PLANTS IN SPACE DEMONSTRATOR NOTES

ABRC *TRAINED Educational Kit* CS19986 "How Can Plants Tell Which Way Is Up?"

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INTRODUCTION

We created this lab experiment based on the ABRC *TRAINED Educational Kit* CS19986 and the associated article by Kiss, Weise & Kiss "How Can Plants Tell Which Way Is Up? Laboratory Exercises to Introduce Gravitropism."

The presentation was pitched at 5th grade level (ages 11-12), but we think the content and experiment could easily be adapted for ages from 10 and up through high school.
The presentation is divided into sections, separated by blank slides:

1. WEEK 1: Introduction to tropisms and an introduction to the lab component
2. WEEK 2: Recap and introduction to the results gathering
3. POST-LAB: Summary of results and explanation from scientific papers.
   Running a class discussion/summary of results would probably work quite well before proceeding to the post-lab.

There are also two slide summaries for each week detailing the relevant experimental procedures.
There are a number of movies embedded in the presentation and a number of the slides have instructions/explanations in their respective notes fields that might be useful during the presentation.

The experiment worked very well in classes of about 20-24 students where the students were divided into pairs, each pair setting up and monitoring a wild type and control between them. Working with this number of students is manageable with the active involvement of two supervisors (e.g. a teacher and an assistant, or a vising scientist and the teacher).

We would happily take questions, comments or suggestions from anyone who runs this module. Contact details above.

GRAVITROPISM EXPERIMENT MATERIALS REQUIRED AND DEMONSTRATOR NOTES

Protocols for basic plant techniques are NOT provided here, but are available on request. These protocols include surface sterilization of seeds, preparation of plant growth media (which normally requires autoclaving), growth of plants to maturity (which requires decent growth space and reasonably bright lights) and starch staining of mature plants.

EQUIPMENT WEEK 1

1. Little tubes of WT and *pgm* seed, which have been surface sterilized (disinfected to neutralize superficial bacteria and fungus that might infect petri plates). We suggest a "volume" of about 20 µl of seed per tube.
2. Square petri plates (e.g. 10 x 10 cm) prepared with plant growth media
3. Tape to seal the petri plates (medical tape such as rolls of Leukopor is ideal)
4. Foil to wrap the plates
5. Light source (desk lamps) and timer (to avoid using 24 hr light, which might upset the school)
6. Grill to set up plates for bonus experiment
7. Trays to hold plates
8. Marker pens
9. Racks for tubes of seed

DEMONSTRATOR NOTES: WEEK 1

1. Emphasize seeds should be spread on to the agar! The tubes should have drawing pin-sized holes punched in them so that seeds can be scattered as if from a mini salt shaker.
2. Students should be able to spread the seeds by shaking the tubes over the opened plates. About 100 more-or-less evenly scattered seeds are ideal (not the whole contents of the tube). Students should be able to scatter the seeds quickly enough to maintain "sterile" conditions and preclude fungal and bacterial contamination of plates.
3. Plants grown in the dark will be ready in 5 days. Better to put them in the fridge after this so they don't get too big.
4. The BONUS EXPERIMENT light-grown plants might take longer before they are ready, depending on how much light they get and the room temperature. If the room is cool (e.g. in winter and lights are on 12 hour timers), it will likely be 6 days before the plants are ready for the plates to be rotated.

EQUIPMENT WEEK 2

1. Mature WT and *pgm* plants that have been harvested and put in alcohol to remove the pigments. (This protocol includes boiling in 80% ethanol so should be attempted with caution!)
2. POUR OFF the ETOH AND replace with water on day of lab (to avoid students having to deal with the alcohol)
3. Lugol's solution (Iodine; Available from Sigma and other chemical suppliers)
4. MSDS for Lugol's solution
5. Petri plates for whole plant starch staining
6. Transfer pipettes for transferring Lugol's to stain root tips
7. Slides and cover slips
8. Forceps
9. Gloves for students
10. Lab coats?
11. Microscopes to see stained root tips
12. Sample plants still growing in dirt (as they were before bleaching)
13. Box/ bag to take away used plates
14. Marker pens
15. Large (1 L) Schott bottles for pouring off water/ ethanol (labeled as WASTE)
16. Funnels for pouring off water
17. 1.5 ml tubes for Lugol's staining of seedlings
18. Medium (1 L) Schott bottles for water
19. Medium Schott bottles (250 ml) for Lugol's (to make pouring it into the 50 ml tubes easier)
20. 50 ml Schott bottles for use with transfer pipettes/ seedlings
21. Roll of paper towel for spills clean up
22. Don't forget the foil-wrapped plates if they have been put in an off-site fridge!

DEMONSTRATOR NOTES: WEEK 2

1. For Whole plant staining, pour off the 80% ethanol (see above) before the session and replace it with water. The stain will not work so well if the mature plants are still saturated with ethanol.
2. In a 1.5 hour session,
   30 min for plates and drawings
   30 min for starch staining and microscope
   Remainder for wrap-up and cleaning
   Probably it is better to have a timer so that there is time for wrap up.
3. 1.5 h is an absolute minimum for this week. Probably better as two 1 h sessions, with examination of plates in the first and starch staining in the second. If this is possible, the plates can be stored in a fridge for a week, if required, to stop the plants growing more.
4. Starch session works well as one station per 4-6 students, so go with equipment for that set up!

Setup for whole plant staining


Setup for root tip staining