The Field Museum

Collections and Research Scholarship Committee

2012 Summer Interns

Founded on collections originally assembled for the World's Columbian Exposition of 1893, The Field Museum now houses 24 million anthropological, botanical, geological and zoological specimens and objects from around the world. These collections - from narwhal horns to treeferns, fish fossils, and Chinese rubbings - help us understand and conserve the world's biological and cultural diversity. The Museum's research, collection, and conservation areas are home to dozens of scientists and students studying, managing, and telling the world about this incredible library of diversity.

The Field Museum recognizes the need to support basic research on its collections by interested students. To this end, the Field Museum's Scholarship Committee, directed by Dr. Petra Sierwald (Scholarship Committee Chair, Zoology, Insects) and coordinated by Stephanie Ware (Scholarship Committee Secretary, Zoology, Insects), supports summer internships for undergraduate students to work directly with scientists at The Field Museum for research and training in our scientific collections and state-of-the-art laboratories.

About the REU (Research Experiences for Undergraduates) Program

In 2012, the Field Museum REU program trained a cohort of eight students in biodiversity-related research in a 10-week summer program. Each participant undertook an independent research project supervised by a museum scientist in a discipline such as taxonomy and systematics, phylo/biogeography, paleontology, molecular phylogenetics, or conservation. Students experienced biological diversity through the use of the museum's collections in their research, and were trained in project-relevant techniques and equipment such as the scanning electron microscope, various light microscopy set-ups, and equipment in the Pritzker DNA lab. A six-week course in phylogenetic systematics ran concurrently with intern projects and provided a common theoretical framework for their research. REU students received an introduction to the Encyclopedia of Life in Field Museum's Biodiversity Synthesis Center. At the conclusion of the summer, students presented their research results to their peers and museum scientists at the Undergraduate Research Symposium.

The current REU program is funded through an REU-Site grant of the National Science Foundation, DBI 11-56594 (PIs Petra Sierwald in Zoology and Kenneth Angielczyk in Geology). The 2009- 2011 REU program was funded through an REU-Site grant of the National Science Foundation DBI: 08-49958 (PIs Petra Sierwald in Zoology and Peter Makovicky in Geology).

About the High School and Undergraduate Intern Program

In 2012, eleven full-time paid summer internships were available to nine eligible junior or senior high school students and two eligible undergraduate students. Interns had the option of working in one of the following four research departments of the Field Museum: Anthropology, Botany, Geology, and Zoology. Each project focused on collections. Each intern worked with dedicated collection staff members, graduate students and other undergraduate interns. Interns received training in modern collection management, including computer training, and learned about the various applications of collections-based research. Interns sorted, identified, and databased collection specimens and integrated specimens into the collections. After hours, interns had the opportunity to attend a college level course in biological systematics, and present their work at the Undergraduate Research Symposium on August 11, 2012.

The high school and undergraduate intern program is generously supported by the Prince Charitable Trust and the Wood Internship Fund.

Special Thanks

A *very* special thank you must be extended to the C&R curatorial and collections staff who participated as advisors and mentors in the internship programs. The interns received an immense amount of time, care, knowledge and dedication from these C&R staff members and they are to be commended. Thank you also to Scholarship Committee members Philipp Heck (Geology), Robert Lücking (Botany), Bruce Patterson (Zoology, Mammals) and John Terrell (Anthropology).

2012 REU Intern: Anthony Deczynski

Entomology / Wildlife Conservation double major at University of Delaware (Junior)

“Ever since I was a child I have loved nature and enjoyed exploring it during my free time. As I grew older my interests focused and I became interested primarily in insect systematics, particularly of Leaf Beetles. I have kept insects as pets since I was young including a colony of Madagascar Hissing Cockroaches which I have kept since first grade in addition to a pinned collection of insects which I have been curating since I was thirteen. I was born and raised in New Jersey and I am currently attending the University of Delaware for my undergraduate degree in Entomology and Wildlife Conservation.”

“I plan to continue my education in order to receive a PhD in Entomology. I am interested in a career doing academic research on beetle systematics either as a museum curator or college professor.”

“My project as an FMNH intern focused largely on insect taxonomy, studying and describing a new genus of rove beetle from Tasmania. While we initially thought the genus would consist of a single undescribed species we found within the first week that it was actually two separate undescribed species. In addition to taxonomic work the genus was coded into a phylogenetic analysis of related rove beetles to find where it fits in the evolutionary tree.”

“While this internship has not changed my career plans it has strengthened me on my path towards reaching my goals. Through the program I have gained the experience of actually writing entomological species descriptions and many of the methods used to find diagnostic characters as well as how to construct and analyze phylogenetic trees. These are techniques I will likely use for the rest of my career and by gaining this knowledge I have taken a significant leap forward towards becoming an independent researcher.”

Project Advisor: Dr. Margaret Thayer (Associate Curator of Insects, Zoology)

Project Title: Bringing new beetles to light

Project Description: The beetle family Staphylinidae – the rove beetles – is the largest beetle family in the world, with over 57,000 species and nearly 3,600 genera already described. Several hundred new species and at least two dozen new genera are described every year, the largest proportion of them from Asia. The faunas of Australia, New Zealand, and southern South America also include many new genera awaiting naming and description but have received less attention. This relative lack of attention means that even identifying specimens belonging to described genera is difficult, because there are no comprehensive identification guides. International collaborative work is just beginning on two guides to beetle genera, one focused on Australia and one on southern South America, similar to the two-volume work American Beetles published in 2000 and 2002. Margaret Thayer is a coordinator of the rove beetle chapters of both guides, and hopes to describe the 20 currently known new genera from those areas so they can be included in these guides. The guides will promote more detailed work on those faunas by any researchers, including describing additional species, synthesizing information on all the species, and analyzing their distributions and evolution.

This REU project involved primarily describing one of the new genera (and, if necessary, new species) belonging to the subfamily Omaliinae, based on existing museum specimens from the collections of The Field Museum and others. The intern also helped with some aspects of work on other genera. Research work included training in the beetle family Staphylinidae – the rove beetles - skeletal morphology; dissecting, microscopy, and imaging techniques (including some SEM – scanning electron microscopy); databasing and georeferencing specimen collecting records; and using the georeferenced records to map the known distribution of one or more species. The intern worked with the sponsoring curator on writing, for publication, a modern description of the genus with illustrations (drawings, digital macro- and microphotos, SEM) and comparisons to other genera of Omaliinae. This project provided experience with museum collections, entomological study techniques, and scientific literature on rove beetles. It also involved developing and testing identification keys. Although not directly involving the genus being studied, some local fieldwork enabled the intern to see other rove beetles in the field.

Symposium Presentation Title: **Wingless in Tasmania: A New Genus of Flightless Rove Beetle from Tasmania (Coleoptera: Staphylinidae: Omaliinae)**

Symposium Presentation Abstract: The family Staphylinidae – the rove beetles – is the largest family of beetles in the world and also one of the least understood. There are currently over 57,000 described species in over 3,600 genera and more are still being discovered at a rapid rate. In this project we describe a new flightless staphylinid genus from Tasmania belonging to the tribe Omaliini of the subfamily Omaliinae, extending knowledge of the highly endemic Australian fauna. We studied the beetles whole as dry specimens and in alcohol as well as cleared and dissected in permanent or temporary microscope slides. Scanning electron microscopy (SEM) allowed us to examine and image selected characters not clearly visible with optical microscopy. Using these sources of data we prepared descriptions and images of the beetles including species-specific genitalic structures and compiled all known distributional and ecological data. We added the genus into an ongoing phylogenetic analysis of World Omaliini by the second author to infer its phylogenetic placement. While we initially believed that this genus consisted of a single undescribed species from Tasmania we discovered that there are actually two species inhabiting different areas of that island. Several other genera of Omaliini have austral disjunct distributions that probably reflect an ancient origin on Gondwana. Our new genus needs to be compared carefully with several undescribed species of wingless Omaliinae known from southern New Zealand to assess whether they are all phylogenetically close – representing another disjunct genus – or convergently wingless.

2012 REU Intern: Franco Gallastegui

Biology and Geophysical Sciences major at the University of Chicago (Junior)

“My ultimate academic goal is to pursue a career in Paleontological research. I have been absorbed in both history and animal life from a young age and am pleased to see that these interests have matured into something more tangible over the past few years. I find Evolutionary Biology to be not only a fascinating scientific field, but also a subject matter that contributes deeply to my worldview. The opportunity to be involved in a variety of research projects, together with the classes I have taken and the scientists I have spoken to, have fostered, in me, a poignant and active appreciation of the natural world, a passion for discovering its history and diversity, and an ambition towards understanding the contextual implications it has on my life.”

“I feel that the Field Museum, in particular, is an incredible resource for any aspiring researcher and an exemplary element of Chicago community life. By bringing the scientific community closer to the general public, the FMNH represents the microcosm of what I would like to accomplish not only as a scientist, but also as a member of society, namely, making critical thinking and respect for the world we inhabit fundamental elements of our future paradigm. Ultimately, I think the evolutionary biology has the valuable potential of inciting the curiosity of any individual, and as a rising paleontologist and educator, I hope to be able to cultivate and share my interests in a meaningful way, by encouraging others to have a more conscious and responsible attitude towards the world, and by developing a sense of discipline and humility in my professional and personal life.”

Project Advisor: Dr. Peter Makovicky (Associate Curator of Paleontology, Geology)

Project Title: Using systematic traits of teeth to test trophic niche evolution in theropod dinosaurs

Project Description: Tyrannosaurid dinosaurs were dominant predators reaching extraordinary body sizes, but they definitively only occupied this niche for the last two geological stages (83-65 MYA) of the Mesozoic. It has recently been hypothesized that another theropod clade, the allosauroids, competitively excluded tyrannosauroids from the top predator niches for most of the Jurassic and Cretaceous. The theropod fossil record is relatively poor, however, and support for this hypothesis relies on the temporal and geographic distribution of a handful of body fossils. Theropod teeth are relatively abundant, however, as they were replaced throughout life, and therefore offer a richer source of data with which to test this hypothesis. The museum has collections of theropod teeth from three American Cretaceous formations ranging from >112 to 98 million years ago.

Using the museum's SEM, the REU intern analyzed microstructural characters of the enamel of select teeth from each formation, along with gross morphological characters for a wider sample, and used these traits to assign the teeth to different theropod clades based on synapomorphies. The size distributions of teeth referable to allosauroids and tyrannosauroids were compared to determine whether they supported the competitive exclusion hypothesis. Statistical approaches to determining minimum numbers of individuals and to account for sampling of juveniles were applied to determine the robustness of the comparisons between clades.

Symposium Presentation Title: **Using Systematic Traits of Teeth to Test Trophic Niche Evolution in Theropod Dinosaurs**

Symposium Presentation Abstract: Tyrannosaurids are the subclade of coelurosaurian dinosaurs that include T. rex and its closest relatives. While notorious for achieving colossal body sizes, tyrannosaurids evolved from small- bodied Asian precursors and did not become a dominant predator until the latest stages of the Mesozoic (Campanian and Maastrichtian). Based on observations from the Asian record, it has been suggested that allosauroids competitively excluded tyrannosauroids from the top-predator niches in North America during most of Cretaceous. Support for this hypothesis, however, consists of a small number of temporally and geographically disparate body fossils. Theropod teeth, because they are abundant across several well-correlated sections in NA, provide a richer source of data for which to test this hypothesis. In addition, studies have established that the 3D arrangement of enamel crystallites (the schmelzmuster) is a character that exhibits a strong phylogenetic signal in theropods, which allows for isolated teeth to be taxonomically diagnosed with family and even genus-level precision. In this study, I measured variables pertaining to size, shape, and serration density for a number of tooth samples from three Lower Cretaceous formations in western NA. In addition, I coded the teeth for several morphological characters used in a previous analysis of theropod phylogeny. Since enamel visualization requires destructive sampling, representatives were chosen from clusters based on morphological similarity as well as on rough taxonomic affinity. Teeth were sectioned in longitudinal and transverse planes and their enamel examined using scanning electron microscopy. Together, the microstructural and gross morphological characters will be used to assign teeth to different theropod groups. The size distribution of teeth referable to allosauroids and tyrannosauroids will be compared to determine whether they support the competitive exclusion hypothesis.

2012 REU Intern: Jennie Lee

Biology major at the University of Chicago (Junior)

“I am a native of Georgia, born and raised in the Atlanta area, and rarely ventured outside the southeastern U.S. until I decided to go to school in a real city. I study biology at the University of Chicago, with a particular interest in evolutionary biology.”

“When I’m not sleeping, studying, or carrying out other tasks upon which my life depends, I enjoy watching and reading about movies, listening to music, and making animated GIFs at the amateur level.”

“I remain undecided as to whether I want to continue on to academia and research, but do know that public perception and understanding of science is important to me. Improving scientific literacy in young students (future voters) is particularly important, so teaching is also something I am considering.”

“My experience at the Museum has been wonderful. I have wanted to work here for a long time, so it's been thrilling to be one of the people behind the curtain. I’ve lost track of all the interesting people I’ve met, whether they be visitors, volunteers, staff members, or students like me.”

“In addition to gaining research experience, I’ve found that museums are an effective (and fun) interface between science and the public. In the future I hope to spend more time working at museums like the Field.”

Project Advisors: Dr. John Bates (Associate Curator of Birds, Zoology), Dr. Jason Weckstein (Staff Scientist)

Project Title: Amazonian speciation in a ring: Phylogeographic history of the Channel-billed and White-throated toucans

Project Description: Toucans are among the most prominent symbols of New World tropical forests and have attracted the attention of biologists for centuries. They are particularly well known for their gaudy plumage coloration patterns and large bills. Several conspicuous characteristics make the Amazonian *Ramphastos* toucan species particularly interesting. First, at all localities in Amazonia two species of *Ramphastos* are found, and one is from the smaller-bodied Channel-billed Toucan complex (*Ramphastos vitellinus*) and the other is from the larger bodied White-throated Toucan complex (*Ramphastos tucanus*). Second, each of these toucan species complexes include multiple morphologically differentiated subspecies and these subspecies hybridize producing populations with novel or intermediate coloration patterns. We are using DNA sequence data (both mitochondrial and nuclear DNA) to study patterns of introgression (movement of different classes of genes between these differentiated populations) across these two overlapping hybrid zones to understand whether both species complexes show similar patterns of gene flow and hybridization. The central question of this work is whether similar evolutionary events have affected patterns of hybridization and introgression in these two co-distributed toucan species. We will use specimens collected from toucan populations across the Amazon and standard laboratory techniques to collect DNA sequence data for this study.

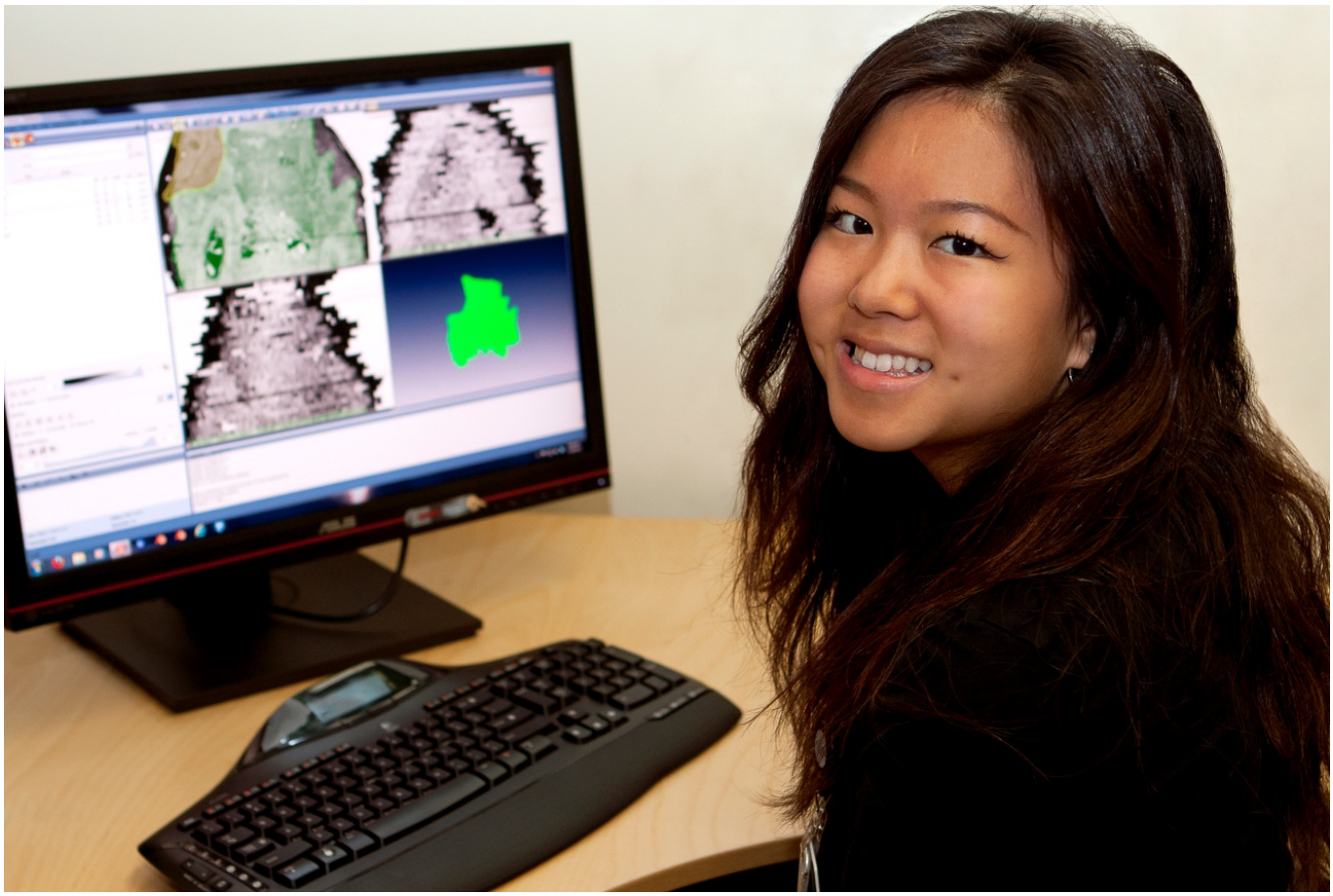
The REU intern on this project received training in DNA extraction, PCR, and sequencing in the Museum's core genetics facility, the Pritzker Laboratory and the DNA Discovery Center and also learned to analyze DNA sequence data including phylogeographic and population genetic analytical methods.

Symposium Presentation Title: **Amazonian Speciation in a Ring: Phylogeographic History of the Channel-billed and White-throated Toucans**

Symposium Presentation Abstract: Toucans are among the most prominent symbols of New World tropical forests and have attracted the attention of biologists for centuries, notably for their gaudy plumage coloration patterns and large bills. The Amazonian *Ramphastos* toucan species are a particularly interesting system for several reasons. First, throughout Amazonia two species of *Ramphastos*, one in the smaller-bodied Channel-billed Toucan complex (*Ramphastos vitellinus*) and the other in the larger-bodied White-throated Toucan complex (*Ramphastos tucanus*), overlap in geographic range. Second, each of these toucan species complexes includes multiple morphologically differentiated subspecies, and these subspecies hybridize to produce populations bearing intermediate or novel coloration patterns. This study focuses on uncovering the patterns of introgression (movement of different classes of genes between these differentiated populations) across these two overlapping hybrid zones. Using standard laboratory techniques and tissue samples from specimens obtained from toucan populations across the Amazon, I collected sequence data from two mitochondrial loci, cytochrome-*b* (cyt-b) and cytochrome oxidase I (COI) to reconstruct patterns of phylogeographic history. Phylogeographic analyses were performed on the resulting nucleotide alignments with the goal of comparing and contrasting patterns of hybridization and introgression in these two co-distributed toucan species. Future work in this system will include nuclear loci to form a more complete picture of gene flow and hybridization in these species complexes across evolutionary time.

2012 REU Intern: Florence Lin

Anthropology major at University of Illinois at Urbana-Champaign (Freshman)



"My parents named me Florence after the Renaissance city, not Florence Nightingale, Henderson, or even Flo from *Finding Nemo*. I currently reside in suburban Chicago with my mom, dad, brother, and cat. I am interested in the interdisciplinary fields of anthropology—biological, cultural, archaeological, linguistic—and how they apply to humanities and medicine. In my spare time, I enjoy practicing yoga, visiting art museums, trying new recipes, and watching a good film."

"In the future, I hope to have a career in the field of medicine. Currently, I am considering the field of oncology and the potential it holds for upcoming generations. Although my interest may fluctuate in the years to come, one thing I would love to do is travel! Either for humanities/medicine research or conferences, it's something I would like to incorporate into my career."

"My experience as a Field Museum intern has left me wondering 'where did the time go?' I have always enjoyed visiting museums in my free time so it was truly an honor to have been able to work for one of the most renowned museums. The most eye-opening thing was being able to see the behind-the-scenes workings of so many great minds and even more, to have been able to work alongside them. The Field treats their interns so well and the REU program really made my time memorable!"

"My internship this summer has given me invaluable insight into the vast number of directions I can go in the future. After seeing the Field's scientific researchers and their specializations, it has really shown me you can study anything from ancient synapsids to bats to lichens. My research this summer has strengthened my knowledge on integrative biology, evolution, and technological research—all which will allow me to approach the multi-faceted field of medicine with different perspectives and an open mind."

Project Advisor: Dr. Kenneth D. Angielczyk (Assistant Curator of Paleomammalogy, Geology)

Project Title: Who is Anomodont A? Archiving and Reconstructing Serially-sectioned Dicynodont Skulls

Project Description: Anomodonts are an extinct group of ancient mammal-relatives (nonmammalian synapsids), and during the Permian and Triassic periods of Earth history, they were the most diverse and abundant tetrapod herbivores. In 1944, the paleontologist Everett Olson published a long paper describing the braincase morphology of several nonmammalian synapsid specimens, including anomodonts, in the Field Museum's paleontology collections. To carry out this work, Olson serially-sectioned the specimens, essentially cutting them into thin slices and then studying the arrangement of the bones exposed in the successive cross-sections. Unfortunately, Olson did not provide detailed identifications for the specimens he sectioned, making it hard to use his data in further comparative studies. Of particular interest is a specimen he identified only as "Anomodont A," which may be a rare specimen of a non-dicynodont anomodont. The sections that Olson made are still housed in the Geology Department's collections.

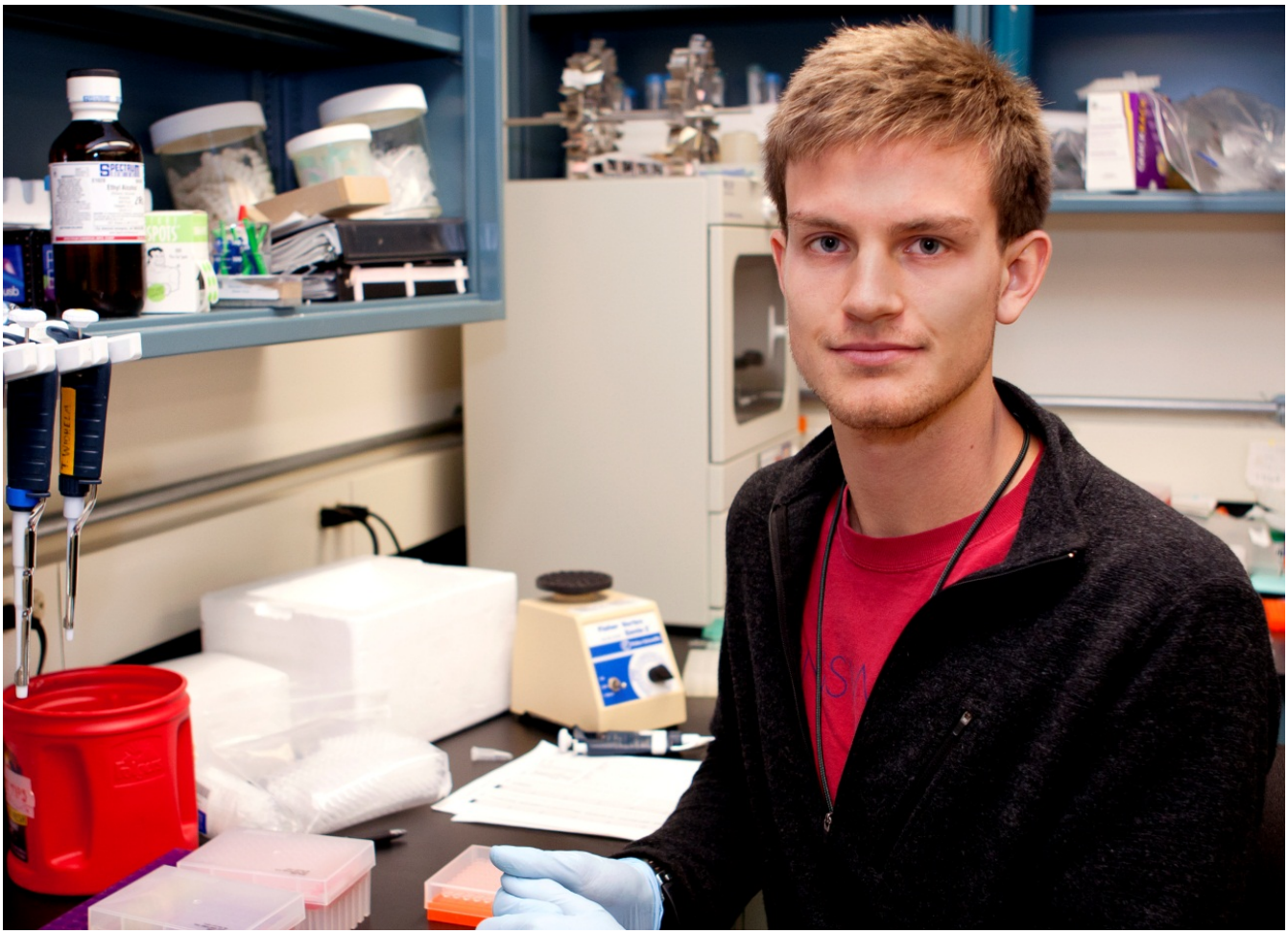
In this project we first scanned the sections that Olson made, and then made virtual 3D reconstructions of the specimens using software designed for processing CT scan data. Once the reconstructions were available, it was possible to identify the specimens more precisely, making the specimens much more valuable for research on synapsid braincase evolution.

Symposium Presentation Title: **Who is Anomodont A? Archiving and Reconstructing Serially-sectioned Dicynodont Skulls**

Symposium Presentation Abstract: Anomodontia is the most successful group of extinct therapsids, surviving the Earth's largest mass extinction and occurring on every continent from the middle Permian through the late Triassic. In 1944, Everett Olson serially-sectioned several therapsid specimens and then created nitrocellulose peels from the specimens. Among the remaining peels were those from various specimens of anomodontia, cynodontia, and therocephalia. Due to the fragility of the peels, we wanted to digitally archive them to improve accessibility for researchers. Of particular interest was the specimen that Olson designated Anomodont A, which possessed an elongated snout and anteriorly-positioned canines, similar to those seen in basal anomodonts. Because basal anomodonts are rare and poorly known, it would be of great interest if we could confirm such an identity for Anomodont A. We scanned the individual peels and then stacked the slices in Amira to create a 3-D reconstruction. We labeled prominent morphological features such as the canines, external nares, and postcanine teeth, and used these characteristics in comparisons with 23 species of basal anomodonts and dicynodonts from the middle Permian. Our 3-D reconstruction of Anomodont A revealed the presence of a secondary palate and tusk. Furthermore, it possessed a shorter, very dicynodont-like snout and no premaxillary teeth, making it highly unlikely for Anomodont A to have been a basal anomodont. Instead, it shared a considerable number of similarities with basal dicynodonts such as *Brachyprosopus*, *Chelydontops*, and *Pristerodon*. The resemblance between Anomodont A and basal dicynodonts indicates that Olson's depiction is inaccurate. Correctly identifying and archiving Olson's specimens is important because it allows researchers to more accurately apply Olson's data on braincase morphology to modern phylogenetic and evolutionary questions.

2012 REU Intern: Bradley Loomis

Biology major at Green Mountain College (Sophomore)



“I was brought up in a small college town in Maine where I was able to spend a lot of time in the woods and on the water. This exposure to the great outdoors, combined with my innate desire to understand how things work, made me want to study biology. I’ve always been fascinated by the myriad ways that organisms take advantage of what is available to them to make energy to reproduce.”

“In the future I would like to become involved with biotechnology—possibly in the production of genetically modified food organisms. A world where, for example, novel fruits and vegetables that are both appealing to the senses as well as nutritious are patented and marketed in a manner analogous to candy would be one that I would like to help bring about. Let’s bring brand loyalty to the produce aisle!”

“Before my first day in the lab, I was a little worried about how friendly and patient the staff would be with the interns. I was envisioning very frazzled-looking academics who would reluctantly field my barrages of questions and then leave me to panic in the corner. Thankfully, I was wrong. Everyone I have interacted with this summer was extremely personable and happy to help. Because of this welcoming environment, I was able to learn useful laboratory techniques with negligible pain and suffering.”

“As I am currently interested in working with plant genes in the future, I am happy to have gotten the opportunity to work in the botany department at the Field Museum. I learned and became comfortable with carrying out very important and commonly used laboratory techniques that will be invaluable in my future endeavors.”

Project Advisor: Dr. Thorsten Lumbsch (Botany Chair and Associate Curator)

Project Title: Understanding morphological evolution in lichens

Project Description: Lichen-forming fungi are unique among the fungal kingdom since these organisms form specific vegetative thalli to host their photosynthetic symbiotic partner (wither algae or cyanobacteria) that provide energy for the symbiotic system. These thalli have certain morphologies and include adaptations, such as a cortex covering the algal layer to protect them from UV radiations. Other adaptations include crystals in the algal layer to increase the light intensity for species growing in shady habitats in tropical rainforests. Currently, our knowledge about the evolution of these adaptations is very poor.

In a project focusing on the tropical lichen family Graphidaceae, this project addressed the origin of morphological adaptations in a phylogenetic context. DNA sequence data was used to address these issues. The lichens selected for this group belonged to the so-called Topeliopsis clade within the family Graphidaceae (Ostropales). The REU intern received training in molecular and organismal research methods. He learned how important a combination of both methods is for an understanding of the evolution of the diversity of life. The training included introduction to the literature and handling of herbarium specimens. Chemical examination included chromatographic methods, such as HPTLC and HPLC. Molecular methods included DNA isolation, PCR and subsequent direct sequencing of certain gene regions. Subsequently, the analysis of DNA sequence data was performed.

Symposium Presentation Title: **Species Delimitation and Evolution in the Foliose Lichen Genus *Montanelia***

Symposium Presentation Abstract: Species circumscriptions in lichenized fungi that focus primarily or entirely on morphology often have aggregated many genetically distinct species into single taxa. Results from recent molecular studies have shown the potential for morphologically cryptic species-level diversity within some groups that are considered virtually indistinguishable based on morphological characters. To better understand diversification within the foliose brown parmelioid lichens (family Parmeliaceae), sequence data from six genetic markers from 46 specimens representing the newly described genus *Montanelia* were analyzed within a phylogenetic context. The species of *Montanelia* occur on siliceous rocks in arctic-alpine habitats of the northern Hemisphere. The results from this research suggest that multiple traditionally circumscribed *Montanelia* species include previously unrecognized species-level diversity. Within the four traditionally circumscribed species investigated here, a total of nine candidate species were recognized. The results of this preliminary data show the limitations of using morphology to circumscribe species in *Montanelia*. Future studies investigating character evolution and the role of biogeography in the brown parmelioids will be essential to better understand biogeography and factors driving diversification in these commonly occurring lichens.

2012 REU Intern: Daniel Montgomery

Biology major at Indiana State University (Sophomore)

“I worked in an angiogenesis lab my freshman and sophomore year at Indiana State University. During a Field Museum Members’ Night, I asked a few people if I could volunteer at the museum. I ran into Dr. Bates who said he could use an extra set of hands. I helped Dr. Bates and Josh Engel during the summer of 2011 and came back again this year as an REU.”

“I hope to go into forensics specializing in DNA. I may go into medical research but at this point, all I really know is I’m going into a lab somewhere.”

“I’ve learned so much while an intern at the Field Museum. I’ve learned so much about phylogenetics, DNA analysis, and also about other departments in the Field Museum.”

“It blows you away when you discover how many people and how much work goes into one project, and this is just one project out of dozens in the lab, and probably hundreds in the Field Museum.”

“I think my internship has had an impact on my future career goals. I spent most of my time at the Field in the lab working on DNA. That’s exactly what I’ll be working with in forensics and if I’m going into medical research then I’ll have plenty of lab experience to help me out.”

Project Advisors: Dr. John Bates (Associate Curator of Birds, Zoology), Josh Engel (Research Assistant)

Project Title: Genetic structure of birds in the Albertine Rift of Africa and implications for conservation and climate change

Project Description: The Albertine Rift, a long chain of highlands that runs through the eastern Democratic Republic of Congo, and western Uganda, Rwanda and Burundi, is considered to be one of the most critical biodiversity hotspots in Africa. Using samples that have been collected through long-term field work in the region, we are gathering DNA sequence data on the genetic structure of endemic birds to understand what structure exists and to study what that structure tells us about how these species will respond to changing climates in the region. Our research includes isolating and sequencing DNA from 100 year-old museum specimens to compare with modern samples to assess if genetic structure has been altered over this short evolutionary period. The documentation of genetic structure in these birds will provide valuable data to guide long-term conservation planning in the region.

The REU intern received training in DNA extraction, PCR, and sequencing in the Museum's core genetics facility, the Pritzker Laboratory and the DNA Discovery Center. The intern also learned the basics of sequence data and phylogeographic analyses.

Symposium Presentation Title: **Genetic Structure of *Phyllastrephus fischeri* in the Albertine Rift**

Symposium Presentation Abstract: The Albertine Rift comprises a chain of highlands stretching 1000km from north to south in East Africa. Many of the forested highland regions are isolated due to the geologic activity of the Rift. We set out to learn if the birds in these highlands have become genetically isolated. In order to asses this question, we sequenced two mitochondrial genes of 45 individuals of *Phyllastrephus fischeri* from various highland forests across the region. The results show two distinct geographic clades, one widespread clade and one limited to the Mt. Kabogo highlands in the south. Our original prediction that birds would show genetic isolation within the Albertine Rift was accurate. This research is important not only to further our understanding of evolution in the region, but also to help set conservation priorities in a region with limited conservation resources. Further research can look into other birds' genetic structure in the Albertine Rift. If more birds from the Mt. Kabogo region are shown to be genetically distinct, it will highlight the importance of these forests for the conservation of genetic diversity.

2012 REU Intern: Iqra Mushtaq

Anthropology / Biology double major at Loyola University of Chicago (Sophomore)

“I am going to be a junior at Loyola University Chicago this fall. I am studying Anthropology and Biology with a pre-med focus. My career goal is to become a Medical Anthropologist. Outside of academics, I am the president of Loyola’s Women in Leadership organization where I work to provide leadership opportunities and workshops to the student body.”

“Medical Anthropology is an integrative field that involves healthcare, cultural healthcare systems, and biological adaptations. To be successful, it is necessary to view humans from a multidimensional perspective. This means I have to be able to understand medicine, as well as cultures and societies. Variations are the hard reality of life and I have to be able to adjust to whatever comes my way.”

“I thoroughly enjoyed my experience as a FMNH intern! I feel like it was a wonderful research experience that truly delivered the benefits that an internship is supposed to deliver. Throughout the summer, I felt like a true scientist doing meaningful work. I was able to be a part of the research process from the start, all the way to the end. I gained invaluable experiences not only in research methodology, but also in problem solving, working with a research team, and what it is like being at a science-orientated organization.”

“My internship gave me the experience and tools to be a great researcher. More importantly, my internship gave me the experience and tools to be a great anthropologist. I picked up the holistic viewpoint that most of my Museum colleagues embody. I was able to experience many diverse areas of study and life, which opened and expanded my mind. I learned to think outside of the norm and problem-solve. These are life skills that are valuable in any career.”

Project Advisors: Dr. Rüdiger Bieler (Curator of Invertebrates, Zoology), Dr. Sid Staubach (Postdoctoral Fellow)

Project Title: The Bivalve Tree of Life: Understanding the evolution of clams, mussels, oysters and their relatives

Project Description: This project is a part of the Assembling the Tree of Life initiative, a large research effort sponsored by the National Science Foundation to reconstruct the evolutionary origins of all living things. The BivAToL effort uses hundreds of selected target species from around the world and studies their morphology, anatomy, ultrastructure, and genetic makeup.

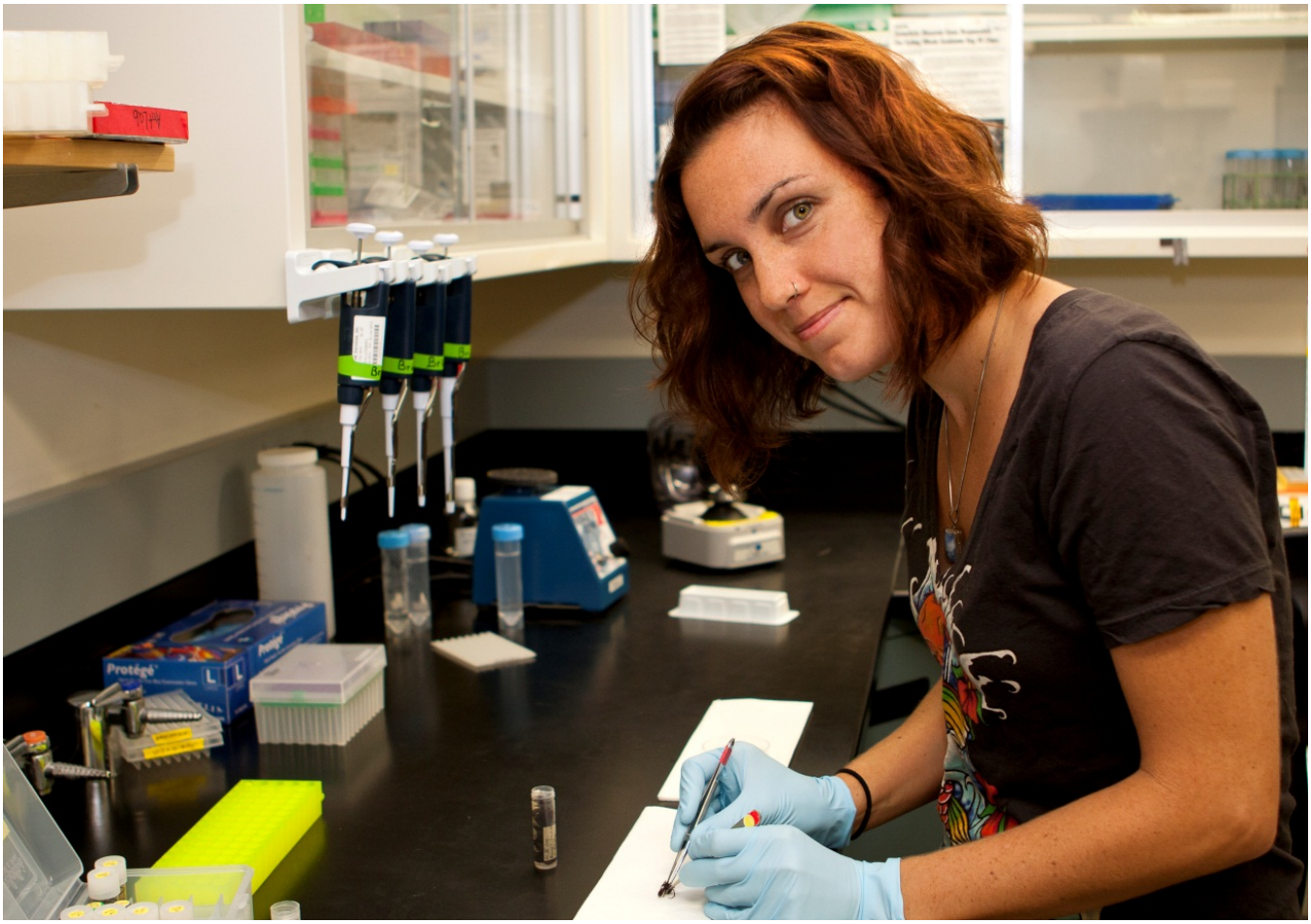
The REU intern received an introduction to bivalve morphology and systematics. She dissected and prepared specimens for microscopy, documented diagnostic characters with optical and scanning microscopy, and gained experience with relevant literature research and collection management techniques. Various histological techniques (in Field Museum's histology laboratory) and 3-D computer reconstruction was also part of the training experience.

Symposium Presentation Title: **Evolution of the Labial Palps and Gills within the Palaeoheterodonta (Mollusca: Bivalvia)**

Symposium Presentation Abstract: Bivalves are easily recognizable animals that are known for their "two-shells" (bi-valves) connected by a hinge. They are most familiar to the public as clams, oysters, mussels, and scallops which may have come across their plate at a seafood restaurant. BivAToL is a part of the Assembling the Tree of Life initiative, a large research effort sponsored by the National Science Foundation to reconstruct the evolutionary origins of all living organisms. The BivAToL (Assembling the Bivalve Tree of Life) project aims to understand bivalve evolution by focusing on bivalve anatomy, morphology, and genetic makeup. Within the BivAToL project, my project for the summer was to reconstruct a plausible hypothesis of evolution for a specific bivalve organ system, the labial palps and gills. Labial palps and gills are very important organs in the Bivalvia as they are not only used for respiration, but are also essential for feeding and reproduction. The anatomical organization of gills is highly varied throughout the Bivalvia and an understanding of gill evolution is necessary in order to understand the evolution of bivalves in general. Using scanning electron microscopy, I investigated the labial palps and gills of seventeen species with a focus on the superorder Palaeoheterodonta and documented the most varied characters within a morphological data matrix using MorphoBank (www.morphobank.org). The morphological data matrix was used with molecular phylogenies in ancestral character state reconstruction to determine how the labial palps and gills evolved and how the labial palps and gills of ancestor species might have looked like and functioned. After reconstructing the evolution of the labial palps and gills, it is apparent that pearls are not the only prizes that can be extracted from bivalves.

2012 REU Intern: Arista Tischner

Biology major at the University of Illinois at Chicago (Junior)



"As someone who has always been a little intimidated by big commitments, I put off going to school for many years, choosing instead to join the work force out of high school. Despite doing well financially, I couldn't help but feel as though I'd cheated myself out of something more rewarding. And so, at the not-very-old-but-no-spring-chicken age of 25, I decided to enter into my freshman year of college. Here I am three years later, and fully recognizing the immense value in getting an education. I am so incredibly grateful for all of the people that I have met in the last few years who have contributed to who I am today."

"While it may sound cliché, I very much want to 'give back' to the world. I want to devote my life and my career to something that will leave a positive mark on this world when I'm gone. Whether that means a career path in renewable resources/conservation, education and outreach, or medical research, I don't know yet. I'm working on some ideas that might be able to incorporate all three. That would be ideal."

"Spending my summer as an intern at The Field Museum was one of the most positive and rewarding experiences I've ever had. The energy found in this place fosters such academic, professional and personal growth! Every person I encountered seemed like it was their personal mission to provide support and encouragement, and to make themselves available to answer any questions, however great or small. Housing not only some of the world's most impressive collections, but also some of the world's most brilliant scientists, the museum is a wonderful place to learn and get experience."

"I did a lot of troubleshooting in the lab this summer, trying to find the reason for why a certain project was not working. Along the way I learned quite a bit about the reasoning behind certain methods, how things work, and what they mean. I know that I will be able to apply this new kind of critical thinking skill to similar situations in the future."

Project Advisors: Dr. Corrie Moreau (Assistant Curator of Insects, Zoology), Dr. Stefanie Kautz (Postdoctoral Researcher)

Project Title: Origin and rise of a giant: Phylogeography of the Neotropical bullet ant *Paraponera clavata*

Project Description: The Neotropical bullet ant *Paraponera clavata* has its name on account of its painful sting. It is said that being stung by a bullet ant feels like being shot by a bullet. This ant is a conspicuous component of lowland Neotropical rainforests. It has an extremely wide distribution ranging from Honduras in the north to Bolivia and Brazil in the south. We will use DNA sequence data (the mitochondrial gene cytochrome oxidase I, mtCOI) to study the genetic population structure and phylogeography of the bullet ant across its entire range in Central and Southern America. More specifically, we are asking whether gene flow occurs between geographically well separated sites or on the contrary, whether populations are genetically isolated leaving room for speciation events. A central question of this research topic is where the giant bullet ant has its origin and in which direction it populated its current range. We will also assess the time frame in which population of the Americas occurred using divergence estimates and fossil calibration, as well as several outgroup taxa. To pursue these topics, we will include ants from several populations throughout the entire distribution range in our studies and analyze data using standard techniques.

The REU interns received training in DNA extraction, PCR, and sequencing in the Museum's core genetics facility, the Pritzker Laboratory and the DNA Discovery Center. Moreover, the intern learned sequence data analyses and phylogeographic analyses methods.

Symposium Presentation Title: **Origin and Rise of a Giant: Phylogeography of the Neotropical Bullet Ant *Paraponera clavata***

Symposium Presentation Abstract: Known for their powerful sting, the giant Neotropical bullet ant *Paraponera clavata* (Formicidae: Paraponerinae) is a conspicuous member of ecosystems in lowland tropical rainforests throughout Central and South America, ranging from Honduras in the north to Brazil and Bolivia in the south. This distribution range is much larger than is typical for ants of a single species. They are the last remaining species in the genus *Paraponera*, and the only species to the subfamily Paraponerinae. We aimed at analyzing large and small scale genetic patterns in bullet ants. Firstly, on a larger scale, we investigated the phylogeography of the species using the mitochondrial gene, cytochrome oxidase I (mtCOI). More specifically, we asked whether gene flow occurs between geographically well separated sites, or on the contrary, whether populations are genetically isolated leaving room for speciation events. Methods included DNA extraction, PCR, cycle sequencing, and sequence analysis. A central question of this research topic is where the giant bullet ant has its origin and in which direction it populated its current range. Based on a mtCOI sequences, we generated a phylogenetic tree inferred from 43 individuals, including three ponerine outgroup taxa. This revealed that bullet ants arose in the Brazilian Amazon and then spread outward into Peru, Ecuador, and eventually into the Central American countries of Panama, Costa Rica, Nicaragua and Honduras. On the small scale, we investigated genetic colony structure including number of queens and number of mates per queen in a single population. To address this question, we developed microsatellite primers specific to bullet ants. So far, we were able to develop 18 primers variable for bullet ants of which 8 were variable within a single population. These primers will be used to screen 971 ants of 81 nests belonging to a single Costa Rican population.

2012 Undergraduate Intern: Stephanie Garcia

Biology major at Loyola University of Chicago (Freshman)

“I live in Boystown with my 4lb Maltese dog named Tink. I’m a passionate student who also loves going to music festivals. My favorite color is purple and my favorite beetle family is the Buprestidae.”

“I want to eventually work in a lab, museum, or do fieldwork. I always want to constantly be learning to keep me motivated and interested in my work. I want to go to graduate school after I finish my bachelors in biology.”

“I started interning at The Field Museum as a high school intern right after my senior year. I worked with beetles and loved learning how to identify them and integrate them into the collection. I continued to come in and volunteer during the school year. I love working at the Field Museum because every day is never the same and there’s so much to explore here. Working here doesn’t feel like ‘work’.”

“I feel like my internship has already impacted my future career goals. When most people hear that I’m a biology major but not on a pre-med course they ask me what I’m going to do with my degree. I always tell them ‘Well, I’m actually going to *do* biology’. I feel like most people see a biology degree only as a path that leads you to medical school. Working at The Field Museum has opened my eyes to endless opportunities and careers in Biology and inspired me to do something different and not go pre-med.”

Project Advisor: James Boone (Collections Manager, Insects, Zoology)

Project Title: Insect Collection - Specimen Transactions

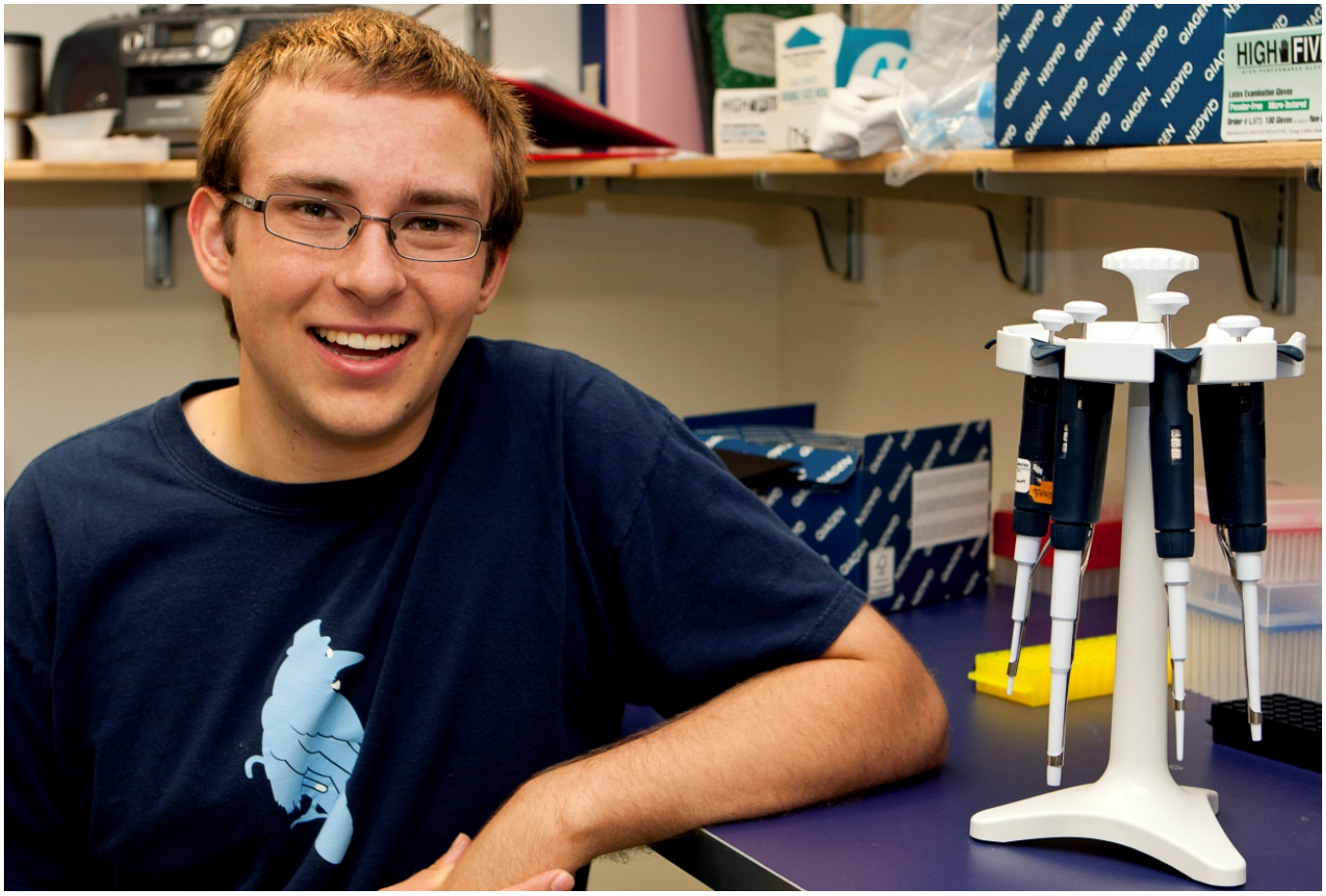
Project Description: The Division of Insects is the largest of the Zoology Department's six divisions, covering insects, arachnids (spiders and their relatives), and myriapods (millipedes, centipedes and their relatives). The curators and collection management staff work together closely to maintain a world-class collection of more than 12 million specimens, over half the Museum's holdings. The Division of Insects' holdings of worldwide Arthropoda (excluding Crustacea) rank fifth in overall size among North American collections and are of worldwide importance for many groups.

The collection presently includes roughly 4.1 million pinned insects plus 8.3 million specimens or lots in alcohol or on microscope slides. In addition, there are over 17,000 partly-sorted "bulk samples" from traps or leaf-litter extractions. The collection receives heavy use by US and international research visitors and borrowers as well as extensive educational use.

The undergraduate intern learned how to process specimen loans and donations, which are fundamental components in natural history collection management. The intern was trained to navigate through the insect collection to find specimens and learned how to pack and ship these specimens for loans to other institutions. She learned how to curate loan returns and donations and also how to integrate them into the collection. The intern learned how to database donations and loans to and from the Field Museum and process invoices and permits. This project targeted freshman college students.

2012 Undergraduate Intern: Mark Swanson

Biology and Environmental Studies major at Illinois Wesleyan University (Sophomore)



“I am an undergraduate student with a passion for exploring and preserving biological diversity. Learning about the many shapes, colors, patterns, life cycles, and ecological roles that living organisms develop has always been thrilling to me. Because of this fascination, I am hoping to attend graduate school and continue to participate in ornithological research.”

“I’ve loved working with the museum staff. They are a group of people who are as passionate about biology and evolution as I am. Additionally, it’s been a pleasure to work in the museum’s Bird Division and Pritzker Lab, as they are very supportive and collaborative environments.”

“My internship this summer has changed the way I think about birds and has helped me start to acquire the skills and techniques I need in order to ask and answer cool questions about them. Hopefully, I will be able to go to graduate school and get a job that will allow me to make that quest into a career.”

Project Advisors: Dr. John Bates (Associate Curator of Birds, Zoology), Josh Engel (Research Assistant)

Project Title: Genetic and Morphologic Structure in the Barred Owl

Project Description: Barred Owls (*Strix varia*) occur throughout North America. Across this large range, there are well documented plumage patterns which are believed to have weak geographic structure. Using modern tissue samples and traditional specimens we will assess the degree to which plumage patterns correlate with genetic differentiation across a large number of individuals that have been prepared by the Bird Division in recent years. These specimens come from throughout the Midwest and Florida. The analyses, including assessment of both genetic and morphologic data, will quantify whether or not there is a correlation between coloration, morphology and genetic structure in these birds.

The undergraduate intern received training in measuring and scoring coloration patterns in traditional museum specimens. He received training in DNA extraction, PCR, and sequencing in the Museum's core genetics facility, the Pritzker Laboratory and the DNA Discovery Center. The intern also learned the basics of sequence data and phylogeographic analyses.

Symposium Presentation Title: **Genetic and Morphologic Structure in Midwestern Barred Owls**

Symposium Presentation Abstract: Barred Owls (*Strix varia*) are ecologically important predators in forests across much of Eastern North America and can be separated into two distinct clades based on mitochondrial DNA sequences. A recent study showed these two clades intermingle in Minnesota. I gathered mitochondrial control region sequences from Barred Owls from Minnesota, Wisconsin, and Illinois. I also collected morphological data from owls of this region by using 20 skeletal measurements of nearly 100 individuals to produce a Principal Components Analysis. My results to date suggest all Illinois owls belong to a single mtDNA clade found mainly to the south. There also appears to be significant differentiation in morphology across this same region. Future research will include an increased sample size from additional localities in order to gain a clearer understanding of genetic and morphological structure in this region.

2012 High School Intern: Niall Griffin

Incoming Neuroscience / Evolutionary Psychology major at Colorado College from Glenbard West High School

“I just graduated from high school in the spring of 2012. Now, I am getting ready to shove off to Colorado Springs for college in the fall. I plan to study either neuroscience or evolutionary psychology. My career goals are still hazy, but in the long term, I hope to become a research scientist and/or a college professor.”

“I had an excellent internship experience this year at the Field Museum. Last year, I interned at the museum, but I spent the whole summer down in the CRC [Collections Resource Center]. This year, I worked both in the CRC and on the third level, in the Geology department. This allowed for more interaction with museum staff and gave me the opportunity to become a part of the museum community. Maybe next year, I will try to intern at the Field Museum again, as I would really like to give a talk at the symposium.”

“I believe my internship will impact my future career goals because it has allowed me to experience a lifestyle and work-style that I have never experienced and of which I was not aware. This internship will help me make more informed decisions about my future trajectory as a scientist.”

Project Advisor: Dr. Ian Glasspool (Adjunct Curator and Collections Manager, Fossil Plants, Geology)

Project Title: Documenting Coal-Forming Floras of the Late Carboniferous Period

Project Description: The Paleobotany Collections at the Field Museum comprise ~88,000 catalogued hand specimens, palynological slides, SEM stubs and bulk samples that range in geologic age from the Precambrian to the Recent. Of these specimens, approximately 3,500 are either types, are figured or are referred. These "type specimens" are housed separately from the general collection and are organized by publication.

Most groups of plants are well represented in the Paleobotany Collections, though particular strengths include Pennsylvanian coal-forming floras from the Illinois Basin and early angiosperm mesofossils from the Atlantic Coastal Plain.

Paleobotany is in the process of digitizing its collections to promote them through the web. The collections' current priority is therefore data entry and photography. The intern was instructed in the photography and scanning of fossil plants and the digitization of their associated data. In particular, the intern focused on coal-forming floras and specimens of Pennsylvanian age (approximately 318-299 million years ago).

2012 High School Intern: Charles Griggs

Incoming Environmental Studies major at Middlebury College from Proviso Mathematics and Science Academy

“This fall I will be venturing off to the pastoral region of Middlebury, Vermont to become more scientifically literate and share my curiosity and love of science with others. When approaching the ever-expanding field of environmental science, from studying climate change to analyzing visions of vertical farming, I always encountered a struggle circumscribing to a field that held my interest. Throughout high school I had a strong interest, and completed research, in agriculture and food production. It interested me how food travels from grain elevators, to market shelves and into hands of consumers.”

“In the future, working with Oxfam International or an international relief group would be rewarding. If I choose go along the medicine track, Doctors Without Borders would be the most ideal. But working in the Pritzker Lab has taught that the life of a researcher would be just as fulfilling.”

“Working at the Field Museum was an experience full of insightfulness, discovery and more questions to be answered. Throughout school and research past, I concluded that lab work can be weary and colorless. My experience at the FMNH as an intern put a new spin on lab work. The people I encountered and interactions that were formed made the work seem less like work, but more like a hobby that I looked forward to doing! But most importantly it was a learning experience that I will take through college and beyond. I also learned to keep an open mind and look at things from a different perspective. I would have never thought coming from a world of food science that extracting DNA from ants indigenous to different parts of Costa Rica could be such an enriching experience.”

“I think my internship will have a positive impact on my future career goals. It has taught me that the more flexible I am as a person, the more people are inclined to work with me. Another lasting impact that it will have on my future career goals is that research is always an exciting option, and I should always remember that.”

Project Advisor: Dr. Corrie Moreau (Assistant Curator of Insects, Zoology)

Project Title: Ant Lab - Collection Studies and Molecular Methods

Project Description: The Field Museum's ant collection is worldwide in scope and includes the important Robert E. Gregg Collection. Although the majority of the Gregg collections are from the USA, it also includes important collections from around the world. There are also extensive wet (alcohol preserved) worldwide collections due to the efforts of previous collectors including H.S. Dybas and S.B. and J. Peck (many of these bulk arthropod samples have not yet been sorted for any taxonomic groups). Specimens from each species stored in the wet collection are being mounted and added to the pinned collection. The thousands of pinned ants are currently being inventoried, databased and given unique identifiers. As the pinned material is databased, it is being made available on our online EMu collection database.

Research in the ant lab focuses on the origin and evolution of ants, and in particular, how different factors may influence patterns of diversification -- from the rise of the flowering plants, associations ants have with other insects and plants, to their microbial community are all potential underlying factors that may have facilitated their ecological dominance in almost all terrestrial ecosystems. In addition the scientists in the ant lab are interested in how biogeography, climate change and invasive ants have and will continue to affect the evolutionary processes that generate and sustain high biological diversity in tropical rainforests and other habitats. More specifically they are interested in how they can use molecular methods, next-generation sequencing, and comparative genomics to address these questions.

The intern participated in basic insect curation and identification and worked on ant samples in the DNA Discovery Center at the Field Museum. He also sorted ants from bulk/mixed jars of invertebrates collected from around the world. The intern participated in DNA based research on ants. He learned basic insect classification and identification and DNA based molecular laboratory skills.

2012 High School Intern: Stacey Huynh

J. Sterling Morton East High School (Junior)

“I’m a 17-year old about to start my last year of high school. During my time in high school so far, I’ve managed to keep a perfect GPA, be a state qualifier on my school’s math team, hold the title of President and Treasurer of the Class of 2013, get elected Secretary of my school’s National Honor Society, and make it on my school’s Varsity Girl’s Track & Field team. I’m also Co-President of the Youth Initiative for Civic Engagement (Y.I.C.E.) in my community. When I’m not busy with school and volunteering, I like hanging out with my friends and eating good food. I plan on going to college and graduating with a degree. I might even get more than one degree. I want to have a successful career and be happy with what I’m doing.”

“Being an FMNH intern is amazing. There’s a lot of hard work involved, but there’s also fun. Having an awesome supervisor and cool co-workers definitely helps with that. During my internship, I’ve learned so much. I can safely say I know how to process specimen transactions correctly.”

“I think my internship will have an impact on my future career goals because the Field Museum has high prestige and being affiliated with it is an honor. When you think of a typical teenage summer job, you think of being a cashier at a store or being a waiter at a restaurant. Not many people can say they had the opportunity to intern at the Field Museum for the summer. Because of this, I wish to move forward with my goals and not backwards.”

Project Advisor: James Boone (Collections Manager, Insects, Zoology)

Project Title: Insect Collection - Specimen Transactions

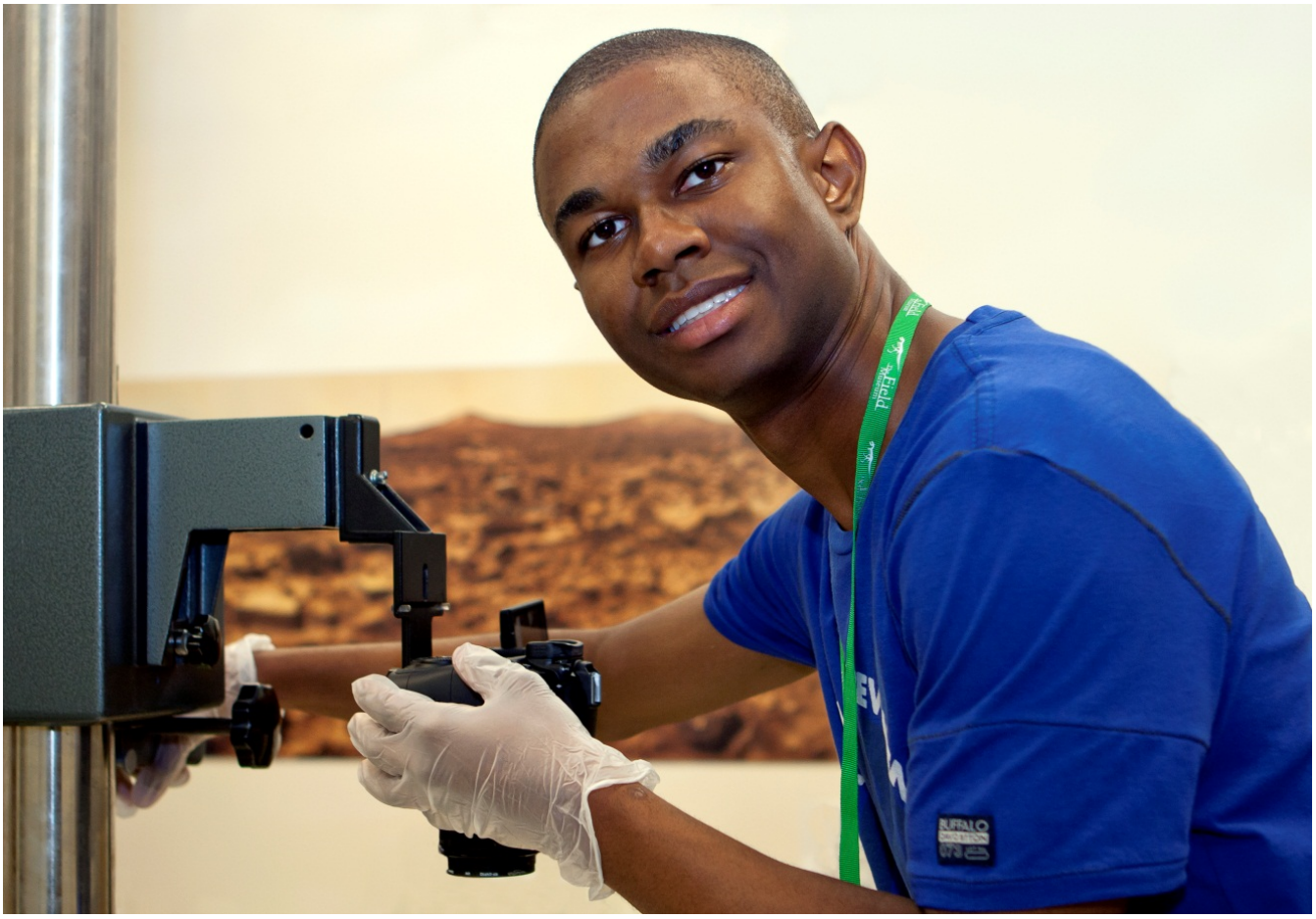
Project Description: The Division of Insects is the largest of the Zoology Department's six divisions, covering insects, arachnids (spiders and their relatives), and myriapods (millipedes, centipedes and their relatives). Our curators and collection management staff work together closely to maintain a world-class collection of more than 12 million specimens, over half the Museum's holdings. The Division of Insects' holdings of worldwide Arthropoda (excluding Crustacea) rank fifth in overall size among North American collections and are of worldwide importance for many groups.

The collection presently includes roughly 4.1 million pinned insects plus 8.3 million specimens or lots in alcohol or on microscope slides. In addition, there are over 17,000 partly-sorted "bulk samples" from traps or leaf-litter extractions. The collection receives heavy use by US and international research visitors and borrowers as well as extensive educational use.

The intern learned how to process specimen loans and donations, which are fundamental components in natural history collection management. The intern was trained to navigate through the insect collection to find specimens and learned how to pack and ship these specimens for loans to other institutions. She learned how to curate loan returns and donations and how to integrate them into the collection. The intern learned how to database donations and loans to and from the Field Museum and process invoices and permits. This project targeted junior and senior high school students.

2012 High School Intern: Evan Johnson-Ransom

Brother Rice High School (Junior)



“I am enthusiastic and goal-oriented. My interests are paleontology, manga/anime and paleoart. I am a member of the National Honors Society and Project Exploration.”

“I plan to pursue a degree in the Geophysical Sciences leading to a future career as a paleontologist, college professor and curator in a museum.”

“My experience as an FMNH intern can be described as a dream come true. I met curators, scientists and other interns that have the same interests I do.”

“While working with the meteorites, I learned how important they are to scientists, mostly to help in understanding the history and origin of our solar system. I have learned that other institutions and faculty are allied with the Field Museum in this pursuit.”

“I think my internship will have an impact of my future career goals. I have been given the opportunity to get hands-on experience through working with scientists and curators. The time spent at the Field Museum is a once in a lifetime experience.”

Project Advisor: James Holstein (Collections Manager, Meteoritics and Polar Studies, Geology)

Project Title: RAPC: Reweighing, Photography and Storage of the Murchison Meteorite

Project Description: The Robert A. Pritzker Center for Meteoritics and Polar Studies' mission is to enhance our knowledge of nature through rigorous scientific studies in meteoritics, the planetary sciences and polar studies.
One of the main goals of the Center is to curate one of the world's largest meteorite collections and to provide the scientific community with samples for high quality scientific research. The Center strives to maintain a balance between serving current research needs and preserving the collection for the future generations.

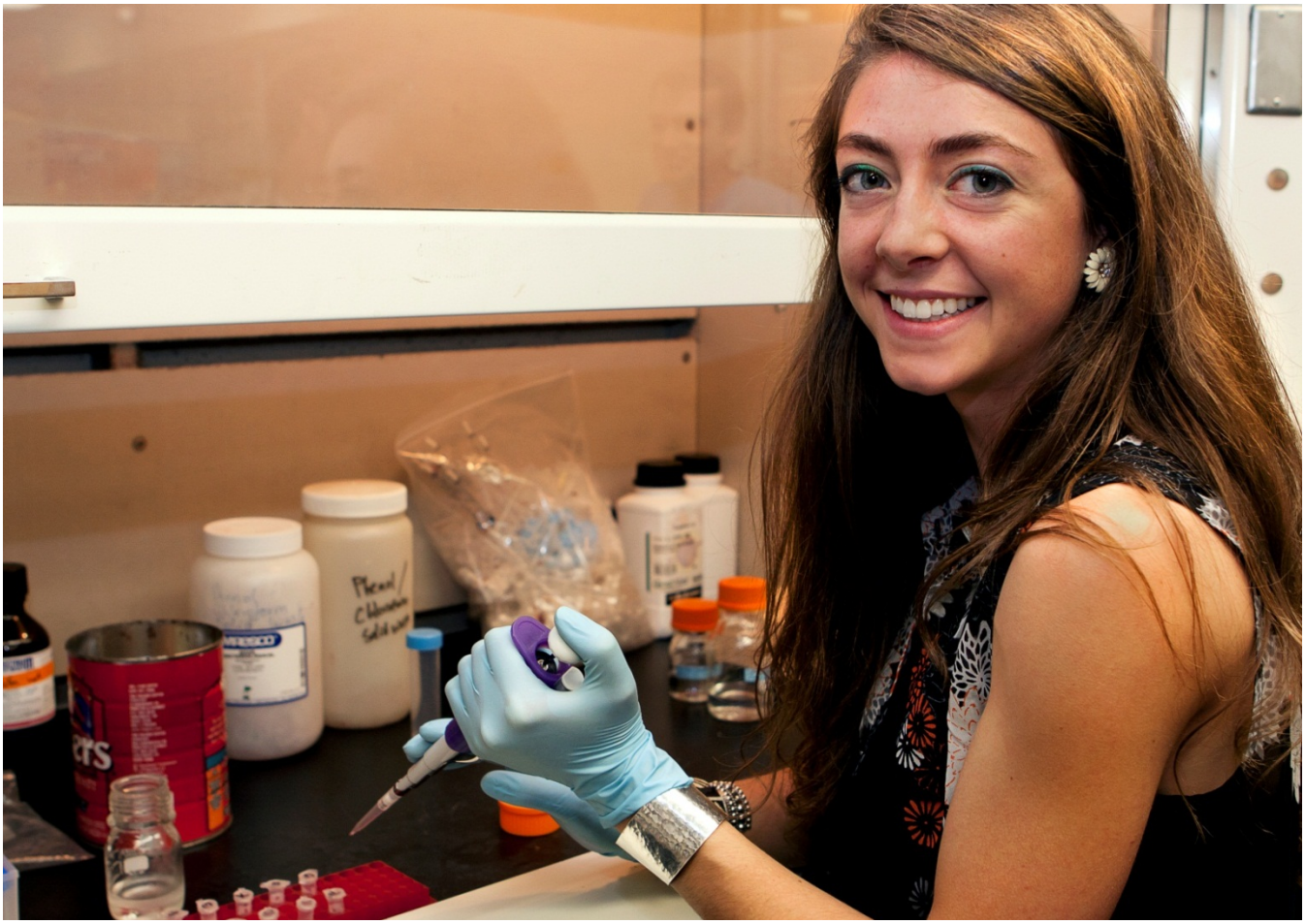
The world-class meteorite collection at The Field Museum is an invaluable resource to the cosmochemistry and meteoritics community. The Robert A. Pritzker Center was established in 2009 through a major grant by the Tawani Foundation.

The current research focus at the Center is on presolar grains, to understand our parent stars and the history of our Galaxy, and on the delivery history of extraterrestrial matter to Earth through the study of fossil meteorites and micrometeorites found in sediments and terrestrial impact craters. We are also part of the international research consortium involved in the study of modern interstellar dust brought back by NASA's Stardust mission.

The objective for this internship was to weigh, photograph and repack one of our most scientifically valuable meteorites. Individual specimens had to be weighed, photographed and stored in new cabinets. The images and weights were entered into a database.

2012 High School Intern: Katherine (Kit) McDonnell

Incoming Biology major at Tufts University from St. Francis High School



“I am aspiring biologist who is fascinated by all things science - from the DNA research I’m conducting in the lab to the chemistry of cooking to organic gardening! Uniting my many, seemingly-unrelated, interests (such as graphic design, tennis, and writing) through a scientific lens keeps things interesting.”

“The entire scientific method intrigues me! I would love to pursue a research career in the biological sciences and teach aspiring scientists, whether that be in a classroom or laboratory setting or in the field. I think I’d like to add Field Museum curator to my list as well!”

“Being able to intern at the Field Museum has been monumental in shaping my career goals, and I’ve enjoyed every minute! Becoming a part of the day-to-day operations (public and behind the scenes) of the Field Museum has been a fantastic experience. I seem discover something new about the museum on a daily basis, whether it be a hidden staircase, a curator’s latest project, or a 19th century French almanac from the library stacks. The Field Museum simply has so much going on, and I cannot wait to get to work every day. I have gained invaluable skills in scientific research that I will take with me to college and beyond, but I’ve also tried to take full advantage of the museum and the wealth of information it has to offer.”

“Interning in the DNA Discovery Center/Pritzker Lab last summer convinced me to pursue a career in research, and since returning to the museum for a second summer, my career decision had been reaffirmed. I was able to work alongside professionals in the science field and get a firsthand look at what they do. Working at the museum has also created a wonderful network of mentors who have helped me define my future goals and the path I would like to take to achieve them.”

Project Advisor: Dr. Corrie Moreau (Assistant Curator of Insects, Zoology)

Project Title: Ant Lab - Collection Studies and Databasing Techniques

Project Description: The Field Museum ant collection is worldwide in scope and includes the important Robert E. Gregg Collection. Although the majority of the Gregg collections are from the USA, it also includes important collections from around the world. There are also extensive wet (alcohol preserved) worldwide collections due to the efforts of previous collectors including H.S. Dybas and S.B. and J. Peck (many of these bulk arthropod samples have not yet been sorted for any taxonomic groups). Specimens from each species stored in the wet collection are being mounted and added to the pinned collection. The thousands of pinned ants are currently being inventoried, databased and given unique identifiers. As the pinned material is databased, it is being made available on our online EMu collection database.

Research in the ant lab focuses on the origin and evolution of ants, and in particular, how different factors may influence patterns of diversification - from the rise of the flowering plants, associations ants have with other insects and plants, to their microbial community are all potential underlying factors that may have facilitated their ecological dominance in almost all terrestrial ecosystems. In addition the scientists in the ant lab are interested in how biogeography, climate change and invasive ants have and will continue to affect the evolutionary processes that generate and sustain high biological diversity in tropical rainforests and other habitats. More specifically they are interested in how they can use molecular methods, next-generation sequencing, and comparative genomics to address these questions.

The intern helped translate georeferenced data from ant field collections between formats to facilitate integration into the Field Museum's extensive collections database. This job consisted of entering data into an online latitude and longitude translator and entering the results into a spreadsheet. In addition the student was asked to help sort ants from bulk/mixed jars of invertebrates collected from around the world. The intern also participated in DNA based research on ants.

2012 High School Intern: Janet Morales

Lane Tech High School (Sophomore)

“I enjoy science, and learning about new things that affect my world. I am a committed person, and never like to miss school. One of my favorite hobbies is drawing, and anything else that involves creativity.”

“My future career goals involve going to college and majoring in a type of science. I want to work in research and discovery. The idea I like most about science is that it changes as time moves on.”

“My experience as a FMNH intern has been a very important part of my life that I will not forget. I worked in the project ‘The Lichens of Fiji’ with Dr. Thorsten Lumbsch in the Department of Botany. I prepared thin layer chromatography plates for identifying lichens.”

“This was my first internship, and I enjoyed learning something new. I could not have asked for a better summer, especially with valuable intern workshops. Everyone was very helpful, and I met lots of other interns as well.”

“I think my internship will have an impact on my future career goals because now I have gained knowledge and skills. I have more experience in botany. This internship will help support the science background I am trying to build.”

Project Advisor: Dr. Thorsten Lumbsch (Botany Chair and Associate Curator)

Project Title: The Lichens of Fiji

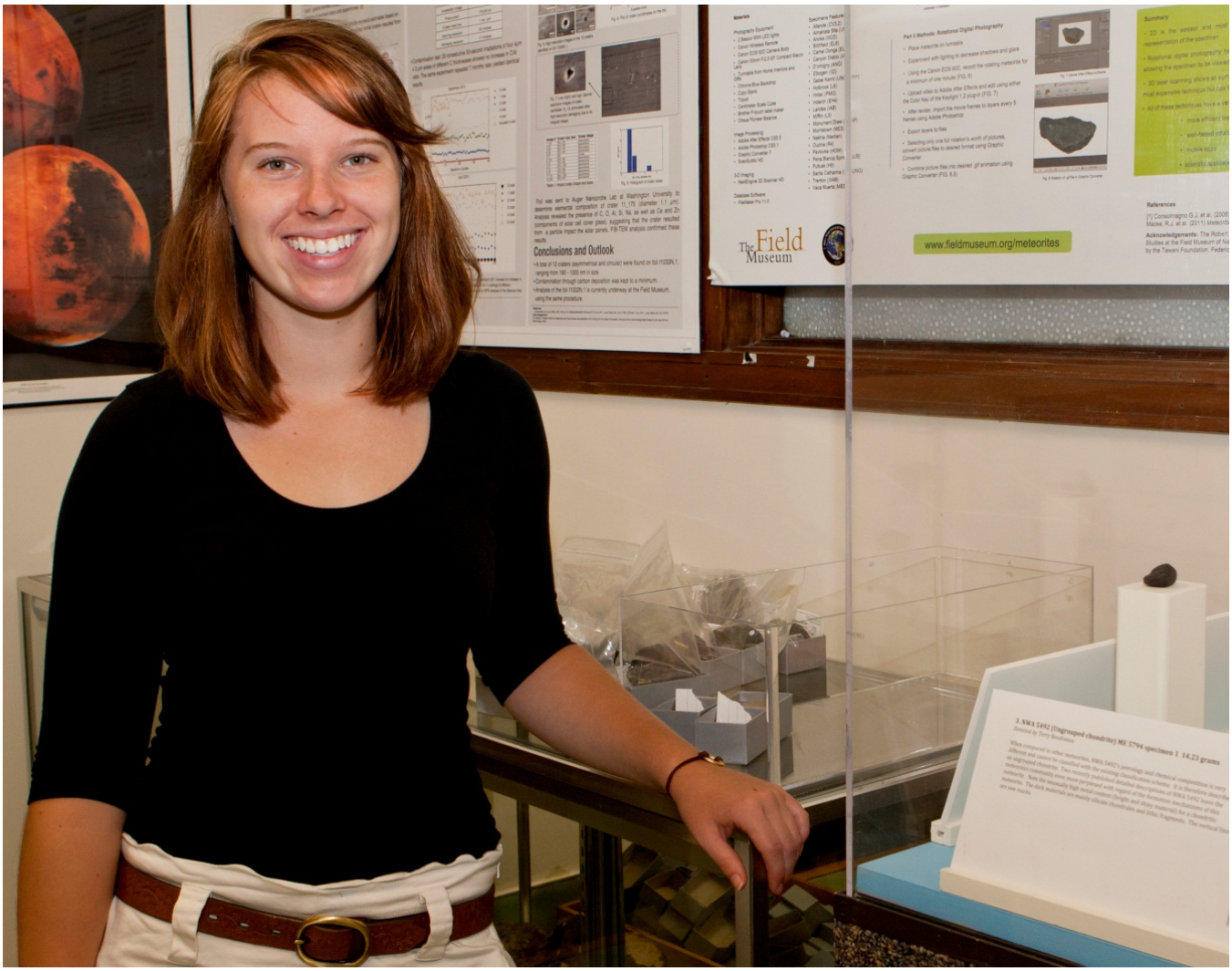
Project Description: The mycology collection at The Field Museum is a major resource for studies in evolution, systematics, and biodiversity of fungi and lichens and conservation of their habitats. It consists of currently over 200,000 specimens with world-wide coverage and broad taxonomic representation. It is rich in type collections, especially of Neotropical taxa and historical types from North America, Europe, and Asia. The strengths of the
collection are the Agaricales sensu lato in the Basidiomycota or club fungi (e.g., mushrooms, boletes, false-truffles, puffballs, chantrelles, tooth fungi, and coral fungi), the Sordariomycetes in the Ascomycota or sac fungi, and the lichenized Ascomycota and Basidiomycota, specifically tropical and leaf-inhabiting species and collections from the Great Lakes region. The mycology collection is especially significant in that it represents one of only two active, large centers for Neotropical Agaricales in North America, and one of only a handful of herbaria active in such studies in the Western Hemisphere.

The lichen collection consists of currently over 80,000 specimens, including nearly 1,500 types, and ranks sixth nationally. Important collections include those of A. W. Herre and E. Hall (North America), P.C. Standley (Guatemala, Honduras, Nicaragua), J. A. Steyermark (Guatemala), C. Sbarbaro (Europe) and A. B. Seymour (Eastern North America) and, more recently, those of Associate Curator H.T. Lumbsch (world-wide) and Adjunct Curator and Collections Manager R. Lücking (largely tropical plus one the largest collections of leaf-inhabiting lichens world-wide).

The intern prepared specimens collected recently on a field trip to Fiji and worked with the project leader on assembling morphological and chemical data of the specimens. The intern learned microscopic and chromatographic methods. She sorted lichen specimens into generic groups based on the morphological and chemical data. In this process, the intern learned lichen morphology and chemistry and was trained in lichen identification and systematics of fungi. The intern also learned to search for literature on lichen taxonomy and prepared data for publication on the EOL website.

2012 High School Intern: Sarah Pipal

Incoming Environmental Geology major at Beloit College from Lyons Township High School



"Reading (a copy of the latest *Discover* or *Scientific American* magazine can typically be found on my bedside table), playing various sports, and spending time outside are a few of my most time-consuming hobbies. I adore traveling, especially to visit family in Australia. To experience other cultures and environments is something I value and recommend to everyone, regardless of age, nationality, and personality. I am greatly interested in geology as a future career path, and I hope to obtain a master's degree in that or a similar field. A job working for the federal government is my ultimate goal, perhaps with an organization like the National Oceanic and Atmospheric Administration. Wherever my future may lead me, I hope to always be working for a better understanding of the earth."

"Although thrilled to have gotten an internship position, I was a little wary that I would be overwhelmed by the work to which I was assigned at the Field Museum. Contrarily, I found my work with in the geology department enjoyable, my colleagues even more so, and the museum to be a positively wonderful place to work. The opportunities offered to interns are incredible, what with the benefits and ability to view the museum through a different perspective. Through my time at FMNH, I have been inspired by the care, enthusiasm, and finesse with which the museum's employees work to preserve history's finest offerings. I have always had a great interest in science, but am unsure of what specific area to go into. With experiencing the environment of a research institution like the FMNH, I have found that the dedication of its employees is unrivaled by any other occupation I have witnessed. I have gained valuable computer skills and knowledge about the geology collection. With these factors, I can be certain that my internship has persuaded my future career goals to be in the direction of research and educating the public in a manner akin to that of the Field Museum."

Project Advisor: James Holstein (Collections Manager, Meteoritics and Polar Studies, Geology)

Project Title: RAPC - Data Cleaning for the Physical Geology Collection

Project Description: The Robert A. Pritzker Center for Meteoritics and Polar Studies' mission is to enhance our knowledge of nature through rigorous scientific studies in meteoritics, the planetary sciences and polar studies.

One of the main goals of the Center is to curate one of the world's largest meteorite collections and to provide the scientific community with samples for high quality scientific research. The Center strives to maintain a balance between serving current research needs and preserving the collection for the future generations.

The world-class meteorite collection at The Field Museum is an invaluable resource to the cosmochemistry and meteoritics community. The Robert A. Pritzker Center was established in 2009 through a major grant by the Tawani Foundation.

The current research focus at the Center is on presolar grains, to understand our parent stars and the history of our Galaxy, and on the delivery history of extraterrestrial matter to Earth through the study of fossil meteorites and micrometeorites found in sediments and terrestrial impact craters. We are also part of the international research consortium involved in the study of modern interstellar dust brought back by NASA's Stardust mission.

Data management is fundamental to the proper care and tracking of a museum collection. The Field Museum has over 45,000 specimens in the physical geology/meteorite collections. This internship focused on the consolidation, maintenance and correction of data.

2012 High School Intern: Christian Valderrama

John F. Kennedy High School (Junior)

“I am a 17-year old high school student entering my senior year in high school. I was born in Puerto Rico but grew up in the north side of Chicago. I have been taking honors, AP, and college classes all throughout high school.”

“I plan to pursue a career in engineering, biology, astronomy or a combination of the three. Ideally, I would like to achieve a doctoral degree. This career will allow me to create, discover, and explore. It will allow me to do something I love while benefiting others, possibly all of humanity.”

“I had an enjoyable and informative time at the Field Museum. I learned a lot and felt this was a very good way of spending my time. This experience has awakened a childhood interest of mine: Entomology. Working among experts in a scientific environment has been an honor and increased my knowledge and experience in science and given me an even greater work ethic.”

“This internship will have a great impact in my future career goals. Being exposed to first-hand scientific work and research has broadened my experience and has fueled my determination and drive to do more.”

Project Advisor: Dr. Margaret Thayer (Associate Curator of Insects, Zoology)

Project Title: Insect Collection - Sorting, Specimen Preparation and Care

Project Description: The Division of Insects is the largest of the Zoology Department's six divisions, covering insects, arachnids (spiders and their relatives), and myriapods (millipedes, centipedes and their relatives). The curators and collection management staff work together closely to maintain a world-class collection of more than 12 million specimens, over half the Museum's holdings. The Division of Insects' holdings of worldwide Arthropoda (excluding Crustacea) rank fifth in overall size among North American collections and are of worldwide importance for many groups.

Coleoptera (beetles) is the best-represented and most heavily used order in the collection, with unusually comprehensive material at family and generic levels. Besides the Staphylinidae collection highlighted below, the holdings of other beetle families such as Histeridae, Ptiliidae, Leiodidae, Cleridae, Mordellidae, and Lucanidae are unmatched among New World collections for world representation of genera and species, and are probably surpassed only by the much older The Natural History Museum (London) and the Muséum National d'Histoire Naturelle (Paris). The holdings of other families have tremendous strengths in specific regions, such as North American Elateridae, Buprestidae, Cleridae, Elmidae, Dryopidae, and Cerambycidae; South American Tenebrionidae (also world genera); or particular subgroups, such as the Scarabaeidae subfamily Cetoniinae.

Foremost among the Coleoptera holdings are the Staphylinidae, or rove beetles, the largest beetle family with over 57,000 named species. The division's collection of over one million specimens is one of the largest and most comprehensive in the world, and includes primary types (holo-, lecto-, neo-, or syntypes) of over 8,000 species (rivaled only by The Natural History Museum in London). This family accounts for about a third of all loan use in Insects. Major historically important collections include those of Max Bernhauer, Alexander Bierig, Ludwig Benick, David Kistner, and Orlando Park.

The intern prepared beetle and some other insect specimens (now stored in alcohol) for incorporation into the main pinned collection. These are important reference vouchers for specimens stored in liquid nitrogen tanks for future extraction of their DNA (or, in some cases, specimens whose legs were removed to that storage). The work consisted of pinning or point-mounting (depending on size), labeling, and sorting the specimens by family, and included some common and many rare species from around the world. Training included how to handle pinned insect specimens; how to pin, point-mount, and label pinned specimens; and general training in insect classification and collection management practices. This intern had to be very attentive to detail and have excellent coordination in order to handle small delicate objects, working partly under a microscope, in order to prepare the specimens according to museum curatorial standards and ensure that labeling was done accurately.

2012 High School Intern: Evelina Yarmit

Incoming History and Psychology major at Stanford University from Highland Park High School

“I was born in Belarus and moved to the United States when I was one and a half. I am trilingual, speaking Spanish, English, and Russian. In high school, I was involved in Debate, Scholastic Bowl, and theatre. I’m excited to start the new chapter of my life in California.”

“I want to be a corporate executive, either in a managerial sector or in a legal department. My dream would be to work for an international luxury brand company.”

“This program was my first official job, and of course it had the typical job stuff. I sat in an office, worked on databases and filing cabinets, while eating lunch at noon every day. Still, I am more than lucky that I worked with some of the most amazing people I have ever met, who I will surely call my friends for years to come. Not to mention, that everything that I was filing fell from space at some point. I am very sad to leave this program, but I know that the people I’ve met and the meteorite dust on my clothes will stay as residue for many years.”

“I have always loved museums, a love that my parents have instilled in me at a young age. Now that I see what the Field Museum does first hand, beyond the exhibits, and into research, I would love to continue to work with this institution. While long term I don’t believe that I will be in science, if I have the means, I will try to fund the Field, and museums like it, across the world.”

Project Advisor: James Holstein (Collections Manager, Meteoritics and Polar Studies, Geology)

Project Title: RAPC - Accession of a New Collection

Project Description: The Robert A. Pritzker Center for Meteoritics and Polar Studies' mission is to enhance our knowledge of nature through rigorous scientific studies in meteoritics, the planetary sciences and polar studies.

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This internship was focused on the documentation of a new meteorite and rock research collection donated to the Field Museum. This included the photography, weighing description of basic characteristics and data entry of individual specimens that will be accessioned in the museum's collection. Special care had to be taken to prevent cross-contamination of samples, and most of the work needed to be performed with gloves (vinyl or nitrile). The intern also worked at the University of Chicago's Department of Geophysical Sciences.

Photographs were taken by Stephanie Ware (Research Assistant, Zoology, Insects; Secretary of the Scholarship Committee; Team Member of Chicago Peregrine Program, Zoology, Birds), with the exception of Stacey Huynh, which was taken by James Boone (Collections Manager, Zoology, Insects). Design and content for this booklet were provided by Stephanie Ware.