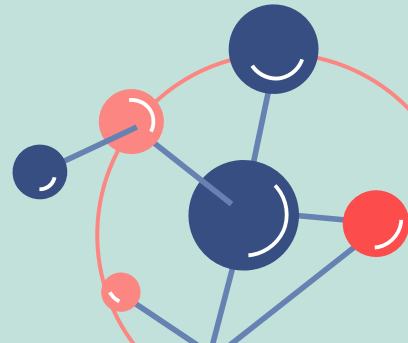




Amit's Biolympiad

Training Sessions

Orientation Day
July 15, 2023



A Little Bit About Me...


- Rising Junior at WHS (Go Trojans!)
- 2023 USABO Semifinalist
- 2023 International Biology Battle Silver Medalist



USA
BIOlympiad
2023



The purpose of this class is to...


- Build foundations in biology
 - Future coursework and careers
 - Begin preparing for USABO
 - Have fun!
- 



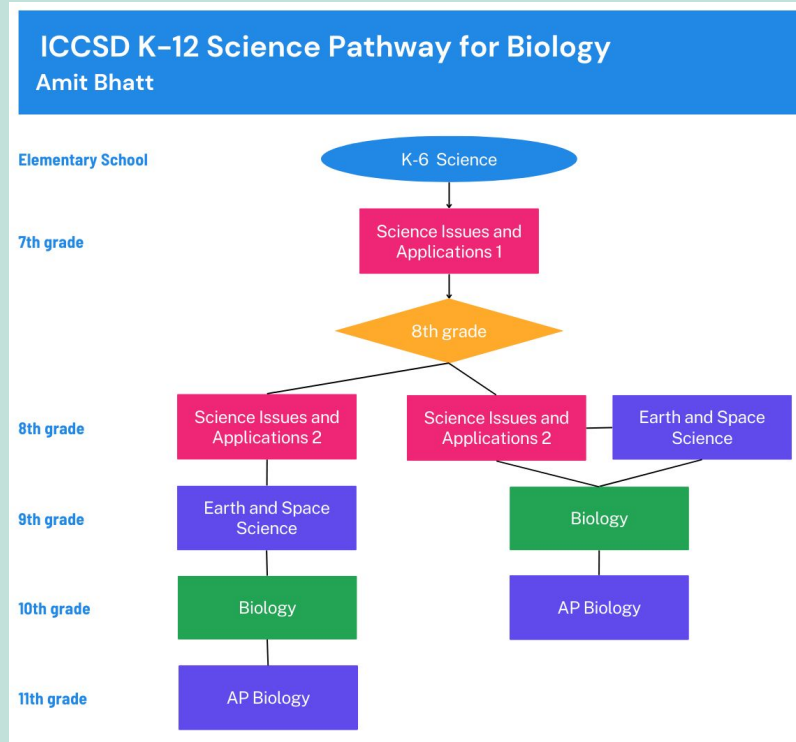
**What is
USABO?**



What is USABO?

- Multi-stage biology competition
 - Material spans the field
 - Biochemistry to ecology
 - Structure
 - Open Exam
 - Semifinals (top 10%)
 - Nationals (top 20)
 - International Biology Olympiad (IBO)
 - Team USA: top 4 people from Nationals!
 - Advanced high school level
- 

School Science Pathway



Begin competing in USABO!



Content

- Organ systems
- Hormones
- Immune system

- Organelles (6th grade cell modeling!)
- Transport of materials
- Protein structure

- How are traits passed through generations?
- How does the benefit/harm of traits impact their prevalence over time?

- Plant structure and classification

- Populations and ecosystems
- Impact of environmental changes

- Animal behaviors (e.g. instincts)

- Modeling evolutionary relationships between species



Animal Anatomy and Physiology: 25%



Cell Biology: 20%



Genetics and Evolution: 20%



Plant Anatomy and Physiology: 15%



Ecology: 10%



Ethology: 5%



Biosystematics: 5%

USABO-AP Bio Mapping

Unit 1: Chemistry of Life

You'll learn about water's role as the basis of life and the functions of macromolecules like lipids and proteins.

Unit 2: Cell Structure and Function

You'll study the makeup of cells and the fundamentals of evolution.

Unit 3: Cellular Energetics

You'll explore how cells interact with their environment and how fundamental biological processes work at the cellular level.

Unit 4: Cell Communication and Cell Cycle

You'll learn how cells grow and reproduce, as well as how cells communicate.

Unit 5: Heredity

You'll learn how traits are passed down from one generation to the next.

Unit 6: Gene Expression and Regulation

You'll study how hereditary information passes from parent to offspring and how those traits are expressed.

Unit 7: Natural Selection

You'll learn about Darwin's theory, the concept of natural selection, and evolution.

Unit 8: Ecology

You'll explore biological concepts at a broader organism level and analyze how populations interact within ecosystems.



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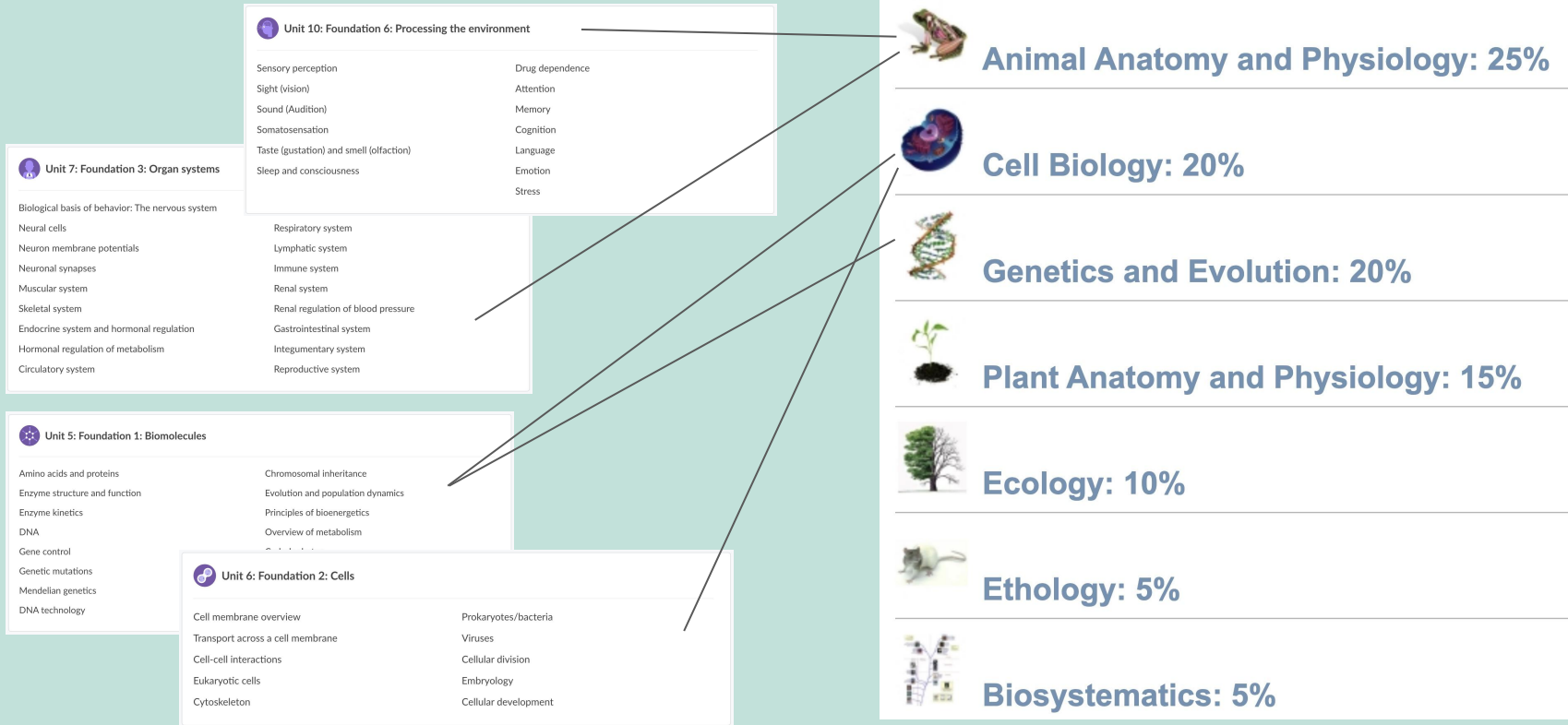


Ethology: 5%




Biosystematics: 5%

USABO-MCAT Mapping





Our Curriculum

- July 15: Introduction and ***Meet the Organelles!***
 - July 22: ***Intro to Genetics and Inheritance***
 - August 5: ***Gene Expression and Regulation***
 - August 12: ***BioMath: Evolution and Ecology***
 - August 19: ***Chemistry of Life***
- 

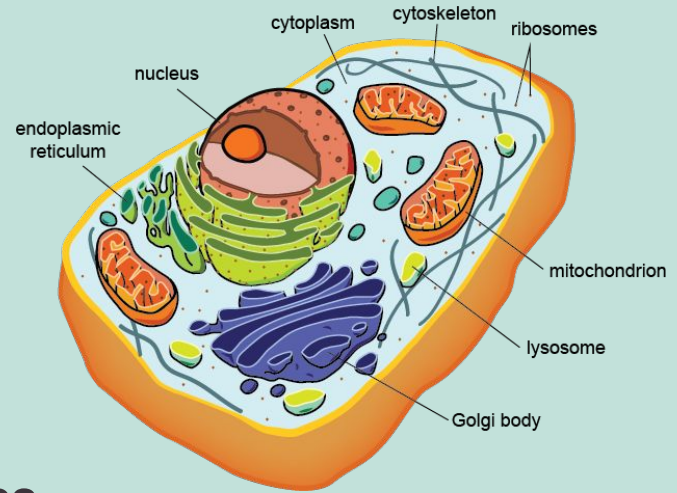


Lesson 1: Meet the Organelles!

What do you remember about organelles?

Quick Review...

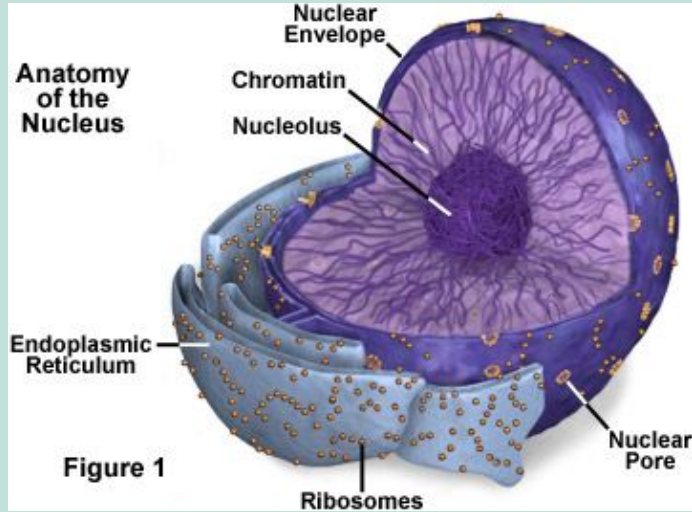
- Cells: the tiny building blocks of life
- Eukaryotic cells have smaller components
 - Each have their own function in sustaining life
 - Energy production, storing genetic information, etc.
- These components are called **organelles**





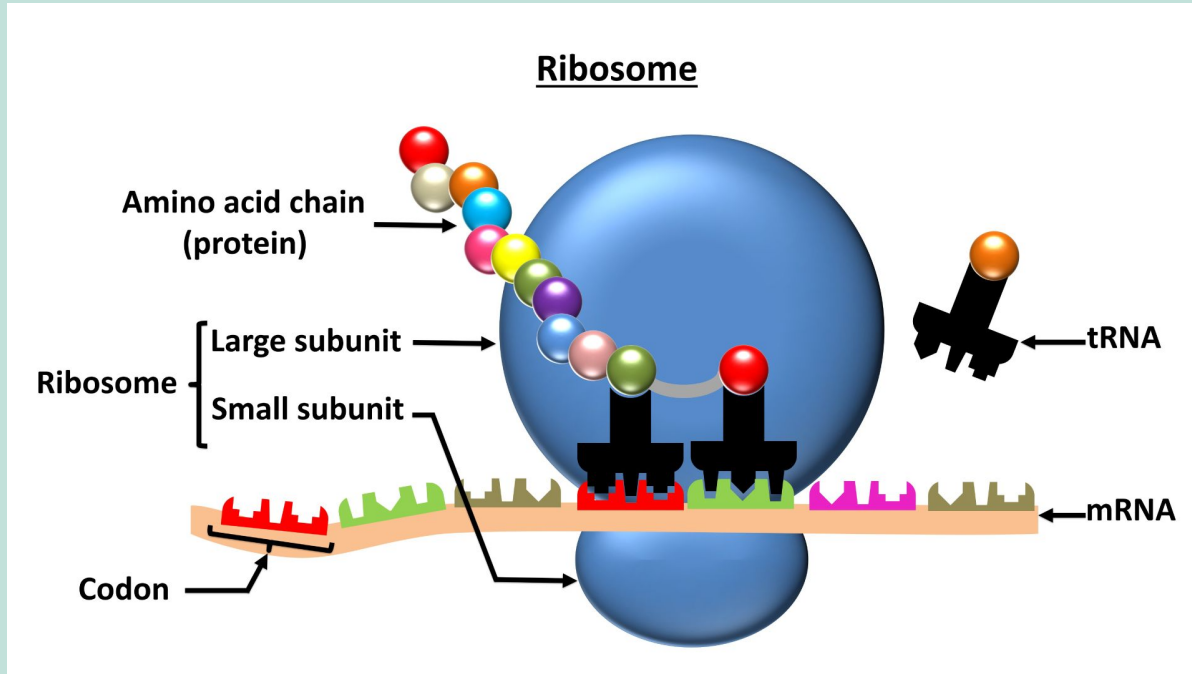
**Let's take a
tour!**

Meet the Nucleus!



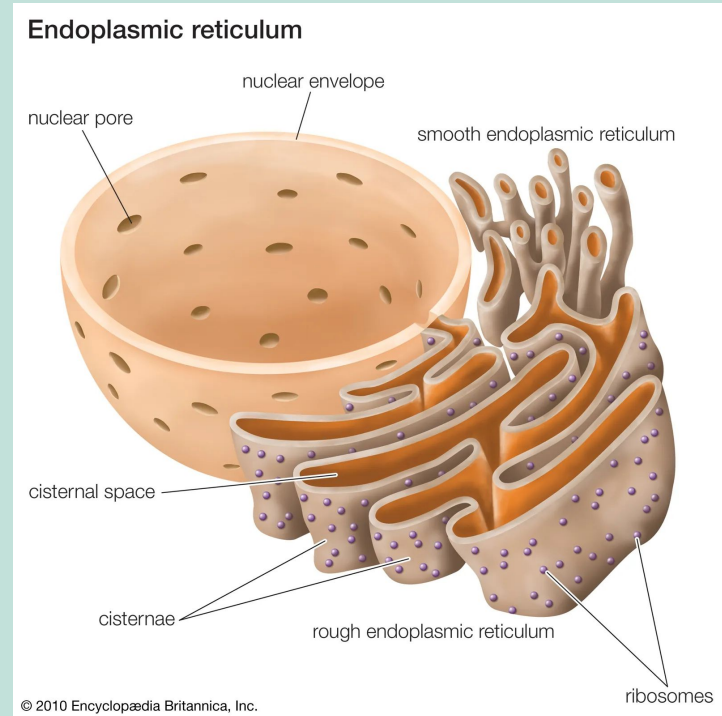
- Control center
- Contains genetic information (DNA)
 - chromatin -> chromosomes when dividing
- Nucleolus produces ribosomes

Meet the Ribosomes!



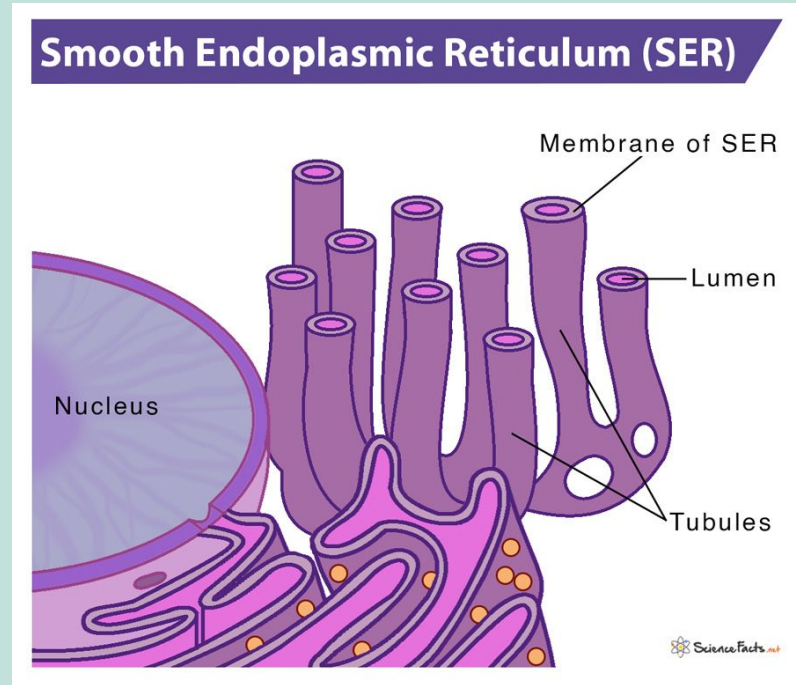
Meet the Rough ER!

- Studded with millions of ribosomes
- Protein powerhouse
 - Some production
 - Folding
 - “Quality control”



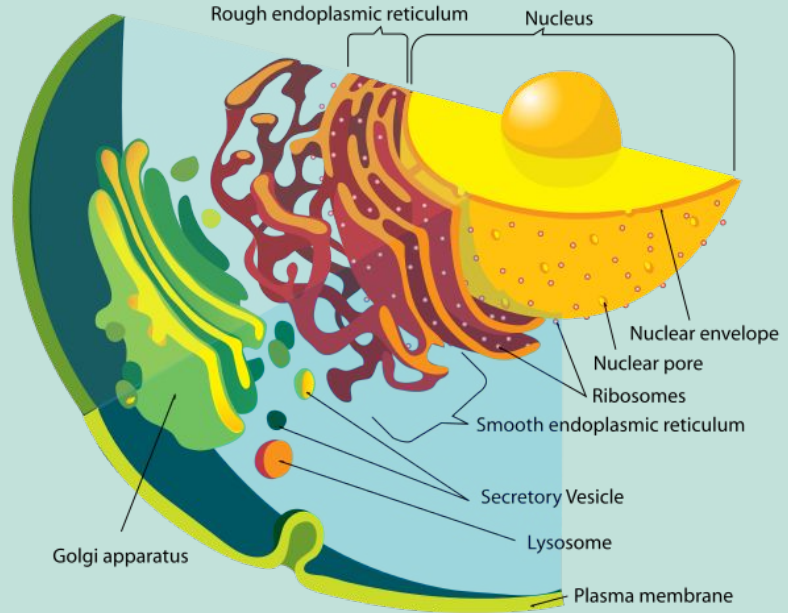
Meet the Smooth ER!

- Lipid synthesis
 - Produces molecules that make up the membrane
 - Production of steroids in endocrine cells
 - Detoxification in liver cells



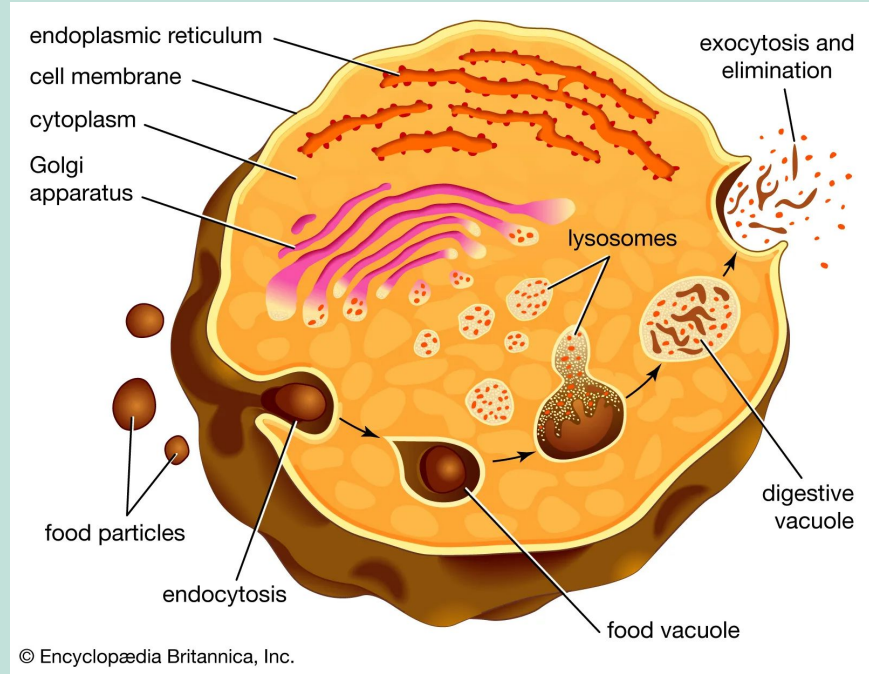
Meet the Golgi Body!

- Receives proteins from rough ER
- Repackages proteins and lipids into vesicles
- Transports vesicles to destination
- Like a post office!



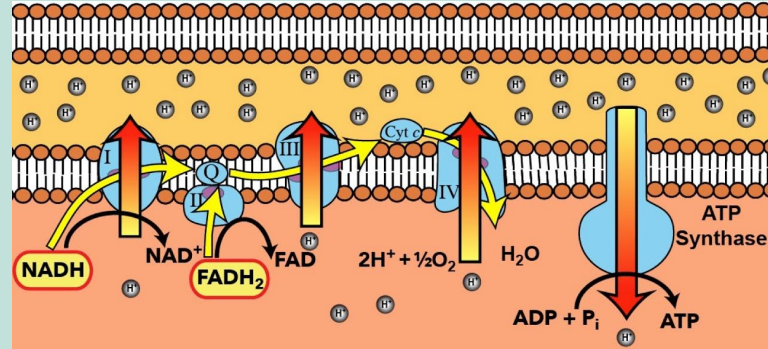
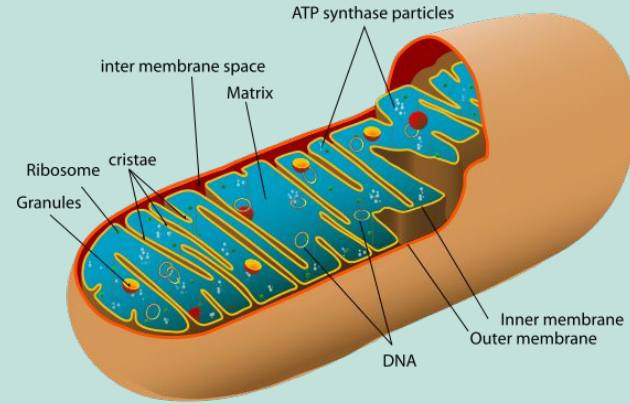
Meet the Lysosomes!

- Digest biomolecules with hydrolytic enzymes
- Recycling of materials
- Destruction of pathogens



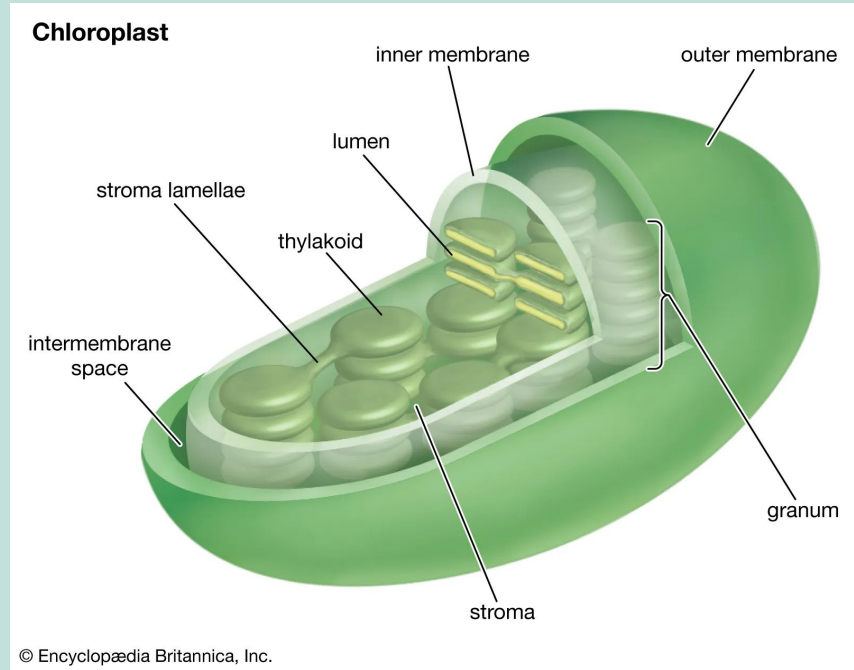
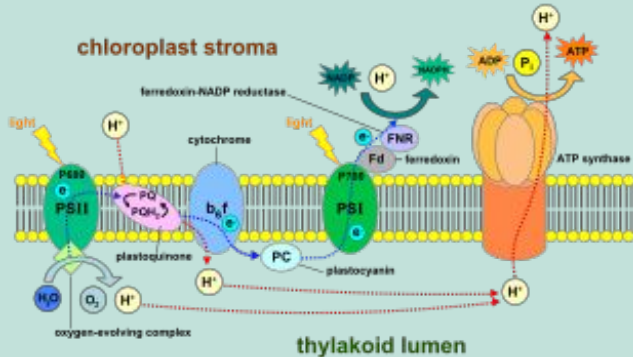
Meet the Mitochondria!

- Involved in generating energy (ATP) from nutrients
- Krebs Cycle
- Electron Transport Chain
- Endosymbiotic theory

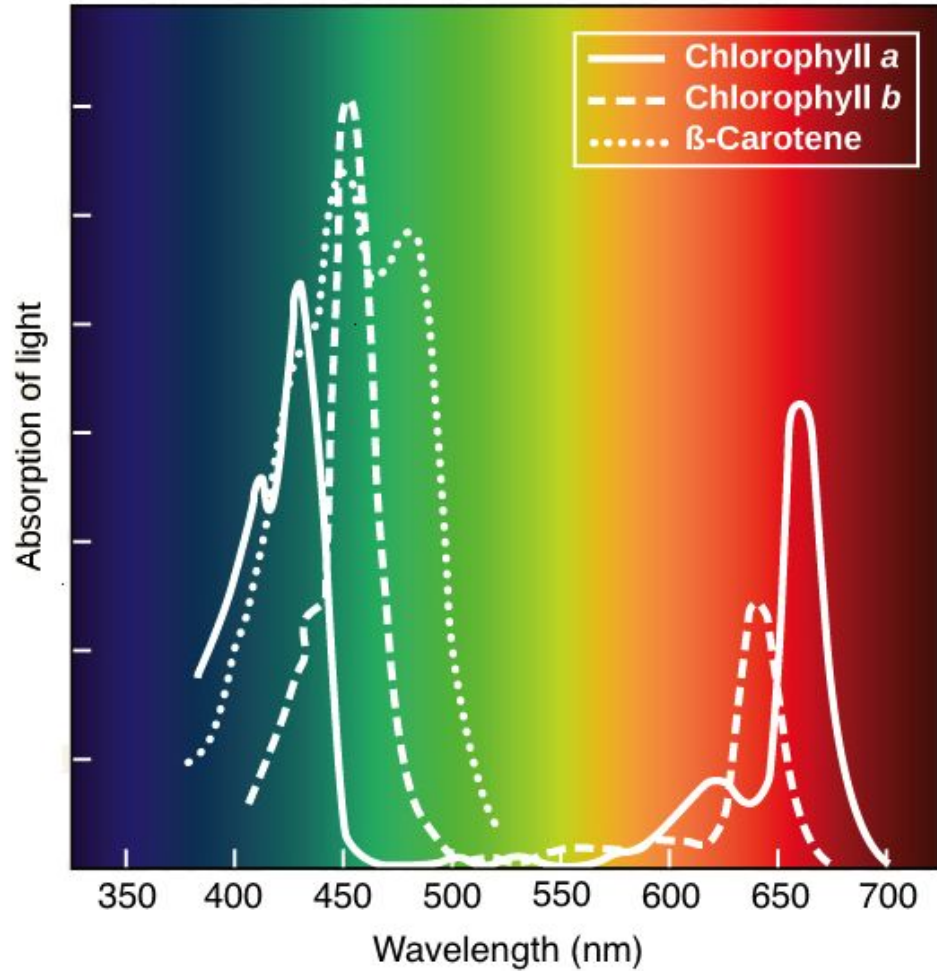


Meet the Chloroplasts!

- Uses light to generate sugar for plant cells
- “Reverses” cellular respiration
- Chlorophyll -> green!

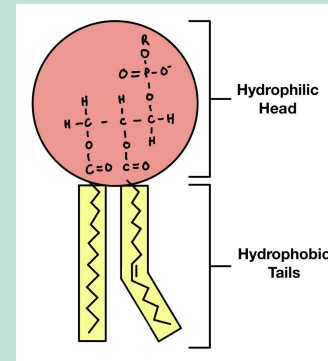
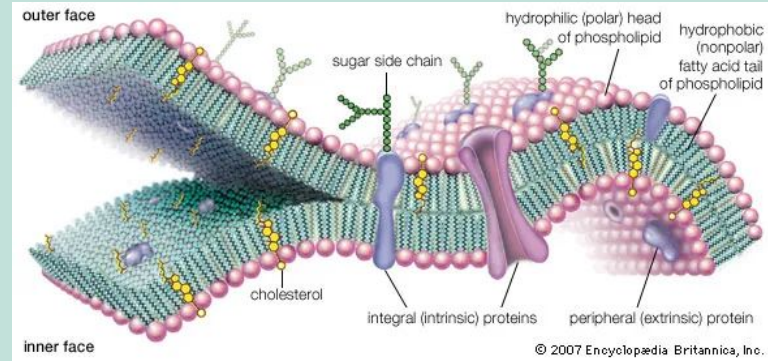


Absorption Spectra of Pigments



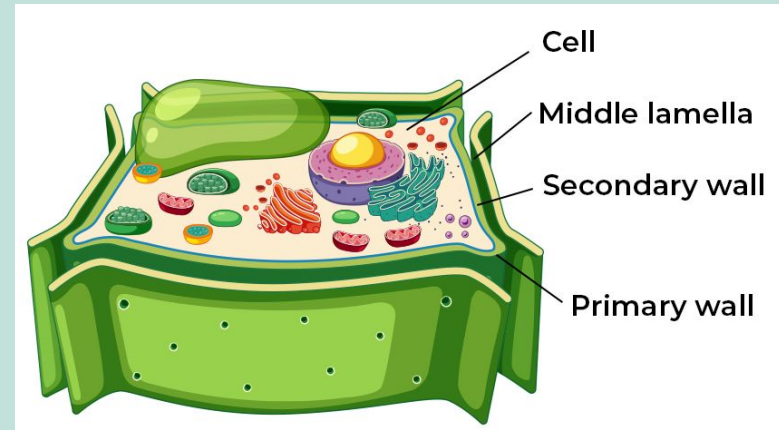
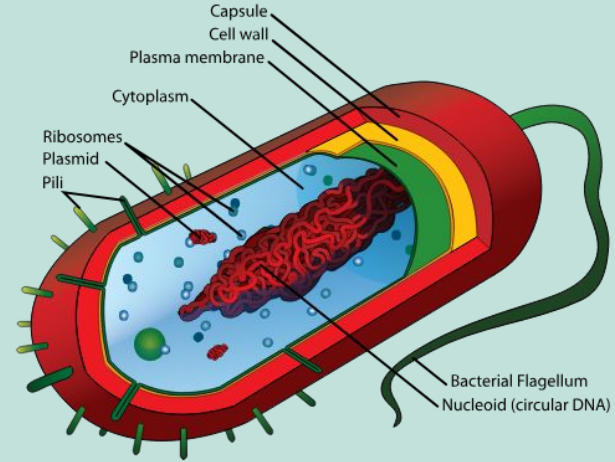
Meet the Plasma Membrane!

- In all cells!
- Separates interior from exterior
- Selectively permeable
- Phospholipids
- Cholesterol controls rigidity
 - High temp: maintains structure
 - Low temp: increases fluidity



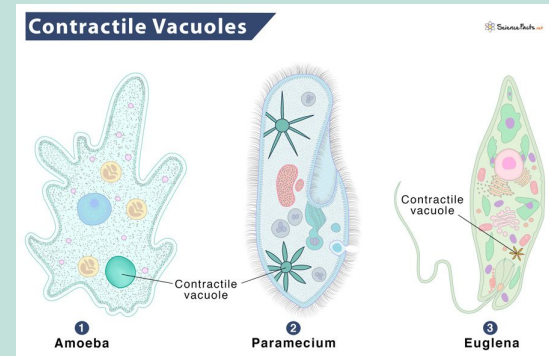
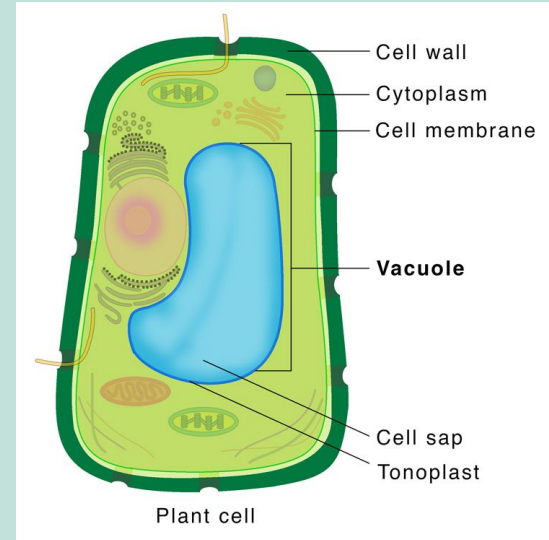
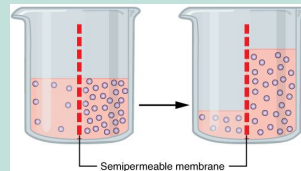
Meet the Cell Wall!

- In prokaryotes, fungi, and plant cells
- Protective layer outside the cell membrane
- Supports cell structure
- Penicillin inhibits production of bacterial cell wall

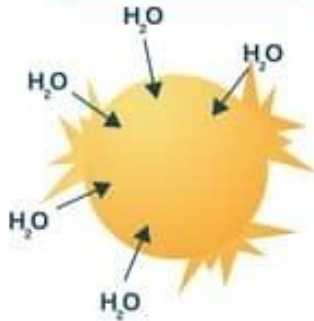


Meet the Vacuole!

- In animals
 - Small and sequester waste products
- In plants
 - Quite large, maintains water balance
- Contractile vacuoles (protozoans)
 - Expel excess water to prevent lysis



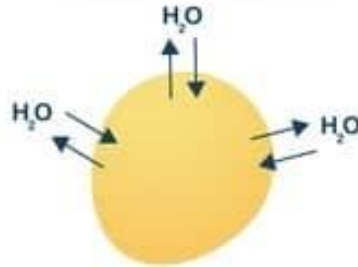
Hypotonic solution



Outside < Inside
LOWER
concentration

Water move into the cell

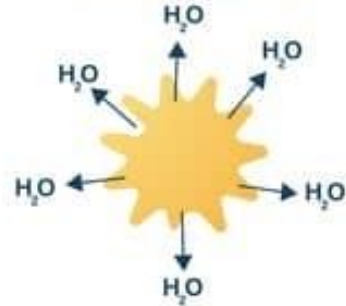
Isotonic solution



Outside = Inside
EQUAL
concentration

Overall concentration are equal
Cell remain constant

Hypertonic solution



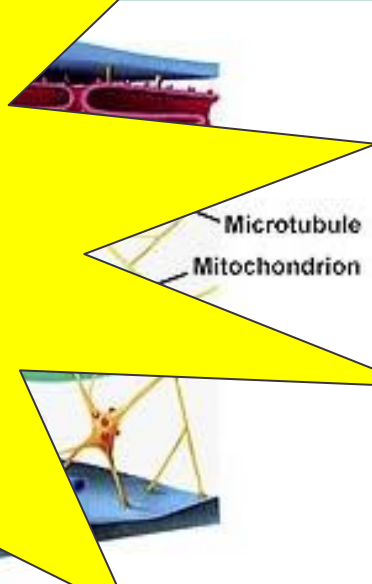
Outside > Inside
HIGHER
concentration

Water move out from cell

Meet the Cytoskeleton

- New protein filaments
- Cell
- Transport of organelles in the

POP QUIZ!

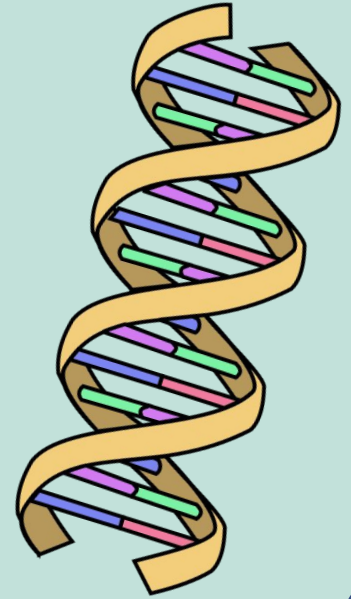


Let's Practice! USABO Open #12

12. The Death Star experiences a power outage. Darth Guha, being the hipster he is, really doesn't want his kale to die. He uses his red lightsaber as an emergency light source for his beloved kale. Anticipating this scenario, Darth Guha engineered his kale to overexpress beta-carotene. What is the engineered kale's photosynthetic rate, compared to wild-type kale, under the red lightsaber?
- A. The engineered kale has a significantly higher photosynthetic rate compared to wild-type kale because beta-carotene absorbs red light better than chlorophyll.
 - B. The engineered kale has a significantly lower photosynthetic rate compared to wild-type kale because beta-carotene interferes with the absorption of red light.
 - C. The engineered kale has a significantly lower photosynthetic rate compared to wild-type kale because beta-carotene does not significantly absorb red light.
 - D.** The engineered kale has approximately the same photosynthetic rate compared to wild-type kale because beta-carotene does not significantly absorb red light.
 - E. The engineered kale has approximately the same photosynthetic rate compared to wild-type kale because beta-carotene is not an accessory pigment to chlorophyll a or chlorophyll b.

What's next?

- July 22: ***Intro to Genetics and Inheritance***
 - What are genes?
 - How are they passed on?
 - How can we make predictions about inheritance?
 - Mendelian Genetics vs. Non Mendelian Genetics



Unit 5: Classical genetics

0/500 Mastery points

Introduction to heredity

Pedigrees

Non-Mendelian inheritance

Sex linkage



Thank you!
See you next week

ambha25@icstudents.org