DISCOVER

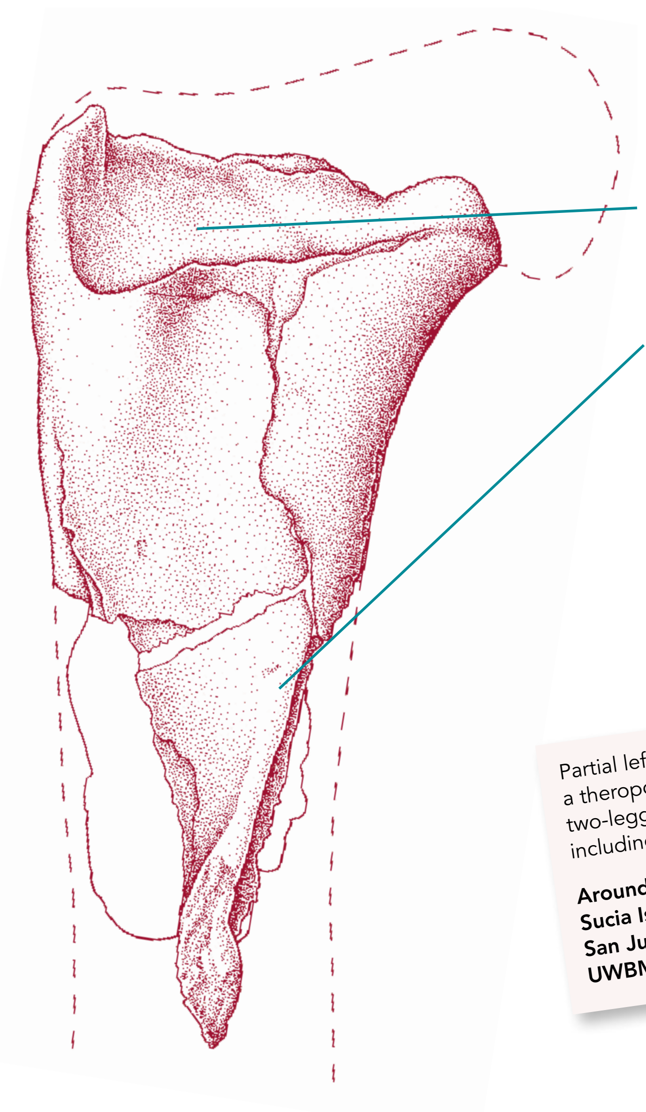
BURKE MUSEUM RESEARCH NEWSLETTER

VOLUME NO. 2 **JUNE 2015 ISSUE**

IN THIS ISSUE

Washington's First Dinosaur

In 2012, Burke Museum research associates found a peculiar fossil while collecting ammonites on the shores of Sucia Island State Park in the San Juan Islands. After three years of preparation and study, the Burke was able to announce it had found the first dinosaur fossil from Washington state. The description of this discovery was published on May 20, 2015, in the journal "PLOS ONE."



How do we know it's a dinosaur?

Hollow cavity in middle of bone is unique to theropod dinosaurs from this time period.

Anatomical feature, the fourth trochanter, is prominent and relatively close to the hip; a combination of traits known only in some theropod dinosaurs.

Partial left femur (thigh bone) of a theropod dinosaur—a group of two-legged, meat-eating dinosaurs, including *T. rex.*

Around 80 million years old
Sucia Island State Park,
San Juan Islands, Washington
UWBM #95770

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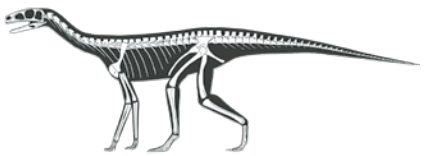
VOLUME NO. 2 **JUNE 2015 ISSUE**

VERTEBRATE PALEONTOLOGY

GREG WILSON, ADJUNCT curator of vertebrate paleontology, is working with fossil preparator Bruce Crowley to create replicas of mammal teeth from the Mesozoic Era (252–66 million years ago). These tiny teeth belong to some of the earliest known mammals, which were smaller than today's mice. By creating casts, Wilson can see the teeth more easily when taking photos or using CT scanners, with no risk of damaging the original fossil. By examining the shape of the teeth, Wilson can analyze what these mammals ate, and also use the casts to teach courses about mammal evolution.

What Happened During the Largest Extinction on Earth?



The largest mass extinction took place at the end of the Permian period (252 million years ago). Wiping out an estimated nine of every ten species, this event drastically changed the course of life on Earth. Fortunately, its survivors included early relatives of dinosaurs and mammals, as well as the ancestors of turtles, lizards and amphibians. Despite the global impact of this extinction, most fossils from this critical time have only been collected in Russia and South Africa—representing only a few pieces of this important prehistoric puzzle.

Dr. Christian Sidor, curator of vertebrate paleontology, leads teams to Tanzania, Zambia and Antarctica to fill geographic gaps in the fossil record. At the time of the end-Permian mass extinction, these three areas were connected as part of the supercontinent Pangea. By comparing the fossils discovered from his fieldwork to specimens already in museum collections, Sidor and colleagues created two "snapshots" of four-legged animals about five million years before and about 10 million years after the extinction event.

Sidor's team discovered fossils from 10 million years after the mass extinction that reveal a lineage of animals that led to dinosaurs in the mid-Triassic period (247–237 million years ago), many millions of years before dinosaurs have been found in the fossil record elsewhere on Earth. Archosaurs, a group of reptiles that includes crocodiles, dinosaurs and birds, were in Tanzanian and Zambian basins, but not distributed across all of southern Pangea as had been the pattern for four-legged animals prior to the extinction. Archosaurs led to animals like *Asilisaurus kongwe*, a dinosaur-like animal, and *Nyasasaurus parringtoni*, a dog-sized creature with a five-foot-long tail that could be the earliest dinosaur.

Most vertebrate fossils are known from a very limited number of places on Earth, so Sidor's goal of understanding the geographic complexity of extinction and recovery is a big one. The Zambian and Tanzanian fossil beds preserved both plants and animals, which is unusual, and provides information on paleoclimate before and after the extinction. In addition, members of Sidor's group will analyze the stable isotopes of fossil soils as another estimate of ancient climate. Mass extinctions have unpredictable consequences, but looking at the past can shed light on how life on Earth responds to cataclysmic events.

Top photo: UW graduate student Chuck Beightol excavates a dinocephalian skeleton in Zambia, 2014.
Inset photo: Skeletal reconstruction of *Asilisaurus kongwe*, a dinosauriform discovered by Sidor's team in Tanzania.
Sidebar illustration: BY JUDE SWALES.

INVERTEBRATE PALEONTOLOGY

Peruvian Desert Once Home to Wealth of Ancient Life

The coast of southern Peru is a desert. Raked by vigorous winds, with not a blade of grass in sight, the Peruvian coast looks remarkably different from its past. Today it is raised hundreds of meters above sea level, but Peru's Pisco Basin contains a plethora of fossils that tell stories of its past as a shallow, cold sea. Dr. Thomas DeVries, paleontology research associate, has spent 35 years collecting invertebrate fossils from this area and leading field trips for vertebrate paleontologists. These collaborations led to the discoveries of giant tropical penguins, massive great white sharks, aquatic sloths and the four-legged ancestors to whales, dating from 60 million years ago to the last ice age. So far, DeVries has formally named and described 40 new species of fossil snails from the Pisco rocks and established the only reliable time-zonation of these fossil beds. This time scale is referenced by other paleontologists and geologists to place their finds in a reliable sequence.

Peru's Pisco Basin contains a plethora of fossils that tell stories of its past as a shallow, cold sea.

DeVries' studies revealed many lines of species extinction and the origination of snails, particularly limpets and the predatory snails that are typical of rocky intertidal zones and shallow marine bays. He has shown that some of these mollusks are direct ancestors to modern species that live along the Peruvian and Chilean coast lines, and provided links with species in other Southern Hemisphere regions. He discovered the ancestor to and the evolution of one snail, *Concholepus*, which is part of a multi-million-dollar food industry today and is one of the main sources of income for locals on the Peruvian coast. Fifteen million years ago, when this predatory snail evolved, it had no shell spines around the opening to its shell. But 13 million years later, it developed two strong spines that are now used to dislodge its food—barnacles and limpets—off the rocks. This suggests a change in food source was the dominant factor to its evolutionary survival, even though these spines make it easier for crabs to flip *Concholepus* off the rocks for their dinner. DeVries is the first to research fossil invertebrates in this region of Peru, and has discovered dozens of ancestors to other modern snails. *Concholepus* is the first of many that he will give scientific names and descriptions to in the future.

Top photo: Forty-million-year-old fossil oyster beds are exposed in the sands of the southern Peruvian desert.

THE BURKE IS ONE OF SEVEN museums recently awarded a National Science Foundation grant to digitize collections of marine invertebrate fossils from the west coasts of the Americas, dating from 66 million years ago to today. When completed, this project will produce 80,000 specimen descriptions along with photos of 2,000 fossils from the Burke's collection and will be available online through a multi-institutional database.

These fossils, including those from southern Peru, represent animals that lived during major environmental changes, such as the global hothouse 50 million years ago and the rapid expansion of the Antarctic ice sheets 12 million years ago. Through the database, researchers and others from across the globe can access a record of ecological and evolutionary responses to past environmental changes. These records are key to developing models for predicting responses to climate change by modern marine animals along our coastline.

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PALEOBOTANY

MORE GIRLS IN SCIENCE!

Women are underrepresented in STEM (science, technology, engineering and math) fields, and girls start losing their interest in STEM topics as early as 5th grade. The Burke Museum is addressing this problem by giving girls access to scientists and collections. In addition to its Girls in Science summer camp, Caroline Strömberg launched a National Science Foundation-sponsored Girls in Science weekend program at the Burke Museum, which allows 5th–8th grade girls to engage in research with a broad range of women scientists throughout the school year. So far, 25 girls have used fossils to reconstruct how Pacific Northwest climates changed 15 million years ago, learned computer programming and analyzed plankton to detect ocean acidification, among many other activities. And girl, do they love it!

Tiny Crystals Show Major Ecosystem Change

Do plant and animal communities respond when climates change? It is a question that concerns scientists, farmers and environmental policymakers alike in times of changing global temperatures and rainfall patterns. Ecologists can observe changes over their lifetime and try to predict what will happen in the next few hundred years. Paleoecologists, on the other hand, can search the fossil record for evidence of ecosystem change in response to tens of thousands to millions of years of climatic cooling and heating.

Dr. Caroline Strömberg, Estella B. Leopold curator of paleobotany, and Dr. Regan Dunn, former paleontology collections manager, are interested in finding out how vegetation in southern South America was affected as global climates got progressively cooler and drier over the last 50 million years. To figure this out, they spent several field seasons in Patagonia, Argentina, collecting hundreds of samples from rocks spanning 49–11 million years ago. From the samples, they extracted tiny crystals that formed inside once-living plants and were then left in the soil after the plants died and decayed. These crystals, known as phytoliths or "plant stones," tell us what kinds of plants lived in an area. Dunn and Strömberg also discovered that the shape of certain phytoliths reflects the amount of light the plants were exposed to when they were alive. This, in turn, indicates how open the vegetation was, and provides clues to the type of environment plants lived in, such as grasslands or forests.

By using this new approach, Dunn and Strömberg were able to uncover a fascinating story of vegetation change in response to climate. As Patagonia started drying up 45 million years ago, the cover of subtropical forests opened up—not into the grasslands typically found in drier climates, but into open palm shrublands unlike anything we find on Earth today. This opening-up of landscapes also coincided with major changes in the local plant-eating animals, which showed incrementally taller—sometimes even ever-growing—teeth, a pattern that suggests that animals evolved over millions of years in response to feeding in increasingly dry, open environments. These results help us better understand how fast plants and animals can respond to major climate change, such as the one we are currently experiencing.

Top photo: Close-up of fossil phytoliths (plant silica) under a microscope.
Inset photo: Caroline Strömberg *(left)* and Regan Dunn in Patagonia.

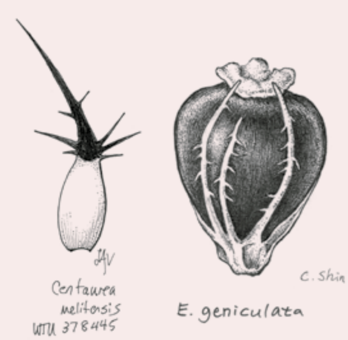
Barcoding Fungi—a New Era in Mycology

Advancements in DNA analysis have opened doors to numerous new areas of research in the biological sciences. In mycology—the study of fungi—DNA sequence data is playing a critical role in answering challenging questions about the identification, distribution and relationships of fungus species. Traditional methods of study, including morphology and habitat data, remain important to understanding these organisms, but DNA sequencing allows researchers to more easily identify species, develop in-depth phylogenetic studies of thousands of fungi, study their distribution and migration patterns, and evaluate their presence and function in a variety of terrestrial ecosystems.

Dr. Joe Ammirati, adjunct curator of mycology, has collaborated extensively for more than three decades with local, regional and international researchers to better understand the hundreds of species that compromise the large mushroom genus *Cortinarius*, the most common mushrooms found in Western Washington's north temperate ecosystems. Currently, Ammirati and colleagues are developing DNA "barcodes"—a unique DNA sequence—that can be used to identify species from mushroom tissue, spores or environmental samples. These mushrooms with a barcode could be easily identified by non-mushroom experts. The barcodes will be placed in online public databases, allowing full access to the data by everyone, including medical and veterinary staff dealing with mushroom poisonings, who could use the databases to rapidly identify the species of mushroom ingested.

Ammirati and colleagues are currently conducting a study of the species of *Cortinarius* that grow in association with Oregon oak trees in the Columbia Gorge, where these trees are part of unique habitats that support a rich array of fungi, plants, animals and other organisms. This is one of the first extensive studies of the fungi associated with Oregon oak in our region. The species of *Cortinarius* that grow in association with the roots of Oregon oak are almost all new to science and often represent previously unknown evolutionary lineages.

THE BURKE MUSEUM Herbarium is revising *Flora of the Pacific Northwest*, an invaluable technical reference for field identification of vascular plants of the Pacific Northwest. The *Flora* covers plants from northern Oregon, Washington, southern B.C., Idaho and western Montana. When published in 1973, *Flora of the Pacific Northwest* included 4,200 species, subspecies and varieties and hasn't been updated since. The newest edition will include 5,300 taxa, with illustrations accompanying each new addition. The 1,100 new plants consist of new species discovered over the last 40 years, and weeds that are well known to science but only arrived in the Pacific Northwest recently. In addition to professionals, students and enthusiasts interested in the native flora, this updated version is crucial to helping federal, state and tribal resource managers accurately identify invasive weeds, which can threaten native habitats. Publication of the new *Flora* is planned for spring 2017.



Top photo: Cortinarius parkeri, a common spring species in conifer forests. BY ANDREW PARKER.
Inset photo: Oregon oak habitat in the Columbia Gorge. BY J. AMMIRATI.
Illustrations: (Left) BY LINDA VOROBIK. *(Right)* BY CRYSTAL SHIN.

GENETIC RESOURCES COLLECTION

1 TISSUE SAMPLE IN A VIAL

UP TO **81** VIALS IN A BOX

16 BOXES IN A RACK

20 RACKS IN A FREEZER

6 SUBZERO FREEZERS SET TO -80 CELSIUS

23,000 TISSUE SAMPLES
SENT TO RESEARCHERS TO-DATE TO STUDY QUESTIONS RELATING TO EVOLUTION, HUMAN HEALTH AND WILDLIFE CONSERVATION MANAGEMENT

EQUALS

70,000 TOTAL SAMPLES IN THE GENETIC RESOURCES COLLECTION
1-2,000 TISSUE SAMPLES LOANED PER YEAR TO RESEARCHERS ACROSS THE GLOBE
3RD LARGEST BIRD TISSUE COLLECTION IN THE WORLD

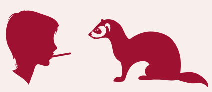
ONE EXAMPLE OF THIS WORK

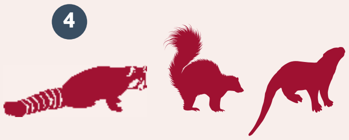
1

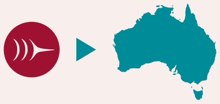
Red panda passes away from old age at a zoo. Red panda brought to the Burke Museum.

2


Prepared for mammal collection, tissue sample preserved.

3

Australian researchers are studying how ferrets and humans both get influenza.

4

They want to know if other mammals are susceptible to the flu and why.

5

Researchers from Australia contact the Burke for 20 tissue samples including red panda, river otter and harbor seal.

6

Analyzing the genetic material reveals that an ancient genetic mutation is responsible for our susceptibility to the flu.

7

Understanding how/when genes changed guides new studies about how flu strains can mutate and affect humans.

8

Remaining samples from the same animals are at the Burke for future studies.

Help or Hindrance? Snailfish Eggs in the Gill Cavities of King Crabs

In a remarkable study led by Jennifer R. Gardner, University of Washington undergraduate research assistant in the Burke Museum's fish collection, the egg masses of snailfishes deposited inside the gill cavity of North Pacific King Crabs were identified for the first time using molecular techniques. Among the many bizarre reproductive strategies employed by fishes, only snailfishes of the genus *Careproctus* have been known to lay their eggs within the protective gill chambers of lithodid (King) crabs. Until now, attempts to identify the species that deposit the eggs have been inconclusive, puzzling biologists for decades, because snailfish eggs and larvae all look the same. Determining what species of snailfish are depositing eggs in lithodids has implications for the multi-million-dollar commercial crabbing industry.

Determining what species of snailfish are depositing eggs in lithodids has implications for the multi-million-dollar crabbing industry.

Gardner, with the help of colleagues at the Alaska Fisheries Science Center, collected DNA samples from egg masses found in the commercially important Golden King Crab (*Lithodes aequispinus*) and the closely related Scarlet King Crab (*Lithodes couesi*). Mitochondrial DNA was sequenced using embryos sampled from snailfish egg masses and compared with DNA sequences from eggs of positively identified adult voucher specimens from the Burke's collection.

Surprisingly, the results yielded evidence of four species of *Careproctus*: *C. melanurus*, *C. colletti*, *C. furcellus* and *C. simus*. Each egg mass contained eggs from only one species, and appeared to be from a single parent. These results are the first positive identification of the snailfish species responsible for depositing egg masses in lithodid crabs.

The true nature of this strange relationship, however, remains to be discovered. While it is surely beneficial to the fish—providing a convenient, safe haven from egg-eating predators—the effect on the crab is unknown. It is hard to imagine that the crab receives any benefit in return; parasitism on the part of the fish seems more likely. In many cases, the egg masses take up a large volume of the gill cavity, significantly displacing the gills and seemingly having a deleterious effect on respiration, a situation that could lead to reduced growth rates and even premature mortality. The impact on the King Crab fishery has yet to be assessed.

Top photo: Golden King Crab (*Lithodes aequispinus*). BY BORIS KASIMOV.
Sidebar photos: (Top) BY RACHEL ARNOLD. *(Bottom)* BY CHARLES G. MESSING & TOMASZ K. BAUMILLER © 2013.

UW GRADUATE STUDENT Rachel Arnold described a new genus and species of frogfish from Botany Bay, New South Wales, Australia, as part of her dissertation work on the biology of these circumtropical fishes. Dubbed the Red-Fingered Frogfish, it is unique among its close relatives in having bright red pigmentation on the tips of its pectoral fin rays. The only known specimens are now part of the Burke Museum's fish collection.

UW GRADUATE STUDENT Katie Moyer is analyzing rare video of a bizarre deep-water, bottom-living fish known as a Jellynose for its soft, gelatinous snout. Little is known about this rare creature, which lives at a depth of 450 meters. Material in the Burke's fish collection will serve as a basis of comparison between this species and its nearest relatives.

MAMMALOGY

So Close, Yet Far Away: San Juan Islands Bats

The loss and fragmentation of habitats caused by human activities is one of the greatest threats to biodiversity. Understanding the factors that make species vulnerable to such threats is critical to conservation and management.

Bats are commonly thought to be less susceptible to habitat fragmentation because of their ability to fly. While all bats do fly, different species need substantially different foods and environments to survive, which can severely decrease their ability to cope with habitat fragmentation. Can ecological differences among bat species predict which ones are most vulnerable? Answering this question is vital to bat conservation and society: bats fulfill many important ecological roles, such as being the primary predators of nocturnal insects, including pests.

The naturally fragmented landscapes of the San Juan Islands are an ideal setting to study the effects of geographic barriers on bats. Rochelle Kelly, a UW graduate student working with Dr. Sharlene Santana, curator of mammals, is documenting which species occur among the islands to address whether island size and degree of isolation affects species diversity. She is also examining the diets of San Juan Islands bat species and the habitat types they rely on for foraging. The ten species that inhabit the islands primarily eat insects; some specialize on certain kinds (e.g., moths or beetles), whereas others are far less picky. Some species forage for insects out in the open, whereas others prefer to fly in cluttered habitats like the forest understory.

Kelly began researching the species compositions of San Juan, Orcas and Vendovi Islands last summer. Local land conservation organizations and residents invited Kelly to study the bats on their land. She captured and released over 140 individuals of eight species, from which she collected data for analyses of anatomy, diet, echolocation and population genetics.

Kelly will apply modern genetic methods to investigate whether ecological traits influence the population genetic structure of San Juan Islands bat species. If ecologically specialized species are restricted in their ability to disperse across a fragmented landscape, then their populations will be more genetically isolated from one another. Kelly aims to identify whether and which characteristics of a bat species' foraging habitat predict their vulnerability to habitat fragmentation, and thus provide a resource for land managers to develop conservation strategies for these important mammals.

Top photo: The Townsend's Big-Eared Bat is one of the San Juan Islands species Kelly is studying.
Sidebar photo: BY ZONSFOTO/FLIKR.

A PLAIN FACE IS MORE EXPRESSIVE

Primates use facial color patterns and facial expressions to communicate during social interactions. While color patterns allow individuals to identify each other, expressions communicate their behavioral intentions. The Santana Lab investigated the relationship between these variables and found that primates with highly expressive faces have also evolved plain facial color patterns, which may make it easier for primates to read each other's facial expressions.

Interestingly, having a highly expressive face is not directly the product of having numerous facial muscles; instead, primates that have more expressive faces are larger and have a larger facial nucleus (a group of neurons in the brainstem that controls facial expressions). This recent study highlights complex relationships among facial features during primate evolution.

ORNITHOLOGY

Big Data, Small Birds: Migratory Connectivity in the Rufous Hummingbird

Hummingbirds are universally regarded as fantastic animals, but much of their life history remains a mystery. Migratory species in particular present a challenge for researchers: they are too small to track with a GPS or radio tag, and their annual life cycle takes place over huge geographic areas. CJ Battey, a UW graduate student working with Dr. John Klicka, curator of birds, is studying the Rufous Hummingbird (*Selasphorus rufus*), which starts flying north from Mexico in January, and by April can be heard calling along the Inland Passage of southern Alaska. Rufous Hummingbirds play the important role of pollinators to flowers as they travel their migration routes. They time their return journey to the subalpine wildflower bloom in the Rockies and Sierra Nevadas, for an annual North American circuit of over 7,000 miles. Battey is describing how and why the timing and direction of migration differs within the species: when do individuals in different parts of the range begin their migration, what routes do they take, and what is the balance of learned versus genetic factors in controlling migratory behavior? To address these questions, he is using banding records and citizen science data to track the seasonal movement of populations across North America, and sequencing DNA from tens of thousands of variable sites in the genomes of hummingbirds caught on different migratory routes to detect population genetic structure and locate genes, which are likely important in regulating this behavior.

Rufous Hummingbirds play the important role of pollinators to flowers as they travel their migration routes.

This summer, members of the Klicka Lab will be in central Idaho collecting specimens from the species' easternmost breeding population for genetic analysis. By fall, they will have the first look at the genetic data from across the range. Early results from Battey's analysis show that the timing of migration is highly differentiated across the range, and that southern migrants split between the Sierra Nevada and Rocky Mountains in the fall. The mystery of these tiny, but hearty, birds is starting to unfold.

Top photo: Rufous Hummingbirds pollinate plants along their 7,000 mile migration route. BY B. GARRETT.
Inset photo: Allen's Hummingbird, Pescadero, California. BY CJ BATTEY.
Sidebar photos: (Top) BY FELIX URIBE. *(Bottom)* BY DAN PANCAMO.

JOHN KLICKA IS INVESTIGATING the evolution of distributions and diversity of New World songbirds (including warblers, blackbirds, sparrows and tanagers). In a current study, Klicka is conducting genetic sampling across several lineages of highland and lowland tropical bird species from throughout their ranges in Central and South America to determine how the formation of the Isthmus of Panama three million years ago affected the diversification of birds in this region. Preliminary results show that this connection of the Americas greatly affected the distributions of bird lineages in the Neotropics, and that intercontinental patterns of dispersal and diversification for birds are remarkably similar to the patterns observed for mammals.

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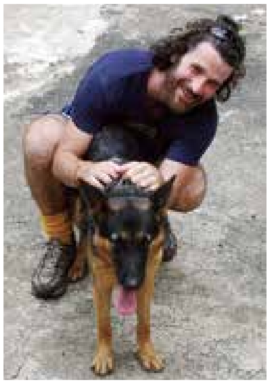
HERPETOLOGY

THIS SUMMER, PETER MILLER, herpetology collections manager, will join researchers from the Komodo Survival Program for a week of intensive scientific research and monitoring programs of Komodo dragons on Komodo Island, Indonesia.

Miller will observe training and capacity building for Indonesian nationals to conduct scientific research, monitoring, conservation and management of Komodo dragon populations, their environment, and the plants and animals that live alongside the largest lizards on Earth. They will promote sustainable development and conservation awareness initiatives to local communities within and around the natural habitat of the dragons to help ensure this now endangered predator that has thrived for millions of years on the island will survive in the future.

Puerto Rican Lizards Adapt to a Variety of Climates



It only takes 2 ½ hours to drive across the main island of Puerto Rico, but despite its small size, Puerto Rico is home to a wide variety of climates. Dry scrub forests, high elevation forests and the only tropical rainforest in the U.S. all reside on one island. Lizards are one of the most abundant animals on the islands of Puerto Rico, with some lizards highly specialized to certain environments, and others that can be found in both the driest, hottest environments and mountainous, cool climates.

Matt McElroy, UW graduate student working with Dr. Adam Leaché, curator of herpetology and genetic resources, is studying lizards of the genus *Anolis* in Puerto Rico. Specifically, McElroy studies the relationship between phylogeography (the process of how today's individuals came to be geographically distributed) and thermal physiology (the study of how animals function in response to heat) in order to understand how species and populations adapt to different climates. He seeks to answer how and why speciation occured in the past, and what role thermal adaptation played in this process. He is also interested in how thermal adaptation influences population connectivity and gene flow in species whose distributions span thermal habitats.

By analyzing the lizards' DNA, McElroy recently found that one widespread Puerto Rican species, *Anolis cristatellus*, actually comprises multiple genetically distinct populations and that the population in Puerto Rico's scrub forest may be locally adapted to the dry and hot climate found there. In addition, genes flow from the southern hot shrublands to northern Puerto Rico's cooler mountains—but not from colder to warmer climates. This indicates that warm-adapted lizards may survive in cooler habitats, but warmer habitats are too stressful for cool-adapted lizards.

These findings provide insight into what can happen to lizards in Puerto Rico if temperatures rise. For the lizards that aren't adapted to handle warmer climates, even a few degrees of increased temperatures can impact their abilities to eat and digest food, move and mate. By understanding how lizards adapt to different temperatures, policymakers and scientists can predict how populations will respond to climate change and make efforts to preserve thermal habitats for generations to come.

Top photo: A male *Anolis krugi*, Mata de Plátano, Puerto Rico.
Inset photo: Matt McElroy and the research station dog, Bosque Guajataca, Puerto Rico.
Sidebar photos: (Top) BY AARON MENTELE. *(Bottom)* BY CATUR WIDODO.

ARACHNOLOGY

Burke Researchers Discover New Spider Habitat

On a sunny day in May 2008, Rod Crawford, curatorial associate of arachnids, and field volunteer Laurel Ramseyer went on a spider collecting field trip to Swauk Prairie outside of Cle Elum, Washington. It was a blustery day, which proved difficult for collecting spiders, with the wind blowing away anything loose and exposed.

Then Ramseyer saw a spider run into a large fallen pine cone, so she picked up the pine cone and started to whack it inside her net in an attempt to collect the spider. It worked! The two were in a ponderosa pine woodland with a lot of pine cones, so Ramseyer continued whacking more cones and added three good species to that site's spider list.

This small beginning led to a major endeavor, and Ramseyer began using this method at other sites. To-date, she has whacked nearly 7,000 pine cones inside a heavy-duty net held against her leg, looking for pine cone spider fauna. Ramseyer and Crawford collected 1,060 spiders from 4,600 eastern Washington pine cones between 2008 and 2013. Crawford identified the spiders and added them to the Burke's collection.

Ramseyer and Crawford have discovered an entirely new habitat for spiders. Prior to these collecting expeditions, no spider species were recorded as collected from pine cones. They found spiders use pine cones for a variety of reasons: some live in pine cones long-term, while others just use them to molt, lay eggs or to rest when not out hunting. Or they wander in at random, like the first one Ramseyer saw back at Swauk Prairie.

Prior to these collecting expeditions, no spider species were recorded as collected from pine cones.

The spider they most commonly found in Washington pine cones was *Euryopis formosa*. Sampling pine cones more than quadrupled the number of *E. formosa* specimens in the Burke spider collection—it was found at 47% of sampling sites.

Crawford and Ramseyer recently published the findings in "Western North American Naturalist," where their study was the first to describe the spider fauna of fallen pine cones. There are 89 species recorded in the published paper, including two species not previously found in Washington state.

Top photo: Euryopis formosa spider on a pine cone scale, Teanaway Campground, Kittitas County, Washington.

ROD CRAWFORD RECENTLY rediscovered a long-lost, unnamed species of harvestman (a group of arachnids that includes daddy longlegs). In 1932, John Schwartz collected an unidentified harvestman on the Olympic Peninsula's Satsop River. Unfortunately, the specimen was damaged during a 1973 shipment to a harvestmen specialist in California. From the fragments, the specialist was able to determine it was a new species, but couldn't publish a paper based on its condition. For 42 years, Crawford searched for additional specimens. In May 2015 during a collecting trip to the Olympic Peninsula's Deckerville Swamp, Crawford located two harvestmen that appear to match the species first discovered in 1932 while sifting through leaf litter. This exciting find will likely be confirmed with further study.

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HOLLY BARKER IS USING the power of social media to learn more about a turtle shell fan from the Marshall Islands. Donated by the estate of W. Jean O'Hearn Clayman and Charles O'Hearn, the fan was collected by the couple while they lived in the Kwajalein Atoll in the Marshall Islands from 1949–1950—right after World War II. On the fan is a name: "Neiroj L."

According to Marshallese community members who responded to Barker's Facebook post about the fan, most turtle shell fans from this time period came from the Likiep Atoll, where a woman named Neiroj lived. We hope to learn more by sharing in this newsletter!

Achieving Matai (Chief) Status

UW undergraduate student Cory Fuavai sits in the Burke collections next to beautiful fala mats from Samoa. He is studying these mats as part of an independent study course with Dr. Holly Barker, curator for Oceanic and Asian culture. Made from Pandanus tree leaves, fala mats range in size from a few feet to mats that cover the floor of an entire house. "During my childhood, we used to sit and watch my Grandma, my mom and all the ladies in our family prepare these mats," Fuavi said. "This is what we put down as decorations for our houses because a lot of Polynesians cannot afford to buy the rugs that we have in America. We are using what God has given us in land and nature. Making falas is one of the ways we stay connected with our roots, our ground, where we come from."

"We are using what God has given us in land and nature. Making falas is one of the ways we stay connected with our roots, our ground, where we come from."

Fuavai is researching Samoan objects from the Burke's collection not only for his coursework, but also to advance his goal to become a matai—a high chief in Samoan culture. Matais have the important role of communicating on behalf of their families to the greater community. At funerals, weddings and other big gatherings, matais perform ceremonies and speak the matai language.

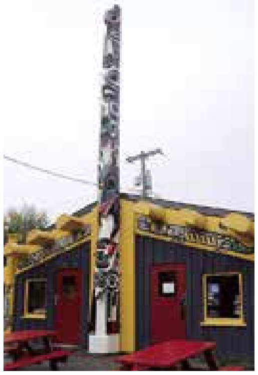
In addition to fala mats, Fuavai is researching kava bowls, toto'os (orators' whisks) and other objects, collecting information from reference publications and interviewing his grandparents and other community members.

Sharing his knowledge of Samoan culture and matai language is another important step in becoming a matai. The Burke offers Fuavai opportunities to demonstrate this knowledge because it is a museum and community resource. Fuavai leads tours for visitors interested in Samoan culture, and is also visiting schools to help students learn about his culture before they travel to Samoa. In addition, he co-curated a display on the importance of tattoos in Samoan culture as part of the Burke's recent exhibit *Imagine That: Surprising Stories and Amazing Objects from the Burke Museum*.

Top photo: Fuavai's tattoos are inspired by the weaving patterns of fala mats, like this one from the Burke's collection.

NATIVE AMERICAN ART

Solving the Mysteries of Ballard's Red Mill Totem House



The Red Mill Totem House in Seattle's Ballard neighborhood is a landmark beloved by locals and tourists. Despite its popularity and well-known history, the identity of the carvers who made the frontal pole and corner posts has been misrepresented for years. Dr. Robin K. Wright, curator of Native American art, is now able to correct the record.

Totem poles were originally created by British Columbian and Alaskan indigenous communities, and were not historically a part of Washington's Native American art traditions. During the 1890's gold rush, the Seattle Chamber of Commerce stole a totem pole from the Tlingit village of Tongass to position the city of Seattle as the gateway to Alaska. The iconic artwork continues to symbolize the city, with buildings like the Totem House adorned with this Northern-style art.

Built in 1939, the Totem House was originally the Northwesters' Arts and Crafts Shop. Subsequent owners of the shop said the frontal pole was carved by Jimmy John, a well-known Nuu-chah-nulth carver from the west coast of Vancouver Island. This seemed curious to Bill Holm, curator emeritus of Northwest Coast art, and Wright, since the frontal pole is Haida in style. Unlike the frontal pole, the two watchmen figures that were originally placed on the corner posts (now displayed inside the restaurant) are carved in the Nuu-chah-nulth style, characterized by the figures' stepped flat oval facial planes, brows stepped up from flat cheek planes and eyes flat on the cheek planes. Haida facial structure typically has rounded eye orbs and carved ovoid-shaped eye sockets, so Wright determined that only the corner posts' figures were likely carved by Jimmy John.

Holm determined that the Haida-style frontal pole is very similar to an argillite model pole in a local private collection, which was possibly for sale in the shop at the time the frontal pole was carved. Wright has now identified Zacherias Nicholas as the likely Haida artist who carved the model pole. A 1939 newspaper article stated the Totem House's main pole was carved by J. Houston and Leonard Porter, two non-native employees of the shop. Wright suspects they copied the model pole made by Nicholas.

Attribution of Northwest Coast art is not always easy; as information is unearthed, opinions change. We may learn more about the creation of these carvings in the future!

Top photo: The Totem House's frontal pole *(left)* is Haida-style; the watchmen figures are Nuu-chah-nulth in origin.
Inset photo: The Red Mill Totem House in Seattle's Ballard neighborhood.

PAT COURTNEY GOLD, A member of the Wasco tribe, is an accomplished basket weaver and researcher who helped revive the art of making Wasco Sally bags—cylindrical baskets made by Columbia River tribes. Gold researched the Burke's collection of Sally bags, and recently held workshops for Native artists with Patricia Whitefoot of the Yakama Nation at the museum. The workshops included how to harvest materials, weave baskets and how to teach these skills to future generations in order to sustain traditions and foster skills among Native youth. One of Gold's baskets is on display in the Burke's *Here & Now: Native Artists Inspired* exhibit until July 27, 2015.

Burke Museum
UNIVERSITY of WASHINGTON

VOLUME NO. 2 **JUNE 2015 ISSUE**

Stitching Together Lost Techniques for New Boats

Before the days of raingear and Gor-Tex, the Native peoples in Alaska, like the Sugpiat/Alutiiq people from Kodiak Island, used natural materials to keep themselves dry. Intestine scraped, cleaned and dried from animals like the Kodiak Brown Bear was used as waterproof material for jackets, raincoats, bags and hats, and as coverings for model boats. Over the years, this skillset has been nearly forgotten. Dr. Sven Haakanson, curator of Native American anthropology, is referencing Burke collections to reverse-engineer how this material was made and used in the past so it can be used again in the present. He's learning techniques of bear gut waterproof stitching and cultural designs to share this knowledge with his community.

Specifically, Haakanson is examining kayaks, boats, bags and parkas from the Burke's collection. He also recently processed intestine taken from a Kodiak Brown Bear that was legally hunted on Kodiak Island—which has a thriving bear population. Over the last century, bear intestine and its meat have not been processed by outside hunters; it is discarded. Local bear guide Paul Chervenak brought the meat and intestine to Haakanson to teach these traditional practices for making raingear and bags. The combination of referencing museum collections and reengineering traditional techniques has allowed Haakanson to create new pieces. UW students and Burke visitors helped with the project, which provided a hands-on teaching opportunity for everyone to learn how traditional tools and materials are applied to today's cultural practices.

By relearning how bear gut is used, Haakanson and Alutiiq community members are able to stitch together covers that wrap the frames of traditional model boats and make bags. These model boats are practice for creating a full-size, working Angyaaq, a traditional Alutiiq open boat that carried large groups of people and goods. These boats were seized by Russian settlers in the early 1800s, eventually leading to the loss of this practice entirely on Kodiak and the surrounding regions.

Referencing historic models from the Burke collection helped Haakanson and community members create both models and full-size Angyaat on Kodiak. The first new Angyaaq on Kodiak Island since the 1850s was built this year by local community members.

Top photo: Haakanson analyzed this children's jacket from the Burke's collection to reengineer stitching techniques.
Inset photo: Haakanson works with youth to process salvaged bear gut.

IN ADDITION TO RESEARCHING bear gut materials, Sven Haakanson is analyzing the frames and coverings of full-scale and model boats in the Burke's collections. This spring, Haakanson and UW undergraduate students will create drawings and images for building a traditional Angyaaq. The team will start by building one here at the Burke Museum to learn the techniques involved in the construction of the boat. Haakanson will then go with a student to Kodiak Island, where they will work with the community of Akhiok to help them build their own boat over the next year.

As resources like timber become scarcer on Alaska's shorelines, it becomes more important to understand how traditional boats like the Angyaat were made. These boats are lightweight and don't require full-size trees; they can be made fairly quickly using salvaged timber. Revitalizing traditional boats restores knowledge, carries on cultural traditions and provides solutions to contemporary problems.

Plants and Traditional Coast Salish Diets

Plants were an integral part of the Coast Salish diets prior to Euro-American colonization. They provided fiber and crucial micronutrients not available through the consumption of animal foods, particularly for children and pregnant and nursing women. In addition to their dietary importance, plants played central roles in the social systems of Northwest Coast peoples, from the marking of seasons to the organization of labor, and the maintenance of relationships to ensure access to important foods. The harvest and stewardship of plant resources fell primarily to Northwest Coast women, so the study of people-plant relationships is also the study of women's contributions to social well-being.

Joyce LeCompte, a UW graduate student, used the Burke Museum's archaeology collection to update the Burke's Puget Sound Traditional Foods Database. Specifically, LeCompte analyzed ethnographic and ethnohistorical records along with archaeobotanical reports from 18 archaeological sites in Western Washington's Duwamish-Green-White River Watershed. LeCompte's study adds 12 new edible plants to the original database, including several carbohydrate-rich root foods identified in sites on the Enumclaw Plateau and in the Cascade Mountains.

LeCompte also found foods like processed camas and hazelnut in archaeological sites at higher elevations than they're known to grow, and charcoal in prairie sites where key root foods were found. These findings suggest that Coast Salish peoples were trading and/or transporting a variety of foods, and also intentionally altering the landscape to cultivate specific foods. LeCompte theorizes that the higher proportion of root foods and greater evidence for resource cultivation at inland sites are related phenomena. Roots may have played a more important role in villages farther from the saltwater due to the lower fat content of animal foods (particularly salmon) farther inland. Farther north in the region, the ethnographic record suggests that these root gardens were maintained by women and accessed through matrilineal lines.

Plant materials have received inadequate attention in archaeological studies on the Northwest Coast based on assumptions in the archaeological community about the relative unimportance of plant foods in relation to marine resources—particularly salmon. This project is the first to synthesize the archaeobotany of this portion of the Puget Sound region, and helps tell the story of Native women's contributions to the well-being of their communities. Today, these plants are integral to traditional foods revitalization, food sovereignty and ecological restoration efforts of Coast Salish communities.

Top photo: Evidence of camas plants was found in sites at higher elevations than they are known to grow.
BY U.S. FOREST SERVICE NORTHERN REGION.

ARCHAEOLOGY

THE OLDEST STONE TOOLS in western Washington were recently discovered in an archaeological site along Bear Creek in Redmond. Led by Dr. Robert Kopperl, affiliate curator of archaeology, the excavation yielded thousands of artifacts: cutting tools, hammerstones, stone flakes and several projectile points with styles that are new for this region and time period. The artifacts are around 10,000–12,500 years old, and represent life in the Puget Sound during the transition out of the last ice age.

To narrow the dates of the stone tools, Jack Johnson, archaeology curation services manager, is using luminescence dating to measure the ages of sediment layers at Bear Creek. This technique measures electrons trapped in tiny mineral crystals found in sediments, soils and artifacts. Electrons slowly accumulate in these crystals, and when stimulated with a laser, they emit a tiny burst of light that can be used to calculate age. The UW Luminescence Lab is a world leader in dating archaeological materials.

DISCOVER...

THE MYSTERY OF HUMMINGBIRD MIGRATION, WHO SURVIVED THE LARGEST EXTINCTION ON EARTH, THE IDENTITIES OF THE RED MILL TOTEM HOUSE CARVERS, A NEW SPIDER HABITAT, THE ELUSIVE JELLYNOSE, HOW TO BECOME A CHIEF.

Burke
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VOLUME NO. 2 **JUNE 2015 ISSUE**

Burke Museum Research Newsletter

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