اسم المقرر: علم النبات العام
رمز المقرر: 102نبت

Plant biology 102 BOT

تعريف بعضو هيئة التدريس ومعلومات التواصل

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خطة المقرر

وصف عام للمقرر:

مقدمة عن الخلية النباتية ، الأيض ، التشريح : الأنسجة ، السيقان ،الأوراق ، الجذور ، العلاقات المائية في النبات وأنظمة الامتصاص والنقل ، التمثيل الضوئي ، الوراثة ودورة الحياة ، التصنيف والتطور ، الحزازيات ، السراخس ، عاريات البذور ،كاسيات البذور ، الأزهار والثمار ، بيئة النبات.

قائمة الموضوعات
تعريفات و مصطلحات في علم النبات وفروعه
الخلية النباتية تركيبا ومكونات كيميائية
التشريح والشكل الظاهري (الخلايا والأنسجة ، الساق ، الورقة، الجذر وتحوراتها)
الوراثة ودورات الحياة
الأيض في النباتي (بناء ضوئي و تنفس و تغذية معدنية، أنظمة الامتصاص والنقل)
التصنيف والمملكة النباتية
الحزازيات والسراخس وعاريات البذور
كاسيات البذور (البذور والأزهار والثمار)
بيئة النبات

قائمة - الكتب و المراجع :

Raven, P.H., Evert, R.F. and Eichhorn, S.E.(1992). Biology of plants 5th. E. W.H. Freeman and company, Worth Publishers. New York.

Raven, P.H., Evert, R.F. and Eichhorn, S.E.(1999). Biology of plants 6th. E. W.H. Freeman and company, Worth Publishers. New York.

سياسة التقييم وتوزيع الدرجات

بناء على قرار مجلس الكلية:

يتم توزيع درجة المقرر الكلية (100 درجة) كالاتي:

1. درجة الأعمال الفصلية (60 درجة)

أ. الجزء النظري من المقرر (30 درجة) ويتم تدريسه من قبل د. فيصل الحربي.

ب. الجزء العملي من المقرر (30 درجة) ويتم تدريسه من قبل الأستاذ المسؤول عن العملي.

2. درجة الاختبار النهائي (40 درجة)

مواعيد الاختبارات الشهرية والنهائية:

1. الاختبار الفصلي للجزء النظري سوف يتم عقده في الفترة ما بين الأسبوع السابع الى التاسع من بداية الفصل الدراسي، وسوف يتم إعلام الطلاب بالموعد المحدد والمؤكد قبل الاختبار بأسبوع كامل.

2. الاختبار النهائي محدد موعده في البوابة الاكاديمية للطالب.

Introduction

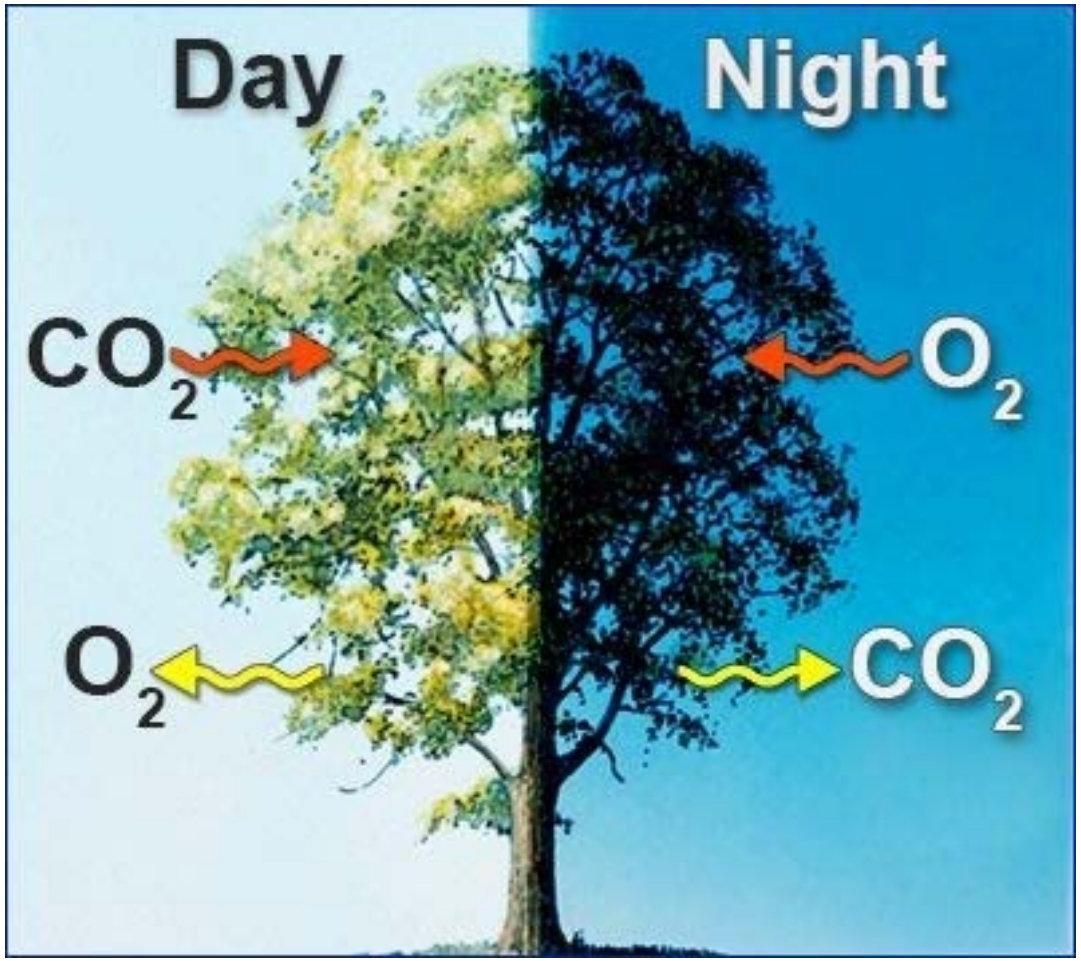
المقدمة

- The study of living organisms (Plant and Animals) is called as **BIOLOGY**.
- The study of plants is called as **BOTANY**
- The study of animal is called as **ZOOLOGY**
- Plants are green in color because of the presence of chlorophyll.
- Fungi do not have chlorophyll.
- Thallophyta الثالوسية , Bryophyta الحزازية , Pteridophyta التريدية , Gymonosperms عاريات البذور and Angiosperms كاسيات البذور are the different groups of the plants.

Plant Importance

أهمية النبات

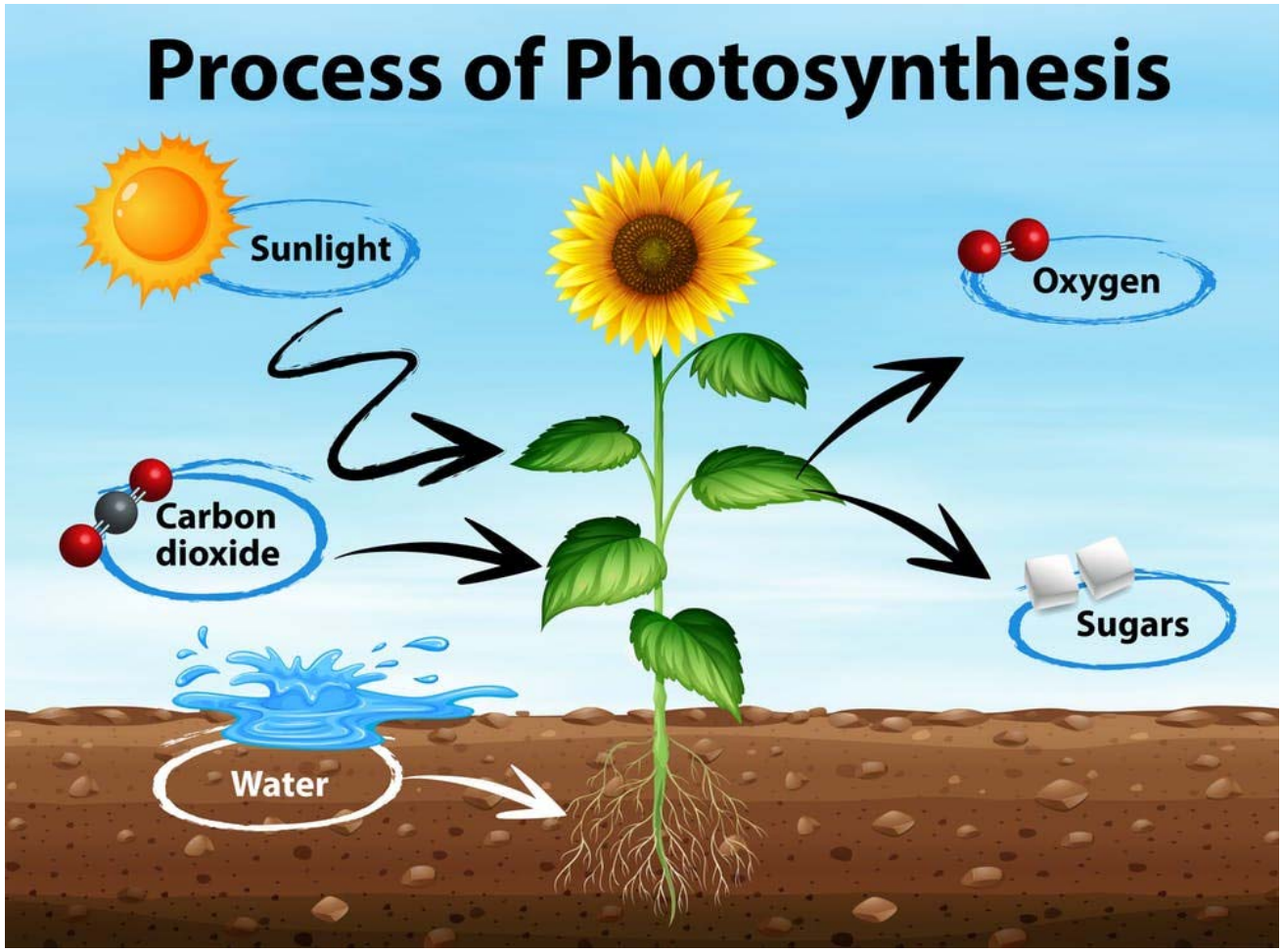
- انتاج الاوكسجين
- Plants produce most of the **oxygen** we breathe.



Plant Importance

أهمية النبات

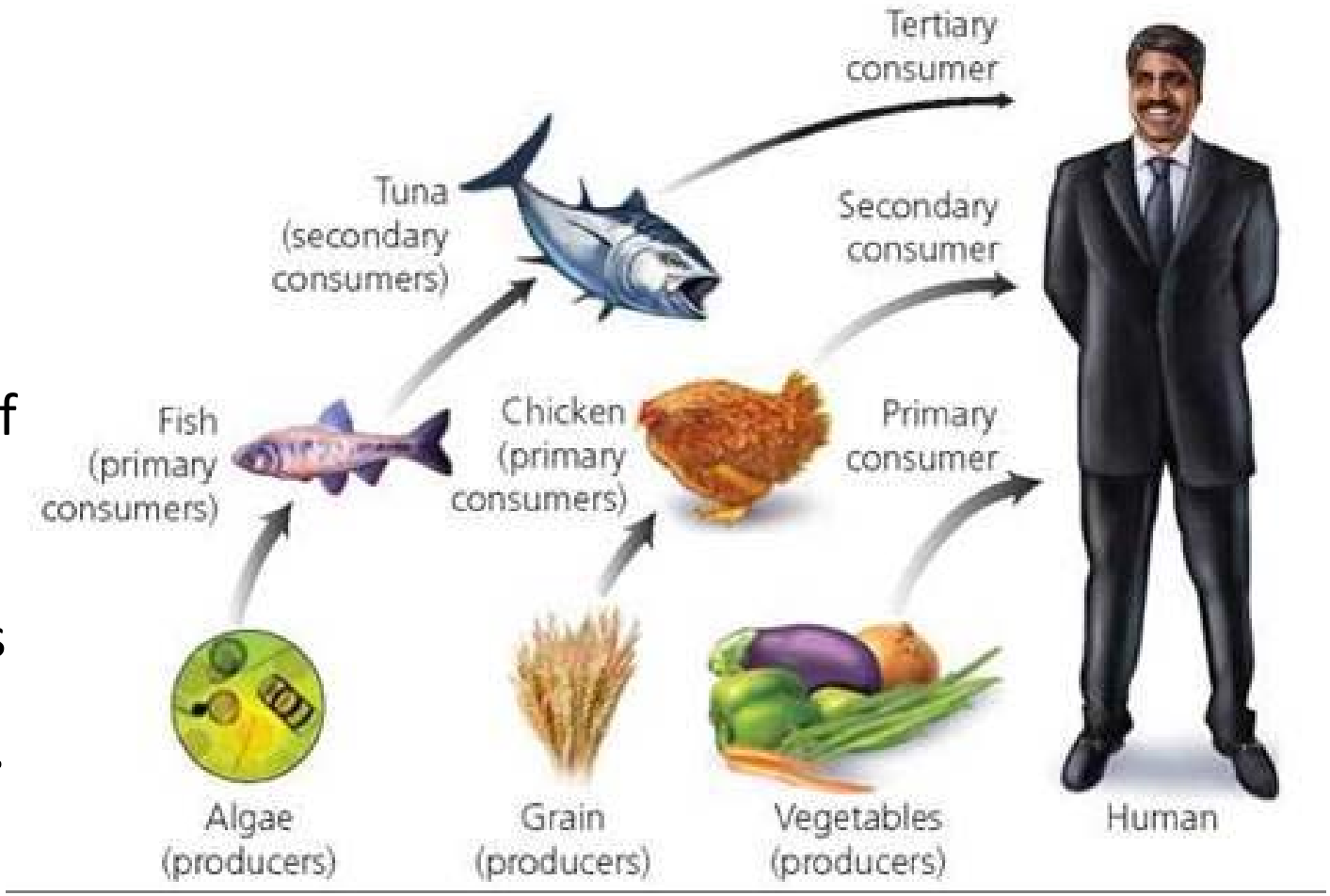
- Plants convert/fix **Carbon di oxide** gas CO2 into **sugars** where human & animals can use as food (energy- rich molecules), through the process of **photosynthesis**.
- النبات يثبت ثاني اكسيد الكربون الى مركبات غنية بالطاقة من خلال عملية البناء الضوئي



Plant Importance

أهمية النبات

- Every things we eat comes directly or indirectly from plants.
- Plants produce most of the chemically stored energy we consume as food and burn for fuel.



Plant Importance

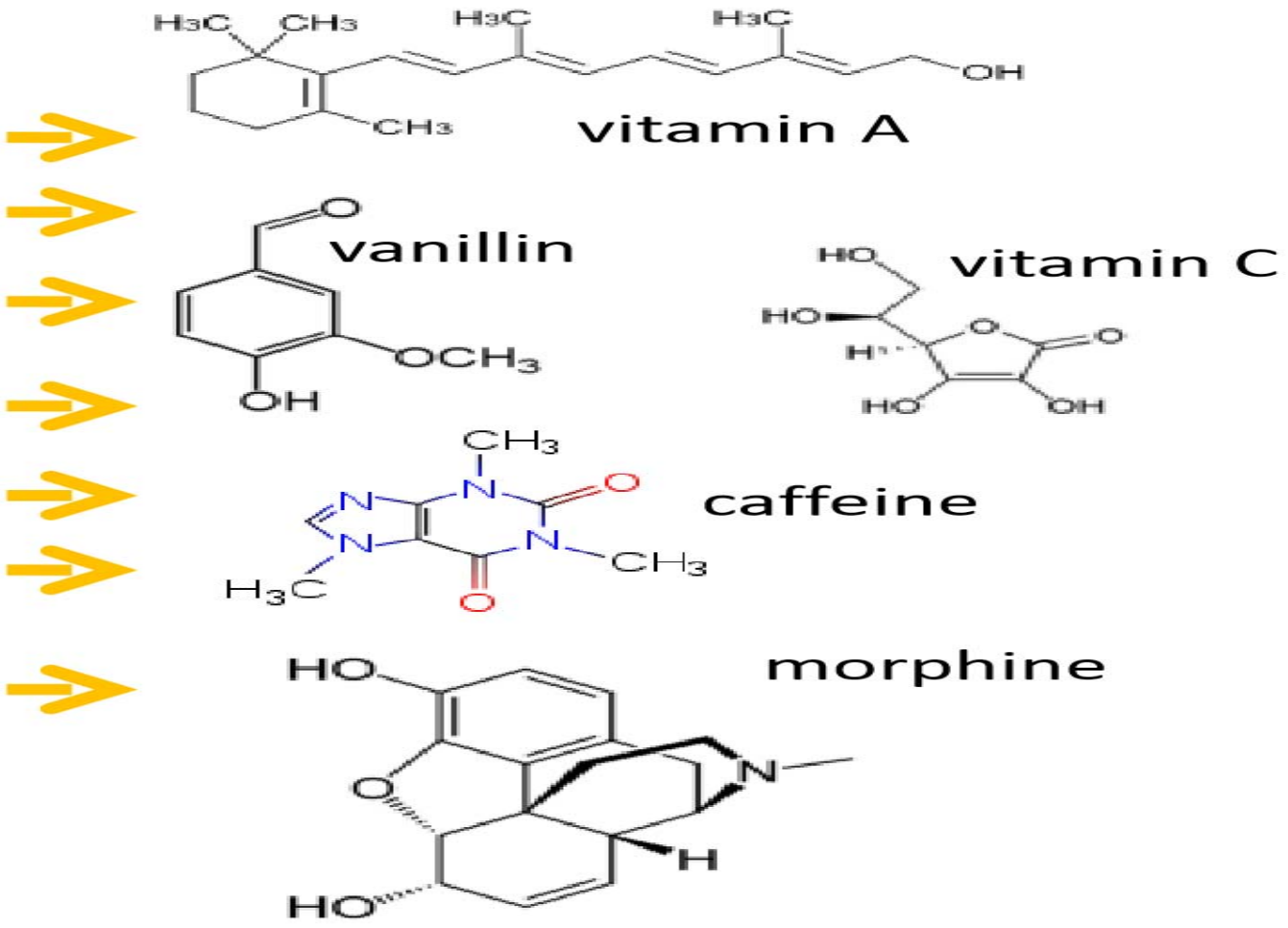
أهمية النبات

- Many chemicals produced by the plants used as medicine.
- العقاقير الطبية

Plant Importance

أهمية النبات

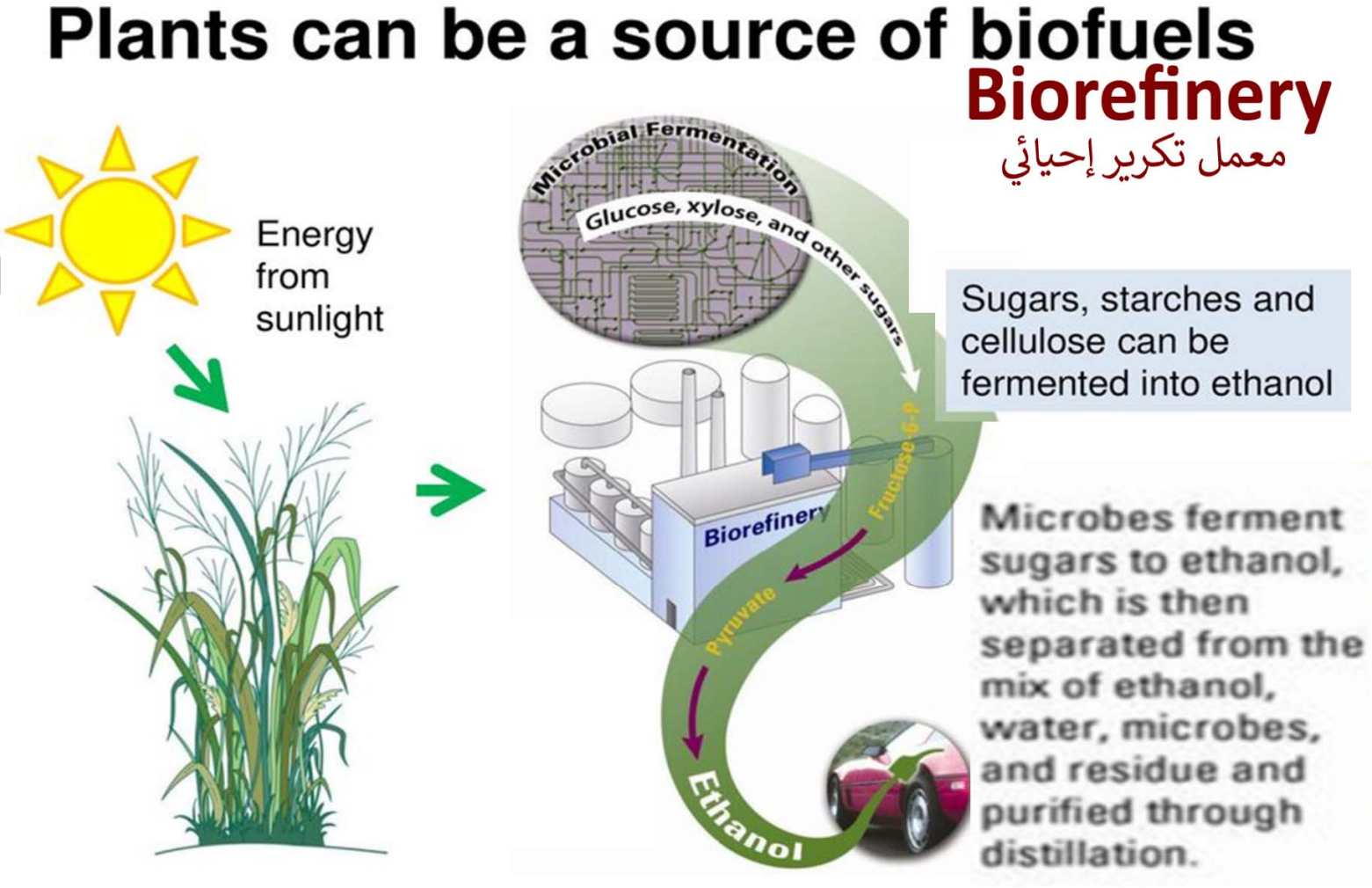
- Plants can produce an amazing and useful assortment of chemicals
- يمكن للنباتات ان تنتج تشكيلة مذهلة من المواد الكيميائية



Plant Importance

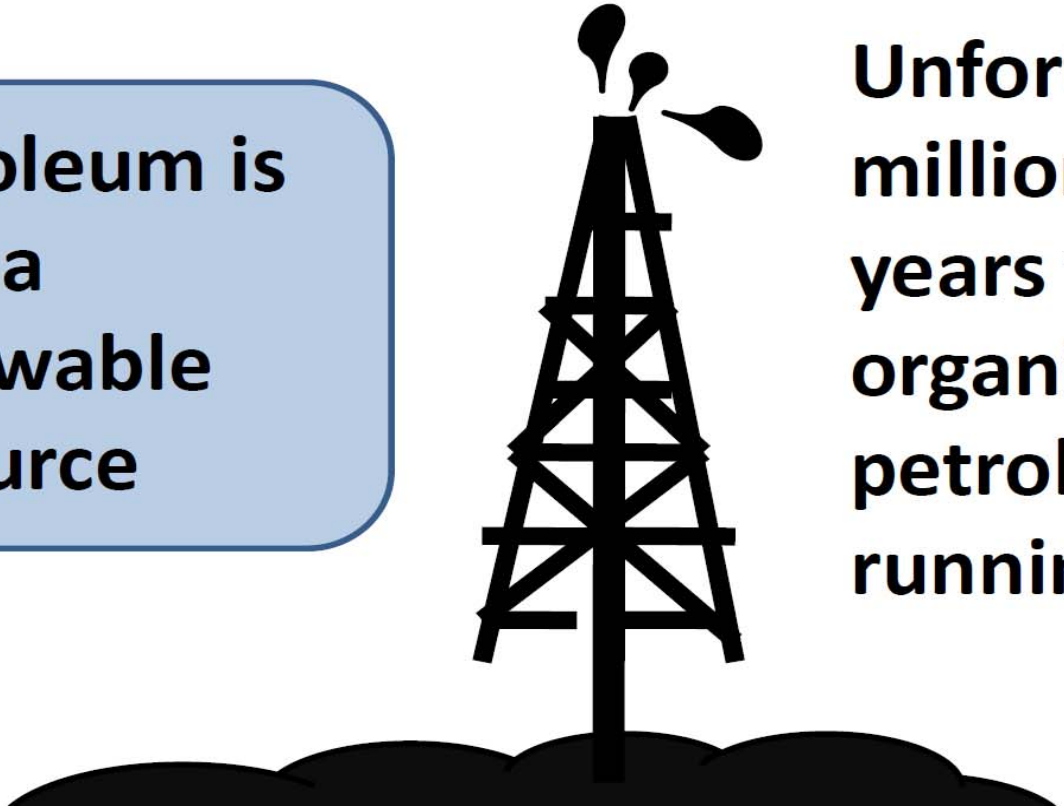
أهمية النبات

- Plants can be a source of biofuels. Sugars, starches and cellulose can be fermented into ethanol. Ethanol is used as fuel.
- الوقود الحيوي Biofuels



Plants can replace petroleum for many products and purposes

Petroleum is NOT a renewable resource



Unfortunately, it takes millions and millions of years to convert dead organic material into petroleum...and we are running out of it.

Plants provide us with more than food

Plants:

- are sources of novel (new) therapeutic drugs عقاقير طبية
- provide better fibers for paper or fabric الياف
- sources of bio renewable products منتجات حيوية متجددة
- provide renewable energy sources مصادر طاقة متجددة

Branches of Botany

فروع علم النبات

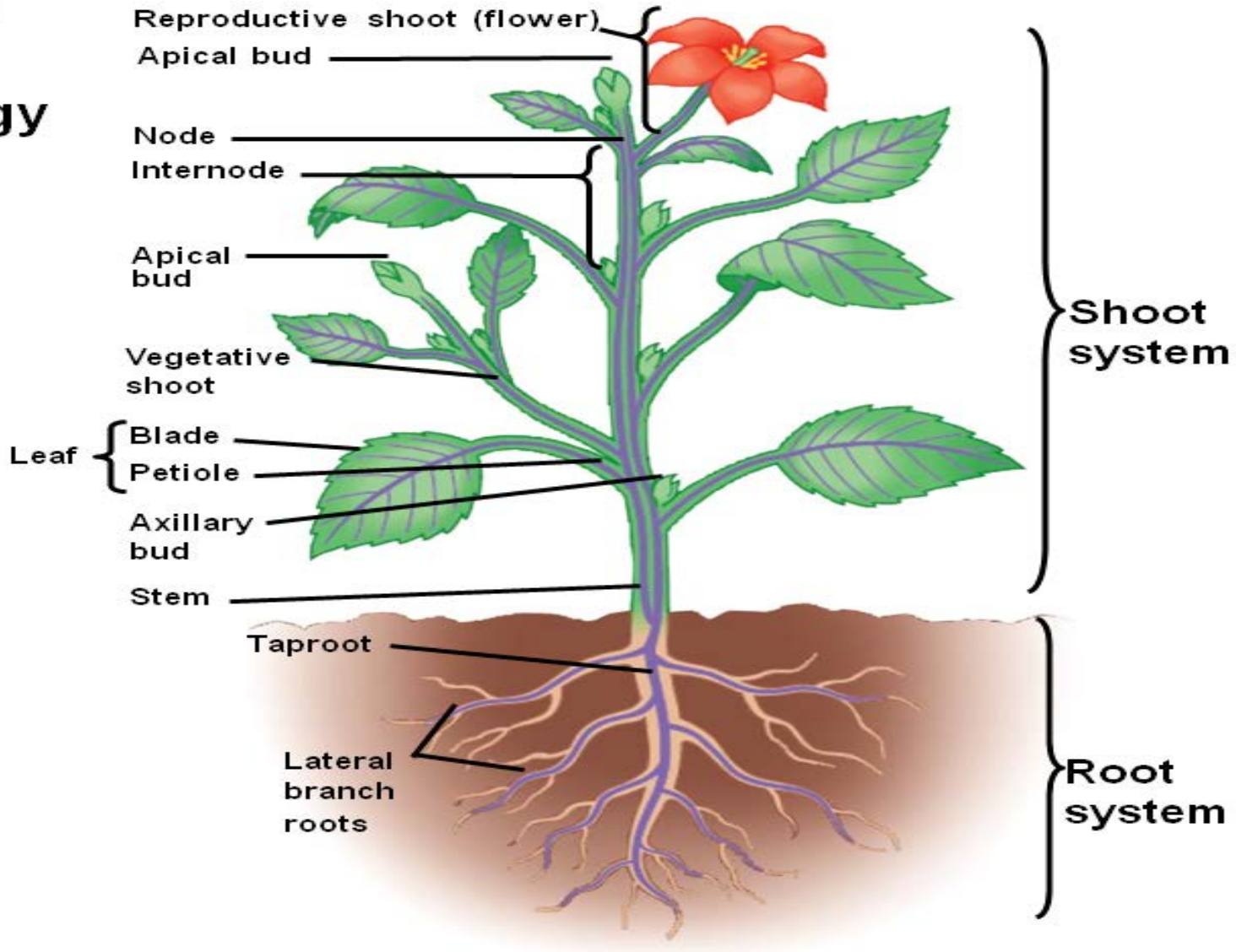
Morphology علم الشكل الظاهري	Study of external structure of plant.
Anatomy علم التشريح	Study of internal structure of plant.
Histology علم الانسجة	The study of cells and tissues with the help of microscope.
Cytology علم الخلية	The study of the cells.
Plant Physiology علم وظائف الأعضاء	The study of various vital activities of the plant.
Taxonomy علم التصنيف	Study of the classification of the plants.
Ecology علم البيئة	Relations of organisms to one another and to their physical surroundings.
Plant Geography علم جغرافية النبات	Distribution of plants on the earth.
Genetics علم الوراثة	The study of heredity and variations.
Plant breeding علم التهجين	The development of improved varieties of plants.
Embryology علم الأجنة	The study of embryos and their development.
Economic Botany علم اقتصاديات النبات	The study of the relationship between people and plants.
Plant Pathology علم أمراض النبات	The study of the different types of disease of plants and control methods
Palynology علم حبوب اللقاح	Study of pollen grains.
Agronomy علم الزراعة الحقلية	Study of the crop plants.
Horticulture علم البستنة	The study of flowering and fruiting plants.
Pharmacognosy علم العقاقير الصيدلانية	Study of the medicinal plants.
Microbiology علم الأحياء الدقيقة	Study of microorganisms (viruses, bacteria, fungi, microalgae and protozoa).
Genetic Engineering علم الهندسة الوراثية	Adding, removing or repairing part of genetic material, thereby changing the phenotype of organism as desired.

Flowering Plant Morphology

Morphology
علم الشكل الظاهري

Study of external structure of plant.

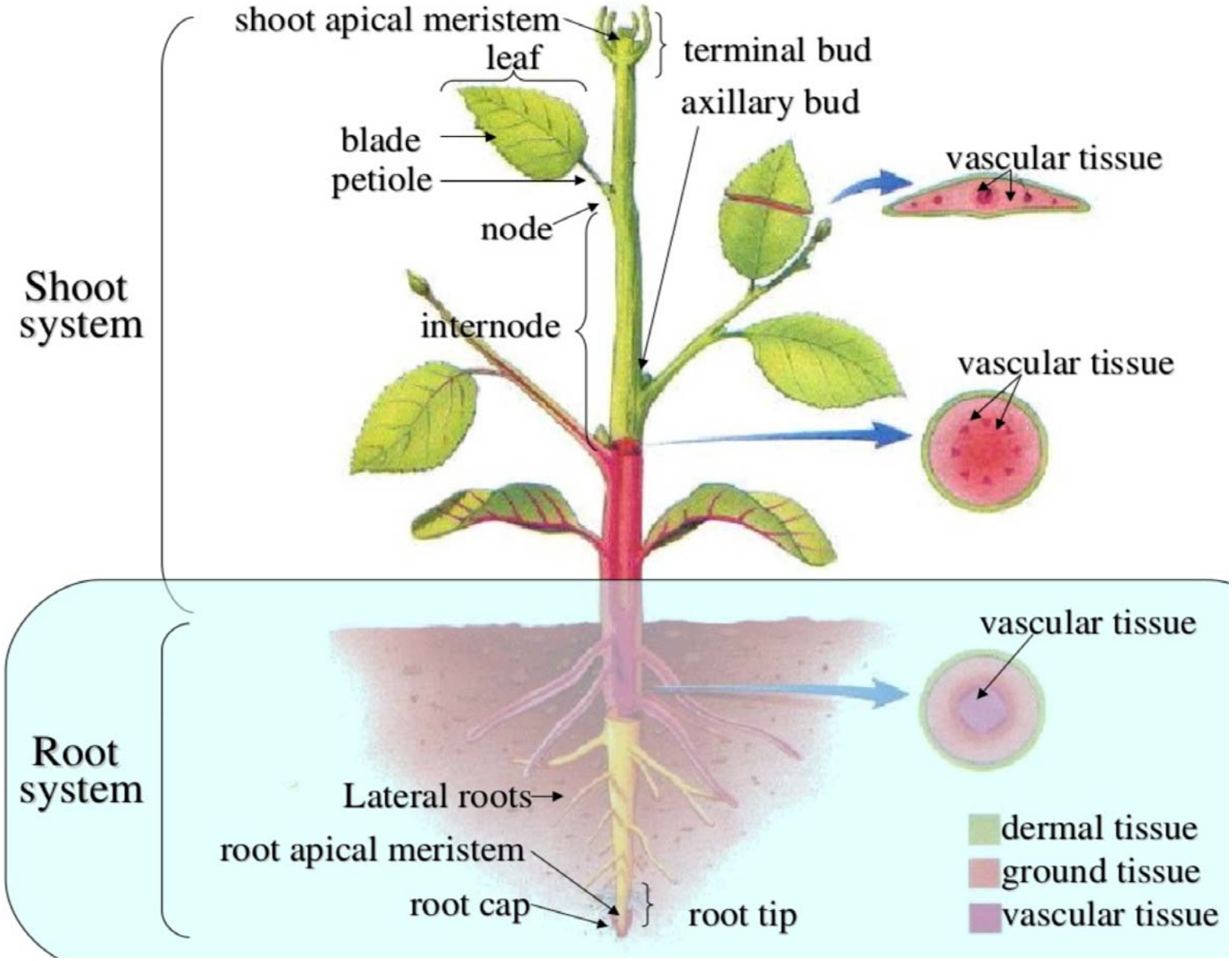
دراسة التراكيب الخارجية للنبات



Anatomy علم التشريح

Study of internal structure of plant.

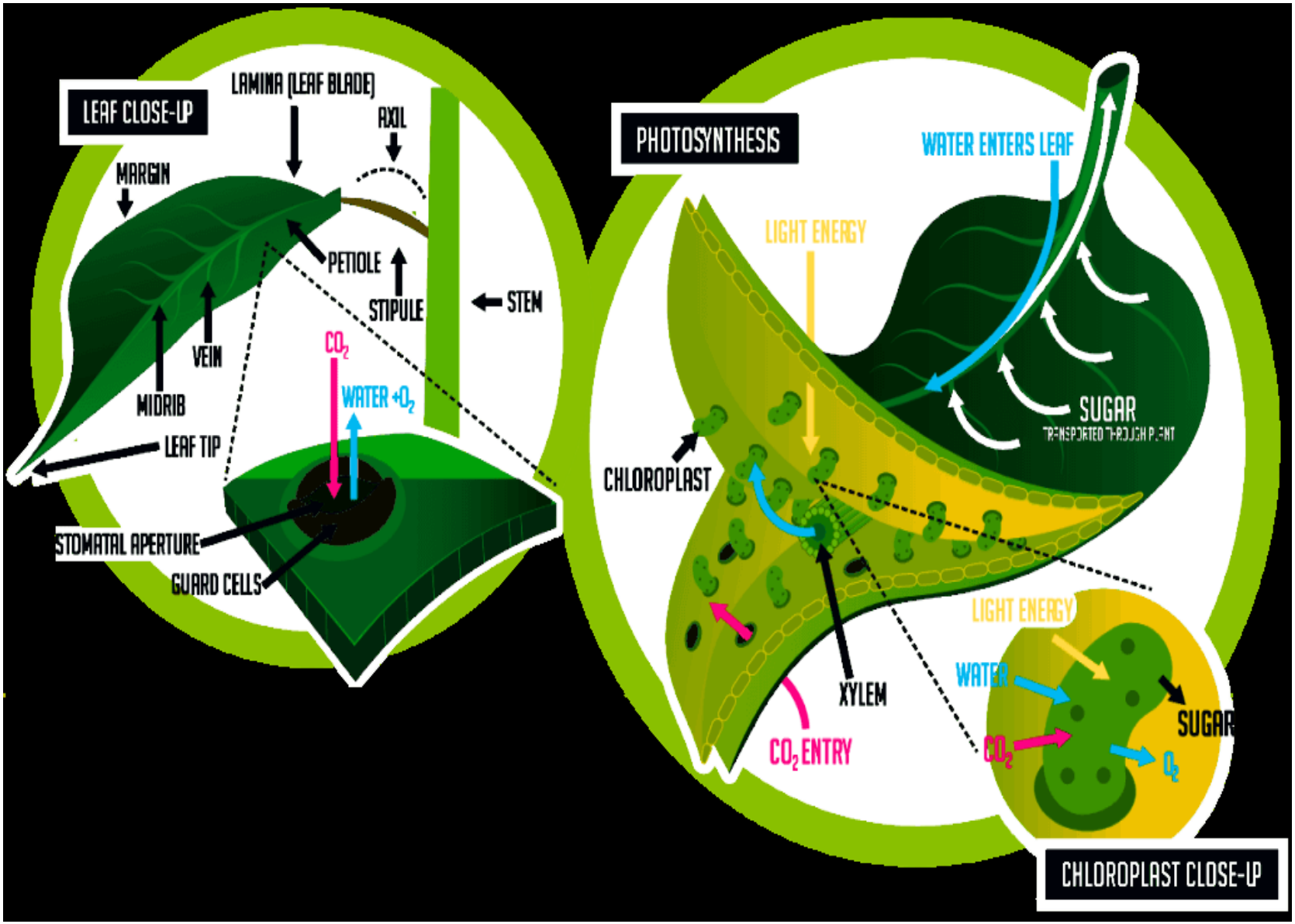
دراسة التراكيب الداخلية للنبات



Plant Physiology
علم وظائف الأعضاء

The study of various vital activities of the plant.

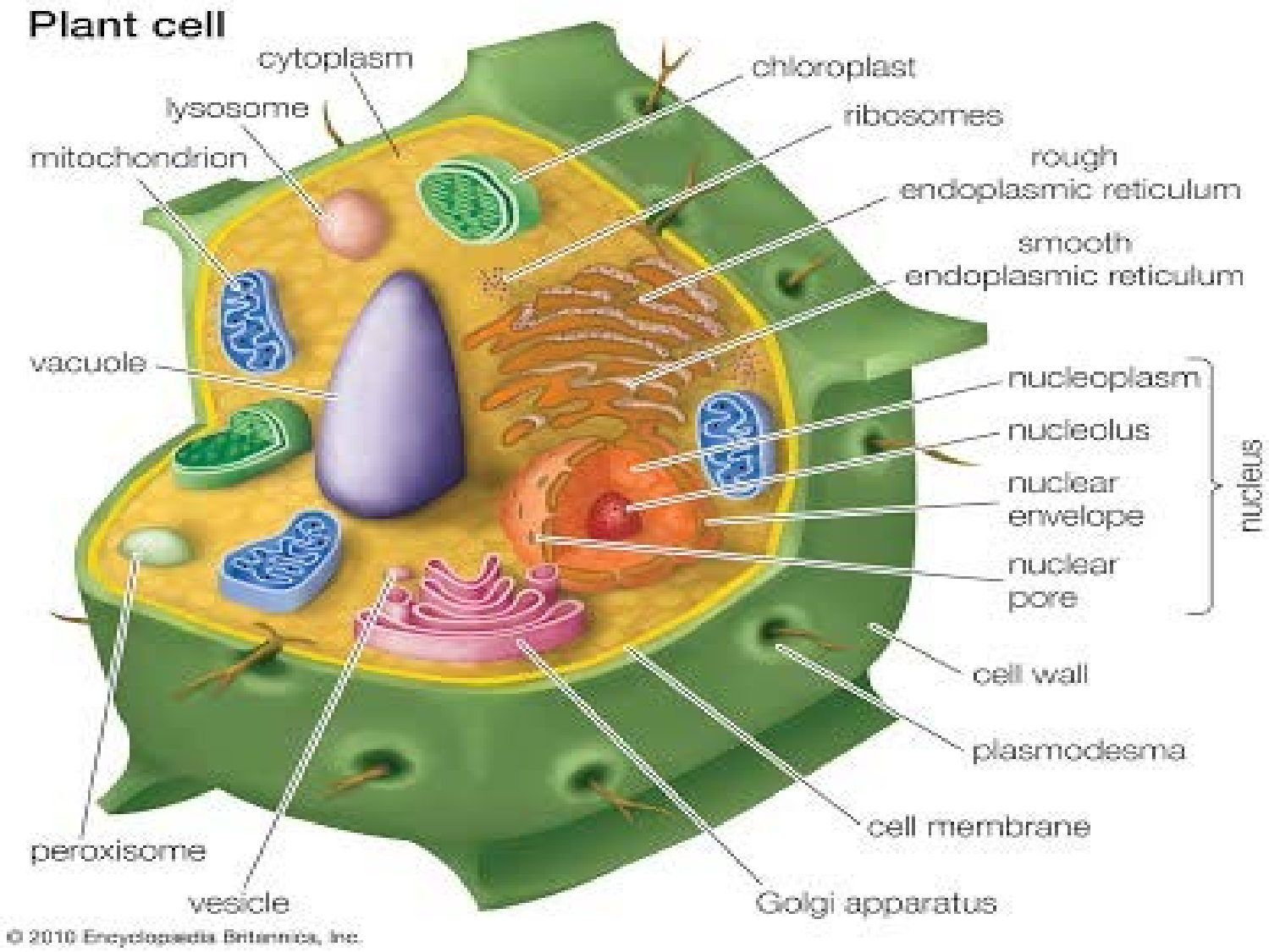
دراسة الانشطة الحيوية الهامة للنبات



Cytology
علم الخلية

The study of the cells.

دراسة الخلية وتراكيبها

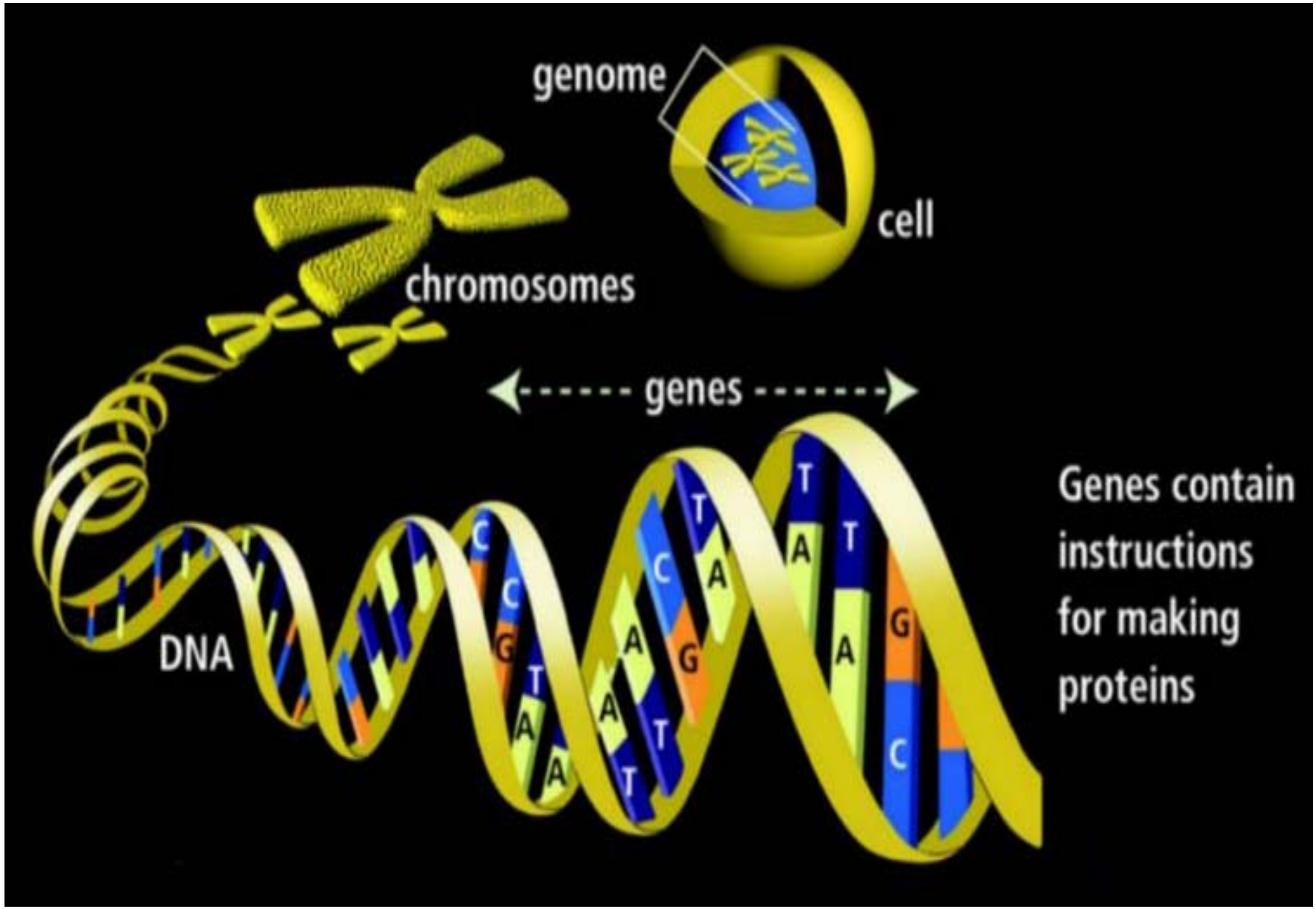


Genetics

علم الوراثة

The study of heredity and variations.

دراسة الآليات لانتقال الصفات الوراثية عبر الاجيال



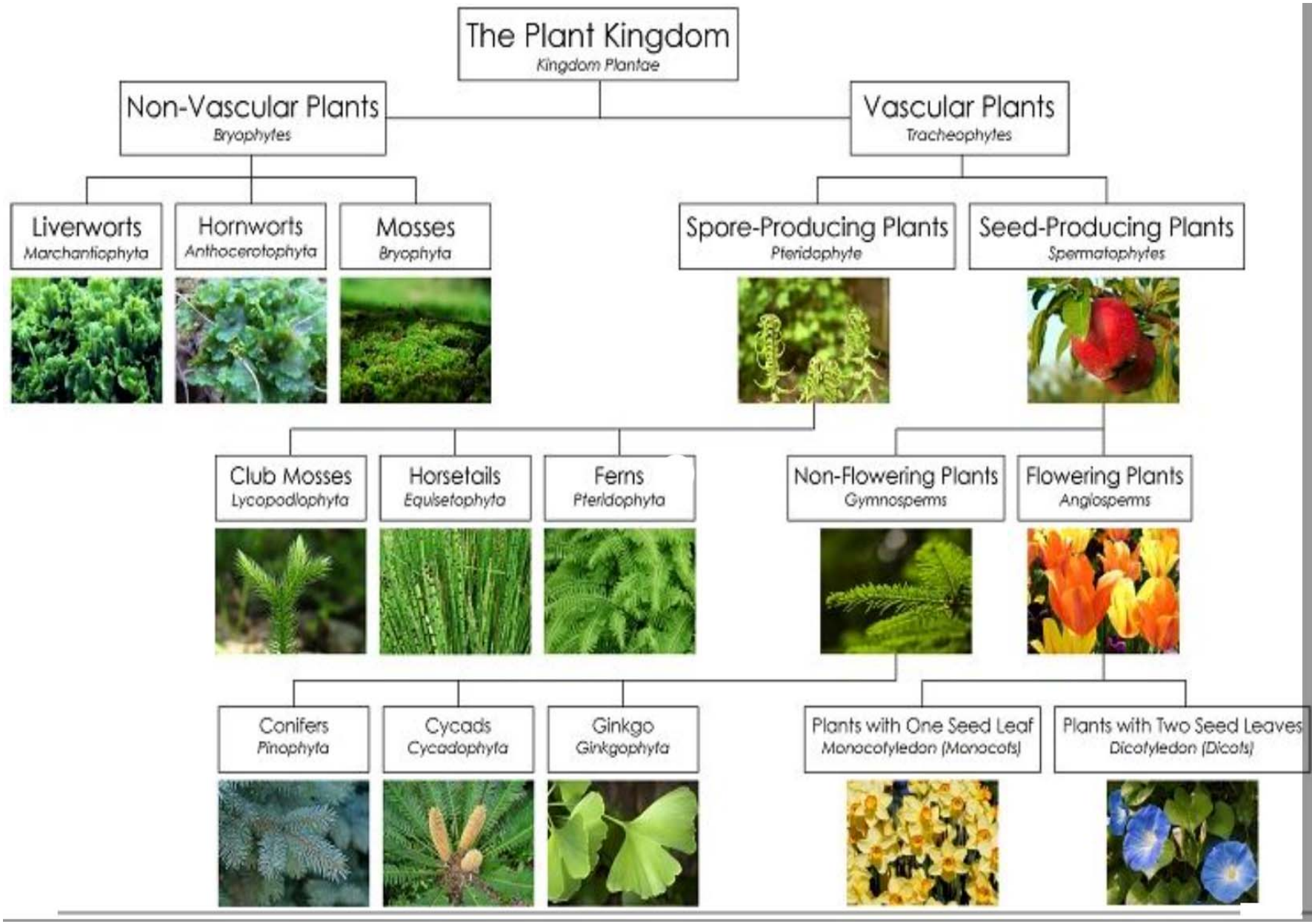
Mendel's studies of peas revealed the laws of inheritance

Taxonomy

علم التصنيف

Study of the classification of the plants.

دراسة تقسيم و تصنيف الانواع النباتية المختلفة



Plants are diverse

Ferns
سرخس

Grasses

Broad-leafed plants

Flowering Plants

Seed Plants

Clubmosses
أرجل الذئبيات

Cone-bearing plants

Vascular Plants

Mosses
حزازيات

Liverworts
Marchantiophyta
النباتات الكبدية

Land Plants
Non Vascular

Green algae

Plants have evolved the ability to thrive in diverse land habitats.

أهمية دراسات علم النبات المختلفة

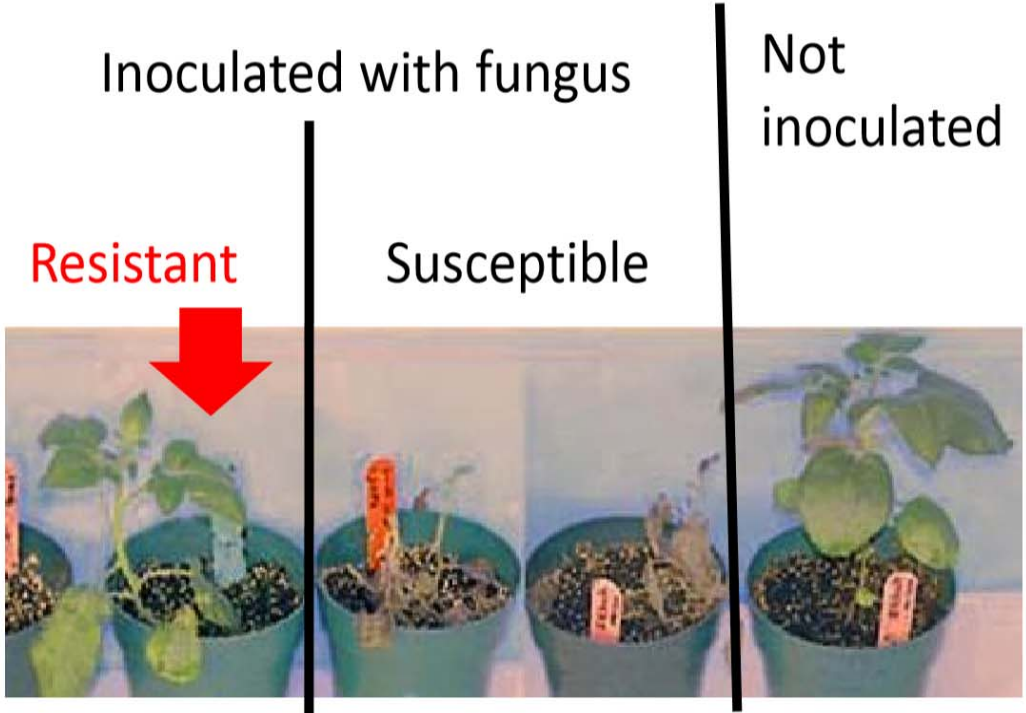
By developing plants that

- are drought or stress tolerant
  مقاومة للجفاف
- require less fertilizer or water
  تتطلب كميات اقل من الاسمدة والماء
- are resistant to pathogens
  مقاومة للأمراض
- are more nutritious
  مغذية اكثر

أهمية دراسات علم النبات المختلفة

Geneticists have identified the gene conferring resistance and are introducing it into edible varieties.

حدد علماء الوراثة الجينات التي تمنح المقاومة وتم ادخالها في الأصناف القابلة للأكل.



The plant on the left carries the resistance gene and is free from disease symptoms.

Plant biologists study ways to keep plants fresh after harvesting

After harvesting, fruits soften, ripen, and eventually rot.

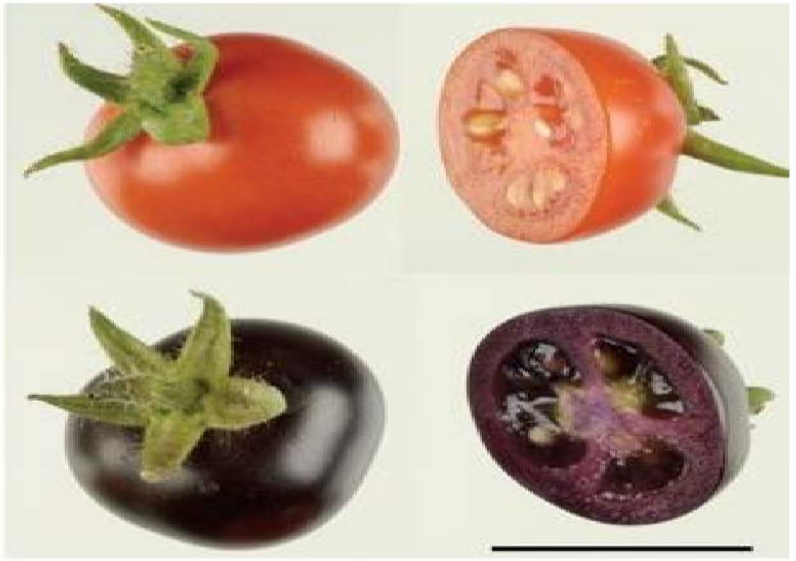
These processes make the fruit less appealing and affect the nutritional qualities.

أهمية دراسات علم النبات المختلفة

Iron-enriched rice

()

Vitamin A–enriched rice



Wild-type (top) and antioxidant-enriched tomatoes

أهمية دراسات علم النبات المختلفة

- Plant surfaces and inventions.
- الاسطح النباتية و محاكاتها في الاختراعات والصناعات الحديثة

More reasons .....?

- To help conserve endangered plants and threatened environments

  تساعد في الحفاظ على النباتات والبيئات المهددة بالانقراض

- To learn more about the natural world

  معرفة المزيد عن العالم الطبيعي

- To enhance the abilities of plants to provide us with food, medicines, and energy

  لتعزيز قدرات النبات لتزويدنا بالغذاء والأدوية والطاقة

PLANT CELL

CELLULAR COMPONENTS & PROCESES

What is Life?

Life is a characteristic that distinguishes objects that have self-sustaining biological processes, other things are classified as inanimate.

Properties of life .....

- Cellular structure (unit of life)
- Metabolism (perform function) الأيض
- Movement (intracellular)
- Homeostasis التوازن الداخلي
- Organization التعضي
- Growth (enlargement) النمو
- Adaptation / Evolution (long term adaptation) التأقلم
- Behavior (response to stimuli) الاستجابة للمستحث
- Reproduction (avoid extinction) التكاثر
- Pass on their traits to offspring (heredity)

The cell theory states:

1. The cell is the basic unit of structure and function of all living things.
2. All living things are composed of one or more cells.
3. All cells come from pre-existing cells.
4. The cells of all living things carry on similar chemical activities.
5. All cells carry on their metabolic activities in organelles.

الخلية هي الوحدة الأساسية للبنية والوظيفة لكل الكائنات الحية.

تتكون جميع الكائنات الحية من خلية واحدة أو أكثر.

كل الخلايا تأتي من خلايا سالفة (موجودة مسبقا).

مماثلة. خلايا جميع الكائنات الحية تؤدي أنشطة كيميائية

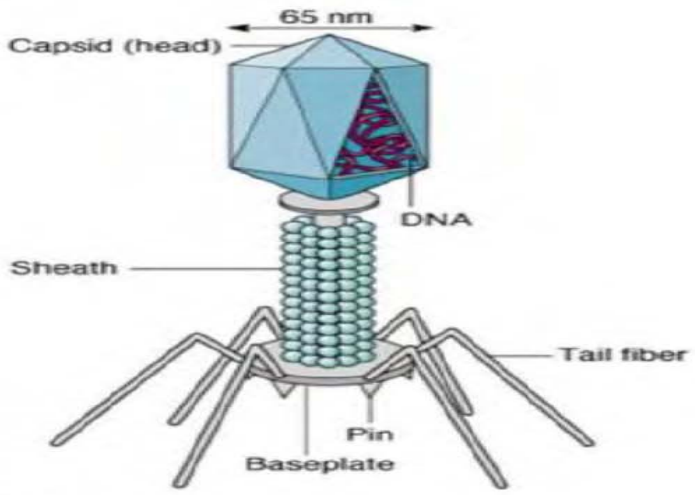
جميع الخلايا تؤدي أنشطة أيضية في العضيات.

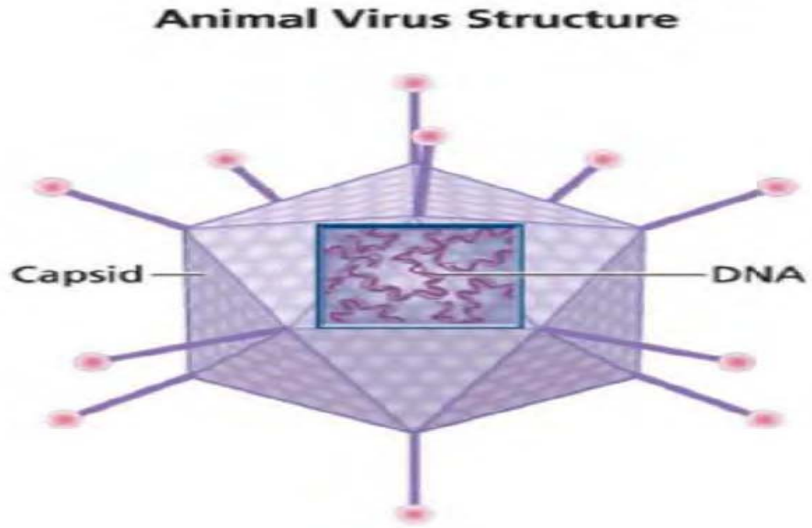
A virus and a prion are not considered cellular nor living organisms because of their simplicity (only Nucleic acid surrounded by a protein coat in the case of a virus or only a single strand of protein in the case of a prion). Neither exhibit characteristics of life unless they are in a host cell and cannot replicate outside the host cell.

prion (proteinaceous infectious particle)

لا يعتبر الفيروس والبريون كائنات حية خلوية بسبب بساطة تركيبها (فهي حمض نووي محاطة بغطاء من البروتين في حالة الفيروس ، أو فقط شريط واحدة من البروتين في حالة بريون). ليس لها خصائص الكائنات الحية إلا إذا كانت في الخلية المضيفة (العائلة) ولا يمكن ان تتضاعف خارج الخلية المضيفة.

بريون (عبارة عن جسيمات بروتينية معدية)

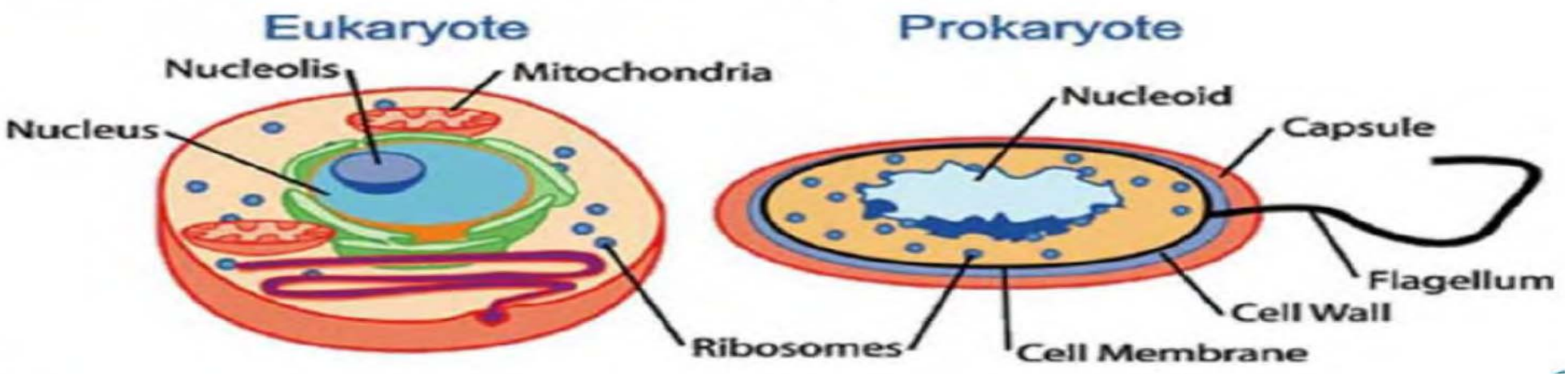




There are two types of cells:

1. **Prokaryotic- cells that DO NOT have a well-defined NUCLEUS or other cell ORGANELLES**
2. **Eukaryotic- cells have a NUCLEUS with nuclear membrane & cell ORGANELLES**

بدائية النواة – خلايا ليس لها نواة واضحة المعالم ولا عضيات خلوية أخرى
حقيقية النواة – خلايا لديها نواة مع الغشاء النووي وعضيات خلوية



Prokaryote cells

Oldest of cell types, first appeared 3.5 billion years ago.

1. Cells that do not contain a nucleus.
2. DNA is not contained in an internal structure.
3. Have a cell membrane.
4. Do not have membrane-bound organelles.
5. Generally smaller and simpler than eukaryotic cells.
6. Can live in hostile environments. Halophiles and thermophiles that are archeabacteria.
7. Very diverse in their metabolic process: obligate aerobes (require O_2), obligate anaerobes (killed by O_2), and facultative anaerobes (can survive with or without O_2).

Example: Bacteria

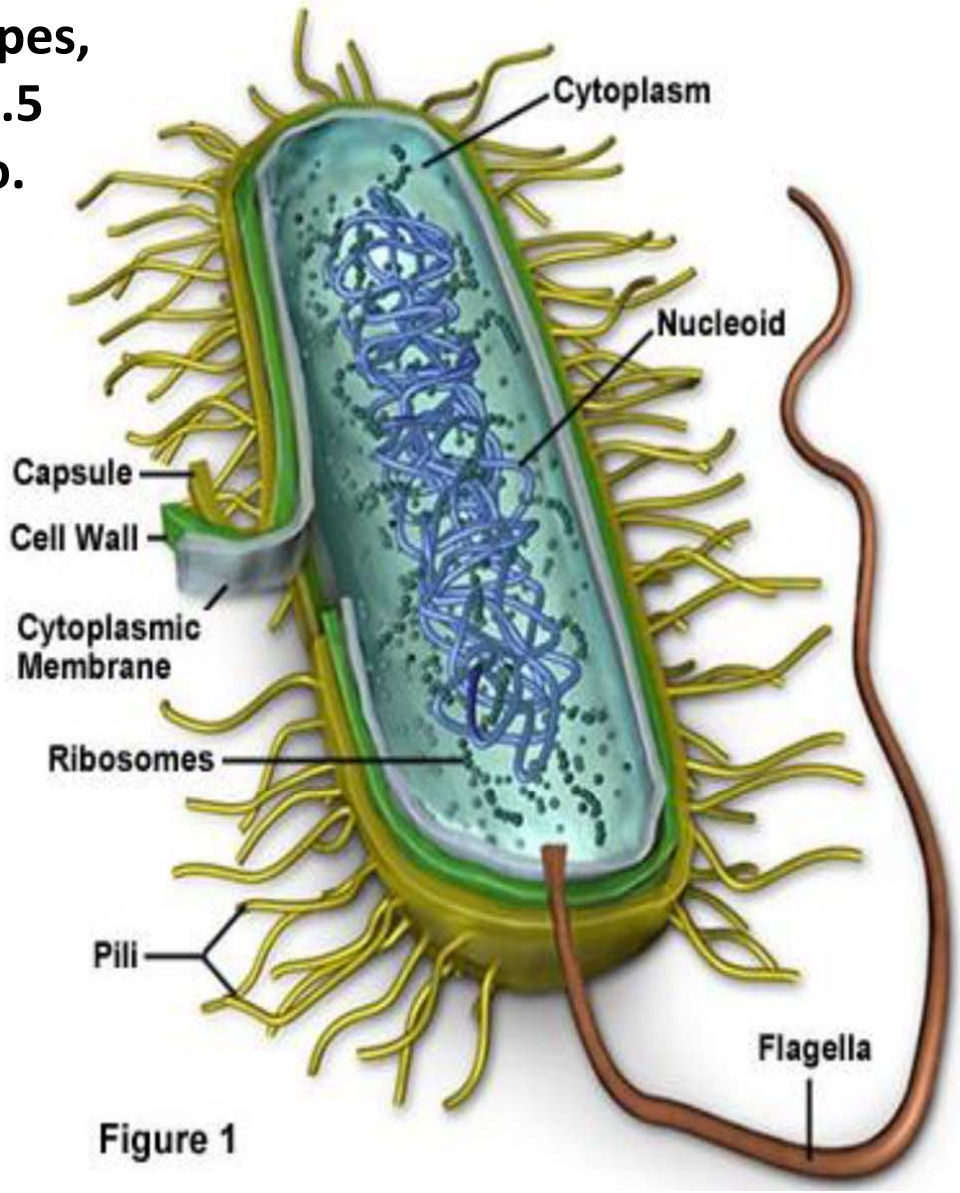


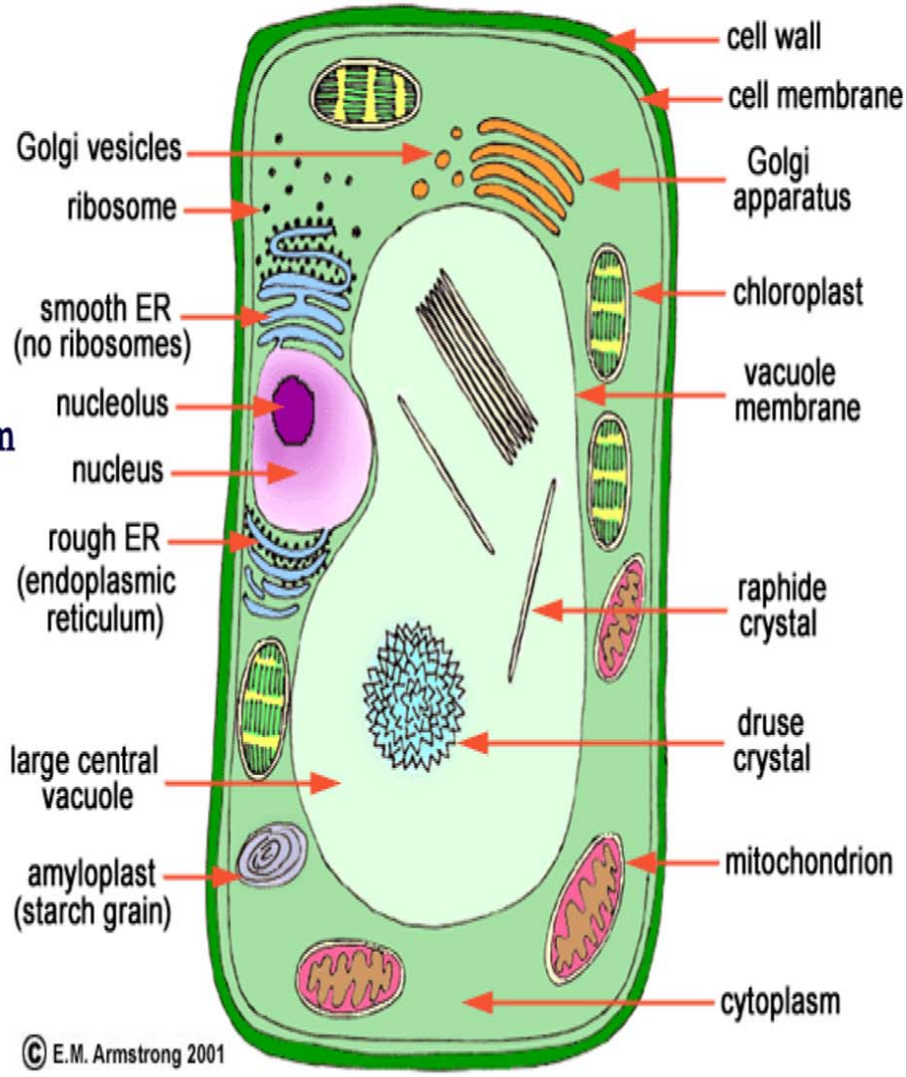
Figure 1

Eukaryote cells

1. Eukaryotes are organisms that have a nucleus in each cell.
2. The nucleus contains that cell's DNA.
3. Have a cell membrane.
4. Generally larger and more complex than prokaryotic cells.
5. Have complex membrane bound organelles (mitochondrion, chloroplast, Golgi apparatus, etc.)
6. Many eukaryotic cells are highly specialized.
7. Examples: Plants, animals, fungi, and protists.

First appeared in the fossil record 1.5 billion years ago.

- Plasma Membrane
- Nucleus
- Ribosomes
- Nucleolus
- Endoplasmic Reticulum
- Golgi Bodies
- Lysosomes
- Plastids
- Chloroplasts
- Mitochondria
- Vacuoles
- Microtubules
- Cytoplasm



Cell wall consists of:

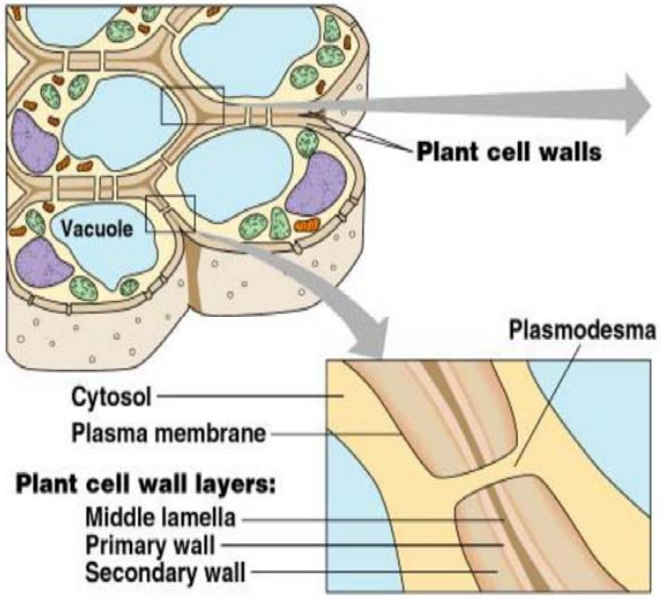
(1) Middle lamella – mostly pectin, cements adjacent cells together الصفيحة الوسطى معظمها بكتين ، تدعم وتربط الخلايا المتجاورة

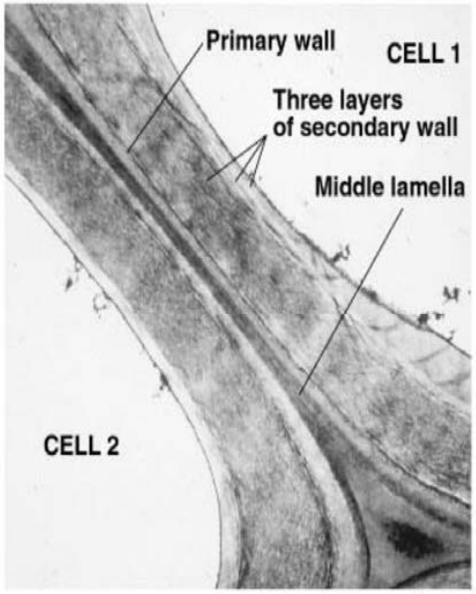
(2) Primary cell wall الجدار الخلوي الابتدائي

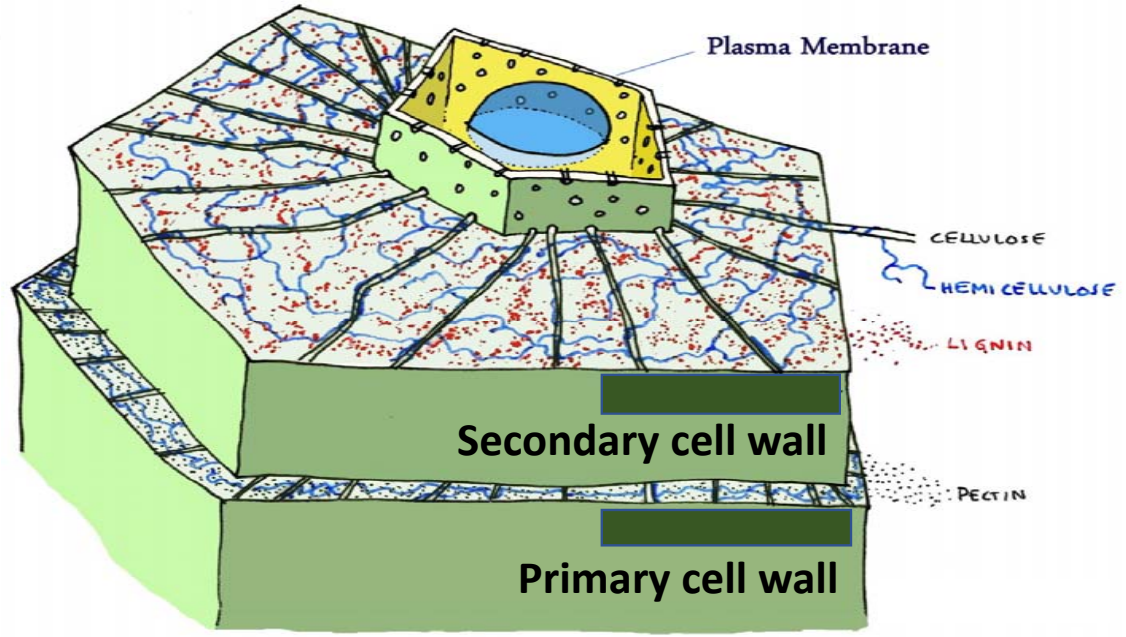
- Found in all plant cells في جميع الخلايا النباتية
- Cellulose matrix with hemicellulose, proteins, pectin, lignin, cutin, and wax. حشوة سليلوز مع هيميسيلولوز، والبروتينات....
- Characteristic of undifferentiated cells or ones that still are growing يميز الخلايا غير المتمايزة أو التي لا تزال تنمو

(3) Secondary cell wall

- Just inside primary cell wall مبطن لجدار الخلية الإبتدائي من الداخل
- Characteristic of mature cells يميز الخلايا البالغة (الناضجة)
- Comprised of hemicellulose and lignin مكون من هيميسيلولوز واللجنين



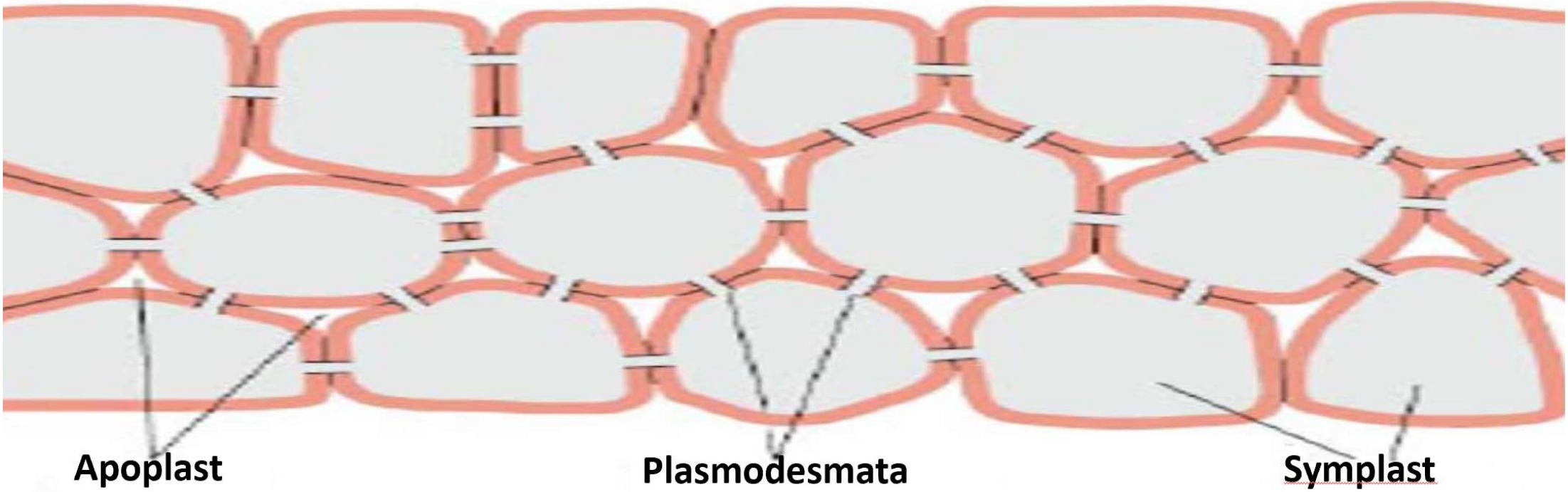




Connections between Cells:

Plasmodesmata singular form: plasmodesma)

are intercellular organelles found only in plant and algal cells. The plasmodesmata consist of pores, or channels, lying between individual plant cells, and connect the symplastic space in the plant. They can also be termed as "bridges" between two plant cells.



Cell Membrane or Plasma Membrane

- **The cell membrane's function is to form a barrier between the cell's inner and outer environment. It is selectively permeable meaning that it allows certain materials to pass through and prevents the movement of other through it.**

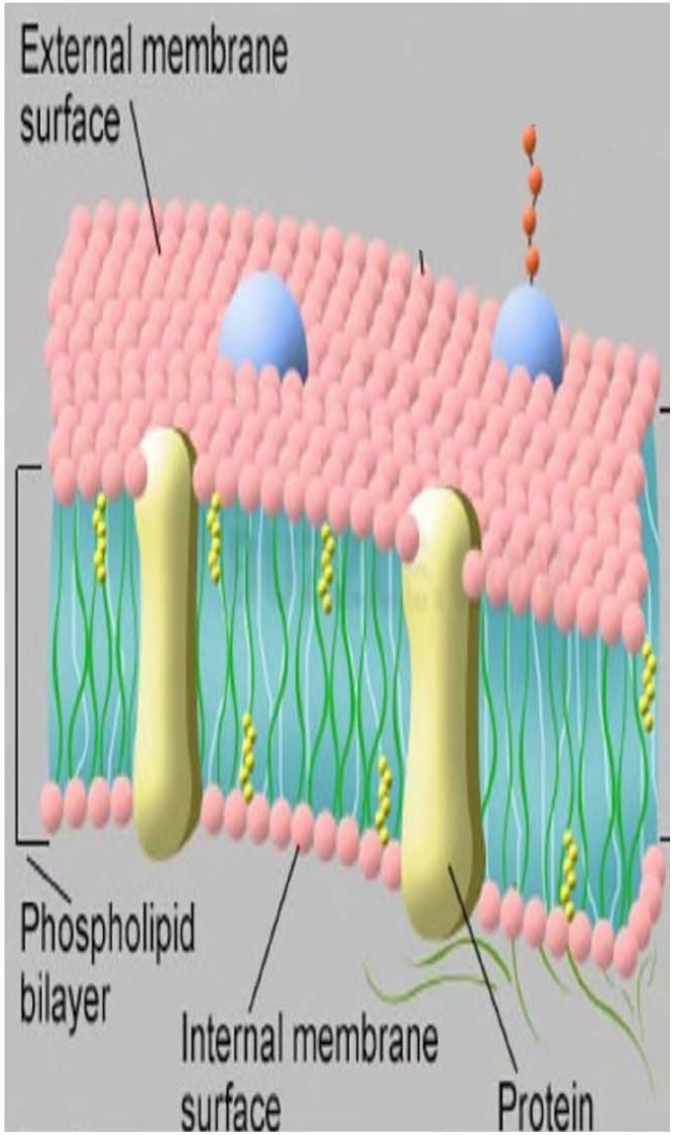
وظيفتة غشاء هي تشكيل حاجز بين البيئة الداخلية لخلية و البيئة الخارجية. ومن مميزاته النفاذية الاختيارية حيث يسمح لبعض المواد بالمرور ويمنع بعضها من خلاله حسب حاجة الخلية.

- **It is composed of a phospholipid bilayer with protein molecules (integral proteins) embedded within in the bilayer. Some of these proteins pass completely through both layers of phospholipids. There are also other types of molecules such as cholesterol and carbohydrates that are associated with the cell membrane's outer surface.**

يتألف من طبقتين من الدهون الفوسفورية وجزيئات البروتين (البروتينات المتكاملة) مغمورة في الطبقة الثنائية. بعض هذه البروتينات عابرة تماما من خلال طبقات الدهون الفوسفاتية. وهنالك أنواع أخرى من الجزيئات مثل الكوليسترول والكربوهيدرات التي ترتبط بالسطح الخارجي لغشاء الخلية.

- **The phospholipids and proteins are not in a static state, but have the ability to move from one location to another or change positions within the bilayer. Therefore the molecules which make up the membrane are described as being in a fluid state. The structure of the membrane is called the "fluid-mosaic model." The membrane is literally a mosaic of molecules that have the ability to move from area to area on the surface of the membrane.**

الدهون الفوسفاتية والبروتينات ليست في حالة ثابتة، لكن لها القدرة على الانتقال من مكان إلى آخر أو تغيير وضعها داخل الطبقة الثنائية. وتوصف الجزيئات التي تشكل الغشاء بأنها في حالة سائلة. ويدعى تركيب الغشاء بـ "نموذج الفسيفساء السائل" . الغشاء عبارة عن جزيئات فسيفسائية لديها القدرة على الانتقال من منطقة إلى أخرى على سطح الغشاء.

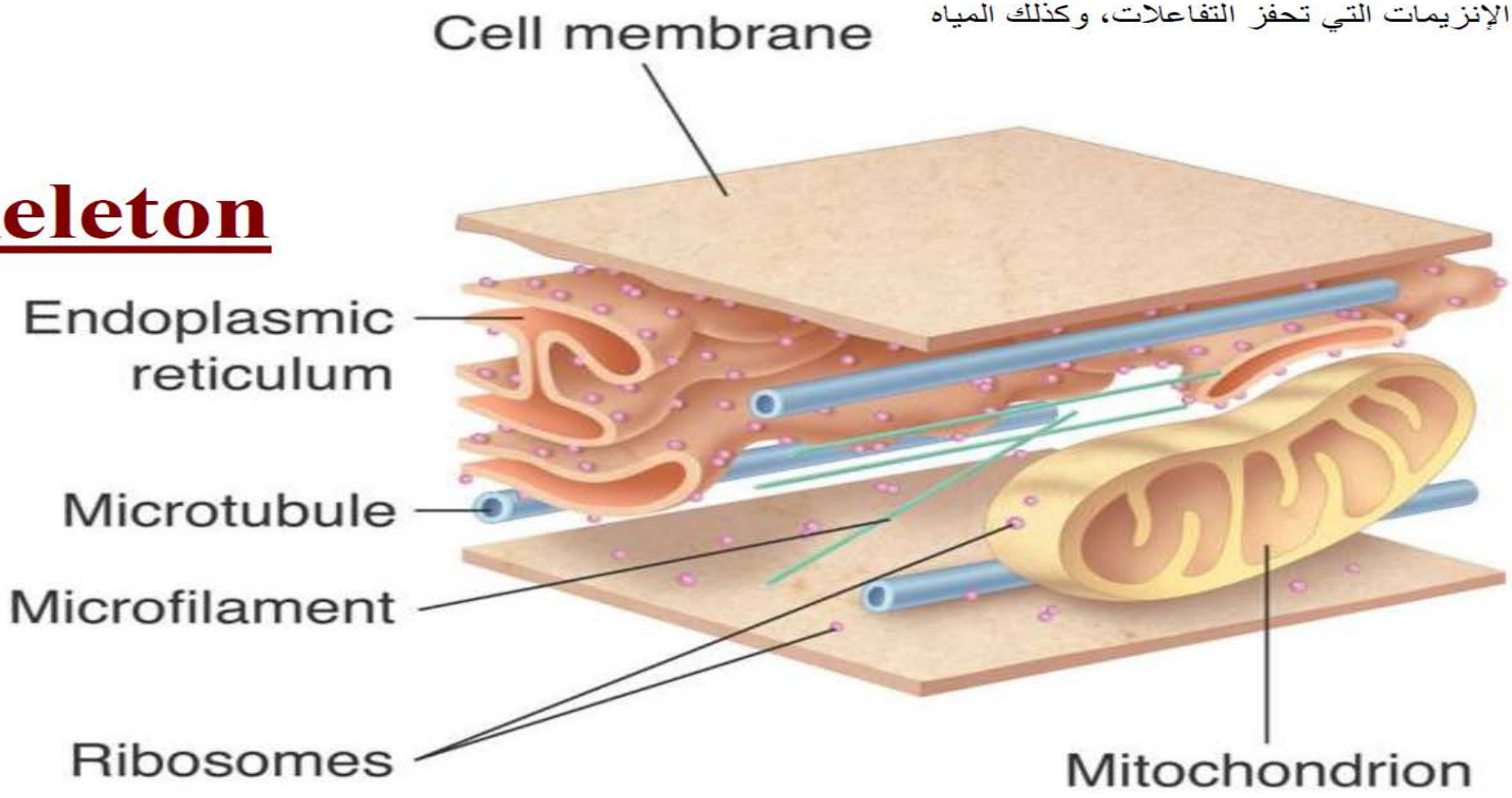


Cytoplasm

A watery solution made of cytosol that contains the cell organelles. Cytoplasm includes salts, an assortment of organic molecules, including many enzymes that catalyze reactions, as well as water

محلول مائي مكون من العصارة الخلوية يحتوي على عضيات الخلية. ويشمل السيتوبلازم الأملاح، مجموعة متنوعة من الجزيئات العضوية، بما في ذلك العديد من الإنزيمات التي تحفز التفاعلات، وكذلك المياه

Cytoskeleton



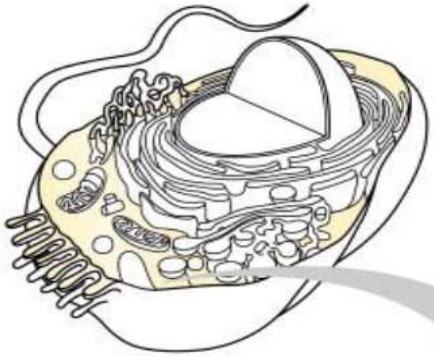
Cytoskeleton

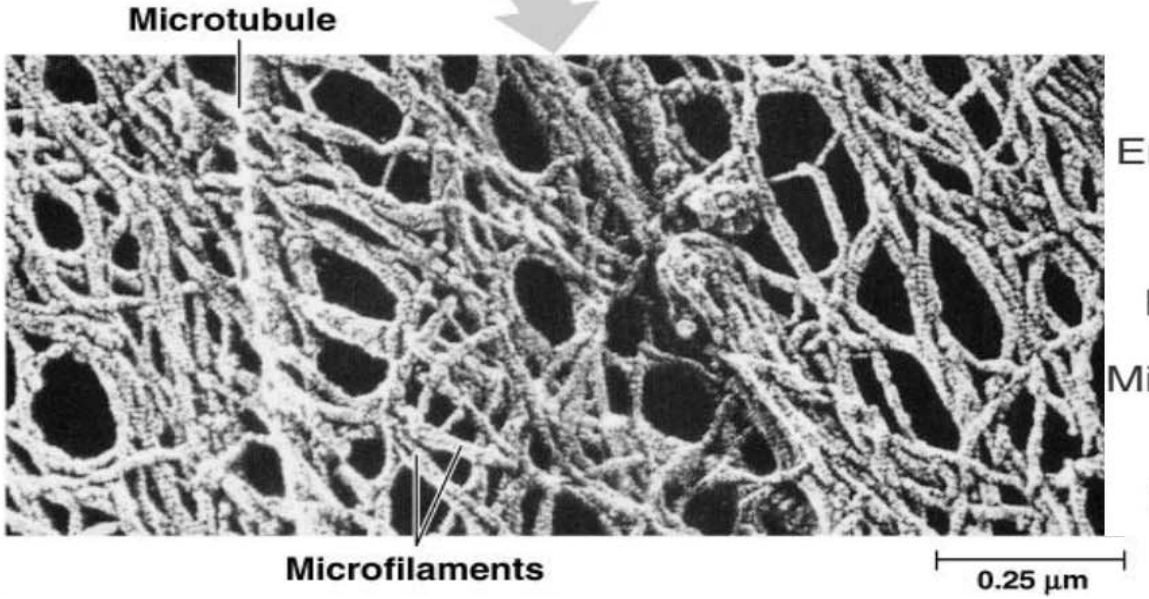
Cytoskeleton:

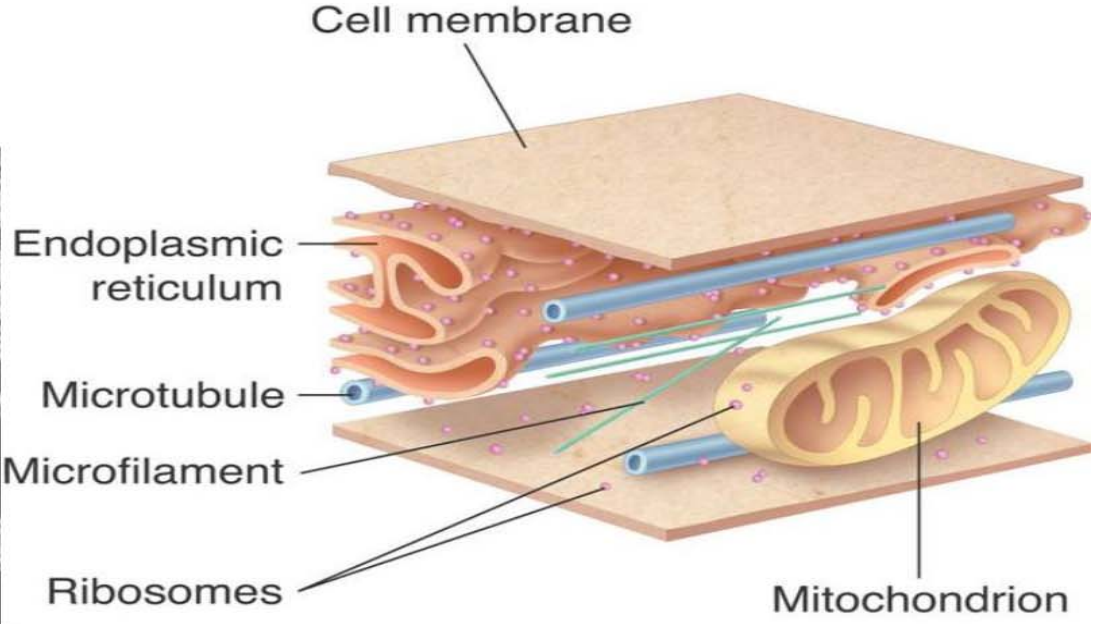
The cytoskeleton is a “framework” that supports the cell membrane and other cell structures within the cytoplasm.

الهيكل الخلوي:

الهيكل الخلوي هو "الإطار" الذي يدعم غشاء الخلية و هياكل الخلايا الأخرى داخل السيتوبلازم







Cytoskeleton

- Eukaryotic cells are given their shape and internal organization by the cytoskeleton.
- The cytoskeleton is made up of:
  Microfilaments and microtubules

Microfilaments

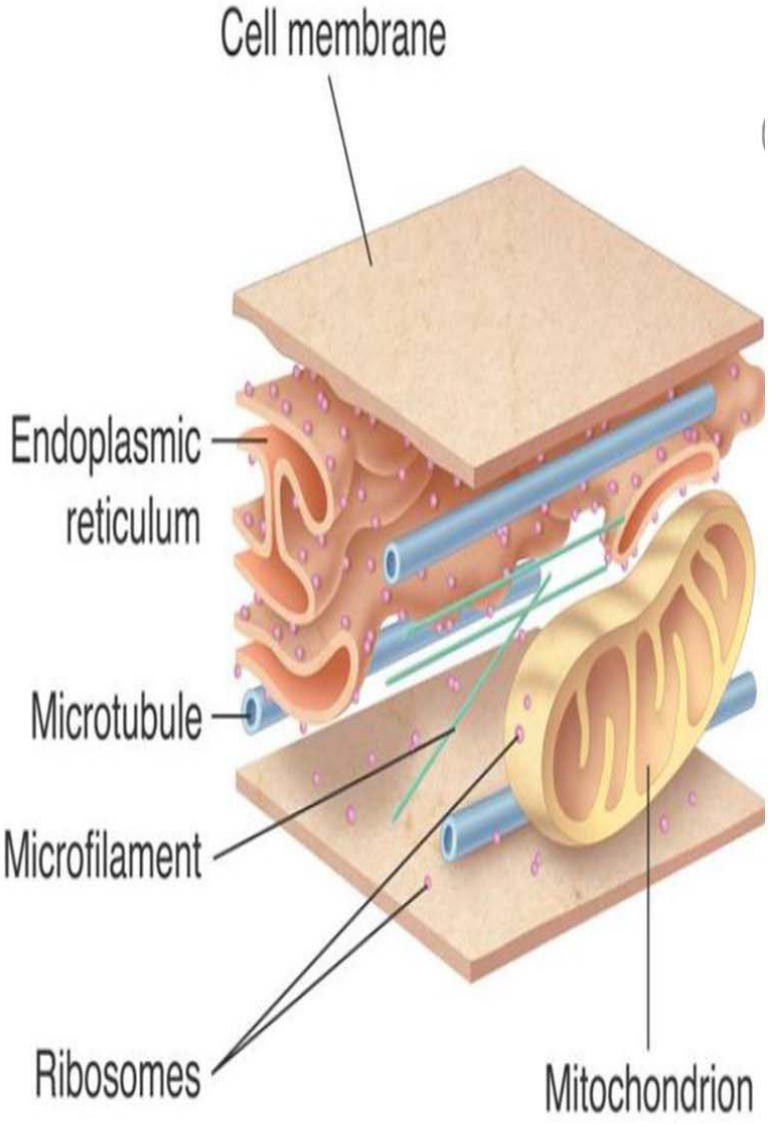
خيوط متناهية الصغر (خيوط الأكتين)

- are threadlike structures made up of the protein actin.
- form extensive networks in some cells.
- produce a tough, flexible framework that supports the cell.
- help some cells move.

Microtubules

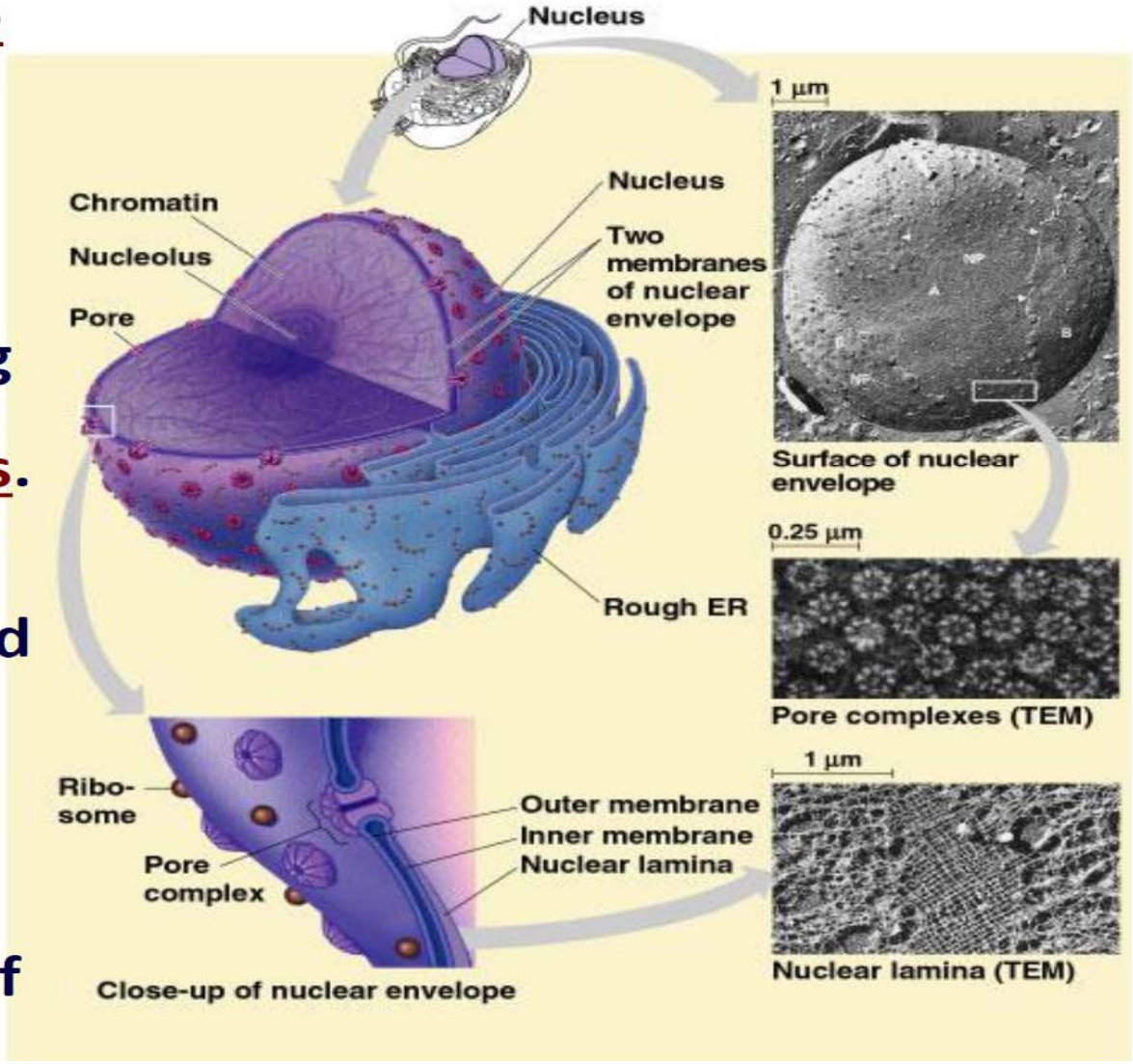
الأنابيب متناهية الصغر

- are hollow structures made up of proteins known as tubulins. maintain cell shape.
- are important in cell division.
- build projections from the cell surface-cilia and flagella-that enable some cells to swim rapidly through liquids.



Nucleus

The Nucleus is enclosed in an envelope which is a double membrane structure. It has pore complexes in the membranes which allow the movement of materials in and out of the structure. It contains DNA and proteins in the form of loose threads called chromatin. During mitosis or meiosis the chromatin super coils to form chromosomes. Self duplicating structure divides when the cell divides. The nucleolus is a structure composed of RNA located in the nucleoplasm. There maybe be more than one present and it functions in the production of ribosomes. The overall function of the nucleus is the regulation of cellular activities.



Cell Organelles

العضيات الخلوية

Plastids are double membranous cellular organelles found only in the plant cell.

عضيات خلوية ثنائية الغشاء توجد فقط في النباتات

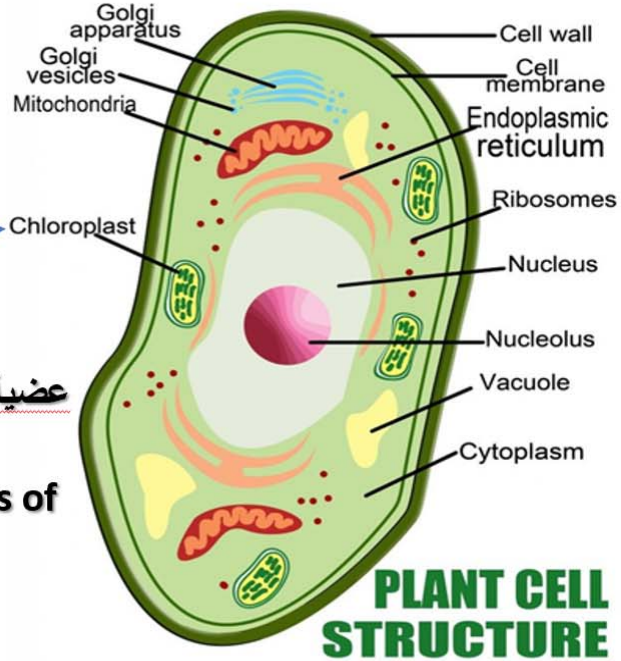
Plastid are meant for **photosynthesis and storage**

وظيفتها عملية البناء الضوئي و التخزين

Plastids are of three types - chloroplasts, chromoplasts and leucoplasts.

لها ثلاثة انواع: خضراة، ملونة ، و عديمة اللون

CHLOROPLASTS -البلاستيدات الخضراء

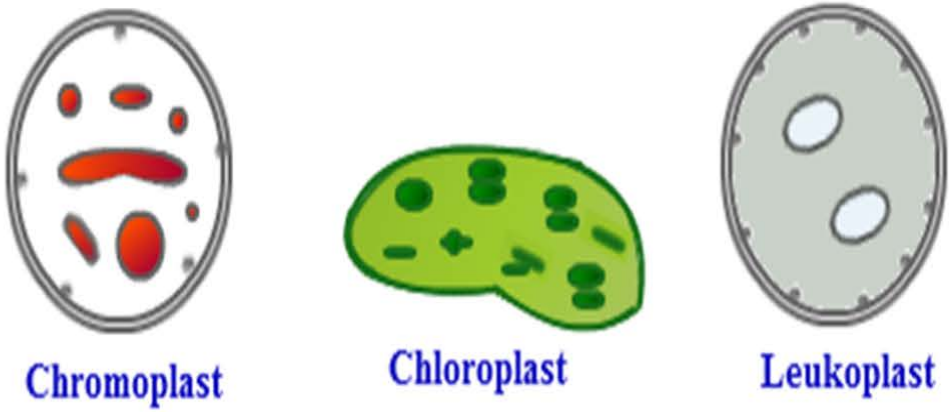


- ❑ Chloroplast occurs in the cytoplasm of the cellتتواجد في السيتوبلازم
- ❑ Chloroplast are elongated disc shaped cell organelles which contains chlorophyll. عضية قرصية الشكل ممدودة
- ❑ Chlorophyll كلوروفيل is present in green plants which helps them make food by the process of photosynthesis.
- ❑ Green plants takes carbon dioxide (CO_2) from the air, and water (H_2O) from the soil. The plants combine the CO_2 with the H_2O to make the sugar (Glucose ($C_6H_{12}O_6$)

- ❑ Photosynthesis is the conversion of light energy to chemical energy by chlorophyll in chloroplasts

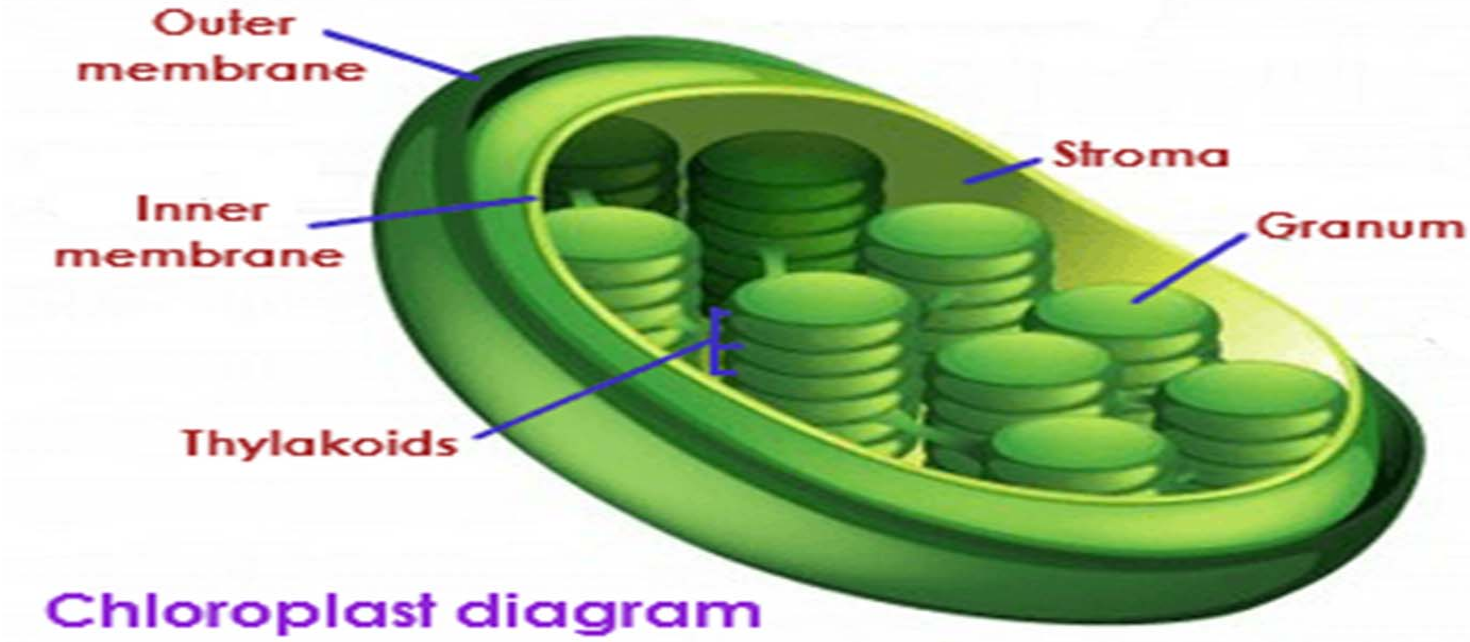
- ***Chromoplasts*** البلاستيدات الملونةare plastids which are found in
- fruits and are yellow, orange and red in color.

- ***Lecuoplasts*** البلاستيدات عديمة اللونare colorless plastids. They found
- in roots, seeds and underground stems.



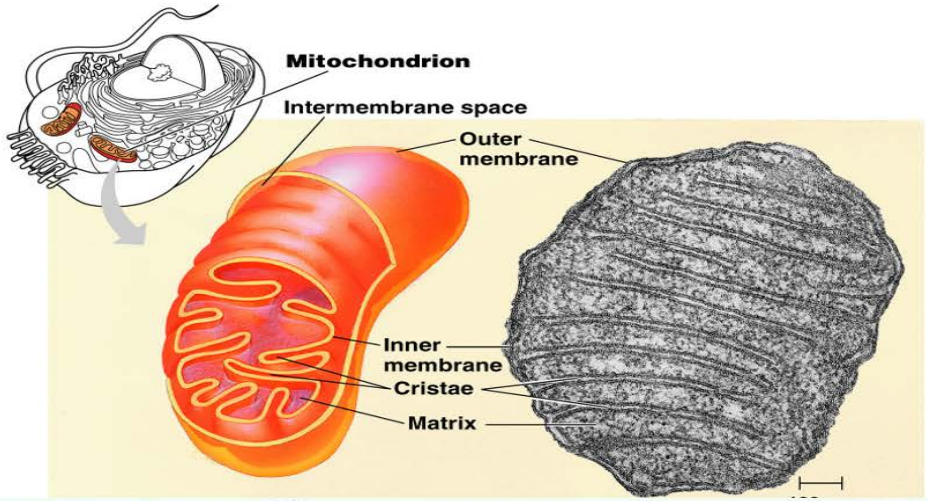
Chloroplast Structure

- The chloroplast are double membrane bound organelles البلاستيدات الخضراء تحاط بغشاء مزدوج
- The chloroplast contains flattened sacs called thylakoids. تحوي حويصلات مسطحة تسمى ثايلوكويدز
- The thylakoids are stacked one on top of another مكدسة فوق بعضها
- A stack of thylakoids is called a granum or grana كومة من الثايلوكويدز تسمى جرانا
- The space in between the grana is called the stroma المساحة بين الجرانا تسمى ستروما

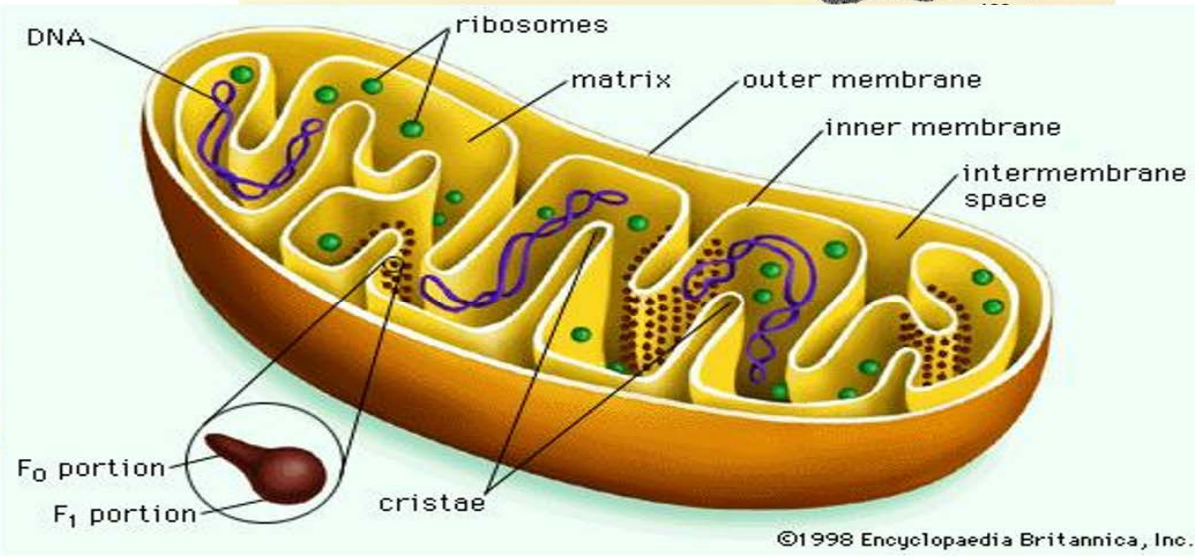


Chloroplast diagram

Mitochondria



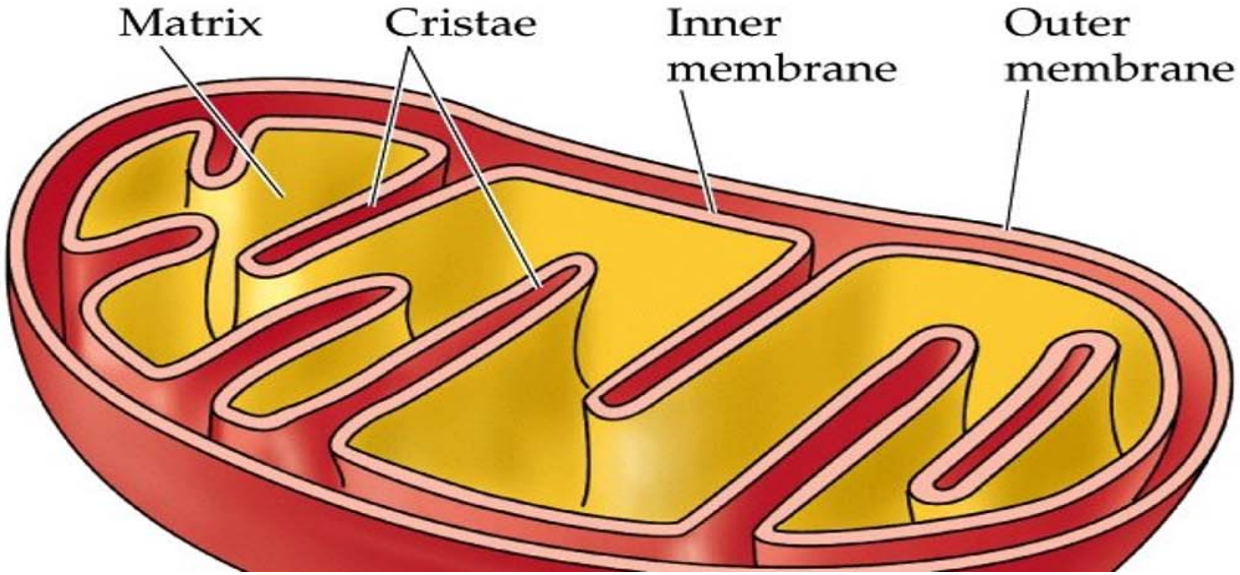
The mitochondria is a double membrane structure with an outer membrane which surrounds a highly folded inner membrane. It is the site of aerobic cellular respiration in which ATP is produced. The inner membrane has finger like projection called cristae which increase the surface area. The inner space within the mitochondrion is called the matrix and contains cytoplasm, ribosomes, and DNA. Mitochondrion are self replicating. They are found in both plant and animal cells and are sometimes called "the powerhouse of the cell".



الميتوكوندريا تراكيب ذات غشاء مزدوج غشاء خارجي يحيط بغشاء داخلي كثير الثنيات. وهي موقع التنفس الخلوي الهوائي التي تنتج مركب الطاقة (أ تي بي). الغشاء الداخلي لديه ثنيات تدعى أعراف تزيد من مساحة السطح. ويسمى الفراغ الداخلي للميتوكوندريا بالحشوة ويحتوي على سيتوبلازم و ريبوسوم والحمض النووي. الميتوكوندريا قادرة على التكاثر الذاتي. توجد في كل الخلايا النباتية والحيوانية وتسمى أحيانا "بيت الطاقة للخلية".

In Summary

The mitochondria is a double membrane structure
The mitochondria occurs in cytoplasm.
The inner membrane of the mitochondria has finger like projection called cristae
The mitochondria produces energy in the form of ATP.
The mitochondria is also called as power house of the cell



Golgi Apparatus (Dictyosome)

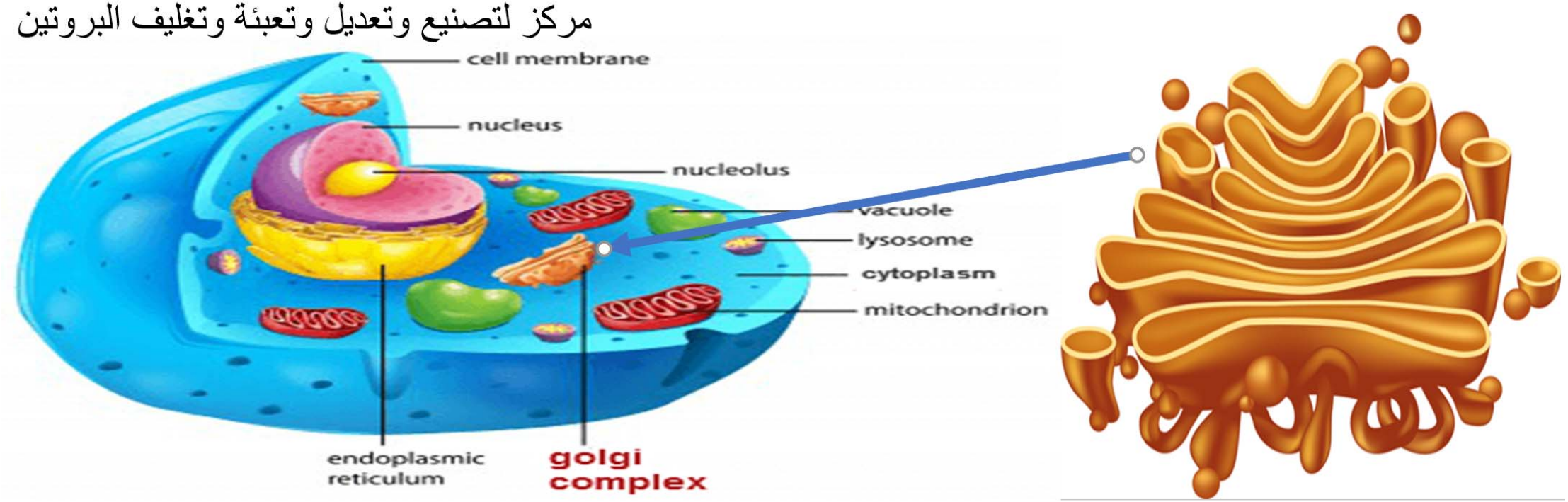
The Golgi apparatus is single membranous cell organelles occurs in cytoplasm. احادية الغشاء

The Golgi apparatus appears as a series of flattened, stacked, membrane sacs. جهاز جولجي

عبارة عن سلاسل من أكياس غشائية مفلطحة مكدسة فوق بعضها

The Golgi apparatus is the center for manufacturing, modifying, and packaging of protein.

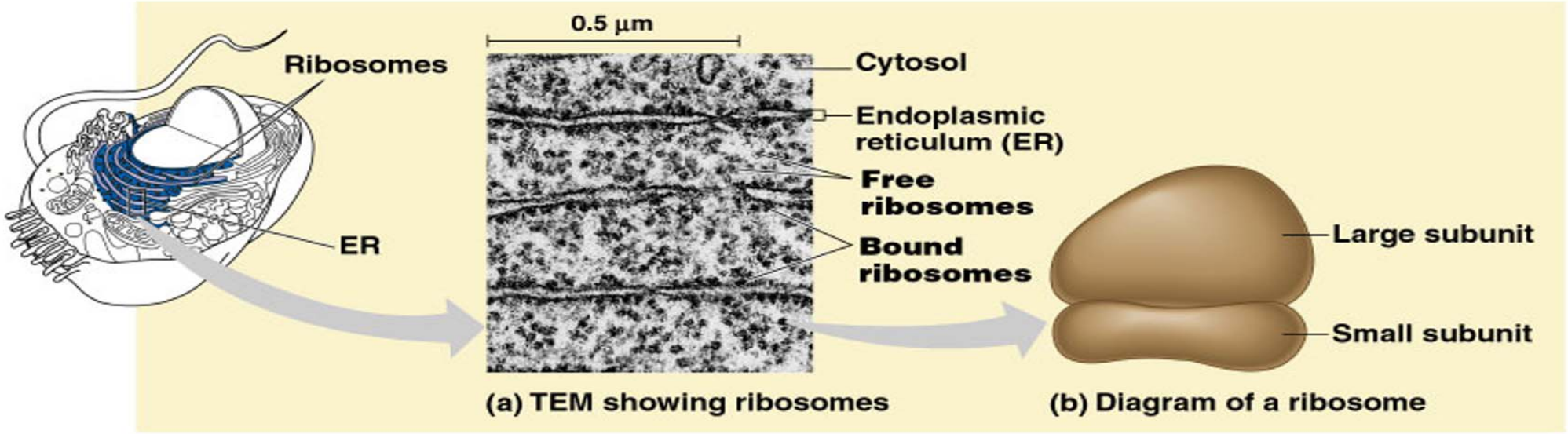
مركز لتصنيع وتعديل وتعبئة وتغليف البروتين



Ribosomes

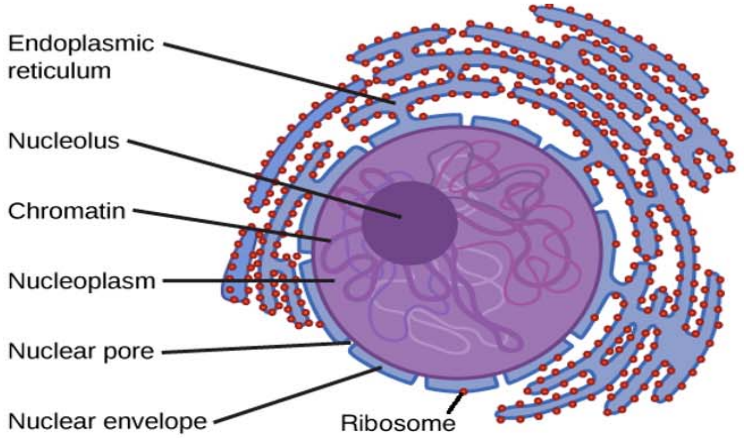
Ribosomes are the structures within the cell which read m-RNA and assembles amino acids into polypeptide chains. They are found free floating in the cytoplasm or attached to the nuclear envelope or the rough endoplasmic reticulum. They are found in all prokaryotic and eukaryotic cell types. They are composed of two subunits. Prokaryotic cells have smaller ribosomes (70s) and eukaryotic cells have the larger (80s) form.

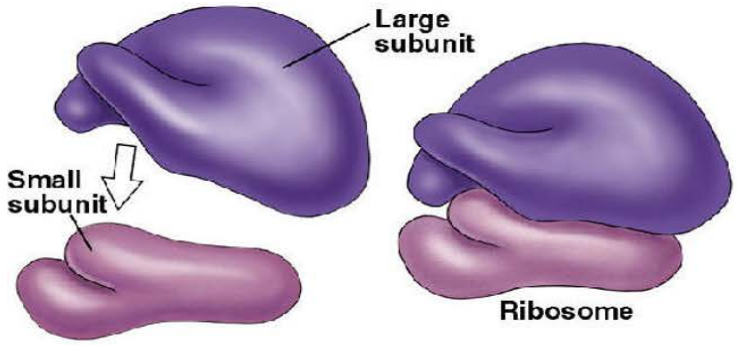
الريبوسوم تراكيب داخل الخلية تقرء الشفرة المحمولة على الرنا الرسول وتجمع الأحماض الأمينية في سلاسل عديد الببتيد لتكوين البروتين.
توجد في جميع أنواع الخلايا بدائية وحقيقية النواة عائمة حرة في السيتوبلازم أو على الغلاف النووي أو الشبكة الإندوبلازمية الخشنة.



In Summary

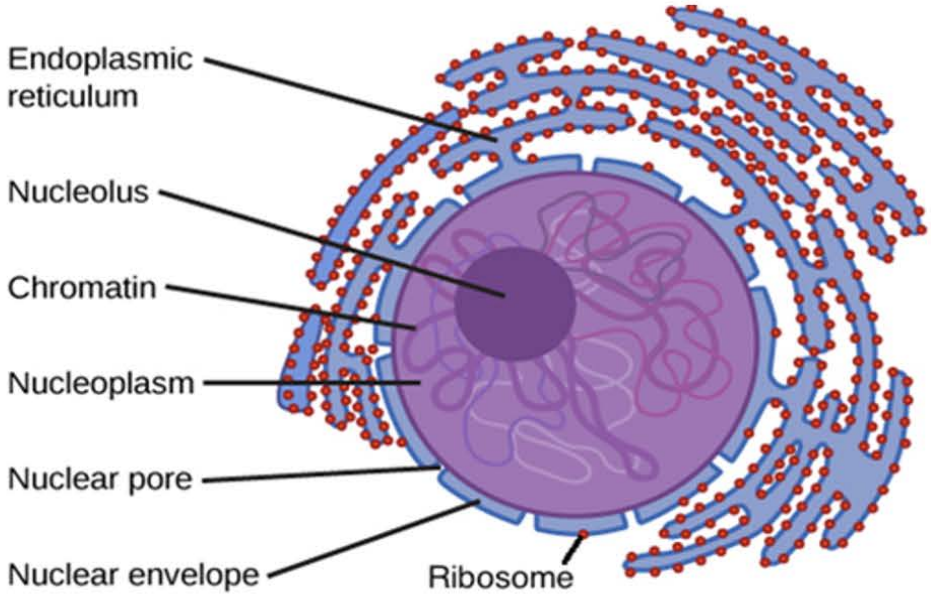
- Ribosomes are found freely floating in the cell or bound to Endoplasmic reticulum.
- Ribosomes are the site for protein synthesis of the cell.
- Ribosomes are composed of two subunits, a small subunit and a large subunit.
- Prokaryotic cells have smaller ribosomes (70s) and eukaryotic cells have the larger (80s) form

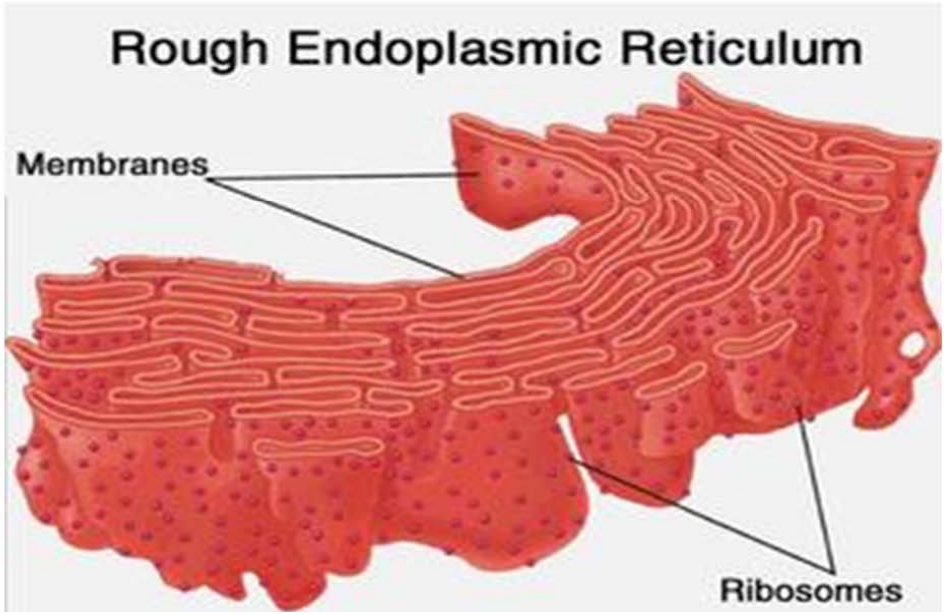




Endoplasmic Reticulum الشبكة الاندوبلازمية

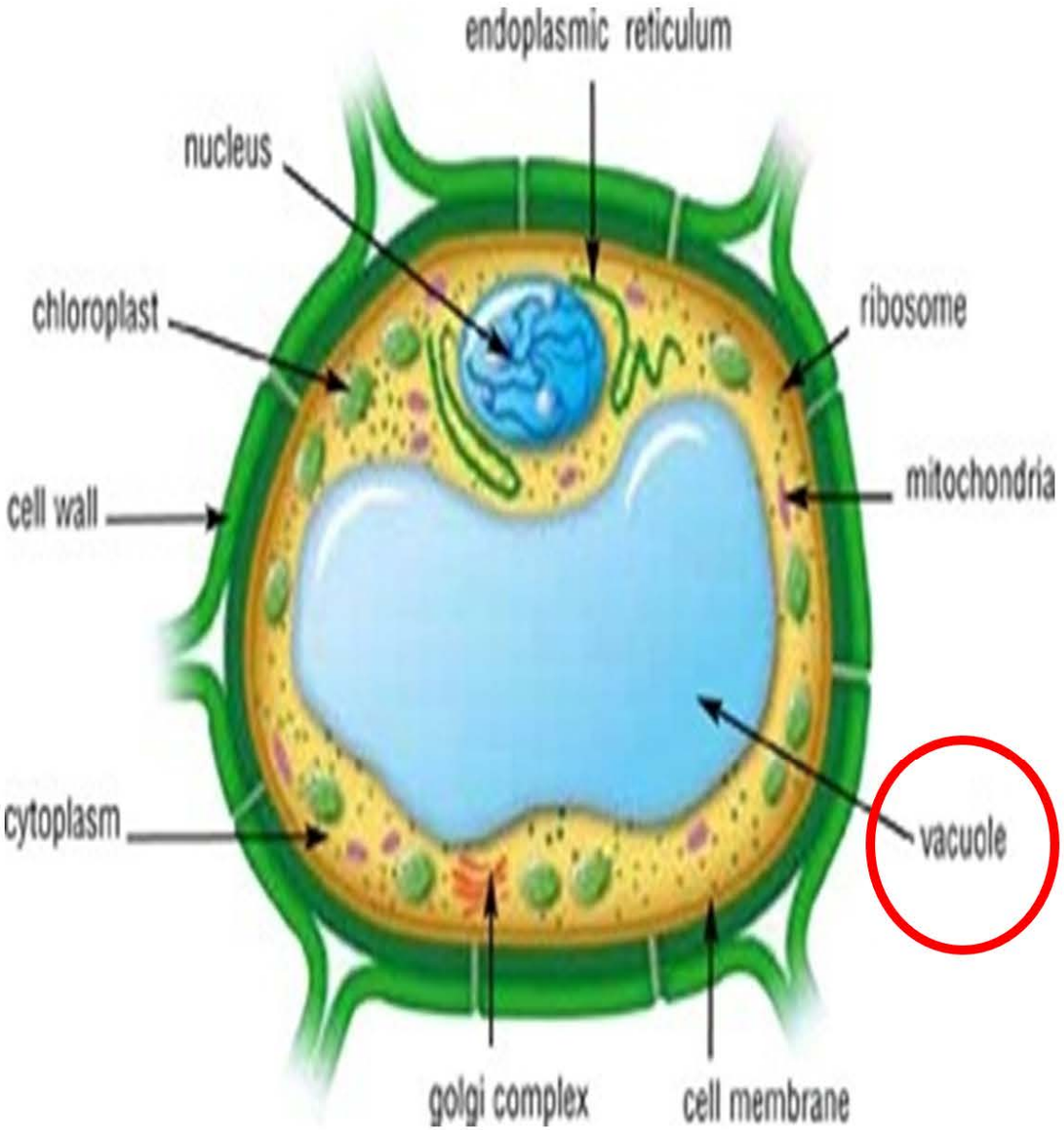
- The endoplasmic reticulum (ER) is a series of single membrane channels which run throughout the cytoplasm of the cell. سلسلة من القنوات احادية الغشاء
- There are two types of ER (Smooth ER and Rough ER) نوعان: ناعمة وخشنة
- The smooth endoplasmic reticulum (SER) is free of ribosomes and functions in lipid synthesis and metabolism of carbohydrates.
- هي ملساء خالية من الريبوسوم وظيفتها بناء الدهون والتمثيل الغذائي للكربوهيدرات، وكمركز إزالة السموم من الخلايا
- The rough endoplasmic reticulum (RER) has ribosomes bound to its outer membrane layer and is the active site of protein synthesis.
- خشنة لديه ريبوسوم مرتبطة بالطبقة الخارجية للغشاء وهي موقع نشط لتخليق البروتين





Vacuoles الفجوات

- **Vacuoles are storage areas of the cell. الفجوات مناطق التخزين**
- **Vacuoles also serve as the site of chemical digestion. وتكون بمثابة موقع الهضم الكيميائي داخل الخلية نفسها**
- **Vacuoles in animal cells are often small.**
- **The plant cells have a large centrally located vacuole which contains water and dissolved solutes.**
- **فجوات الخلايا الحيوانية غالبا تكون صغيرة. وفي الخلايا النباتية غالبا ما تكون كبير ومركزية وتحتوي على الماء والمواد المذابة**

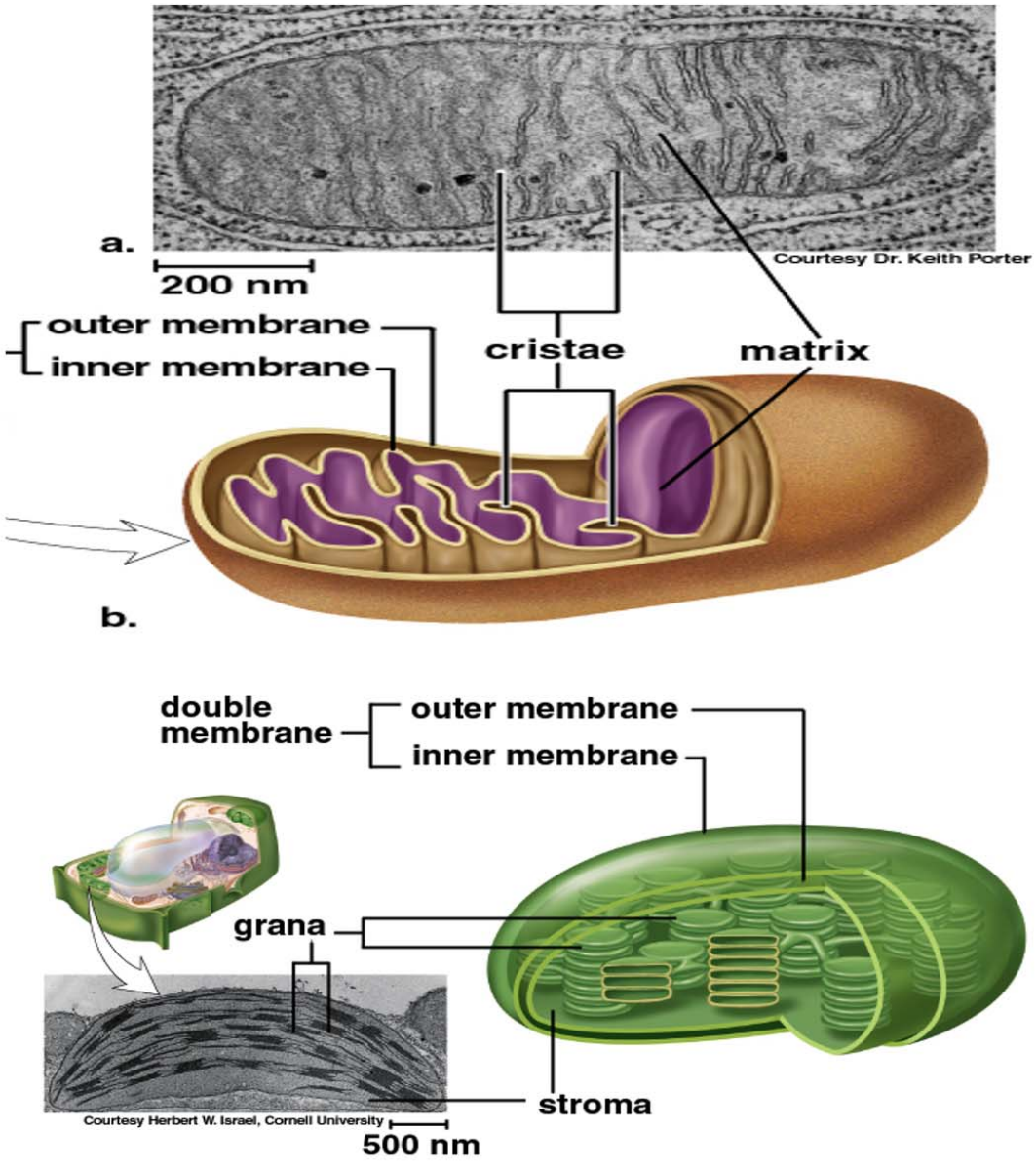


Self-Replicating Organelles
العضيات ذاتية الانقسام

لا تخضع لتحكم الخلية او النواة

- **Mitochondria**

- **Plastids**



The Cellular Basis of Reproduction and Inheritance

الأسس الخلوية للتكاثر و الوراثة

Cell Reproduction

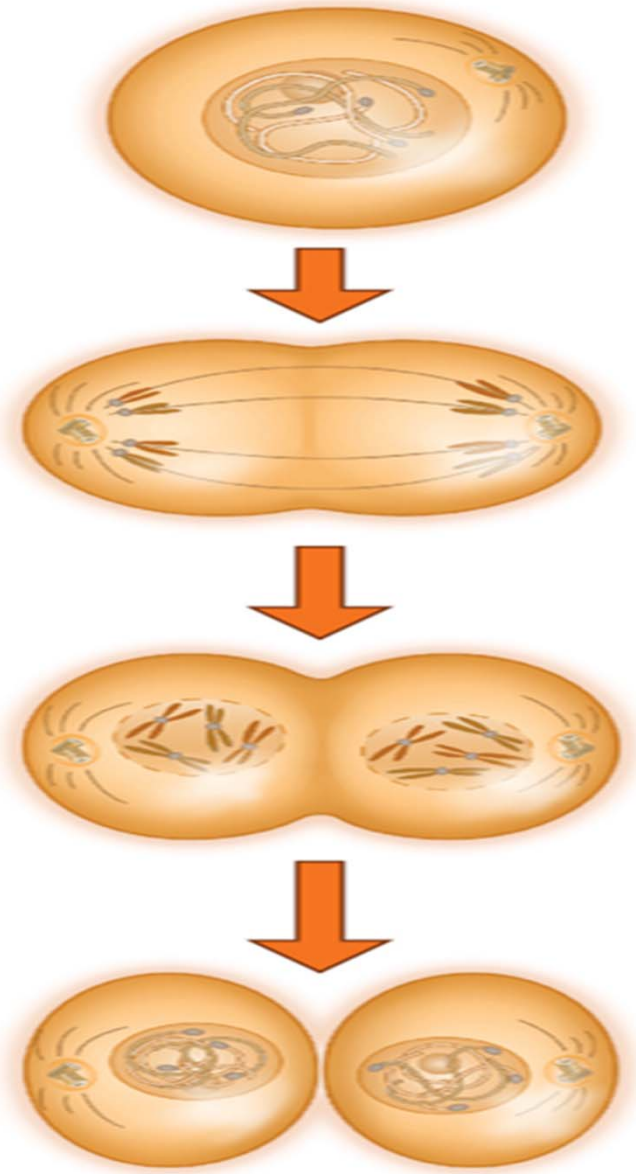
I. The Cell Cycle

A. Growth

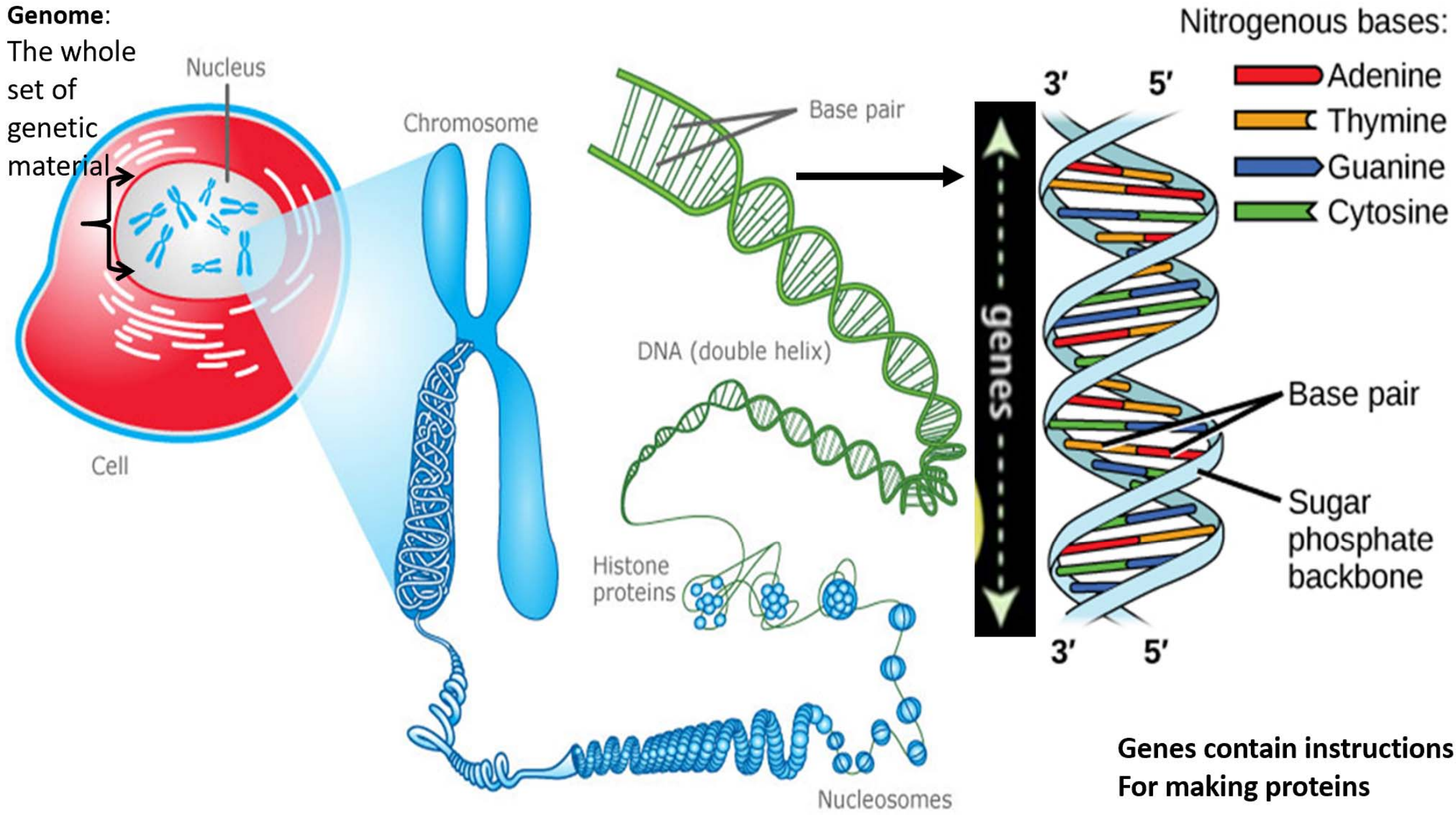
- Increase in cell size.

B. Division

- Production of new cells
- Two overlapping processes
  - Karyokinesis – nuclear division
  - Cytokinesis – cytoplasm division

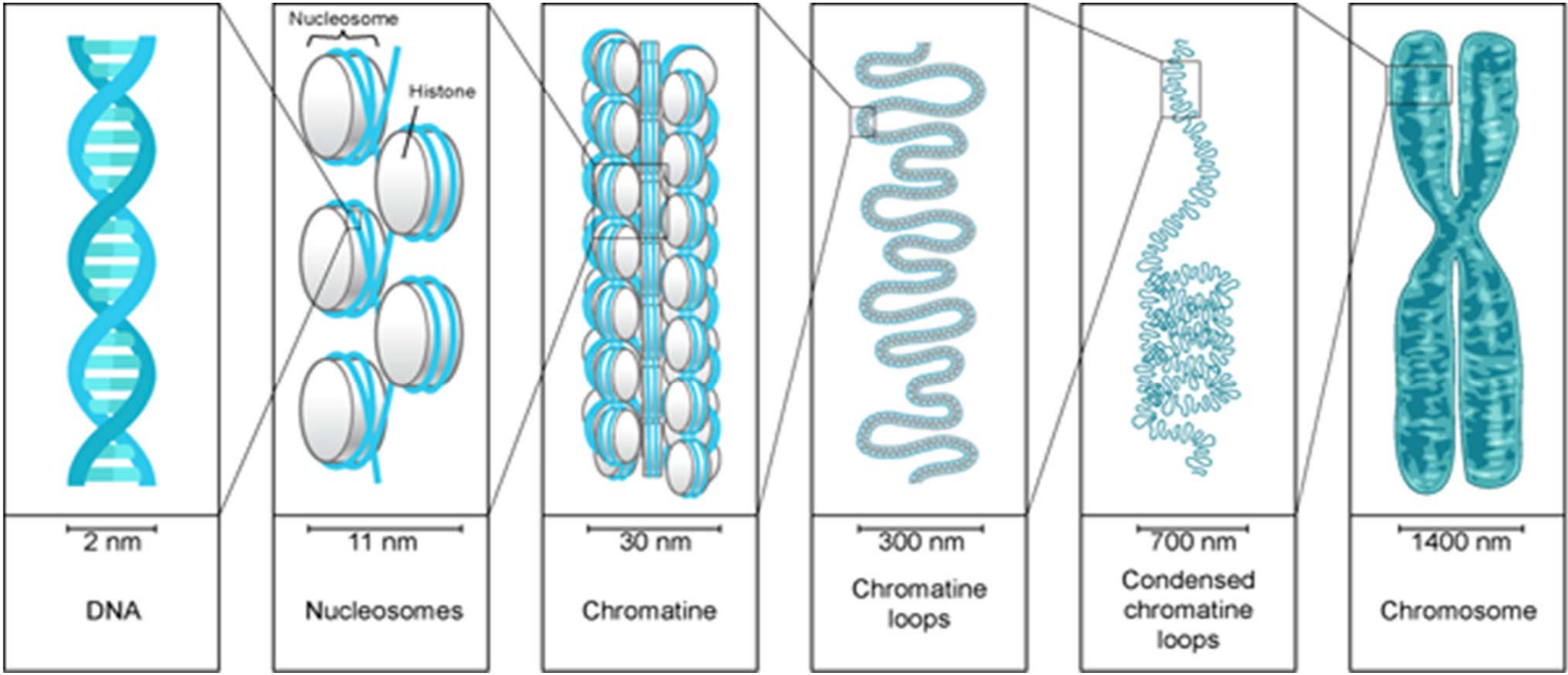


Genome:
The whole set of genetic material



Genes contain instructions For making proteins

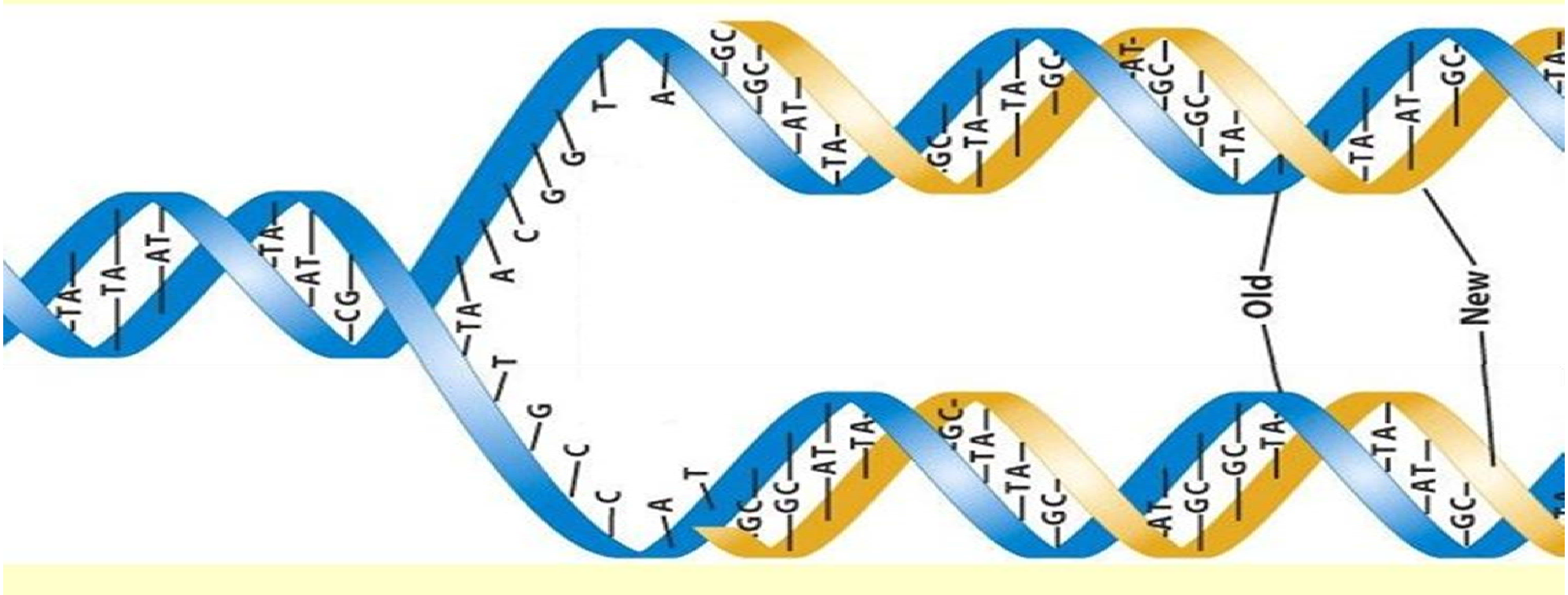
1. DNA in the form of Chromosomes
2. Chromosomes are composed of Chromatin which contain Nucleosomes containing Histones (Proteins the DNA is wrapped around) and DNA
3. They usually have more than 1 chromosome (Humans have 23 pairs)



DNA Replication نسخ أو تضاعف

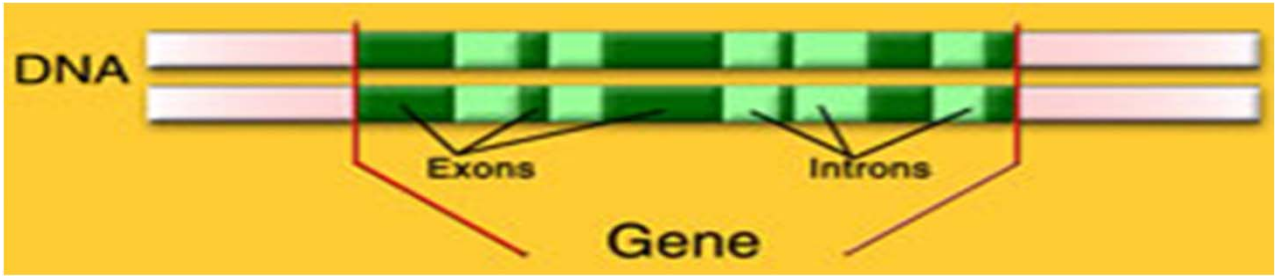
- **The process of the producing two identical DNA from one original DNA**

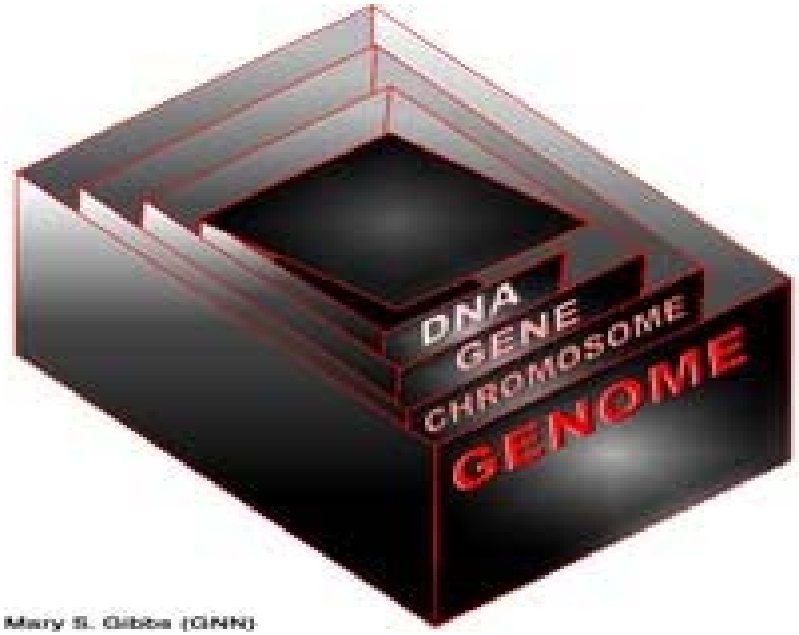
- **DNA replication occurs during cell division**
  تحويل أحد شريطي الحمض النووي إلى شريطين متطابقين.



- **Genome:** Complete complement of an organism's DNA. هو كامل تسلسل الدنا ضمن مجموعة وحيدة من الكروموسومات .
  - Includes genes (control traits) and non-coding DNA organized in chromosomes.
- **Gene**
  - a unit of heredity information determining the nature of a specific trait and have specific places on chromosomes. وحدة من المعلومات الوراثة تحدد طبيعة صفة محددة لها أماكن محددة على الكروموسومات.
  - a section of DNA that codes for a protein, tRNA or rRNA molecule

جزء من DNA يحمل شفرة لبروتين، الحمض الريبي النووي النقال أو جزيء الرنا الريباسي





- **Chromatin**
  - **Material in an active nucleus.**
    - **Submicroscopic "threads" consisting of 50% DNA and 50% supporting proteins.**

الكروماتين
المادة في النواة النشطة
«خيوط» مجهرية تتكون تقريبا من 50٪ DNA و50٪
بروتينات داعمة.

Structure of the Chromosome

Chromosome – a package of hereditary material with supporting proteins visible in condensed form during cell division.

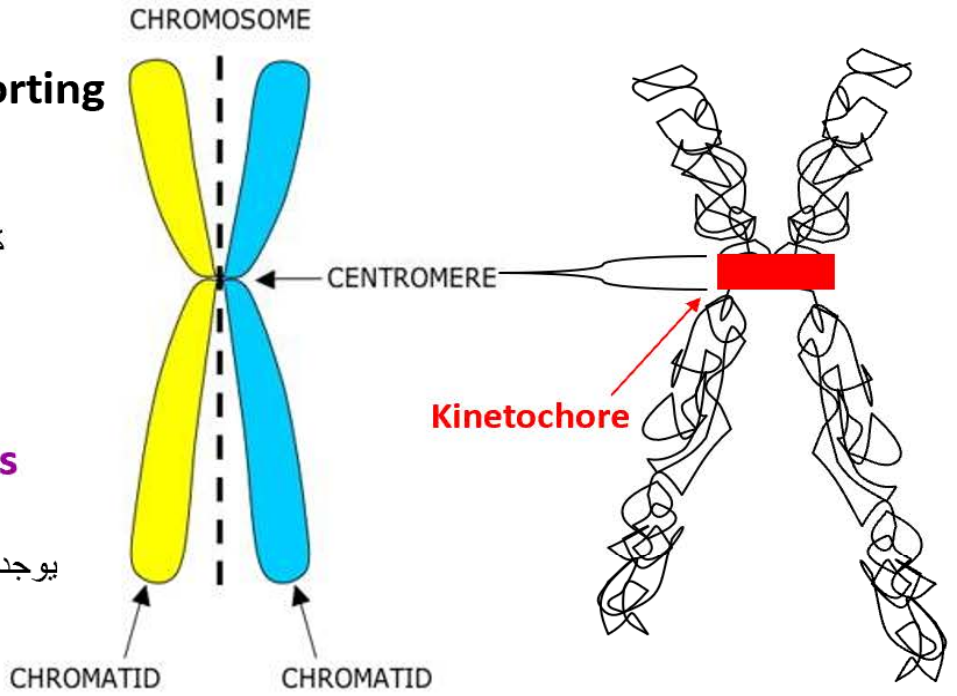
كروموسوم - مادة وراثية مع بروتينات داعمة ترى واضحة في شكل مكثف أثناء انقسام الخلية.

Chromatid – a single strand of DNA

خيط (شريط) مفرد من الحمض النووي(دنا)

During most of the life of a cell the chromosomes exist as a single strand called a"monad".

يوجد الكروموسومات خلال معظم حياة الخلية على شكل خيط (شريط) مفرد



Sister chromatids have identical DNA

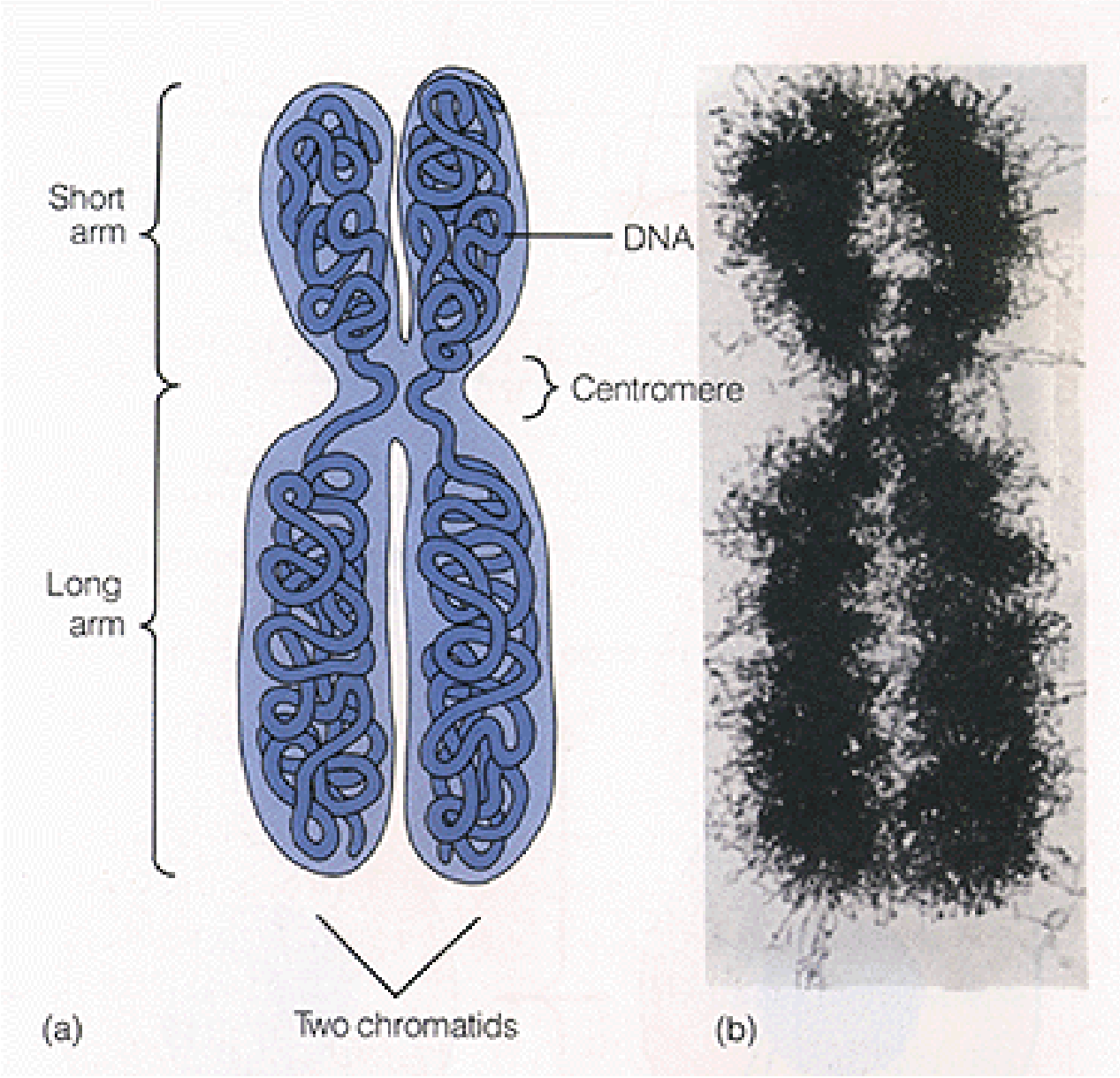
At the beginning of karyokinesis the single strand is replicated forming two identical chromatids attached to one another, a "dyad".

في بداية الانقسام النووي يتضاعف الشريط المفرد لتشكيل
كروماتيدين متماثلين يتصلان مع بعضهما ليتشكل الخيط الصبغي

Centromere

Kinetochore on centromere provides binding site for microtubules

- **Chromosomes are DNA wrapped tightly around proteins called histones.**



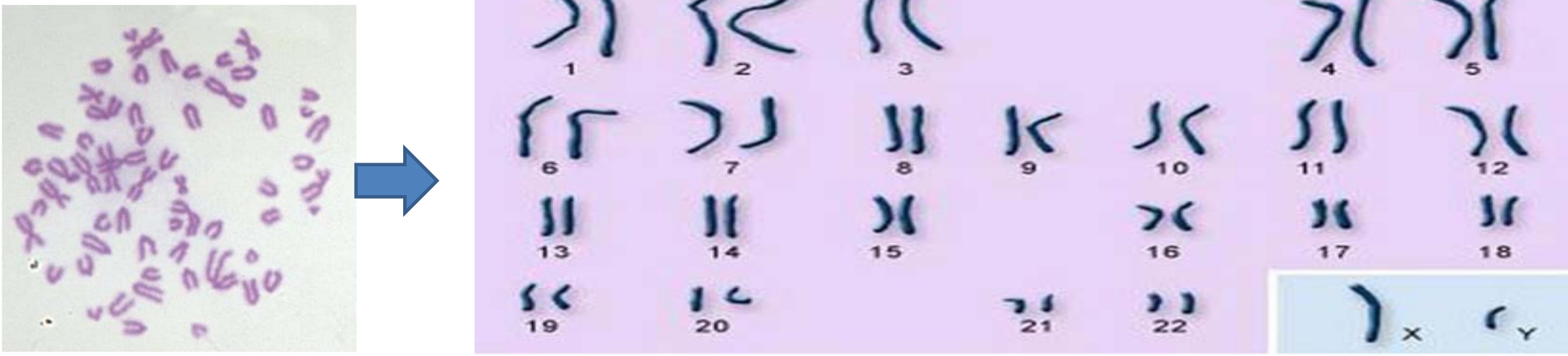
•Homologues Chromosomes

- **Chromosomes exist in homologous pairs in diploid cells.**

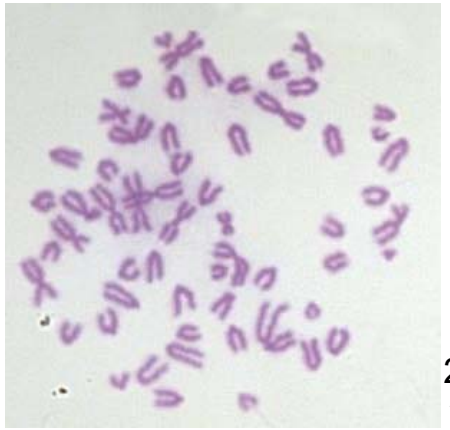
. توجد الكروموسومات في أزواج متماثلة في الخلايا ذات العدد المزدوج 2n

Exception: **Sex chromosomes in human** (X, Y).♀,♂
Other chromosomes are known as **autosomes**, they have homologues.

باستثناء الكروموسومات الجنسية في الإنسان (إكس و واي).
الكروموسومات الأخرى في الإنسان التي تعرف بالكروموسومات (الجسمية أو الجسدية) متماثلات.



- **Chromosome Set**
  - One copy of each of the different chromosomes in the nucleus containing one copy of each different gene.
- **Haploid Number (n)**
  - The number of chromosomes comprising one set.
    - For humans, n=23
    - For some ferns, n=250
  - A haploid individual has one set of chromosomes per cell.
- **Diploid Number (2n)**
  - The number of chromosomes in a cell containing two sets.
  - A diploid individual has 2 sets per cell.
  - (Triploid is 3 sets, Tetraploid is 4 sets, etc.)



المجموعة كروموسومية
نسخة واحدة من الكروموسومات المختلفة في النواة التي
تحتوي على نسخة واحدة من كل جين مختلف.

أحادي المجموعة الكروموسومية العدد المفرد (ن)
عدد الكروموسومات التي تضم مجموعة واحدة.
مثال : البشر، ن = 23 بعض السراخس، ن = 250
الفرد أحادي المجموعة الصبغية لديها مجموعة واحدة من الكروموسومات في كل خلية.

ثنائي المجموعة الصبغية العدد المزدوج (2ن)
عدد الكروموسومات في الخلية عبارة عن مجموعتين.
الفرد ثنائي المجموعة الصبغية لديه مجموعتين من الكروموسومات في كل خلية.
(ثلاثي الصيغة الصبغية 3 مجموعات، رباعي الصيغة الصبغية 4 مجموعات، الخ)

Human	**Haploid (n)= 23**
	Diploid (2n)=46
Dates	**Haploid (n)= 14**
	Diploid (2n)=28

Methods of Reproduction

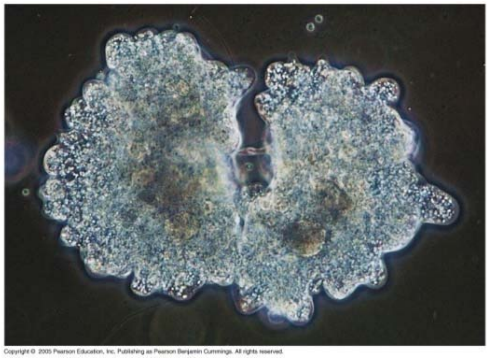
Asexual reproduction

- **Chromosomes are duplicated and cell divides**
- **One copy of each chromosome is placed in each cell**
- **Each “daughter” cell is genetically identical to the parent and the other daughter**

– **Type of Cellular Division required: mitosis**

Advantage = fast and convenient
Disadvantage = very little genetic variation

يتم تكرار (تضاعف) الكروموسومات ومن ثم تنقسم الخلية
يتم وضع نسخة واحدة من كل كروموسوم في كل خلية
كل خلية «بنوية" تكون متطابقة وراثيا مع الخلية الأم (الأصل) ومع الخلية الأخرى
نوع الانقسام الخلوي الذي يحدث هو: الانقسام غير المباشر (الميتوزي)
ميزتة سريعة ومريحة وسلس
عيبه التباين الوراثي فيه ضئيل



Sexual reproduction

- **Offspring inherit DNA from both of their parents**
- **Type of Cellular Division required: meiosis**
- **Offspring can show great variation**

- **Advantage = lots of genetic variation**
- **Disadvantage = metabolically expensive**

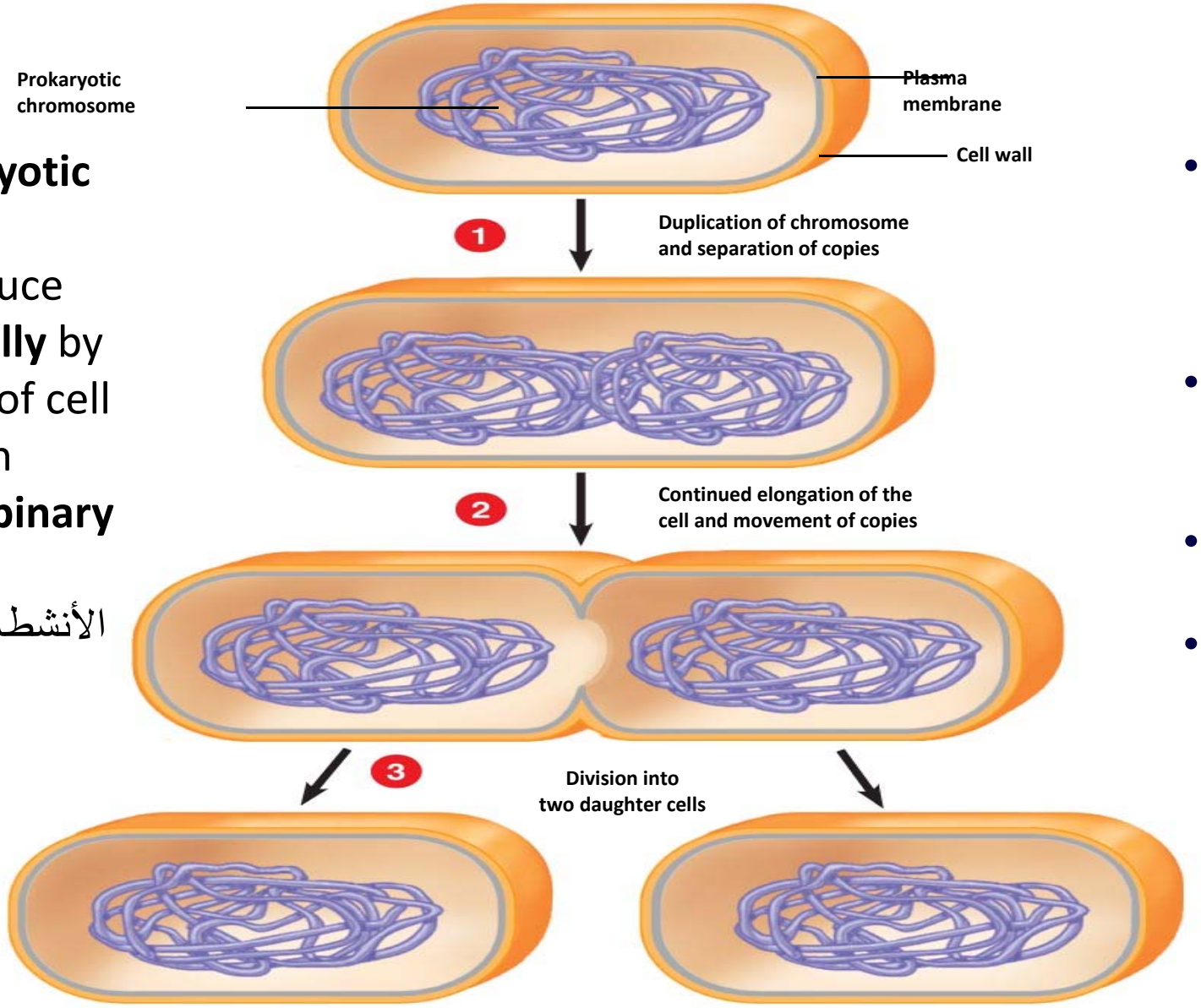
الذرية (النسل) يرث الحمض النووي (الدنا) من الوالدين
نوع الانقسام الخلوي الذي يحدث هو: الانقسام الاختزالي (الميوزي)
يمكن أن يظهر في الذرية (النسل) تباين كبير في الصفات الوراثية.

ميزتة ينتج منه الكثير من الاختلاف الجيني
عيبه يكلف الخلية عمليات أيض

Cell Division

Binary Fission, Mitosis & Meiosis

Prokaryotic cells reproduce **asexually** by a type of cell division called **binary fission**
الأنشطار الثنائي



binary fission

- **The circular DNA molecule replicates to form 2 chromosomes**

يتضاعف جزيء الحمض النووي الدائري لتشكيل 2 الكروموسومات

- **The chromosome copies move apart**

تتحرك نسخ الكروموسوم وتبتعد عن بعضها

- **The cell elongates**

تستطيل الخلية

- **The plasma membrane grows inward, dividing the parent into two daughter cells**

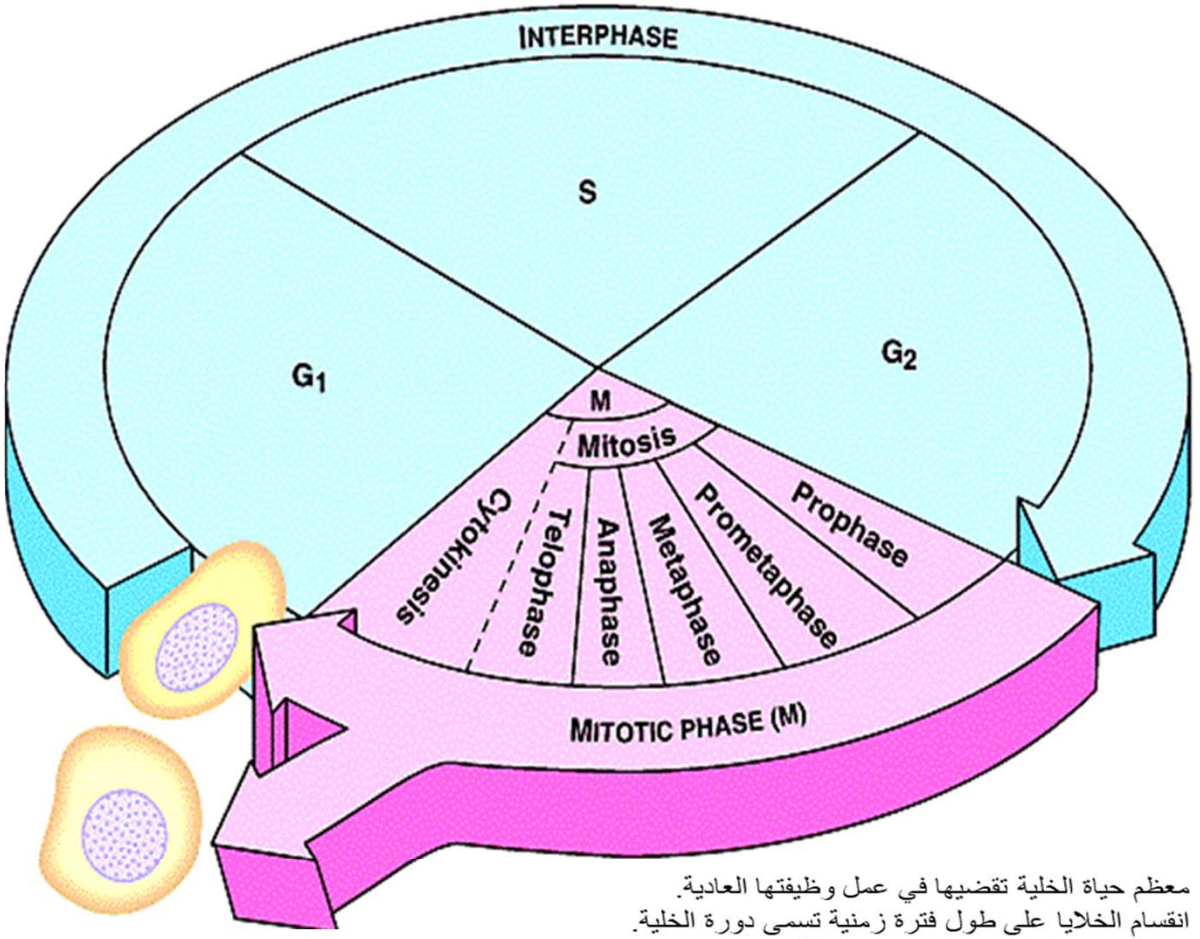
ينمو غشاء البلازما إلى الداخل، وتقسم الخلية الأم إلى خليتين بنويتين

Mitosis cell division

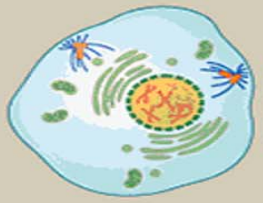
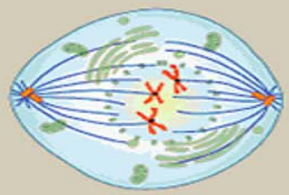
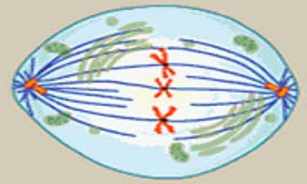
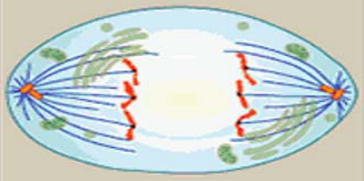
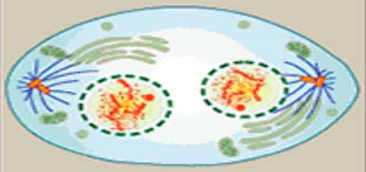
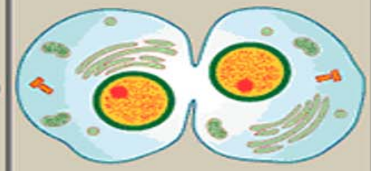
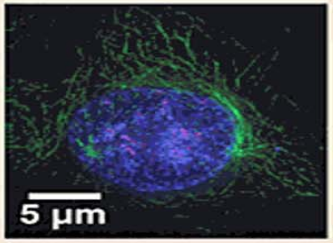
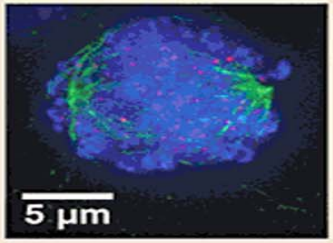
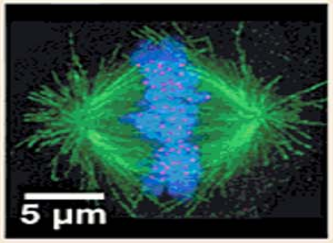
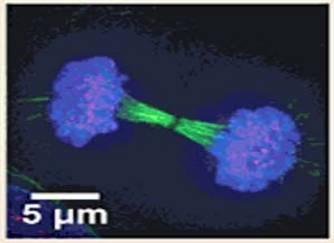
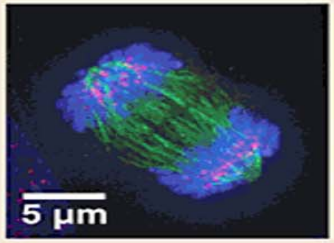
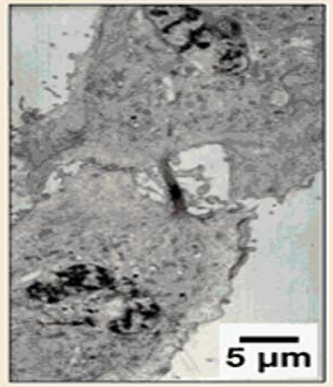
- Eukaryotes divide by a process called as Mitosis

The cell cycle:

- Cells divide along own time frame called its Cell Cycle.
- The Cell cycle consists of the following three steps:
- G1 (Gap 1) Phase - Cell performs its normal function, cells which do not divide, resting phase
- S (Synthesis) Phase - Here the cell actively duplicates its DNA in preparation for division
- G2 (Gap 2) Phase – the amount of cytoplasm and cell organelles increases in preparation for division.
- Mitosis - Actual division occurs (Prophase, Metaphase, Anaphase, Telophase)



معظم حياة الخلية تقضيها في عمل وظيفتها العادية.
انقسام الخلايا على طول فترة زمنية تسمى دورة الخلية.
تتكون دورة الخلية من الخطوات التالية:
- طور النمو1 (جي1) - تؤدي الخلية وظيفتها الطبيعية (الخلايا التي لا تنقسم تبقى في هذه المرحلة مدى الحياة
- طور البناء (إس) – تضاعف الخلية الحمض النووي تمهيدا للإنقسام)
- طور النمو 2 (جي2) – تزيد كمية السيتوبلازم (بما في ذلك العضيات) استعدادا للإنقسام
- الإنقسام الميتوزي يحدث الانقسام الفعلي بعد ذلك.

Prophase	Prometaphase	Metaphase	Anaphase	Telophase	Cytokinesis
					
• Chromosomes condense and become visible • Spindle fibers emerge from the centrosomes • Nuclear envelope breaks down • Centrosomes move toward opposite poles	• Chromosomes continue to condense • Kinetochores appear at the centromeres • Mitotic spindle microtubules attach to kinetochores	• Chromosomes are lined up at the metaphase plate • Each sister chromatid is attached to a spindle fiber originating from opposite poles	• Centromeres split in two • Sister chromatids (now called chromosomes) are pulled toward opposite poles • Certain spindle fibers begin to elongate the cell	• Chromosomes arrive at opposite poles and begin to decondense • Nuclear envelope material surrounds each set of chromosomes • The mitotic spindle breaks down • Spindle fibers continue to push poles apart	• Animal cells: a cleavage furrow separates the daughter cells • Plant cells: a cell plate, the precursor to a new cell wall, separates the daughter cells
					

MITOSIS

Overview of Mitosis

- **Occurs in somatic cells / Requires for growth of the organism**

يحدث في الخلايا الجسدية

Longitudinal division of replicated chromosomes in one nucleus to form two genetically identical daughter nuclei.

الكروموسومات المتضاعفة في النواة تقسم لتشكيل نواتين متطابقة وراثيا.

Each "daughter" nucleus has the same number of chromosomes (and sets) that the "parent" nucleus had.

كل "ابنة" نواة لديها نفس عدد الكروموسومات (والمجموعات) التي تمتلكه نواة الخلية "الأم"

- **Mitosis requires One division.**
  - **1 cell after mitosis division gives → 2 cells *(called daughter cells)***
  - **Daughter cells are genetically identical**

  Chromosome number does not change after mitosis division.

Cell Division

Prokaryotic cells

reproduce **asexually** by a type of cell division called **binary fission**
الأنشطار الثنائي

Eukaryotic cells

Cell Cycle

Interphase — **First**

- G1 (Gap 1) Phase-Cell mature
- S (Synthesis) Phase-DNA copied
- G2 (Gap 2) Phase- Cytoplasm increases

Second

- Cell could go through
  - Mitosis Or
  - Meiosis

Meiosis

Meiosis occurs in 2 phases;
Meiosis I, & Meiosis II

Meiosis I:
1- Prophase I
2- Prometaphase I
3- Metaphase I
4- Anaphase I
5-Telophase I
- (cytokinesis)

Meiosis II:
1- Prophase II
2- Prometaphase II
3- Metaphase II
4- Anaphase II
5-Telophase II
- (cytokinesis)

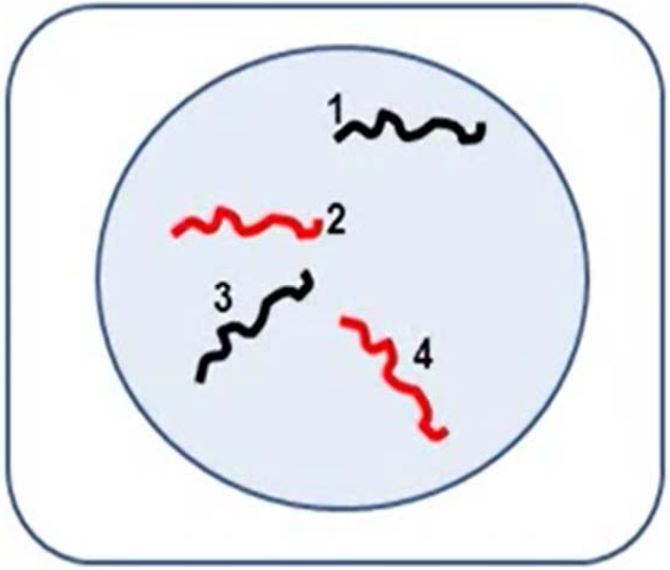
Mitosis

Mitotic phase

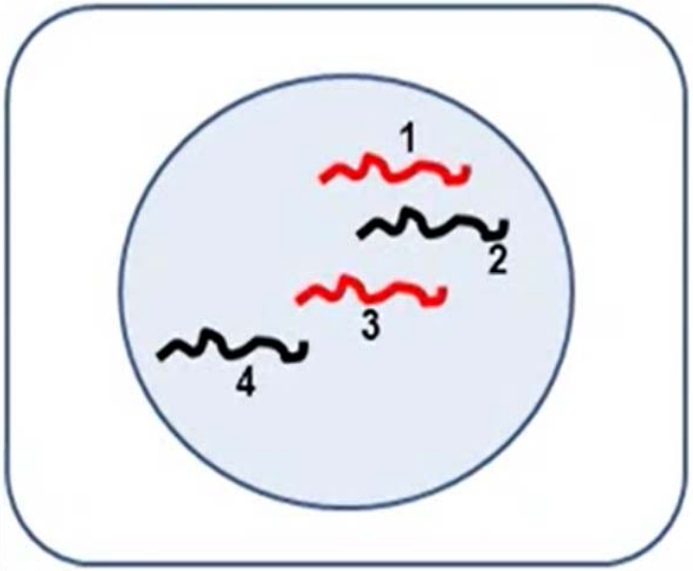
1- Prophase
2- Prometaphase
3- Metaphase
4- Anaphase
5-Telophase
- (cytokinesis)

4 strands of DNA at the start

Interphase (S stage) prior to mitosis



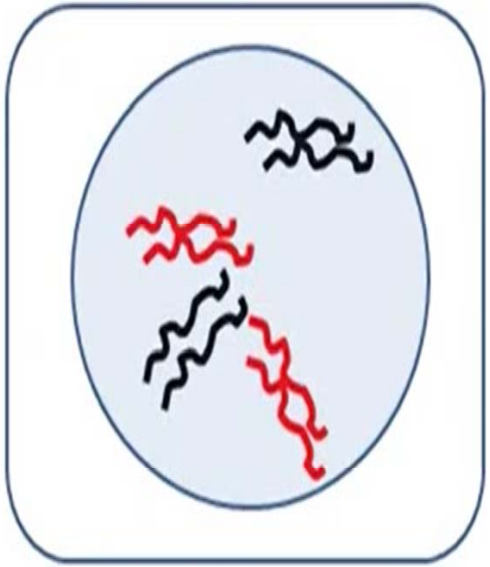
Interphase (S stage) prior to meiosis



4 strands of DNA at the start

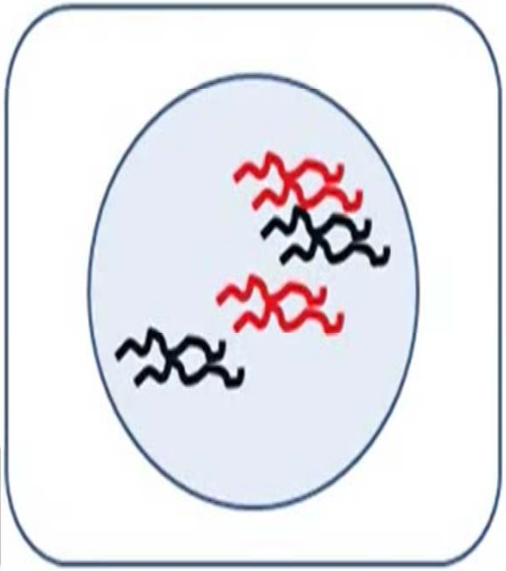
4 strands of DNA at the start

Interphase (S stage) prior to mitosis



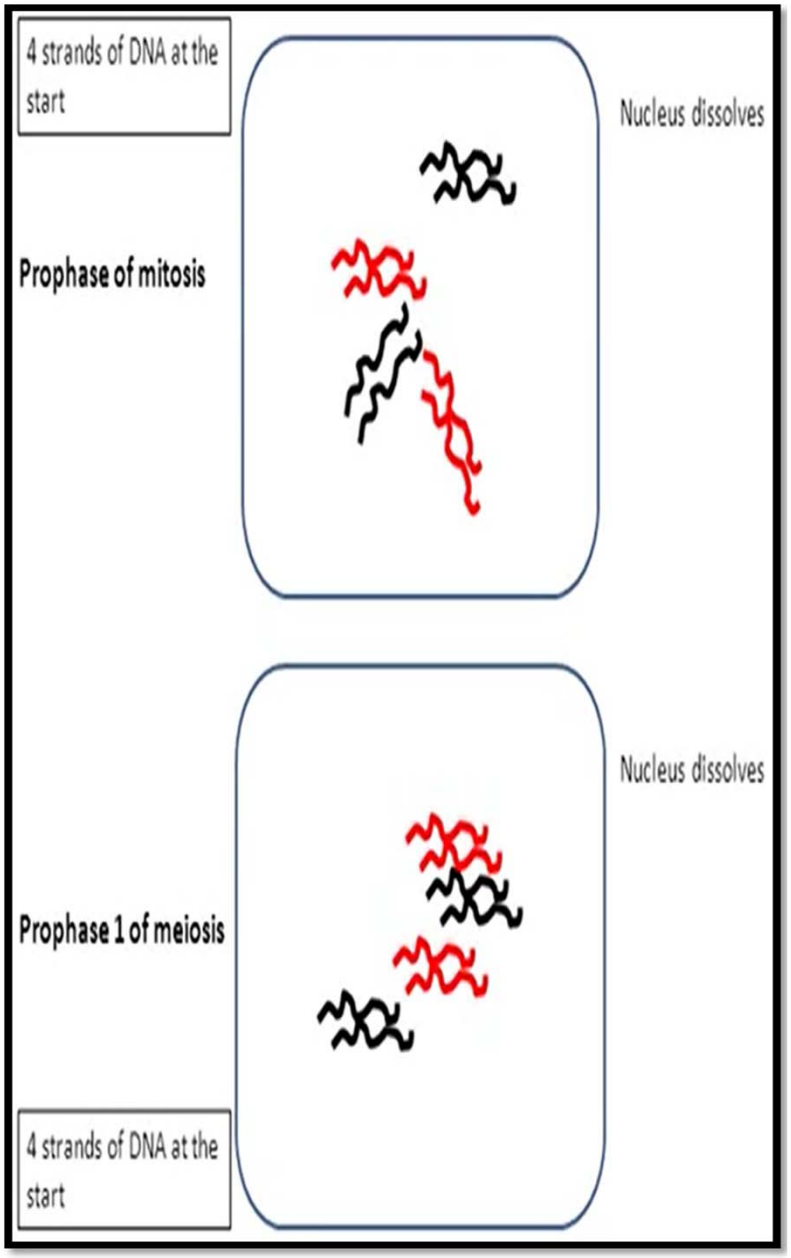
Chromatin duplicated

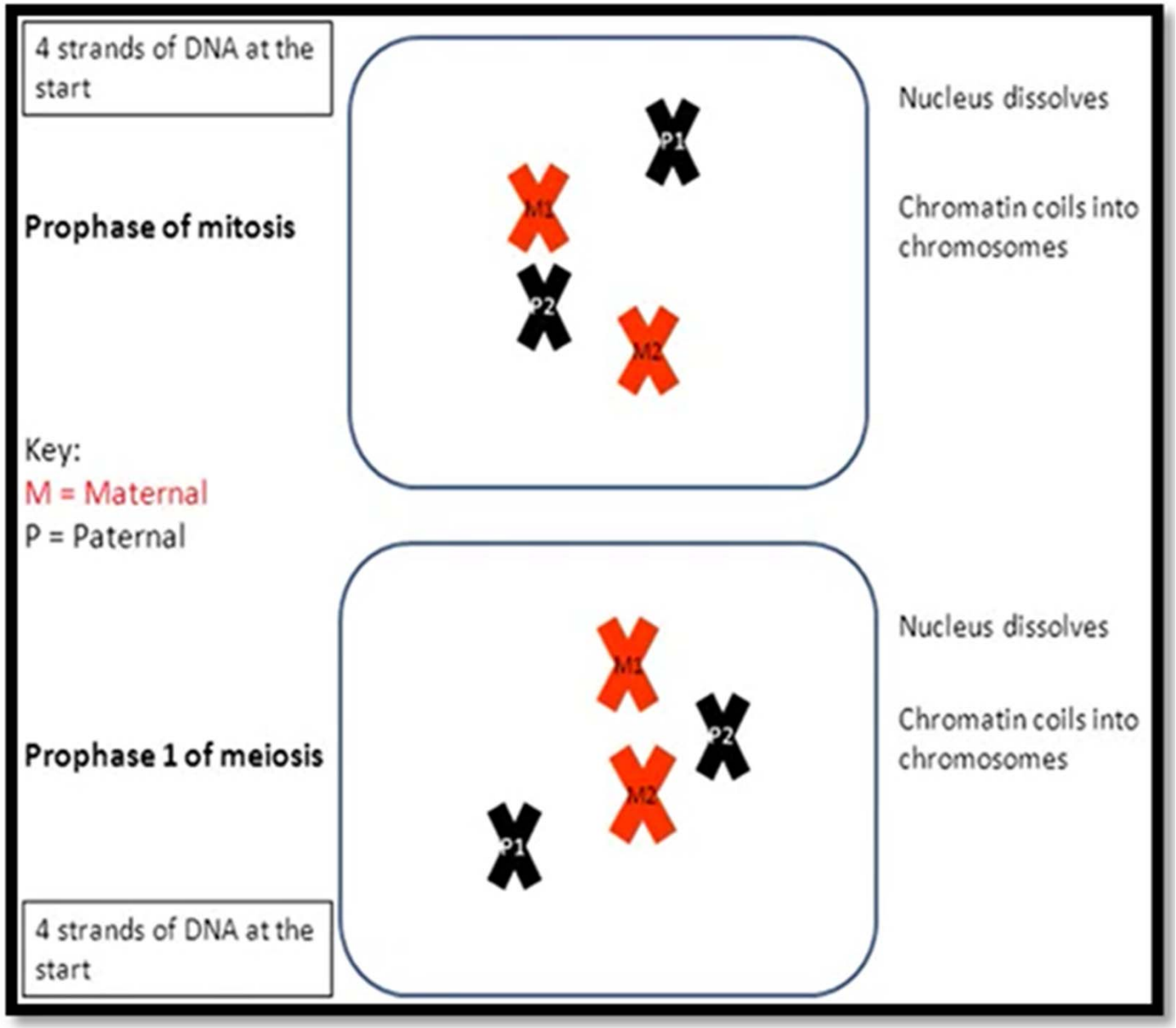
Interphase (S stage) prior to meiosis



Chromatin duplicated

4 strands of DNA at the start


4 strands of DNA at the start
Nucleus dissolves
Prophase of mitosis
Nucleus dissolves
Prophase 1 of meiosis
4 strands of DNA at the start


4 strands of DNA at the start
P1
M1
P2
M2
Nucleus dissolves
Chromatin coils into chromosomes
Prophase of mitosis
Key:
M = Maternal
P = Paternal
M1
P2
M2
P1
Nucleus dissolves
Chromatin coils into chromosomes
Prophase 1 of meiosis
4 strands of DNA at the start

4 strands of DNA at the start

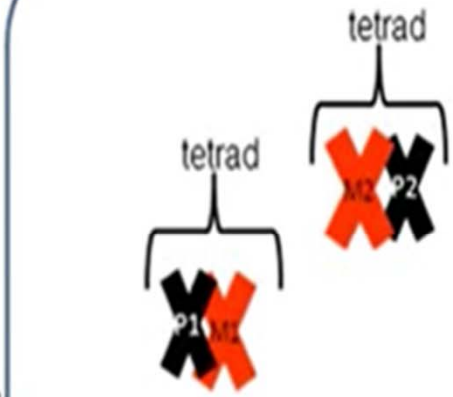
Prophase of mitosis

Key:
M = Maternal
P = Paternal

Nucleus dissolves

Chromatin coils into chromosomes

Prophase 1 of meiosis



Nucleus dissolves

Chromatin coils into chromosomes

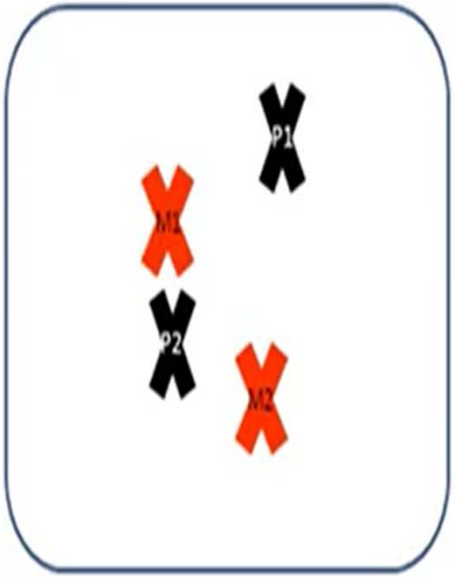
Synapsis occurs (pairing of homologous chromosomes)

4 strands of DNA at the start

4 strands of DNA at the start

Prophase of mitosis

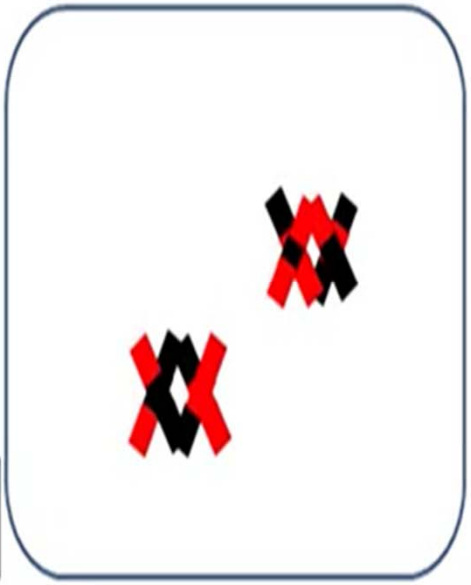
Key:
M = Maternal
P = Paternal



Nucleus dissolves

Chromatin coils into chromosomes

Prophase 1 of meiosis



Nucleus dissolves

Chromatin coils into chromosomes

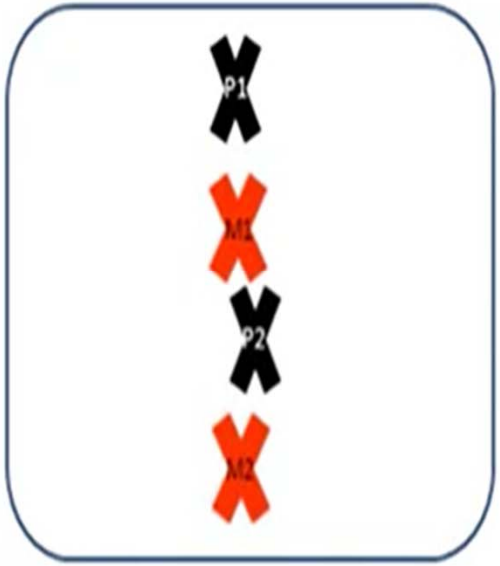
Synapsis occurs

Crossing Over

4 strands of DNA at the start

4 strands of DNA at the start

Metaphase of mitosis



Chromosomes randomly pulled to middle of the cell

Key:
M = Maternal
P = Paternal

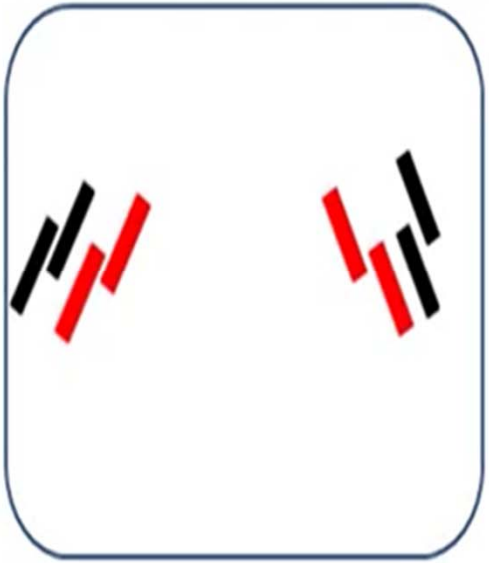
Metaphase 1 of meiosis

Tetrads randomly pulled to middle of the cell

4 strands of DNA at the start

4 strands of DNA at the start

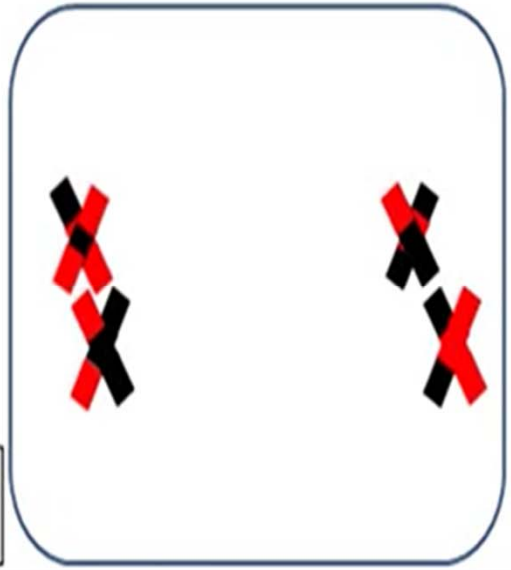
Anaphase of mitosis



Chromatids pulled to opposite ends of the cell

Key:
M = Maternal
P = Paternal

Anaphase 1 of meiosis

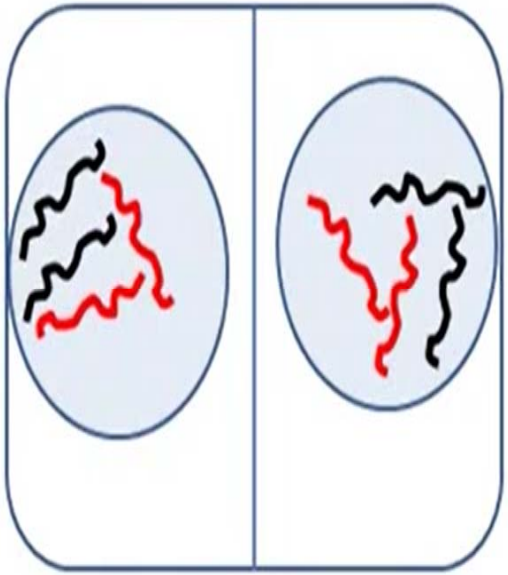


Chromosomes pulled to opposite ends of the cell

4 strands of DNA at the start

4 strands of DNA at the start

Telophase of mitosis

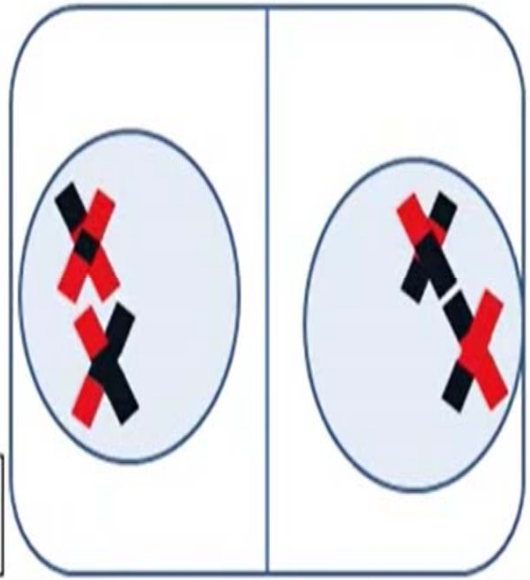


Cytokinesis splits the cell in half

Nucleus regrows

Chromatids unwind back into chromatin

Telophase 1 of meiosis

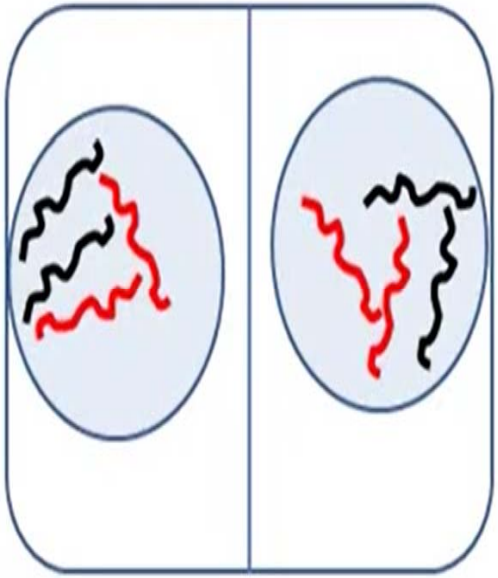


Cytokinesis splits the cell in half

Nucleus regrows

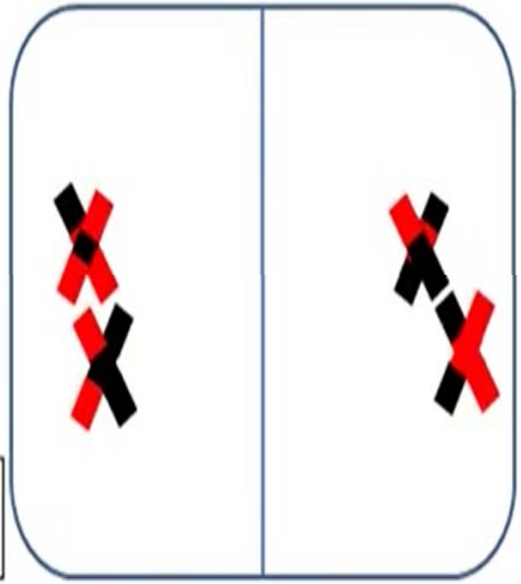
4 strands of DNA at the start

4 strands of DNA at the start



Mitosis End Result: two diploid cells

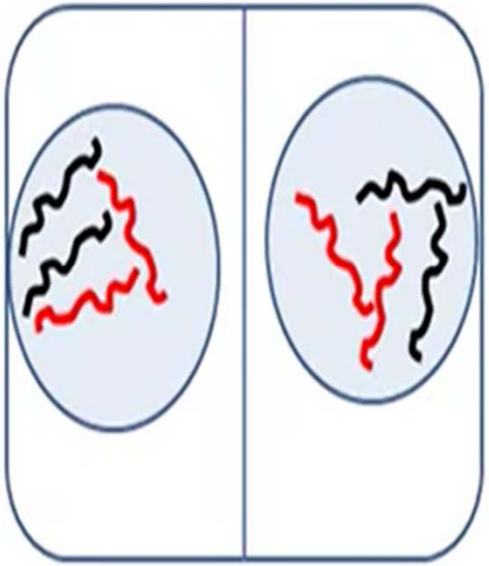
Prophase 2 of meiosis



Nucleus redissolves

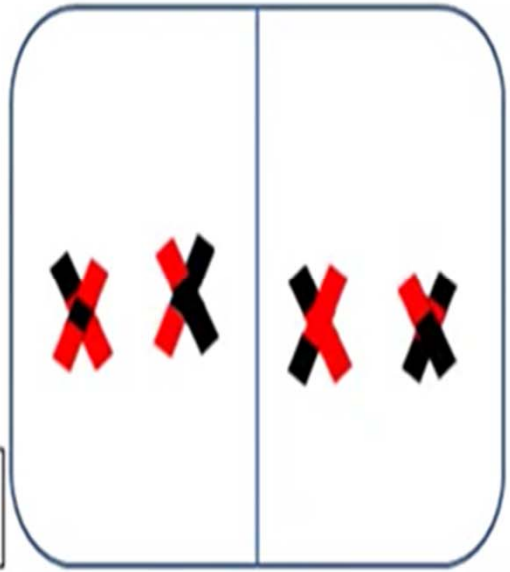
4 strands of DNA at the start

4 strands of DNA at the start



Mitosis End Result: two diploid cells

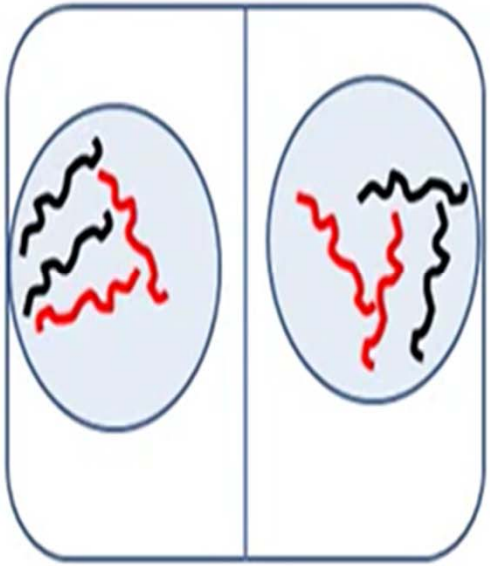
Metaphase 2 of meiosis



Chromosomes pulled to middle of the cell

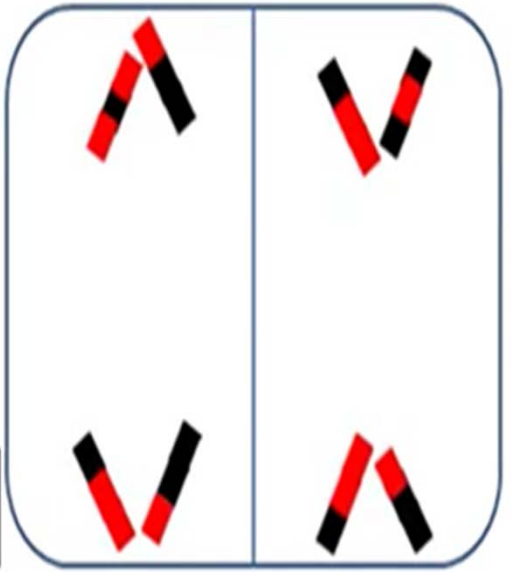
4 strands of DNA at the start

4 strands of DNA at the start



Mitosis End Result: two diploid cells

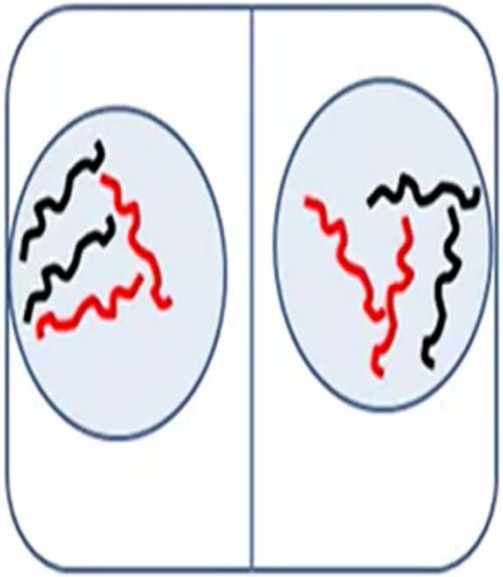
Anaphase 2 of meiosis



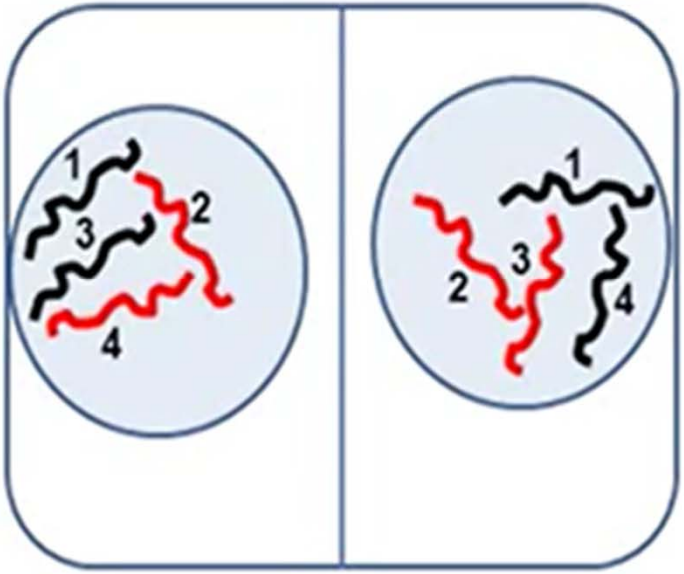
Chromatids pulled to opposite ends of the cell

4 strands of DNA at the start

4 strands of DNA at the start



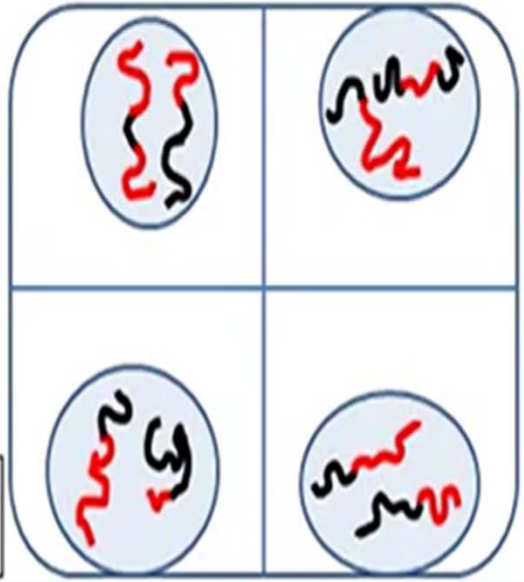
Mitosis End Result: two diploid cells



Mitosis End Result: two diploid cells

New cells have the same amount of chromatin from the start

Both cells are identical

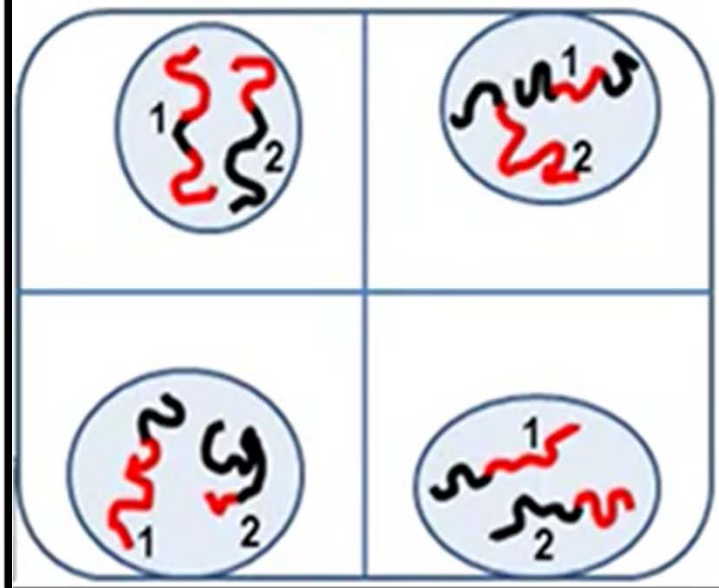


Cytokinesis splits the cells in half again

Nucleus reforms in all four cells

Chromatids unwind back into chromatin

Telophase 2 of meiosis



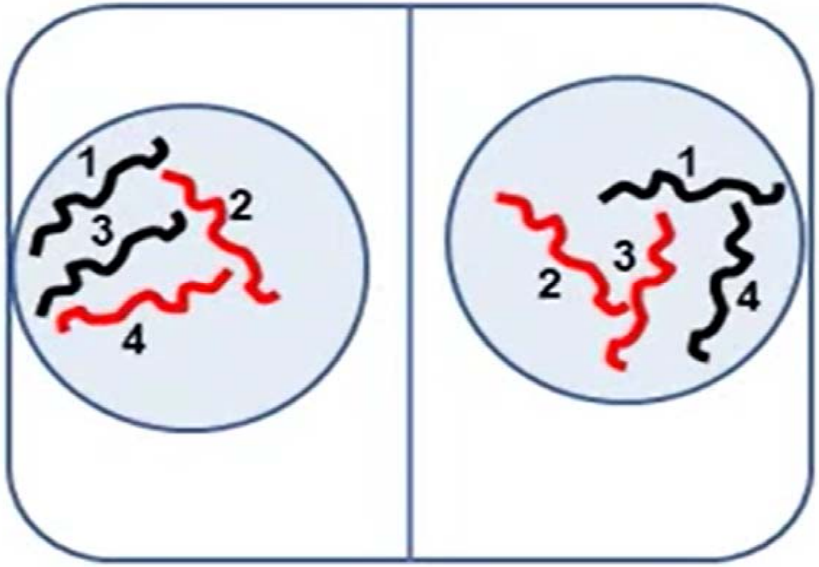
New cells have the half the amount of chromatin from the start

Each cell is genetically unique

Meiosis End Result: four haploid cells

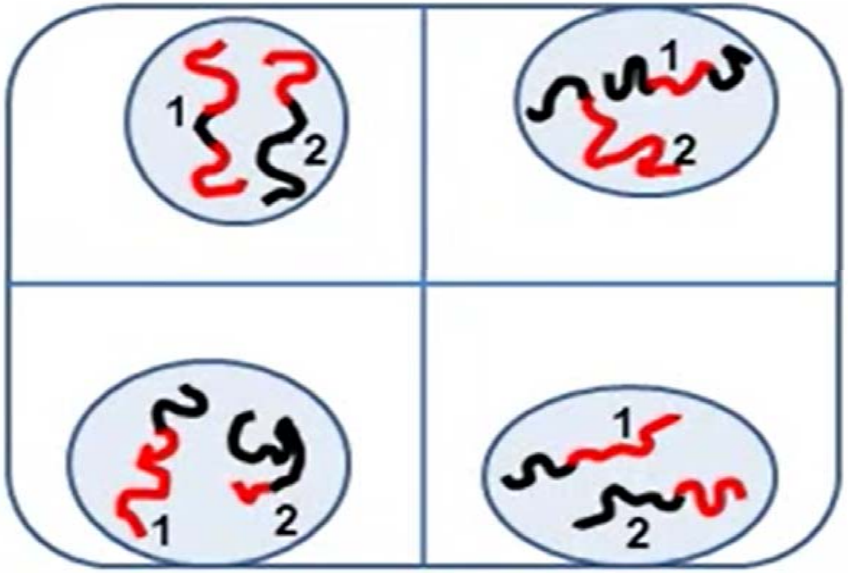
4 strands of DNA at the start

Cells that go through mitosis, start diploid...



...and end diploid.

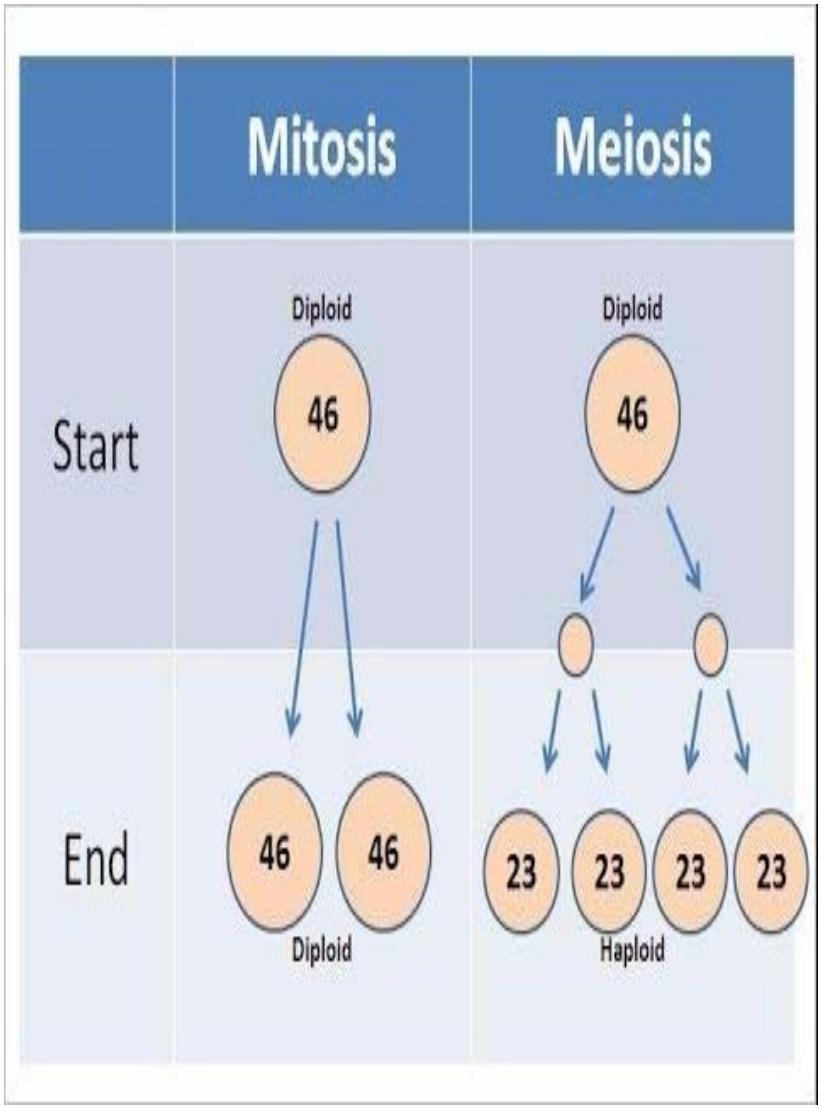
Cells that go through meiosis, start diploid...



...and end haploid.

Differences in between Mitosis and Meiosis cell division

- There are two cell divisions (Meiosis I and Meiosis II) involves in meiosis cell division.
- As a results of Meiosis cell division, one parent cell gives 4 daughter cells & the chromosomes number reduced to half in the daughter cells
- Reduction of Chromosome number occurs in Meiosis I division
- Crossing over occurs in Meiosis I (prophase I)
- Meiosis II is just similar to Mitosis cell division.
- Mitosis cell division occurs in somatic cell but meiosis cell division occurs in reproductive cells



Male
(Diploid / 2n)

Meiosis I | Meiosis II

Primary spermatocyte (diploid)

Spermatids

Sperm cells (haploid)

(a) Spermatogenesis

Haploid(N)

Female
(Diploid / 2n)

Secondary oocyte

Second polar body

Primary oocyte (diploid)

First polar body

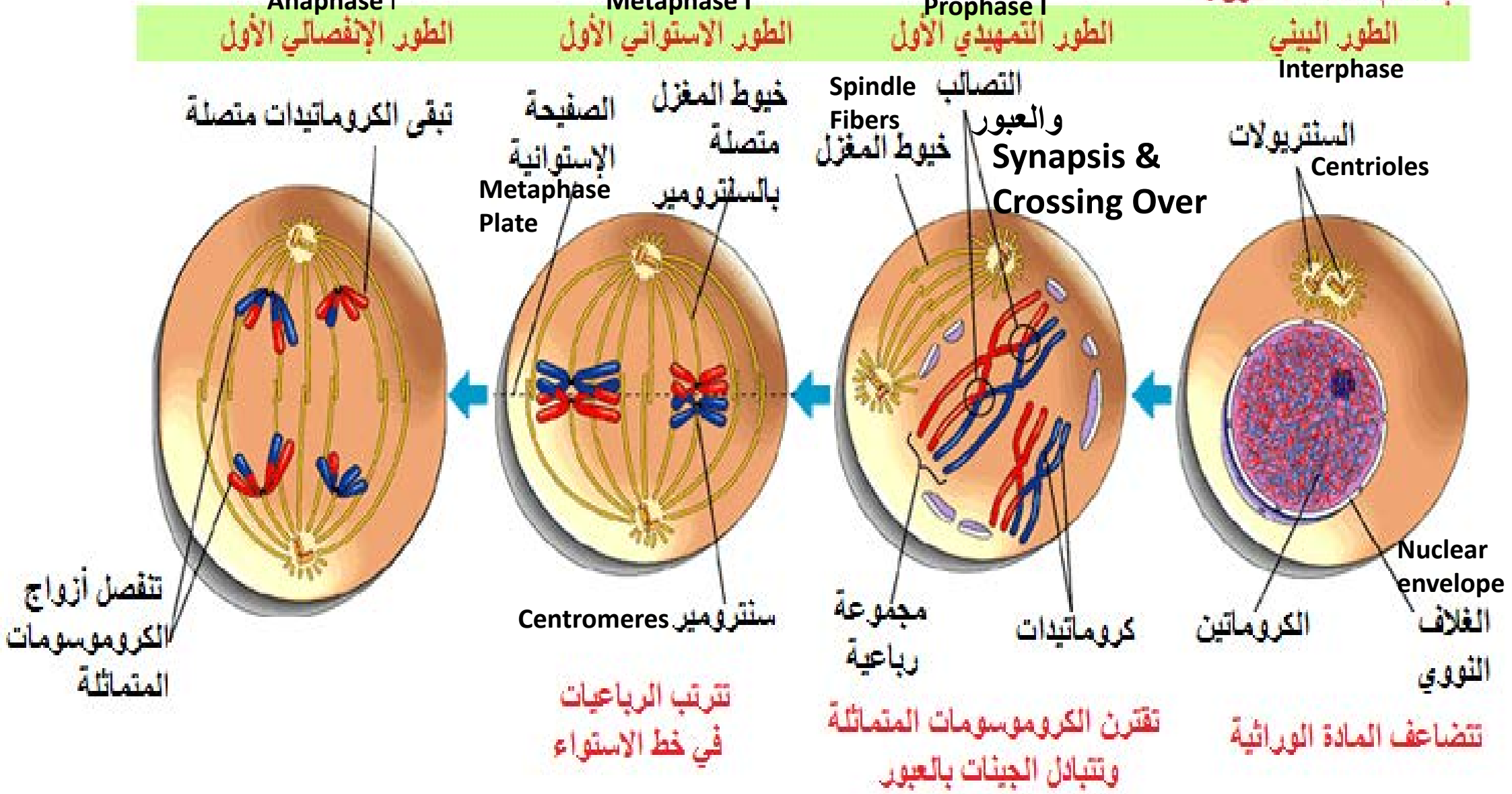
Egg cell (haploid)

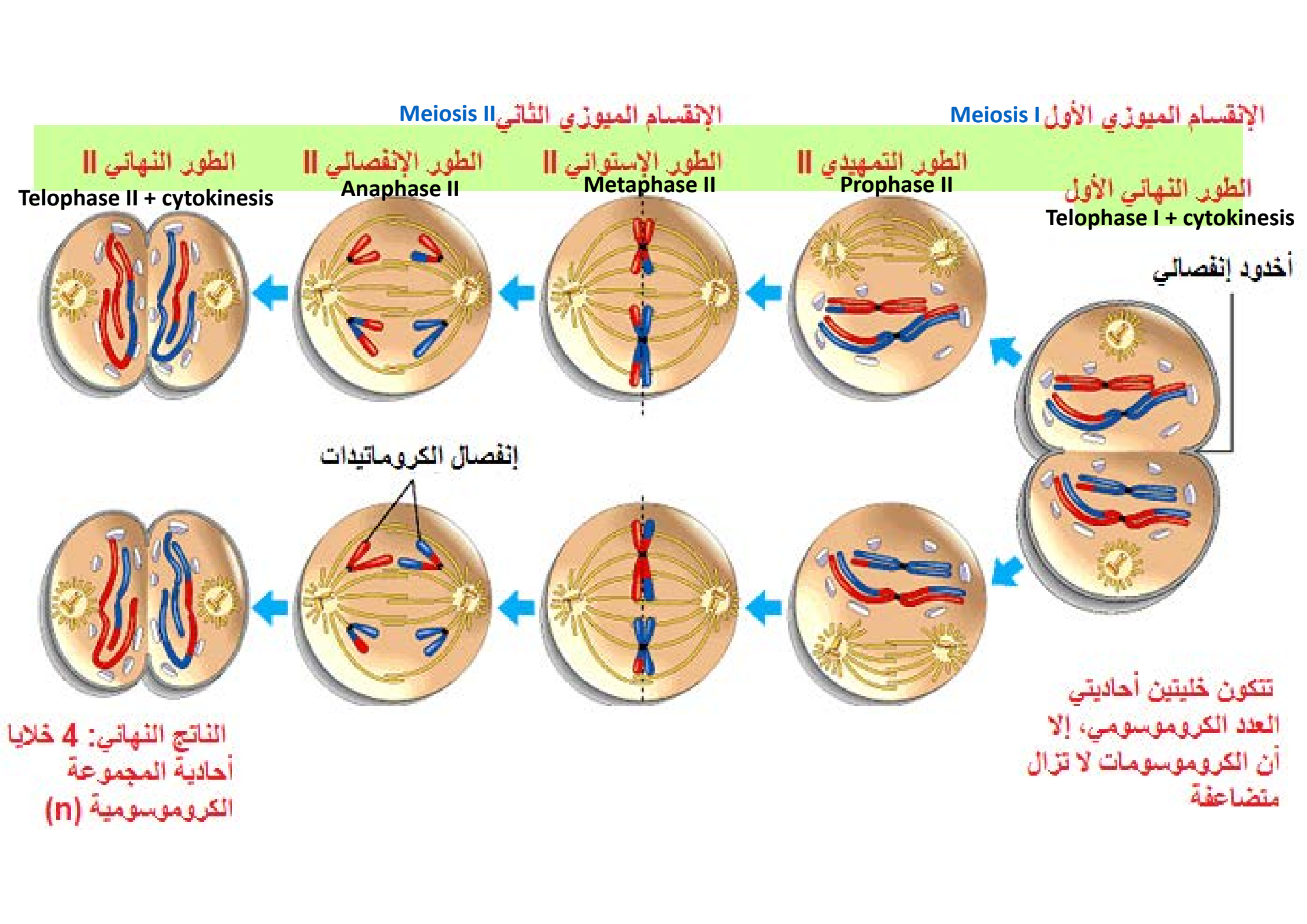
(b) Oogenesis

Zygote (2n)

(Diploid / 2n)

الإنقسام المنصف الأول | Meiosis I

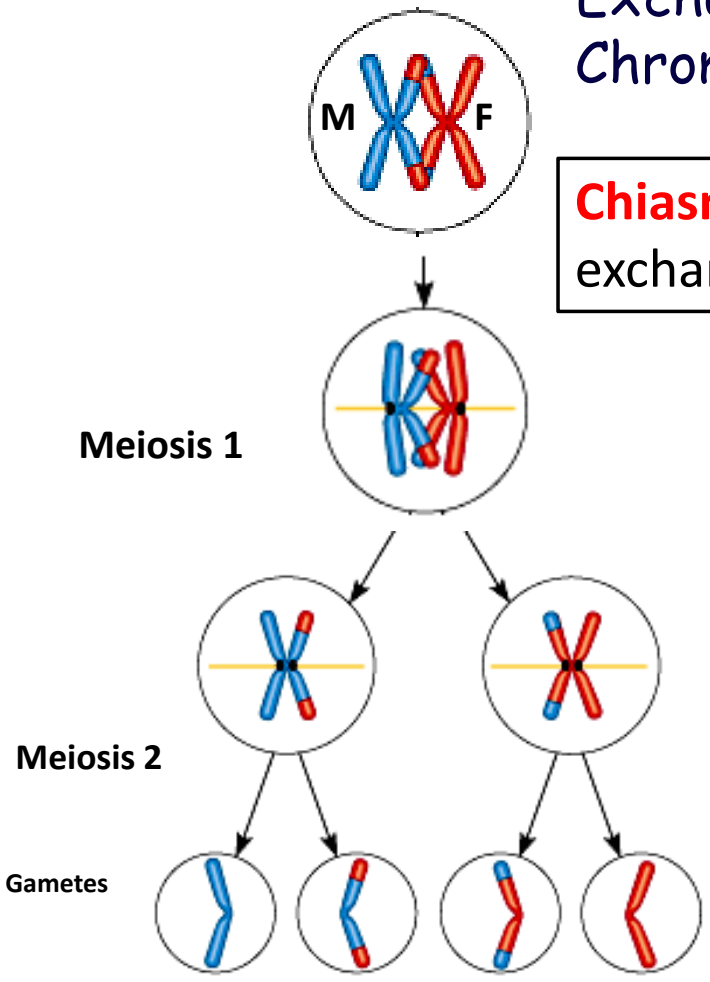



الإنقسام الميوزي الأول Meiosis I
الإنقسام الميوزي الثاني Meiosis II
الطور التمهيدي II
Prophase II
الطور الإستوائي II
Metaphase II
الطور الإنفصالي II
Anaphase II
الطور النهائي II
Telophase II + cytokinesis
الطور النهائي الأول
Telophase I + cytokinesis
أخدود إنفصالي
إنفصال الكروماتيدات
تتكون خليتين أحاديتي
العدد الكروموسومي، إلا
أن الكروموسومات لا تزال
متضاعفة
الناتج النهائي: 4 خلايا
أحادية المجموعة
الكروموسومية (n)

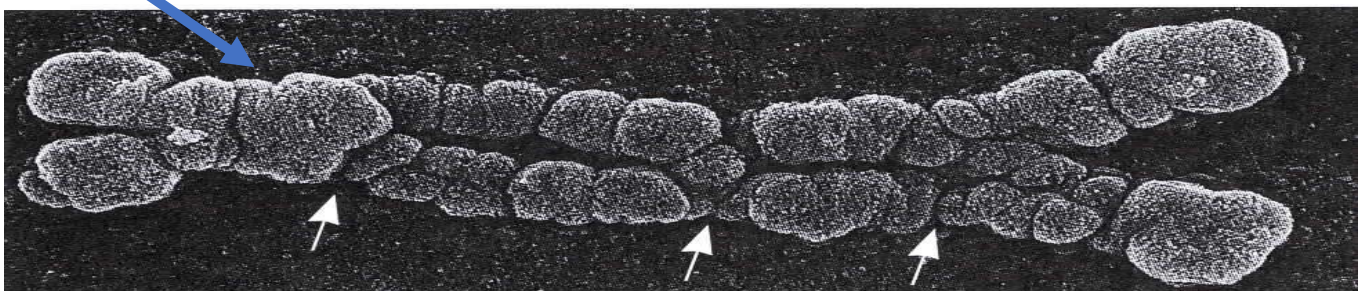
Crossing over (contd.)

عملية العبور: تبادل الأجزاء بين زوج من الكروموسومات المتماثلة

Exchange of genetic material between Homologous Chromosomes · **During Prophase I** *occurs at CHIASMA*



Chiasmata= the point where two homologous non-sister chromatids exchange genetic material during chromosomal crossover in meiosis



Produces new genetic combinations Of Chromosomes with both Maternal الام & Paternal الاب components

تنتج تركيبات جينية جديدة من الكروموسومات من كل من المكونات الأبوية والأم

GENETICS علم الوراثة

The study of hereditary and variations is called as Genetics

Classical / Mendelian Genetics

- Genetics is the scientific study of **heredity**.

  هو العلم الذي يدرس المورثات (الجينات) وانتقال ما تحمله من صفات.. الدراسة العلمية للورثة.

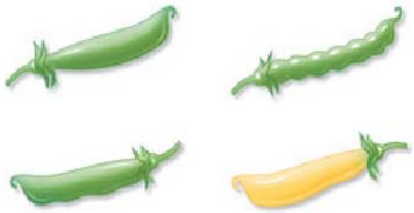
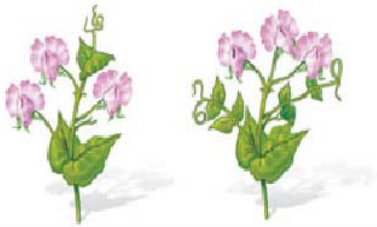
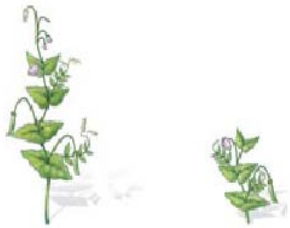
- Gregor Mendel (1860's) an Austrian Monk, was interested in figuring out how heredity was determined in plants and animals.
  - used pea plants
  - **quantitative** approach to collect data.

- Mendel studied seven different pea plant **traits**.
  - Seed shape & color, pod shape & color, plant height, flower color and seed coat color

- A **trait** is a specific characteristic, such as seed color or plant height, that varies from one individual to another.

Gregor Mendel: Father of Genetics

Gregor Mendel's Experiment

Character	Contrasting traits	
Seed shape	round/wrinkled	
Seed color	yellow/green	
Pod shape	full/constricted	
Pod color	green/yellow	
Flower color	violet/white	
Flower position	axial/terminal	
Stem height	tall/dwarf	

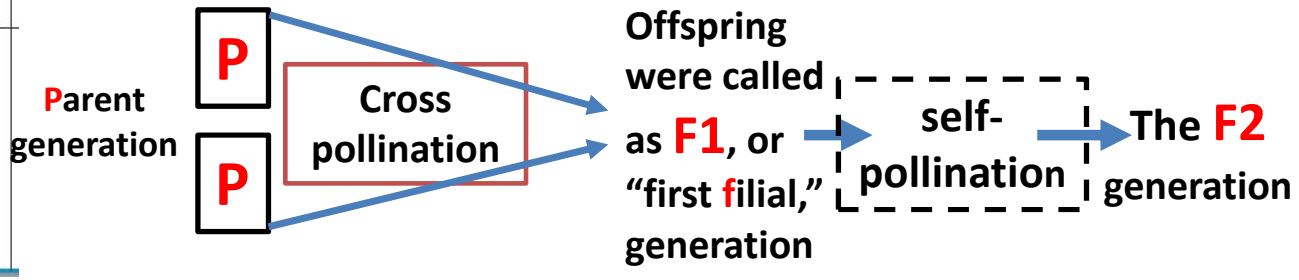
Seven pairs of contrasting traits selected by Mendle

Monohybrid cross is a cross between two individual having single contrasting traits.

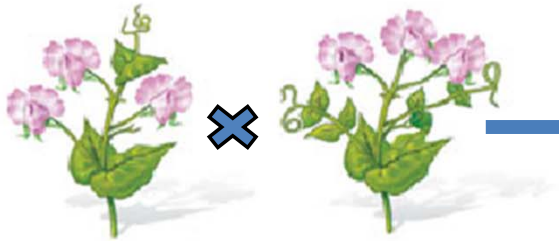
Dihybrid cross is a cross between two individual having two different traits.

Cross pollination التلقيح الخلطي The transfer of pollen from an anther of a flower of one plant to a stigma of a flower of another plant) self-pollination التلقيح الذاتي(on the same plant).

The offspring of crosses between parents with different traits are called hybrids ويطلق على الذرية الناتجة من التلقيح الخلطي بين الآباء مختلفي الصفات (الهجينة).



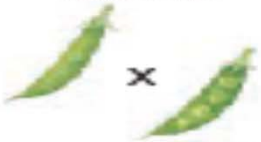
Seven pairs of contrasting traits and the results of Mendel's seven monohybrid crosses of the garden pea

Character	Contrasting traits		F_1 results	F_2 results	F_2 ratio
Seed shape	round/wrinkled		all round	5474 round 1850 wrinkled	2.96:1
Seed color	yellow/green		all yellow	6022 yellow 2001 green	3.01:1
Pod shape	full/constricted		all full	882 full 299 constricted	2.95:1
Pod color	green/yellow		all green	428 green 152 yellow	2.82:1
Flower color	violet/white		all violet	705 violet 224 white	3.15:1
Flower position	axial/terminal		all axial	651 axial 207 terminal	3.14:1
Stem height	tall/dwarf		all tall	787 tall 277 dwarf	2.84:1

MONOHYBRID CROSSES: THE PRINCIPLES OF DOMINANCE AND SEGREGATION

Results of Mendel's F1 Crosses:

When Mendel crossed plants with contrasting characters for the same trait (for example All round), the resulting offspring had only one of the characters in F1 generation.

P	Round  Wrinkled	Yellow  Green	Gray  White	Smooth  Constricted	Green  Yellow	Axial  Terminal	Tall  Short
F_1	Round 	Yellow 	Gray 	Smooth 	Green 	Axial 	Tall 

But the population of F1 generation self pollinated, the resulting offspring had characters of two different traits 3: 1 (F2 ratio) . From these, Mendel concluded that:

- Each **Phenotype** (traits or morphological characters to which we can see) of an organism is governed by a specific Factor
- Each organism has 2 factors for each of traits (Factors = Allelles = Genes), one trait is dominant and other trait is recessive . Or it may be said that one factor Is **dominant** and other factor is **recessive**.
- The two factors segregates at the time of gamete formation

Mendel's conclusions: Rules

1. Rule of Unit Factors

Each organism has 2 factors for each of its traits (alleles: gene alternatives)

كل كائن حي لديه 2 من العوامل لكل صفة من صفاته واحد من الأب واخر من الأم.
(**الأليلات**: اشكال مختلفة من الجينات).

2. Rule of Dominance قانون السيادة

For each trait there exists 2 possible factors that are expressed in physical characters, one that may be dominant, and the other recessive.

لكل صفة 2 من العوامل يتم التعبير عنهما في الصفات الطبيعية، احدهما قد تكون سائد والآخر المتنحية.

3. Law of Segregation قانون انعزال السمات

The two alleles for each trait must separate when gametes form.

الاليلين الخاصة لكل صفة تنعزل (تنفصل) عند تشكيل الأمشاج.

Expression of Traits ظهور الصفة

1. phenotype:

physical expression of a gene

الطراز المظهري (النمط الظاهري): التعبير الظاهري للجين
(أي الصفة التي يظهرها الجين على الشكل الظاهري للكائن مثل اللون او الطول

2. genotype:

a make of genes on a chromosome

الطراز الجيني (النمط الجيني): بناء او وضعية الجينات على الكروموسوم مثل YY

3. homozygous:

alleles for a trait are the same

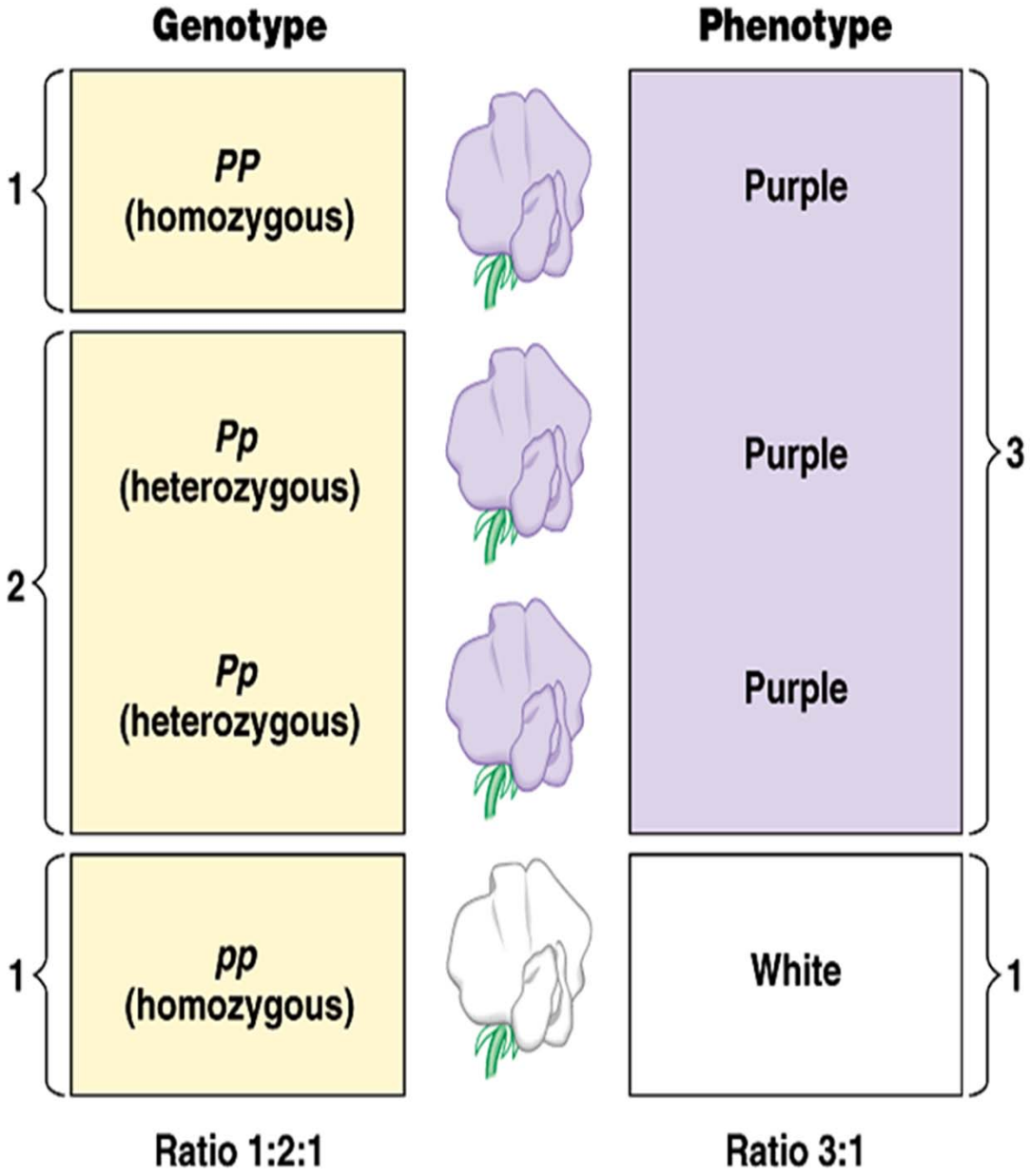
متماثل الجينات: الأليلات لسمة ما (لصفة ما) هي نفسها مثل YY

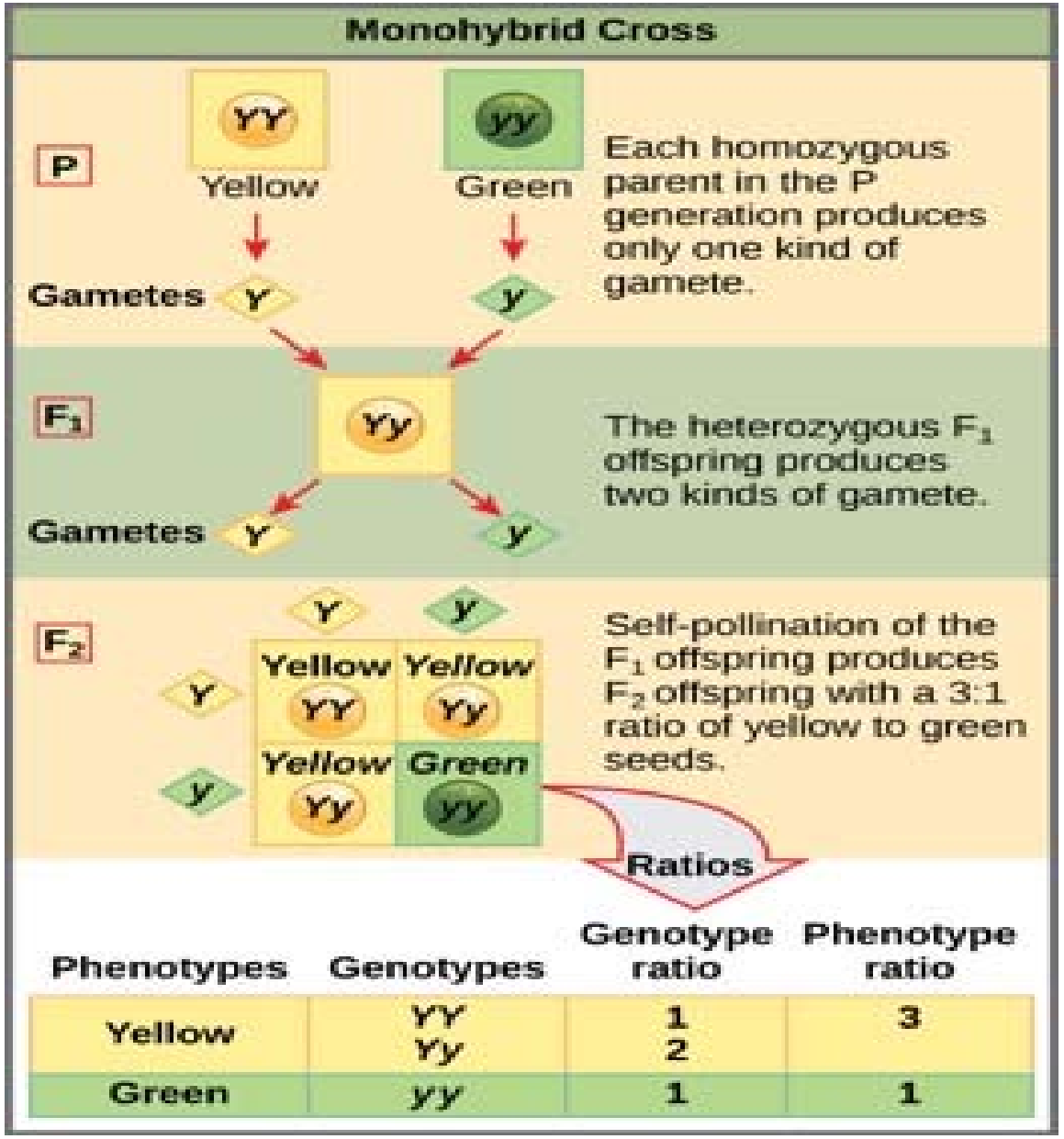
4. heterozygous:

alleles for a trait are opposite

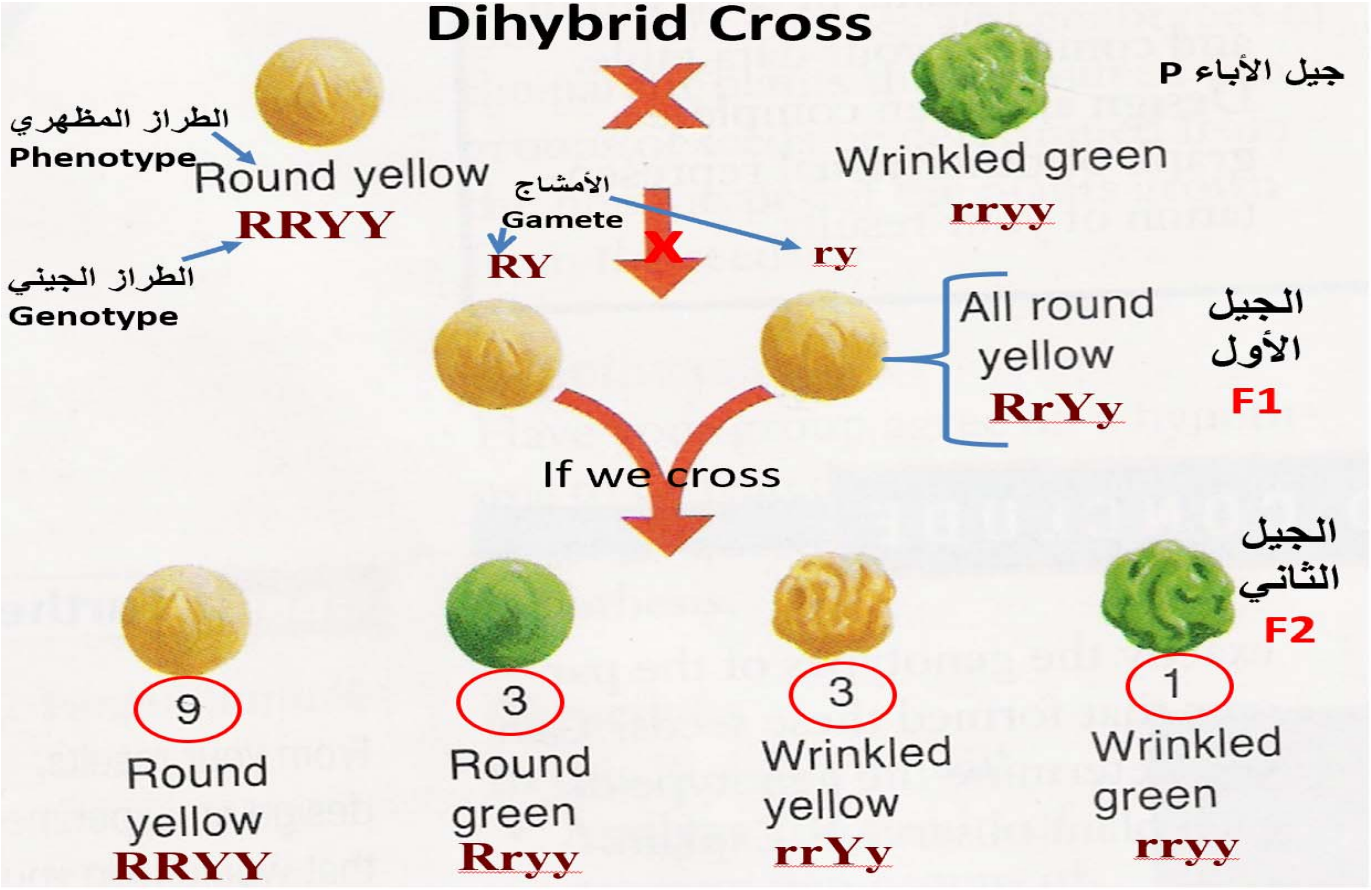
متباين الجينات: الأليلات لسمة ما مختلفة مثل Yy

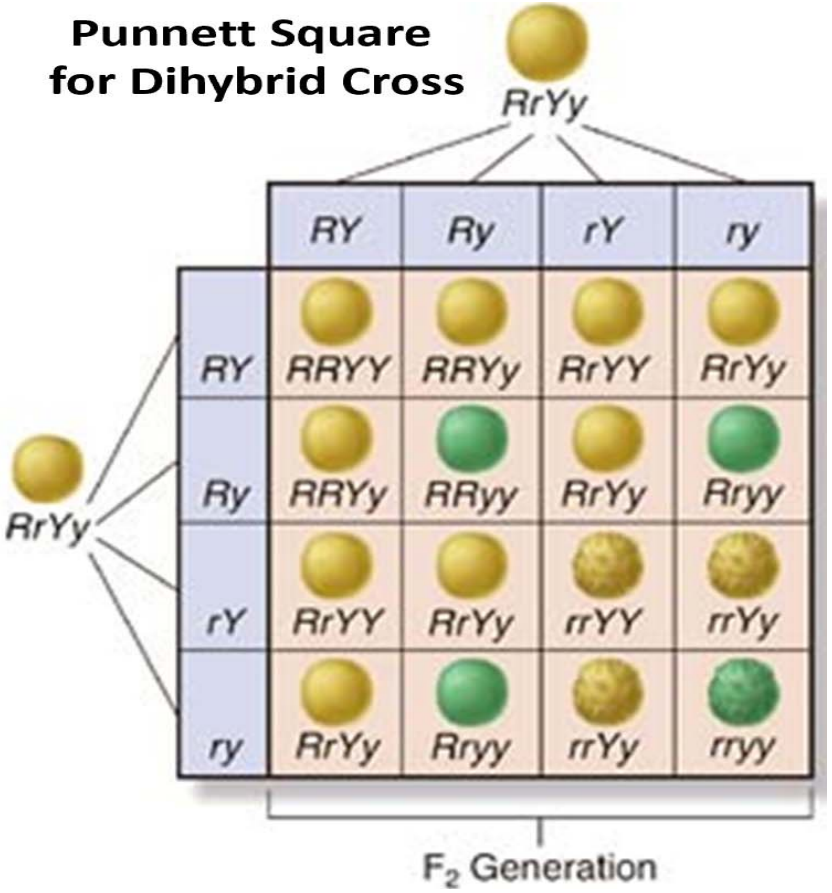
- Genotypes
- Homozygous = same alleles = PP, *pp*
- Heterozygous = different alleles = P*p*





Phenotypes	Genotypes	Genotype ratio	Phenotype ratio
Yellow	YY Yy	1 2	3
Green	yy	1	1





- F_1 generation produced all round yellow seeds
- F_2 generation produced :
  - 9 round yellow
  - 3 round green
  - 3 wrinkled yellow
  - 1 wrinkled green

Punnett Square for Dihybrid Cross

(Cross between 2 parents that are Heterozygous for two traits)

Round Yellow Seeds X Round Yellow Seeds

RrYy X RrYy

Law of Independent assortment –

- different traits are passed independently of each other. OR
- Genes for different traits are inherited independently of each other.
- All possible combinations of gametes with the two traits must be considered possible.

قانون التوزيع الحر: يتم توريث الصفات المختلفة بشكل مستقل عن بعضها البعض
بمعنى إذا تزاوج فردان يختلفان في أكثر من زوج من الصفات المتضادة فإن كل زوج من الجينات الخاصة بهذه الصفات يتوزع توزيعاً حراً ومستقلاً عند تكوين الجاميتات

Did this mean that the two dominant alleles would always stay together?

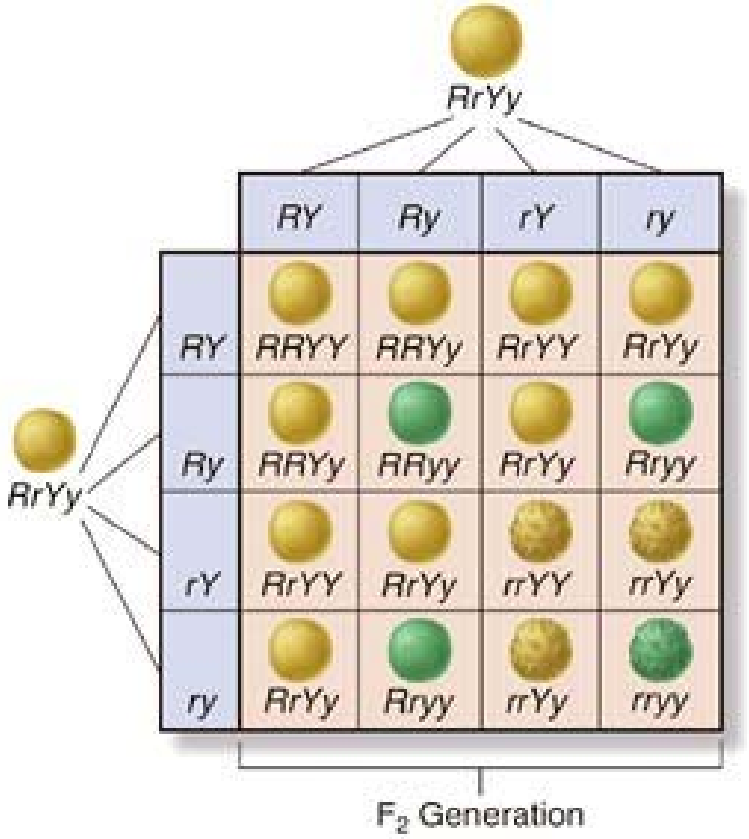
When Mendel let the F_1 self pollinate, he got a definite ratio of visible phenotypes:

9 with both dominant (RY)-Round Yellow

3 one dominant and one recessive (Ry)-round green

3 one recessive and one dominant (rY) – wrinkled yellow

1 both recessive (rryy) - wrinkled green



عندما ترك مندل F1 يلقح ذاتيا، وحصل على نسبة محددة من الطراز المظهري:

MONOHYBRID CROSSES:

Conclusions/ Rules:

The principles of Dominance and Segregation

From these, Mendel concluded that:

- Each Phenotype (traits or morphological characters to which we can see) of an organism is governed by a specific Factor
- Each organism has 2 factors for each of traits (Factors = Allelles = Genes), one trait is dominant and other trait is recessive . Or it may be said that one factor Is dominant and other factor is recessive.

DIHYBRID CROSSES:

Conclusions/ Rules:

The Law of segregation or Independent Assortment

- The two dominant and recessive factors remains in a pair but segregates at the time of gamete formation

تمارين

P_1 Monohybrid Cross

Trait: Seed Shape

Alleles: R – Round r – Wrinkled

Cross: **Round** seeds x **Wrinkled** seeds

RR x rr

Rr -----F1

Selfing

	r	r
R	Rr	Rr
R	Rr	Rr

Genotype: Rr

Phenotype: Round

Genotypic Ratio: All alike

Phenotypic Ratio: All alike

P_1 Monohybrid Cross Review

- Homozygous dominant x Homozygous recessive
- Offspring all Heterozygous (hybrids)
- Offspring called F_1 generation
- Genotypic & Phenotypic ratio is ALL ALIKE

F_1 Monohybrid Cross

- Trait: Seed Shape
- Alleles: R – Round r – Wrinkled
- Cross: Round seeds x Round seeds
- Rr x Rr

	R	r
R	RR	Rr
r	Rr	rr

Genotype: RR, Rr, rr

Phenotype: Round & wrinkled

G.Ratio: 1:2:1

P.Ratio: 3:1

How to Make a Punnett Square

Punnett squares allow geneticists to predict the possible genotypes and phenotypes of offspring.

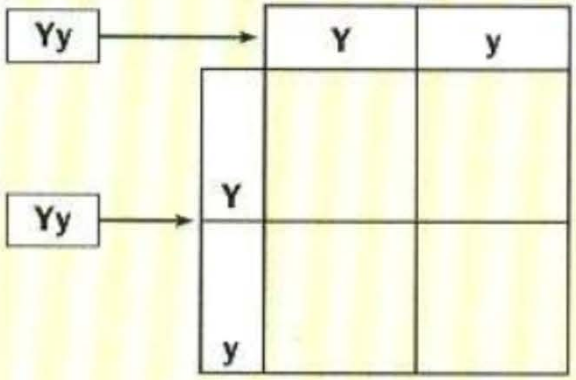
In this example, both parents are heterozygous for yellow-pea allele (*Yy*).

1 Make the grid

Place the alleles of the gametes of one parent along the top of a grid and those of the other parent along the left-hand side.

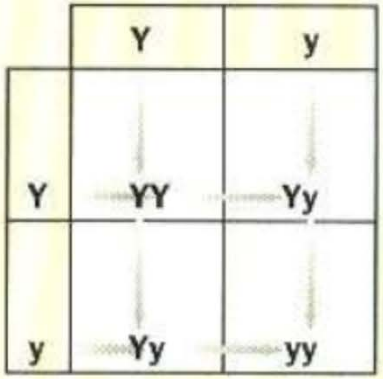
Parent 1

Parent 2



2 Fill in the grid

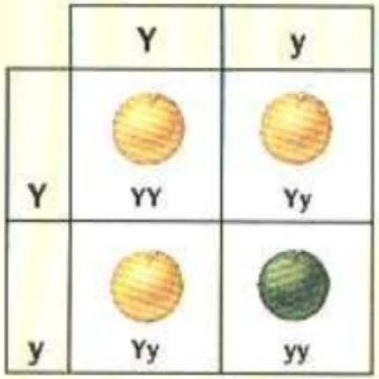
Combine the parent alleles inside the boxes. The letters show the genotypes of the offspring.



The genotype ratio is 1:2:1, meaning 1 *YY*, 2 *Yy*, 1 *yy*.

3 Fill in the offspring

Use the Law of Dominance to determine the phenotypes and phenotype ratio of the offspring.



The phenotype ratio is 3:1, meaning 3 yellow peas to 1 green pea.

Question:

الصفات النوعية الصفات الكمية

1. What is the difference between the Qualitative and quantitative traits ?

2. **If you have a tall wheat plant (TT) and you crossed it with another short cultivar (tt)what the probabilities of having a tall plants at the second generation F2?**

TT X tt --- Tt f1

Self Tt x Tt

Plant Structure
(Morphology & Anatomy)

PLANT MORPHOLOGY

Study of external structure of a plant

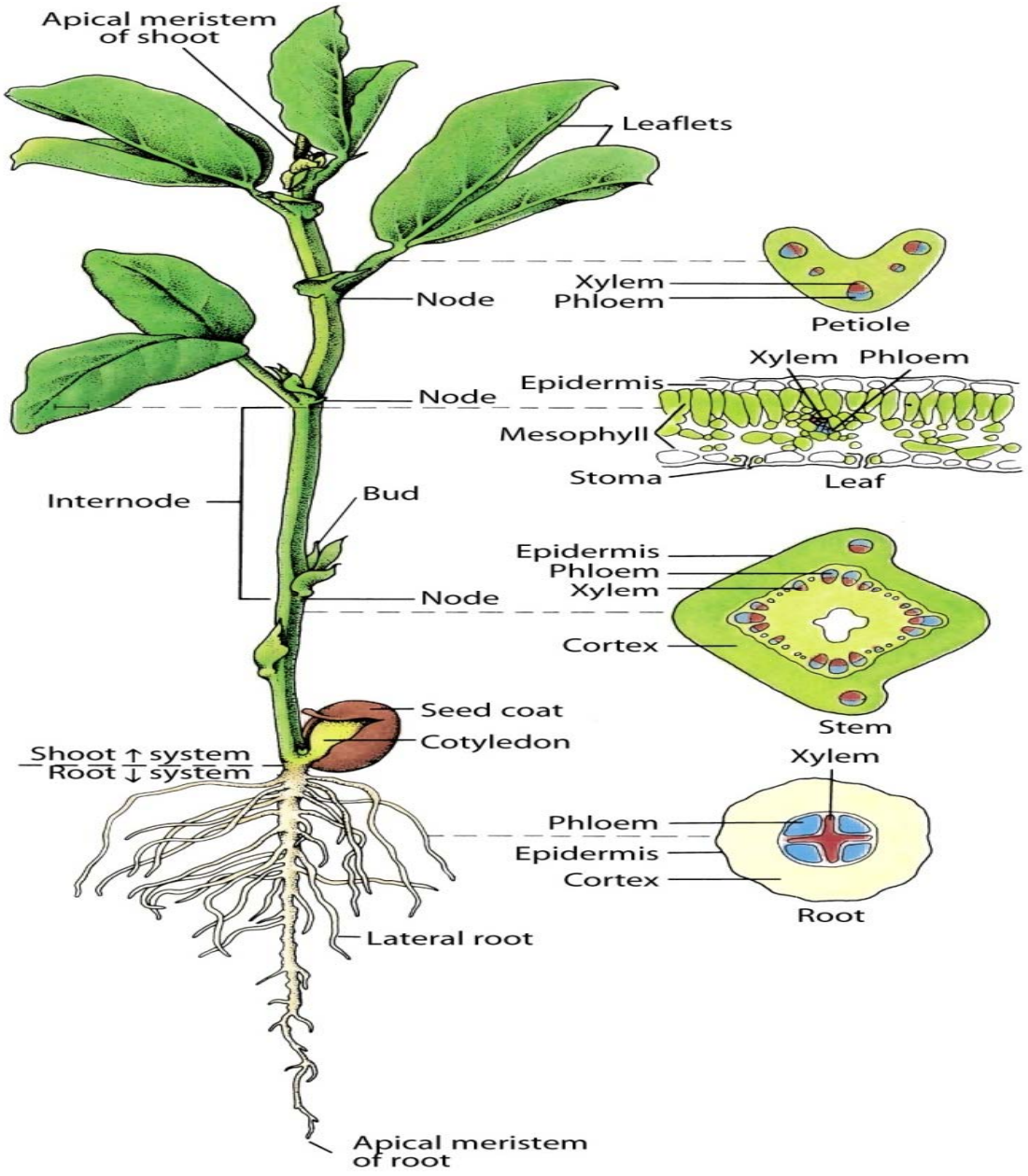
Plant Morphology

Shoot system

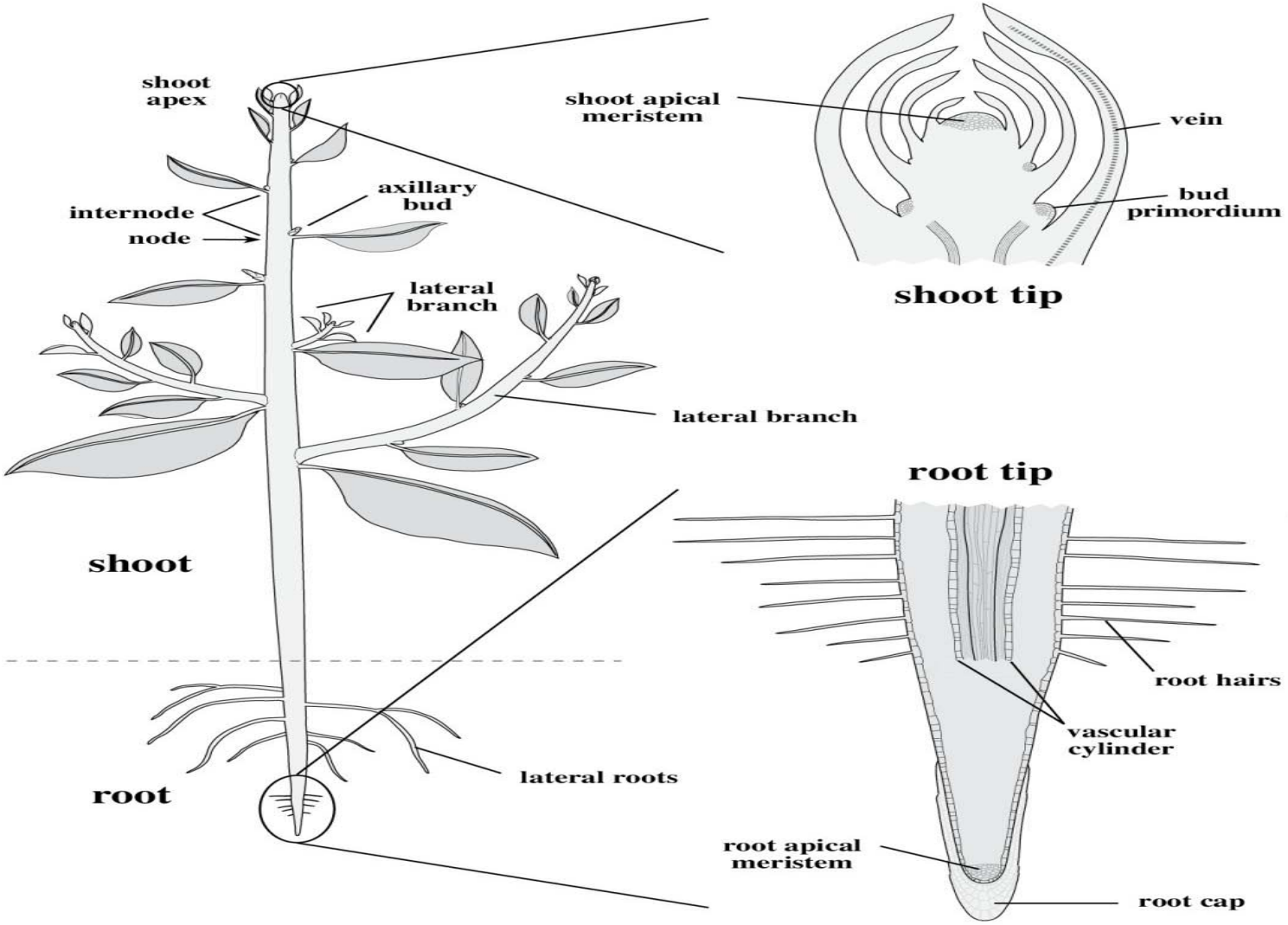
- Stem
  - Supports and places leaves
  - Transports H_2O and nutrients
- Leaves
  - Photosynthesis
- Reproductive structures - Flowers

Root system

- Anchors the plant
- Absorbs water and minerals
- Storage (CHO) & synthesis of some hormones
- Propagation



Root & Shoot Tips



Dicots and Monocots plants

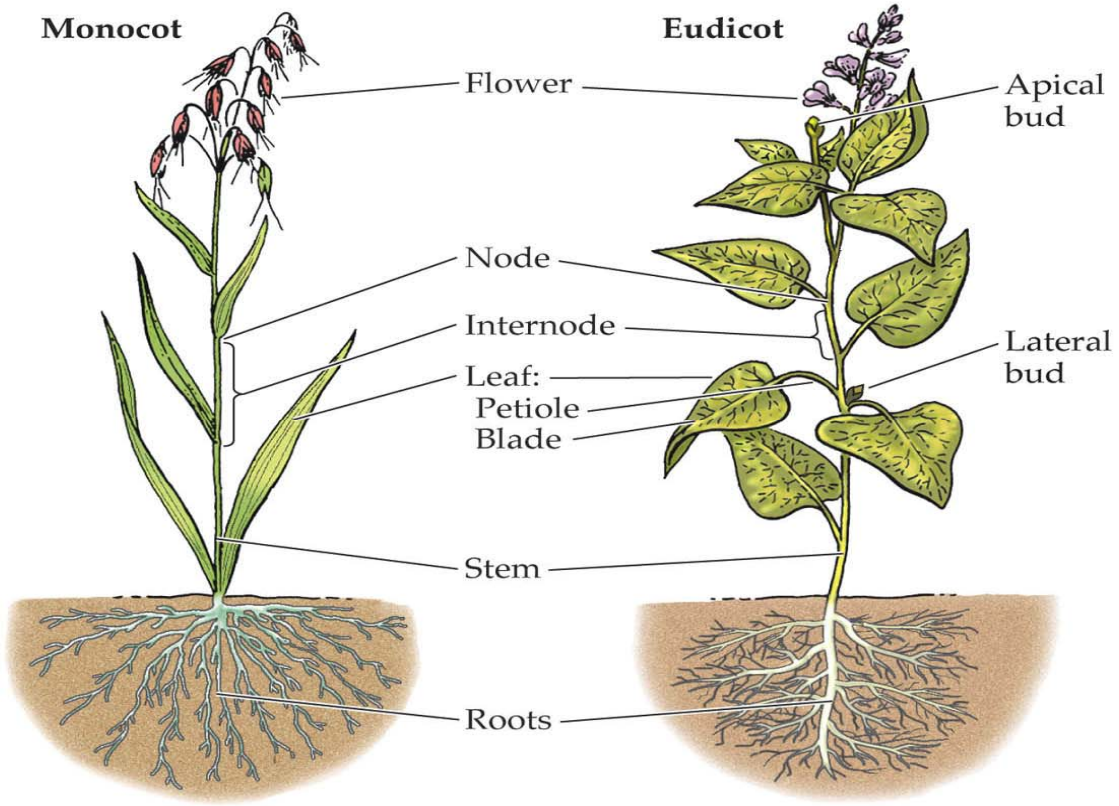
Flowering plants possess three kinds of vegetative (non-reproductive) organs:

Roots, Stems, and Leaves

النباتات الزهرة لها ثلاثة أنواع من الأعضاء الخضرية (غير التكاثرية) : الجذور والسيقان، والأوراق. الزهرة وهي العضو التكاثري لكاسيات البذور.

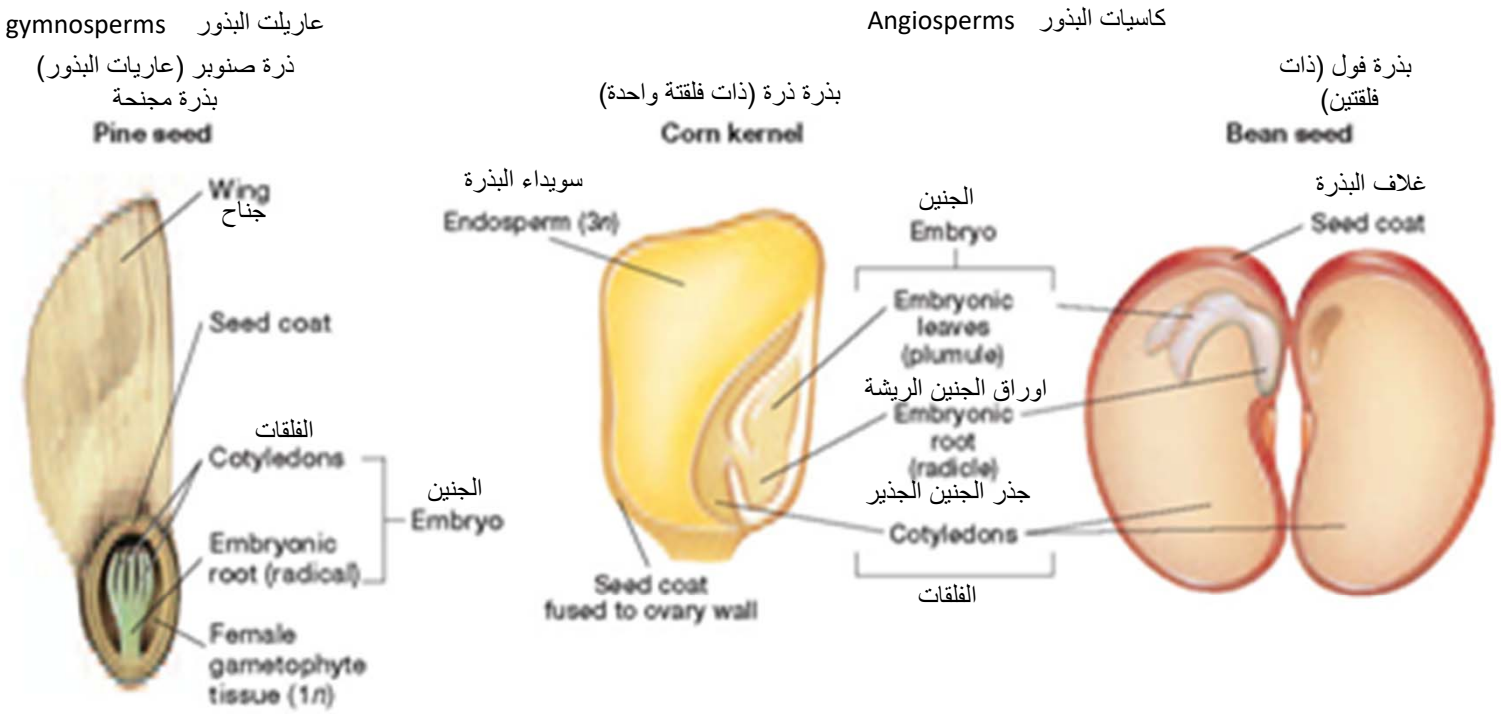
The flower is the reproductive organ of the Angiosperms.

- **Shoots system consist of Stems and leaves.**
- **Functions of Shoots system: Photosynthesis, Support, Reproduction, Storage and Transport**
- **Functions of Roots system: Anchorage, absorption of water and Minerals, provides nutrients for the shoot, storage for food**



LIFE: THE SCIENCE OF BIOLOGY, Seventh Edition, Figure 35.2 Vegetative Organs and Systems

Seed Structure

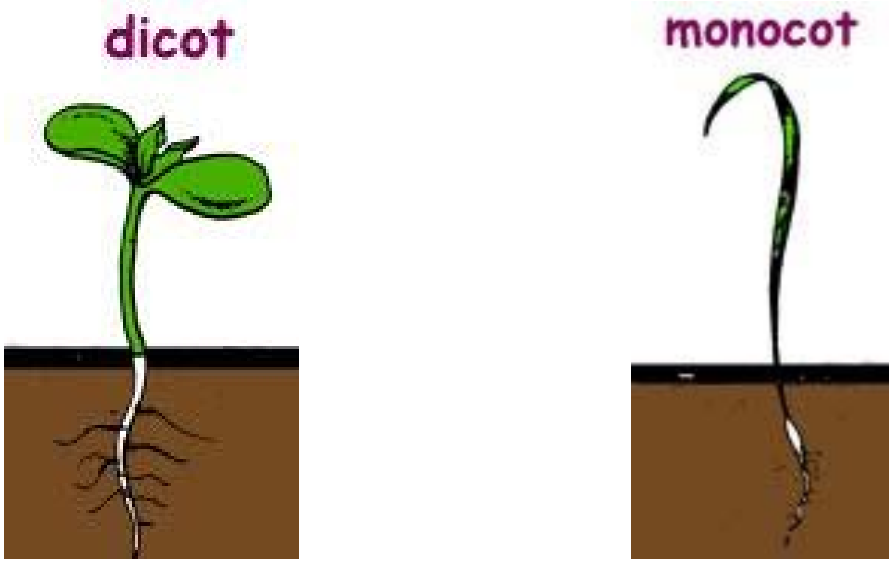


- A seed is a sporophyte embryo with its own food supply in a protective coat

البذرة هي جنين بوغي مزود بمواد غذائية مدخرة في أغلفة واقية تسمى القصرة

- Seed plants (gymnosperms and angiosperms) retain their spores

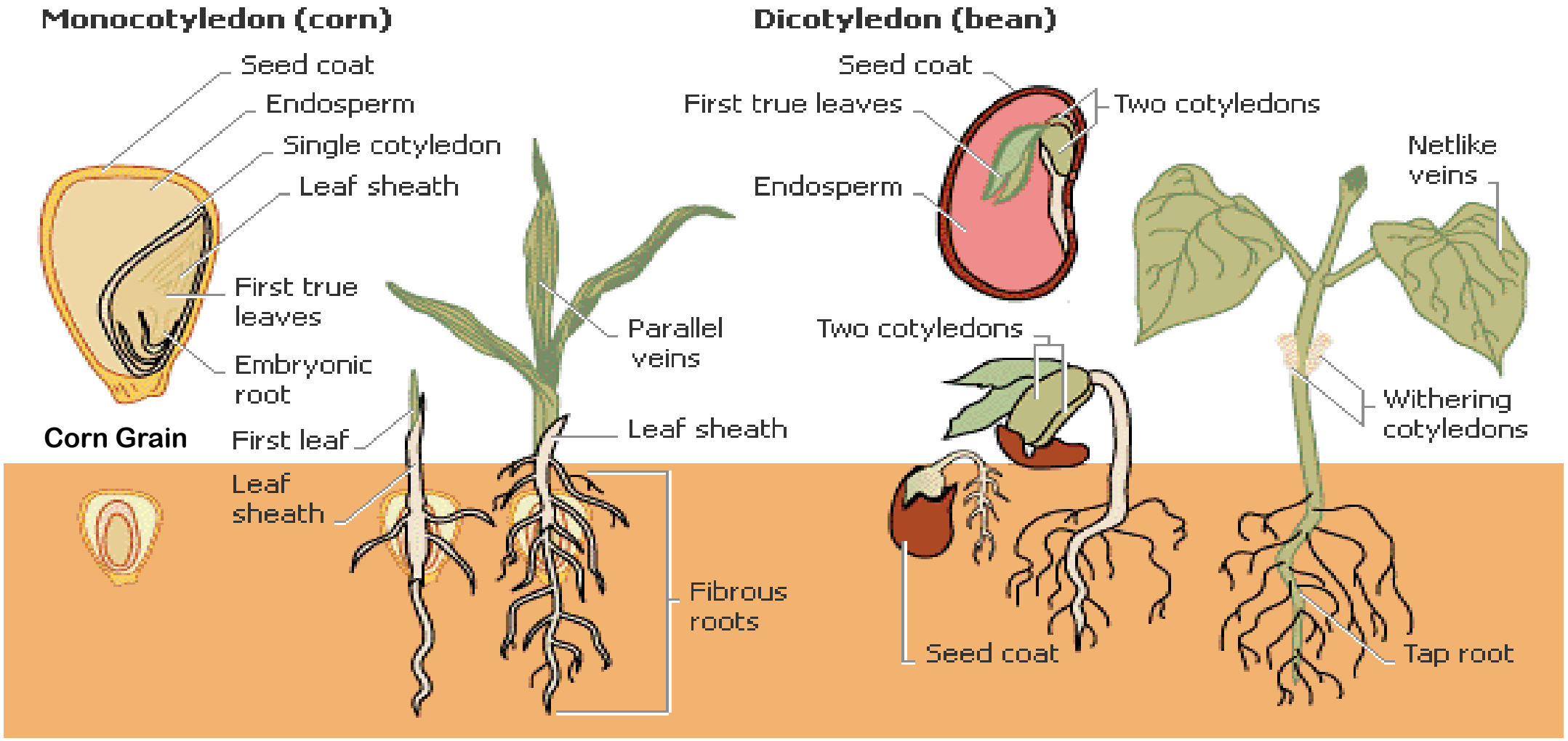
Plant Seedling



– **Monocotyledons (Monocots)- have a single seed leaf**

- **Dicotyledons (Dicots)- have double seed leaves**

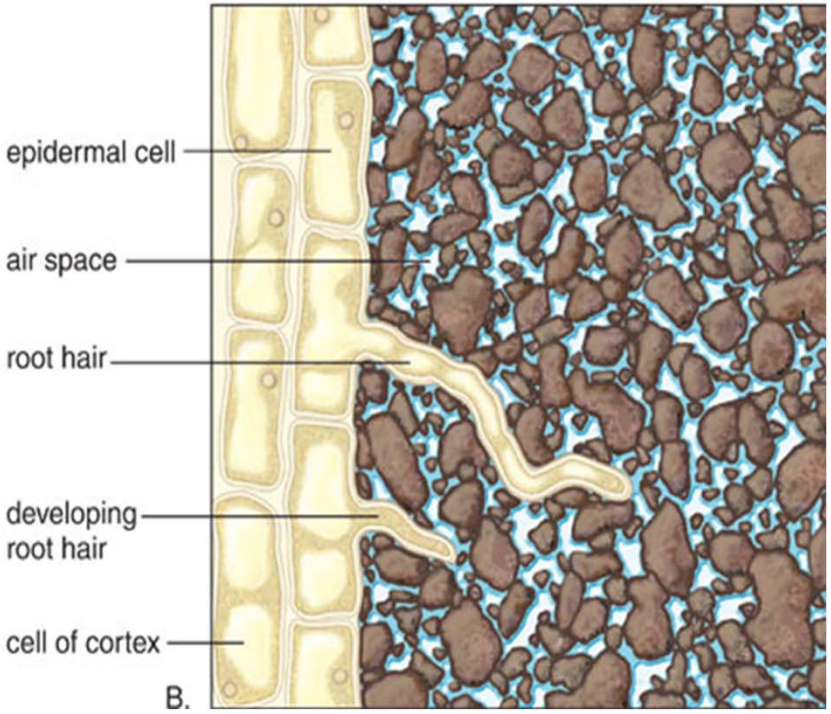
Seed Germination



Roots

Function - absorption, anchorage

Structure – root capقلنسوة, root hairsشعيرات جذرية, endodermisالبشرة الداخلية

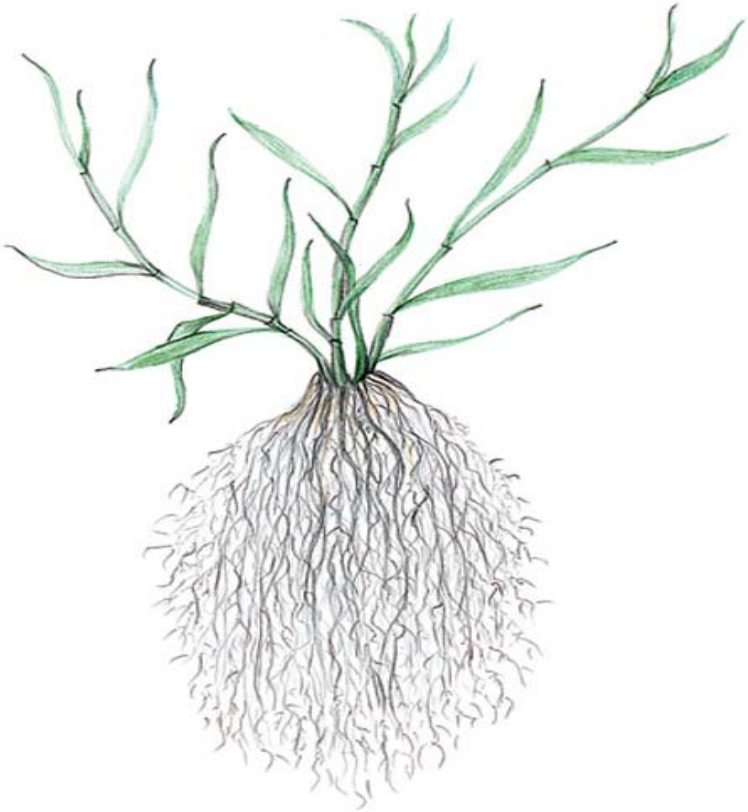


Roots: Specialized for H2O and Nutrient Absorption

Root Types: Adventitious & Tap Root System

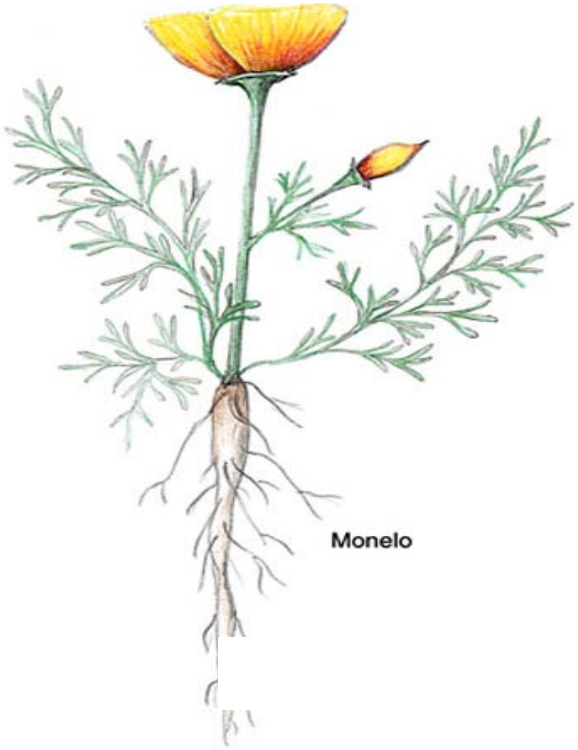
أنواع الجذر: الجذور العرضية والجذور الوتدية

لها عدة أنواع:
ليفيFibrous
دعاميProp
مساعدة buttress
المتسلقClimbing
الدرنيTuberous
التنفسيRespiratory
الهوائيAerial
طفيلية - ممصية parasitic



Adventitious العرضية

لا تنشأ من جذير
جنين البذرة

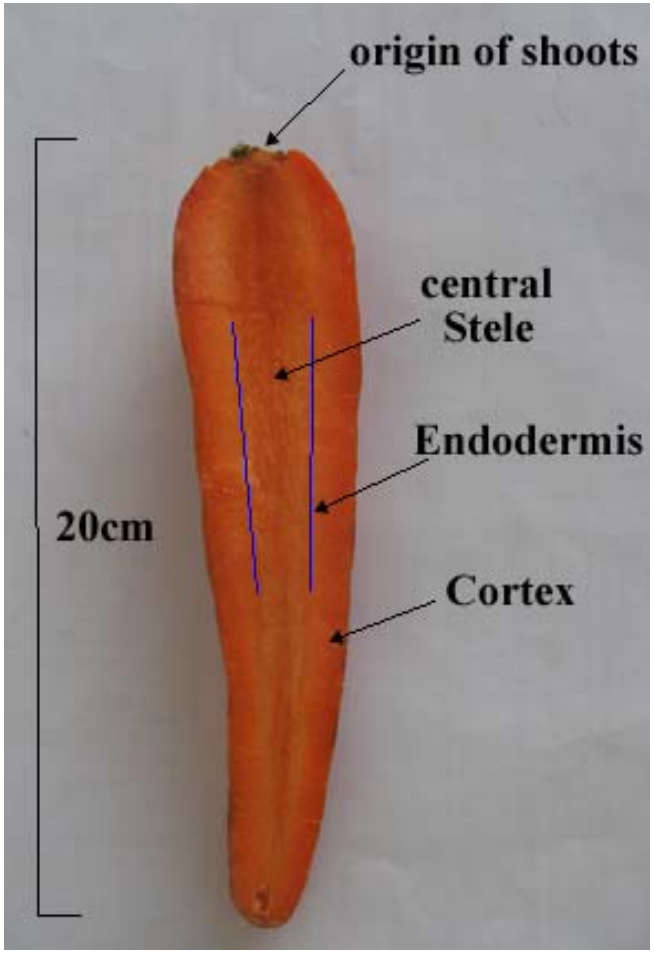


Tap الوتدية

تنشأ من جذير
جنين البذرة

Tap Root System

- **Develops from the primary root.**
- **Reaches deep into the ground**
- **Helps the plant during periods of drought.**



جذر وتدي
ينشا من الجذر الرئيسي.
يصل إلى أعماق الأرض
يساعد النبات خلال فترات الجفاف.

Tap Root Modifications:
Storage Roots

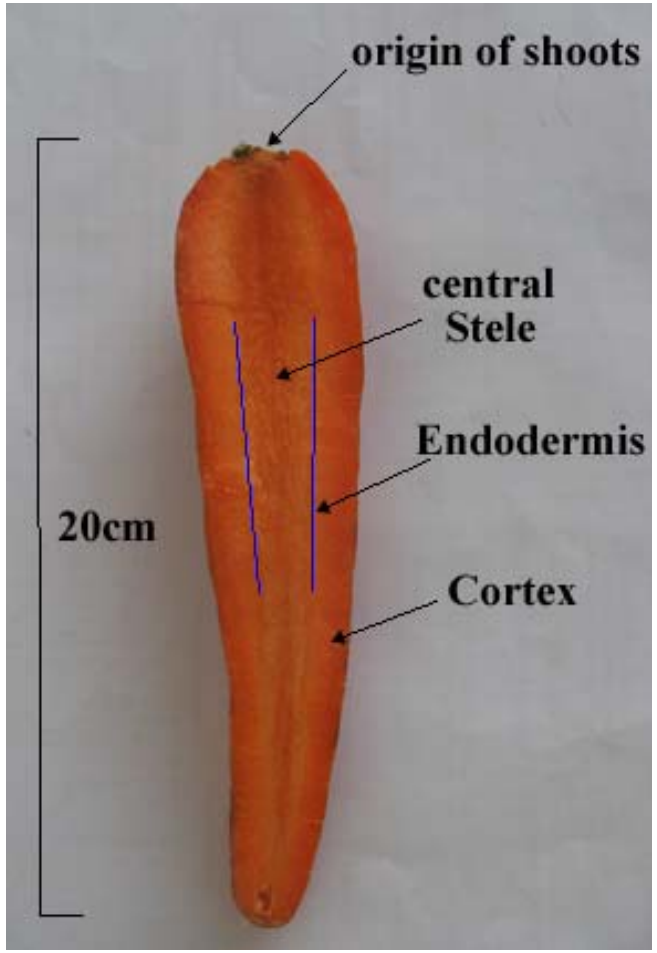
جذور تخزينية

بعض الجذور الوتدية تتحور لاختزان الغطاء فتنتفخ وتأخذ اشكال مختلفة مثل المغزلي(الفجل) او مخروطي(الجزر) او متكور(الفجل الاحمر)

Storage roots
***Raphanus sativus*, Radish**

Storage roots, Sweet potato

Carrot: Tap Root modification

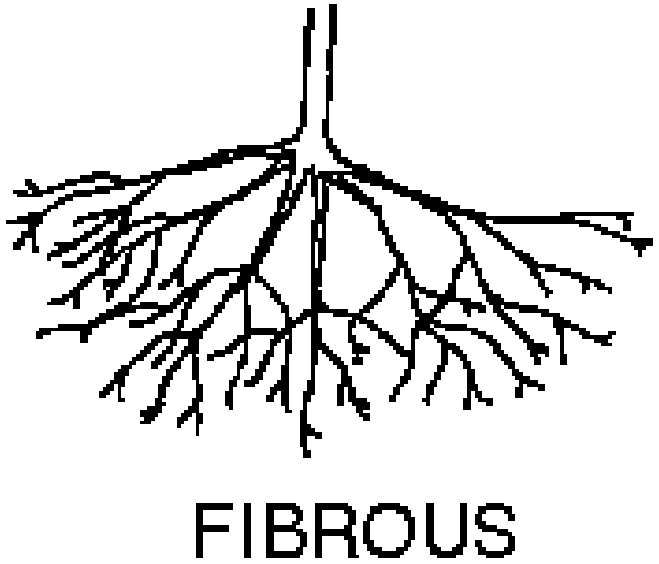


- **Function: Storage of water.**
- **Carrot plants are often associated with very sandy soils.**
- **The root modification allows the storage of water in the cortex and central stele.**
- **The mass of the root stabilizes the plant in the loose sandy soils.**

وظيفة: تخزين المياه.
غالبا ما ينمو في التربة الرملية.
جذر وتدي مألوف لمن يتغذون على الخضروات.
التحورالجذري يسمح لتخزين المياه في القشرة والأسطوان الوعائية المركزية.
كتلة الجذر يثبت النبات في التربة الرملية المفككة.

Fibrous Root System

- **Develops when the secondary roots become the main roots.**
- **Shallow roots but spread over a broad area.**
- **Helps prevent erosion.**



لها عدة أنواع:
ليفيFibrous
دعاميProp
مساعدة buttress
المتسلقClimbing
الدرنيTuberous
التنفسيRespiratory
الهوائيAerial
طفيلية - ممصية parasitic

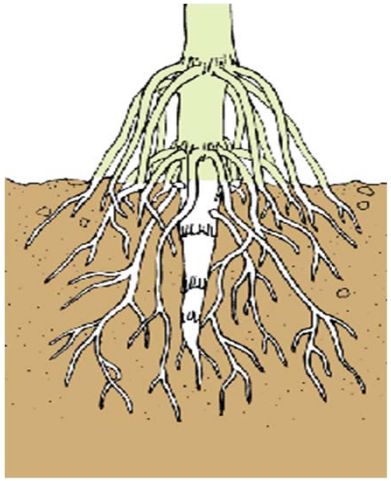
جذور ليفية (جذر ليفي)
ينشأ أو يتطور حيث تصبح الجذور الثانوية جذور رئيسية.
جذور ضحلة لكن تنتشر على مساحة واسعة.
تساعد على منع تآكل التربة (التعرية).

تنمو من العقد الأرضية في قاعدة الساق ومن امثلتها الجذور الليفية في السيقان الأرضية(البصل) وكذلك في السيقان الهوائية المدادة(النعناع)

Prop roots جذور دعامية

لها عدة أنواع:
ليفيFibrous
دعاميProp
مساعدة buttress
المتسلقClimbing
الدرنيTuberous
التنفسيRespiratory
الهوائيAerial
طفيلية - ممصية parasitic

Prop roots (also adventitious)



buttress roots جذور مساعدة

لها عدة أنواع:
ليفيFibrous
دعاميProp
مساعدة buttress
المتسلقClimbing
الدرنيTuberous
التنفسيRespiratory
الهوائيAerial
طفيلية - ممصية parasitic

buttress roots, rusty-leaved fig
جذور مساعدة

لها عدة أنواع:
ليفيFibrous
دعاميProp
مساعدة buttress
المتسلقClimbing
الدرنيTuberous
التنفسيRespiratory
الهوائيAerial
طفيلية - ممصية parasitic

Climbing roots
Hedera helix

لها عدة أنواع:
ليفيFibrous
دعاميProp
مساعدة buttress
المتسلقClimbing
الدرنيTuberous
التنفسيRespiratory
الهوائيAerial
طفيلية - ممصية parasitic

Tuberous root
Sweet potato

لها عدة أنواع:
ليفيFibrous
دعاميProp
مساعدة buttress
المتسلقClimbing
الدرنيTuberous
التنفسيRespiratory
الهوائيAerial
طفيلية - ممصية parasitic

Respiratory roots جذور تنفسية

Pneumatophores (respiratory roots)
Avicennia marina, black mangrove

لها عدة أنواع:
ليفيFibrous
دعاميProp
مساعدة buttress
المتسلقClimbing
الدرنيTuberous
التنفسيRespiratory
الهوائيAerial
طفيلية - ممصية parasitic

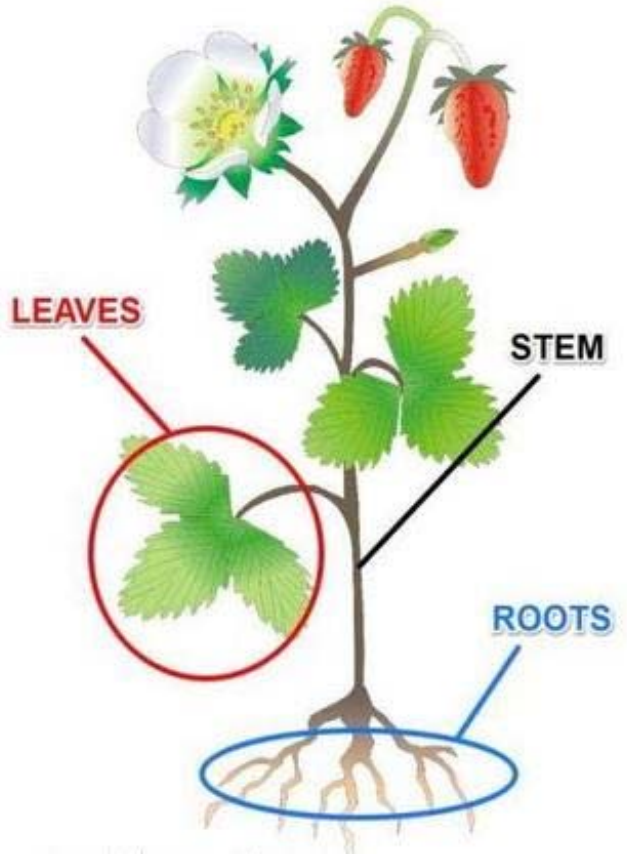
Aerial root
Ficus bengalensis

لها عدة أنواع:
ليفيFibrous
دعاميProp
مساعدة buttress
المتسلقClimbing
الدرنيTuberous
التنفسيRespiratory
الهوائيAerial
طفيلية - ممصية parasitic

Haustoria – parasitic roots

جذورطفيلية - ممصية

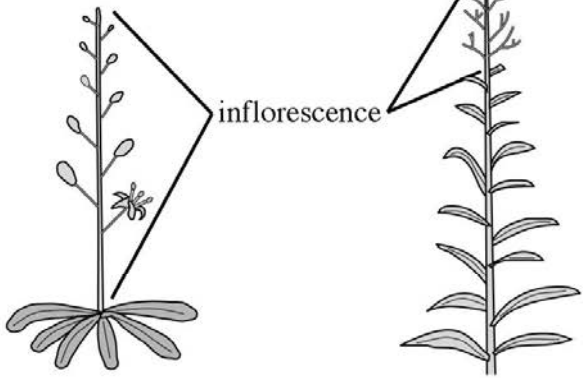
Shoot system
(Stem + Associated Leaves)



Functions:

- **Support for and the elevation of leaves, flowers and fruits.**
- **The stems keep the leaves in the light and provide a place for the plant to keep its flowers and fruits.**
- **Transport of fluids between the roots and the shoots in the xylem and phloem**

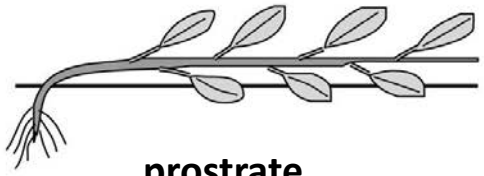
Stem Habit
=relative position of stem (+ growth, structure)



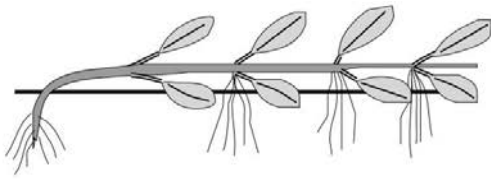
acaulescent
نبات عديم الساق

caulescent
نبات ذو ساق

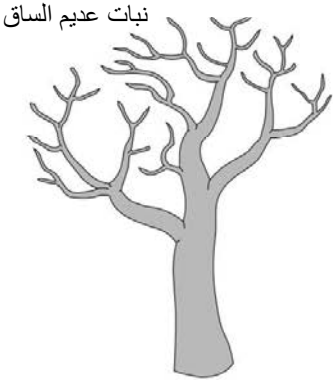
cespitose
نبات ذو ساق خصلي (ذو خصل)



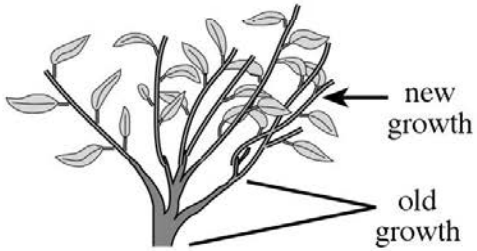
prostrate
نبات ذو ساق زاحف او مفترش



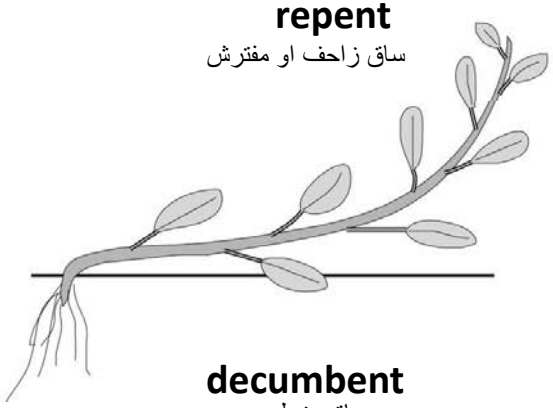
repent
ساق زاحف او مفترش



arborescent
ساق شجري



suffrutescent
ساق متخشبة القاعدة



decumbent
ساق منبطح

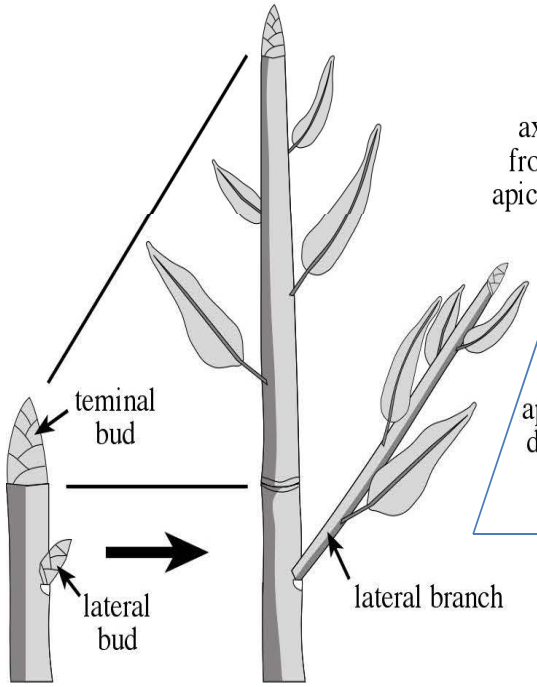
Stem Branching تفرع الساق

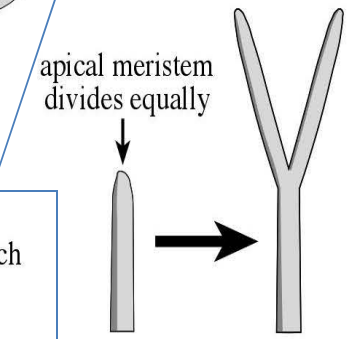
lateral branching
التفرع الجانبى

Dichotomous Branching
ثنائي التشعب (قمي)

lateral branching
التفرع الجانبى

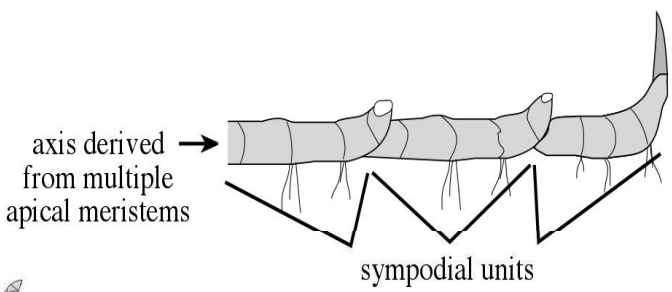
Monopodial Branching
تفرع صادق المحور

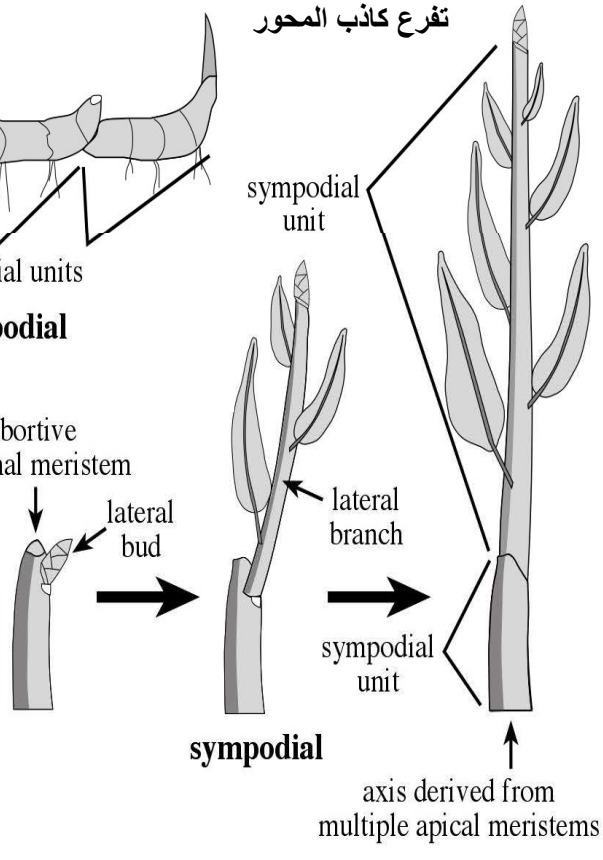




Dichotomous Branching
ثنائي التشعب (قمي)

Sympodial Branching
تفرع كاذب المحور

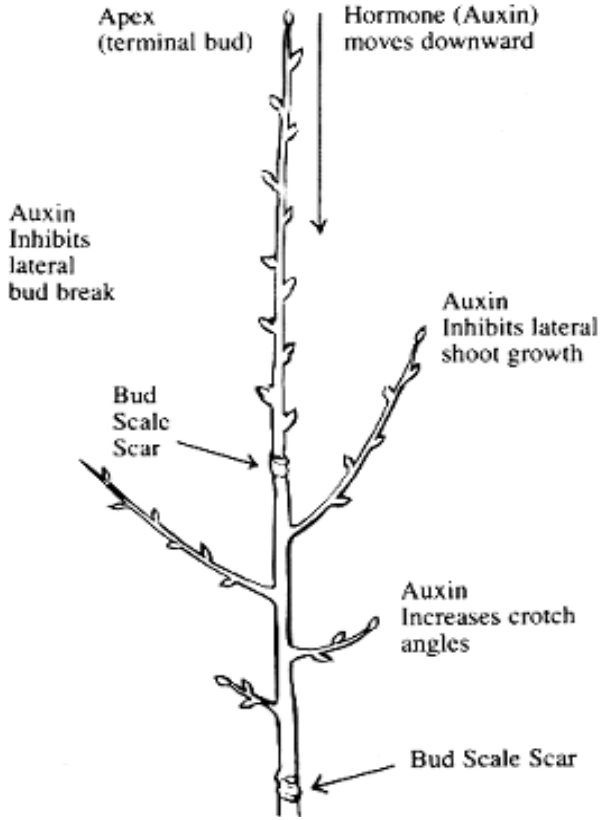


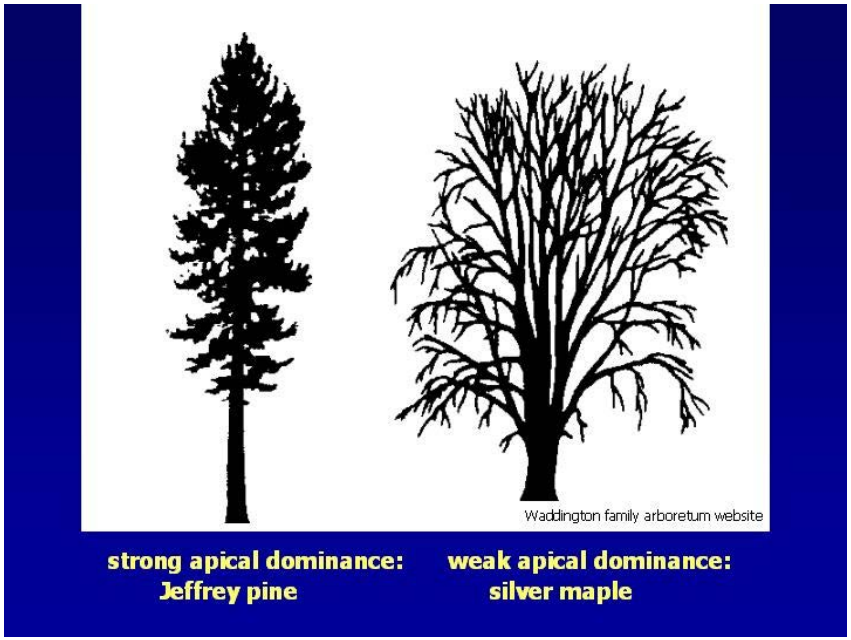


Apical Dominance السيادة القمية

Usually the growing terminal bud inhibits the development of the lateral buds, a phenomenon known as apical dominance – as the influence of the apical meristem lessens the growth of the lateral buds which proceed with their development.

عادة نمو البرعم القمي يثبط نمو وتطور البراعم الجانبية، وتعرف هذه الظاهرة باسم السيادة القمية.



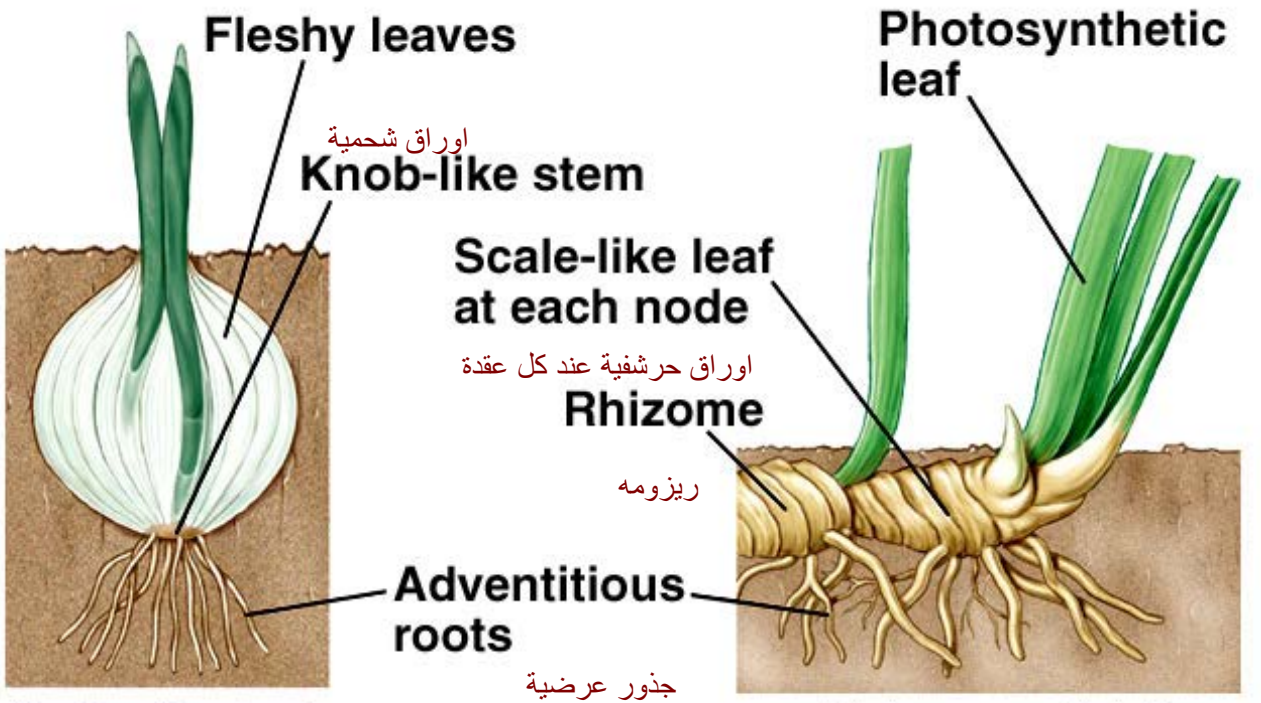


Apical Dominance السيادة القمية

Apical dominance is the phenomenon whereby the main, central stem of the plant grows more than other side stems.

Stem (Shoot) Types & Modifications أنواع وتحور السيقان

Types of Modified Stems (1)



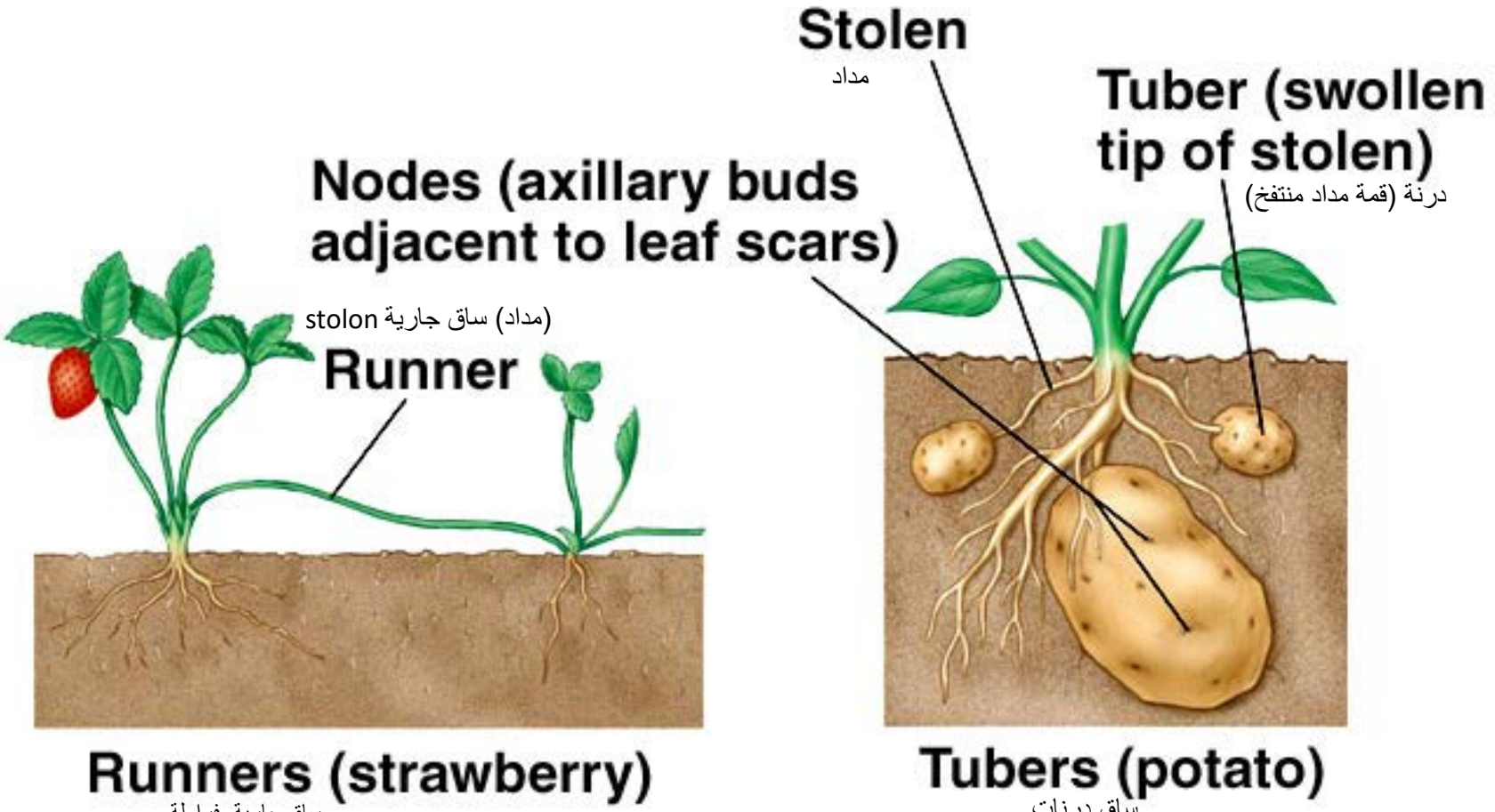
Bulbs (onion)

ساق نبات البصل (بصيلة)

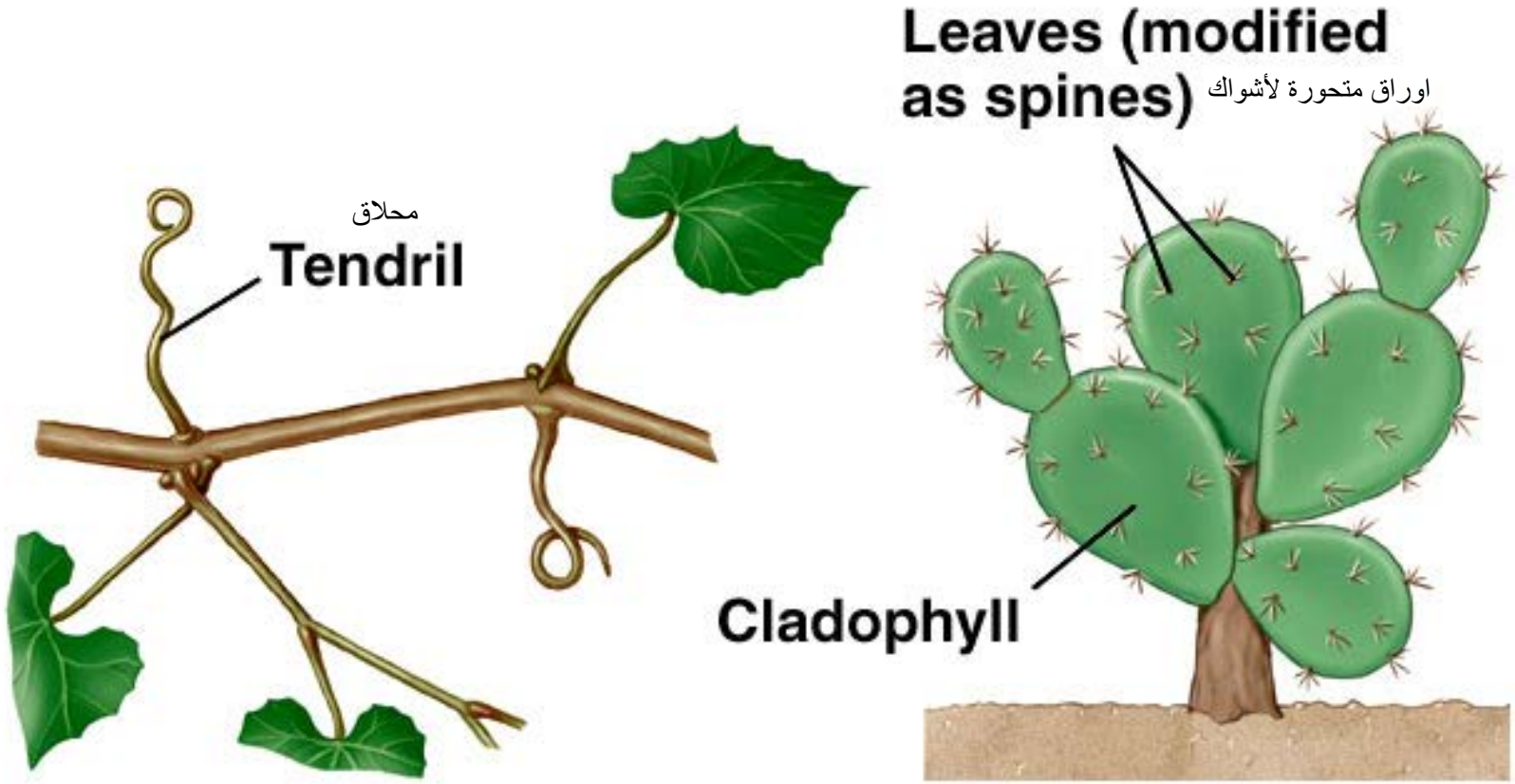
Rhizomes (iris)

ساق نبات السوسن ريزومية

Types of Modified Stems (2)



Types of Modified Stems (3)



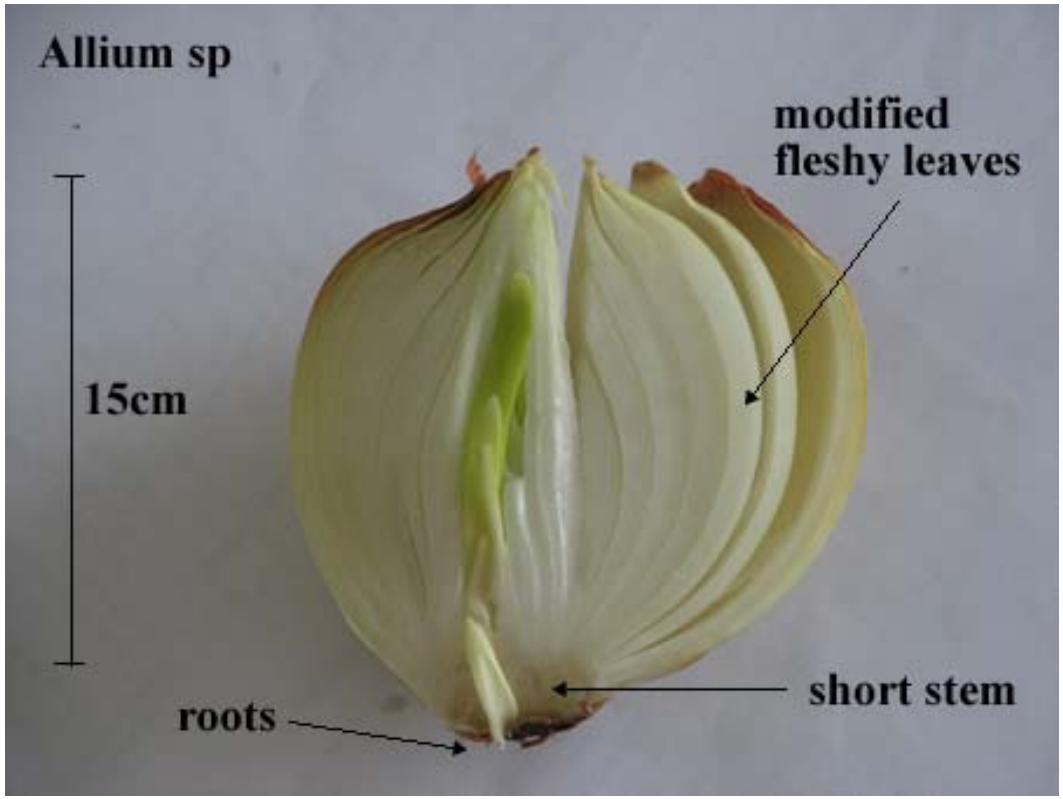
Tendrils (grape) عنب

ساق محلاقية

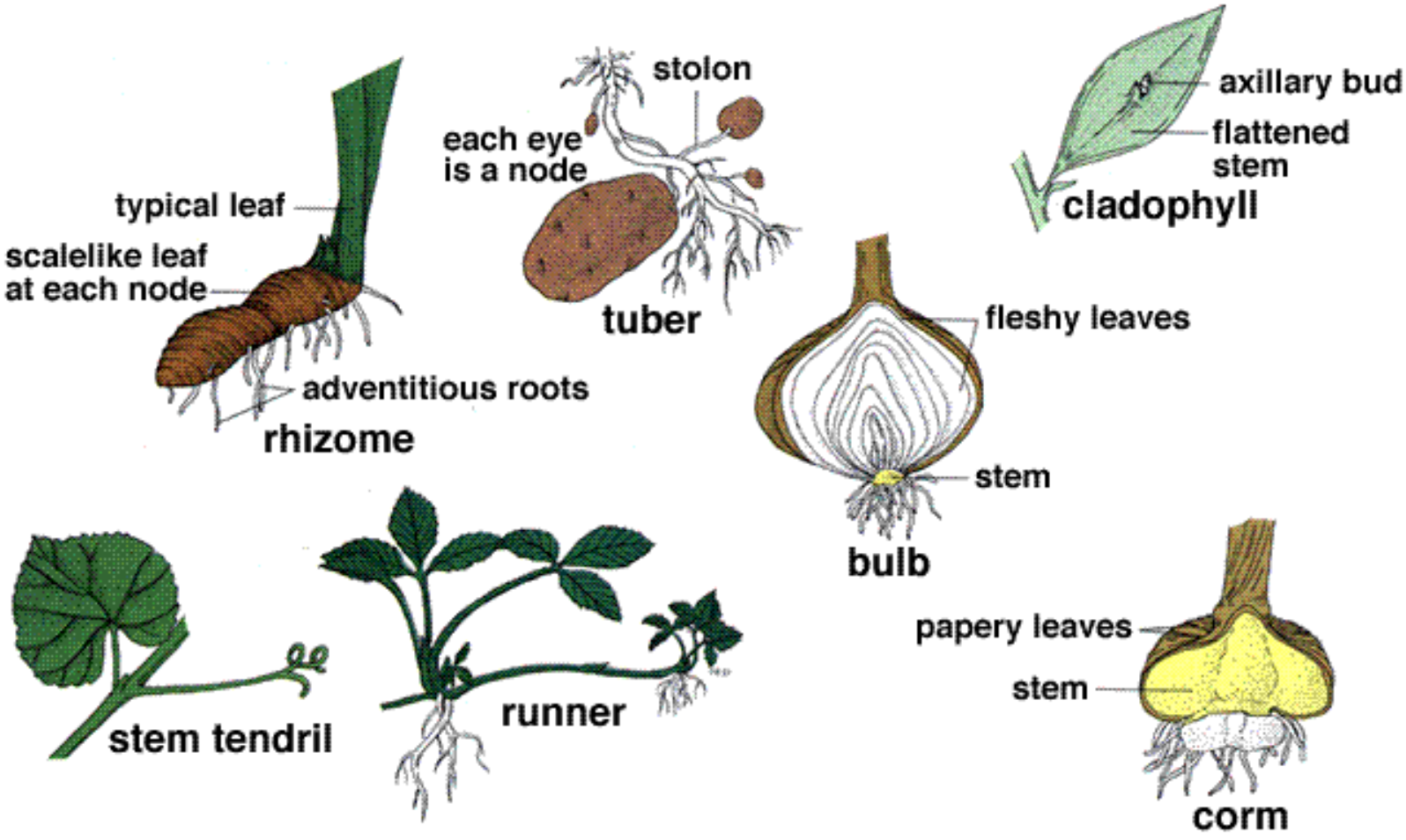
ساق ورقية
التين الشوكي

Cladophylls (prickly pear)

Onion Bulb



Types of Specialized Stems

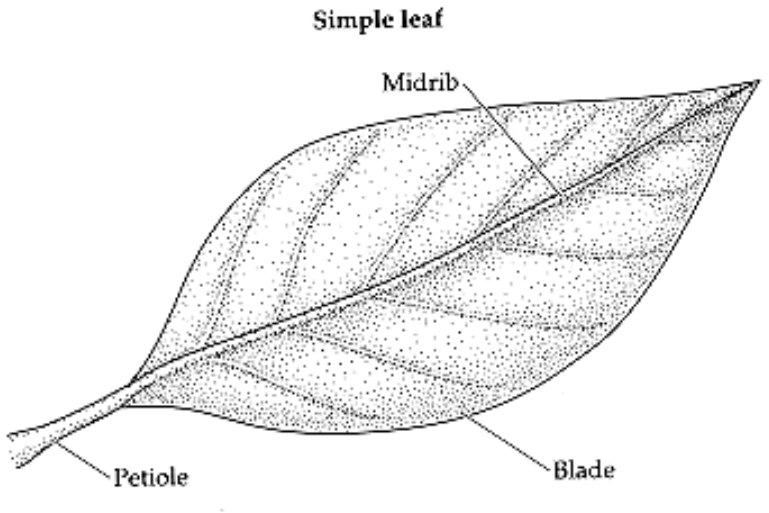


Leaves

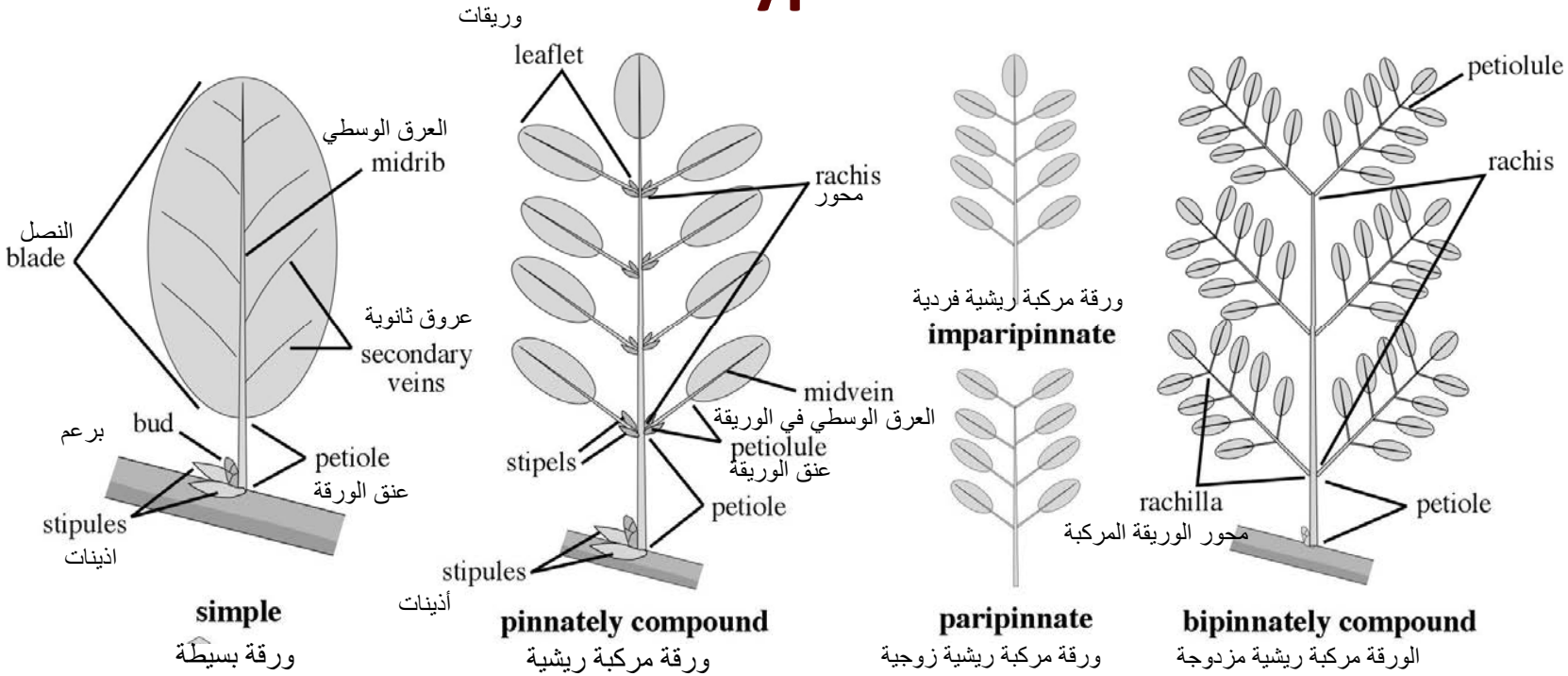
- The leaf- Is the main photosynthetic organ of most vascular plants
- Leaves generally consist of a flattened blade and a petiole, which joins the leaf to a node of the stem
- Leaves may appear different based on whether they grow in shade or full sun
- Some plant species have evolved modified leaves that serve various functions
  - Climbing, pollinator attraction, storage, digestion, prevention of water loss, etc.

External Parts of the Leaf:

- Petiole عنق
  - Leaf stalk or part that connects the leaf to the stem.
- Blade نصل
  - The large, flat part of a leaf.
- Midrib عرق وسطي
  - The large center vein.



Leaf Types



(a) **Simple leaf.**
ورقة بسيطة

A simple leaf is a single, undivided blade.

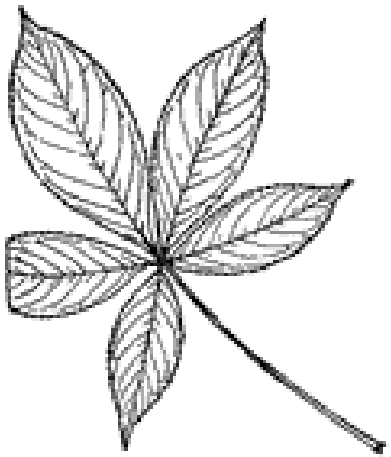
(b) **Compound leaf (Pinnate).**
ورقة مركبة ريشية

In a compound leaf, the blade consists of multiple leaflets. Note that a leaflet has no axillary bud at its base.

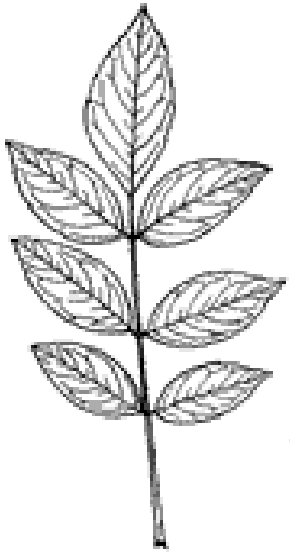
(c) **Doubly compound leaf (Bi-pinnate).**
ورقة مركبة ريشية مزدوجة

In a doubly compound leaf, each leaflet is divided into smaller leaflets.

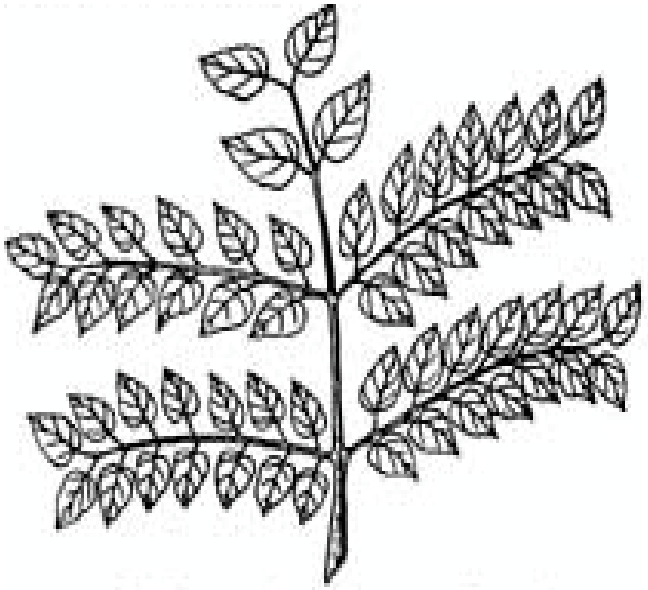
Compound Leaves



palmately compound
ورقة راحية مركبة

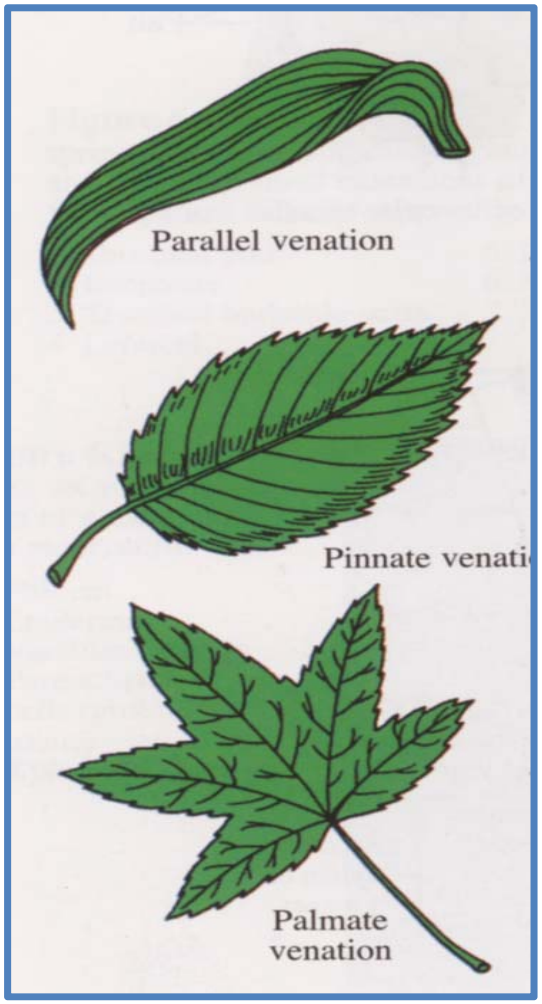


pinnately compound
ورقة ريشية مركبة



Bi-Pinnately Compound Leaf
ورقة مركبة ريشية مزدوجة

Leaf Venation تعرق الورقة



– تعرق متوازي

Parallel-veins extend the entire length of the leaf with little or no cross-linking

– تعرق ريشي

Pinnate-leaves have one major vein from which others branch

– تعرق راحي

Palmate-leaves have several veins which branch

Reticulate
شبكي

Dicot and Monocot Leaves

Parallel
متوازي

Leaf Adaptations/ Modifications

Some plant species have evolved modified leaves to serve various functions.

(a) **Tendrils.** The tendrils by which this pea plant clings to a support are modified leaves. After it has "lassoed" a support, a tendril forms a coil that brings the plant closer to the support. Tendrils are typically modified leaves, but some tendrils are modified stems, as in grapevines.

(b) **Spines.** The spines of cacti, such as this prickly pear, are actually leaves, and photosynthesis is carried out mainly by the fleshy green stems.

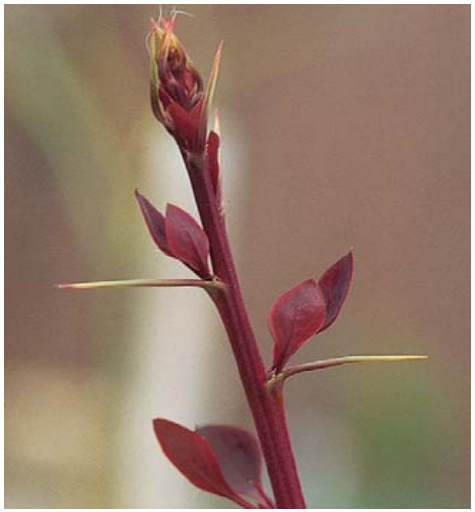
(c) **Storage leaves.** Most succulents, such as this ice plant, have leaves modified for storing water.

(d) **Bracts.** Red parts of the poinsettia are often mistaken for petals but are actually modified leaves called bracts that surround a group of flowers. Such brightly colored leaves attract pollinators.

(e) **Reproductive leaves.** The leaves of some succulents, such as *Kalanchoe daigremontiana,* produce adventitious plantlets, which fall off the leaf and take root in the soil.

Tendril

Spiny leaf- Cacti spines

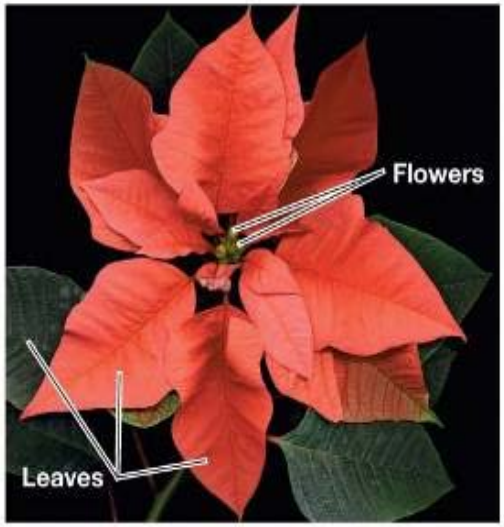


Succulent leaves

Brightly-colored leaves-
to attract pollinators

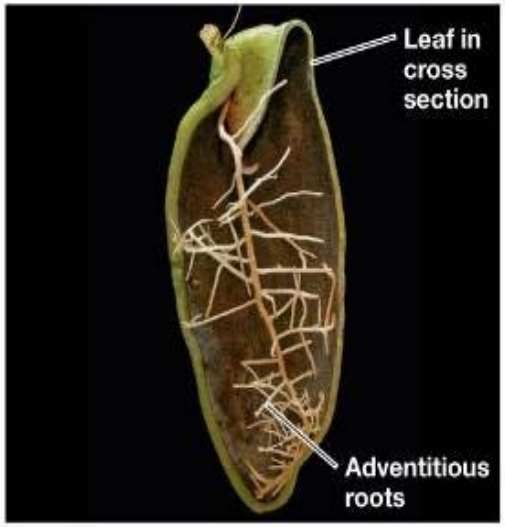
Leaf Modifications

(d) Poinsettia leaves attract pollinators.



(e) Pitcher plant leaves trap insects.

(f) Flowerpot plant leaves collect soil.



Modified into Sharp structure for protection

- Thorn – Hard, long, sharp-pointed
- Spine - Hard, rigid extensions of leaves
- Prickle – Hard, sharp pointed

Tentacular Leaf

A leaf bearing numerous, sticky, glandular hairs or bristles that function in capturing and digesting small animals, e.g. Drosera

Tentacular Leaf - *Drosera* spp (Droseraceae)

Carnivorus plants

- **Insect-Trapping Leaves in areas with low soil Nitrogen**

- **Insect digested by enzymes to release Nitrogen from proteins**

Trap Leaf of *Dionaea muscipula* capturing fly

Leaf modification

(Pitcher plant leaf)

Modification of leaves:

Reproductive Leaves - development of a new plants at tip of the leaf.

Sun and Shade Leaves

Shade Leaves

Sun Leaves

Grown in shade Grown in sun