



Investigations and Experiments with Wisconsin Fast Plants™

Do you want to design experiments to learn about plants?

Are you looking for Science Fair Project ideas?

Look no further! When you explore with Wisconsin Fast Plants™, research, discovery, and the practices of science and engineering **come alive**.

You will find the **thrill** of growing a real, living plant is **irresistible**. Fast Plants **change visibly every single day**, right in front of your eyes. In two short weeks, the tiny seeds will sprout, grow, and bloom. In just over a month, you will be able to plant seeds, tend plants, pollinate flowers, and harvest new seeds.

Preparing to investigate

As a scientist, you'll need to design, plan, and carry out your work with careful attention to detail. Your investigation will include carrying out some or all of the following:

1. Asking questions (for science) and defining problems (for engineering)
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations (for science) and designing solutions (for engineering)
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

Curiosity and creativity are also at the heart of successful investigations and experiments. So, dust off your wonder, and start with a search for questions that sound interesting to *you*!

Environment

- How would changing the light affect the growth of Fast Plants?
- What happens if you change the amount of soil and root space that a plant has?
- What if you interrupt the growth of Fast Plants by breaking off the top of the plant?
- Why would gardeners who want lots of flowers pinch off the growing tips of their plants?
- Why does a plant produce side shoots if the top is pinched off and growth is interrupted? Does this tell you anything about the main goal of a plant, namely, reproduction?

Chemical Conditions for Plant Growth

- What chemical liquids might affect seed germination?
- How does liquid plant food affect seed germination?

Physical Conditions for Plant Growth

- Plants growing outside get touched by all sorts of things such as insects and raindrops and they are moved by the wind. Is plant growth affected by any of these factors?

Fertilization

- What is unique about fertilization in plants?
- What is endosperm and what is its relationship to the embryo?
- How does an embryo develop into a seed?
- How does the maternal parent contribute to the developing embryo?
- Why is the pistil growing longer?
- Do the biggest seed pods produce the most seed?
- Do unpollinated flowers produce seed?

Flowering

- How does a plant know when to produce leaves and when to produce flowers?
- What might be the advantages of flowering sequentially, one flower at a time? What about disadvantages?
- Does a period of high humidity affect pollen viability?

- Will high humidity make open (dehisced) anthers close back up?
- Do all genetic varieties of Fast Plants flower at the same time?
- What environmental parameters might affect the speed of growth and development of a Fast Plant?
- Are different varieties of Fast Plants affected by changes in the environment in the same way?
- Do plants growing at higher temperatures flower faster?
- Do all plants have the same pattern of flower positioning on the stem?
- Are variations in patterns of flower orientation on the stem genetic?
- Do various Fast Plant genetic stocks vary in nectar production?
- Is nectar production in Fast Plants genetically controlled?
- What is the effect of temperature on time to first flower for a Fast Plant?
- When does the first flower open?
- How much nectar is produced?
- What is the sugar concentration of the nectar?
- Why does a plant have flowers?
- What do flowers do?
- Why are flowers colorful?
- Do all flowers have the same number of flower parts as Fast Plants?
- Do stamens outnumber pistils?
- Do all flowers have stamens and pistils?

Germination

- Does crowding the seeds effect germination?
- Do seeds germinate under different colors (wavelengths) of light?
- What effect would various concentrations of solutions have on germination?
- How do different seeds germinate? How about a corn seed vs. a grass seed?
- How does seed orientation effect germination?
- What chemicals might a germinating Fast Plant seed give off?
- What chemicals affect seed flavor?

Germination (continued)

- What seeds do we eat?
- How are the hilum and micropyle like a belly button?
- How might light impact germination?
- On a seed, which way is up?
- When planting a seed, is there a best way to orient it?
- Does the root or shoot grow faster in a Fast Plant during germination?
- What percentage of Fast Plant seeds germinate under ideal conditions?
- How does light color affect germination?
- How does a germinating Fast Plant seedling respond to gravity?
- What are the main components of the environment necessary for germination?
- What enables the emerging plant to shift its dependency from stored energy to the energy from light?
- Do all seeds germinate as fast as Fast Plants?
- Would the seeds germinate if you changed the environment? For example, would the seeds germinate if you put them in the refrigerator?
- What is inside a seed?
- Where do seeds come from?
- Why did the seed swell?
- Does a seed germinating in soil look the same as one germinating in a petri dish?
- Will seeds germinate while still in the pod?

Growth and Development

- What happens when an apical meristem is removed?
- Does the effect of removing an apical meristem vary depending on the point in a plant's life cycle?
- What environmental conditions might affect seed emergence?
- How might soil type effect seed emergence?
- Does the plant from deeply sown seeds emerge later?
- Does the plant from a deeply sown seed flower later?

- In how many ways can you measure and quantify growth?
- How many different organs are growing at various stages in a plant's life cycle?
- Can you find a plant trait that predicts seed yield?
- Can you determine when a plant is growing 'most rapidly'?
- Does the number of hairs on a leaf margin correlate with the number of hairs on the whole plant?
- Are there ways that you can set up an experiment that alters the gravitational field for a plant?
- How could you use a turntable to give you some clues about the effect gravity has on hypocotyl growth?
- How does a Fast Plant respond to light?
- How tall is a Fast Plant at different stages?
- How many hairs are on the leaf margin of a Fast Plant?
- How important are the cotyledons for Fast Plants fast growth?

Nutrition

- What is 'food' for plants?
- How does limiting essential growth components affect plant growth?
- How does proximity (population density influence competition for essential growth components?
- Are plants capable of growth without light?
- What is the ideal amount of fertilizer pellets to add to Fast Plants?
- Will Fast Plants produce seed when lots of pellets are added?
- How do Fast Plants grow with other fertilizer treatments instead of fertilizer pellets?
- Does exposing the plant to stress stimulate flowering? For example, will the plants flower if they are deprived of fertilizer? If they do, can they set viable seed?
- How does liquid plant food affect seed germination?

Photosynthesis

- Do Fast Plants make starch in their leaves? If they do, can you devise a method for the quantitative measurement of photosynthesis, for example by using leaf discs? Do discs cut from cotyledons behave any differently from discs cut from leaves?
- How do young and old leaves compare?
- Cotyledon discs float in a sodium hydrogen bicarbonate solution, but sink if all the air is sucked out of them. They rise again if exposed to light (and sink if placed in darkness). Can these observations be used to investigate which wavelengths of light are involved with photosynthesis?
- What pigments are present in Fast Plants? Is it possible to relate the pigments identified with the action spectrum for photosynthesis above? What effect does variation in light intensity have on photosynthesis?

Pollination

- How does the varying length of the anthers and the orientation of the stamens relate to the position of the bee as it visits a brassica flower?
- Beyond pollination, what might be the specialized roles of other bee body parts?
- Is pollination more successful if a whole bee is used rather than just a bee thorax?
- What other materials would substitute for a bee stick?
- Are some flower parts more important in relation to pollination and sexual reproduction than others? Why?
- Consider testing your hypothesis using floral mutants such as the apetalous or male sterile mutant of Fast Plants.
- What might affect pollen tube germination and growth? Consider factors such as environment, flower age, genetics.
- How can you quantify pollen tube germination and growth?
- How fast does a pollen tube grow?
- How does humidity affect pollen viability?
- How quickly does a pollen tube germinate?
- How old can a Fast Plant flower be and still be successfully pollinated?
- How do flower parts function to influence mating behavior?

- How does the flower recruit the bee?
- How does pollination occur?
- How does the flower discriminate between self and non-self in the mix of pollen?
- What would happen if you didn't pollinate Fast Plants?
- What happens if you pollinate only one plant?
- Are flowers pollinated by means other than bees?
- Which is the best agent for pollination: a paintbrush, a 'bee stick' or cotton wool bud?

Seeds

- How does the abscission zone of a petal compare to that of a leaf or cotyledon?
- How does the abscission zone of a Fast Plant petal compare to the petal from a different species?
- How could you test for the effect of environmental stress on the development of Fast Plant embryos?
- When does a pistil become a pod?
- Is there a relationship between flower age and the position of the stigma relative to the anthers?
- What happens to the sepals and petals on an unpollinated flower? What happens to the pistil?
- How many ovules can you count in a pod? At what stage of development can you first accurately count the ovules?
- How could you quantify and track senescence during the lifecycle of a Fast Plant? What organs would be the first to senesce?
- What might a senescence mutant Fast Plant look like? How would you identify such a mutant?
- How rapidly does the pistil of a pollinated Fast Plant grow?
- How many seeds does a Fast Plant produce?
- When do the first organs on a Fast Plant senesce?
- When does a Fast Plant's petal first fall off?
- What is unique about fertilization in flowering plants?
- Will large seeds germinate better than small ones?
- Why do some seed pods have lots of seeds and others have few?
- Is there an optimum number of pods per plant? How many seeds are in each pod and what factors influence this number? Does position in the pod confer any advantages or disadvantages on a seed?

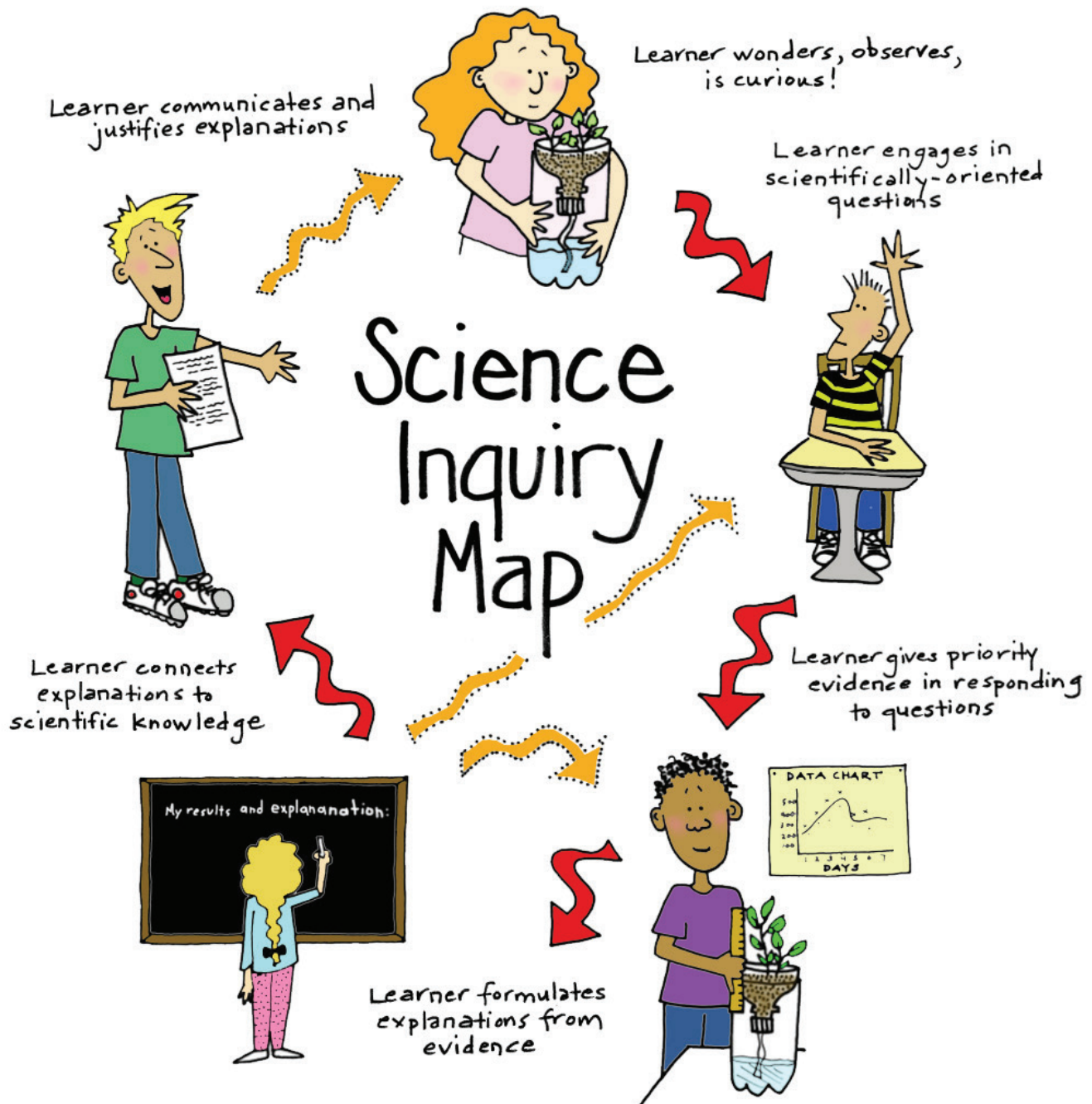
Seed Dispersal

- How has the plant solved the problem of packaging the new generation?
- How is Fast Plants seed dispersed?

Tropisms

- How does a plant grow upward?
- Why does the shoot grow up and the roots grow down?

- How do leaves expand?
- Without light, would plants grow up?
- Do plants respond to light and to gravity?
- Do roots grow down because of gravity?
- Do plants prefer certain colors of light?
- Which wavelength or wavelengths of light elicit the phototropic response? Is continuous or intermittent light more effective?



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