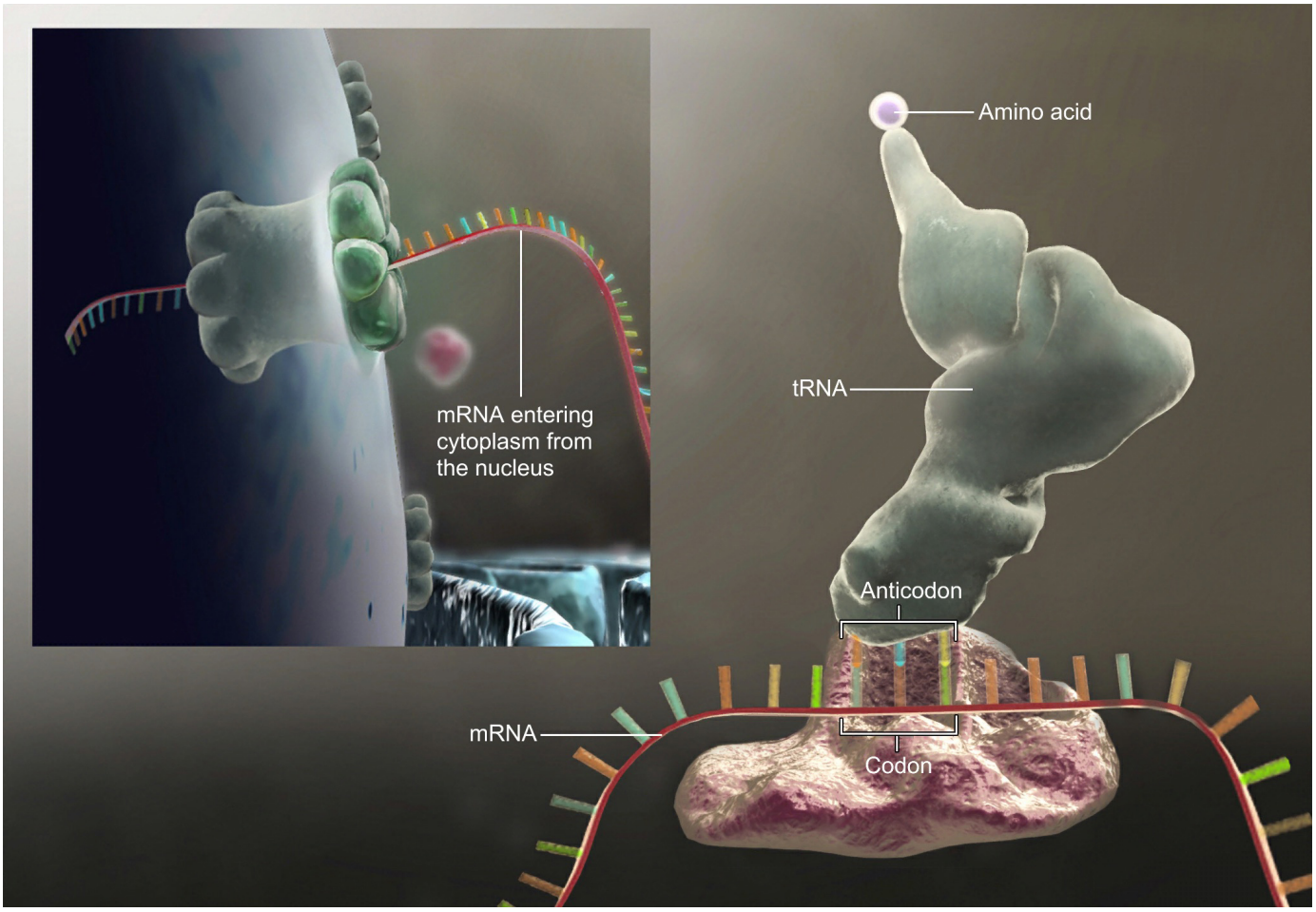
F. Translation

Examine the illustrations in Modules 2.21 Translation Definition and 2.22 Codons and the Ribosome, watch the video in Module 2.23 Translation, and then answer the following questions on translation.

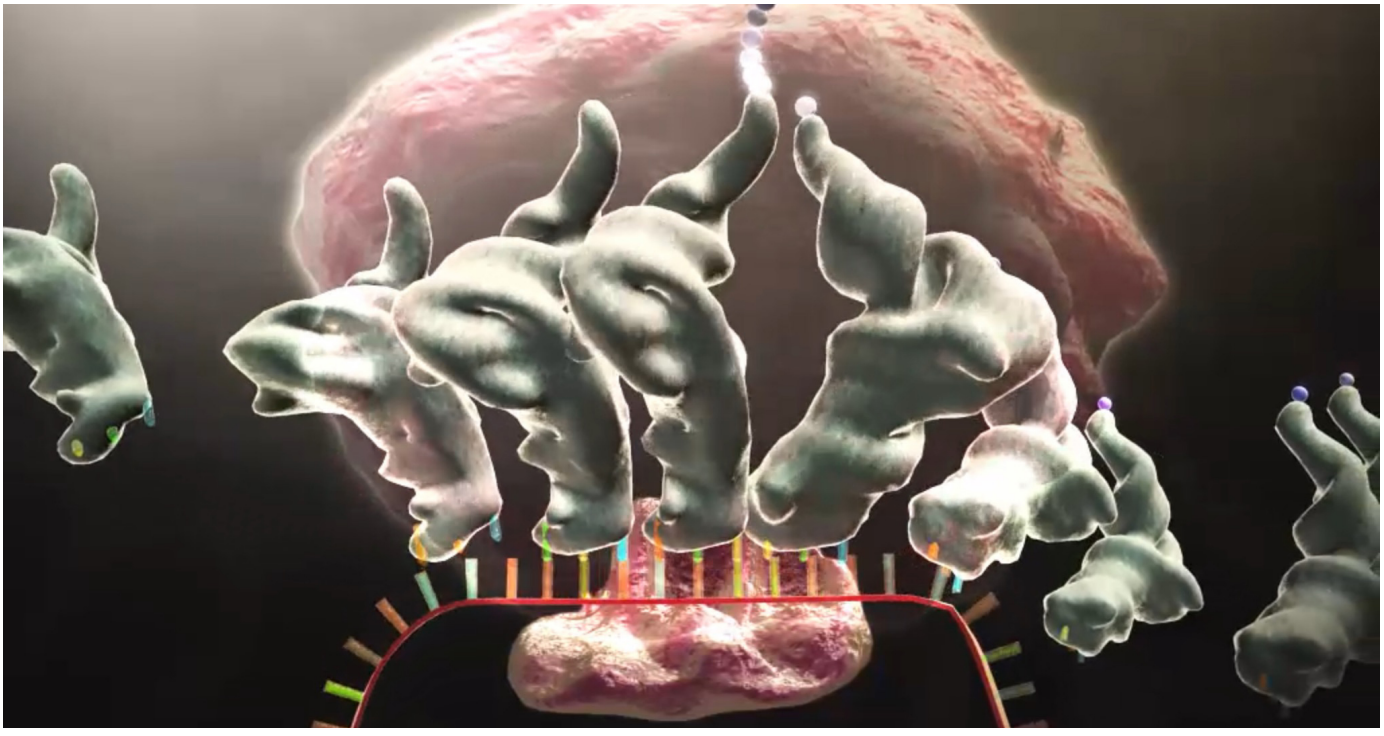
Module 2.21 Translation Definition



Module 2.22 Codons and the Ribosome



Module 2.23 Translation



Read through the following steps of translation and place them in the correct order by numbering them 1–8.

1. _____ A **small ribosomal subunit** binds to an mRNA and the first **tRNA** at the start codon.

2. _____ A stop codon is encountered on the mRNA, which signals that protein synthesis is finished.

3. _____ The large **ribosomal subunit** joins the small subunit, mRNA, and tRNA complex, and a fully functional **ribosome** is formed.

4. _____ The finished protein is released and the ribosomal subunits separate.

5. _____ mRNA leaves the nucleus and enters the cytoplasm.

6. _____ The ribosome binds to a second tRNA with the proper anticodon.

7. _____ New tRNAs with the proper anticodon come into the ribosome and their amino acids are added to the growing protein; old tRNAs are ejected from the ribosome.

8. _____ The amino acids associated with the first two tRNAs are joined.

PUTTING IT ALL TOGETHER

We began this lab thinking about the characteristics of living things and cells, and then we worked through some of the structures and organelles that function to maintain these characteristics in cells. There are some disorders that affect normal cellular function and may result in disease. Based on what you've learned about cells and organelles, pair each disease or disorder with the type of organelle it affects.

A. Peroxisome

B. Mitochondrion

C. Nucleus

D. Rough endoplasmic reticulum

E. Ribosomes

F. Lysosome

1. _____ Kearns-Sayre syndrome: This condition results from a decrease in cellular energy production and muscle weakness in many parts of the body, especially the eyes, where it can cause paralysis of the eye muscles.

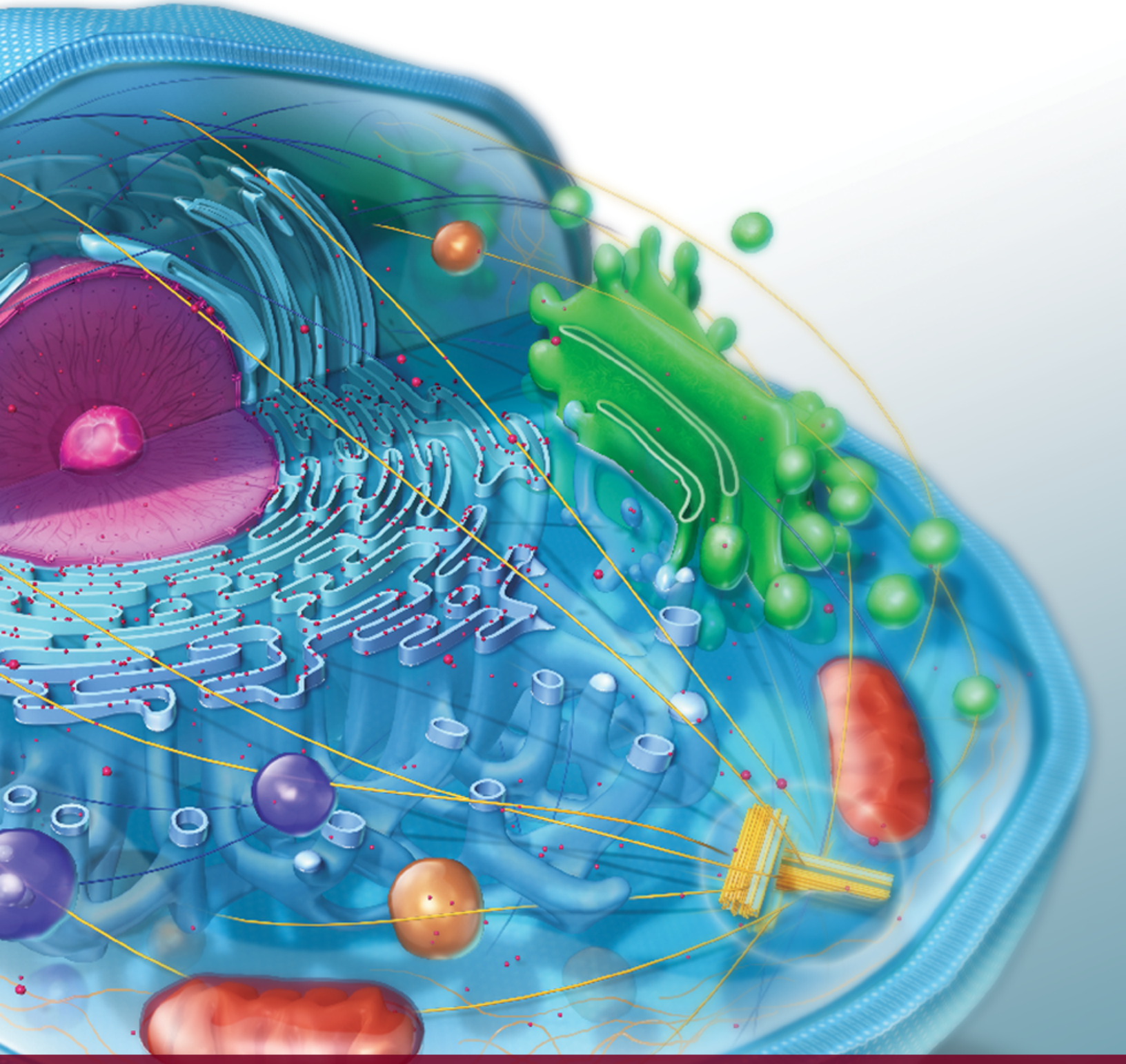
2. _____ X-linked adrenoleukodystrophy (X-ALD): This inherited neurodegenerative disorder results from a failure of neurons to oxidize very long chain fatty acids (VLCFA).

3. _____ Treacher Collins syndrome: This condition results from defects in the organelle responsible for protein synthesis, which kills the cells responsible for the development of the facial bones and tissues.

4. _____ Cystic fibrosis: This inherited disease of the mucus and sweat glands causes mucus to thicken, and it can accumulate in the lungs, causing breathing problems and increased risk of bacterial infection. It results from defects in the synthesis of a protein by ribosomes on a membranous organelle.

5. _____ Tay-Sachs disease: This rare inherited disorder destroys nerve cells in the brain and spinal cord, resulting in muscle weakness and lack of coordination, as well as neurological disorders. It results from defects in a hydrolase that normally breaks down a specific lipid, which causes the lipid to build up in cells, particularly neurons, ultimately destroying them.

6. _____ Hutchinson-Gilford progeria syndrome: This genetic disorder, which results from a defect in a protein that supports the membranes of the organelle that contains genomic DNA, causes accelerated aging.



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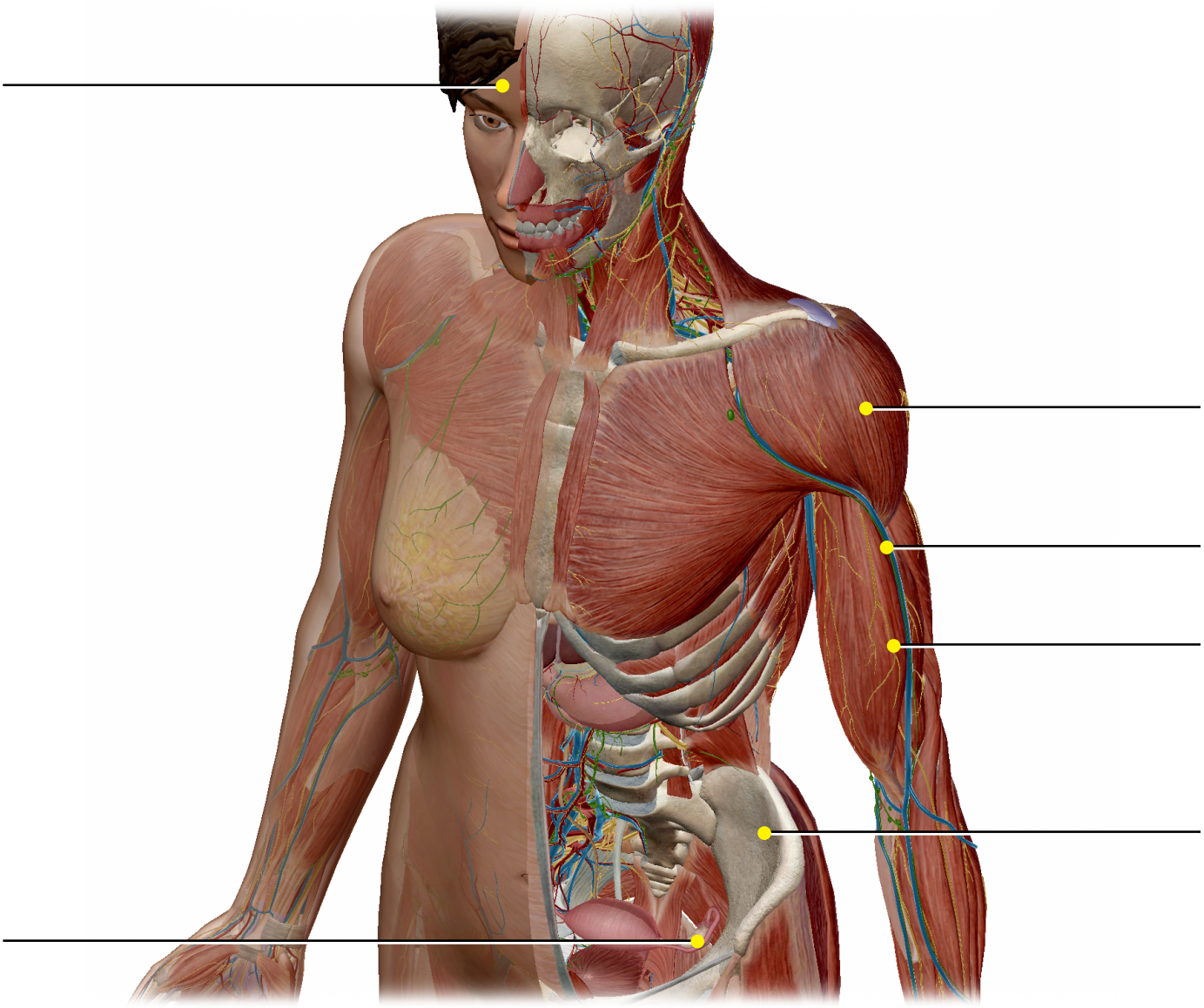
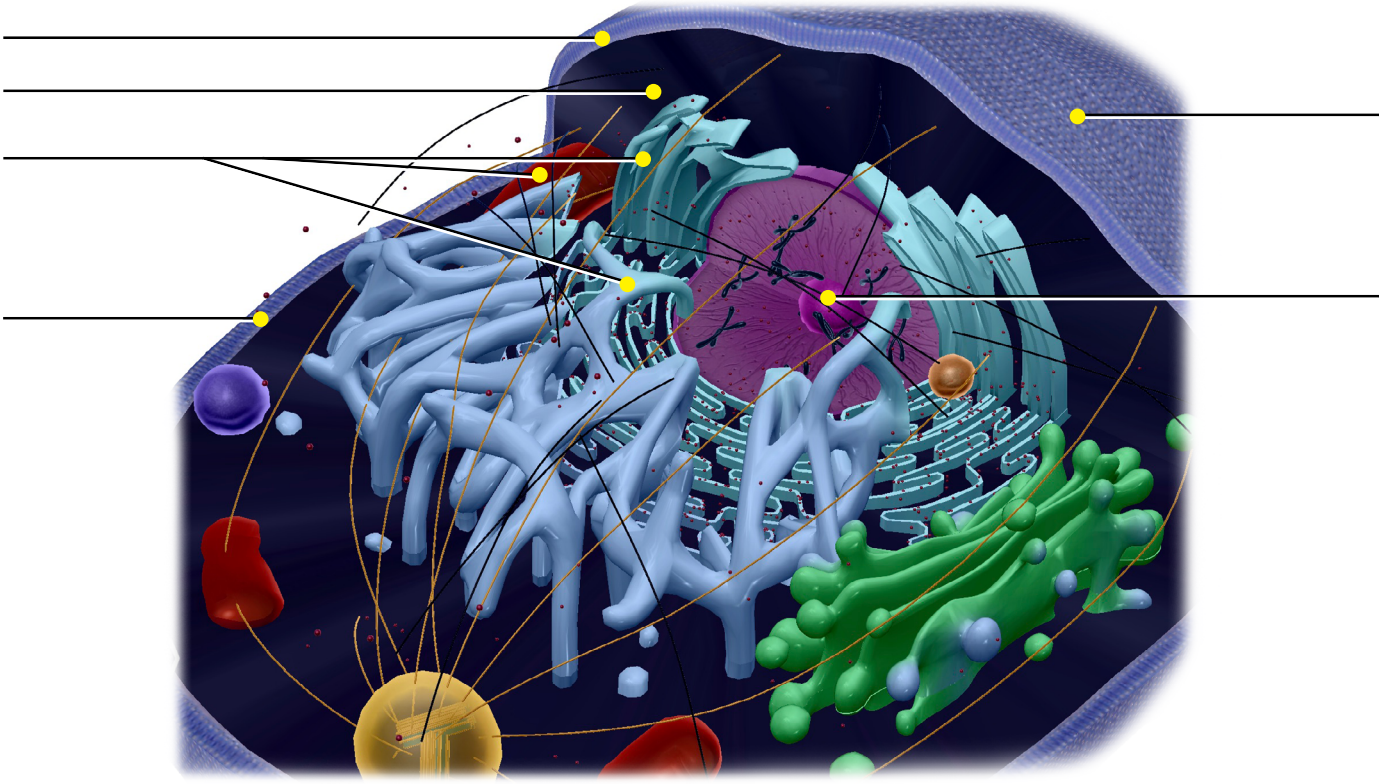
Student Practice

Label the structures in the following figures.

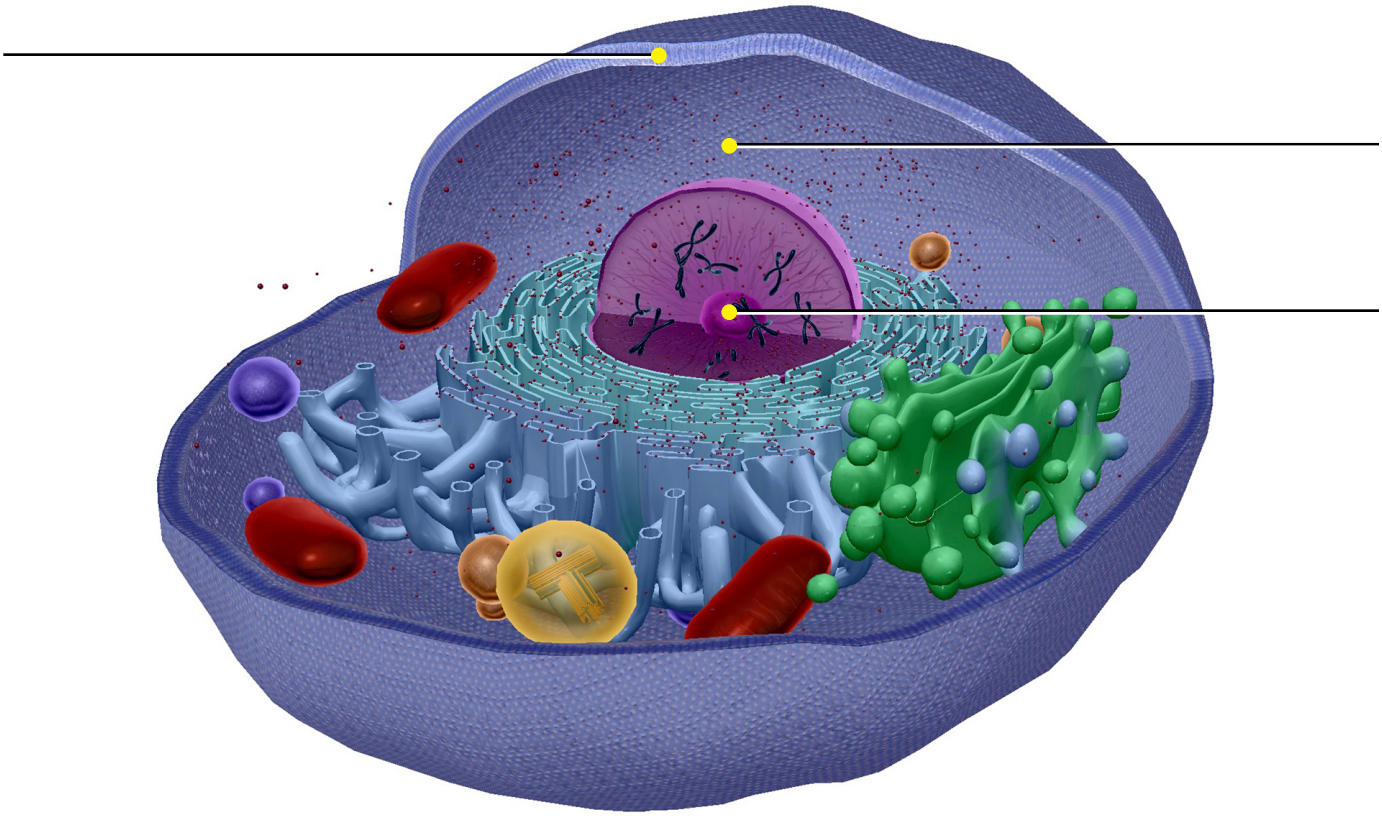
Module 1.2 Cell Functions



Module 2.1 Parts of a Cell



Module 2.2 Plasma Membrane



Module 2.5 Transport Vesicles