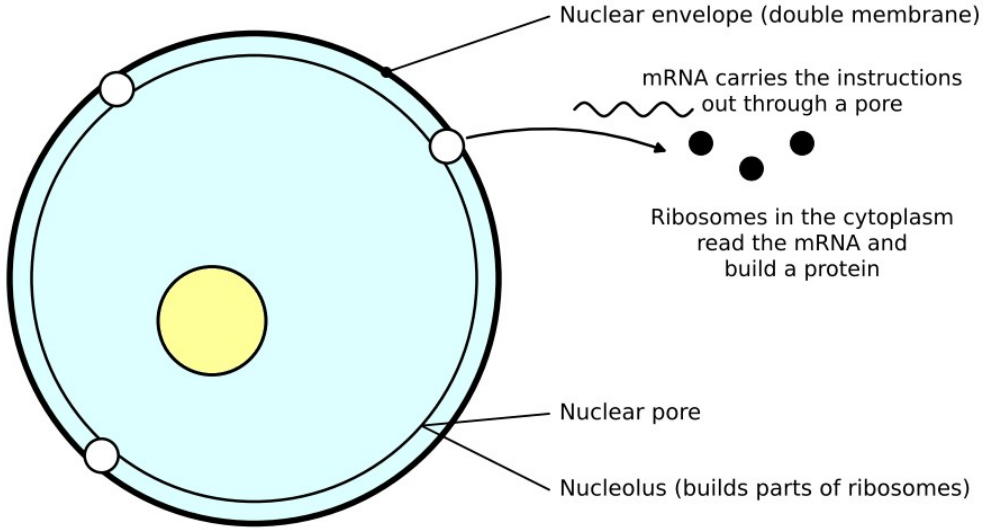
Essential Question

How do organelles work together to keep a cell alive?

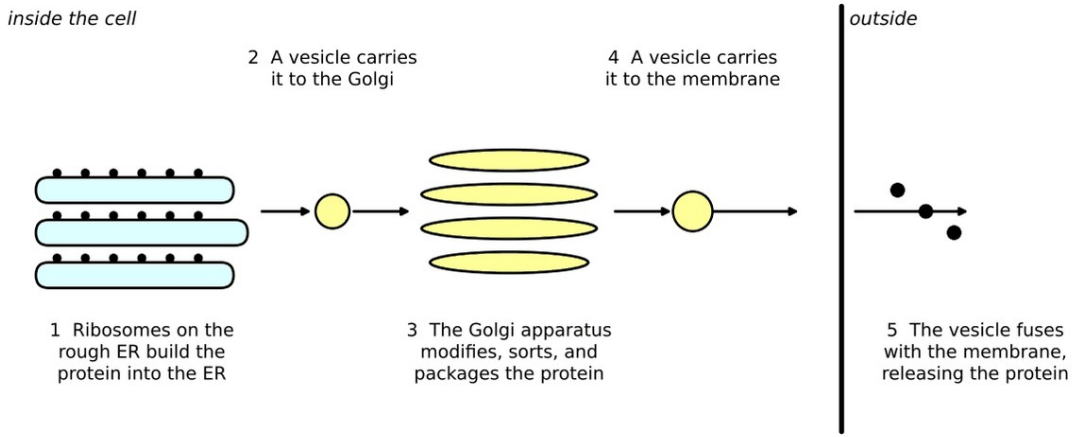
The Nucleus and Ribosomes

- The nucleus holds the DNA
- Pores in the nuclear envelope let mRNA leave
- The nucleolus builds parts of ribosomes
- Ribosomes build proteins



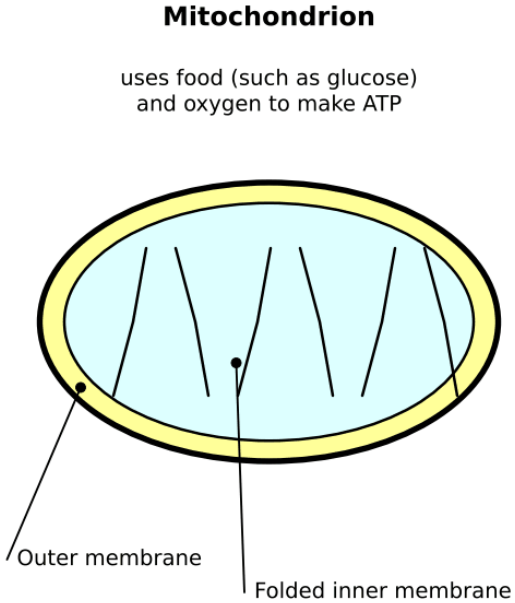
Making and Moving Proteins

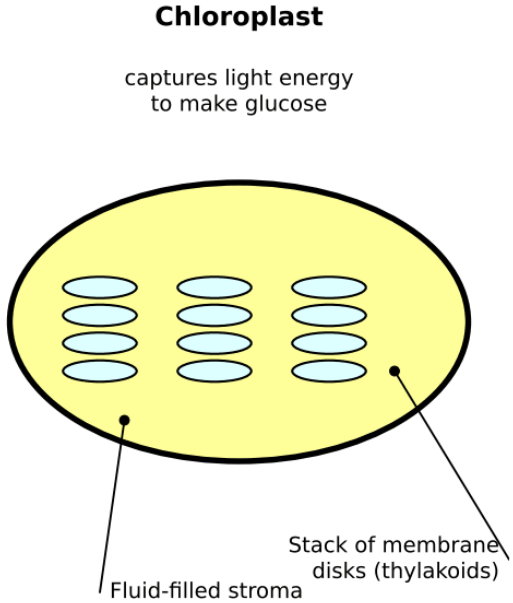
- Rough ER: ribosomes build proteins into it
- Smooth ER makes lipids
- Golgi apparatus modifies, sorts, and packages
- Vesicles carry cargo between parts



Energy Organelles

- Mitochondria release usable energy as ATP
- Folded inner membrane gives more surface
- Chloroplasts carry out photosynthesis
- Chloroplasts are in plant and algae cells

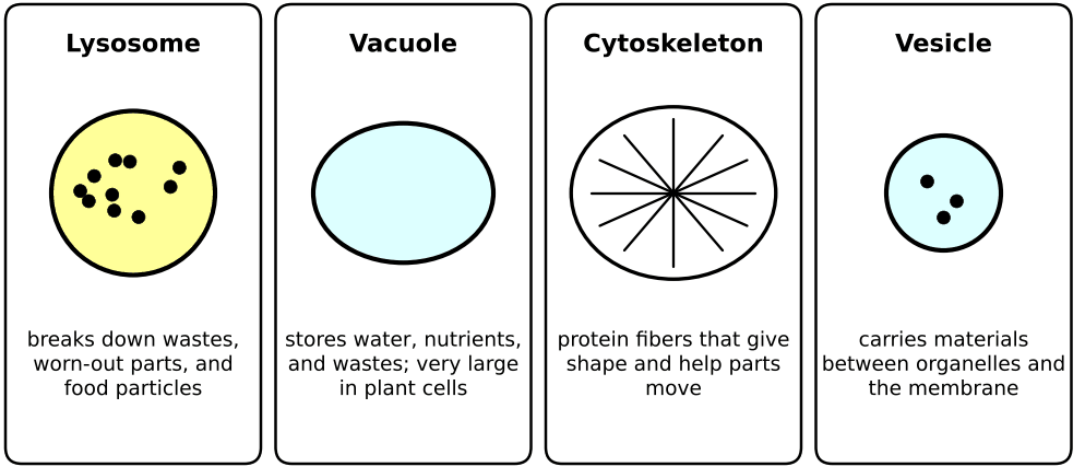




Organelles

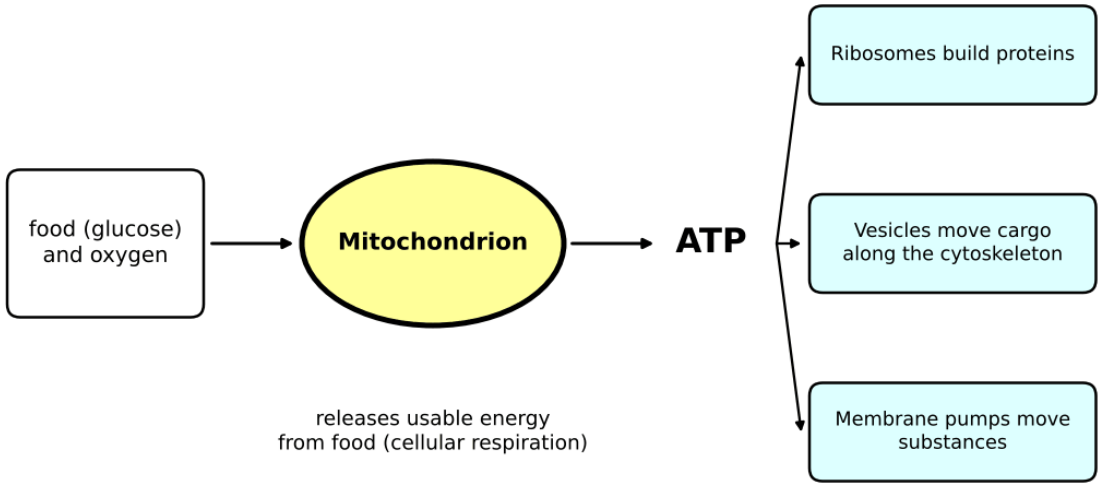
Storage, Breakdown, and Support

- Lysosomes break down wastes and old parts
- Vacuoles store water and other materials
- The cytoskeleton gives shape and helps parts move
- Vesicles move materials around the cell



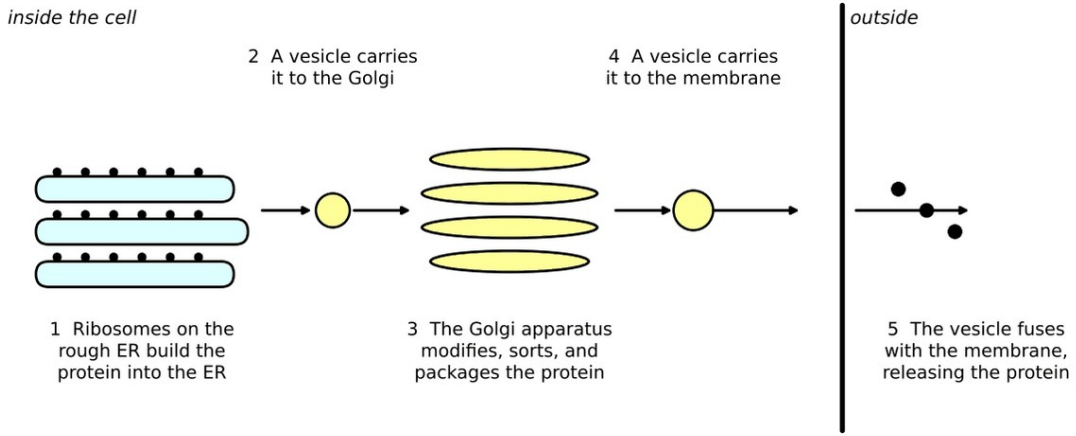
Organelles Work Together

- Mitochondria make ATP for the whole cell
- ATP powers protein building and vesicle movement
- A protein passes through several organelles
- If one organelle fails, the others are affected



Example: Trace a Secreted Protein

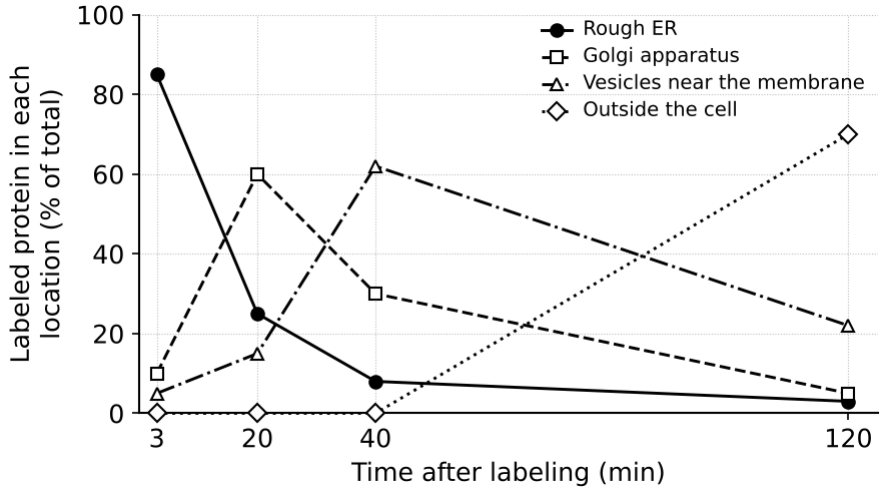
A cell in the pancreas makes a digestive enzyme (a protein) and releases it outside the cell. Use the model to list, in order, the structures the protein passes through, from the ribosome to the outside of the cell. Give the job of each step.



Example: Follow the Label

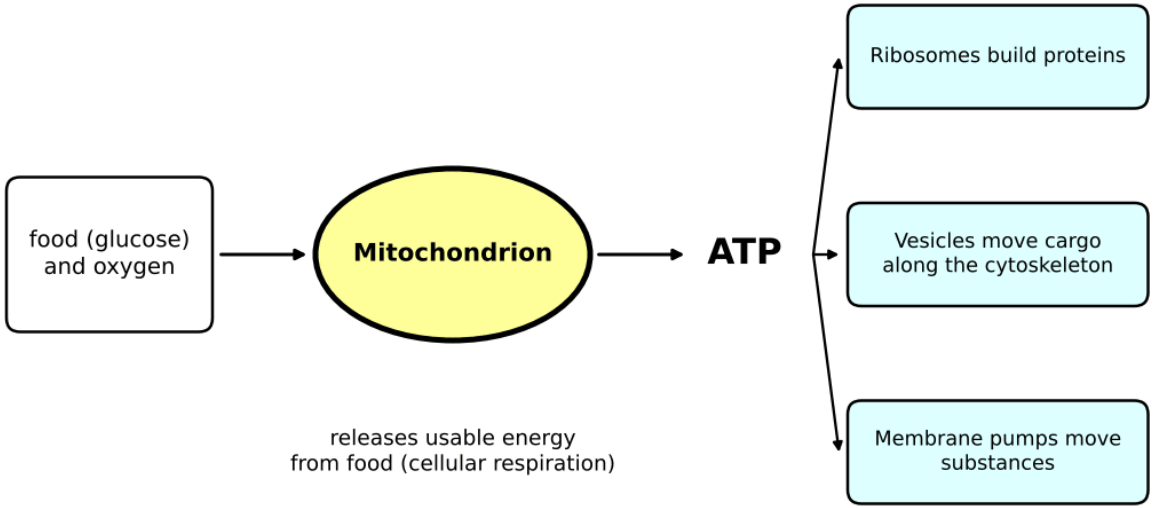
Scientists gave a cell radioactive amino acids for a short time, then measured where the labeled protein was over the next 2 hours (sample data). Which organelle does the protein reach first? Write a claim, evidence, and reasoning about the path it takes.

Time (min)	Rough ER (%)	Golgi (%)	Vesicles (%)	Outside (%)
3	85	10	5	0
20	25	60	15	0
40	8	30	62	0
120	3	5	22	70



Example: A Mitochondria Poison

A poison stops the mitochondria in a cell. Use the model to predict what will happen to the cell's ability to build and move proteins.



Organelles

Big Ideas

- The nucleus holds DNA; ribosomes build proteins
- Rough ER, Golgi apparatus, and vesicles make and deliver proteins
- Mitochondria release usable energy as ATP; chloroplasts capture light energy
- Lysosomes, vacuoles, and the cytoskeleton store, break down, and support
- Organelles depend on one another