**Biotechnology and Agriscience Research I**

**16.00 Genetics in Agriculture**

**Sexual Reproduction Process**

* 1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ - The union of haploid cells in both plants and animals.
  + Occurs in the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* 2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ - a fertilized egg / ovule that will grow to produce new offspring.
* 3. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ - organ responsible for the production of eggs / ovums in plants and animals.

**Sexual Reproduction in Animals**

* 1. Fertilization occurs internally in most animals - \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
  + a. Some \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are exceptions.
* 2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ -
  + a. Male cells are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (sperm) - released in semen to aid in the process of fertilization.
  + b. Female cells are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ - produced in the ovary, fertilized and developed within the uterus.
    - i) Females release eggs on a \_\_\_\_\_\_\_\_\_\_\_\_\_\_ (\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ cycle) that \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

**Sexual Reproduction in Plants**

* 1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ - the transfer of male pollen to the female reproductive organs.
  + a. Pollination must occur before fertilization.
  + b. Removal of the stamen is the first step in mechanical cross pollination.
* 2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ - the initial vegetative growth of a seed.
* 3. Male Reproductive Parts - \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + a. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ - top of the male part of a flower, contains \_\_\_\_\_\_\_\_\_\_\_\_\_.
  + b. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ - long slender stock on which the anther sits.
* 4. Female Reproductive Parts - \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + a. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ - the swollen end of the pistil, sticky to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
  + b. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ - stalk connecting the stigma to the ovary- pollen on the stigma forms long tubes through the style.
  + c. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ - produces and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (seeds), and protects seeds during development.
  + d. 1 \_\_\_\_\_\_\_\_\_\_\_\_\_\_ = 1 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ & 1 \_\_\_\_\_\_\_\_\_\_\_\_ = 1 \_\_\_\_\_\_\_\_\_\_\_\_\_\_
* 5. Types of Flowers in Plants:
  + a. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_- have all the parts of a flower (Stamen, Pistil, Sepals, Petals).
  + b. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_- missing any part of the flower.
  + c. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_- have all the reproductive parts of a flower (Stamen & Pistil).
  + d. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_- missing any reproductive part of the flower (Stamen, Pistil, or any part of either).

**Selective Breeding Techniques in Animals**

* 1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is used to determine the value of male livestock by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* 2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ has proven to have the greatest impact on animal breeding since the first domestication of livestock.
* 3. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Process
  + a. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is collected from male individuals- methods vary widely by the type of animal.
    - i) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are used for larger mammals.
  + b. Semen is checked for \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in specialized straws.
    - i) Straws should be placed in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, till use
    - ii) Semen stored under proper conditions \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. (\_\_\_\_\_\_\_° F)
* c. Female is treated with \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (hormone) to induce estrus or heat.
* d. Semen straws are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (\_\_\_\_\_\_\_° F) and soon after inserted into the mother using a specialized release gun.
* 4. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ - utilizes a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ cell sorter to separate male sperm from female sperm.
  + a. Sperm with \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ sperm) weigh more (\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_) than those with a Y and can thus be dyed and separated because they absorb more dye.
* 5. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ - method of removing eggs from a mother for fertilization under laboratory conditions.
  + a. A large number of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ from the ovaries of an outstanding female \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ dishes under laboratory conditions.
  + b. Embryos can be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ or frozen for later use.
  + c. Offers the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and requires the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* 6. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ -
  + a. Hormones are used to cause the female to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (produce a large number of eggs).
  + b. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ undergoes \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + c. Fertilized eggs are removed by a process called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to be placed in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

**Cross-Pollination in Plants**

* 1. Definition- Method used to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ for the production of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* 2. Cross-Pollination Process:
  + a. Plants possessing desirable characteristics \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and carefully \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
  + b. Pollen can be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ from male plants (or flowers) months or in some cases, years in advance and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
  + c. Flowers on the female plant must be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ prior to opening, and if capable of self-pollination, must have the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ removed.
  + d. Once the female flowers open, pollen from the male should be placed on the stigma, and the flower covered again.
    - i) Record keeping is critical in crossing plants.

**Cloning in Agriscience**

* 1. Allows \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of large numbers of genetically identical organisms.
  + a. Agriculturists can quickly disseminate outstanding traits.
* 2. Most often utilized for the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ - cheaper, easier process, and less political opposition. (The ability to differentiate is more in plants than animals.)
  + a. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ - the production of plants from small amounts of vegetative material in an invitro environment, is an increasingly popular and effective method of plant production.
* 3. Animals are cloned almost exclusively by the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. In recent years, diploid cells have been cloned, but the process is extremely expensive and results in high losses.
  + i) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ was produced from \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ gland cells in a sheep.
* 4. Clones are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (the exact same DNA).
  + a. Any genetic differences results from environmental factors - disease, nutrition, physical injuries, etc..

**Asexual Propagation**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* 1. Section of the stem or a branch is cut, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, and placed in soil or water to encourage the development of roots.
* 2. Stem cuttings should always be taken \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ for best rooting.
* 3. Most \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ method of asexual propagation, used for both woody and herbaceous plants.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* 1. Section of the stem or branch has the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ applied. The area is then covered with soil wrapped cellophane until well developed \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* 2. The branch or stem is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ only after roots have fully developed.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* 1. Common method of asexual production \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of plant material.
  + a. Often uses \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ tips- the tip of a branch where \_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* 2. Tissue is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ from the plant, sterilized and cultured on agar in aseptic conditions.
* 3. Meristimatic tissue develops shoots, is transferred to another media to develop \_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, is hardened off, and finally transferred to soil.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* 1. Method of plant propagation conducted by physically separating a plant into \_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* 2. Often used for \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
  + A variation is the production of non-tunicate bulbs from scales. (each scale must contain a part of the bottom of the bulb, the basal plate.)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

The process of removing plant material from one plant for incorporation into another plant.

* 1. Often used with fruit trees to create dwarf varieties.
* 2 parts
  + a. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_- the top portion of a graph that will form the main part of the plant.
  + b. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_- the bottom portion of the graph that usually controls growth habit (size of the plant) but produces no vegetation.
* 3. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is related to graphing- instead of using a scion; exchange of plant material is accomplished with a single bud.
* 4. SCION & ROOTSTOCK REMAIN GENETICALLY DISTINCT EVEN AFTER COMBINATION.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Leaf Cuttings
2. Root Cuttings

**Characteristics of Transgenic Organisms**

* 1. Can POTENTIALLY be created \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ from \_\_\_\_\_\_\_\_\_\_ living organism.
  + a. The trick is finding a method for \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and successful expression.
* 2. Genetically modified organisms transmit inserted genes at the same rate as naturally occurring genes.
  + a. Once a gene is inserted, it can be passed on through sexual reproduction.

**Steps in Creating a Transgenic Organism**

* 1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ / Goal- the transmission of genes from one organism to another is both expensive and potentially dangerous, expectations for work should be laid out carefully.
* 2. DNA must be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ from the target organism and the specific gene to be introduced isolated utilizing \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* 3. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are used for the transmission of target genes.
  + a. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ make good vectors, as they often insert DNA into organisms they affect.
    - i) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are the viruses most often used as vectors.
    - ii) Plasmids can \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ or even one or more chromosomes.
  + b. Some vectors can \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ simply through contact with target cells in a liquid solution or by microinjection.
* 4. Isolated DNA is inserted into the new organism by:
  + a. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_- the isolated DNA segment is injected into a target cell utilizing a microscopic syringe under high magnification.
    - i) Most common for the creation of transgenic organisms.
  + b. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_- uses a gene gun to fire gold plated .22 caliber shells that have been covered with the target gene into a mass of plant cells.
    - i) Most often used for plants, as cell mortality is high.