As always summer brings a certain calmness, with most of the student body gone for the summer. However, this summer it is also a time of sadness, with the passing of Robbin W. Thorp. Robbin was iconic in the field of pollination biology and bee systematics. He assisted so many people without any interest in recognition or compensation. He will be greatly missed.

On more cheerful topics, we have a group leaving for several weeks collecting in Belize at the end of June and moth night is coming up in August.

If you have any “insect” related topics you’d like to see explored in the Spotlight on a Species column please let me know.

Have a great summer and let us know about any insect related adventures you might have.

Lynn Kimsey

As part of a continuing flea theme in recent newsletters, it seemed appropriate to finish with the most infamous disease vectored by fleas, plague, and its role if any in the U.S. Plague is a disease caused by the bacterium, *Yersinia pestis*. *Yersinia pestis* is a pathogen of some rodents, particularly chipmunks and ground squirrels, that is transmitted by fleas. The bacterium can cause severe disease in atypical hosts, such as rats and humans. It is rare for humans to become infected directly by fleas from wild rodents, usually rats act as intermediate hosts. Fleas are generally not host specific and if the host they have been feeding on dies, they will leave to find another host.

Plague is unusual among diseases because it can take on several pathologies, which then change how it is transmitted to and among humans. The most common form is so-called bubonic plague, which is transmitted by a fleabite. As the pathogen enters the skin it infects the lymphatic system, resulting in enlargement of the adjacent lymph nodes (buboes). If the bacteria enter the bloodstream instead, the disease becomes systemic and is quickly lethal (septicemic plague). Finally, if the bacteria reach the lungs the pathogen can be spread through the air by coughing. This form of the disease, called pneumonic plague, is highly contagious from person to person.

There are a number of puzzling questions about plague. Plague bacteria are endemic in wild rodent populations in Eurasia and western North America. For millennia, severe plague epidemics have been recorded in Western Europe and China. However, after the last major outbreak in the eighteenth century, plague appears to have disappeared from western Europe, whereas outbreaks have continued to occur in China, and in human populations in other parts of the world.

The Triumph of (the Black) Death is a painting by Pieter Bruegel the Elder, circa 1562.
MUSEUM NEWS

Dixon May Fair

The Bohart has been a regular presence at the Dixon May Fair in May. This is the oldest district fair in California and it draws visitors from much of northern California. Jeff Smith and Alex Dedmon staffed the exhibits Saturday afternoon, and Brennen Dyer, Emma Cluff and Tabatha Yang did set-up and take down of the exhibits. Kathy Garvey recorded events on her blog: https://ucanr.edu/blogs/blogcore/postdetail.cfm?postnum=30188.

Student Project

A junior high student in New York City used our poster on the California dog face butterfly and Fran Keller’s book to make a model of the butterfly for her school project.

Spider Day Open House

Our last weekend open house of the academic year celebrated spiders. We had over 140 visitors to the event. Our new faculty member, Jason Bond, and his graduate students Rebecca Godwin, Lacie Newton and Xavier Zahnle, and postdoc Vera Opatova took the lead on showing off spiders and their relatives to visitors to the museum. In addition, Geoff Attardo, the medical entomologist in the department brought his 3D imaging system for visitors to “play” with a three dimensional walking tarantula. Since spiders have to feed by sucking in the body contents of prey, we also had visitors drink apple sauce through a straw to imitate how spiders feed. A great time was had by all.

Bohart Museum Society Newsletter Summer 2019
**New Donations**

**Richard Brown Collection**
Richard Brown donated his impressive collection of butterflies and moths earlier this year. Steve Heydon and Jeff Smith drove to Stockton to help move the collection, which consisted of ten 24-drawer insect cabinets and 34,000 specimens.

**Richard Peigler Donation**
We recently received an incredible donation of textiles and other materials made of silk from several different silk moth species from Richard Peigler.

Dr. Peigler is a professor of biology at the University of the Incarnate Word (UIW), where he teaches classes in entomology, evolution and systematics.

He has a passion for moth produced textiles and has donated ethnographic articles, various textile pieces, and books to a large number of universities and museums, including Clemson, Texas A&M and Montana State Universities. Most recently he sent a collection of these materials to the Bohart, including his book “Eri Silk: Cocoon to Cloth”.

We were surprised to learn how many different moths, both families and genera are used in creating textiles. The species we always think of is *Bombyx mori*, the so-called silk moth in the family Bombycidae. However, two genera of Notodontidae, *Anaphe* and *Epanaphe* (Nigeria); four genera of Saturniidae, including *Antheraea* (China, India), *Attacus* (Java), *Cricula* (Java) and *Samia* (Ethiopia, India); and two genera of Lasiocampidae, *Borocera* (Madagascar) and *Gonometoa* (Africa) are also used in textiles.

Tussar silk, which was highly prized in Victorian England, is actually produced by species of *Antheraea* silk moths (image to the right). This silk is valued because it has a naturally bright golden color and a different texture than the silk produced by the commercial silk producer, *Bombyx mori*.

**Tom McKenzie Collection**
Tom McKenzie, a UC Davis Entomology department alum, recently contacted us about donating his insect collection to the museum. In all he donated 1,438 specimens, with a beautifully curated collection of 559 mosquitoes. He also donated a 24-drawer California Academy style cabinet with nine drawers, Schmidt boxes, books and other curatorial supplies.

**Bohart T-shirts Out and About**
John Heraty sent us this photo of his grandson modeling one of our t-shirts.

**Bohart Museum Society Newsletter Summer 2019**
There are two theories about how plague came to be in North America. One, that plague was first introduced by ship to the Pacific Coast in 1900 from southern China. Two, that plague entered North America with migrating mammals during the Ice Ages.

If plague came to North America from China it probably originated in an outbreak in Shanghai in the 1890’s. From there plague infected rats and fleas were carried in ships to major ports worldwide, including Cape Town (1899), San Francisco (1900), and South American ports (1902-1905).

The first recorded outbreak of human plague in North America occurred in 1900, when steamships arriving from Shanghai carried plague infected rats and fleas. During this outbreak the disease was isolated in the Chinatown district, with some 25,000 inhabitants, resulting in 22 deaths. The outbreak was eventually suppressed by intensive rat eradication programs. Evidently, the pathogen was still present in wild rodents in the hills around the city, so the first outbreak was followed by a second outbreak as a consequence of the 1906 earthquake. This outbreak began in May and peaked the following fall in 1907. All parts of the city were involved this time and the outbreak resulted in 77 deaths.

When the epidemics occurred in California, scientists began to study the transmission cycle of the pathogen. They discovered that California has many wild rodent species that are closely related to Eurasian species that are involved in plague transmission cycles. Rodents immune or at least resistant to the pathogen include chipmunks and some ground squirrel species. Other wild rodents, including marmots (also called groundhogs or woodchucks), squirrels and prairie dogs are susceptible to plague bacteria and die during outbreaks. The major link between these wild rodent populations and humans is rats, either roof rats (Rattus rattus) or sewer rats (Rattus norvegicus), and their fleas.

The San Francisco epidemics were largely stopped by major eradication programs focused on rats and ground squirrels. No antibiotics to treat plague were available until two decades later. Professor Bohart used to tell a story about how he and his brother earned money in high school by shooting ground squirrels for 10 cents a pelt, but that bullets cost nearly the same so they would try to shoot two squirrels at once.

If plague reached North America much earlier, during the Ice Ages, it had to have been carried by mammals migrating across Beringia, linking Asia and Alaska. During the Pleistocene, much of Beringia was dry land, free of ice. Migrating mammals undoubtedly brought their parasites and pathogens along with them.

The rodent vectors endemic in the Eurasian steppes are the same as in North America, ground squirrels and chipmunks. In North America, plague occurs in mountain regions and plains, west of the 100th latitude.

If plague originated in the port of San Francisco, it then had to disperse as far as New Mexico and become well established in less than 40 years. Since the first recognized outbreak of plague in New Mexico occurred in prairie dogs in 1938. In California, the first human cases of plague occurred in 1900 and the pathogen had spread throughout rodent populations in the San Francisco Bay region by 1907. If it took plague three years to spread 15 miles away from San Francisco how could it spread 1,000 miles in only 40 years?

On the other hand, you would expect some cultural evidence of plague if it were present when humans established a presence in North America. There is little or no cultural history of disease among California tribal groups, but this may be more a function of their community structure and lack of “written” records. There was also no mention of plague-like diseases by Spanish colonists. Spain in the 1500’s was very familiar with the symptoms of plague, having just survived the Black Death in the mid 1400’s. In the American Southwest, the Zuni live in plague areas, and they have taboo against entering a home if someone died in it; the home was always abandoned. This could be a cultural defense against plague or it might be due to hanta virus.

Several studies have looked at the genetic relationships among plague bacteria from different regions. These studies support the theory that plague was introduced into North America from China in the early 1900’s. However, they appear to have only sequenced plague bacteria from California and not the Southwest. In addition, this does not account for the distance the pathogen would have to spread in a short period from San Francisco to New Mexico.

Today, only a few plague cases a year occur in North America. In June 2012 a man in Oregon, attempting to rescue a cat choking on a mouse, was bitten by the cat and came down with septicemic plague. There were two cases of plague in Yosemite National Park and 15 cases nationwide in 2015, including 2 deaths in Colorado caused by infected dogs. In 2017, there were three cases of plague in New Mexico and in 2018 just one case of plague in Idaho.
Arthropods have been used by humans for food and as medicine for millennia. Some have even been found to contain medically valuable pharmaco-active compounds. However, much of the medical use of arthropods is based on the resemblance of the insect, scorpion, centipede or spider to some part of human anatomy or symptoms. This is otherwise known as the Doctrine of Signatures, where plants and other organisms that resemble various body parts can be used to treat problems with those body parts. This idea dates from the time of Dioscorides a Greek physician who authored the Materia Medica around 60 AD.

Globally most cultures use arthropods as food and/or medicinally. However, western European and Russian cultures, and cultures derived from those regions in the Americas, Australia and New Zealand do not. This may be partly due to the lack of sufficient quantities of any particular kind of insect, except locusts, to become a food staple in the region.

Grasshoppers are commonly eaten worldwide, and are also used medicinally. Indigenous Mexicans use grasshoppers to treat kidney diseases, and relieve intestinal pain. Because grasshopper femora vaguely resemble the human liver, they are used to treat liver ailments. In other regions powdered grasshoppers are mixed with water and ash and are painted on the forehead to treat headache pain. Headaches are also “prevented” by inserting grasshopper paste under the neck skin.

Beetles have a variety of uses depending on the family. Scarab grubs are large and meaty and are often eaten. Medicinally, they resemble swollen legs and have been thought to help individuals suffering from elephantiasis. Along the same lines, dung beetles have been used to treat constipation. Blister beetles (Meloidae) contain the compound cantharidin, which is very poisonous if taken internally, but externally is a skin irritant and has been used as an aphrodisiac (Spanish Fly).

Much like scarab beetles, silk moths have a variety of uses, both as food and medicine. Silk moth caterpillar frass is eaten to improve circulation and alleviate vomiting and diarrhea caused by cholera. The pupae are eaten to treat hemorrhage, stroke, pneumonia, convulsions, and even frequent urination.

Ants are either consumed whole, or their venom is used to treat a variety of conditions. Red harvester ant venom was used to treat arthritis, and poliomyelitis, and the whole ant was consumed to induce visions in indigenous peoples in California. In China the black mountain ant, Polyrhachis vicina, is said to have anti-aging properties, replenish Qi and act as an aphrodisiac.

Honey bees and their nest materials have a wide variety of uses. Honey is used on the skin to treat burns and rashes, and is used as a poultice to treat eye infections. It is also used to treat digestive problems head colds, cough, throat infections, laryngitis, tuberculosis, and lung diseases. Honey bee stings are used to treat arthritis, rheumatism, peripheral nerve disorders, and asthma. Propolis, used by bees in nest construction, is sometimes consumed by menopausal women because it supposedly has a high hormone content! Where the hormones would come from is unclear. Propolis is also thought to have antibiotic, anesthetic, and anti-inflammatory properties. Royal jelly, produced by worker bees to feed the queen, is used to treat anemia, gastrointestinal ulcers, arteriosclerosis, hypo- and hypertension, and as an aphrodisiac. Finally, honey bee bread and pollen are eaten to increase health and treat infections.

Other arthropods used medicinally include cockroaches, termites, centipedes and scorpions. In China cream made from powdered cockroaches is used to treat burns, and cockroach syrup is sometimes used to alleviate symptoms of gastroenteritis. Material from termite mounds, which largely consists of termite saliva and soil, is used in India as a topical paste and is mixed with water and consumed to treat anemia, ulcers and for pain relief. Because centipedes have many legs, they are sometimes used to treat leg problems. They are also used to treat liver disease, lockjaw, seizures and convulsions. The stings of some scorpions are thought to be a good way to get high (not sure who thought this was a good idea).

Finally, some insect parasites are also highly valued. There is a huge market for insects mummified by Cordyceps fungi. In China they are used to create a tonic to improve energy, appetite and stamina, as well as increase longevity, treat infertility, general weakness, tuberculosis, colds, malignant tumors, arthritis, liver and kidney disease, enlarged prostate, heart disease, diabetes, and of course as an aphrodisiac.

Some of these arthropods have been found to contain medically useful compounds, but the majority are used because of resemblance and tradition. Many of these, particularly ones like Cordyceps that resemble genitalia are used as aphrodisiacs. However, consumption of arthropods does carry some risks as the market is unregulated and arthropods may contain toxins, heavy metals and even parasites, such as nematodes that could prove to be harmful.
By Kathy E. Garvey

Dr. Robbin Thorp, a global and legendary authority on bees and a distinguished emeritus professor of entomology at the University of California, Davis, passed away Friday, June 7 at his home in Davis, surrounded by family. He was 85.

Dr. Thorp, a member of the UC Davis entomology faculty for 30 years, from 1964-1994, achieved emeritus status in 1994 but continued to engage in research, teaching and public service until a few weeks before his death.

A tireless advocate of pollinator species protection and conservation, Dr. Thorp was known for his expertise, dedication and passion in protecting native pollinators, especially bumble bees, and for his teaching, research and public service. He was an authority on pollination ecology, ecology and systematics of honey bees, bumble bees, vernal pool bees, conservation of bees, native bees and crop pollination, and bees of urban gardens and agricultural landscapes.

"Robbin's scientific achievements during his retirement rival the typical career productivity of many other academic scientists," said Steve Nadler, professor and chair of the UC Davis Department of Entomology and Nematology. "His contributions in support of understanding bee biodiversity and systematics are a true scientific legacy."

In his retirement, Dr. Thorp co-authored two books Bumble Bees of North America: An Identification Guide (Princeton University, 2014) and California Bees and Blooms: A Guide for Gardeners and Naturalists (Heyday, 2014). Locally, he was active in research projects and open houses at the Bohart Museum of Entomology and the Häagen-Dazs Honey Bee Haven. In his research, he monitored bees in the Häagen-Dazs Honey Bee Haven, a half-acre bee garden on Bee Biology Road operated by the UC Davis Department of Entomology and Nematology. He established a baseline in 2008 and detected more than 80 species of bees.

Born Aug. 26, 1933 in Benton Harbor, Mich., Dr. Thorp received his bachelor of science degree in zoology (1955) and his master's degree in zoology (1957) from the University of Michigan, Ann Arbor. He earned his doctorate in entomology in 1964 from UC Berkeley, the same year he joined the UC Davis entomology faculty. He taught courses from 1970 to 2006 on insect classification, general entomology, natural history of insects, field entomology, California insect diversity, and pollination ecology.

Every summer from 2002 to 2018, Dr. Thorp volunteered his time and expertise to teach at The Bee Course, an annual workshop sponsored by the American Museum of Natural History and held at the Southwestern Research Station, Portal, Ariz. The intensive 9-day workshop, considered the world’s premiere native bee biology and taxonomic course, is geared for conservation biologists, pollination ecologists and other biologists.

Highly honored by his peers, Dr. Thorp was named a fellow of the California Academy of Sciences, San Francisco in 1986; recipient of the Edward A. Dickson Emeriti Professorship of UC Davis in 2010; and recipient of the UC Davis Distinguished Emeritus Award in 2015. Other honors included: member of the UC Davis Bee Team that won PBESA’s Team Award in 2013. In addition, he was a past president (2010-2011) of the Davis Botanical Society, and former chair (1992-2011) of the Advisory Committee for the Jepson Prairie Reserve, UC Davis/Natural Reserve System.
ASK THE BUG DOCTOR

If you have an insect question, need advice, want an identification of something you’ve found, or would like to see an article in the newsletter on a particular topic let us know. Email us at bmuseum@ucdavis.edu.

More Flea Problems

The Los Angeles City Hall and Central Police Station in downtown Los Angeles have a major flea problem linked to a large population of rats in and around the building. The problem was made worse by a number of employees infected with murine typhus by flea bites. The police station and city hall have been fumigated repeatedly since August. As of this March the flea problem seems to be under control.

This is yet another reminder that large populations of pest rodents, feral cats and their associated parasites must be controlled in urban and suburban settings.

In the Eye of the Beholder

A woman in Taiwan recently went to the hospital with what appeared to be a severe eye infection, with stinging pain. Her eye was swollen shut. When a doctor at Foyin University Hospital examined her eye he discovered four living sweat bees (family Halictidae), which apparently got into her eye searching for salt.

Recycling Bees

In a recent study published in the journal Apidologie the authors documented instances of leaf cutter bees using discs cut from plastic to make the cells in their nests in Canada and Argentina. We’ve also observed something similar in Davis, where Megachile bees were observed cutting colorful discs from fluorescent pink plastic flagging tape for their nests.

Spring brings Termites

This spring we found termite tubes coming up around the base of a tree on campus. They build these tubes in the spring to allow their winged alates easy escape from the colony to find mates. The presence of these tubes probably didn’t bode well for the tree.

Butterfly Beer

First Magnitude Brewing and the Florida Museum of Natural History have teamed up to make a one of a kind beer, Frosted Elfin New England-style Session Pale Ale. The beer was fermented using yeast swabbed off the bodies of the endangered frosted elfin butterfly. The beer was launched as part of a fund-raiser staged by the brewery in Gainesville to raise funds to protect various endangered butterflies.

Leaf-footed Bug Nymphs

Spring is also the time for other insects hatching. Christopher Smith sent us this photo of newly hatched Leptoglossus leaf-footed bugs (family Coreidae).

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Palm Flower Moth

Litoprosopus coachella, an erebid moth native to California that feeds on fan palms is causing problems with ornamental palms in the state. The larvae feed on the flowers and the larvae pupate in cocoons built out of debris beneath fallen palm fronds though we’ve even seen them pupate indoors in carpets beneath furniture.

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Bohart Museum Society

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Don’t miss
Moth Night
August 3, 2019
8-11pm