The Field Museum

Undergraduate Research Symposium 2011

Program and Abstracts

Saturday, August 13

Lecture Hall I

2011 REU Projects

2011 REU^ participants, projects and college/university:

REU participant: *Katherine Anderson*, junior, University of Michigan
Project: Bivalves in Time and Space (BiTS) - Clams as tools to understand macroevolution
Advisor: Dr. Rüdiger Bieler, Zoology/Invertebrates, in collaboration with postdoctoral fellow Dr. André Sartori

REU participant: *Warren Chatwin*, sophomore, Brigham Young University
Project: Resolving species limitations in lichens
Advisors: Dr. Thorsten Lumbsch, Botany, and postdoctoral fellow Sr. Steven Leavitt

REU participant: *Elizabeth Everman*, junior, at William Jewell College
Project: Tracing the evolution of venom in scorpionfishes and waspfishes
Advisor: Dr. Leo Smith, Zoology –Fishes

REU participant: *Graham Haviland*, junior, University of Chicago
Project: Do some nocturnal Malaysian mammals see in color?
Advisor: Dr. Robert Martin, Anthropology/Biological Anthropology, in collaboration with graduate student Edna Davion (University of Chicago and Field Museum, Anthropology).

REU participant: *William Montag*, sophomore, Bowdoin College
Project: The Evolution of Mutualism in Plant Ants
Advisor: Dr. Corrie S. Moreau, Dr. Stefanie Kautz, and Benjamin E. Rubin, Zoology, Insects

REU participant: *Stephanie Smith*, junior, John Hopkins University
Project: Do skeletal dimensions predict daily activity patterns in rodents?
Advisor: Dr. Kenneth Angielczyk, Geology

REU participant: *Gregor-Fausto Siegmund*, junior, University of Chicago
Project: Calibrating phylogenies: are we using the right fossils?
Advisor: Dr. Peter Makovicky, Dept. of Geology

^The REU research internships are supported by NSF through an REU site grant to the Field Museum, DBI 08-49958: PIs: Petra Sierwald (Zoology) and Peter Makovicky (Geology).
* Funded through NSF grant 09-18982 to R. Bieler
#Funded through NSF DBI-1026783 to M. von Konrat, J. J. Engel, R. Lücking, & T. Lumbsch
+Funded by the Field Museum of Natural History

REU participant: *Hannah Wirtshafter*, junior, Carnegie Mellon University
Project: The Bivalve Tree of Life—understanding the evolution of clams, mussels, oysters and their relatives
Advisor: Dr. Rüdiger Bieler, Zoology/Invertebrates, in collaboration with postdoctoral fellow Dr. Sid Staubach

Affiliated Undergraduate Interns in Collections and Research
Sara Parilo (senior, Roosevelt University, Chicago)
Major: Project: Digitization of Identification Keys of Apioceridae and Mydidae flies.
Advisor: Dr. Torsten Dikov, Biodiversity Synthesis Center

** Martha Iserman* (graduate student, California State University, Monterey Bay)
Major: Science Illustration Program
Project: Scientific Illustration of Bivalvia
Advisors: Drs. R. Bieler and Sid Staubach

Arista Tischner (Harold Washington College, Chicago)
NSF Cirrus program, Ant lab Collection intern
Project: Strategies of acacia-ants: to grow or to reproduce?
Advisor: Dr. Corrie Moreau, Zoology - Insects

Asna Ansari (Northwestern University, Senior)
Main project: Interstellar Examination Phase of Samples from NASA's Stardust Mission
Advisor: Dr. Philip Heck, Geology

Sergio Garcia (DePaul University) CIRRUS intern
Project: Cryptic diversity and evolutionary relationships in 'camouflage' lichens: genus *Melanohalea* and their cryptic diversity in North America
Advisors: Dr. Thorsten Lumbsch, Botany, , and postdoctoral fellow Sr. Steven Leavitt

Vernon Meidlinger-Chin (Augustana College)
Project: Anatomy of the brain and inner ear of the Antarctic dinosaur *Cryolophosaurus* based on CT data

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Advisor: Dr. Peter Makovicky

Elizabeth Fisher (Augustana College)
Project: Anatomy of the brain and inner ear of the Antarctic dinosaur *Cryolophosaurus* based on CT data Advisor: Dr. Peter Makovicky

C&R Prince Collection's Summer Interns +
Stephanie Garcia (Carl Sandburg High School), interning with James Boone (Zoology, Insects) College: Loyola University, Chicago

Samuel Simon **(**Illinois Mathematics and Science Academy), interning with James Holstein (Geology), College: Carnegie Mellon University

Gina Charles **(**Perspectives Leadership Academy), interning with Dr. Ian Glasspool (Geology).

Jacqueline Fuentes (attending Kelly High School), interning with Petra Sierwald (Zoology) College: University of Illinois at Chicag

Cristina Vera (Chicago High School for Agricultural Sciences) interning with Dr. Matt von Konrat (Botany).
Jasmia Hamilton (Nicholas Senn High School) interning with Dr. Matt von Konrat (Botany).

Lauren Hennelly (sophomore, University of Wisconsin-Madison)
Project**:** Evolution and ecology of Neotropical rodents and bats
Advisors: curator Bruce Patterson (Zoology/Mammals), with graduate student Nate Upham (UC, CEB).

2010 Phylogenetic workshop

Instructors: Dr. Stefani Kautz (postdoctoral fellows, Zoology – Insects, Dr. Moreau's Ant lab) and Dr. Andre Sartori (postdoctoral fellows, Zoology-Invertebrates, Dr. Bieler's mollusk lab)

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+Funded by the Field Museum of Natural History

PROGRAM

9:00 – 9:15 am Opening of the Symposium, Welcome, Petra Sierwald

Session 1

Moderator: Edna Davion

University of Chicago and Dept. Anthropology, Field Museum

9:15 – 9:30am **The evolution of mutualism in plant-ants**
William Montag, Bowdoin College

9:30 – 9:45am **Strategies of acacia-ants: to grow or reproduce**
Arista Tischer, Harold Washington College, Chicago

9:45 – 10:00 am **Tracing the evolution of venom in Scorpionfishes and Waspfishes**
Elizabeth Everman, William Jewell College

10:00 – 10:15am **Gill structure of the Bivalvia, Scientific Illustrations**
Martha Iserman, California State University, Monterey Bay

10:15-10:45am **Speaker Group Photo, Illustration and Poster presentation**
Coffee Break

Scientific Illustrations presentation: by *Martha Iserman*
Poster: Holstein, J., Pelker, E., *Simon, S*. & Heck, P.: Pilot Digitalization Project for the meteorite collection at the Robert A. Pritzker Center for Meteritics and Polar Studies.

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Session 2

Moderator: Dr. Sid Staubach

Postdoctoral fellow, Dept. of Zoology – Invertebrates, Field Museum

10:45 – 11:00am	**Flexing our Mussels: Comparative Bivalve Gill Morphology** *Hannah Wirthshafter*, Carnegie Mellon University
11:00 – 11:15am	**Diversity of Venus clams: building an online resource for species identification** *Katherine Anderson*, University of Michigan
11:15 – 11:30 am	**Digitization of Identification Keys of Flower-Loving and Mydas flies** *Sara Parilo*, Roosevelt University
11:30 – 11:45pm	**Evolution and ecology of Neotropical rodents and bats** *Lauren Hennelly* , University of Wisconsin-Madison
11:45- 1:00pm	**Lunch Break**

Session 3

Moderator: Nathan Smith

University of Chicago and Dept of Geology, Field Museum

1:00 – 1:15pm **Measuring the quality of the avian fossil record to explain the 'rock-clock' divide of the avian evolutionary timescale**
Gregor-Fausto Siegmund, University of Chicago

1:15 – 1:30pm **Do orbit dimensions predict daily activity patterns in rodents?**
Stephanie M. Smith, John Hopkins University

1:30 – 1:45pm **Endocranial and inner ear anatomy of *Cryolophosaurus ellioti* (Dinosauria: Theropoda) from the early Jurassic of Antarctica: Implications for dinosaur phylogeny and braincase evolution**
Vernon Meidlinger- Chin and *Elizabeth Fisher* (Augustana College)

1:45 – 2:00pm **Shortwave sensitive opsins in the Euarchonta - a preliminary analysis**
Graham Haviland, University of Chicago

2:00 – 2:15pm **Coffee Break**

Session 4

Moderator: Dr. Stefanie Kautz

Postdoctoral fellow, Dept. of Zoology - Insects, Field Museum

2:15 – 2:30pm **Resolving species limitations among the lichen genus *Melanohalea***
Warren Chatwin, Brigham Young University

2:30 – 2:45pm **Cryptic diversity and evolutionary relationships in lichen-forming fungi**
Sergio Garcia, DePaul University

2:45 – 3:00pm ***Tayloria mirabilis* spore dispersal via insects in the southern hemisphere**
Kimberly Mighell, University of North Texas

3:00 pm **End of Symposium**

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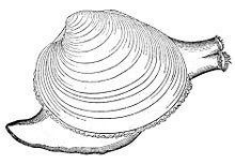
ABSTRACTS

Diversity of Venus clams: building an online resource for species identification

Katherine Anderson, University of Michigan, and Dept. Zoology - Invertebrates, Field Museum of Natural History, Chicago, IL

Venerids, commonly known as Venus clams, are the most diverse family of marine bivalves, with over 500 extant species. They are found on every continent except Antarctica, and many are edible, commercially collected and cultured, comprising an important food source worldwide. Despite their prevalence and economic importance, there is still no freely accessible, online catalogue available to aid in recognition of venerid species. Species identification is crucial not only for economic reasons, but also for conserving biodiversity and ensuring accuracy in scientific studies. An online catalogue consisting of individual species pages with detailed morphological descriptions and high quality photographs is being built in order to provide a resource that is both complete and available for anyone to use. Specimens from the collections of the Field Museum of Natural History were identified to species level using primary and secondary literature. Following identification, the morphology of the shell of each species was thoroughly described based on characteristics of all specimens available. Descriptions include details of overall shape and coloration, as well as features important for bivalve taxonomy, such as the morphology of the hinge teeth, lunule, escutcheon and ligament. In order to aid in identification, differences among similar species that may be commonly confused were also noted on each species page. High quality photographs of the dorsal view, external and internal views of one valve, and the hinge plates of both valves were taken of a representative specimen of each species. Species pages were published on eBivalvia, a collaborative database for information about bivalves, which shares its contents with the Encyclopedia of Life. In addition to species pages, genus pages were also created containing descriptions of characteristics shared by all species within a genus. At this time, over 100 species of venerids have been described and photographed. The species pages may become more comprehensive in the future, as information such as habitat and distribution is appended. The online catalogue not only documents the diversity of Venus clams, but also provides an accurate and accessible resource for species identification that can be utilized by researchers, students and shell collectors, as well as conservation agencies and fisheries.



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Resolving Species Limitations Among the Lichen Genus *Melanohalea*

Warren Chatwin, Brigham Young University, and Dept. of Botany, Field Museum of Natural History, Chicago, IL

Lichens are known for being difficult to identify morphologically, so with the decreasing costs of DNA sequencing lichen classifications are being revised. In 2004 the lichen genus *Melanohalea* was created from the genus *Melanelia* after a study of morphological and molecular characteristics. In this study we are using two ribosomal markers, one mitochondrial marker, and three protein coding markers to determine the molecular phylogeny of 13 of the 22 recognized species of *Melanohalea*. Our findings indicate that the classification of *Melanohalea* is overall mostly correct with each lineage forming monophyletic groups, but those groups often have different sister taxa from gene to gene therefore each gene tree is not congruent with the others. There are also cryptic lineages present among a few species. The trees were created using total data as well as a coalescence approach. Further studies will be needed to completely resolve the relationships among these groups.

PHOTOGRAPHER: D. Bochkov , see at: http://www.eol.org/pages/6370630

The phylogeny of scorpionfishes and stonefishes (Teleostei: Scorpaenoidei) and its implications for the evolution of venom

Elizabeth Everman, William Jewell College, and Dept. of Zoology, Field Museum of Natural History, Chicago

Morphological and molecular datasets are combined to analyze the inter-relationships and intra-relationships of the Scorpaenoidei fishes. This phylogenetic analysis is also used to infer the evolution of characters such as the evolution of venom, live birth and modified pectoral rays. Data were collected for 50 taxa representative of three outgroups and 18 scorpaenoid families, including the venomous Scorpaenidae, Sebastidae, Setarchidae, Synanceiidae, Apistidae, Tetrarogidae, Aploactinidae, Gnathanacanthidae, Neosebastidae, and their relatives Pataecidae, Bembridae, Parabembridae, Plectrogeniidae, Congiopodidae, Triglidae,

Peristediidae, Hoplichthyidae and Platycephalidae. The scorpaeoid relationships are distinct from previous hypotheses based on either morphological or molecular data. Ancestral states reconstruction shows that the evolution of characters such as venom and pectoral rays occurred multiple times. It is probable that an increased number of taxa will provide greater insight and further resolve the interrelationships and intra-relationships of the scorpaenoid fishes.

Endocranial and inner ear anatomy of *Cryolophosaurus ellioti* (Dinosauria: Theropoda) from the early Jurassic of Antarctica: Implications for dinosaur phylogeny and braincase evolution

Elizabeth A. Fisher,[1] *Vernon J. L. Meidlinger-Chin*,[1] William R. Hammer,[1] Peter J. Makovicky,[2] and Nathan D. Smith[2,3]

[1] Department of Geology, Augustana College, 639 38th Street, Rock Island, Illinois 61201, U.S.A.; [2] Department of Geology, The Field Museum of Natural History, 1400 S. Lake Shore Drive, Chicago, Illinois 60605, U.S.A.; [3] Committee on Evolutionary Biology, University of Chicago, 402 Culver Hall, 1025 E. 57th Street Chicago, Illinois 60637, U.S.A.

Cryolophosaurus ellioti, a theropod dinosaur discovered in 1991, represents both the most complete dinosaur skeleton from Antarctica and the largest theropod from the Early Jurassic. The holotype skull, FMNH PR 1821, contains a nearly complete and undistorted braincase. Noninvasive studies of braincase anatomy are possible through readily available CT scanning technology. Our research will provide a detailed comparative anatomical description of the endocranial and inner ear anatomy of *Cryolophosaurus*. These data will be used to assess: **1)** the timing and pattern of braincase evolution in theropods; **2)** the origin and evolution of novel avian neuroanatomical features; **3)** the phylogenetic signal of braincase characters, and **4)** behavioral and paleobiological aspects of *Cryolophosaurus*. The skull was scanned using an industrial scanner at the Ford Motor Company and the endocranial and pneumatic volumes will be rendered out to create a three-dimensional reconstruction. Raw scans reveal new information on the bony elements of the braincase (e.g., a dorsal sulcus on the parasphenoid rostrum, a well-defined pituitary fossa), aspects of neuroanatomy (position and relative size of the olfactory bulbs), as well as evidence for extensive pneumatization (e.g., an expansive basisphenoid recess, contralateral pneumatization of the occipital condyle). This wealth of data will yield novel insights into dinosaur behavior, anatomy, and phylogeny.

Cryptic diversity and evolutionary relationships in lichen-forming fungi
Sergio Garcia, DePaul University and Dept. of Botany, Field Museum of Natural History, Chicago, IL

In general, lichen species are catalogued by traditional phenotypic means, grouping together species of similar traits. Molecular genetics has revolutionized the ability to assess the known traditional species. Mounting evidence suggests a substantial number of lichen-forming fungi lie hidden within said species. We focused on the genera, *Melanelixia* and *Melanohalea*, using DNA sequencing to create phylogenetic trees. These diagrams work as analytical tools. Cryptic species were identified in a few morphologically-circumscribed species within both *Melanelixia* and *Melanohalea.*

Functionality of the Short Wave Sensitive Opsin in Euarchonta
Graham Haviland, Dept. of Biology, University of Chicago, and Pritzker Laboratory for Molecular Systematics and Evolution, The Field Museum of Natural History, Chicago, IL

The short wave sensitive opsin gene (SWS1) codes for a photosensitive pigment found in the s-cone cells of the retina in the mammalian eye. While it was once hypothesized that nocturnal mammals lost opsin functionality due to the limited utility of color vision in low light environments, studies have shown that many have in fact retained functional opsin genes. We used PCR techniques to sequence the SWS1 gene in species of the three closely related orders that comprise the grandorder Euarchonta: Scandentia, Dermoptera, and Primates. These sequences were examined to determine the functionality of the gene in each taxon and, where possible, the wavelength to which the gene is tuned. Lastly, we generated a gene tree for SWS1 using six species of mouse lemur (*Microcebus*).

Evolution and ecology of Neotropical rodents and bats
Lauren Hennelly, University of Wisconsin-Madison, and Dept. Zoology – Mammals, Field Museum of Natural History, Chicago, IL

The Neotropical fauna of South America encompasses some of the most diverse and magnificent mammal species in the world. With 1,145 mammal species inhabiting a range of ecosystems, from the vast Amazon rainforests to the peaks of the Andes mountains, these animals exhibit dramatic variation and niche specialization still unknown to science. Among the 12 mammal orders that inhabit the Neotropics, my project focuses on Rodentia and Chiroptera, or commonly known as rodents and bats. The lineage of rodents that are endemic to South

America, Caviomorpha, have diversified to inhabit wide niche variations, some in the place of ungulates and squirrels, resulting to an even wider range of adaptation and morphology. Ecological and reproductive information was compiled for caviomorph rodents from a variety of sources to construct a database of variables, which will ultimately be combined with a corresponding phylogenetic tree to discover how caviomorphs have diversified throughout time. This database encompasses 14 reproductive and 9 ecological variables with over 700 species incorporating a wide range of outgroups including Phiomorpha, Ctenodactylidae, Hystricidae, Pedetridae, Sciuridae, Geomyidae, and Criceridae. Furthermore, in order to study the diversification of Neotropical mammals and understand present-day biodiversity patterns, it is essential to correctly identify captured specimens to species. Through a field expedition to Ecuador for three weeks in June, Dr. Bruce Patterson collected 194 bat specimens, which allowed me to analyze the 42 bat species through statistical and genetic analysis.

Gill structure of the Bivalvia, Scientific Illustrations

Martha Iserman, California State University, Monterey Bay, and Dept. Zoology - Invertebrates, Field Museum of Natural History, Chicago, IL

The term illustration is used to describe artwork that is meant to convey a specific message to the viewer, and science illustration does so for the many scientific disciplines. Illustrators in this field therefore need to be both scientifically literate and artistically trained. The work produced by science illustrators ranges from highly detailed to general overviews, stylized to diagrammatic, literal to abstract, and can be done in both traditional and digital mediums. Some illustrations demand great detail and precision, while others require a more expressive and conceptual approach, which requires flexibility in the illustrator and their skills. A major misconception about imagery that accompanies research is that it all can be done with photography. While this may be true for many cases, there are major restrictions to what a camera can portray, such as reconstructing extinct species from fossil records. Photography is also limited in how it captures a subject, whereas a science illustrator can add emphasis to certain attributes and compile a variety of information into one image that is physically impossible in the natural world. Transparencies, cutaway drawings, glow-through illustrations, and exploded diagrams are just a few of the techniques used to accurately include layers of information in an illustration.

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Tayloria mirabilis spore dispersal via insects in the southern hemisphere

Kimberly Mighell, University of North Texas, Research conducted within Omora Ethnobotanical Park, Pto. Williams, Magallanes, Chile.

Splachnaceae are a family of mosses set apart by a coprophilous nature. Additionally, it has characteristic morphological and chemical adaptations to this niche, some of which include attracting flies to disperse spores to dung. This relationship, however, has only been recorded in the northern hemisphere. One species of Splachnaceae, *Tayloria mirabilis*, an endemic to the temperate rainforests of South America, is hypothesized to utilize flies to disperse spores to dung. This research involved investigating the spore dispersal of *T. mirabilis* within Omora Ethnobotanical Park within the Cape Horn Biosphere Reserve in Chile. Flies were trapped over T. mirabilis, analyzed with microscopy for spores and identified to family while the spores were germinated for comparison. Nine different species of Muscidae were found carrying spores of *T. mirabilis*, and this fly family is known to utilize dung for feeding/oviposition. For the first time, spore dispersal of a moss via insect has been recorded in the southern hemisphere.

The evolution of mutualism in plant-ants

William Montag, Bowdoin College, and Department of Zoology, Division of Insects, Field Museum of Natural History, Chicago, IL

Mutualisms play a vital role in generating complex relationships and behaviors between radically different groups of organisms. Among those organisms are three groups of ants within the genus *Pseudomyrmex* who have formed mutualistic relationships with acacia, *Tachigali*, and *Triplaris* plants. The ant species protect the host plant against herbivores and competing plants in return for plant-derived food resources and shelter. I generated sequence data and performed a phylogenetic analysis using sequences from both mutualist and generalist ants of the genus *Pseudomyrmex,* using *Tetraponera* as an outgroup in order to determine whether the ant-plant mutualism originated from a single ancestor common to all three plant-ant groups. The Wnt (wingless) and ef-1a genes were used to generate sequences for each sample that were then concatenated. A tree was generated using both Bayesian and Maximum Likelihood analysis that showed the acacia, *Tachigali*, and *Triplaris* plant-ant groups originating from different generalists. The phylogenetic analysis did not display evidence for a monophyletic ant-plant mutualism group within the genus *Pseudomyrmex*. The presence of convergent mutualisms in different *Pseudomyrmex* species groups may provide insight into the development of mutualisms. Further research into the initial stages of mutualism formation is necessary to determine why mutualism would occur multiple times in one genus and what environmental factors trigger the development of this behavior.

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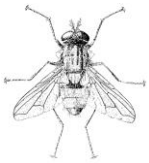
Photocredits: http://bio390parasitology.blogspot.com/2011/03/acacia-trees-acacia-ants-mutualism.html

Digitization of Identification Keys of Flower-Loving and Mydas flies

Sara Parilo, Roosevelt University, and Biodiversity Synthesis Center, Field Museum of Natural History, Chicago, IL

Dichotomous identification keys are used to describe new or unknown species of any type of organism. The keys use a system of choosing between two selections in order to eliminate the characteristics that the organism does not display. Once all the characteristics that the species does not display are eliminated, the last species left within the key is the species being described. The project that I worked on for the summer was digitizing identification keys of Mydas and flower-loving flies. In order to digitize these keys, the terminology needed to be updated, they needed to be translated into English, and photos of each fly were attached to the keys.



Lucid Phoenix Builder was the program used to deploy all keys to the web. Uploading these keys online will assist researchers around the world because they will be easily available to everyone. The accessibility of the keys will allow species to be described in a more efficient way, instead of scientists having to receive books/journals/specimens from around the world. The world of science is entering a new era by having almost everything available on the web, and this new virtual world is proving to be very helpful for research scientists across the globe. Projects can be carried out in a more timely manner thanks to the availability of the tools on the internet.

Measuring the quality of the avian fossil record to explain the 'rock-clock' divide of the avian evolutionary timescale.

Gregor-Fausto Siegmund, University of Chicago, and Dept. of Geology, Field Museum of Natural History, Chicago, IL

Over the course of the past two decades, a series of studies have posited that modern birds (Aves: Neornithes) diverged in the early to mid-Cretaceous, suggesting that most modern orders were present prior to the Cretaceous-Paleogene (K-Pg) extinction event 65.5 million years ago. Nearly the entire, reliable neornithine fossil record, however, is younger than the K-Pg boundary, a discrepancy that has made establishing an absolute timescale for modern avian origins contentious. Explanations pinning the incongruity in estimates on inadequate molecular rate models or on a poor and an unevenly sampled fossil record abound, yet comprehensive tests of the latter are lacking. To address this issue, I compiled and annotated a database of stratigraphic horizons, completeness of material, and taxonomic assignment for Mesozoic and Paleogene avian fossils. Raw measures of taxonomic diversity through time, of basal and modern birds, show both lower standing diversity and uneven sampling in the Mesozoic. The latter conclusion is likewise supported by the Simple Completeness Metric, a measure of fossil record quality, which suggests that avian orders are far less well-sampled in the Mesozoic than in the Cenozoic. A further gap analysis, which places confidence intervals on observed fossil horizons, supports this result and suggests that past studies that have calculated confidence intervals for avian orders by assuming a random distribution may have been too assumptive. Sister group relationships have also been unaccounted for in these studies, indicating that there is at least some room to decrease the rock-clock divide. While these metrics point to a level of neornithine diversification in the Cretaceous, discord between molecular and paleontological approaches remains, suggesting that fossil sampling alone does not account for the disagreement in divergence dates.

Do orbit dimensions predict daily activity patterns in rodents?

Stephanie M. Smith, John Hopkins University and Dept. of Geology, Field Museum of Natural History, Chicago, IL

Inability to directly observe the activities of extinct species means that all information must come from specimens and geologic context. However, this information is limited; for example, how does one determine patterns of daily activity based only on skeletal remains? Successful distinction among nocturnal, diurnal, and crepuscular amniotes has been achieved in those organisms having bony structures that provide close eyeball

size correlates, including the scleral ring and postorbital bar; these structures can indicate, according to optical principles, whether an organism is adapted to a high- or low-light environment. But some taxa do not possess these features, and those that do often have them poorly preserved. Other eye size correlates are available, but their reliability as predictors of diel activity pattern has not been established in mammals or basal non-mammalian synapsids. Here we use skeletal data from 51 species of extant sciurids and one fossil specimen to determine the possibility for such predictions. Using a variety of statistical analyses, we show that the use of orbital dimensions alone is sufficient to distinguish nocturnal species from non-nocturnal species, but only in cases of morphological extremes. However, differences in structure between extant sciurids and basal non-mammalian synapsids indicate that it might be possible to obtain a cleaner distinction in the latter group.

Strategies of acacia-ants: to grow or reproduce

Arista Tischer, Harold Washington College and Dept. of Zoology - Insects, Field Museum of Natural History, Chicago, IL

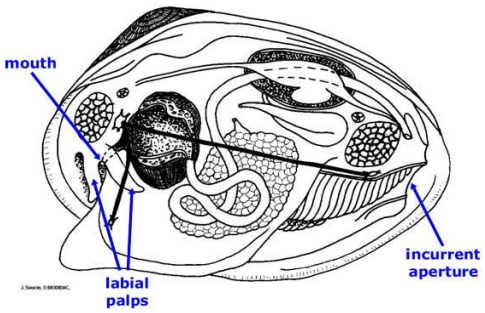
In the mutualism between *Pseudomyrmex* ants and acacia plants, the ants defend their hosts against herbivores, and encroaching vegetation. In return, the plant provides nesting space in hollow thorns and produces extrafloral nectar and protein-rich beltian bodies as food rewards. However, some *Pseudomyrmex* and other ant species - referred to as parasites - can take advantage of these resources without protecting the plant. Ant colonies usually consist of a reproducing queen and sterile workers that perform colony tasks. Sexuals (so-called alates) represent the next generation of a colony. We wanted to investigate whether mutualists invest more in host plant protection via workers and whether parasites invest more in reproduction via alates. In this study, we focused on three mutualistic and two parasitic ant species. We could show that colonies of mutualists always contained more individuals (average of 1,064 workers/acacia) than parasites (average of 114). In contrast to our predictions, one mutualist species (*Pseudomyrmex ferrugineus)* produced more male alates than the other species. This observation might be due to the fact that parasite colonies were rarely complete with queens missing (28.6%; n=7 colonies), while for the mutualists we found queens in 62.5% of the colonies examined (n=16). As parasites depend less on their host, it is important to consider differences in habit selection. I reconstructed a molecular phylogeny including all five focal species demonstrating that the mutualists and parasites each evolved from generalist ancestors. This finding highlights different evolutionary pathways of both life styles that help to explain

differences in colony composition and habitat selection. Future studies might benefit from larger sample sizes to increase the chances of finding complete colonies.

Flexing our Mussels: Comparative Bivalve Gill Morphology

Hannah Wirtshafter, Carnegie Mellon University, and Dept. Zoology - Invertebrates, Field Museum of Natural History, Chicago, IL

The dual-shelled bivalves are arguably the most widely used class of mollusks: their organs are used for food, their pearls for jewelry, and their shells for decoration. Despite their many uses, detailed morphological analysis using modern techniques has not been thoroughly carried out on the majority of known species. The aim of the NSF funded BivAToL project is to assemble the bivalve tree of life, using morphological and molecular data. Within our study, I used scanning electron microscopy to analyze the gills and labial palps of 25 species of bivalves, with a focus on the superorders Pteriomorphia and Palaeoheterodonta**.** The gills and labial palps, which are essential for feeding, reproduction, and respiration, are an important character complex for determining phylogenies due to their high complexity and variability. Gill and labial palp novel character states were then identified and the species morphology was analyzed and specific characters were traced on recent phylogenies. The comparative analysis was then used to reconstruct a morphological phylogeny and to postulate a hypothesis on the evolutionary history of the gill and labial palp complex, which was then compared with evolutionary trees obtained through DNA sequence data.



Participants

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