

Cell Structure



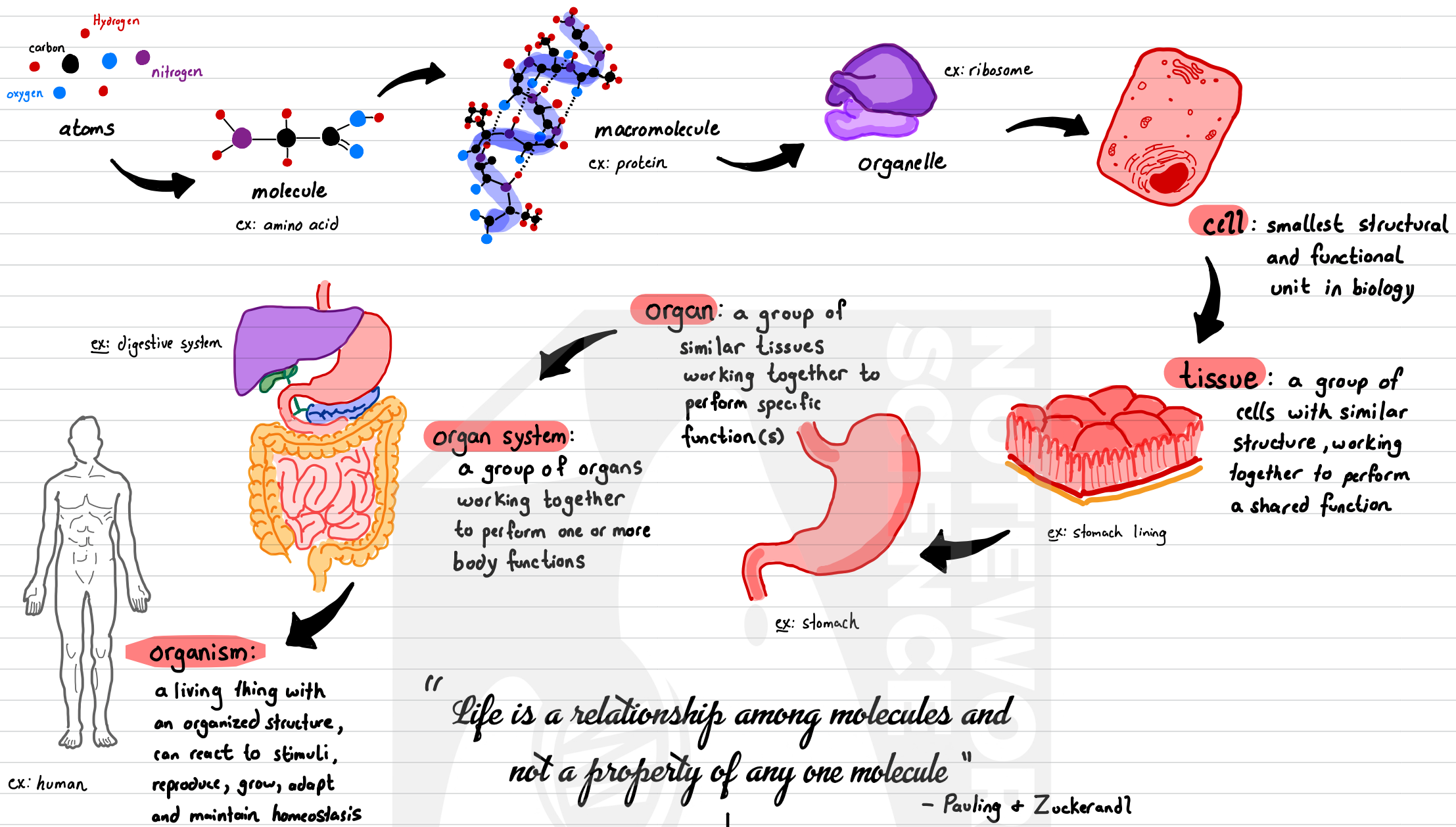
Learning Outcomes

- **1.1.1 – Describe** the characteristics of living organisms by describing:
 - a) movement as an action by an organism or part of an organism causing a change of position or place
 - b) respiration as the chemical reactions in cells that break down nutrient molecules and release energy for metabolism
 - c) sensitivity as the ability to detect and respond to changes in the internal or external environment
 - d) growth as a permanent increase in size and dry mass
 - e) reproduction as the processes that make more of the same kind of organism
 - f) excretion as the removal of the waste products of metabolism and substances in excess of requirements
 - g) nutrition as the taking in of materials for energy, growth and development
- **2.1.1 – Describe** and **compare** the structure of a plant cell with an animal cell, limited to: cell wall, cell membrane, nucleus, cytoplasm, chloroplasts, ribosomes, mitochondria, vacuoles
- **2.1.2 – Describe** the structure of a bacterial cell, limited to: cell wall, cell membrane, cytoplasm, ribosomes, circular DNA, plasmids
- **2.1.3 – Identify** the cell structures listed in 2.1.1 and 2.1.2 in diagrams and images of plant, animal and bacterial cells
- **2.1.4 – Describe** the functions of the structures listed in 2.1.1 and 2.1.2 in plant, animal and bacterial cells
- **2.1.7 – Describe** the meaning of the terms: cell, tissue, organ, organ system and organism as illustrated by examples given in the syllabus

Biological Organization

Anatomy: the study of how organisms are structured and organized

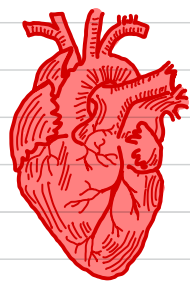
Biology can be studied by examining how things are organized in a hierarchy



life is defined in terms of **interactions, relationships, and collective properties** of many systems and their parts

Emergent property: a property which a collection or system has, but which individual members do not have

examples: aka "the whole is greater than the sum of its parts"



heart is made up of heart cells. The heart can pump blood but individual heart cells cannot



human emotions (joy, anger) or memories are formed and stored in the brain. No individual neuron can form these

salt (NaCl) has the property of 'saltiness' and edible but Na and Cl are dangerous and not salty



▶ at every higher level of complexity, new emergent properties appear

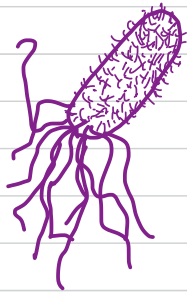
i.e. tissues have properties that cells do not, organs have properties that tissues do not ... etc.

Physiology: the study of functions and mechanisms in a living body

~ Anatomy looks at how something is structured ~
Physiology looks at how those structures work

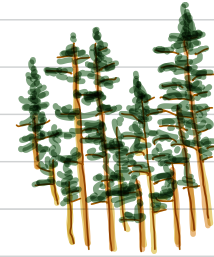
Prokaryotic Cell Structure

Organisms can be organized into 2 major categories:

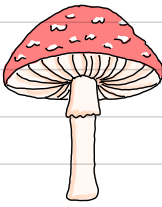


Prokaryotes

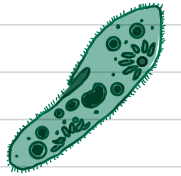
- always unicellular
- no nucleus surrounds genetic material
- no compartments within cell
- ex: bacteria



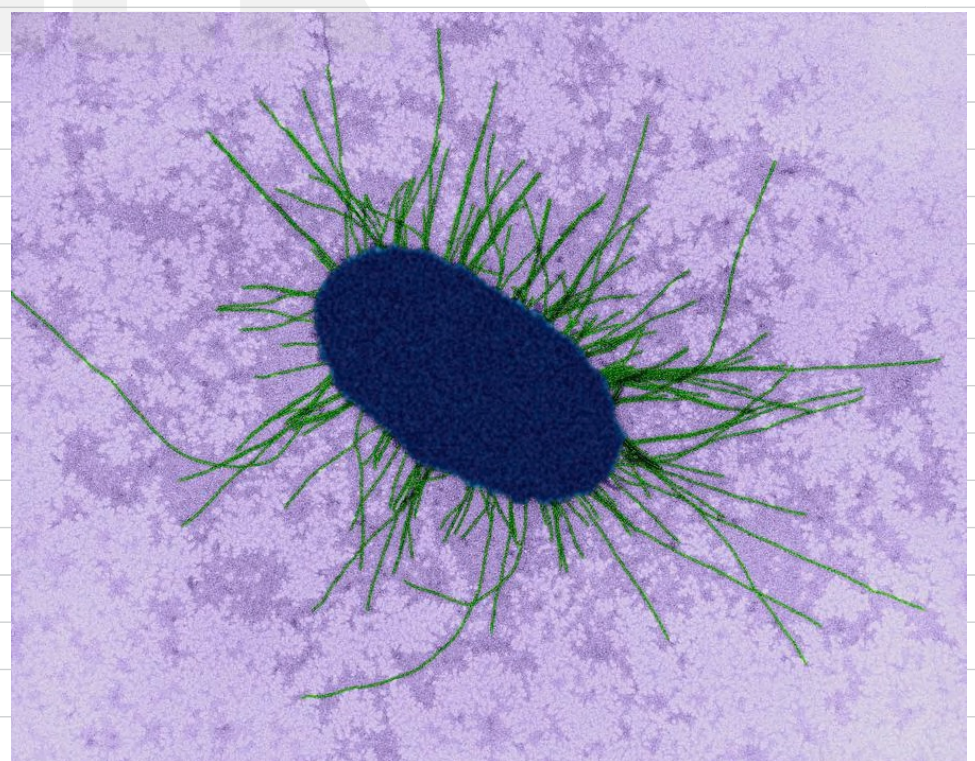
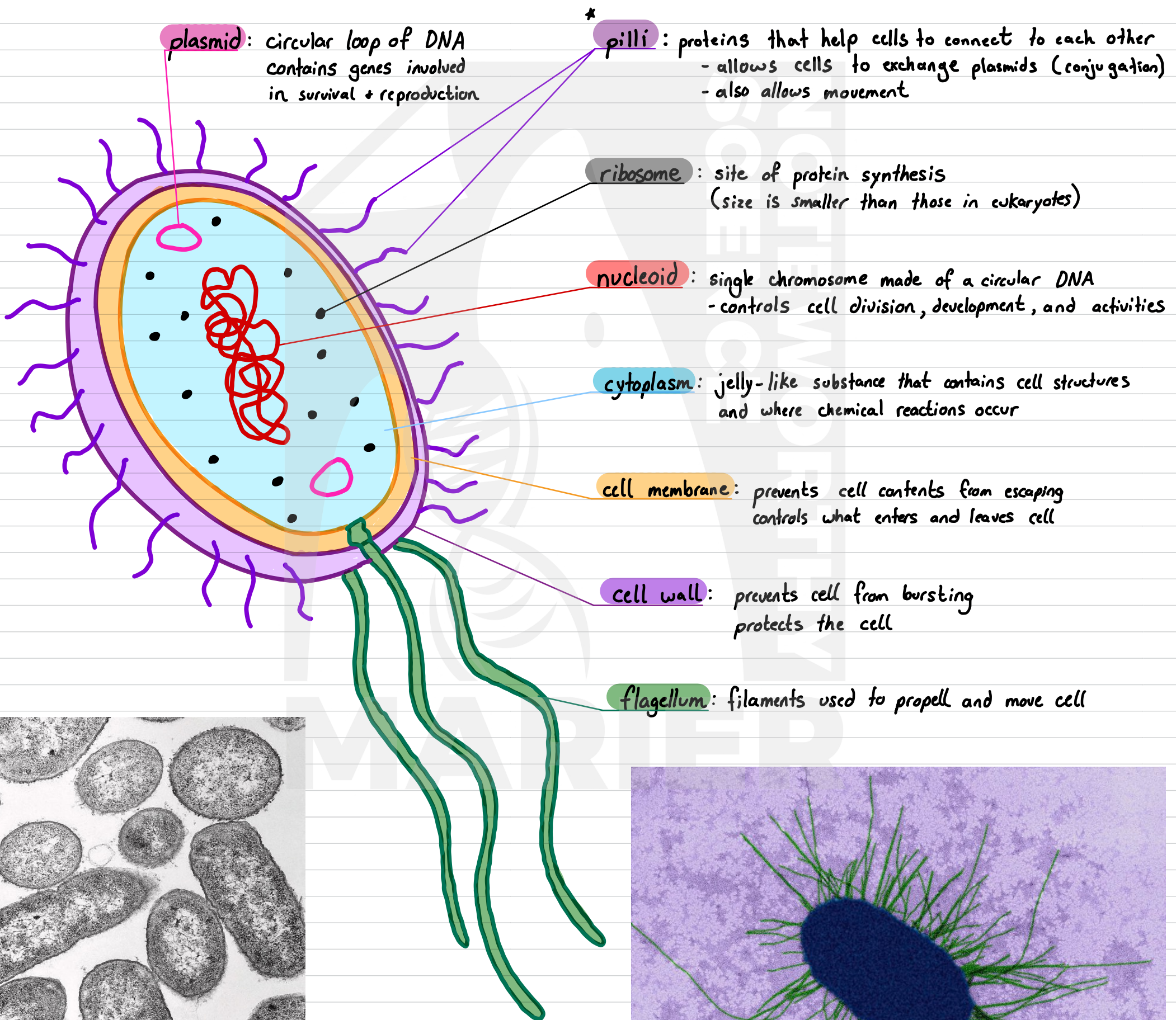
Eukaryotes



- mainly multicellular but can be unicellular
- nucleus encloses genetic material
- compartments (organelles) within cell
- ex: animals, plants, fungi, protists



Bacterial cell structure

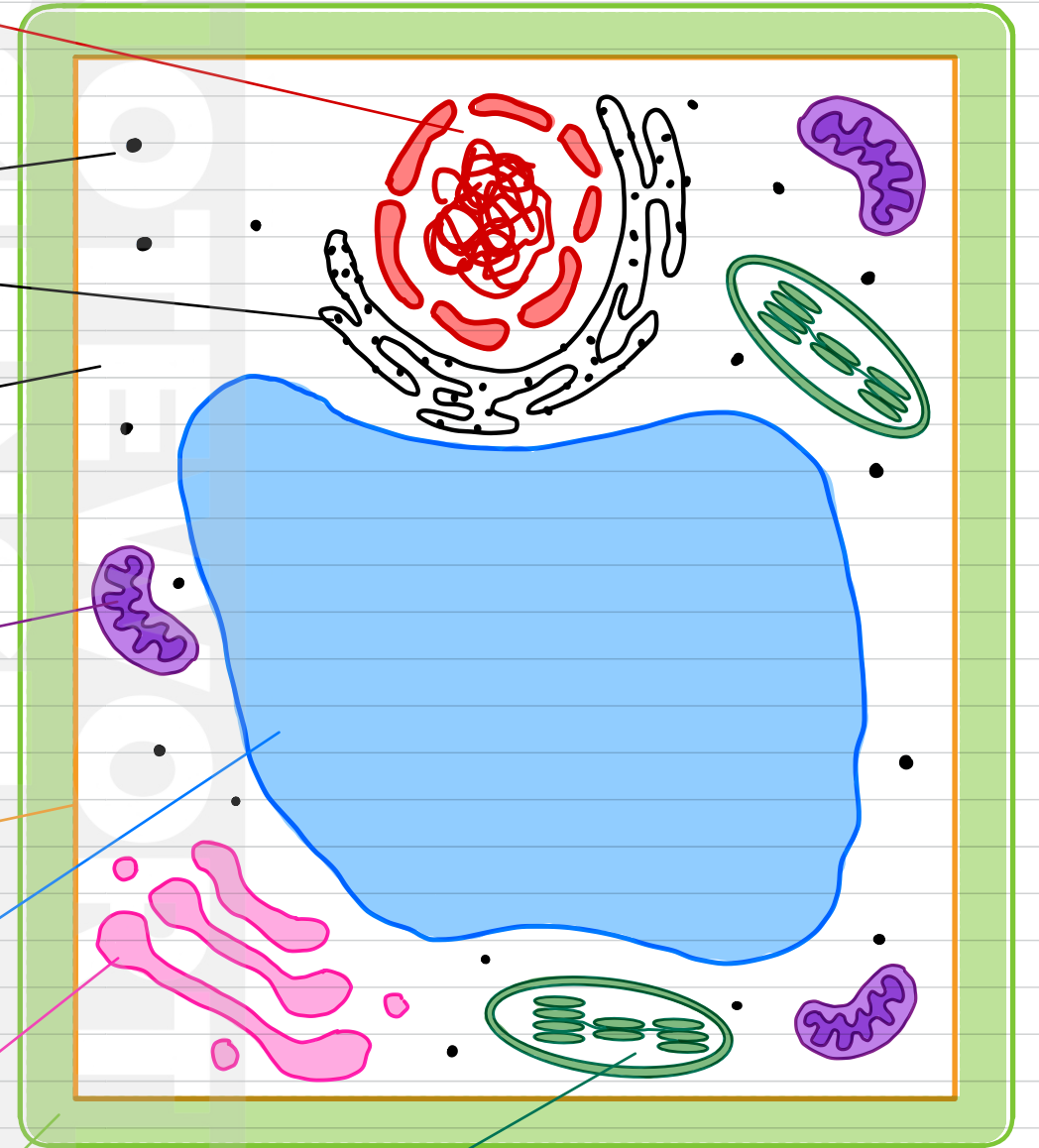
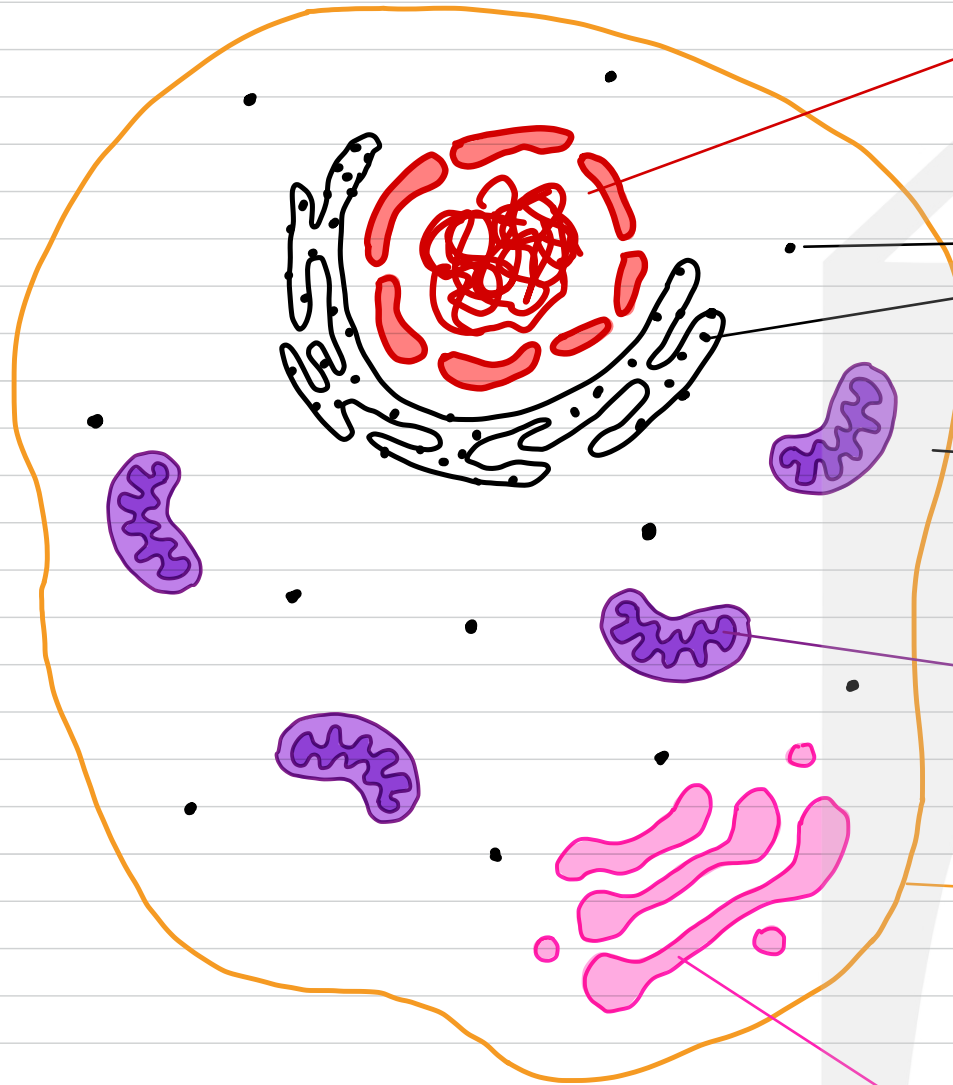


* extra content

Eukaryotic Cell Structure

Animal cell structure (typical)

Plant cell structure (leaf)



nucleus

membrane structure which contains DNA as linear chromosomes Controls cells activities

ribosome

site of protein synthesis (can be free or bound to membranes)

cytoplasm

jelly-like substance that contains cell structures and where chemical reactions occur

mitochondrion

site of aerobic cellular respiration

cell membrane

prevents cell contents from escaping controls what enters and leaves cell

large central vacuole

contains salts and sugars helps to keep plant cells firm

*** Golgi apparatus**

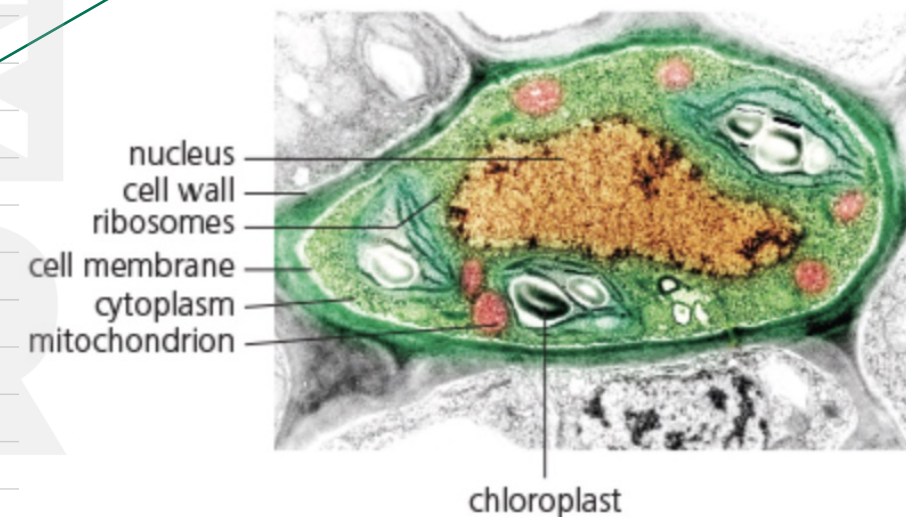
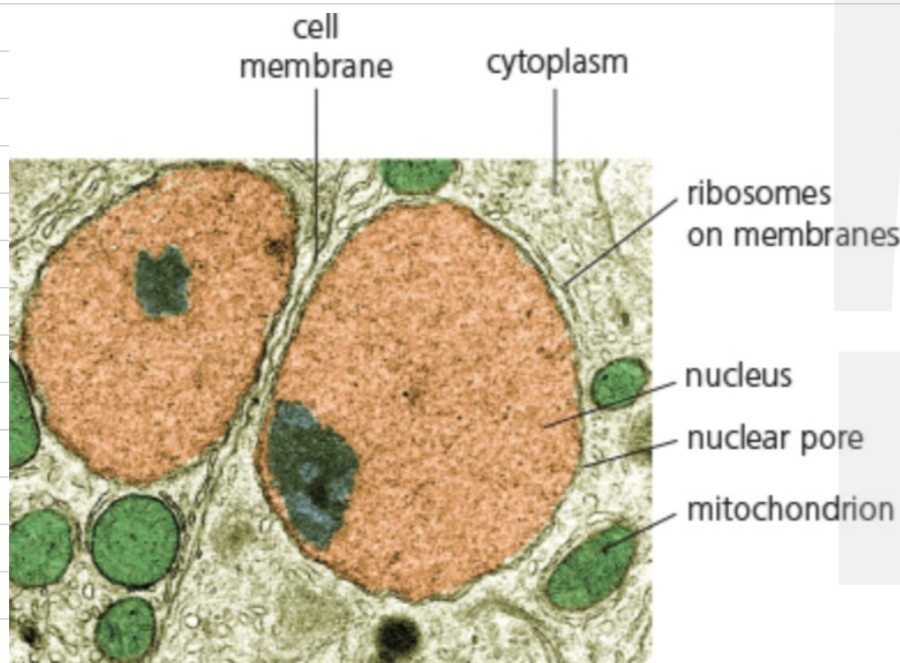
modifies and packages proteins for export

cell wall

prevents plant cells from bursting permeable to water and salts

chloroplast

traps light energy for photosynthesis



* extra content

Characteristics of Living Organisms

Biology is the study of life and living organisms.

↳ what does it mean to be 'alive'?

In order for any organism (unicellular or multicellular) to be considered alive, they must meet all of the following characteristics:

Movement - action by an organism or part of an organism causing a change in position or place

Respiration - chemical reactions in cell that break down nutrient molecules and release energy for metabolism

Sensitivity - ability to detect and respond to changes in the internal or external environment

Growth - permanent increase in size and dry mass

Reproduction - process that make more of the same kind of organism

Excretion - removal of waste products of metabolism and substances in excess of requirements

Nutrition - the taking in of materials for energy, growth and development

To better understand these characteristics, examine examples from a variety of organisms

Examples:

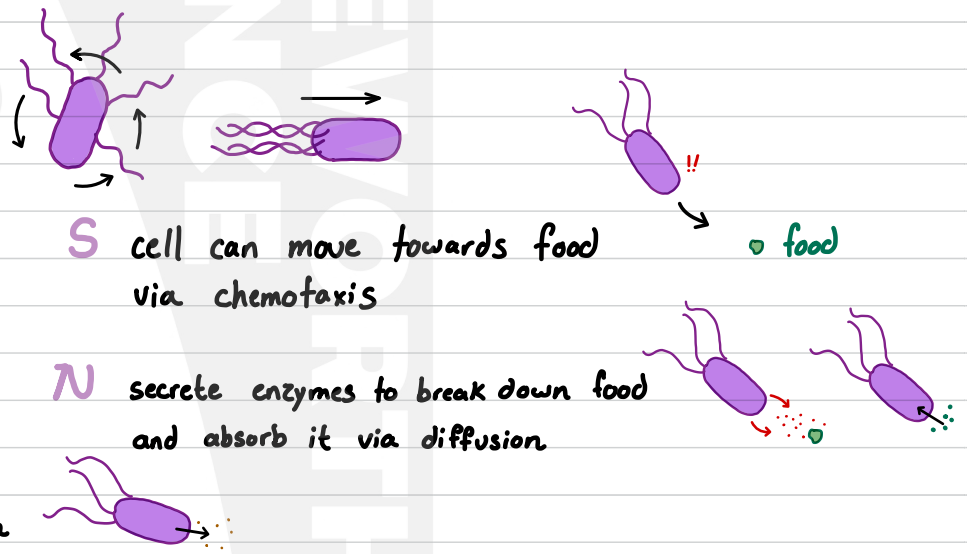
Unicellular organism - bacterium: *E. coli*

M cell moves by contracting flagella, spinning and propelling it
G as it takes in nutrients it grows until it reproduces

R reproduces asexually via binary fission

R breaks down nutrients and stores as ATP using oxygen (aerobic) and mainly without oxygen (anaerobic)

E waste from chemical processes (metabolism) expelled via diffusion



S cell can move towards food via chemotaxis

N secrete enzymes to break down food and absorb it via diffusion

Multicellular organism - animal: *H. sapiens* (human)

M - humans can move by contracting muscles which moves the skeleton

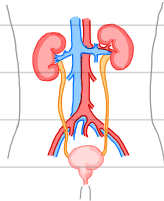
R - reproduces sexually using gametes (sperm + ovum)

S - detects smell, taste, light, sound, temperature, touch using nose, tongue, eyes, ears, skin respectively

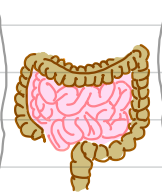
G - grows larger with intake of food and maturity into adult

R - breaks down nutrients and stores as ATP using oxygen (aerobic) and without oxygen (anaerobic)

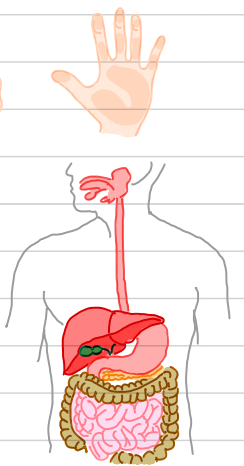
E - removes metabolic waste via excretory system (urine)



and nutritional waste via digestive system (faeces)



N - takes in, breaks down and absorbs nutrition via digestive system



Multicellular organism - plant: *Q. alba* (white oak)

M - roots and shoots can move toward soil and light respectively

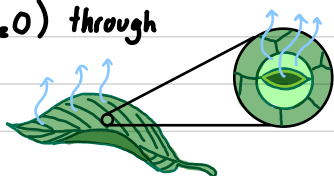
R - breaks down nutrients and stores as ATP using oxygen (aerobic) and without oxygen (anaerobic)

S - sense change in temperature and light of their surroundings and respond (like losing leaves in winter)

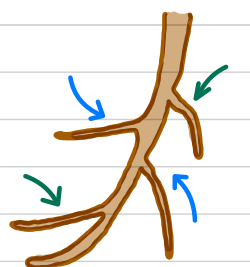
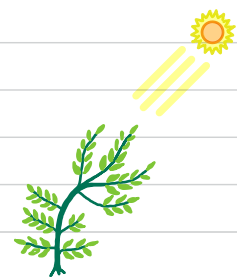
G - start as seeds and grow throughout their life, becoming >20m tall

R - reproduce sexually using seeds which fertilize other plants becoming acorns

E - release metabolic waste (CO_2 , O_2 , H_2O) through stomata in their leaves via diffusion



N - takes in nutrients using roots



Assessment Tasks

Answer the following questions:

① Choose one bacteria, animal, and plant species (not found in this lesson)

For each, explain how they meet all the criteria for being considered alive

② Compare and contrast animal cells and plant cells in terms of their structure

③ Viruses are generally considered to not be alive - explain and justify why

④ Complete the following table for humans:

organ system	organ	tissue	cell
	trachea		neuron
lymphatic		cardiac muscle	

⑤ label the following

