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## BIOL 305L Spring 2020

### Laboratory Four

#### Fruit structure and its link to the mechanism of seed dispersal

#### Introduction

In this lab we will: consider the structure, function, and dispersal of **fruit bodies**. To summarize:

The ovules are contained in the ovaries of flowers. After pollination and fertilization of the egg inside the ovule, the ovule develops into a **seed** and the surrounding ovary develops into a **fruit**.

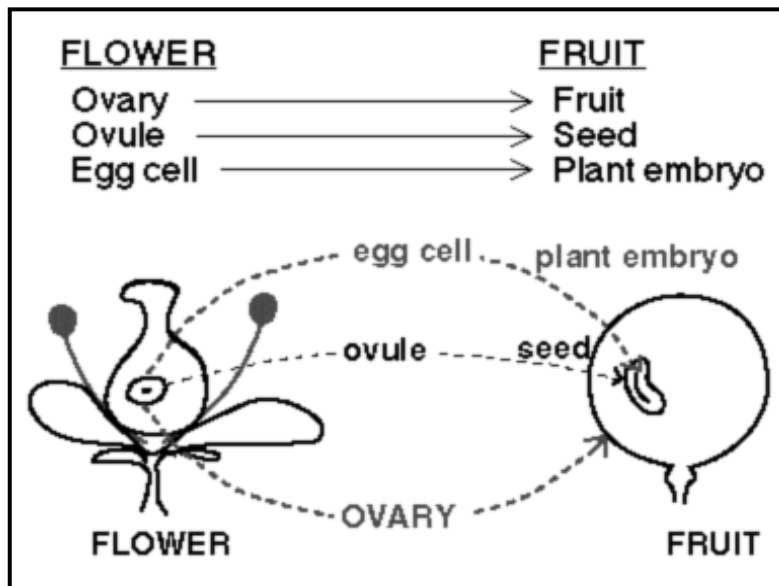


Figure 1: Generalized depiction of the structures produced during fruit development.

In some cases, ovaries develop into fruits without fertilization of ovules. This kind of fruit development which does not require fertilization is called **parthenocarpy** and the resulting fruits are called parthenocarpic fruits.

As fertilization is required in order to produce a viable seed, parthenocarpic fruits do not have seeds. Many of the "seedless" varieties of fruits found in the supermarket (e.g., watermelons, grapes, bananas, cucumbers, etc. . .) are the result of parthenocarpy.

## **Fruit Structure**

Fruits are classified according to the arrangement of the carpels from which the fruit develops:

**Multiple fruits** consist of gynoecia of more than one flower. Pineapple and mulberry are good examples of multiple fruits.

**Aggregate fruits** are formed from separate carpels of a single gynoecium. Individual parts of aggregate fruits are known as fruitlets. Examples include raspberry, strawberry, and magnolias.

**Simple fruits** develop from one carpel or several united carpels. This is the most common type of fruit, of which there are several categories:

1) **Dry fruits** are simple fruits that are dry, woody, or papery at maturity.

**Dehiscent fruits** are dry fruits that break open at maturity to release the seeds. Dehiscent fruits are classified by the way the ovary wall breaks apart:

- **Follicles** - the fruit wall breaks open along 1 seam (milkweeds)
- **Legumes** - the fruit wall breaks open along 2 seams (beans, peas, lentils)
- **Siliques** - the ovary wall breaks open with seeds intact on the central portion of the fruit (canola, members of the Brassicaceae (cabbage family))
- **Capsules** - split open longitudinally or have holes through which the seeds are released (okra, cotton and poppy)

2) **Indehiscent fruits** are dry fruits in which the seeds remain within the fruit and are dispersed with the fruit wall intact.

- **Achenes** - small single-seeded fruits with the seed attached to ovary wall only at one point (buttercup and buckwheat)
- **Samaras** - achenes with "wings" modified for wind dispersal (ashes and elms)
- **Caryopsis** - seed and fruit wall are totally fused (rice, wheat and other cereals)
- **Cypsela** - the fruit of Asteraceae (dandelion and marigold) family that has an achene-like fruit but is attached to pappus, which helps in its dispersal.

- **Nuts** - have a stony fruit wall (hazelnuts, cashews, and acorns)
- **Schizocarps** - fruits which break into one-seeded bits at maturity (maples)

3) **Fleshy fruits** are simple fruits that are soft when ripe. Most of the fruits and vegetables we eat belong to this group. Different terms are applied to different types of fleshy fruits based on the structure and texture of the different fruit layers and where the seeds are placed in the fruit. Some of the types of fleshy fruits are listed below along with a few examples of each:

- **Berries** have a soft and fleshy inner wall. (tomatoes, blueberries, peppers)
- **Pepos** have a papery outer wall and fleshy inner wall to which the seeds are attached. (melons, cucumbers, squashes)
- **Hesperidia** (singular: hesperidium) can be divided into segments (citrus fruits, such as oranges, lemons, and grapefruits)
- **Pomes** have a thin papery inner wall. (apples, other fruits of Rosaceae (rose) family)
- **Drupes** have a stony inner wall with a single seed. (peaches, plums, cherries and olives)

## Fruit Function

Beyond the differences in structure, different categories of fruits also suggest differences in modes of **dispersal**. Most fleshy fruits are attractive and brightly colored at maturity. They tend to have soft fruit walls and high concentrations of sugars. This attracts a variety of animals that will eat the sweet flesh and subsequently disperse the seeds. As seeds pass through the digestive systems of some animals, their seed coats are weakened by the animal's digestive acids which aids in germination. In some species of plants, the seeds *will not* germinate until they've passed through the gut of their animal disperser.

Some fruits are modified to be dispersed by attaching to the fur and feathers of animals. These fruits are generally small and dry. They might also have sticky substances, barbs, hooks, or spines to aid in attachment to their dispersal agents. Fruits adapted for dispersal by wind often have appendages like wings or modified floral whorls attached to the seeds. In plants such as orchids, appendages for flight are not necessary as the seeds are sufficiently small that they are easily dispersed by wind. In plants like tumbleweed, seeds are dispersed as the whole intact plant is blown across the landscape. Fruits dispersed by water, such as coconuts, often have air trapped inside their tissues that help them float and get carried to different places.

In most cases, fruits are passive and different agents actively disperse them. However, in some plants, the fruits are adapted so that the plant itself can actively disperse the seeds. This is usually accomplished by a fruit wall modified to

shatter as the fruit flesh dehydrates, throwing the seeds a distance from the parent plant. For example, in the parasitic eudicot mistletoe, a very high hydrostatic pressure builds up in the fruit and the seeds are ejected as far as 15 meters from the parent!

## Lab Activity:

You will be provided with several different kinds of fruits and it is your goal to classify each one. Examine your chosen samples using a dissecting microscope to achieve a greater detail of the internal structure. In the space provided draw and label, in detail, the structure of a:

- Multiple fruit
- Aggregate fruit

As for the Simple fruits, draw, label, and identify three examples from the selection of:

- Dry fruits
- Indehiscent fruits
- Fleshy fruits

An example of what to label is shown below.

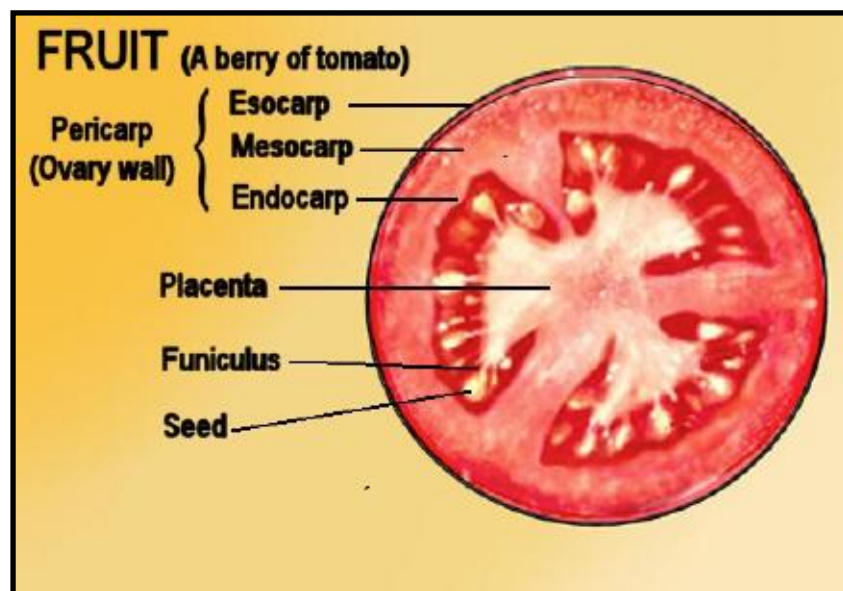
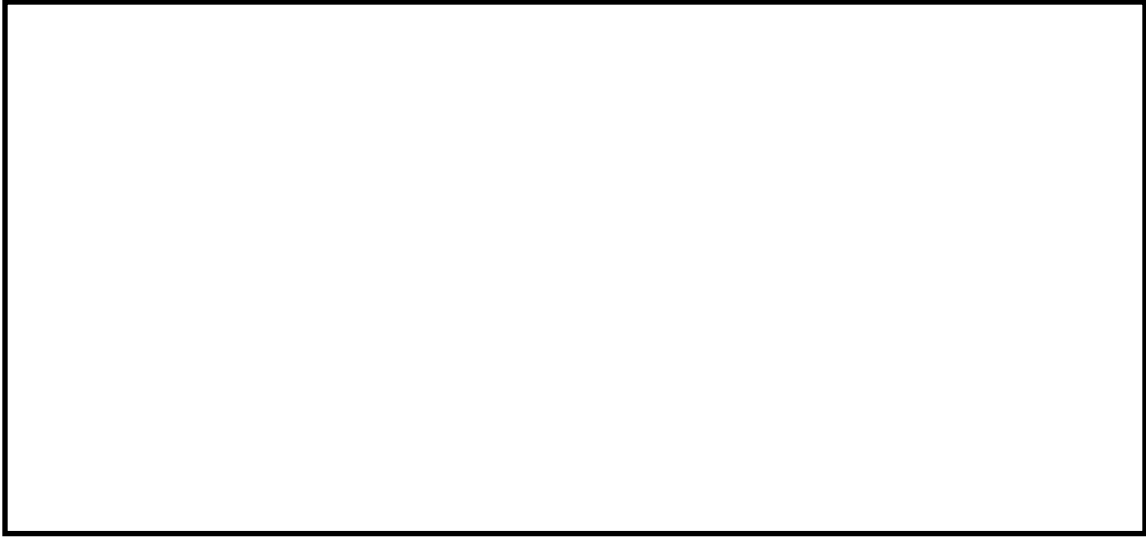


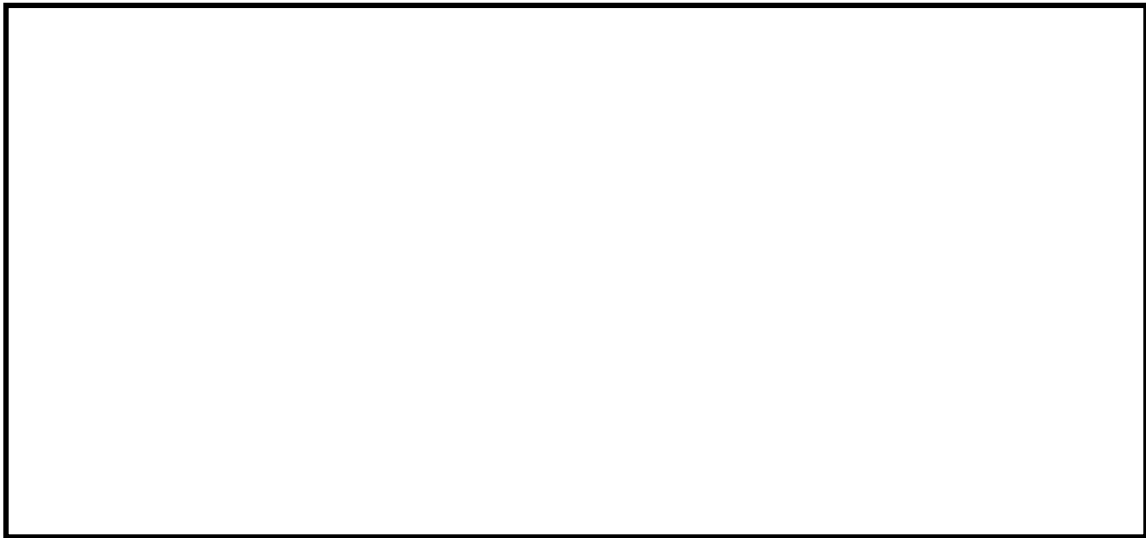
Figure2: The internal structure of a tomato fruit.

In each case consider within your group about the possible method of dispersal of each fruit. Base these on the structure of each fruit examined, and FULLY explain your reasoning under each of your drawings

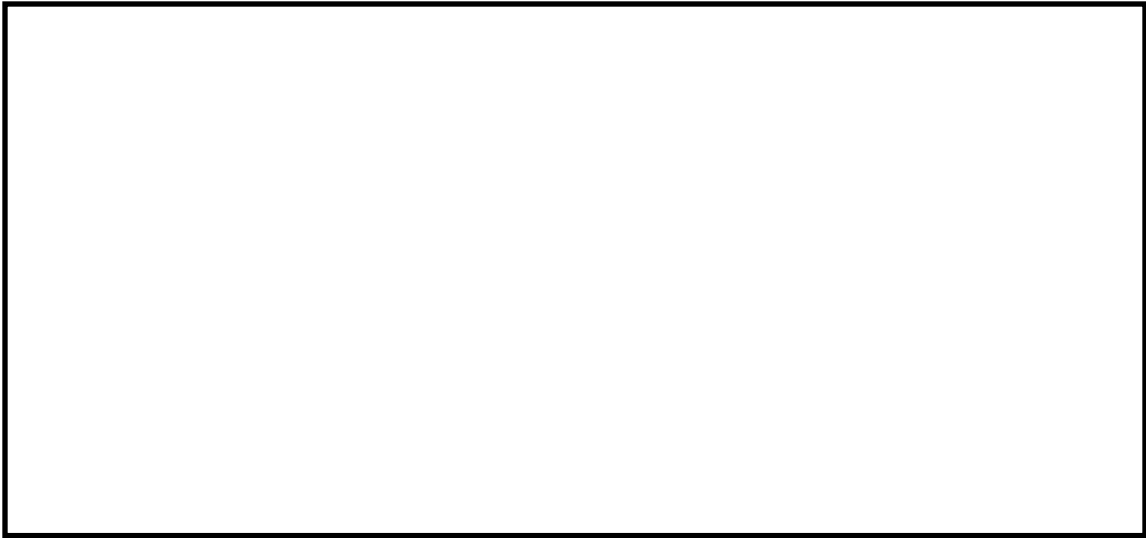
**Multiple fruit**



**Aggregate fruit**



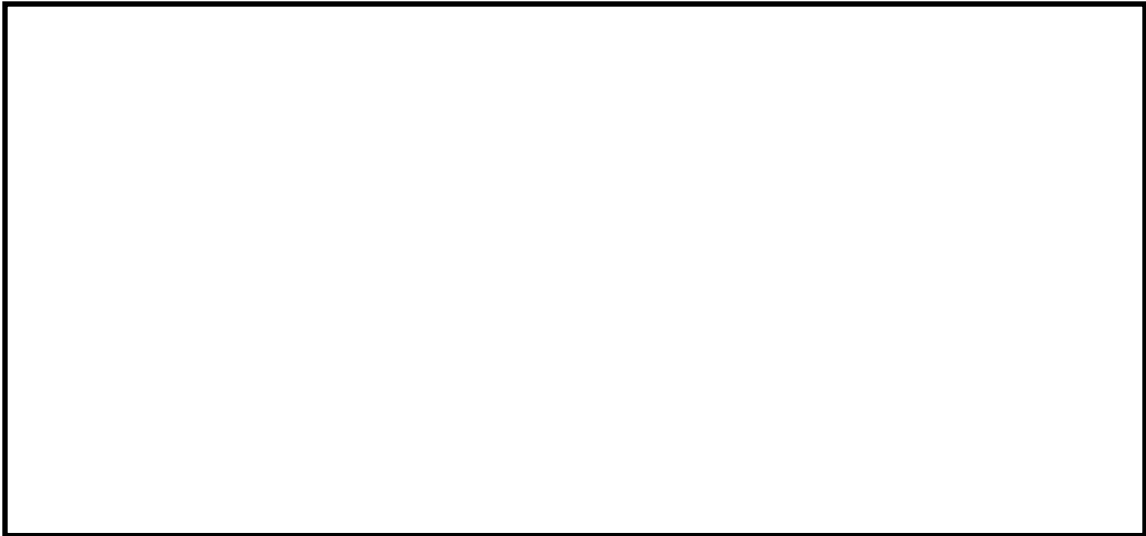
**Simple Fruits**  
**Dry fruit (1)**



**Simple Fruits**  
**Dry fruit (2)**



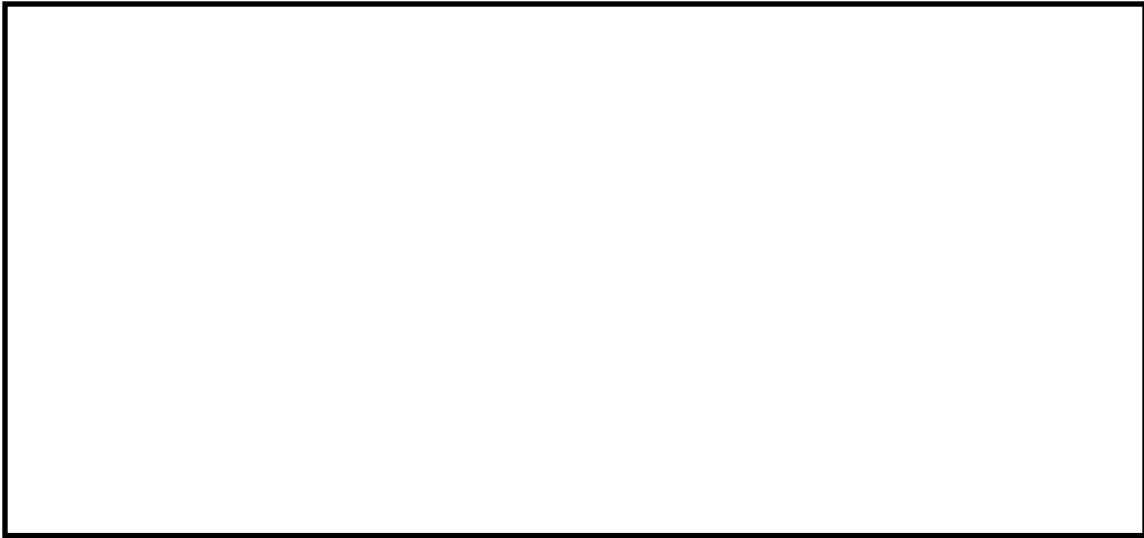
**Simple Fruits**  
**Dry fruit (3)**



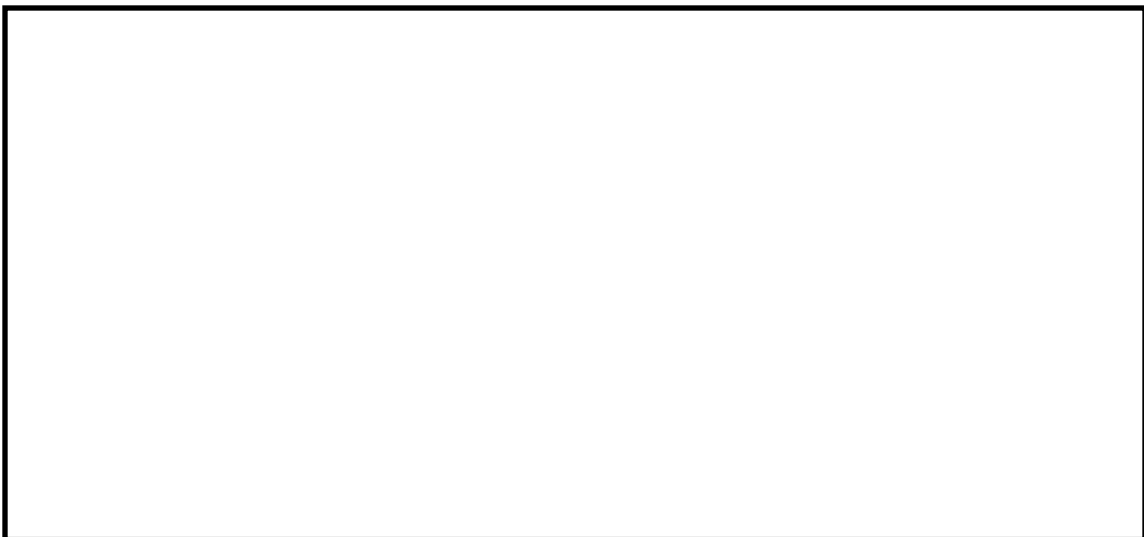
**Simple Fruits**  
**Indehiscent fruit (1)**



**Simple Fruits**  
**Indehiscent fruit (2)**

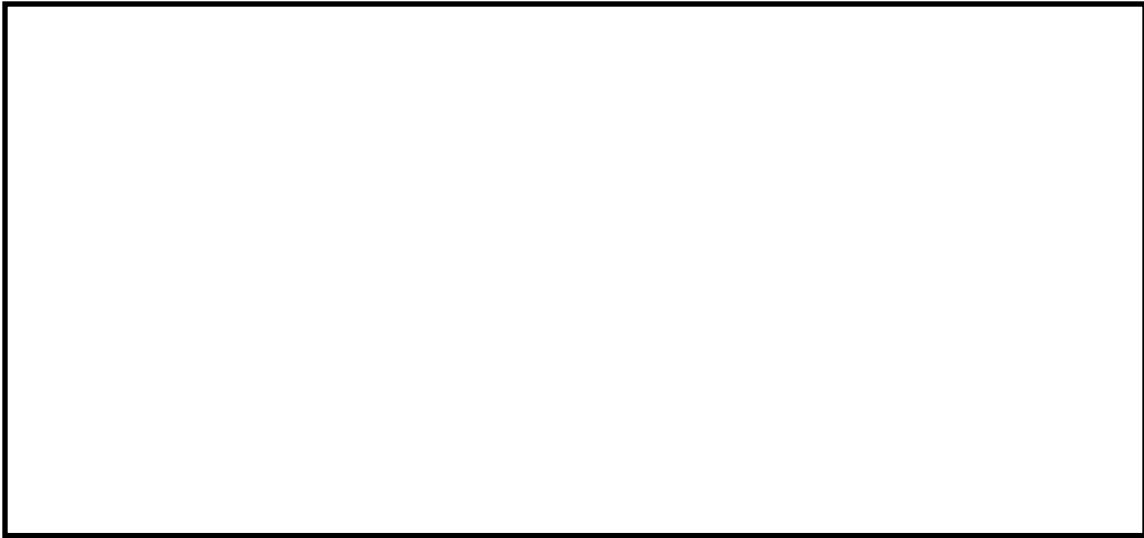


**Simple Fruits**  
**Indehiscent fruit (3)**

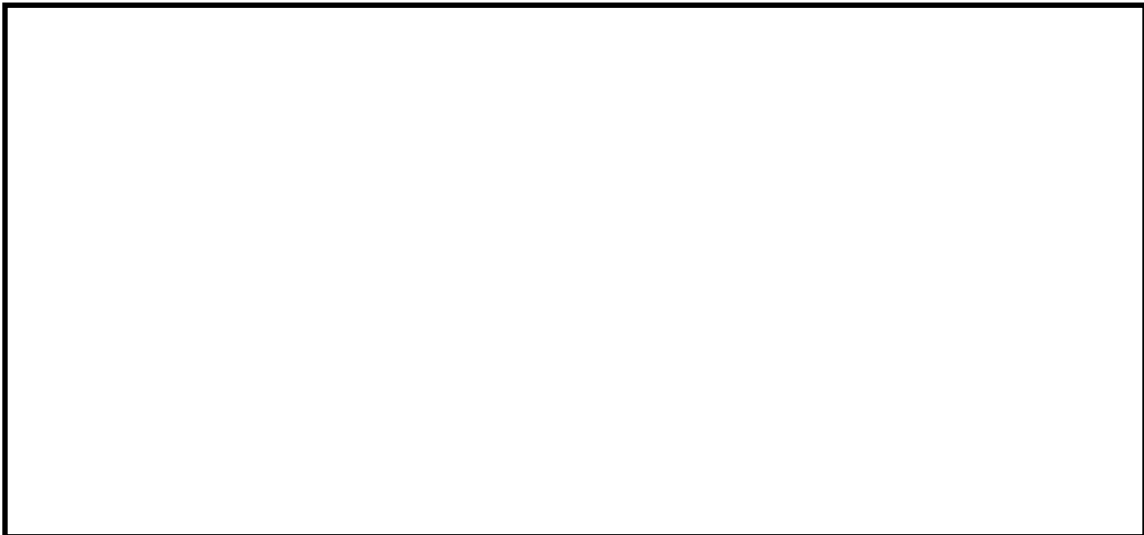




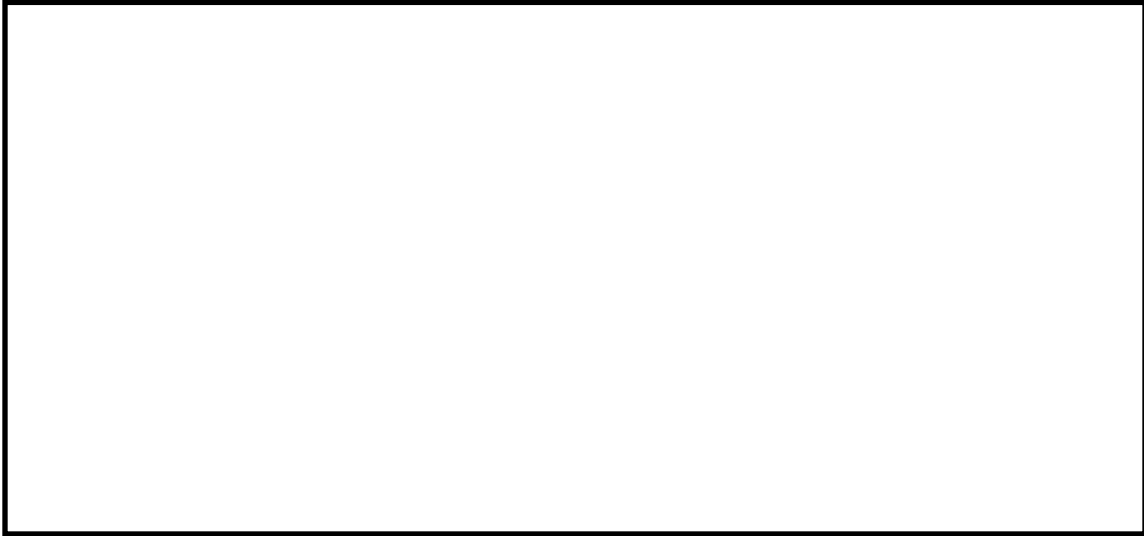
**Simple Fruits**  
**Fleshy fruit (1)**



**Simple Fruits**  
**Fleshy fruit (2)**



**Simple Fruits**  
**Fleshy fruit (3)**



**Post-lab Questions:**

(1). Immature fruits are generally green in color but change to bright, attractive colors when ripe. What is the potential evolutionary advantage of fruits changing color with respect to their potential for dispersal? (i.e., why aren't immature strawberries red?).

(2) In seedless varieties of fruits (e.g., grapes, watermelons, bananas) fruits develop even though there has been no fertilization. Why are there no seeds in those fruits? How are those plants propagated if there are no seeds?