AMBIENT – Elementary Level
Particulate Observation

Purpose

To collect, observe and identify common substances in samples of dust taken from students' homes and/or daily environment.

Overview

Students collect samples of common dust from their homes and school for examination under a microscope. Students identify their samples and describe the location where they were collected. Students can take samples from a variety of sources, compare their samples and locations collected and make hypotheses about the generalizability of their findings.

Time

One hour to examine samples and discuss findings.

Key Concepts

Dust is ubiquitous in the home and school environment.
The composition of dust changes depending on its location and source.
Dust is made up of particles of different types and sizes, many of which are allergens and/or asthma triggers for some individuals.
Controlling dust can be a major factor in improving some people's asthma.

Skills

Collecting samples for observation
Using the microscope, media
Labeling data
Forming hypotheses
Understanding and describing visual findings
Using deductive reasoning to generalize findings

Materials

3M 810 Scotch Magic™ Tape (clear adhesive tape)
Plain Unlined White Paper
Intel Play™ QX3 + Computer Microscope and Software*

*The IntelPlay™ QX3+ Computer Microscope can be ordered for $39.99 by contacting J&R Electronics at 1-800-221-8180. It is item #24221.

Facilitator Preparation

The teacher may want to prepare samples ahead of time to serve as reference samples for given particles (i.e. insect parts, skin flakes). The teacher could alternately provide a variety of samples for students to make hypotheses about the location of the sample, for instance, a sample with a high concentration of pet hair might be from a floor near a back door where pets frequently come and go. It is highly recommended that the teacher do the experiment before teaching it to be comfortable with using the Intel Play™ QX3 + Computer Microscope and Software*. Detailed instructions are provided below.
Note to teachers: Prior to sampling you can make some sampling set-ups as per procedure below. Take a piece of tape a bit longer than the length of a microscope slide

Background

Discuss with students the various ways that dust particles can be generated in the home/school. Identify common sources of dust in the home such as human skin, pet hair, cat litter, carpet fibers, paper fibers, sand, soil tracked in on shoes, etc.

Procedure

Adhesive Tape Sampling

You want to target smooth surfaces for sampling such as tile, linoleum, painted surface, wood, TV screens, computer monitors, or even a painted surface (note: you may inadvertently pull some paint up with the adhesive tape).
1. Firmly rub a strip of the clear adhesive tape onto the sampling surface.
2. Lift the tape from the surface. Particles will be positioned in the tape adhesive as they were deposited onto the surface.
3. a. If using a microscope – have students press the adhesive onto a glass microscope slide to protect the particles from further contamination and disturbance. Use a marker on the slide to label the sample (by location or number or name etc.).

b. If you do not have access to an Intel Computer, have students press the adhesive tape onto a sheet of white paper and students can label particulate and location of collection under each section of tape on the paper.

Bulk Dust Sampling

You can collect your own set of reference particles. Look around the room and see what kind of materials might generate dust particles. Examples include carpeting, chalk, art paint, any fabric, clothing, paper, abrasive cleaners, dirt from outside that might be tracked in. You can get cellulose samples by collecting the fibers released as you shred facial tissue or toilet paper. If you have any dead ants, dust mites, ticks, or other insects, they are fun to see under the microscope. These samples can then be prepared (see below) and used to identify particles observed in the adhesive tape samples. Bulk dust samples can also be collected in lieu of using adhesive tape. If there is a really dusty surface, take a small stiff piece of paper (like a business card) and collect the dust into a static free container (wrap it into aluminum foil, or a very small glass sampling container, or petri dish).

Sample Preparation

Adhesive tape samples should be laid dust-side up on microscope tray and power adjusted to allow for larger or smaller particles. Bulk samples should be transferred to the adhesive tape by sprinkling and spreading with a toothpick.

Analysis

You can analyze the samples on a number of different levels.

1. Have students try to match their particles with the reference slides prepared by the teacher.

2. a. Have students try to identify their particles as either a “fiber” (e.g., cotton, cellulose, hair) or “particle” (i.e., non-fiber) then compare the different samples from different locations.

b. If the students can reasonably identify a few different particle types or groups, and calculate the relative percentage of each particle type. Here again different samples from different locations can be compared.

c. If the students can identify the particle type, they should be able to identify a source.

Additional Activities

Air conditioning filters in homes, schools and offices or filters in vacuum cleaners or edges of ceiling fans can be interesting sources of dust samples. Dust samples collected in, on and around the bed using either the adhesive tape or bulk dust methods can be interesting illustrations of indoor dust and important sources of allergens for allergic persons.

Note: samples collected from bed mattresses will collect dust mites, although they will not be visible at low power.

Follow-Up Activities

The adhesive tape or bulk dust methods can also be used to examine outdoor sources such as plants (particularly flowers to look at pollen). This is also a good way to look at bugs.

Another example of an important source of indoor air pollution that is composed of particulates is tobacco smoke. To illustrate this point, the teacher can light a cigarette, cigar, or pipe, inhale the smoke and then blow the smoke out with a clean piece of filter paper or tissue paper placed over the mouth. The darkened color in the area of exhalation on the paper is created by the particulate pollutants contained in tobacco smoke. Students can research the content of tobacco smoke particulate. Students can also use the spent ash as a bulk sample, noting the remaining structure of the tobacco plant's leaves.

Other interesting sources are the tail pipes of cars, trucks, buses, and motorcycles using a similar methodology (although students should be cautioned to be careful not to get burned by the metal exhaust pipes, nor to inhale the exhaust of motor vehicles).

Student Assessment

The students should be evaluated using the following questions:

1. Did the students gather samples following the provided instructions?
2. Did students make hypotheses about where what type of particles may be found?
3. Did they students use careful sampling procedures?
4. Did the students show understanding of the use of the microscope?
5. Were the students able to identify particles?
6. Did the students write up their hypotheses, procedure and results in a clear and logical fashion?
7. Did students draw conclusions about the relationship of dust to asthma?