**Achoo! Pollen does more than make us sneeze.**

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| Author(s): | Holly Leddy |
| Author Affiliation and Location: (e.g. Duke, Beaufort, NC) | Duke University, Durham, NC |
| Optional Author Website | <https://www.facebook.com/SMIFoutreach/> <http://smif.pratt.duke.edu/> |
| Optional Author Contact Information (e.g. email) | [holly.leddy@duke.edu](mailto:holly.leddy@duke.edu) [rtnn@duke.edu](file:///C:\Users\hal2\Documents\RTNN\SciREN%20Lesson%20Plan%20Materials\rtnn@duke.edu) |
| Introduction/Abstract to Lesson Plan (max. 100 Words)  Include aspects of the lesson that are unique and innovative. | Harness the power of a scanning electron microscope to let students see that pollen is more than just the yellow dust that makes us sneeze sometimes! Students will watch an introductory video to learn basics of pollen biology. They will then learn to use scale bars to interpret size on microscope images, thus meeting math as well as science standards. They will use that knowledge to extract the sizes of pollen grains from scanning electron microscope images, and see the wide range of pollen shapes and sizes. They will also learn to make inferences about allergic potential and modes of dispersal of different kinds of pollen. After those class activities, student really engage by collecting their own pollen samples and sending them to our lab where we will take images of them with the scanning electron microscope. We will send you the images and interact with the students (video/skype/person) to answer questions and analyze their own pollen images. |
| List of Standards Addressed  Common Core, NC Essential Science, Next Gen, etc. (This should be list of all full standards addressed by the lesson)  Optional: Standards Mapping Grid | **NC Science Standards**  6.L.1.1 -Summarize the basic structures and functions of flowering plants required for survival, reproduction and defense.  **NC Math standards**  6.RP.3 d. Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities.  **NextGen Science standards**  MS-LS1-4. Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively. |
| Learning Objectives using Measurable Verbs (what students will be able to do) | Students will be able to know how to measure size in images with different scales. Students will understand what pollen is for and what forces drive the diversity of pollen size and shape. |
| Appropriate Grade Levels | **6-8** |
| Group Size/# of students activities are designed for | **flexible** |
| Setting (e.g. indoors, outdoors, lab, etc.) | **Classroom for small group activities, outdoors for collecting their own pollen samples.** |
| Approximate Time of Lesson (Break down into 20-50 minute periods) |  |
| Resources Needed for Students (e.g. scissors, paper, pencils, glue, etc.) | -print outs of SEM images  -rulers  -paper/writing utensils |
| Resources Needed for Educators (e.g. blackboard, Powerpoint capabilities, etc.) | -computer to show you tube video to students  -collecting kit for students to collect pollen samples-contact me, I will send these to you. |
| Apps/Websites Needed |  |
| Lesson Activity (step by step description of activity) | Introduction |
| Background  Optional background activity on size and scale to get students thinking about small size scales and small units (micrometers and nanometers).  <http://www.nnin.org/education-training/k-12-teachers/nanotechnology-curriculum-materials/size-and-scale-learning-about>  Watch 4 min video to become acquainted with basic parts of a flower and pollen biology:  <https://www.youtube.com/watch?v=djPVgip_bdU> |
| Step by Step Activity –see PollenLessonPlan\_Student worksheet and –teacher version for details.  Small group activity 1: Scale in Microscope Images and SEM.  Small group activity 2: Size and shapes of pollen grains.  Outdoor activity: Students collect their own pollen samples and send to us for SEM imaging. |
| Reflection/Assessment  Students use images and research to tell the story of the pollen that they collected. |
| Final Product/Assessment (e.g. quiz, blog, presentation, essay, etc.) | Students turn in small group activity worksheets.  Students write the story of their own pollen samples. They research how the plant they collected pollen from is pollenated and show images |
| Feedback Form for Teachers | Please contact me via email if you have any feedback at all! |

Images:

See Pollen SEM images file

Appendices:

Background Reading for Teachers:

<https://www.sciencephoto.com/static/features/1132-Pollen.pdf>

<http://www.alergiainfantillafe.org/ipolenyalergia.htm#top>