Time Lapse Seed Germination with the QX3 Intel Digital Microscope

Overview: Students will use the time-lapse feature of the QX3 Intel Digital Microscope to observe germination of seeds.

Virginia Standards of Learning:

Life Science.3 The student will investigate and understand that living things show patterns of cellular organization. Key concepts include:

- Cells, tissues, organs, and systems
- Functions and processes of cells, tissues, organs, and systems (respiration, removal of wastes, **growth**, reproduction, digestion, and cellular transport).

Biology.5 The student will **investigate and understand life functions** of monerans, protists, fungi, **plants**, and animals, including humans. Key concepts include:

- How their structures are alike and different
- Comparison of their metabolic activities
- Analyses of their responses to the environment
- Maintenance of homeostasis
- Human health issues, human anatomy, body systems, and life functions
- How viruses compare with organisms
- Observation of local organisms when applicable.

Science Topics: Imbibation, seed, germination, sprout, radicle, dicot, monocot, root, shoot, seed leaf

Science Methods Topics: Technology applications, inquiry, active learning, cooperative learning groups, data collection and analysis

Science Thinking: Students will use the QX3 Intel Digital microscope to create time-lapse video films of seed germination experiments.

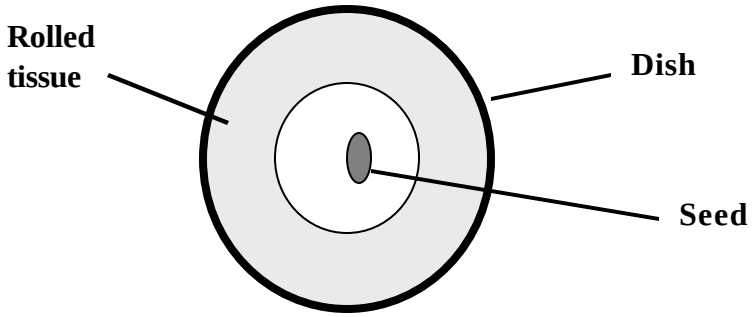
Materials: QX3 Intel Digital Microscope with PC Windows 98 operating system, small container to hold the seeds, water, mung bean, radish or baby lima bean seeds, light source left on throughout the germination project. [Note: the computer used for these time-lapse videos cannot be used for other functions during the germination experiments.]

Technology: Digital microscopy allows students to record time-lapse images of dynamic systems that are too slow to easily observe. The exported video images can

be saved for future viewing. Snapshots of seeds can be labeled and saved in a collection. Still images are easily exported to include in digital documents or presentation materials.

Procedure:

1. Follow the instructions for installation of the QX3 Intel Digital Microscope on your computer.
2. Place two or three small seeds (radis, mung bean or small baby lima beans) in a small dish and cover completely with water. If you are using baby lima beans, use only the smallest single seed possible. Center it carefully in the field of view of the microscope. The seeds will swell significantly during imbibation and may move out of the view of the microscope. Careful intial placement is important.
3. Arrange a light to illuminate the seeds throughout the time-lapse process. The seeds will germinate much quicker with a constant light source.
4. If your dish is large, you might want to consider rolling small pieces of toilet tissue and lining the outside of the dish in order to keep the seeds in the center. If the dish is too deep to maintain a sharp focus on the seeds, paper toweling may be used under the seed to raise them high enough to obtain a proper focus. Note that the seeds will also germinate in water without paper toweling.



5. On the live microscope screen, focus the seeds with the 10X lens. Try to locate the seeds so the seed scar (hilum where germination will first appear) is easily visible. The radicle (the first part of the seed to emerge after the seed coat bursts) will sprout from the hilum.
6. Adjust the lighting to obtain the best image of your seed(s).
7. Take a snapshot of your intial seed and label it with the time, date and type of seed.

Snapshots of Seeds placed on damp paper toweling for germination

8. Click on the time-lapse button on the microscope screen to open the window to set the time interval for image capture. To prevent overloading the memory capability of the microscope program, plan to limit your video capture to 20 hours or less. Images every 30 minutes will provide suitable movies of the germination process. [Note: The clock reads hour: minutes: seconds. A 30 minute time interval looks like this: 0:30:00].

9. If you are interested in the development of the radicle, you may wish to soak your seeds before beginning the time-lapse photography. Mung bean seeds will sprout within 20 hours. Pre-soaking for 8 hours will allow image capture to focus on the emergence of the embryonic root structure (radicle) rather than imbibation (seed swelling due to diffusion of water into the seed).

10. For classroom use with limited microscopes available, consider having students being soaking their seeds as soon as they arrive at school in the morning. Then leave the seeds under the microscope over night with the time-lapse feature operational. The next morning, students will be able to view the germination changes that occurred overnight.

11. After creating a video, export the video file to a disk. Since these files are quite large (200-350 KB), saving several in the microscope collection will quickly overwhelm the storage capacity of the program and cause the computer to freeze up. Exporting them and then removing them from the collection allows you to save the files while continuing to use the microscope to collect additional videos. If a zip drive is available, the larger zip disk will accommodate significantly more files than an ordinary floppy disk.

12. Take snapshots of the seeds after completing the video capture and label the images with seed type and date.

Final Snapshots of Germinating Seeds

13. The video files play best with Windows Media Player. To open this file, go to Programs, Accessories, Multimedia, and select Windows Media Player.

Real World Connections:

http://www.geocities.com/qx3fun/
Visit this QX3 Intel Digital Microscope site to view a movie of a black ant.