

wrong	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
right	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36	
score	100	98.2	96.4	94.6	92.9	91.1	89.3	87.5	85.7	83.9	82.1	80.4	78.6	76.8	75.0	73.2	71.4	69.6	67.9	66.1	64.3	

# Vegetative Propagation Name \_\_\_\_\_

In this exercise you will learn about propagating plants asexually (from cuttings, etc.).

## Leaf and Stem Propagation

**Observation.** All vegetative cells contain two sets of chromosomes. Each set contains genes sufficient for a complete organism. Each cell uses only a small portion of the two genomes present in its nucleus.

**Question.** Is it possible to make cells already specialized (for example as a leaf petiole parenchyma cell) change their developmental pathway toward something else (for example a root meristem)?

**Hypothesis.** An optimal concentration of rooting hormone (auxin, IAA) can cause roots to form from petiole cells of a leaf cutting.

**Prediction.** If the hypothesis is true, then leaf petiole cells will form the most roots, when the optimum one of three concentrations of rooting hormone is supplied.

**Experiment.** You have already made leaf petiole cuttings of *Peperomia obtusifolia* and *Bryophyllum diagremontiana* (or *B. delagoensis*), and stem cuttings of either *Plectranthus australis* (Swedish Ivy) or *P. amboinicus* (Cuban oregano) or *Pelargonium hortorum* (common geranium) or *P. graveolens* (scented geranium), and placed them in the greenhouse. Retrieve the pots now.

The side of the pot should be labeled as to the location of the cuttings of various treatments. The cuttings were: untreated, treated with Hormodin #1, Hormodin #2, or Hormodin #3. **Carefully and gently** uproot the cuttings so as not to damage any young roots, and observe the number of roots which have formed at the base of the petiole. Then gently replant the cuttings. You will observe the cuttings again later in the semester to determine the number of roots which may have formed later. Do not use the  $\infty$  symbol!

	<i>Peperomia</i>	<i>Bryophyllum</i>	<i>P</i> _____
Treatment	___ weeks	___ weeks	___ weeks
Untreated			
Hormodin #1			
Hormodin #2			
Hormodin #3			

**Analysis.** Compare the numbers you have obtained above. Considering that Hormodin #1 has the least auxin, #2 is intermediate, and #3 has the most auxin, at what auxin concentration do the cuttings root best?

<i>Peperomia obtusifolia</i>	none	low	medium	high
<i>Bryophyllum</i> _____	none	low	medium	high
<i>P</i> _____	none	low	medium	high

Why did you have an untreated cutting? \_\_\_\_\_

**Decision.** The hypothesis: “An optimal concentration of rooting hormone can cause roots to form from petiole cells of a leaf cutting”

is  cannot be  rejected.

### Stem Cuttings

**Observation.** See the previous project. In addition, stem cells contain parenchyma in the pith, cortex, and phloem.

**Question.** Could an optimal concentration of rooting hormone cause roots to form from simple stem parenchyma?

**Hypothesis.** At an optimal concentration, auxin causes roots to form from stem parenchyma.

**Prediction.** If the hypothesis is true, then the greatest amount of root formation will occur, when the optimum of three concentrations of rooting hormone is supplied.

**Experiment.** Mung bean stems about 10 days old were cut 2 cm below the cotyledonary node with a razor blade. Ten cuttings were placed immediately in separate cups containing 20 mL of a test solution of Indole Butyric Acid (IBA) as in the chart below. After one or two days, the cuttings used up the test solution and distilled water was added up to the cotyledonary node. After one week, the 10 stems were observed at each concentration for small bumps (root primordia) or small roots. The number of roots on each type of cutting were counted and other necessary observations were made. Do not use the  $\infty$  symbol!

	0 M IBA	$10^{-7}$ M IBA	$10^{-5}$ M IBA	$10^{-3}$ M IBA
# Roots				
Average #				
Observations				

**Analysis.** Compare the results above. Also make a graph of the results on the next page.

Which concentration of IBA maximally stimulated rooting? **0**  $10^{-7}$   $10^{-5}$   $10^{-3}$  M

In Excel, do a 2-tailed, unpaired, t-test comparing results at 0M with the trial having maximum effect:

value of p: \_\_\_\_ decision: **reject** **cannot reject**  $H_0$  conclusion: **same** **different**

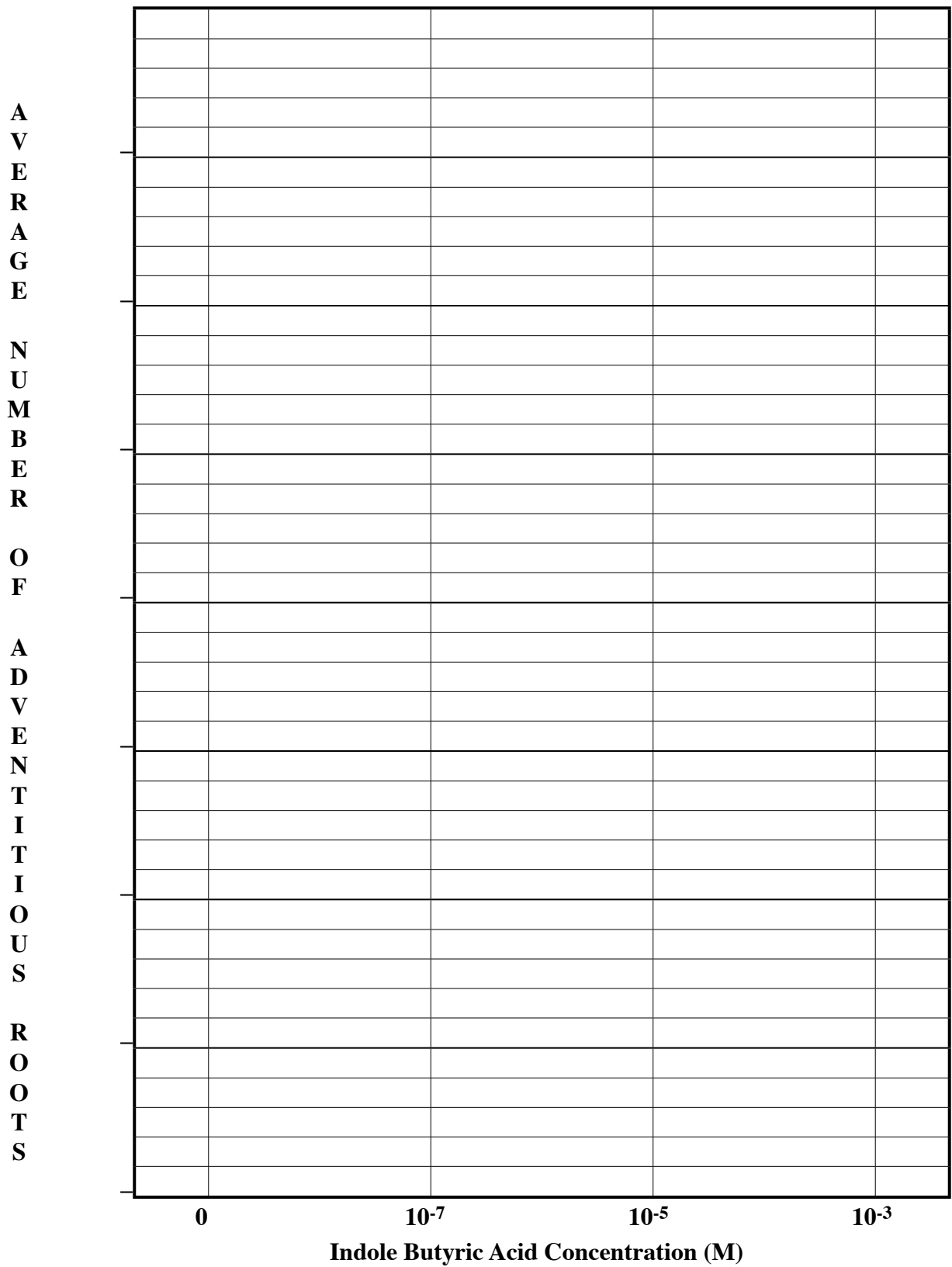
What is the name of the kind of roots formed from stem tissue? \_\_\_\_\_  
 spelling counts!

**Decision.** The hypothesis:

“At an optimal concentration, auxin causes roots to form from stem parenchyma”

**is** **cannot be** **rejected.**

Make a line graph using your Mung Bean data--accuracy and neatness count!



**QUESTIONS:**

Five plants are propagated from the seeds from a single fruit on a plant. Five plants are propagated from leaf cuttings of the same plant. Compare the degree of genetic congruence between:

Mother and Seedlings:  virtually identical  some similarities  completely different

Seedling Siblings:  virtually identical  some similarities  completely different

“Mother” and Cuttings:  virtually identical  some similarities  completely different

“Sister” Cuttings:  virtually identical  some similarities  completely different

When roots form along the mung bean stem, are the cells of the stem (choose ):

being genetically re-programmed into a new pathway of development, or

continuing in their original genetic pathway?

When shoots form from callus at the base of a leaf cutting, are the cells of the callus (choose ):

being genetically re-programmed into a new pathway of development, or

continuing in their original genetic pathway?

If a plant was very bushy (had many stem tips) and continues to branch as it grows, how many individual plants could be cloned from it by stem cuttings?

none  a few  as many as there are stem tips  indefinitely many

When cloning we hope to produce genetically identical plants, but is it possible to obtain at least a few individuals which are genetically different from the original plant?

yes  no  if so, by what biological process? \_\_\_\_\_