



Peg Bolick

Pollen Detective Biography

by Mary
Knudson



wonderwise

Women in Science Learning Series

Science Can Be for You.

This series of learning kits introduces you to women who have made science their career. The kits are produced by the University of Nebraska State Museum in Lincoln, Nebraska. The entire series has been funded by the Howard Hughes Medical Institute.

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It took a cat to make Peg Bolick decide what she wanted to do with her life.

She knew she was interested in science. As early as ages six and seven, Peg and a younger brother “went through the dinosaur crazy stage”, reading about dinosaurs and drawing dinosaurs in crayon on the driveway and sidewalk in front of their house in the suburbs of Winston-Salem, North Carolina.

Then when Peg was 13, a Sunday school teacher who didn’t think the science of evolution was at odds with religion got her really interested in how animals and plants gradually changed to become the forms of life they are today.

Peg’s uncle, who did research to predict tropical storms, encouraged her interest in science. In high school, she had “an absolutely brilliant” chemistry and physics teacher whose love of science “was very contagious,” she says. In college, she really enjoyed freshman biology.

But then came college sophomore anatomy. She had to choose between anatomy of vertebrate animals, which would mean having to dissect a cat, or plant anatomy. And Peg decided right then and there to become a botanist—a scientist who works with plants.

“This is an alternative to killing and cutting up animals,” she says. “you can study evolution either way”—by studying plants or animals.

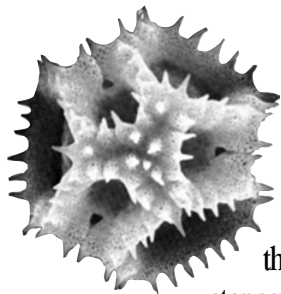
Today Margaret (Peg) Bolick, Ph.D., is Associate Professor and Curator of Botany at the University of Nebraska State Museum in Lincoln, Nebraska. Being curator of botany means she manages the museum’s plant collection, plans exhibits about plants for museum visitors, and writes articles for the public. As an associate professor, she does research on pollen, teaches and writes for scientific journals.



Photo courtesy of Peg Bolick.

Peg in grade school, age 7

Dandelion pollen



Peg's research interest is fossil pollen—that's pollen that is thousands or even millions of years old and has become embedded in the earth's crust. All plants that develop from seed produce pollen, a powdery substance that carries the sperm of one flower to another. The sperm unites with an egg in the pistil of the flower where it lands, and a new seed is formed. This is the beginning of a new plant.

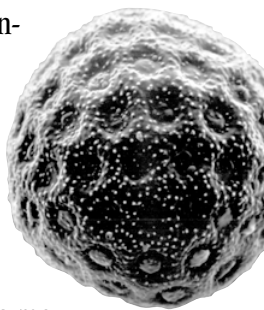
Fresh pollen comes in many pastel colours including yellow, pink and blue. Fossil pollen is a golden-brown. Some pollen fell into mud and dirt in an age before humans existed and became fossilized inside rock. Peg knows how to remove the pollen grains from the ancient rocks, and can tell from the pollen what types of plants existed long ago.

While Peg spends most of her time as a detective examining fossil pollen, she also is interested, personally and professionally, in modern-day pollen. Every morning she goes out on a rooftop at the university to get the latest 24-hour sample of pollen from a small motorized pollen collector. As pollen grains blow by, the collection device traps them on sticky rods.

In a corner of her large office, Peg places the rods containing the pollen under a microscope and counts the individual grains of pollen. She has put a special stain on the rods that makes the pollen stand out as big pink balls amidst hundreds of other brown, black and gold bits of dirt and debris.

When she has finished the pollen count, she faxes it to allergy doctors in the area who make it available to the mass media. A pollen count is the number of pollen grains collected in a certain volume of air during a specific period of time, such as 24 hours. The pollen count also tells what types of plants are producing pollen during the time period the count was taken. A high pollen count is a warning to allergy sufferers to stay indoors.

It is not a coincidence that Peg suffers from terrible allergies to pol-

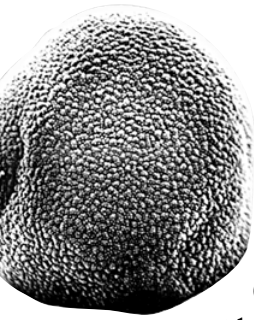


*Russian
thistle
pollen*



Photo courtesy of University of Nebraska-Lincoln

Peg Bolick and the rooftop pollen collector she uses at the University of Nebraska-Lincoln.



Bluegrass pollen

len, among other things. Some people are only allergic to a few types of pollen that appear at certain times during the year. But Peg is allergic to pollen throughout the growing season.

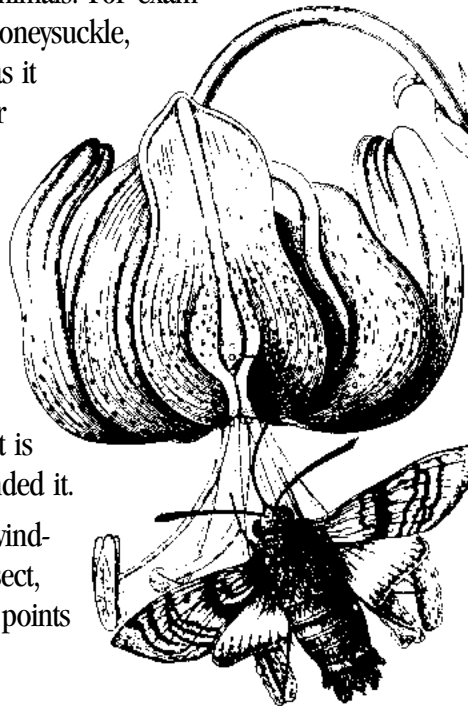
One day while on a leave from the university and working with medical school researchers, Peg was getting treated for her allergies when her doctor asked if she knew anyone at the university who worked on pollen.

When Peg returned to Lincoln, she talked with local doctors and began monitoring the type and level of pollen that floats through the air in the Lincoln area. Pollen can cause sneezing, clogged sinuses and itchy eyes for many miserable residents whose immune systems react to the pollen as if it were a foreign intruder. Commonly known as hay fever, pollen allergies affect about 22 million Americans.

While pollen makes a lot of people miserable, it is essential for the continuation of plant life. For the most part, pollen reaches plants in two ways. Some types of pollen are carried from plant to plant by bees, butterflies and other insects and animals. For example, a butterfly sucks nectar from one honeysuckle, picking up powdery pollen on its body as it drinks. Then the butterfly flits to another flower, depositing the pollen as it touches down and moves about on the next flower.

But much pollen is carried by the wind, sometimes traveling for many miles and falling haphazardly along the way. This airborne pollen is as likely to drop on car tops and people's faces as it is to land on the plants where nature intended it.

"Almost anything that causes allergy is wind-pollinated, because if it's stuck to an insect, it's not going to bother your nose," Peg points



out. Allergy symptoms occur when people who are allergic to pollen actually inhale it.

Pollen comes in a variety of shapes, usually variations of a sphere. The largest pollen comes from the pumpkin. Four grains of pumpkin pollen together are about the size of a pencil lead, Peg says. The smallest pollen, produced by stinging nettles, is only 1/25th that size.

On a heavy pollen day, you can see a powdery dusting of it on the tops of cars and other things left outdoors. Sometimes you can even see it blowing in the air as yellow dust.

Peg made an exhibit for the museum called, “Hay Fever Plants of Nebraska: The Plants that Cause Hay Fever in Nebraska Change with the Seasons.”

The display, which now hangs on a wall outside her office, features a cartoon character with an enormous red nose to illustrate the effects pollen has on people who are allergic to it. Photographs on the display identify different weeds, trees and grass that produce pollen, and a calendar tells when they shed pollen.

Juniper’s season is February to March; elm is March to April; cottonwood is April to May; grasses are May to August and ragweed is August through September.

“The first of the pollen season is the trees,” Peg explains.

“That’s because the trees need to get the pollen out before they completely leaf out, because the leaves would be a really effective barrier to catching the pollen.”

Peg sometimes teaches a course on pollen and allergies. She also teaches courses in how to analyze pollen, how to identify and classify plants, and how people throughout the world use plants for medicine, food, shelter and fiber.

With all her various duties, Peg, 44, keeps very busy. But she has learned not to let work consume her. “I have found to keep the stress



*Cottonwood
pollen*



Photo courtesy of University of Nebraska State Museum.

Peg working with Melissa Saddler.

at reasonable levels, I have to make time (for myself),” she says. “The last couple of years have been sort of rough because it’s been one respiratory infection after another.” Peg took shots to de-sensitize her to the things she is allergic to, which has helped control her sneezing. But she still takes three daily medications for asthma and two for allergies.

Peg was married for four years, but her values clashed with those of her husband. “Ironically, I was more traditional,” Peg says. “I wanted children and the whole bit with all of us in church on Sunday morning.”

Now Peg lives with her two cats, a male and a female. She had a special cat door built into her new house so that her free-spirited little housemates can come and go as they wish. She enjoyed picking out the design of her blue-gray and tan brick house and is planning the landscaping for it. She made sure that it was light and airy inside and that it had a guest area for relatives or friends to stay when they visit.

Peg meets friends for Sunday brunch, plans dinners for friends at home and loves to shop for her nephews.

A good friend, Kathy Keeler, a biologist at the university, often joins Peg for dinner. Kathy says Peg enjoys “recreational cooking” and plans complete dinners for her guests.

Peg has two younger brothers, Neil and Gary, and three nephews. A favorite hobby of Peg’s is getting surprise presents for her nephews and friends. “I work on the philosophy that the best presents are the ones that you get for no reason, just out of the blue,” Peg says, “for no other reason than I saw something that reminded me of them and what they’re interested in.”

Her nephew, Clint, was 13 during the summer the big dinosaur hit Jurassic Park was THE movie to see. Peg arranged for Clint to go on a fossil dig with her. “We got it set up so he could go back to junior high and it would be safe for him to say he was probably the only kid in school that year who had actually been out that summer digging fossils,” Peg says.

“My sister-in-law said she knew he had a good time when he said as soon as he got in the door, ‘Well, Mom, I’ve got to go call my friends and tell them about it.’”

For Clint and his school friends, digging up fossils was a real adventure. But fossil digs are a regular part of Peg’s work world. She often works as part of a team, helping other scientists find pieces to the puzzle of what life was like thousands or millions of years ago.

She works with Jim Swinehart of the Nebraska Geological Survey who is interested in how and when sand dunes took over the central part of the state. He sinks a long pipe down about 30 feet into the ground and brings up a plug of sediment. Peg takes samples from it and looks for pollen. She can recognize different kinds of pollen, and can identify what types of plants lived many years ago from the pollen they left behind.

She also gets a lot of calls from other scientists at the museum who bring back rocks and animal fossils from digs. The museum scientists





Photo courtesy of Jon Farrar

Peg is using hydrofluoric acid, a very dangerous chemical, to dissolve the sediments from fossilized pollen.

work together to try to recreate what kind of total life or ecosystem existed in another age—what animals and plants were living then and what their environment was like. Next door to Peg's office is her lab, a large room about 20 feet wide by 40 feet long with windows across the back. Although her office is in a city, there are no tall buildings to prevent her from seeing for miles across the flat Nebraska land.

The lab has counter tops to work on, three freezers, a cabinet filled with beakers and flasks, jars of chemicals, two kinds of microscopes, electric hot plates and an electric balance for weighing chemicals and rock samples. Also in the lab is a machine known as a centrifuge that spins solutions at very high speeds, separating heavier materials from lighter ones. Peg says that it works “in the same way a washing machine spins off water from clothes.”

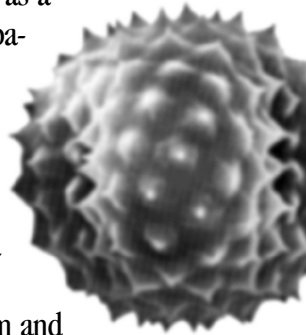
Three fume hoods allow Peg to work safely with chemicals that have dangerous fumes. By working at a table under a fume hood, vapors from chemicals are taken out of the room so that Peg will not breathe them and irritate her lungs.

In most scientific laboratories, there are bottles of chemicals that are used to conduct experiments, but are dangerous to touch or breathe. Scientists are taught to wear protective clothing and to handle the chemicals very carefully. No one is ever supposed to be alone in a lab while working with a dangerous chemical. Following the safety rules is very important.

To remove pollen from chopped up fossil rock, Peg uses a very dangerous chemical called hydrofluoric acid. The chemical dissolves sand away from the sediment. But it would also dissolve the scientist's flesh and bone if it spilled on her.

“If you get hydrofluoric acid on as little as two percent of your skin, it will kill you,” Peg says. “You want to make sure all your skin is covered when you use it.”

Today she is working on a rock sample taken from a dig not far from the university. She wears a plastic helmet over goggles to shield her face. A rubber apron starts above her chest and drapes down almost to her ankles and she has on long rubber gloves that go midway up her arms, so she is completely covered. She adds hydrofluoric acid to the rocks to rid them of sand. The reaction is spectacular. Smoke begins rising from the top of the plastic beaker, and then its contents



*Ragweed
pollen*

boil up and steam rises into the air as though it were a pot of coffee boiling on a stove.

Next, she wants to separate the chemical from the sediment. To do this, she spins the remaining mixture at a very high speed in a centrifuge, and then pours off the chemical. “You keep adding chemicals that will react and remove different parts of the sediment,” Peg says, “until what you have left is hopefully a pollen-rich residue.”

One of her most interesting pollen finds didn't come out of rock sediment, but from the skull of a prehistoric animal. George Corner, who manages the museum's collection of prehistoric fossils, says Peg's work has been very interesting.

“She has been able to recover pollen from sites we didn't think were possible!” he exclaims. “We got a baby mammoth skull about the size of a basketball, and she recovered pollen by taking samples of these cranial sinuses that preserved this stuff better than the surrounding sediment did.” The mammoths had breathed in pollen, which remained in their sinuses, cavities in the skull that allow secretions to

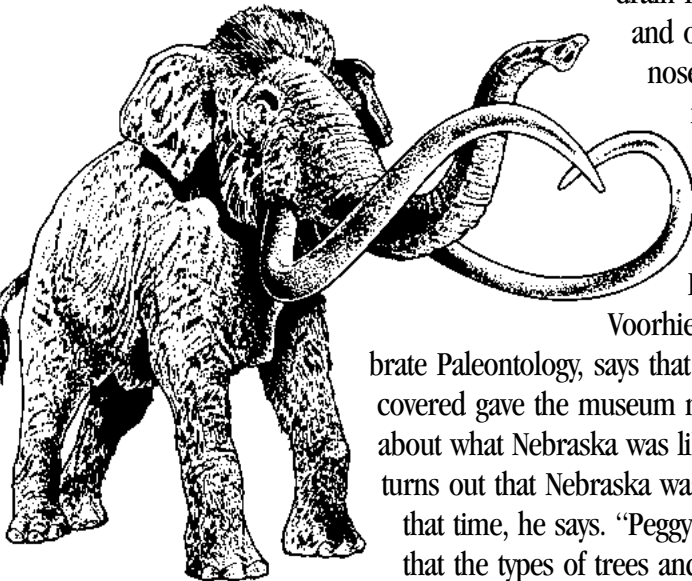
drain into the nasal cavities and on down through the nose. There are no mammoths on earth today, but their first cousin is the Indian elephant.

Peg's colleague Mike

Voorhies, Curator of Verte-

brate Paleontology, says that the pollen Peg recovered gave the museum new information about what Nebraska was like in the Ice Age. “It turns out that Nebraska was much different” at that time, he says. “Peggy was able to learn that the types of trees and other plants that

were living here 500,000 years ago were similar to ones



Mammoth



Photo courtesy of Gary Hochman.

*Dr. Peg Bolick is pointing to a light microscope image of pollen from the African species *Vernonia* (Ironweed).*

that live up in northern Minnesota today. Things like spruce and fir and hemlock ... all kinds of plants that are not native to Nebraska today.” Mike says Peg is “a very, very determined woman” who has improved techniques of finding pollen in fossils.

George says it's exciting to work with Peg because “she exudes enthusiasm. She loves the thrill of discovery, and will give us a blow-by-blow description of what she has recovered as she goes through it, step by step. You can tell she enjoys what she's doing. She likes to impart that knowledge to others around her.”

Although Peg has been interested in science all her life and has worked hard at it, being successful has not come easily. On the one hand, she says, she couldn't have gotten as far as she has without the help and support of many male professors and scientists.

However, like many female scientists her age, Peg says she has experienced discrimination in a field long dominated by men. She found time and again that she was treated with less respect than male col-



Photo courtesy of Gary Hochman.

Dr. Peg Bolick and paleontologist Dr. Mike Voorbies examine fossils at Ashfall Fossil Beds State Historical Park, Royal, NE.

leagues and that it took longer for her to get equal professional status. Altogether, the discrimination she has felt has taken its toll on her and made her feel discouraged at times. But, she adds, “It helps to remember the guys who have gone to bat for me—my advisor in school and colleagues like Mike, George and Jim.”

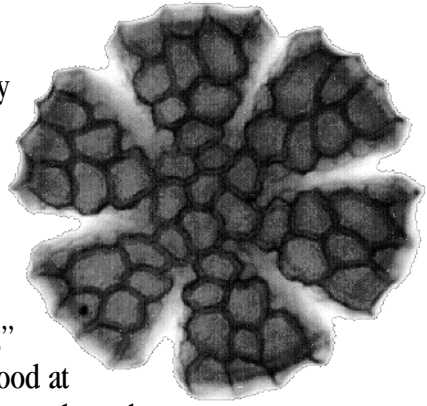
Once Peg gave a talk in Cambridge, England, on her research findings, and then later overheard two male scientists remark how interesting the talk was. And, one added, “Her husband must have helped her with it.” Peg was not married at the time, and she felt hurt by the men's remarks because she realized that they were not willing to grant her the respect she deserved as a professional colleague.

And, in Lincoln, Nebraska, at the university where Peg works, she continues to feel discrimination because she is a woman. Some other scientists, both male and female, agree that women do not yet have equal footing with their male colleagues. Peg says, for instance, that a lot of students, particularly male students, tend to take for granted that women scientists don't have Ph.D.s, the highest educational degree a person can get. Because Peg has a Ph.D., she normally could

expect to be called “Dr. Bolick.” But many of these students apparently assume only men would have such a high degree, and they call male professors “Dr.” and female professors “Miss” or “Mrs.”

Peg’s role model is her male colleague, Mike Voorhies. “He loves what he’s doing,” Peg says. “He’s very good at it. He’s very good at both the science and conveying the science to the public.”

Like Mike, Peg wants to continue doing what she enjoys doing—researching fossils and passing on what she learns to other scientists and to the public.



Basil pollen



Pine pollen

Glossary

Allergic – Having a physical reaction to a substance, such as pollen or a particular food, that most people are not bothered by. Symptoms include such things as sneezing, sinus congestion, difficulty breathing or breaking out in hives.

Botanist – A scientist who studies plants.

Centrifuge – A large container that spins liquids at a very high speed in order to separate a heavier ingredient from a lighter one.

Curator – A person who cares for and manages all or part of a museum collection.

Ecosystem – A naturally occurring neighbourhood of all living things and their environment. Some plants and animals are dependent upon one another within their ecosystem.

Evolution – A gradual change. In biology, the gradual change in form of animals or plants from prehistoric forms to modern ones.

Fossil – A part of or an impression of a plant or animal preserved in rocks or other sediment.

Hydrofluoric Acid – A very caustic and dangerous chemical used in laboratories to dissolve glass and sand.

Mammoth – A prehistoric animal, now extinct, whose first cousin is the Indian elephant.

Pollen – A pollen grain is a very small particle that carries the sperm of a seed plant from one flower to another. Pollen is produced by all plants that grow from seeds. A pollen grain usually has a very tough outer wall that is not affected by most chemicals.

Sediment – Matter deposited by water or wind; also, matter that settles to the bottom in liquid.

Vertebrate – An animal that has a spinal column.