NDSU Electron Microscopy Center
SEM Samples Available (up to seven loaded per session; see Recipes)

❖ **Bacteria** – better save this sample for last, even though it is first in the list (the SEM alphabetizes recipes automatically.) Because the bacteria are very small, locating them and focusing is more difficult than on the larger items. You will need to increase the magnification to 10,000X or more to get a good look at them.

❖ **Insect** – this is a pseudoscorpion (false scorpion or book scorpion). It's not really an insect at all, but rather an arachnid, related to spiders and true scorpions. Pseudoscorpions are not harmful to humans; they eat clothes-moth larvae, carpet-beetle larvae, booklice, ants, mites, and small flies. They are rarely seen because they are so small. This one, only about two mm long, was caught in a bathroom.

From the Wikipedia article on pseudoscorpions: The abdomen, known as the opisthosoma, is made up of twelve segments, each protected by plates (called tergites above and sternites below) made of chitin. The abdomen is short and rounded at the rear, rather than extending into a segmented tail and stinger like true scorpions. The color of the body can be yellowish-tan to dark-brown, with the paired claws often a contrasting color. They may have two, four or no eyes.

A pseudoscorpion has eight legs with five to seven segments — the number of fused segments is used to distinguish families and genera. They have two very long *palpal chelae* (pedipalps or pincers) which strongly resemble the pincers found on a scorpion.

The pedipalps generally consist of an immobile "hand" and "finger", with a separate movable finger controlled by an adductor muscle. A venom gland and duct are usually located in the mobile finger; the poison is used to capture and immobilize the pseudoscorpion's prey. During digestion, pseudoscorpions pour a mildly corrosive fluid over the prey, then ingest the liquefied remains.

Pseudoscorpions spin silk from a gland in their jaws to make disk-shaped cocoons for mating, molting, or waiting out cold weather. Another trait they share with their closest relatives, the spiders, is breathing through spiracles. However, they do not have book lungs as most spiders do.

❖ **Leaf XS** – this is a cross section of a cotton plant leaf, showing fractured surfaces of the leaf vein and leaf epidermis and mesophyll cells. Most of what you see is cell wall; the cell contents have mostly been lost. This leaf was prepared by freezing in liquid nitrogen and fracturing to produce a clean break.

❖ **Lice** – these are *Pediculus capitis*, the human head louse, captured from some-one near and dear to us. Look around in this sample. In addition to the adult louse that you started with, you may see immature lice (nymphs) and eggs (nits). There are hairs present, too, and you can increase in magnification to see the scales on the hair. There is at least one louse holding onto a hair with its prehensile claws, and one egg attached to the hair shaft.

❖ **Mosquito** – this is a female mosquito, *Aedes vexans*. You can tell because she has hair-like antennae; the males have feathery antennae. (The right antenna—on your left as you look at her face—has been broken off.) Points of interest: the eyes are composed of individual facets called ocelli. Increase magnification to look closely at these. Look way down at the end of the tube-like mouthparts: the outer maxillae separate to reveal the mandibles, which resemble a hypodermic needle—and puncture your skin like one.

❖ **Butterfly scales** – this is a portion of the wing of a monarch butterfly, which was found dead in a parking lot. Look at the overlapping scales that cover the surface of the wing: at lower magnifications, each individual scale resembles a Ruffles potato chip. These scales are the tiny colored specks that rub off on your fingers if you handle a butterfly. Increase the magnification. You'll see that there is a structure to the scale

that looks like scaffolding. Continue to increase magnification, focusing as you go. This might be a good object to photograph.

- **Tooth** – a deciduous or baby tooth, which split open after it was lost. The outside is covered with enamel, which is the hardest substance in the body. Most of the tooth is composed of dentin tubules.
- **Salt-sug** – This sample has salt crystals on one half and sugar crystals on the other. Note how easily you can tell them apart using magnification, when they appear so similar to the eye. The salt crystals (sodium chloride, NaCl) are regular and cuboidal, while the crystals of sugar (sucrose, $C_{12}H_{22}O_{11}$, a disaccharide of glucose and fructose) are more irregular, oblong and slanted on the ends, usually a combination of shapes. This sample was prepared last spring, and the summer humidity was a little hard on the sugar—note how the crystals seem to be melting.