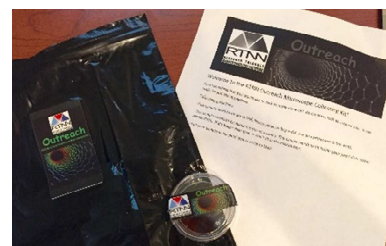


Summary: Duke's Shared Materials Instrumentation Facility (SMIF) invites you and your students to explore science at the nanoscale. Students will learn about size and scale, and how electron microscopy allows us to look at very tiny objects. The students will collect their own samples, and we will join your class to look at the samples using a visible light microscope that we will provide. Next the students will bring their samples to our nanotechnology facility, and they will view their samples under the scanning electron microscope (SEM). They will also tour the nanotechnology facility and learn about specialized equipment that is used to advance engineering, medicine, and biology.

Target grades: This can be adapted for grades 4-12.

Preparation:

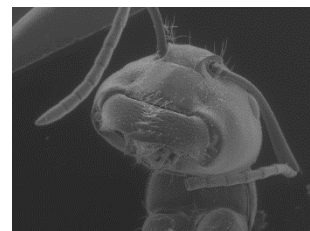
- Watch SEM Coursera video.
- Give out to students sample collection kits and guidelines for collecting samples to image in both the light microscope and SEM.
- Homework: students collect their samples.



Collecting kit given to students.

Session 1 in your classroom or at Duke SMIF lab (~1 hour):

- Size and scale activity (provided by SMIF): sorting images of items that span a size range from nanometers to kilometers and then applying appropriate units.
- What you can see with a visible light microscope vs a scanning electron microscope.
- Discuss scale bars in microscope images
- View student samples with visible light microscopes.
- Draw pictures of microscope images for comparison to SEM images.



Ant head image from electron microscope.

Session 2 visit to Duke SMIF lab (~1.5 hours) or adapted for classroom:

- SEM imaging of samples: Students will be divided into small groups (3-4) and will see their samples imaged in the SEM. Each student will get a chance to control the focus, zoom, and location of image capture. (~30 min per group).
- Site tour and hands-on science activities (in addition to SEM), as time permits.
- Groups of up to 12 can be split into three smaller groups. While one group is at the SEM, the other groups will tour and do the other activities, then the groups will switch, for a total time of about 1.5 hours.
- Students will receive digital copies of all of their SEM images.



Students show off cleanroom gear.

Going deeper: We can work with you to tailor this experience and the type of samples students collect to fit in with your curriculum (botany, zoology, microbiology, geology, etc.). We can also make this a scientific exploration for students by having them construct a hypothesis and take samples to test it (e.g. is pollen from wind-pollinated species of plants smaller than insect-pollinated plants?).

Contact us at rtnn@duke.edu