Key to First Week's Quiz Questions

1. What are the characteristics of a stand of trees that make it a forest? Be as specific as you can.

ANSWER: The most obvious characteristics of a forest that separate it from a stand of trees all include diversity at a multitude of levels—tree species, understory species, trophic levels, age, animals living within, disturbance cycles, biological legacies, etc. Any one particular forest may not have all of these characteristics, however it will have several of them. That being said, there is not a clearly defined line that separates a forest from a stand of trees. To some extent, it is a matter of interpretation and degree of scrutiny. The word "forest" is often modified by other adjectives, e.g. primary forest, second-growth forest, early-stage successional forest. All of these forests differ widely from one another, yet they all contain different types of diversity. In order to receive full credit for this question, you need to have listed a number of examples of types of diversity found within a forest.

2. Some tropical plant species produce flowers that are foul-smelling and brown in color.

- Propose three alternative hypotheses that could explain this observation.
- For each of your three hypotheses, generate at least two predictions that follow from that hypothesis. (Remember that one of the primary purposes of prediction in science is that, when a prediction turns out to be *untrue*, you have effectively *falsified* your hypothesis (and this is the goal). Therefore you are trying to generate predictions that necessarily follow from the hypothesis.)
- Design a test that will enable you to discriminate between at least two of the hypotheses that you have generated. (Your test may be based on field work, laboratory work, or literature review, with natural or perturbed systems—anything that seems appropriate to distinguish between your alternative hypotheses.)

ANSWER: There are many more possible hypotheses, and predictions and tests thereof, than described here. This "key" represents one answer that would have received full credit (and it goes beyond, by giving more predictions and tests than were required).

Call the species in question a stinkblossom, just for ease of communication.

H1: The foul smell and brown color dissuade herbivores from eating the flowers.

Predictions:

A. Flower-eating herbivores exist within the range of stinkblossoms.
B. Native herbivores have a demonstrably negative effect on those plants whose flowers they eat.
C. Native herbivores are not attracted to stinkblossoms.

H2: Stinkblossoms are pollinated by unwitting dung beetles, which the stinkblossoms lure under false pretenses by looking and smelling like feces.

Predictions:

A. Dung beetles exist within the range of stinkblossoms (are you noting a pattern here?).
B. Dung beetles are attracted to stinkblossoms.
C. Dung beetles are effective pollinators of stinkblossoms.
D. If you alter either the color or the smell of stinkblossoms, they will attract dung beetles less effectively.

H3: Stinkblossoms are pollinated by carrion insects, such as blowflies, which are seeking mammal carcasses in which to lay their eggs.

Predictions:

A-C. As for H2, except insert "carrion insects" for "dung beetles."
D. The unspecified "foul smell" of stinkblossoms is chemically similar to amines released during putrefaction of flesh.
E. Mammals native to the range of stinkblossoms are similar in color to stinkblossom flowers (or: similar in apparent color, given the particular color vision of carrion insects).

Two possible tests:

1. To distinguish H1 from both H2 and H3 (experimental, field-based test): Provide free-ranging herbivores with easy, regular access to fresh stinkblossom flowers, and with closely related flowers from within the same range, which are not smelly or brown. Quantify the amount of flowers eaten from each category over the course of several such "choice tests." If herbivores prefer non-smelly, non-brown flowers, you have falsified H1 (unless you attracted the "wrong" herbivores).

2. To distinguish H2 from H3 (lab based test): Set up several terraria that contain both live stinkblossoms and other, closely related but non-smelly, non-brown flower-bearing plants. Separately, establish colonies of carrion insects and dung beetles that are native to the range of both (or all) plants included. In each terrarium, introduce a small number of either carrion insects or dung beetles, and observe (over several weeks) which, if any, plants are fertilized, in which tanks.

A few other notes:

- All of these predictions necessarily follow from their hypotheses, but many of them are not *sufficient*, on their own, to demonstrate the validity of the hypothesis. This characteristic—being necessary but not sufficient—is an important one to keep in mind when assessing scientific claims.
- The flowers are described as "brown and foul-smelling," both of which are imprecise and subjective terms. One useful first step in assessing the adaptive value of these flowers would be to establish exactly what the smell is (either chemically, or what it most resembles in nature), and to determine if the apparent brown color is obscuring a vibrant floral display that is in a range that humans can't perceive—say, ultraviolet.