

Important Word Roots			
<b>Angiosperm</b>	<b>Gametophyte</b>	<b>Sporophyte</b>	
<ul style="list-style-type: none"> <li>• Angion = Vessel</li> <li>• Sperm = Seed</li> </ul>	<ul style="list-style-type: none"> <li>• a wife or husband (the multicellular haploid form in organisms undergoing alternation of generations)</li> <li>• Phyte = plant</li> </ul>	<ul style="list-style-type: none"> <li>• Sporo – Seed (the multicellular diploid) form in organisms undergoing alternation of generations)</li> <li>• Phyte = Plant</li> </ul>	
<b>Phyte</b>		Great site for plant word roots: <a href="http://wpscms.pearsoncmg.com/pls_1256139378_campbell_biology_9/190/48803/12493750.cw/index.html">http://wpscms.pearsoncmg.com/pls_1256139378_campbell_biology_9/190/48803/12493750.cw/index.html</a>	
<ul style="list-style-type: none"> <li>• Plant</li> </ul>			

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**Biology and Society:  
The Buzz on Coffee Plants**

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– Human progress has always depended upon expanding our use of plants for

- food,
- fuel,
- clothing, and
- other trappings of modern life.



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**Biology and Society:  
The Buzz on Coffee Plants**

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- Coffee is one of the most important agricultural products in the world today.
- Ground coffee is made from the seeds of plants belonging to several species in the genus *Coffea*.
- Coffee was discovered in Ethiopia during the 1200s.
- By the 1700s, imported coffee plants were an important crop in the Americas.

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**Biology and Society:  
The Buzz on Coffee Plants**

- People love coffee because of the jolt we get from caffeine, which
  - is naturally produced by the coffee plant as a self-defense against herbivores and
  - stimulates the nervous system of those who consume it.

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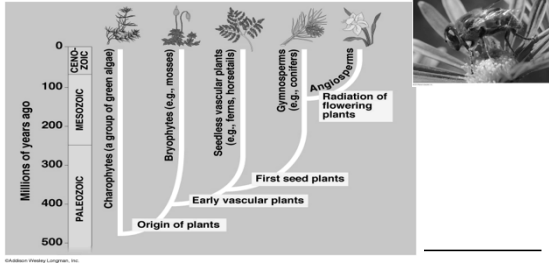
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**THE STRUCTURE AND FUNCTION  
OF A FLOWERING PLANT**

- Angiosperms
  - have dominated the land for over 100 million years and
  - account for about 250,000 species alive today.




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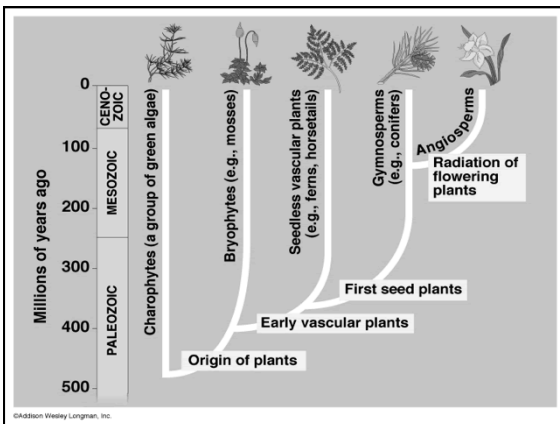
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**Monocots and Dicots**

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– On the basis of several structural differences, angiosperms are classified into two groups:

1. **monocots** and
2. **dicots**.

Monocots				
				
One cotyledon	Veins usually parallel	Vascular bundles usually complexly arranged	Fibrous root system	Floral parts usually in multiples of three
Dicots				
				
Two cotyledons	Veins usually netlike	Vascular bundles usually arranged in ring	Taproot usually present	Floral parts usually in multiples of four or five

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**Monocots and Dicots**

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- The names of the groups refer to **cotyledons**, the first leaves to emerge from a growing seedling.
  - A monocot embryo has one seed leaf.
  - A dicot embryo has two seed leaves.
- The largest group of dicots is the **eudicots**.
- Most flowering plants are eudicots.

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Table 28.1b

Table 28.1 Comparing Monocots and Eudicots		
	Flowers	Roots
<b>Monocots</b>	 Floral parts usually in multiples of three	 Fibrous root system
<b>Eudicots</b>	 Floral parts usually in multiples of four or five	 Taproot usually present

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**Plant Organs: Roots, Stems, and Leaves**

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– Plants have

- **organs** made up of different tissues and
- tissues made up of one or more types of cells.

**Plant Organs**

*Organs: tissues that act together to serve a specific function.*

The diagram shows a plant with labels for Leaf, Flower, Stem, and Roots. Brackets group these into Leaves, Stems, and Roots. A legend indicates that each organ consists of Dermal, Vascular, and Ground tissues.

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**Plant Organs: Roots, Stems, and Leaves**

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– The evolution of plants onto land around 475 million years ago required

- structures for absorbing water and minerals from the soil,
- a large light-collecting surface,
- the ability to take in carbon dioxide from the air for photosynthesis, and
- adaptations for surviving dry conditions.

The graph plots 'Millions of years ago' on the y-axis (0 to 500) against geological eras (Paleozoic, Mesozoic, Cenozoic). Key milestones are marked: Origin of plants (~475 MYA), Early vascular plants, Bryophytes (e.g., mosses), Seedless vascular plants (e.g., ferns, horsetails), Gymnosperms (e.g., conifers), and Evolution of flowering plants.

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**Plant Organs: Roots, Stems, and Leaves**

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– In a land plant, these vital functions are performed by

- roots (below ground) and
- shoots (above ground), including
  - stems,
  - leaves, and
  - flowers.

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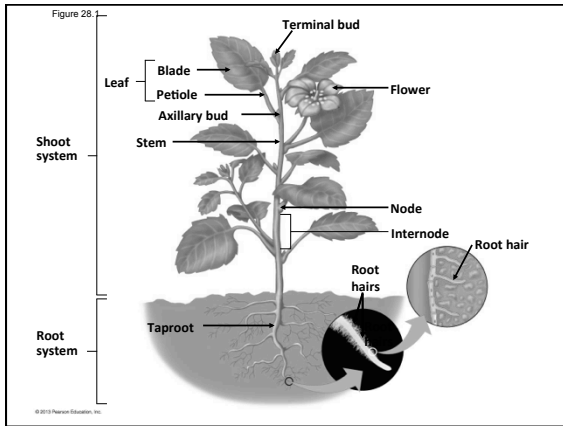
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*Roots*

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- A plant's **roots**
  - anchor it in the soil,
  - absorb and transport minerals and water, and
  - store food.
- All of a plant's roots make up its **root system**.
- **Root hairs**
  - are tiny projections near the root tips and
  - increase the surface area of the root, providing an extensive outer layer for absorption of water and minerals.

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**Roots**

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- **Large taproots**
  - occur in plants such as carrots, turnips, sugar beets, and sweet potatoes and
  - store food in the form of carbohydrates such as starch.
- Other types of modified roots include buttress roots, aerial roots that
  - look like buttresses and
  - support the tall trunks of the trees that produce them.

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*Stems*

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- The **shoot system** of a plant is made up of
  - stems,
  - leaves, and
  - structures for reproduction (flowers).
- **Stems** generally
  - grow above the ground and
  - support the leaves and flowers.

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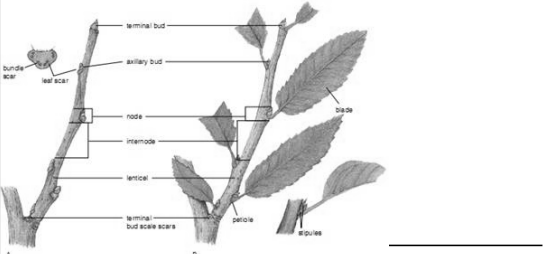
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*Stems*

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- A stem has
  - **nodes**, the points at which leaves are attached, and
  - **internodes**, the portions of the stem between nodes.




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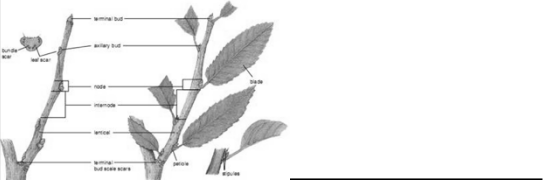
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*Stems*

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- When a plant stem is growing in length, the **terminal bud**, at the apex (tip) of the stem, has
  - developing leaves and
  - a compact series of nodes and internodes.
- The **axillary buds**, one in each of the crooks formed by a leaf and the stem, are usually dormant.




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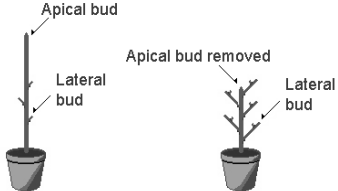
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**Stems**

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- In many plants, the terminal bud produces hormones that inhibit growth of the axillary buds, a phenomenon called **apical dominance**.
- Removing the terminal bud can make a plant bushier.



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**Stems**

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- Stems can take many forms.
- Strawberry plants have horizontal stems, or runners, that
  - grow along the ground surface and
  - serve as a form of asexual reproduction.
- Iris or ginger plants have horizontal underground stems called **rhizomes**.



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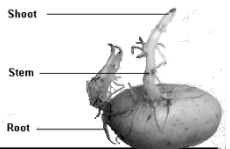
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**Stems**

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- Stems can take many forms.
- A potato plant has rhizomes ending in enlarged structures called **tubers**.
- The "eyes" of a potato are axillary buds, which can grow into new plants, allowing potatoes to be easily propagated.



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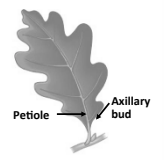
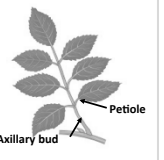
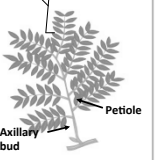
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*Leaves*

– **Leaves** are the primary sites of photosynthesis in most plants and consist of

- a flattened **blade** and
- a stalk, or **petiole**, which joins the leaf to the stem.

Simple	Compound	Doubly Compound
<p><b>LEAF ARRANGEMENT</b></p>  <p>A single individual blade</p>	 <p>One blade consisting of many leaflets (which themselves lack axillary buds)</p>	 <p>Each leaflet divided into smaller leaflets</p>

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**Plant Tissues and Tissue Systems**

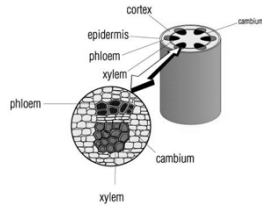
– **Tissues** are a group of cells that together perform a specialized function.

– A **tissue system** consists of one or more tissues organized into a functional unit within a plant. For example, vascular tissue called

- **xylem** conveys water and dissolved minerals upward from the roots to the stems and leaves and
- **phloem** tissue transports sugars from leaves or storage tissues to other parts of the plant.

– The **vascular tissue system**

- provides support and long-distance transport and
- includes xylem and phloem.



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**Plant Tissues and Tissue Systems**

– The three tissue systems occur in eudicot leaves.

1. The epidermis contains **stomata**, tiny pores between two specialized **guard cells**, which regulate the opening and closing of the stomata.
2. The ground tissue system of a leaf contains the **mesophyll**, the main site of photosynthesis.
3. The leaf's vascular tissue system is made up of a network of veins.

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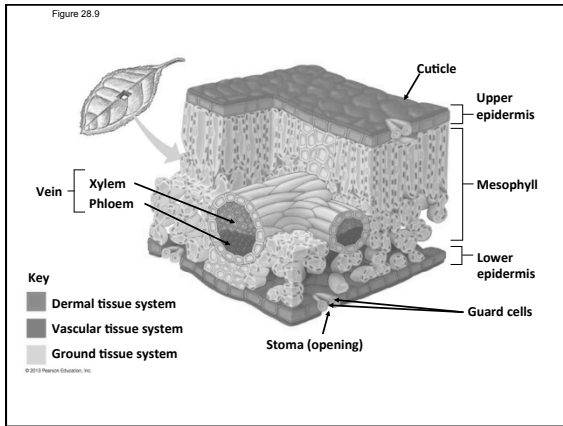
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### Plant Cells

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– Most plant cells have three unique structures.

1. **Chloroplasts** are the sites of photosynthesis.
2. A large **central vacuole** containing fluid helps maintain the cell's firmness (turgor).
3. A protective **cell wall**
  - surrounds the plasma membrane and
  - consists largely of the carbohydrate cellulose.

PLAY
BioFlix Animation: Tour Of A Plant Cell

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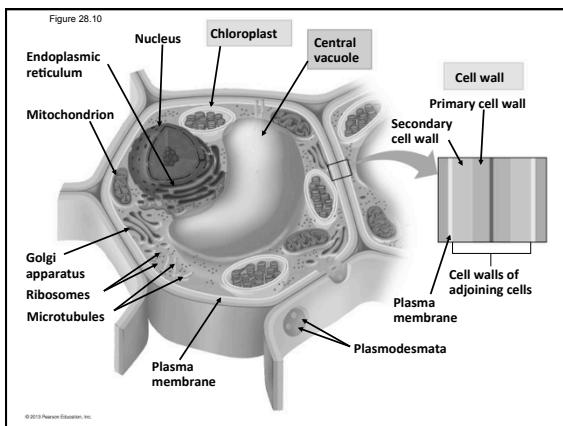
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### THE LIFE CYCLE OF A FLOWERING PLANT

- Many flowering plants can reproduce sexually and asexually.
- **Asexual reproduction** allows a single plant to produce many offspring quickly and efficiently.

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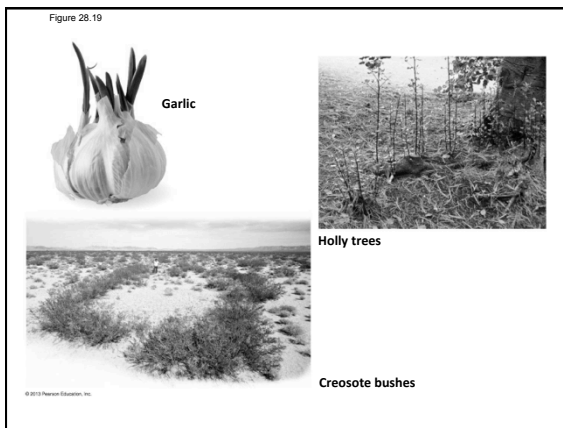
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### THE LIFE CYCLE OF A FLOWERING PLANT

- **Sexual reproduction** in plants involves **fertilization**, the union of gametes from two parents to produce genetically distinct offspring.



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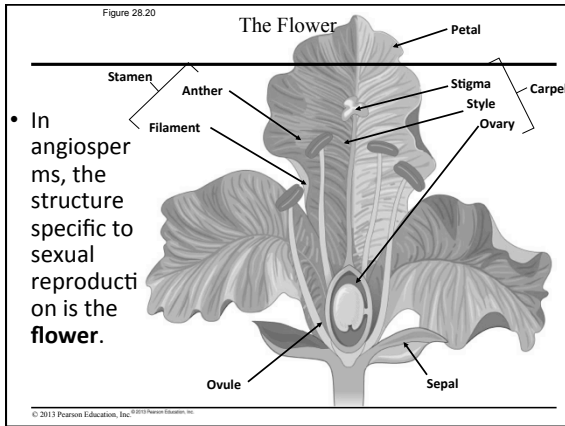
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### The Flower

- The main parts of a flower are modified leaves:
  - **sepals** enclose and protect the flower bud,
  - **petals** are often colorful and fragrant, which may serve to advertise the flower to insects and other pollinators,
- The flower's reproductive organs are the stamen and the carpel.
  - A **stamen** consists of a stalk tipped by an **anther**, where meiosis occurs and pollen grains develop.
  - A **carpel** has a long slender neck (the style) with a sticky **stigma** where pollen grains land.

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### The Flower

- The base of the carpel is the **ovary**.
- Within the ovary are **ovules**, each containing
  - one developing egg and
  - the cells that support it.
- The term **pistil** is sometimes used to refer to a single carpel or a group of fused carpels.

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**Overview of the Flowering Plant Life Cycle**

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**• ALTERATION OF GENERATION**

- The life cycles of all plants include alternation of a
  - haploid generation and
  - diploid generation.
- The diploid plant body is the **sporophyte**.
- The haploid plant is the **gametophyte**.

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**Overview of the Flowering Plant Life Cycle**

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- The sexual life cycle of an angiosperm involves
  - fertilization,
  - the ovule of a flower maturing into a seed containing the embryo,
  - the ovary developing into a fruit,
  - the seed **germinating** in a suitable habitat,
  - the embryo developing into a seedling, and
  - the seedling growing into a mature plant.

**PLAY**      Video: Flowering Plant Life Cycle (time lapse)

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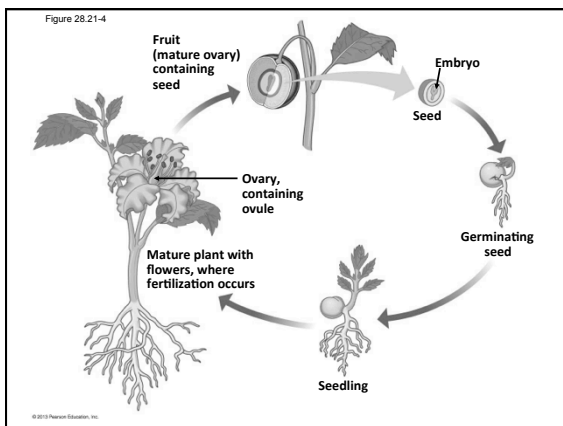
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Pollination and Fertilization

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– Fertilization requires gametes, which are produced by gametophytes.

- The male gametophyte is the **pollen grain**, which
  - is essential for pollination and
  - produces sperm.
- The female gametophyte is a multicellular structure called the **embryo sac**, which produces the egg.

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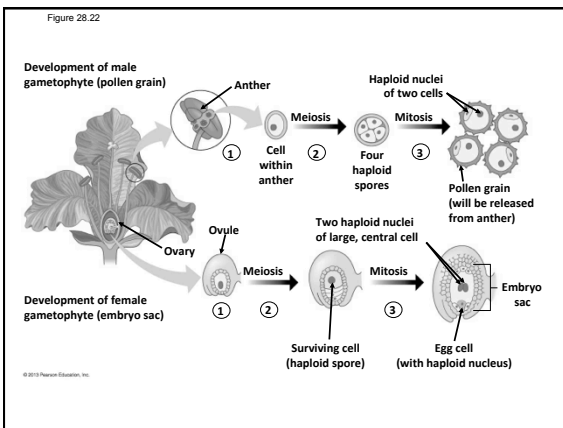
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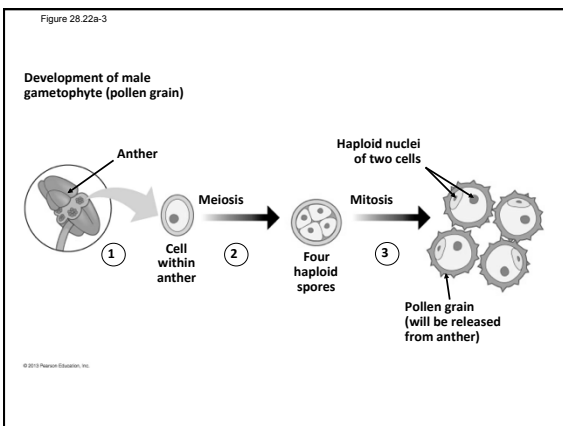
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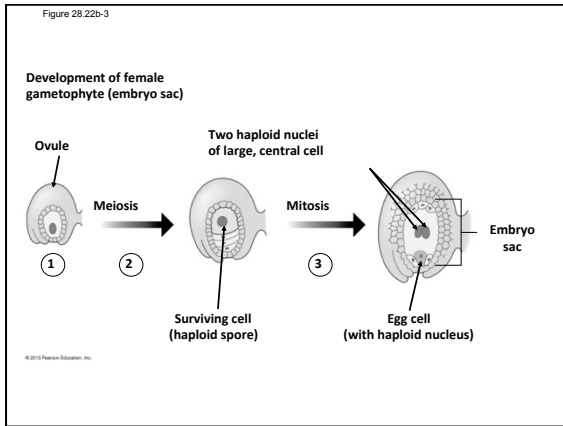
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**Pollination and Fertilization**

- The first step leading to fertilization is **pollination**, the delivery of pollen grains from anther to stigma.
- Many angiosperms are dependent on insects, birds, or other animals to transfer their pollen.

**PLAY** Video: Bat Pollinating Agave Plant

**PLAY** Animation: Plant Fertilization

**PLAY** Blast Animation: Pollination and Fertilization

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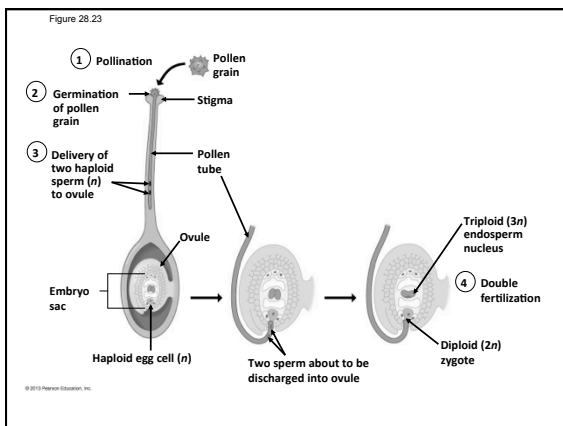
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**Pollination and Fertilization**

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– **Double fertilization** occurs as

- one sperm fertilizes the egg, forming the diploid zygote, and
- the other sperm
  - contributes its haploid nucleus to the large diploid central cell of the embryo sac and
  - produces a triploid cell that will give rise to the food-storing tissue called **endosperm**.

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**Seed Formation**

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– After fertilization, the ovule, containing the zygote and the triploid central cell, begins developing into a seed.

– The zygote

- divides via mitosis and
- forms a ball of cells that becomes the embryo.

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**Seed Formation**

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– The triploid cell

- divides via mitosis and
- develops into the endosperm.

– The result of embryonic development in the ovule is a mature **seed**, a plant embryo and endosperm packaged within a tough protective covering called a **seed coat**.

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**PLAY** Animation: Seed Development

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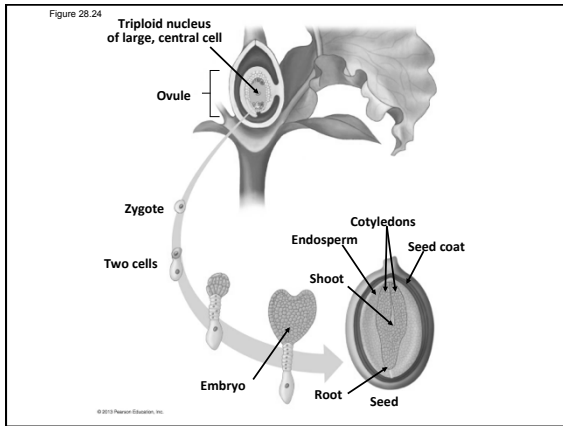
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**Fruit Formation**

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- A **fruit** is a mature ovary that acts as a vessel,
  - housing and protecting seeds and
  - helping disperse seeds from the parent plant.
- Mature fruits can be either
  - fleshy or
  - dry.

Figure 28.26

Fleshy fruits                      Dry fruits

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