



Chapter I.

Introduction to Plant Biology

Plan

Part I: Classification of plants

- Basic concepts of classification
- Subdivisions of living organisms
- Classification of the kingdom Plantae
- Phylum of spermaphytes

Part II. Characteristics of the plant cell



Part I. Classification of plants (Taxonomy)



Systematics of plants = it is the science that studies the classification of plants

Classify plants basing on : the shape of fruits, the color, the weight,.....ect.

A close look at plants in nature reveals a huge diversity :

There are over 300,000 plant species, of which more than 200,000 are flowering, and millions of horticultural varieties.



- Botanists have identified plants by :

1. A precise description of the characteristics of the plants then;

2. Classification according to an ordered coherent system.

- Botanists have grouped living organisms into groups or taxa on the basis of common characteristics.

I- Basic concepts of classification

1- The classification system

This is a hierarchical system comprising different **categories**.

These categories can be subdivided into sub-categories:
Sub-branch - Sub class - Sub order when taxonomic structure is so complicated.

Most scientists accept 07 main levels of taxonomy (ranks) :
the highest is **kingdom, phylum, class, order, family, genus** and **species**.

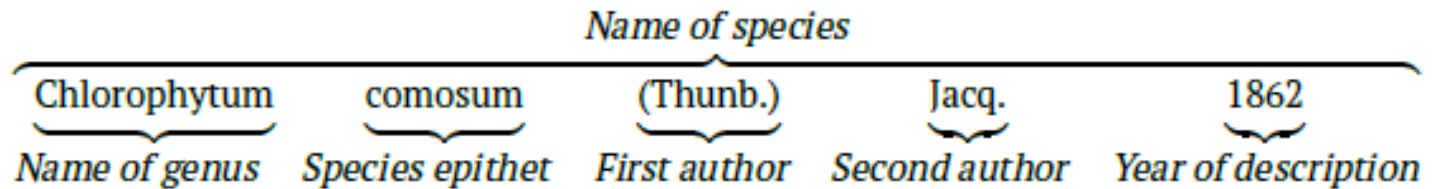
Below is an example of names used for different ranks. Please note that names used for some ranks have standardized endings (underlined):

English	Latin	Example 1	Example 2
Kingdom	Regnum	Vegetabilia	Animalia
Phylum	Phylum	Spermatophyta	Chordata
Class	Classis	Angiospermae (Magnoliopsida)	Mammalia
Order	Ordo	Liliales	Primates
Family	Familia	Asparagaceae	Hominidae
Genus	Genus	<i>Chlorophytum</i>	<i>Homo</i>
Species	Species	<i>Chlorophytum comosum</i> (Thunb.) Jacq.	<i>Homo sapiens</i> L.

(Alexey Shipunov, 2021)

2. The binomial nomenclature

Names of species are **binomials** which consist of the name of genus and **species epithet**:



If one does not know the exact species, "sp." shortcut is used instead of epithet, and "spp." is used as a shortcut for multiple unknown species. It is required to use *slanted font* when one prints a name of species or genus. All scientific names are capitalized, but the second word in a species name (species epithet) always starts from lower case letter. It is a well-known fact that some species have a hybrid origin, and in these cases, botanists use a multiplication sign ($\times$). For example, common plum (*Prunus* $\times$ *domestica*) is a hybrid between blackthorn and cherry plum: *Prunus spinosa* $\times$ *Prunus cerasifera*.

(Alexey Shipunov, 2021)

Carl von Linné (1707-1778),
Swedish naturalist.



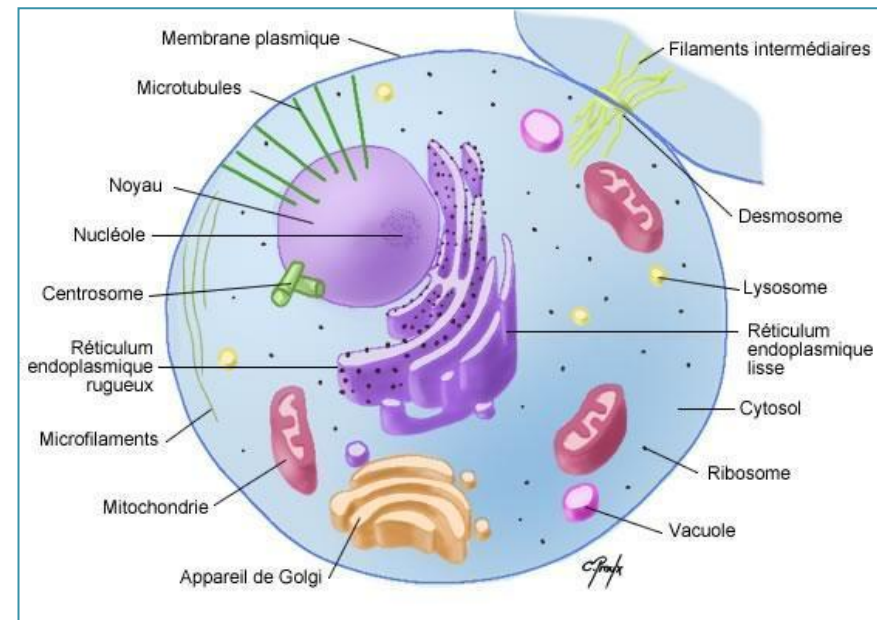
Based on **morphological criteria**, Carl von Linné
subdivided the living beings into 2 **kingdoms**:

Animal

Plant

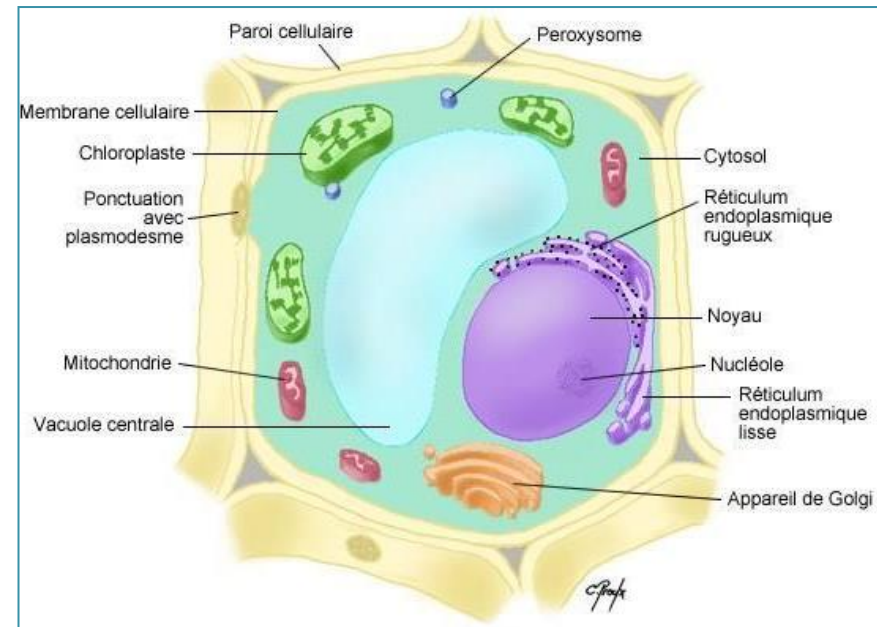
1. The animal kingdom

Unicellular and multicellular composed of **animal cells** (no walls).



2. The plant kingdom

Unicellular and pluricellular composed of **plant cells** (With walls).



Evolution of classification systems and kingdoms

Haeckel (1894) 3 kingdom	Whittaker (1969) 5 kingdom	Woese (1977) 6 kingdom	Woese (1990) 3 fields
Animal	Animal	Animal	Eukaryot
Plant	Fungi	Fungi	
	Plant	Plant	
Protozoa	Protist	Protist	Archée
	Procaryot	Archeobacteria	
		Eubacteria	Bacteria

II. Sub-divisions of living organisms

Empires	Fields
Procaryotes (Prokaria, Prokaryota)	Eubactéries (or Bacteria, Eubacteria)
	Archeobacterias, (Archea, Archaea Archebacterias, Archaeobacterias, Archées)
Eukaryotes (Eukaya, Eukaryota)	Eukaryot (or Eukaya, Eukaryota)

Eukaryots

1. Kingdom of Protists



Phyl. Protozoa



Phyl. Protophytes



Phyl. Algae

2. Kingdom of Fungi



Phyl. Fungi



Phyl. Lichen

3. Kingdom of Plantae



Phyl. Bryophytes



Phyl. Pteridophytes



Phyl. Spermaphytes

4. Kingdom of Animals



Phyl. Vertebrae



Phyl. Inverebrate

III. Classification of the kingdom Plantae

The **Plantae**, or plants in the strict sense of the term, comprise 300,000 species worldwide.

Classification was initially based on their :

- Usefulness : Comestibility, therapeutic and medicinal properties;
- Morphology;
- Reproduction;
- Mode of nutrition.

The **Plantae kingdom** is divided into 3 phylum :



1. Phylum of **Bryophytes**
(mosses)



2. Phylum of
Pteridophytes (Ferns)



3. Phylum of **Spermaphytes**
(Seed crops)

1. Common characteristics

The 3 phyla (Bryophytes, Pteridophytes and Spermaphytes) have, in common, the following 3 criterias :

- Vegetative apparatus (cormus);
- Reproductive system (gametes and spores);
- Mode of nutrition.

■ Plant apparatus

It is a **cormus** composed of a **stem, leaves** and **roots**.

Plants with all this 3 **organs** are called **cormophytes**.



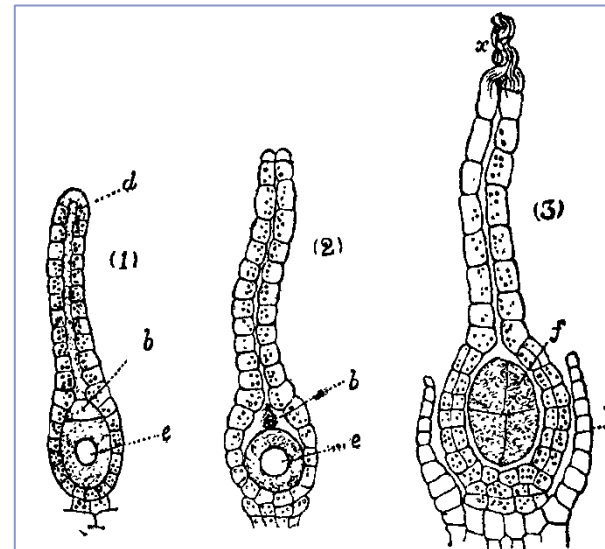
▪ Reproductive système (gametes and spores)

The reproductive organs are surrounded by a layer of protective cells : There are two types of reproductive organs:

a. The sporangium



b. The gametangium



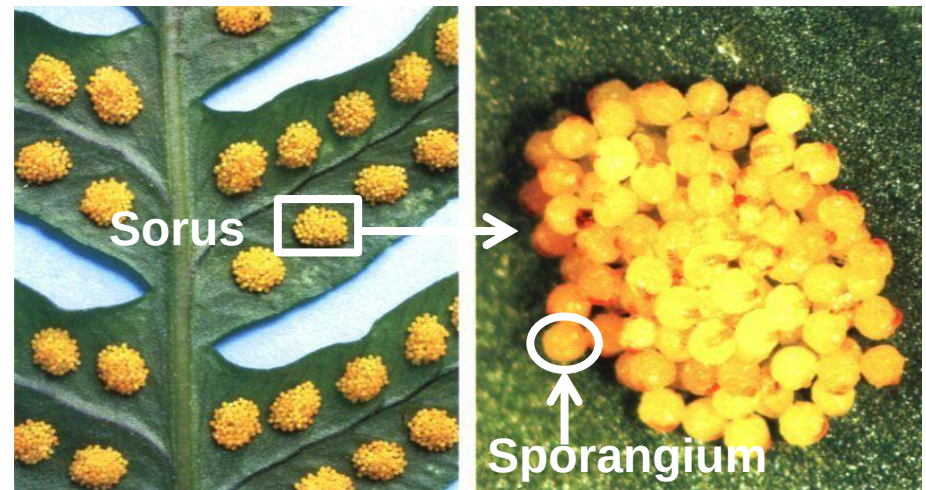
a. The sporangium

angel = means box in Greek, Sporangia are reproductive organs containing spores (asexual structure) : mosses and pteridophytes (ferns).

Behind the leaf of a fern there are clusters of sporangia called **sorus**.

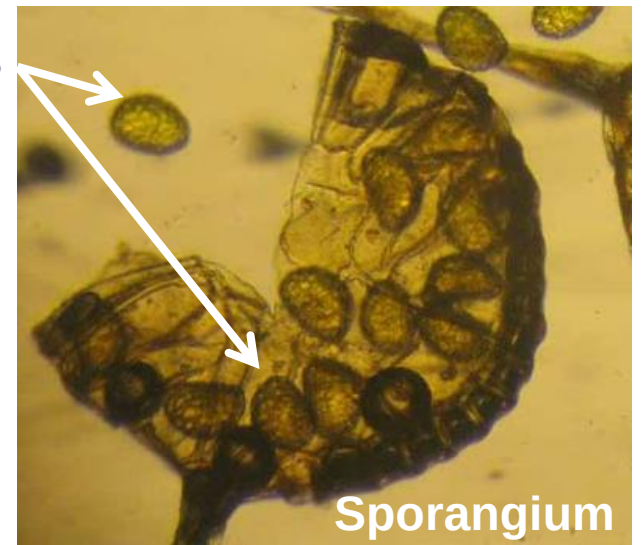


In each **sorus**, there are numerous sporangia.



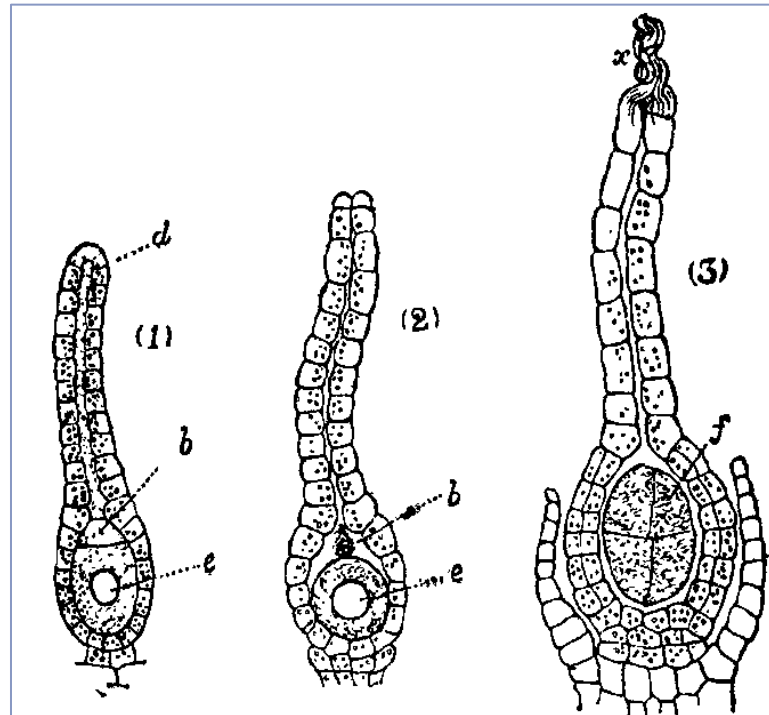
One **sporangium** contains numerous microscopic spores.

Spores



b. The gametangium

They produce gametes for sexual reproduction. These reproductive organs contain numerous male gametes (spermatozoa) and female gametes (bottle-shaped archegonia).



▪ Mode of nutrition

Plantae are chlorophyllous organism capable to synthesize their own organic matter. They are called **autotrophic plants**.



2. Distinctifs features

The distinction between the 3 phyla (**bryophytes**, **pteridophytes** and **spermaphytes**) is based on 2 main criteria :

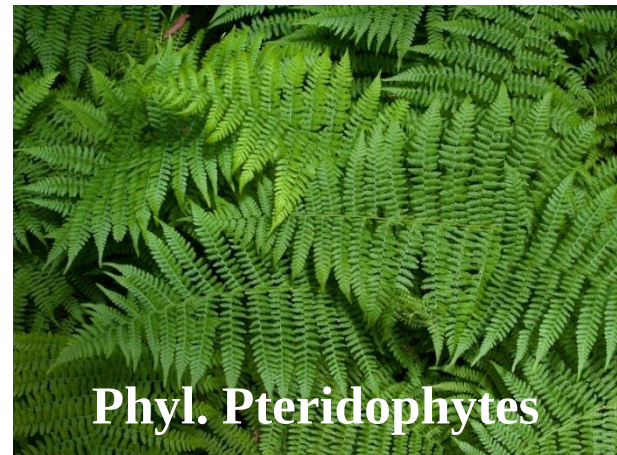
- The reproductive system;
- Conductive tissue.

▪ Reproductive apparatus

Cryptogamy

Crypto = concealed, gamy = reproduction

Cryptogams consists in plants without flowers and have a hidden reproductive organs. They reproduce by spore (sporangia and gametangia):

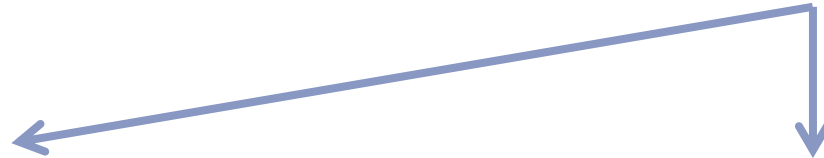


Phanerogamy

Phaneros = visible, gamy = reproduction

Phanerogams are flowering plants with visible reproductive organs:

Spermaphytes



▪ **Conductive tissues**

- **Vascular plants** : These are plants that have conductive tissues. The case of **Pteridophytes and Spermaphytes**

These tissues are more advanced in spermaphytes.

- **Avascular plants** : These are plants without conductive tissue. The sap circulates due to hydroids.

Summary of distinct characteristics

Phylum	Bryophytes	Pteridophytes	Spermaphytes
Reproductive apparatus	Cryptogams		Phanerogams
Conductive tissues (vasculars systèmes)	Avasculars	Vasculars	

IV. Phylum of spermaphytes

The word spermaphyte comes from the Greek, **sperma** : seed, and **phytes** : plant.

Spermaphytes are true cormus plants, vascular and phanerogamous. These plants are classified in the following two sub-phylum :

- 1. S/P. Gymnosperms**

- 2. S/P. Angiosperms**

1. The gymnosperms

- **S/P Gymnosperms** : Bare seed, no ovary, ovule carried by a scale.

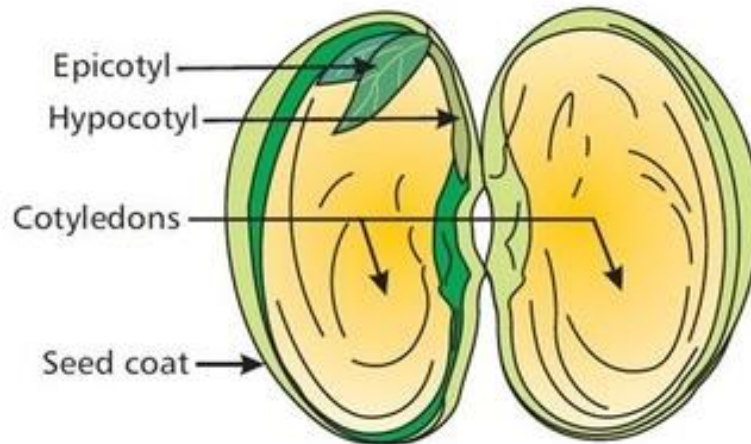
The *Pinus halepensis* L.



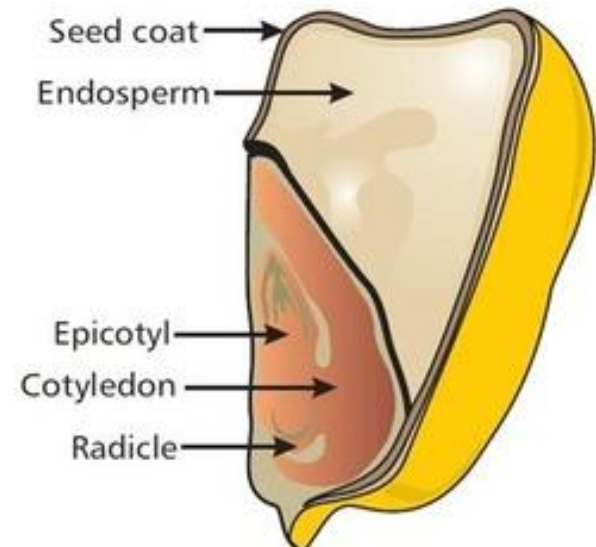
2. The angiosperms

- **S/P angiosperms:** Seeds were inside the fruit, the ovary is present, the ovule is contained in the ovary. This sub-phylum is subdivided into **2 classes**:

Dicotyledons



Monocotyledons



Examples of angiosperms

Dicotyledons
Apple (*Malus*)

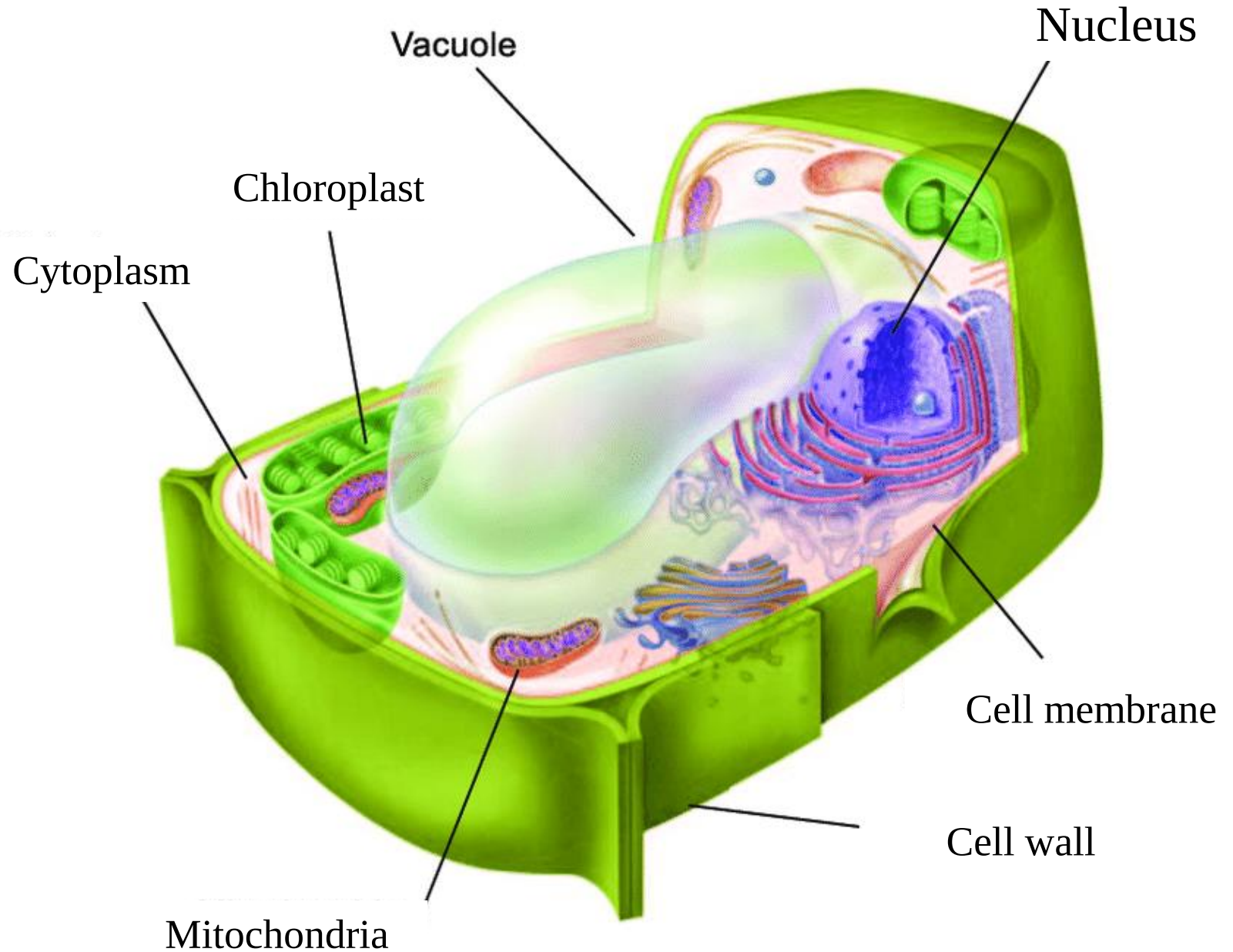


Monocotyledons
Wheat (*Triticum*)

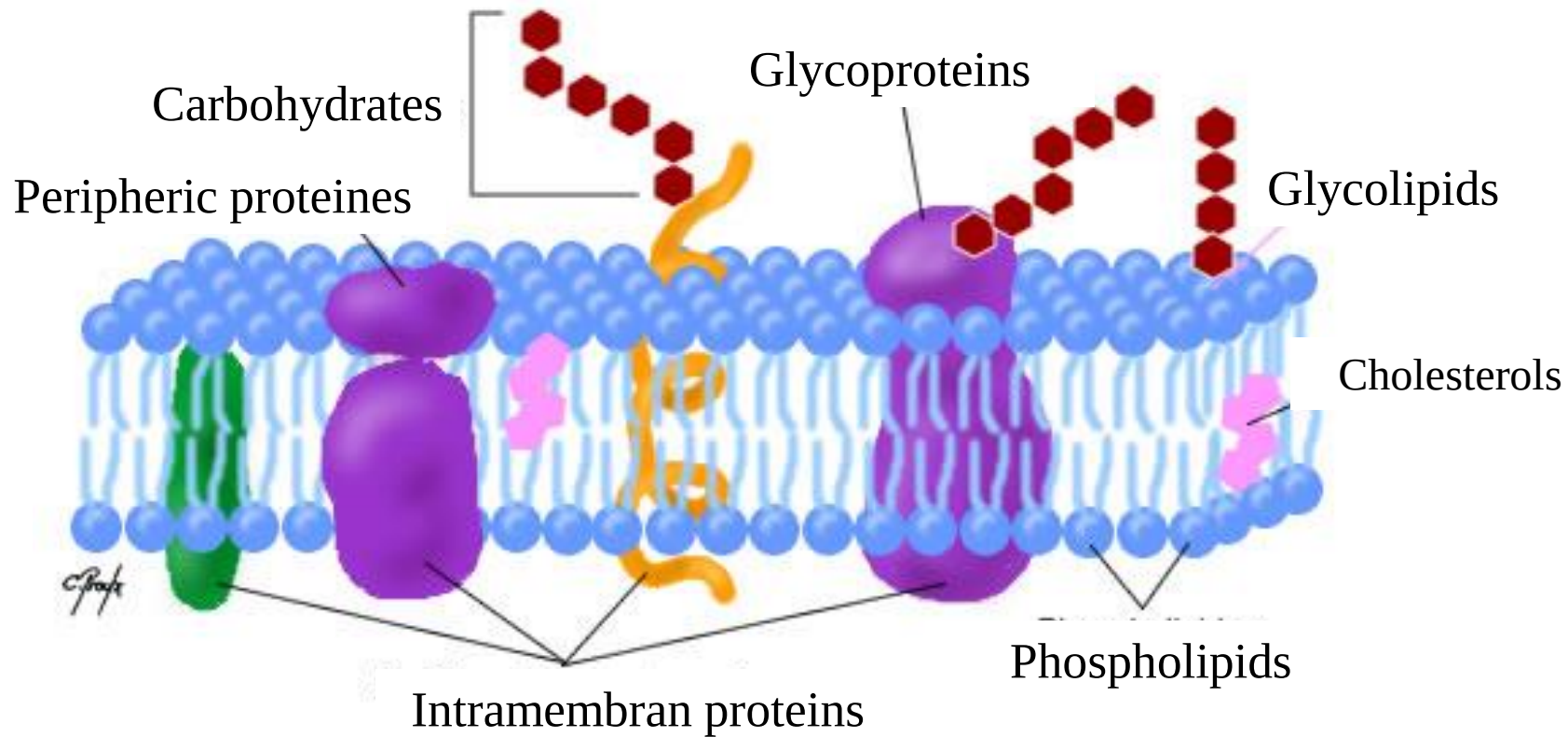


Part II. Characteristics of plant cell.

The plant cell

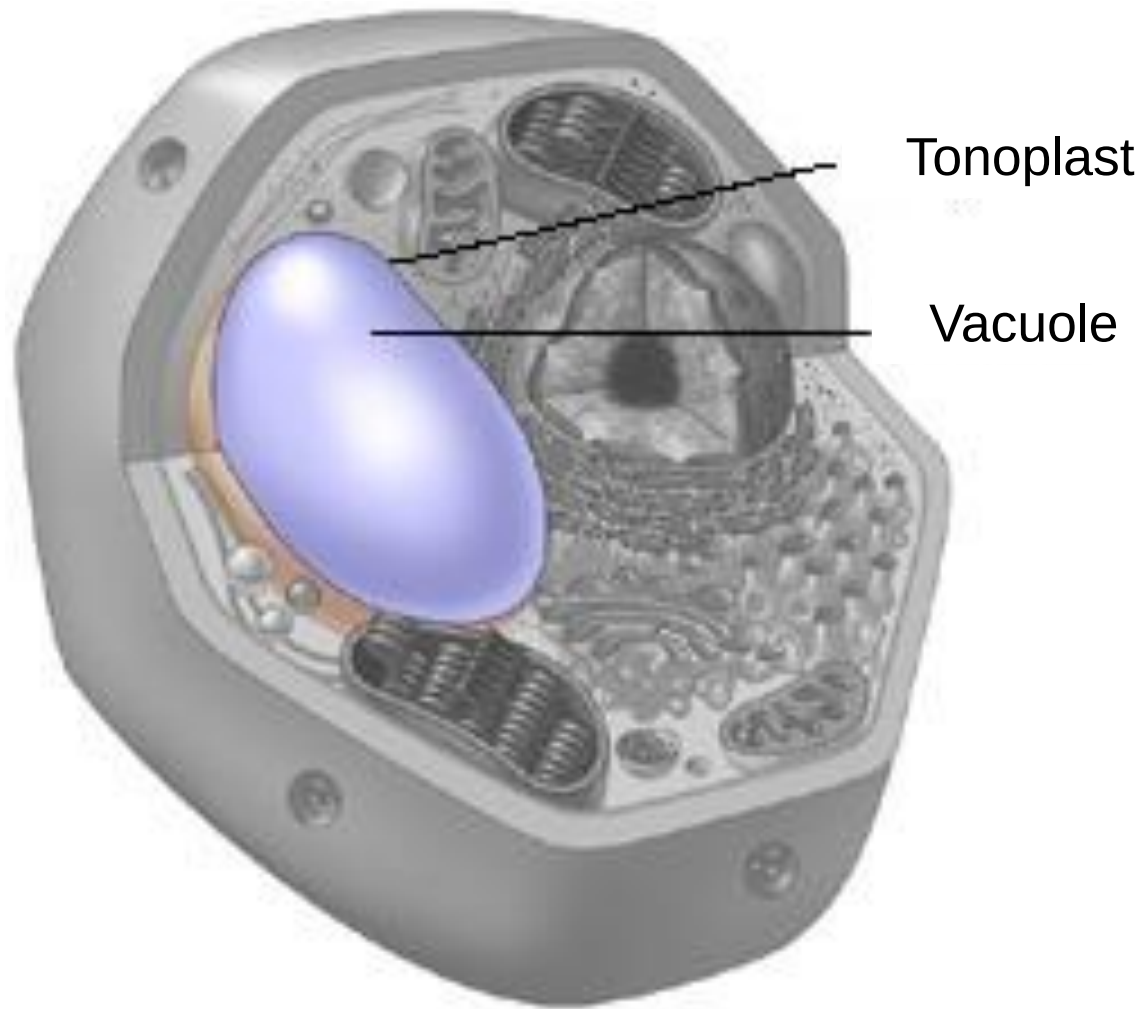


1. The cell membrane

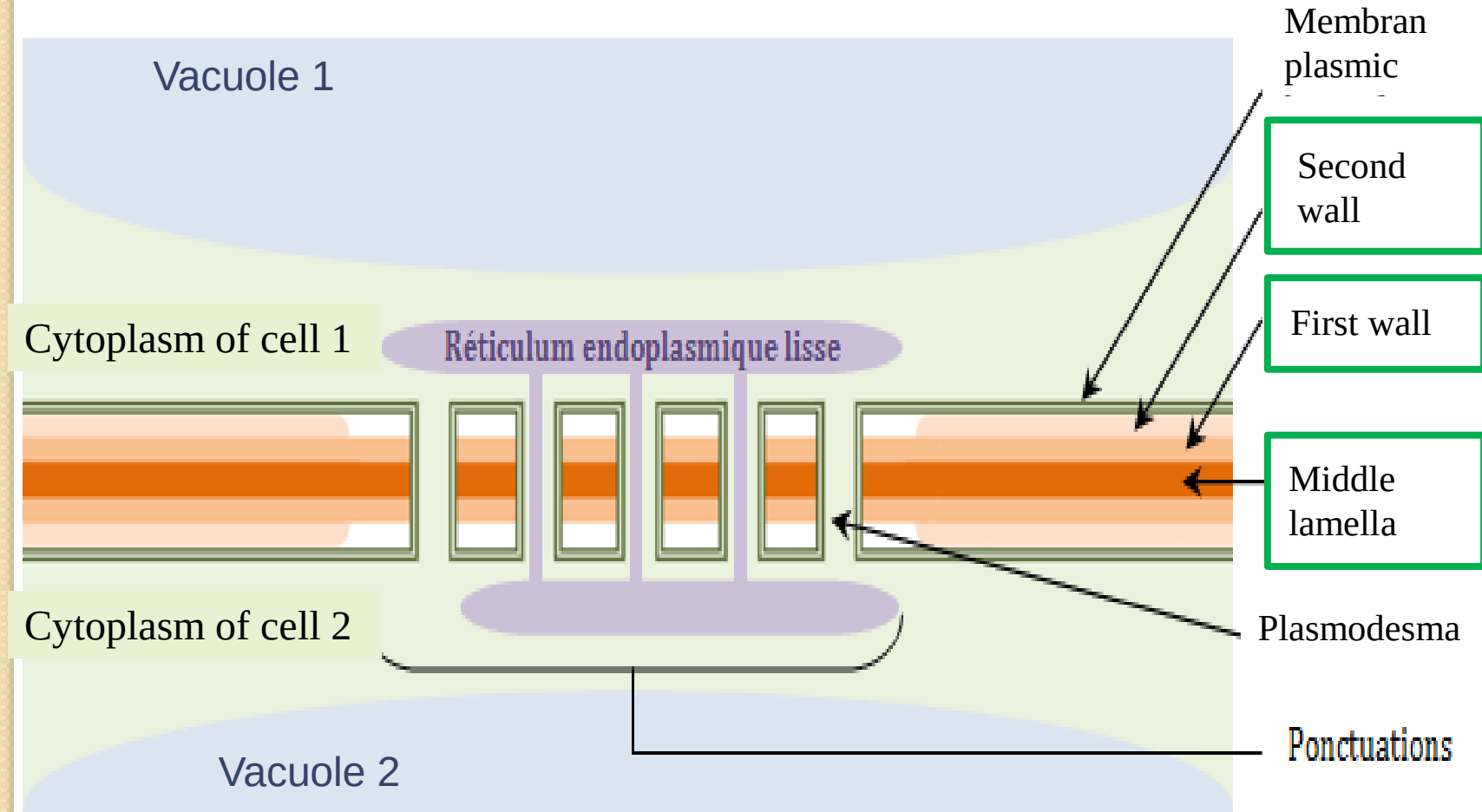


Plasmalemma (= plasma membran)

1. The membran cell

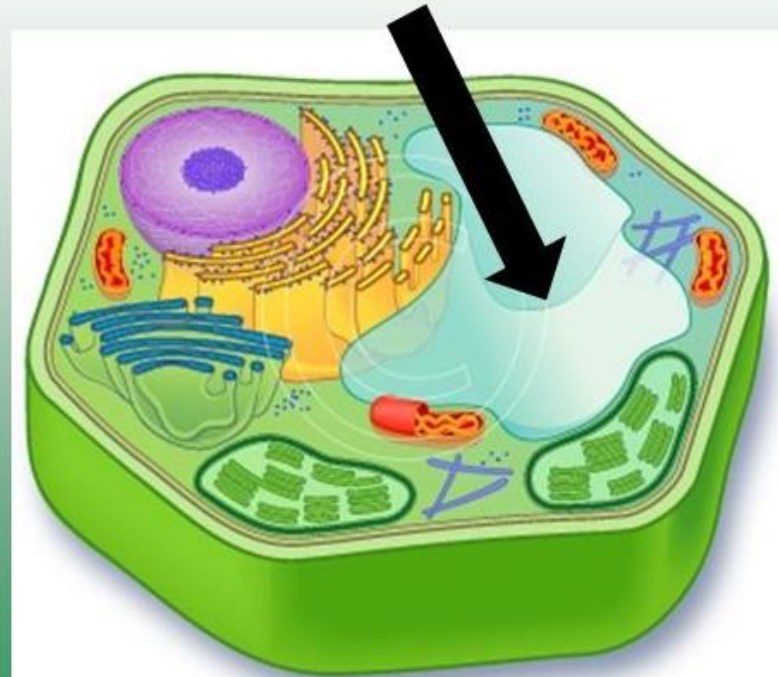


2. The pectocellulosic wall



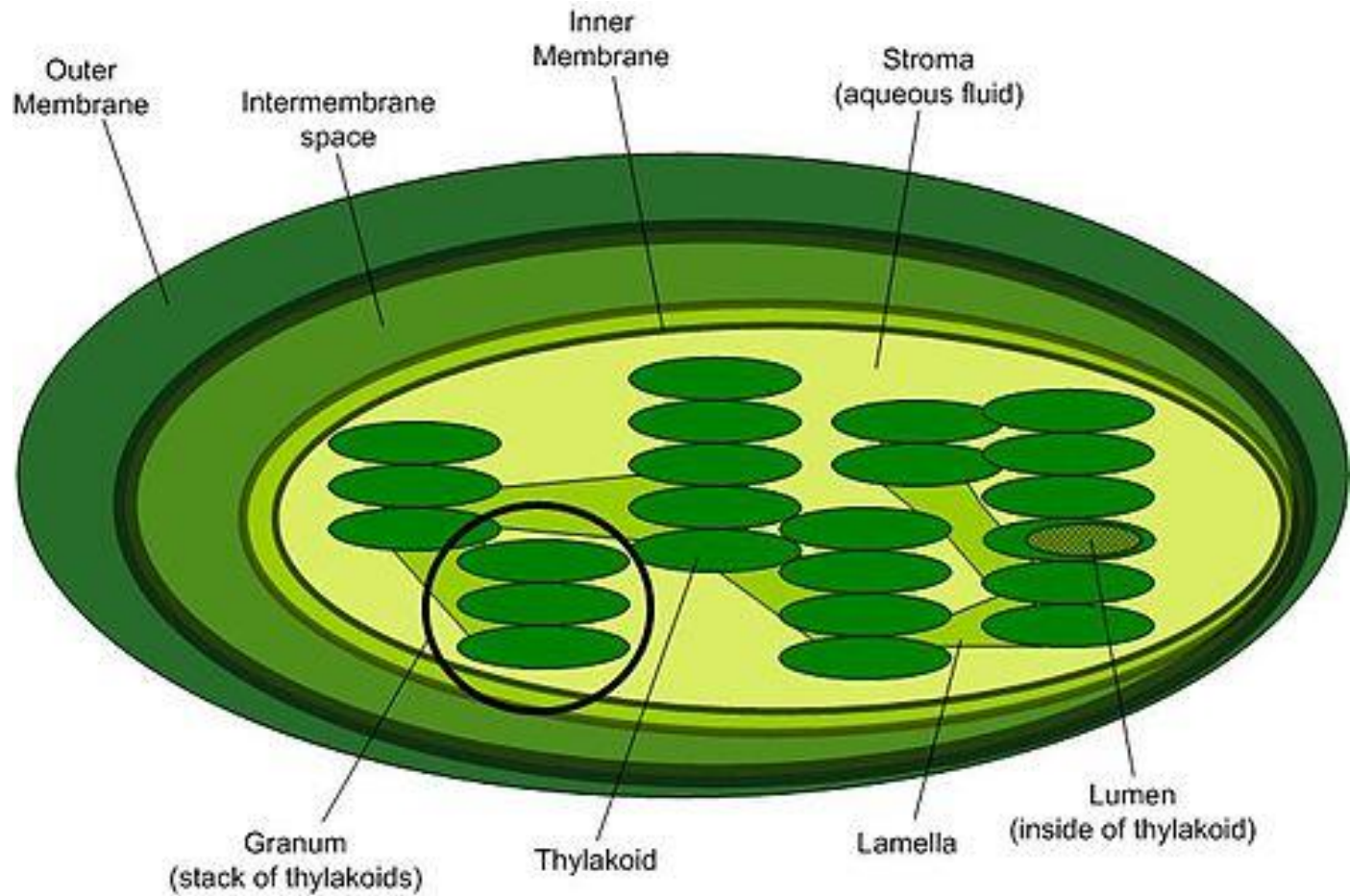
3. Vacuoles

- Most of a plant cell's **volume** is taken up by a large, membrane-bound space called the **Central Vacuole**.
- The central vacuole stores **water** and may contain **ions**, **nutrients**, and **wastes**.



4. Plastes

■ Chloroplasts



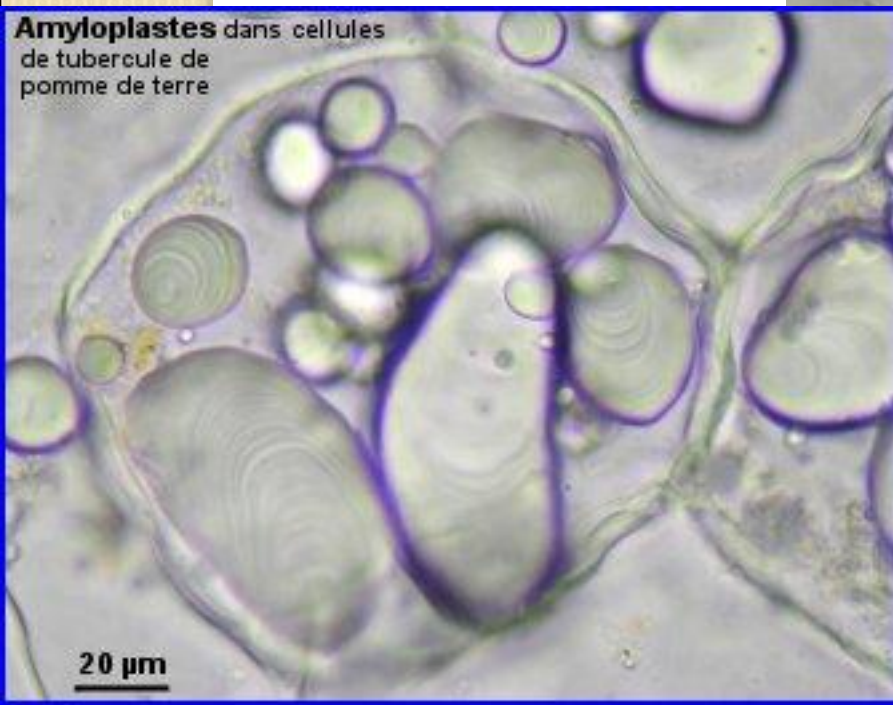
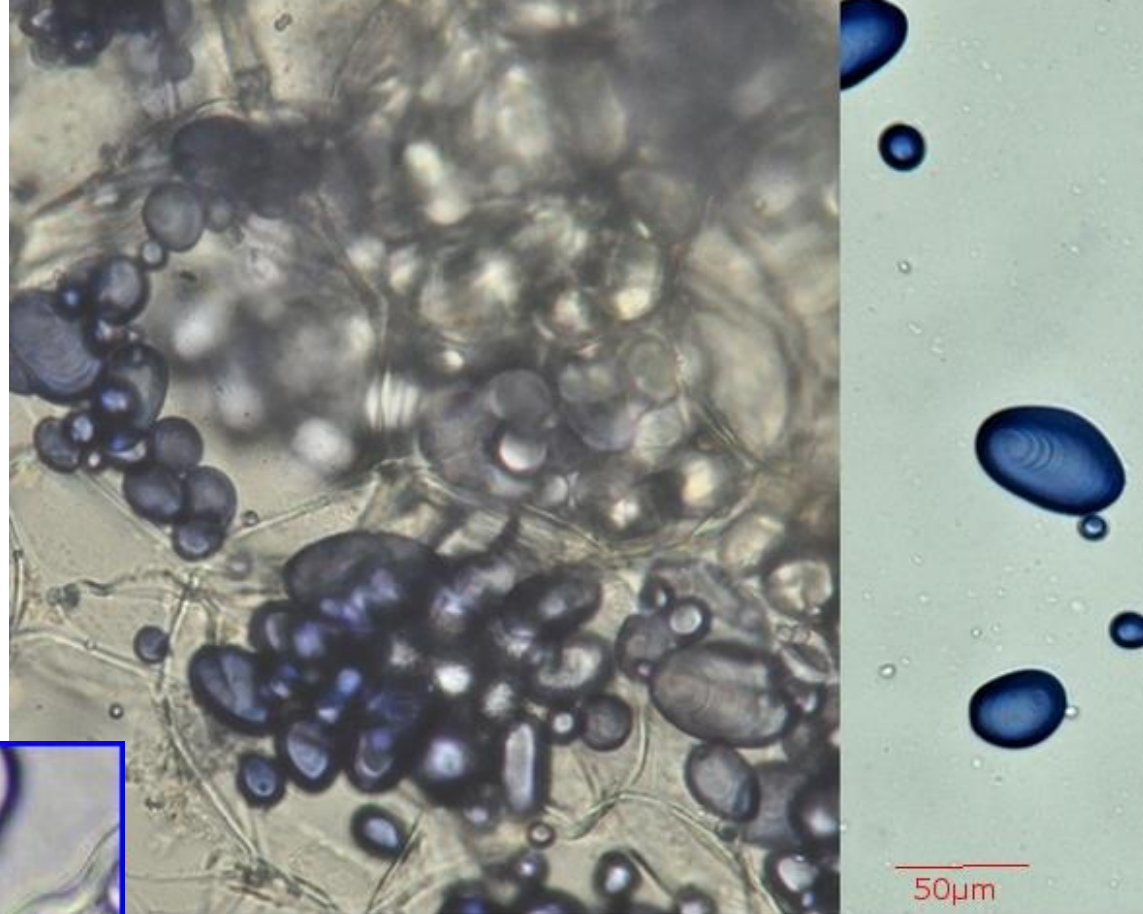
▪ Chromoplasts

Pigments:

- Carotenes (yellow and orange pigments)
- Xanthophyll (light yellow pigment)

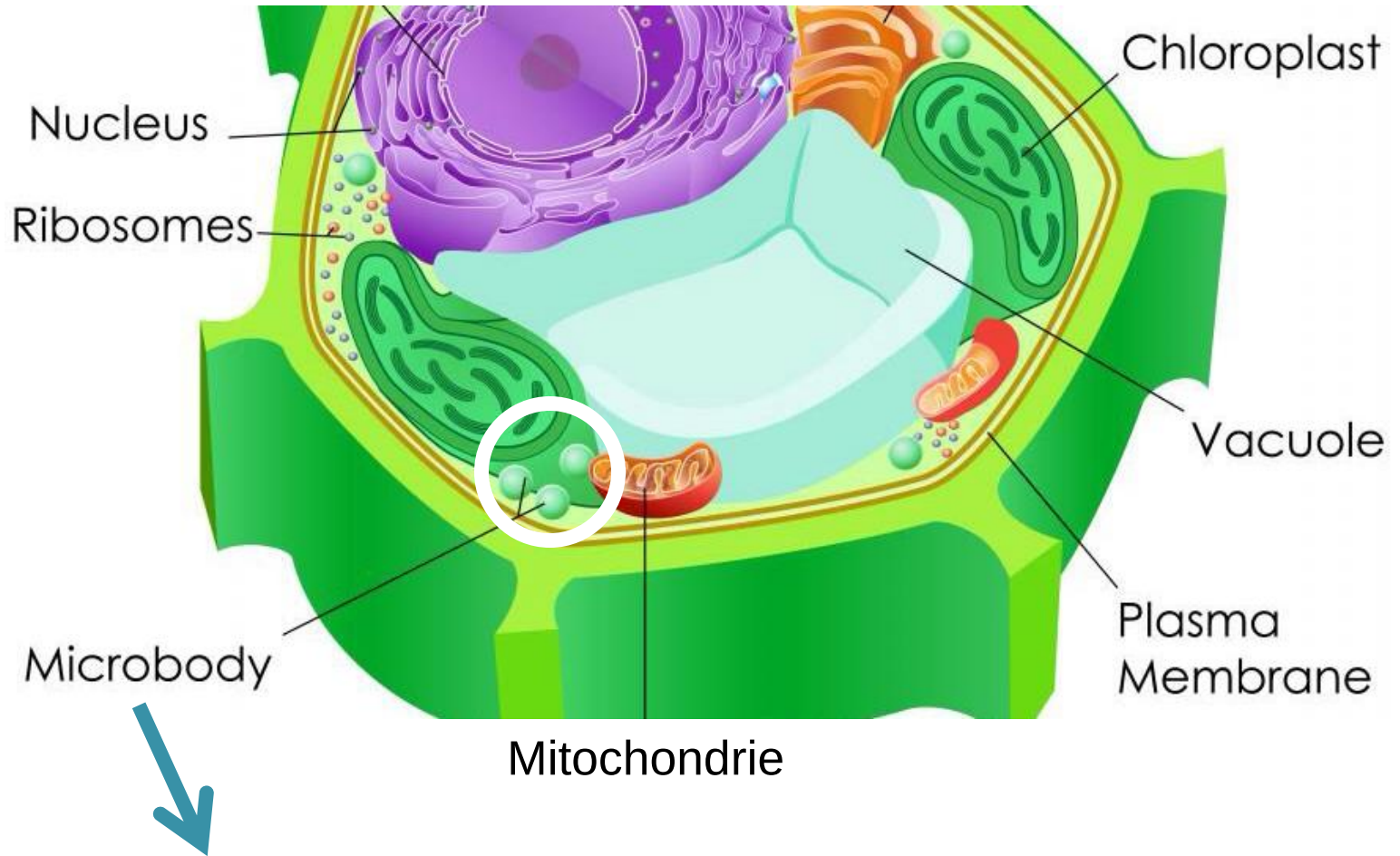


■ Amyloplasts



Amyloplasts in the cells of
potatoes

3. Cytosomes (ou microbodies)



Enzymes:

Lysosomes

Glyoxysomes

Peroxisomes