American Arachnology

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2009 — Arkansas Tech, Russellville, Arkansas
2010 — Greenville, N.C.
2011 — Lewis & Clark College, Portland. Oregon
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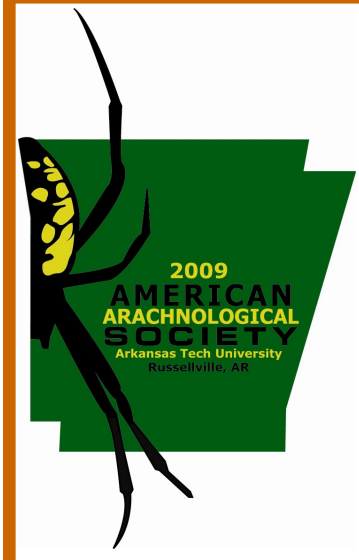

2009 AAS Annual Meeting

Arkansas Tech
Russellville, Arkansas

Friday, 26 June – Wednesday, 1 July

hosted by

Dr. Tsunemi Yamashita

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Report from the 32nd Annual A.A.S. Meeting

UC Berkeley, Berkeley, CA

hosted by

Dr. Rosemary Gillespie
&
Dr. Charles Griswold

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Report from the 32nd Annual A.A.S. Meeting UC Berkeley, Berkeley, CA 25-30 June 2008

hosted by

Dr. Rosemary Gillespie & Dr. Charles Griswold

In 2008, the 32nd AAS conference was held on the campus of the University of California at Berkeley. The meeting started out with a reception in the evening, giving everyone time to socialize and become reacquainted. Oral presentations commenced the next morning, the first topic focusing on systematics and evolution, subsequent sessions on mating biology, paleontology, and ecology and diversity. The poster session started the first night, with a rich array of displays on a broad array of topics, presenters coming from across the USA, Canada, Mexico, Australia, New Zealand, Taiwan, Korea, Iran, and Slovenia. The next morning saw a second series of oral presentations, with the casual arachnid presentations in the evening. This highly entertaining event included outstanding macro photography by Jillian Cowles and a brief and poignant historical review by David Richman who showed photos of several individuals in the beginning of their careers.

The final day of the meeting concluded the oral presentations, topics on this day including venom and silk, systematics and evolution, ecology and conservation, solifuges and other arachnids, and bioinformatics. All presentations throughout the meeting were of exceptional quality and clearly show that arachnological research is gaining momentum and has a bright future. Student presentations in particular incorporated a variety of novel approaches and ideas that are leading the field into exciting new directions. One theme running throughout the presentations was the synthesis of multiple data sources, oftentimes from unrelated fields, to address research questions. Evolution and systematics presentations, for example, routinely used behavioral, ecological, molecular, and morphological data to address phylogenetic questions. Ecological studies also included a broad range of data, some of which had been collected for over fifteen years. Among the highlights from the conference were Edgar and Black's time lapse photography of spider embryology, Gordon and Uetz's recording of seismic patterns in *Schizocosa*, and Stockman and Bond's cohesion species approach.

The meeting concluded on Saturday evening with the annual business meeting after a day of presentations. Attendees then reconvened in the courtyard of the historic Valley Life Sciences Building for food, student awards, and the silent auction. The auction saw Rick Vetter in various roles, including running around in spider-themed undergarments and taking up a collection for George Uetz to perform a spider sing-song. As with other social events, the banquet was given a California flavor, with a plenitude of wine from the Lodi-Woodbridge, E&J Gallo, and Pacific Vineyards. So, despite the chilly weather, arachnologists were in excellent spirits, and were probably a bit sleep-deprived for the next day's field trips.

AAS 2008 Field Trip reports

Napa Wine Tour, June 29, 2008, by Peter Croucher.

A group of (about) ten participants undertook a 'field-trip' to one of California's world famous wine-growing regions: the Napa Valley. Setting off in a mini-van, we left the cold, windy and foggy Berkeley summer to find better weather. We were rewarded by a warm and sunny day and even the smoke from the thousands of fires across Northern California was largely absent. Under the expert guidance of Joel Ledford and his wife, we visited four wineries.

The first stop was the beautiful and grand, family-owned estate winery of St. Supéry with its wine-inspired re-interpretations of classical Mediterranean frescos and its outstanding Sauvignon Blanc, Cabernet Sauvignon and Élu & Virtú blends. The party enthusiastically sipped wines and made their first purchases of the day.

The next stop was the more bijou reserve tasting rooms in the original winery of the Beaulieu wine estate. Founded by frenchman Georges de Latour and his wife Fernande in 1900 and most famous for his introduction of *Phylloxera* resistant European rootstock and the George de Latour Private Reserve Cabernet Sauvignon – which became Napa's first 'cult' Cabernet Sauvignon. In keeping with tradition, our party was served a welcome drink – a young and slightly 'sherried' rosé, followed by more tasting.

Lunch was in the stunning gardens of the V. Sattui estate. Here the party relaxed in the summer sunshine and enjoyed the gourmet grilled foods and pizza offered by the winery, together with the deli and cheese shop and of course, the tasting rooms – for those who needed no break from wine tasting. Founded in 1885, the V. Sattui winery is special; not only do its wide variety of wines regularly bring the accolade of "Top Winery in California", they have no outside distribution and can only be purchased at the winery, by mail-order or online. A lunch-stop here is a must for anyone passing through the Napa Valley.

At this point our guide left us and we moved on to our final winery, on the less traveled Silverado trail to the east of Calistoga and the secluded and balconied Rombauer winery that is nestled on a forested knoll over-looking the Napa Valley and its western mountains. A young winery, founded in 1982, Rombauer wines are featured in many top restaurants. Perhaps the most memorable aspects of this visit were the terraced gardens and the cave system to which they led. As a perfect end to our brief indulgence into finery, we were given an impromptu tour of the miles of specially tunneled and highly aromatic caves that the winery has created in the hillside to provide the optimum temperature and humidity for aging their wines.

Satisfied, we meandered back along the scenic Silverado trail before finally joining the Bay Area traffic once more and returning, sleepy, to a tempestuous Berkeley summer evening.

Tilden Park, June 29, 2008, by Tsunemi Yamashita

The arachnid collecting trip took place at Tilden Regional Park. After a couple of missed turns, we caught up with the lead van and got to the drop off site on the park's south end. The park is in the east Bay's upland area with open habitat mixed with scrubby brush and large redwood trees. It was a nice area to visit with many other users on the trails and roads. From some of the upper elevations, a good view of the surrounding area could be seen showing the typical coastal California habitat. For the most part, collecting was a bit sparse but still worthwhile as the day was sunny with pleasant temperatures and air. After dispersing along the trails and collecting a few spiders, several participants met back at the vans for a casual box lunch. The trip wrapped up in the early afternoon allowing time for an early dinner.

Abstracts of Symposium, Poster and, Oral Presentations - 32nd AAS Meeting, Berkeley, CA 25 - 30 June, 2008

***designates student competition entry**

Podium Presentation Abstracts

Spider silk as a novel humidity-driven biomimetic muscle

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The abrupt halt of a bumble bee's flight when it impacts the almost invisible threads of an orb web provides an elegant example of spider silk's amazing strength and toughness. Spiders depend upon these properties for survival, yet silk's impressive performance isn't limited solely to tensile mechanics. For instance, spider dragline silk 'supercontracts' in high humidity. During supercontraction, unrestrained dragline silk contracts up to 50% of its original length while restrained fibers generate substantial stress. Here we discuss novel findings which demonstrate that dragline silk exhibits two qualitatively different responses to humidity. We show that supercontraction is a permanent, rate dependent, tensioning of restrained silk in response to high humidity, and that post-supercontracted silk differs in some mechanical properties from virgin silk. However, silk also undergoes a previously unknown cyclic relaxation-contraction response to wetting and drying, which involves cyclic intake and loss of water. These powerful cyclic contractions give silk the potential to act as a high performance, water-controlled, mimic of biological muscles, repeatedly generating work 50x greater than that of human muscle. Silk may emerge as a new and powerful model for biomimetic muscle with possibilities in designing light weight and compact actuators for various applications.

Phylogenetic relationships of the spider family Tetragnathidae (Araneae) based on morphological and DNA sequence data

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The limits, phylogenetic relationships and placement of tetragnathid spiders have been controversial for more than a century. Classifications prior to numerical phylogenetic analyses either recognized Tetragnathidae as a separate family, as a lineage of Araneidae, or placed some of its members in both families. There are three central problems regarding the higher level systematics of tetragnathids: the placement of Tetragnathidae in Araneoidea, the exact limits of the family and the monophyly and phylogenetic relationships of the various tetragnathid groups. Despite recent advances, some of these questions remain unsatisfactorily answered and robust cladistic support for several of these groups remains elusive. We have collected morphological, behavioral and DNA sequence data with the main goal of addressing the last two questions. To a lesser extent, our data also are relevant to the first question, since these three problems are hierarchically linked. In this presentation we will discuss our progress in the combined analysis of these data. Our morphological and behavioral phylogenetic analysis includes 48 terminal taxa scored for a total of 213 characters. In addition, we collected an approximate total of 6300 nucleotides positions form the 12S, 16S, 18S and 28S ribosomal subunits and for the protein coding genes cytochrome *c* oxidase subunit I and histone H3. We analyzed these data with dynamic and static homology criteria and we explored clade sensitivity to different data partitions. We also studied the sensitivity of the resulting clades to different phylogenetic inference methods (parsimony and Bayesian phylogenetics) and quantified clade support.

Revision of the genus *Padilla* Peckham and Peckham, 1894 (Araneae - Salticidae): Convergent evolution of secondary sexual characters due to sexual selection and rates of molecular evolution in jumping spiders

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The horned jumping spider genus *Padilla* restricted to Madagascar is revised. The genus comprises 15 species, which are diagnosed, described, and illustrated in detail. Three synapomorphies of the genus are proposed. Twelve species are new. A phylogenetic analysis of 38 morphological characters and two genes (COI and 28S) exhibit a conflict between the morphological and molecular hypotheses due to convergent evolution of the secondary sex traits such as horn shape, which appears to be due to sexual selection. The monophyly of the genus was confirmed both by the Ballinae morphological analysis (Benjamin, 2004) and the Salticidae 28S analysis (Hedin and Maddison, 2003). Within Ballinae, *Padilla* is the sister group of *Phylates*. Within Salticidae, *Padilla* is the sister group of two balline genera: *Pachyballus* and *Ballus* with which it forms a monophyletic group that is sister group to a clade including marpissoids, heliophanines, freyines, euophryines and plexipoids. Penalized likelihood was used to assess the average rates of molecular evolution of the 28S gene and the ages of the genus and members of the family Salticidae for the first time. *Padilla* diverged from the other ballines around 13.06Mya and the Ballinae sub-family from other salticids around 23.17Mya. Those ages are too recent for Gondwanan vicariance hypotheses, the "stepping stone" hypotheses offers a better explanation.

Evolution of male genitalia in the trapdoor spider genus *Myrmekiaphila* (Araneae: Mygalomorphae: Cyrtaucheniidae: Euctenizinae)

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The euctenizine trapdoor spider genus *Myrmekiaphila* comprises 11 species and is widely distributed throughout the southeastern United States. This group is probably best known for their interesting burrow architecture – they are the only mygalomorph spiders in North America that conceal their subterranean side chambers with a secondary trapdoor. These spiders were recently revised and placed into three informal species groups based upon differences in male genitalia, but a phylogenetic hypothesis has never been performed to assess monophyly of these groups. We present the first phylogeny for *Myrmekiaphila* based on DNA sequence data obtained from three mitochondrial and nuclear gene loci (*12S*, *16S*, and *28S*). We use this phylogeny as the evolutionary framework to examine the monophyly of these species groups, to test hypothesized species boundaries, and to comment on the evolution of male genitalia. Our phylogeny demonstrates that species groups (and some species) are paraphyletic, and results from ancestral character state reconstruction analyses show that the distinct forms of genitalia – particularly the absence of a secondary prong – have evolved in parallel (i.e., they do not form clades). These data suggest that characters ordinarily given heavy weight for delineating taxa in *Myrmekiaphila* need to be reconsidered and interpreted in light of this new phylogenetic evidence.

Reevaluation of the canonical model of spider gastrulation

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Gastrulation is a physical process in embryonic development that converts the simple polarities of the egg into the more complex organization of the later embryo. The main body axes arise during gastrulation as a consequence of the organized movements of cells into the interior. The historical literature on spider development reports that gastrulation occurs in one continuous phase with two cell types involved. First, cells internalize at a central blastopore to form the primitive plate, an early two-layered region. Then a group of these deep cells, the cumulus, detaches and migrates to the edge of the germ disc; the direction of migration determines the dorsal-ventral axis. We have studied gastrulation in four species using high-resolution video microscopy and improved histology. We find

that only *Cheiracanthium mildei* develops according to the model. In contrast, gastrulation in *Zygiella x-notata* and *Latrodectus mactans* involves precocious internalization of cumulus cells. In *Z. x-notata* additional cells internalize at a novel structure called the caudal bud. Primitive plate formation in *Loxosceles laeta* is preceded by widespread internalization of a unique population of cells we call cell islands; their fate is unknown.

Taxonomy and phylogeny of the *Tegenaria-Malthonica* complex (Araneae, Agelenidae) using morphological and molecular data – preliminary results

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Malthonica Simon and *Tegenaria* Latreille represent two species-rich genera of the family Agelenidae. They are predominantly Palaearctic in distribution. Currently 41 species and one subspecies are described in *Malthonica* and 101 species in *Tegenaria*, respectively. The group is notorious for its taxonomic problems: lack of diagnoses of the two genera, arbitrary generic assignment of species, availability of information for only one sex in many species, unknown internal phylogenetic relationships and presence in collections of additional undescribed species. Recently, several *Tegenaria* species were transferred to *Malthonica*, based on the embolus length, a character which is on its own not sufficient for phylogenetic reconstructions. An additional problem: *Tegenaria agrestis*, a species native to Europe and introduced into the USA, where it is blamed for biting humans and causing serious wounds followed by necrosis. In Europe, no such case is known. The question of conspecifity of the American and European populations can be answered as a by-product of the revision of the European *Tegenaria-Malthonica* complex. The phylogenetic relationships within the complex will be analysed using morphological and molecular methods. The following aspects are presented: 1) potentially useful morphological characters for delimiting the genera, 2) some taxonomical results and 3) preliminary molecular analyses.

Quality not quantity: Sperm viability not number determines male fertility in the harlequin beetle riding pseudoscorpion

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Despite decades of research since G.A. Parker's seminal papers on sperm competition, the factors responsible for variation in sperm competitive ability remain poorly understood. While numerous investigations have focused on total number of sperm per ejaculate, our findings on the harlequin beetle riding pseudoscorpion, *Cordylochernes scorpioides*, suggest that sperm viability may be the most important factor contributing to variation in male fertilization success. Because *C. scorpioides* males transfer easily quantified sperm in discrete packets, this pseudoscorpion provides a model system for determining the impact of ejaculate characteristics on male fitness. In a study employing live/dead fluorescent staining of sperm, we assessed sperm number and proportion of viable sperm in the first two spermatophores produced by 140 males. This study revealed that proportion of viable sperm is more variable between males and more repeatable within males than total sperm number. The two traits are, in fact, significantly negatively correlated, suggesting a trade-off between number and quality of sperm. Moreover, selection gradient analysis indicates that proportion of viable sperm is a better predictor of male fertility than either total sperm number or the total number of viable sperm. Given the importance of sperm viability to male fertility, the extreme variability in this character (coefficient of variation of 87%) seems paradoxical. Constraints on the capacity of selection to hone maternally-inherited mitochondria for sperm function may provide at least a partial resolution of this paradox. Preliminary data indicating high variation in proportion of viable sperm across *C. scorpioides* matrilines are consistent with this hypothesis.

Mechanical and material properties of silk from *Achaearanea tepidariorum* (Araneae: Theridiidae) differ within the web

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Spiders have up to seven different silk glands that yield different types of silk with distinct composition and properties. Moreover, the same type of silk can be used for many different functions. Major ampullate silk is used in web construction, as a safety line and as a way for spiders to mark their path. In Theridiidae, major ampullate silk is used to spin different components of the cobweb. The cobweb of the theridiid *Achaearanea tepidariorum* includes two components: a network of supporting threads and a series of vertical sticky gumfooted threads directly involved in prey capture. These two components function differently in ways that may require distinct material properties. Supporting threads were thicker and able to bear higher loads before breaking and before deforming permanently compared to sticky gumfooted threads. This could be needed to support spiders and prey. In contrast, sticky gumfooted threads were stretchier and tougher, which allowed them to better absorb kinetic energy during prey capture. Thus, threads formed of the same silk, despite having the same composition, can present different material properties depending on the conditions under which they are spun.

Has passive re-colonization successfully replaced the spider assemblage on a restored tall grass prairie in Ohio?

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The reconstructed prairie on the campus of the Marion Campus of Ohio State University has been in existence since 1977. Restoration efforts have focused on plants. The animals present on the site have re-colonized without active management. Spider assemblages were sampled after 23 years at this restored prairie and compared to those sampled on two remnant prairies, and two old fields. Sampling methods included pitfall traps and sweeps. A total of 1,541 identifiable spiders representing 94 species were captured, about 91% of these with the pitfall traps. There is some evidence that the restored Marion Campus Prairie is inhabited by an assemblage of spiders resembling those present on remnant prairies.

Association of spider abundance with El Niño events: 15 years of data from 3 elevations in the Jemez Mountains, New Mexico

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The El Niño weather pattern strongly affects precipitation in the southwestern US, generally producing more precipitation than average (El Niño) or less precipitation than average (La Niña) from October to May. In the Jemez Mountains of north-central New Mexico I use pitfall traps to monitor ground-dwelling arthropods at three elevation zones: pinon-juniper woodland (1948 m), ponderosa pine forest (2454 m), and mixed conifer forest (2717 m), and ask how the fauna in each zone are affected by these events. Here I report on richness and abundance data for 7 families of spiders from 1993-2007. Results showed that single wet or dry years did not produce significant changes in spider abundance, but a series of wet or dry years had a strong impact. The mostly dry years 1995-1997 and 1999-2004 greatly reduced abundance at all sites, with the pinon-juniper habitat affected most strongly. Abundance during the wet years 1991-1994 and 2005-2007 was more variable across taxa and elevation zone. Cluster analysis based on spider abundance showed that dry years clustered together, but the two extended wet periods did not. Species tended to remain in their elevations zones rather than move during the extended wet or dry periods. Dominant species remained dominant throughout the 15 years, while rarer species reached very low numbers or were not collected at all during dry years.

Phylogenetic placement of the jumping spiders (Salticidae) of Gabon- implications for biogeographic

patterns in body forms

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Jumping spiders (Salticidae) constitute the most species rich family of spiders, with 5000 known species worldwide. Prior to this study, molecular phylogenetic sampling has emphasized New World taxa with some inclusion of groups from Australasia. Little work has been done to understand the diversity from tropical forests in Africa. Here we present a phylogenetic tree with expanded sampling and discuss the evolutionary placement of species from Gabonese tropical forests. We also present a novel primer set for amplifying Actin 5C, a nuclear gene that may prove useful for spider phylogeny.

Analyses based on 28S, Actin 5C, CO1 and 16SND1 data suggest there is a previously unrecognized, independent radiation of jumping spiders unique to Central Africa. Our findings are concordant with previous studies that suggest that many large salticid clades are endemic to a continental region, or nearly so. Isolated radiations on different continents show a similar spectrum of body forms, which may reflect a corresponding diversity of ecological niches occupied. This suggests that body form convergence is widespread in Salticidae and that whole, independently evolving communities may be converging in ecomorphological make-up.

The maritime life of Peruvian coastal solifuges

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The coastal Peruvian desert is one of the driest ecosystems in the world, much of it appearing as barren land devoid of vegetation. Despite its scant primary productivity, this moonscape is inhabited by an abundant arachnid fauna, including large populations of seabird ticks, terrestrial pseudoscorpions, spiders, scorpions and solifuges. How can these animals succeed in such harsh environment? Here we present data supporting the hypothesis that marine productivity is subsidizing populations of two species of solifuges, *Chinchippus peruvianus* and a new *Chinchippus* sp. from Isla La Vieja, Paracas National Reserve. In the first species, individuals feed on intertidal crustaceans, and reach densities of up to 6 solifuges/sq m (mean 1.19 ± 0.14 solifuges/sq) m in the intertidal zone. The number of solifuges decreases with distance from shore. At La Vieja, *Chinchippus* sp. was found in seabird colonies, and likely feed on seabird ectoparasites and arthropod scavengers. Carbon and nitrogen stable isotope analysis indicates the marine source of energy and nutrients for these solifuges. An analysis of stomach contents of one predator of both species, the gecko *Phyllodactylus angustidigitus*, suggests that solifuges are more frequent in insular habitats and the desert adjacent to bays than they are in the desert away from shore or along the cliff-bound shoreline. This study shows how solifuges, by extending their niche to intertidal and insular habitats, can successfully colonize a hyper-arid coastal desert.

Microhabitat types influence soil mite diversity in Northwest forests

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Acari are an extraordinarily diverse order of arachnid, and the most abundant taxon of soil arthropods. Although Acari make up a significant portion of the soil food web, we know little about their abundance, diversity, and factors that influence their micro-distribution. Because Acari are so abundant and are environmentally sensitive, they can be used as indicators of the greater soil arthropod community. Our goal was to compare soil mite diversity between soils with different nitrogen inputs. *Alnus rubra* (Red Alder) has a symbiosis with *Frankia*, an actinomycete that forms nitrogen-fixing nodules on the tree's roots. A significant portion of this nitrogen is directly incorporated into *A. rubra's* biomass, and the decomposition of its tissues causes soil in *A. rubra* stands to be rich in nitrogen. If an increase in nitrogen in *A. rubra* soils significantly affects soil arthropod communities, one would expect to see a difference between mite communities present in *A. rubra* stands and those present in other forests. In this study, we compared the composition and structure of mite communities in two forest types; *A. rubra* stands and *Acer macrophyllum* stands. We found that mean Shannon-Weiner diversity index values were higher in *A. rubra* stands, though variation in the *A. macrophyllum* stands made the difference statistically insignificant. An analysis of similarity (ANOSIM) showed that mite communities are distinct between two *A. rubra* and two *A. macrophyllum* stands. These findings suggest that nitrogen inputs to soil by *A. rubra* in the form of litter create differences in soil microarthropod communities.

Patterns of evolution in Caribbean *Selenops*

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In the Caribbean, biodiversity has been shaped by fragmentation of islands from larger landmasses coupled with intermittent submergence, as well as formation of new land in the form of volcanic islands. Thus, the relationship between vicariance, dispersal, and *in situ* evolution in shaping island biota has long been a subject of debate. Although general patterns can be detected within lineages, there are fewer between lineages, and biogeography is often treated on a taxon by taxon basis. Only once the basis for the differences between disparate taxa are understood will we be able to make generalities in terms of underlying mechanisms of diversification, allowing greater insights into evolution, ecology and speciation on islands. The current study focuses on the genus *Selenops* (Selenopidae), which is extremely diverse in the Caribbean region. We use molecular (multi-gene sequence data) and morphological data from a broad geographic sample to examine whether observed patterns of evolution mirror those of geology. In general, colonization is limited and subsequent diversification is dictated by island age, size and isolation. Specific patterns revealed thus far include 1) Species from southern Caribbean islands generally cluster outside other Caribbean species; 2) *Selenops* in the southern Lesser Antilles are distantly related to those in the northern Lesser Antilles, a pattern mirroring that of similarly diverse *Anolis* lizards; 3) Islands with a greater diversity of habitat types and surface area have more species than smaller islands.

Structure of papillae on the pedipalps of solifuges – revisited

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Some male solifugids in the families Eremobatidae, Karshiidae and Solpugidae (Arachnida, Solifugae) have clusters of conical to hairlike projections on the ventral surface of the metatarsus of the palpal papillae. Previous work indicated that the ultrastructure of the papillae were consistent within families but varied between families. We present microstructural evidence from histogical examination (Transmission Electron Microscopy) that these papillae function as contact chemoreceptors and may be involved in perceiving chemical signals released by females.

Systematics and evolution of the Sclerobuninae (Opiliones, Travunioidea)

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The subfamily Sclerobuninae is a group of laniatorean opilions found in western North America, currently classified into the genera *Zuma*, *Sclerobunus*, and *Cyptobunus*. *Sclerobunus* species are typically found in forested habitats, and range from Arizona north into Idaho and west to Washington and Oregon. Described *Cyptobunus* taxa are restricted to cave habitats in Montana, Nevada, and Utah. Currently these genera are hypothesized to be sister genera. Using CO1 mtDNA and 28S nuclear DNA, we present a phylogenetic analysis of all sclerobunines. The genus *Zuma* is not obviously a sclerobunine, and neither *Cyptobunus* nor *Sclerobunus* are recovered as monophyletic. Within *Sclerobunus*, *S. r. robustus* is split into 5 genetically distinct, geographically concordant clades, which may represent cryptic species. *Sclerobunus r. idahoensis* is found to be more closely related to *S. nondimorphicus* than to *S. robustus*. Specimens morphologically identified as *Cyptobunus* are nested within *Sclerobunus*, with at least three independent ori-

gins suggesting repeated convergence to a cave-dependent morphology. Of particular interest are *Cyptobunus* specimens found near Taos, New Mexico. These particular *Cyptobunus* specimens were found deep in a rock pile, and are genetically closely-related to a syntopic population of *S. r. glorietus*. This suggests a recent, local transition to a "troglobitic" morphology in a non-cave environment.

A new genus of tetragnathid spiders from Australia with an expanded phylogenetic hypothesis for the generic relationships of Tetragnathidae

Dimitar Dimitrov & Gustavo Hormiga

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We present a newly discovered genus of tetragnathid spiders from Western Australia and discuss its phylogenetic placement using comparative data for a wide range of tetragnathids and outgroup taxa. The new genus is highly autapomorphic and has an unusual mixture of morphological characters, both genitalic and somatic. The phylogenetic study is based on a combination of morphological and molecular characters. We have also studied and sequenced several tetragnathid taxa whose phylogenetic position has been very poorly understood. The data have been analyzed using parsimony (both under direct optimization and static homology) and model based phylogenetic methods. We also explored the contribution of various data partitions to the phylogenetic pattern. The new genus forms part of a lineage that so far seems endemic to Australia and Tasmania. The addition of new taxa and the availability of data for some poorly studied genera provide new insights on tetragnathid phylogeny and evolution.

Molecular markers reveal deep divergence in the *Loxosceles rufescens* species group (Aranea: Sicariidae)

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Loxosceles rufescens is a widespread species of *Loxosceles* with a putative native range stretching from North Africa and Mediterranean Europe to the Middle East and Asia. Delineation of this species has been challenged by a combination of low inter-population variation in genital morphology, human-mediated dispersal confounding boundaries of their native range, and limited understanding of related species in Northern and Central Africa. We used molecular phylogenetic and network analyses of *L. rufescens* populations from around the world to (1) distinguish between native and human-mediated ranges, (2) identify populations divergent enough to warrant new species status within the *L. rufescens* species complex, and (3) gain insight into their divergence from other *Loxosceles* in the context of the Gondwanan split and North African biogeography. Analyses showed strong support for a monophyletic group containing Brazilian *L. amazonica*, West African *Loxosceles* and all *L. rufescens*, corroborating previous evidence that the common ancestor of *L. rufescens* and *L. amazonica* predates the Gondwanan split. A basal placement of some Moroccan and Canarian individuals within the *L. rufescens* clade and high percent divergences between some populations in this region and European, Asian and introduced populations suggest that *L. rufescens'* presence in Northwest Africa predates humans and there is more diversity in this group than would be expected for a single species. Morphological assessments of unidentified Central, Northern and Eastern African *Loxosceles* from various museum collections are underway and will help us better understand the extent of the range the *L. rufescens* species complex in Africa.

Phylogenetic analysis of embryonic development in eleven species of spiders

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The modes of embryonic development are potential characters for phylogenetic analyses. The development of two species, *Cheiracanthium mildei* and *Latrodectus mactans,* was investigated with time-lapse videography and histology; additional data on development in nine other species in eight families were coded from the literature. Several prominent heterochronies were detected, and these, along with time-independent morphological characters, were used to create a partial cladogram of the Araneae. This process recovered an accepted, although relatively poorly resolved, phylogeny, bearing a similarity to the tree proposed in Coddington (2005, in Ubick *et al* [eds.] *Spiders of North America*). Developmental character evolution was traced on a version of the Coddington tree, and suggested several developmental synapomorphies in the orb weavers + cobweb weavers, including the mode of gastrulation and sites of cell internalization. Moreover, a heterochronic shift in legbud appearance relative to the division of the left and right halves of the germ band mapped exclusively to the Entgelegynae. Developmental data, including the timing of events, may be a rich source of phylogenetic characters.

Exotic spiders established in Florida: a threat to native species?

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At least 50 species of exotic spiders have been confirmed as established in Florida, and about half that many different species have been intercepted but have not become established. The established exotic species are examined by origin, potential source of infestation, and habitat preference (feral or synanthropic). Nearly half of the introduced species are primarily synanthropic or both synanthropic and feral, whereas most of the primarily feral species occur in disturbed habitats. Nevertheless, reduced frequency of occurrence in collections in recent years suggests that populations of some native species may have been negatively affected by related or guild-similar invasive species.

Complex signal evolution in a diverse group of jumping spiders

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The interaction between complex sexually selected traits produced in different sensory modalities (multimodal signals) is poorly understood. Theory predicts that among a set of potential displays, animals will emphasize the most conspicuous, least costly and most "honest" displays and reduce the production of other suites of traits. In most of the animal groups studied, complexity in one suite of traits is inversely related to complexity of another suite of traits. Recently, the existence of complex substrate-borne (vibratory) songs was described in a jumping spider genus known for its elaborate visual ornamentation. We looked at the interaction between song and visual ornamentation throughout the genus to examine the evolution of display complexity. Contrary to expectations, complexity of visual and substrate-borne displays was positively correlated, suggesting selection for suites of multimodal traits rather than specialization in either modality alone. We discuss these results and their implication in signal processing and species diversification.

Character evolution in the genus *Synsphyronus* (Arachnida: Pseudoscorpiones: Garypidae)

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Systematic biologists ask questions about character evolution in order to better understand the evolutionary history of organisms. I investigated the evolution of ecological and morphological characters in the pseudoscorpion genus *Synsphyronus* (Arachnida: Pseudoscorpiones: Garypidae). *Synsphyronus* are found throughout Australia in semi-arid and arid habitats including the granite outcrops of southwestern Australia, where at least four lineages have been recovered. Trichobothrial pattern and number of tarsi show exceptional patterns of variation in *Synsphyronus*, and these characters were heavily weighed in forming hypotheses of evolutionary relationships in the genus. Trichobothrial pattern is usually fixed at the genus level while the number of pedal tarsi is typically fixed at the family level in most pseudoscorpions. I first inferred a species level phylogeny using molecular data from mitochondrial (*cytochrome oxidase*) and nuclear (*internal transcribed spacer region*) genes. Parsi-

mony and maximum likelihood methods were employed to reconstruct the evolutionary history of the characters on the estimated molecular phylogeny. I specifically tested whether trichobothria are lost but never gained, as predicted by the hypothesis that this character evolves by neoteny. Further, I tested the hypothesis that monotarsate taxa are monophyletic as outgroup comparison suggests. Finally, I investigated the ancestral habitat of *Synsphyronus* and the number of outcrop colonization events. Preliminary analyses suggest that trichobothria have been lost multiple times with no evidence of reversals and that the monotarsate species are not monophyletic. Ancestral state reconstruction analyses suggest that outcrops have been colonized several times.

New molecular and morphological insights into the systematics of New World buthid scorpions

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Scorpions in the New World buthid genera *Centruroides* Marx, 1890, *Rhopalurus* Thorell, 1876 and *Tityus* Koch, 1836 contain many of the world's most dangerously venomous species. Envenomation by these scorpions is a significant cause of morbidity and, in some cases, mortality in Mexico and the southwestern U.S.A., Central America, northern South America, and the Caribbean. Despite their medical importance, these genera are poorly defined and their relationships the subject of much speculation. New species continue to be discovered throughout their distribution and many putative widespread polymorphic species (according the biological species concept) turn out to be complexes of phylogenetic species upon reinvestigation. A morphological data matrix and DNA sequences from six loci in the nuclear (28S rDNA, 18S rDNA, Histone H3) and mitochondrial genomes (Cytochrome Oxidase I, 16S rDNA, 12S rDNA) were combined to produce a phylogeny with important implications for the evolutionary relationships among these genera. The diagnoses and current taxonomic status of some of the genera are discussed in light of the phylogeny.

Spatial resolving power of peg sensilla on scorpion pectines

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Pectines are mid-ventral, comb-like, chemosensory organs on all scorpions. Scorpions lower their pectines to the ground in quick intermittent 'taps' that last fewer than 100 ms and use them to detect substrate-borne chemical cues. The distal, ground-facing surfaces of the pectinal 'teeth' have thousands of peg sensilla, the fundamental units of taste reception on these organs. Some sand scorpions have up to 10,000 pegs per mm^2 or hundreds of pegs in an area the size of a sand grain; biologists have wondered why scorpions have so many sensilla. I hypothesize that the pegs are functionally redundant and serve as parallel samplers for fast, across-tooth averaging of stimulant intensity. To learn more about why scorpions have so many units for taste reception, we measured the chemosensory response of peg sensilla moved within chemical gradients generated by static clouds of volatile compounds. Though instantaneous spiking frequency could not resolve stimulant intensity, it is possible to derive accurate, real-time information of stimulant concentration by parallel averaging of information from several pegs. By merging the electrophysiological data with the time constraints of a pectinal sniff and the density of pegs on a pectinal tooth, chemical concentration cannot be resolved with fewer than seven pegs. Taken together with previous morphological studies that show topographical maintenance of neural projections from pectinal teeth to the scorpion subesophageal ganglion, and the size relationship of scorpion teeth to substrate particles, it appears that the pectinal tooth is the basic unit of information relay to the scorpion brain.

Molecular evolution and diversity of venom neurotoxins from black widow spiders

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The venom of black widow spiders (genus *Latrodectus*) contains α-latrotoxin, a powerful neurotoxin that causes mass release of transmitters from vertebrate neurosecretory cells and severe envenomation in humans. In addition to α-latrotoxin, *Latrodectus* venom contains other neurotoxins with similar molecular features but which selectively affect invertebrates. Collectively, these toxins are considered functionally distinct products of a single gene family (latrotoxins). At the molecular level latrotoxins have been well characterized in a single Eurasian species (*L. tredecimguttatus*). While latrotoxins are virtually unknown outside of *L. tredecimguttatus*, biochemical and clinical data suggest that these toxins occur in other *Latrodectus* species and related genera. To further investigate latrotoxin diversity, we have determined sequences of the *α-latrotoxin* gene from multiple *Latrodectus* species. Polypeptide sequences inferred from these data differ by many non-conservative amino acid substitutions, suggesting they may also exhibit significant functional differences in vertebrate toxicity. We interpret this interspecific genetic variation in light of reported variation in vertebrate toxicity across *Latrodectus* and related species and consider its evolutionary significance.

Seismic communication in *Schizocosa ocreata (Hentz)* wolf spiders: Influence of substratum on mating success and behavioral compensation for environmental constraints

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Courtship displays of male *Schizocosa ocreata* (Hentz) wolf spiders are multimodal, and consist of visual signals (e.g. leg tapping, waving and arching) as well as seismic signals (e.g., stridulation, percussion). In the complex forest floor habitat of *S. ocreata*, signals in one channel or another may be lost due to background noise or transmission properties of the environment, necessitating increased reliance on a single mode. As the microhabitat consists primarily of leaf litter, with patches of wood/bark, bare soil and rock, each with different seismic transmission properties, we tested whether the efficacy of these substrata affected the courtship displays of male wolf spiders and male mating success. In a habitat choice experiment, males and females visited each substratum with equal frequency, but spent longer periods of time on leaf litter. Use of seismic vs. visual signals varied significantly between substrata, and the frequency of certain visual displays (.e.g., leg waving and arching) was greater on rock and soil. Male courtship latency did not vary between substrata, but mating success was significantly greater on leaf litter. Our results indicate that males may compensate for limited transmission properties of certain substrata (e.g., rock, soil) by increasing time spent on others (leaf litter) and/or adding more visual courtship signaling behaviors. These results indicate that while males may prefer a leaf litter substratum, they may be able to change their courtship behaviors depending on the substratum.

Uncovering old cryptic species in a dynamic Californian landscape: Studies of the *Antrodiaetus* (*Atypoides*) *riversi* species complex

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The antrodiaetid mygalomorph taxon *Antrodiaetus* (*Atypoides*) *riversi* is currently classified as a single species, following the taxonomy of Coyle (1968). Both Ramirez & Chi (2004) and Starrett & Hedin (2007) used genetic data to argue for cryptic speciation within this taxon, the latter authors suggesting that perhaps five species exist under the current umbrella of *A. riversi*. Here we extend our prior studies of this species complex with a specimen sample that includes spiders from over 100 populations; DNA sequence data from 4 different genes (one mitochondrial, 3 nuclear) are used to study phylogenetic divergence in this population sample. Our analyses of these data support the following general conclusions: 1) the *A. riversi* complex likely includes eight separate species, all with relatively small allopatric and/or parapatric distributions, 2) phylogeographic structuring within species suggests extremely low

levels of gene flow, for both female (mitochondrial) and bisexual (nuclear) genetic systems, 3) studies of genetic divergence where cryptic species come into contact provide no evidence for gene flow (i.e., genetic barriers seem complete where we've studied them), 4) two different species have geographic distributions that span the Central Valley in a similar fashion; this replicated "trans-Valley" event may have resulted from log rafting on ancient rivers. In sum, studies of the *A. riversi* complex are providing a detailed glimpse into the biogeographic history of California, and invite many interesting questions regarding species delimitation and speciation mechanism in a highly genetically-structured system.

Differences in male and female foraging: Giant females play the lottery

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Spiders in the orb-weaving genus *Nephila* are famous for their extreme sexual size dimorphism, which is due primarily to differences in the number of juvenile instars. In addition, female *N. clavipes* show large amounts of variation in size and timing at maturity that is believed due primarily to differences in the number of juvenile instars. To test this hypothesis, I reared spiders from eggs laid by females collected in several Mexican populations and one Texan population. Spiderlings were randomly assigned to one of three different diets spanning the range observed in the field and reared to sexual maturity. The rearing experiment showed several unexpected patterns. First, there were sexual differences presumably related to small male size: males from all populations were capable of reaching maturity on any diet, but only females from Texas could regularly reach maturity on the low or medium diets. Second, female nutritional needs increased dramatically following the sixth molt. Third, even on the highest diet, developmental rates slowed dramatically in the seventh and eighth instars. I hypothesize that this may reflect the existence of a lottery-style life-history, where females are dependent upon the rare capture of large packages of resources in order to successfully reach maturity.

Black widow males prefer chemical and physical cues from well-fed females

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Recent work suggests that male widow spiders use silk-based, chemical cues to preferentially court and mate with virgin females. Here we report evidence that mating status is not the only signal being transmitted through web-based chemistry. Prey cues in a female's web also elicit heightened sexual interest from males. In the absence of the female, males courted significantly more intensely on the webs of fed females relative to the webs of adult females that had been starved. Similarly, in the presence of the female, males mounted well-fed females significantly faster than starved females. When females from each food treatment were switched to the web of a female from the opposite food treatment, males preferentially courted and mounted well-fed females in the webs of starved females, indicating that direct, physical communication between male and female is more important than indirect communication via chemical cues. Finally, we witnessed relatively high levels of pre-copulatory sexual cannibalism by starved females, suggesting that males benefit by using cues to discriminate against these food-limited females.

Spider predation as a limitation to the success of the beetle, *Diorhabda elongata* (Chrysomelidae) as an agent of biological control on the invasive saltcedar (*Tamarix*)

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The saltcedar beetle, *Diorhabda elongata,* has been useful for biological control in the management of the invasive weed saltcedar (*Tamarix sp).* Native predators, such as spiders may limit the beetle's success in the southwest. The goal of this project is to investigate the impact that spiders inhabiting saltcedar have on *D. elongata.* The spider fauna on saltcedar has been documented by field observations and collections from three field sites at Big Spring, TX. The most prevalent spider species were identified and assessed as potentially important predators of the beetle. Predation experiments were conducted in a quarantine laboratory on adult and larval beetles. Spiders from the families Araneidae, Dictynidae, and Salticidae were found most prevalently. Spider spp. from the Araneidae and Agelenidae were found to consume adult beetles. *Neoscona* was the most successful spider predator. Thus far spider impact on populations of *D. elongata* appears to be low.

A new strain of *Wolbachia* in the harlequin beetle riding pseudoscorpion: male killing, reproductive compensation and horizontal gene transfer

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The cellular endosymbiont, *Wolbachia*, kills or feminizes males or causes cytoplasmic incompatibility in a wide array of arthropod hosts. Here, we describe a new female-biasing *Wolbachia* strain (NFB) from the harlequin beetle-riding pseudoscorpion, *Cordylochernes scorpioides*. Pseudoscorpions are viviparous, with embryos developing in a translucent brood sac. This "external womb" facilitates visual assessment of embryonic development and the consequences of endosymbiont infection for host fitness. In an investigation that combined inheritance studies, antibiotic treatment and molecular assays, sex-ratio distortion was found to be maternally inherited and associated with lower than average reproductive success. Antibiotic treatment cured females of the *Wolbachia* infection, restored offspring sex ratio to 1:1 and significantly improved reproductive success. Photomicroscopy documented that, although infected *C. scorpioides* females produced similar numbers of early-stage embryos as tetracycline-cured females, they gave birth to significantly fewer offspring, indicating that female bias results from the killing of male embryos. Live/dead fluorescent staining of sperm revealed that the few surviving NFB males produced significantly fewer viable sperm than uninfected males, resulting in lowered fertility. Phylogenetic analysis, using multilocus sequence typing (MLST), indicates that the NFB *Wolbachia* strain is closely related to a strain previously described from *C. scorpioides*, but the two differ extensively in their *Wolbachia* surface protein gene sequences, possibly as a result of recombination with a nematode-infecting *Wolbachia* strain. This apparent horizontal gene transfer event is associated with dramatic strain effects on host fitness and the potential for endosymbiont spread within *C. scorpioides* populations.

The golden orb weaver: Update on *Nephila* taxonomy

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With the largest orb webs and extreme sexual size dimorphism, the pantropical spider genus *Nephila* has been the subject of hundreds of biological studies. Unfortunately, their prominence has spawned much substandard taxonomic work, bringing chaos to the nomenclature and despair to revisionary taxonomists, ethologists, ecologists, and other biologists interested in these fascinating spiders. Consequently, the most conspicuous tropical orb weaver with more than 150 available species names has not been revised since Dahl (1912). Two works attempt to fix the problem, the Australasian revision published by Harvey et al. (2007) and the ongoing worldwide revision reported here. The latter attempts to provide a globally consistent concept for *Nephila* species delimitation by examining over 2500 samples from all major collections and documenting intraspecific variation of unprecedented proportions. The total count of valid species is being reduced to only 14 (two in the Neotropics, seven in the Afrotropics, five in Australasia), and all other names are proposed as synonyms or *nomina dubia.* The monophyly of the genus and intrageneric species relationships are continually being tested via phylogenetic analyses of morphological, behavioral and molecular data. The revision, when published, will complete the taxonomy of Nephilidae, and the phylogenetic hypothesis will help understand the evolution of morphological (sexual size dimorphism, developmental plasticity) and behavioral (mating strategies, web biology) traits as well as facilitate new research into nephilid ecology, physiology and biogeography.

Islands underground: species limits, phylogenetics, and conservation of *Neoleptoneta* spiders in Texas caves

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Cave- adapted invertebrates are characterized by their unique morphology and extremely limited geographical distributions. Their patterns of endemism have made them conservation priorities, especially in the Southwestern U.S., where rapid population growth threatens sensitive cave habitat. Here we present a phylogeny of *Neoleptoneta* spiders in Texas, encompassing specimens from all published and several new cave localities, including the endangered species *Neoleptoneta microps* and *Neoleptoneta myopica*. Results show that several species are more broadly distributed than previously known, suggesting the presence of subterranean connections between caves. The phylogenetic history of *Neoleptoneta* reflects a pattern of repeated, independent invasion of caves within a relatively short geologic time scale providing support for a climate- relict hypothesis of speciation.

Systematics and Biogeography of *Callobius* (Amaurobiidae), a spider genus diverse in the California Floristic Province

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The California Floristic Province is recognized as a biodiversity hotspot in terms of both numbers of endemic species and threat to primary habitat, and is one of only five such hotspots occurring in a Mediterannean climate. *Callobius* includes many species believed to be narrowly endemic to the California Floristic Province. I present a phylogeny of *Callobius* inferred from Cytochrome Oxidase sequences, and discuss the evolutionary history of *Callobius* from a biogeographic perspective, in terms of various hypotheses of Geology and Phylogeography concerning the California Floristic Province and Western North America in general. A few new species are inferred from unexplainable haplotypes, and most putative narrow endemics are found to have merely been undersampled.

X-treme arachnids: Extraordinary patterns of molecular evolution

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Analyses of the mitochondrial genomes of arachnids are revealing diverse evolutionary novelties. Unique among all living organisms, opisthothele spiders have lost the sequence that encodes the last third of their transfer RNA genes. The canonical cloverleaf structure of tRNA has been lost multiple times during the evolution of arachnids, and instead tRNA genes encode only two of the three stems and loops. Some arachnid lineages also show evidence for the loss and de novo creation of a tRNA gene. Odd patterns of evolution extend across the mitochondrial genome, with protein-coding genes displaying a number of unusual features, such as changes in the identity of initiation codons and loss of stop codons. Many protein-coding genes are reduced in size compared to other arthropods. A reverse nucleotide bias has also affected the evolution of protein-coding genes in multiple lineages, leading ineluctably to changes in amino acids incorporated into these essential proteins. Together, these rare phenomena make arachnids an exceptionally special group for the study of molecular evolution.

Tolerance and agonistic behaviors in the brown recluse spider: effects of density and hunger condition

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We compared agonistic and tolerant behavior in brown recluse spiders (*Loxosceles reclusa*) from high and low density field population in the St. Louis area. Social encounters between recently captured females were staged in a Plexiglas arena and lasted for ten minutes. Results demonstrated that females from high density populations displayed significantly more tolerant behaviors as compared to agonistic behaviors, whereas females from low density showed no significant difference in tolerant and agonistic behaviors. Additionally, in the laboratory we tested for effects of hunger on spiders originating in low and high density populations. Methodology for social encounters was similar, but spiders had been transported to the lab and maintained in individual housing containers for several weeks prior to testing. The food-deprived group received a cricket every eight weeks; the fed group received a cricket every four weeks. Food-deprived spiders were tested only with food-deprived spiders; fed spiders were tested only with fed spiders. The most important finding was that, in general, tolerance behavior is much more frequent than agonistic behavior. However, tolerance was highest among high density unfed spiders compared to all other spider categories. This may have been due to greater activity in these spiders. These results support the hypothesis that population density and feeding condition can affect social behaviors. They also demonstrate that brown recluse spiders tend to be more socially tolerant than agonistic, under natural conditions, regardless of their population density.

Phylogeography of *Sabacon cavicolens* (Opiliones, Ischyropsalidoidea), focusing on southern Appalachian divergence

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The opilion species *Sabacon cavicolens* is widely distributed throughout the eastern United States. Because *S. cavicolens* is habitat specialized and apparently dispersal limited, it seems likely that cryptic species may be present within this taxon. The southern Blue Ridge province of the Appalachian Mountains is a hotspot for divergence in other arachnid taxa, and so the same might be expected for *S. cavicolens*. In particular, major riverine barriers in the region may be acting as historical or modern barriers to dispersal. To address these questions, mitochondrial cytochrome oxidase I (COI) sequence data was used to assess phylogeographic divergence for a large population sample. Recovered patterns suggest considerable phylogeographic divergence in the southern Blue Ridge, with northern and western range expansions from this likely refugial region. Riverine barriers are sometimes, but not universally, important. Congruence of CO1 phylogenetic patterns with those seen in a preliminary 28S dataset suggests the presence of at least one cryptic species. Phylogenetic relationships between *S. cavicolens* and the sympatrically distributed *S. mitchelli* remain unresolved, but suggest obviously deeper divergence.

Arachnid kleptoparasitism of the purple pitcher plant, *Sarracenia purpurea*

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Spiders and harvestmen may often act as parasitizing residents or prey of the carnivorous pitcher plant, *Sarracenia purpurea*. To determine the extent of this relationship in regards to the diversity, sex ratio, and maturity of arachnid residents and victims in comparison with arachnids found in the surrounding environment, a series of field studies were undertaken at two locations in Virginia and North Carolina. In addition, the concept of the arachnid as an effective or ineffective parasite was considered. The percentage of arachnids found residing on *S. purpurea* was higher for some taxa (*Linyphiinae* and *Agelenidae*) and lower for others (*Erigoninae*, *Salticidae*, and *Araneidae*) compared to the surrounding environment. Similarly, the percentage of captured arachnids was also higher for certain taxa (*Erigoninae* and *Gnaphosidae*) and lower for others (*Araneidae*, *Thomisidae*, and *Theridiidae*) compared to the percentages found in the surrounding area. In contrast, there was no significant difference between the sex ratio or maturity of arachnids found residing on the plant and those found in the surrounding environment. Effective parasites were considered to be those groups that were often found on the plant but were rarely found captured. Likewise, ineffective parasites were those that were more often found captured than residing on or over the plant. Effective parasites included the spider families *Linyphiinae* and *Theridiidae*, and members of the non-spider order *Opiliones* while ineffective parasites included *Erigoninae*, *Salticidae*, and *Gnaphosidae*. Females were found to be more effective parasites than males and immature arachnids were more effective at parasitizing *S. purpurea* than matures.

Revision and Phylogenetic Affinities of the Enigmatic Spider Clade Penestominae (Araneae, Entelegynae)

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The South African subfamily Penestominae was first described from females only and placed in the Eresidae. Discovery of the male decades later brought surprises, especially in the anatomy of the male palp which features a retrolateral tibial apophysis (RTA). The presence of an RTA is synapomorphic for a large clade of spiders exclusive of Eresidae. A molecular data matrix based on four loci was constructed to test two alternative hypotheses: 1) penestomines are eresids and the RTA is convergent, or 2) penestomines belong within the RTA clade. Taxon sampling concentrated on the Eresidae and the RTA clade, especially outside of the Dionycha and Lycosoidea. The results imply revised circumscription of some RTA clade families, including Hahniidae, Amaurobiidae, Dictynidae, and Cybaeidae. Multiple fossil calibration points were used to date events in entelegyne spider evolution. This work was done in the context of a taxonomic revision.

Beyond sexual cannibalism: lifetime foraging success affects female mate choice and aggression in *Schizocosa ocreata* (Hentz) wolf spiders

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Food limitation has been a well-addressed life history trait of spiders and may explain the prevalence of sexual cannibalism. However, less attention has been paid to how feeding history may impact female mate choice outside the context of sexual cannibalism. Recent studies on vertebrates indicate increased female selectivity of male traits when food is limited. In the brush-legged wolf spider *Schizocosa ocreata* (Hentz), it is well established that food limitation influences male secondary sexual traits (foreleg tufts) and increases likelihood of sexual cannibalism, but does it affect female mate choice with regard to male tuft size? This study addressed different levels of food limitation on mate choice. Field-collected juveniles were assigned to high-food and low-food treatment groups for their entire lifetime. At maturation a subset of the high-food group received no more food while a second set and the food restricted group stayed on their same diet. Females were exposed to video playback of courting males with modified forelimb tufts representing the upper and lower 95% CI for tuft size. Females were scored for receptive and aggressive behaviors. Results suggest that females who incur short bouts of starvation after abundant food become extremely aggressive, are less selective and less like to exhibit receptivity. Conversely, females on the long-term starvation treatment were less aggressive, and became extremely choosy, selecting the larger tufted male more often. These results suggest that individual lifetime foraging success may have complex effects on behavior, and thereby influence the preferred phenotype at the population level.

Molecular phylogeny of the order Pseudoscorpiones and the origin of chelal venom glands

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The phylogenetic relationships of the major lineages of the arachnid order Pseudoscorpiones are investigated for the first time using molecular sequence data from two nuclear ribosomal genes and one mitochondrial protein-encoding gene. We obtained sequences from 79 species of pseudoscorpions, representing 74 genera and 22 families. All superfamilies and the majority of currently recognized families were represented. The data show monophyly of four superfamilies (Feaelloidea, Chthonioidea, Cheiridioidea and Sternophoroidea), but not for Neobisioidea, Garypoidea or Cheliferoidea. In all the analyses, Feaelloidea constituted the sister group to all other pseudoscorpions; Chthonioidea is the sister group to the remaining families, which constitute the Iocheirata—a clade including pseudoscorpions with venom glands within the pedipalpal fingers. This phylogenetic pattern suggests that venom glands evolved just once within this order. The sole Paleozoic pseudoscorpion – *Dracochela* from the Devonian – apparently lacks venom glands. Several species of Iocheirata belonging to extant families are known from the Lower Cretaceous, suggesting that venom glands had evolved in pseudoscorpions prior to the Lower Cretaceous, even though venom glands cannot be discerned in the actual fossils. The lack of pseudoscorpion fossils between the middle Devonian and Lower Cretaceous hampers analysis of the early diversification of iocheiratans.

Partitioning between syntopic congeners? A case of desert spiders

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When two syntopic species, with similar morphological and ecological characteristics requirements occupy the same general habitat, selection minimizes resource competition and promotes divergence between them. In general, there are three possibilities. (1) These species tend to have similar morphological and ecological requirements. 2) Differences and patterns of overlapping species might be unrelated to one another. (3) Species occupying the same general habitat might tend to have different morphological and ecological requirements and habitat preferences. There are many examples of spiders that support these ideas, especially between sympatric allotopic species, but there are a few cases of sympatric syntopic species. We studied two endemic syntopic desert species, *Syspira tigrina* and *S. longipes* in the State of Baja California Sur. Their biology is poorly known, but from observations, they co-exist without apparent habitat or spatial segregation. We suspected that evidence of their joint presence can be found at the microhabitat level and from size segregation (indirect trophic segregation) between seasons. Here, we characterize the microhabitat of both species during each quarter (July 2005 through May 2006) and measure the length of the tibia I and width of the carapace to find size segregation (indirect trophic segregation). The results indicate that there was no microhabitat segregation between seasons; however, there is a clear segregation by size (indirect trophic segregation) between species in three of four seasons. We suggest that these two species coexist because of trophic segregation.

Daily and seasonal depletion of silk reserves reduce the stickiness of viscous capture threads from *Argiope aurantia* and *Argiope trifasciata* orb-webs

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The spirally arrayed capture threads of spider orb-webs are deposited from the perimeter inward. To test the hypothesis that depletion of silk reserves during web construction and declining spider condition during the fall season affect the properties of viscous capture threads, we examined threads from the outer and inner regions of orb-webs constructed by adult female *Argipoe aurantia* and *Argiope trifasciata*. Although droplet volume did not differ, the outer capture threads of both species were stickier and had greater adhesion per droplet volume than inner threads. In *A. trifasciata* webs, which were studied later in the fall than *A. aurantia* webs, there were also seasonal declines in both thread stickiness and stickiness per droplet volume. Thus, dwindling silk reserves appeared to reduce the stickiness of both species' threads by changing the composition rather than the volume of their viscous droplets. In *A. aurantia* webs, inner threads and threads from early season webs had more residual extensibility than outer threads and threads from late season webs. The outer capture spirals of *A. trifasciata* were more widely spaced than inner spirals and in this species early season webs had greater stickiness per square centimeter than late season webs.

The Encyclopedia of Life: Relevance to Arachnologists

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February 26th, 2008 was the official launch date for The Encyclopedia of Life (EOL, http://www.eol.org), a mere skeletal template for future participatory functions. EOL is engaged in a joint Global Biodiversity Information Facility (GBIF) Global Names Architecture, will expose resolution services for Life Science Identifiers (LSIDs), and has secured membership with

CrossRef – the not-for-profit registration agency for scholarly works, to assign Digital Object Identifiers (DOIs) to EOL species pages. These three major achievements will coordinate the intelligent interlinking of names and publications in the Biodiversity Heritage Library and scholarly journals at large. We are developing graphically-rich, easy to use, communal, and manipulative online environments called LifeDesks to better integrate the global commitments to unique, shared identifiers. Simultaneously, LifeDesks will provide an opportunity for taxa-centric communities to coalesce around creation and management of biologically relevant media on species pages. In time, functionality will be extended to permit management of specimen records, phylogenies, and import of structured and unstructured data.

The goblin spider genus *Scaphiella* (Araneae, Oonopidae)

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Currently 23 species are placed in the goblin spider genus *Scaphiella*, but two of those species (*S. maculata* Birabén 1955 from Argentina, and *S. ula* Suman 1965 from Hawaii) are misplaced in the genus and belong elsewhere. Aside from those misplacements, the monophyly of the group is supported by at least two characters. First, the ventral abdominal scutum of females is greatly enlarged, extending completely up the sides of the abdomen to the dorsal surface, so that the abdomen looks like a taco shell. Second, the female epigastric region is uniquely modified, with circular, epigynum-like external modifications. The genus occurs from California, Utah, Texas, and southern Florida south to Chile and Argentina, and is significantly more speciose and diverse than previously recognized. We hypothesize that the genus consists of two quite different species groups, which vary in cheliceral, female palpal, and male palpal characters. As with other oonopids, many highly peculiar features occur within the genus. Some species have characteristically asymmetrical male palps, with the right palp being uniformly reduced relative to the left one. Other species have lost the posterior median pair of spinnerets, and seemingly have no cylindrical silk glands. Two new species, from Mexico and Colombia, are oddly enlarged and, at 3.3 mm, may be the world's largest oonopids.

Living with stress: Web structure in the cave spider *Meta ovalis* (Gertsch 1933)

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Cave ecosystems are known for their high levels of ecological stressors, such as low temperatures, high relative humidity, low prey availability, and aphotic conditions. Because of these factors, cave organisms behave differently than their surface relatives and often have evolved special traits to survive in this environment. These factors have been well studied among troglobites and stygobites, but are underrepresented among troglophiles. The North American cave spider, *Meta ovalis*, is a little-studied, troglophilic orb-weaver found throughout the three cave zones (entrance, twilight, and dark) in numerous cave systems. This species is the largest endemic terrestrial predator in many caves, but little is known about its basic feeding ecology. Repeated mark-recapture studies show no observed movement of adults between populations within a single cave or between caves, and preliminary observations suggest that individuals may stay in the same web location for up to 3 months. Web location and structure are both factors that can affect prey-capture rates in a stationary predator. Web size and mesh width are key factors in web construction, affecting both the size of the prey captured and the retention rates. Measurements of web diameter, mesh spacing, and hub size were used to calculate the capture area of adult and juvenile orb webs in large and small caves.

Molecular systematics of North American Travunioidea (Opiliones: Laniatores) indicates evolutionary relationships inconsistent with current classification

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Recent classifications (e.g., Giribet and Kury 2007) have posited that holoarctic taxa be split from austral Triaenonychoidea and have reassigned the northern groups to the superfamily Travunioidea. Six families or subfamilies of travunioids are recognized: Cladonychiidae (NA, EU), Nipponony chinae (JAP), Paranonychinae (JAP, KOR, NA), Pentanychidae (NA), Sclerobuninae (NA), and Travuniidae (JAP, NA, EU); comprising about 56 species (with 25 classified subspecies) in 24 genera. We explore the phylogenetic relationships of North American travunioids using molecular markers. Our current sample includes data for multiple genes and exemplars from about 22 species or subspecies from all (12) North American genera. Phylogenetic results suggest that at least three of the major recognized groups of Travunioidea are not monophyletic including the Cladonychiidae, Paranonychinae, and Sclerobuninae. The current system of classification for Travunioidea is weighted heavily on the number of lateral prongs on tarsal claws III and IV. Juveniles typically have more lateral prongs than adults and high numbers of lateral prongs in adults is considered paedomorphic. Consistent with hypotheses of some previous authors, it appears that convergence of morphologies within Travunioidea has led to a high level of homoplasy in characters previously used to classify these taxa.

Male *Dolomedes scriptus* (Hentz) (Araneae: Pisauridae) detect female mating status by chemical cues in silk

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Communication has been widely studied in many taxa, particularly in the context of mating search strategies and assessment. Males of many species assess reproductive status or receptivity via a number of cues to enhance courtship decisions. Females of many spider species are known to embed pheromones in their silk. Depending on the species, these chemical cues can be found in web-bound or dragline silk and can convey crucial information about the female. We tested male response to female chemicals in the fishing spider, *Dolomedes scriptus*. In a closely related species, *D. triton*, previously mated females often exhibit cannibalism of males. The risk of cannibalism makes poor courtship decisions in this species particularly costly. To determine whether male *D. scriptus* can detect female mating status by chemical cues deposited in dragline silk, males were randomly exposed to female-deposited silk within a female's container. In the first part of the test, the female was absent; the female was subsequently returned to her container. Males performed more overall overt courtship behavior in the presence of silk from virgins than in the presence of silk from either mated or penultimate females. Male mating behavior and male ability to discern female mating status are particularly important in this potentially cannibalistic species. The adaptive value to females of signaling their mating status is unclear and needs further investigation.

Environment and grouping behavior in colonial web-building spiders in coastal California

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Although relatedness-based theories have been used to explain the existence of sociality in many animal taxa (e.g., eusocial insects), examples of non-kin based societies continue to emerge. Dynamic shifts between solitary and group living in coastal populations of the colonial orb-weaving spider *Metepeira spinipes* in California following the 1997-1998 El Niño have provided a rare, yet ideal opportunity to examine how environmental variables affect genetic structure of populations, and ultimately the evolution of spider social behavior. We are investigating this question using both field-based studies and molecular techniques, presenting data here on ecological factors and grouping patterns. Populations of *M. spinipes* from geographically and microclimatically distinct field sites in central California were surveyed during August 1998-2007. Population size, proportion living in groups, and location of colonies was recorded at each field site. Additionally, weather data (average monthly/annual precipitation and temperatures) for each site were acquired from the NOAA website. Populations in mesic sites tend to have more spiders in colonies (2-10+ individuals), while more exposed/xeric sites have mostly solitaries. The proportion of colonial vs. solitary individuals has varied between populations over time, but large colonies (30+ individuals) have persisted at some sites. These data (in addition to previous studies) suggest that environmental variables influence grouping behavior and/or population dynamics in this spider species. The development of suitable molecular markers (i.e., microsatellites) for examining population genetic structure is currently underway.

Goblin spiders of the world – Understanding the Megadiverse, Microdistributed Spider Family Oonopidae

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This multi institution project, which is largely supported by the NSF Planetary Biodiversity Inventories (PBI) program, involves more than 40 investigators from 11 countries on six continents who aim to discover, describe, map and understand the evolution of the approximately 2500 species of goblin spiders (Oonopidae) throughout the world. Team members are assembling and sorting the specimens available in collections and acquiring new material through expeditions that concentrate on securing better samples of litter- and canopy-dwelling species, as well as fresh material for DNA sequencing. Team members are using existing cyberinfrastructure to build Internet-accessible databases of the taxa, all specimen locality data, and images; a new application allows team members to enter descriptive data into a multi-user database, in a highly structured format that will allow direct use of that information in formal descriptions for publication, on species web pages, in phylogenetic analyses, and in interactive keys. Automated identification systems, using artificial neural networks, will be developed, and the accuracy of those systems will be compared with that achieved by workers, ranging from total beginners to knowledgeable specialists, using interactive keys to the same taxa.

The first fossil Mecysmaucheniidae from Lower Cretaceous (Upper Albian) amber of Charente-Maritime, France

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The first known fossil mecysmaucheniid spider is described from Lower Cretaceous (Upper Albian) amber of Charente-Maritime, France. This is the first fossil spider to be formally described from French Cretaceous amber and extends the geological record of Mecysmaucheniidae back into the Cretaceous, the family having previously been known only from the Recent. The fossil differs from other Mecysmaucheniidae in having four, rather than two spinnerets, so it can be considered plesiomorphic with respect to modern members of the family in this character. The amber of the Archingeay-Les Nouillers area is uniquely considered a litter fauna, and our specimen corroborates this hypothesis. Sister group to mecysmaucheniids, the Archaeidae, and now the Mecysmaucheniidae, have been found as fossils only in the northern hemisphere, yet their Recent distributions are entirely southern hemisphere (Gondwanan). The find suggests a former pancontinental distribution of Mecysmaucheniidae, thus supporting the theory of ousted relics.

A new arachnid order

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Silk production from opisthosomal glands is a defining characteristic of Araneae. Silk emerges from spigots (modified setae) borne on spinnerets (modified appendages). Spigots from *Attercopus fimbriunguis*, from Middle Devonian (386 Ma) strata of Gilboa, New York were described in 1989 as evidence for the oldest spider and the first use of silk by animals. Slightly younger (374 Ma) material from South Mountain, New York, conspecific with *A. fimbriunguis*, includes spigots and other evidence which elucidate the evolution of early Araneae and the origin of spider silk. No known *Attercopus* spigots, including the original specimen, occur on true spinnerets but are arranged along the edges of plates. Enigmatic flagellar structures originally described as Arachnida *incertae sedis*, are shown to be *Attercopus* anal flagella, as found in *Permarachne*, also originally described as a spider. A new arachnid order, Uraraneida, is erected for a plesion including these two genera based on this combination of characters. Spinnerets originated from biramous appendages of opisthosomal somites 4 and 5; while present in *Limulus*, no other arachnids have opisthosomal appendage homologues on these segments. The spigot arrangement in *Attercopus* shows a primitive state prior to the re-expression of the dormant genetic mechanism which gave rise to spinnerets in later spiders. The inability of Uraraneida to control silk weaving suggests its use as a burrow lining or homing material.

The Canadian Arachnologist & Nearctic Spider Database

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The Canadian Arachnologist was inaugurated May 2000 by David Shorthouse and Christopher Buddle as a free newsletter. A rudimentary web site was created to help assemble a mailing list for its distribution. Very quickly thereafter, this web site was expanded to include the Nearctic Spider Database and the Nearctic Arachnologist' Forum, which in concert now receive on average 2,500 daily visits (25,000 hits) with over 350 active members. The Database uses the World Spider Catalog as its taxonomic scaffold, which drives a community-based display of specimen records and peer-reviewed species pages. The Forum is a platform for individuals seeking assistance with identifications, collecting techniques, helps coordinate collecting trips, and permits announcements on new literature, special events, and job or post-doc opportunities. Spider WebWatch, an entertaining outreach project is a spin-off from these efforts. This paper is an overview of the Canadian Arachnologist website, but focuses on how the Nearctic Spider Database works as a simple conduit to often intractable global biodiversity informatics efforts.

Biogeographic origins and relationships of the leiobunine harvestman fauna (Opiliones: Sclerosomatidae) of eastern North America: a preliminary phylogenetic analysis

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The authors' ongoing studies of reproductive evolution in leiobunine harvestmen of eastern North America (NA) requires a thorough understanding of phylogeny. Relationships within and among the four eastern NA genera -- *Leiobunum* (~20 spp.), *Nelima* (1 sp.), *Hadrobunus* (2-3 spp.), and *Eumesosoma* (5 spp.) -- are potentially complex, because *Leiobunum* and *Nelima* also occur in western NA, Mesoamerica, East Asia and Europe/North Africa. To determine the phylogenetic composition and biogeographic history of eastern NA leiobunines, we obtained mitochondrial and nuclear DNA sequences (~5900 targeted bases/taxon) from representative sclerosomatid and outgroup species from each biogeographic region and analyzed these data using parsimony and Bayesian methods. We recovered Gagrellinae, Leiobuninae, *Leiobunum* and *Nelima* as para- or polyphyletic groups but in a pattern suggesting independent evolution in the New and Old Worlds. In fact, NA leiobunines depart from most other NA harvestmen (e.g., Phalangiidae, Caddidae, ortholasmatine Nemastomatidae, *Crosbycus*) in lacking clear affinities to Eurasian taxa, with only *Nelima* appearing to have entered NA from Asia. *Leiobunum*, *Eumesosoma* and *Hadrobunus* of central and eastern NA appear to form a monophyletic group with certain Mesoamerican species (e.g. *L. royali*) and probably arose by introduction of at least two closely related Mesoamerican lineages via an Atlantic coastal corridor, with subsequent radiation. The phylogenetic structure of the eastern NA radiations indicates that sexual arms races with large impacts on reproductive anatomy have arisen four times.

Silk gland transcripts from *Liphistius malayanus* (Araneae, Mesothelae) reveal an early diversification of silk genes in spiders

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Silk is a key innovation for spiders. However, little is known about the origin of silk and the diversification of silk function in early spider evolution. Here, we have characterized the silk gene transcripts of *Liphistius malayanus*, a species in the suborder Mesothelae. Mesothelae is a basal lineage in the spider phylogeny and is estimated to have separated ~300 million years ago from all other extant spiders (i.e., the suborder Opisthothelae: Mygalomorphae, tarantulas and their kin, and Araneomorphae, true spiders). Yet, mesotheles have not received attention in terms of their silk genetics and function. A cDNA library was

generated from *Liphistius malayanus* silk glands and an unexpectedly large diversity of silk transcripts was discovered. This variety was surprising because mesothele spiders use their silks to construct simple burrows and sensory lines, and do not have the ability to weave the more complicated sheet-, cob-, and orb-webs constructed by araneomorph spiders. The abundance of *Liphistius* silk genes suggests that ancient spiders had a biochemically rich assortment of silk proteins before the evolution of highly specialized, complex webs. However, a recently published study found that mygalomorph spider silk proteins are relatively low in biochemical diversity. Thus it is also possible that there may have been an independent radiation of silk genes in mesotheles. The cDNA library has also revealed that the most abundantly expressed silk gene is homologous to an araneomorph egg case silk protein, consistent with the hypothesis that the original function of spider silk was for reproduction.

An integrative method to delimiting cohesion species: finding the population-species interface in trapdoor spiders with extreme genetic divergence and geographic structuring

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Here we present an objective, repeatable approach to delineating species when populations are divergent and highly structured geographically using a number of trapdoor spider model systems. These systems are particularly difficult because under strict criteria of geographical concordance coupled with estimates of genetic divergence, an unrealistic number of population lineages qualify as species. Our phylogeographic approach, which is generally applicable but particularly relevant to highly structured systems, uses genealogical exclusivity to establish a topological framework to examine lineages for genetic and ecological exchangeability in an effort to delimit cohesion species. Both qualitative assessments of habitat and niche-based distribution modeling are employed to evaluate selective regime and ecological interchangeability among genetic lineages; adaptive divergence among populations is weighted more heavily than simple geographical concordance.

Effects of diet manipulation on male ornamentation in a colorful jumping spider (Salticidae)

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In many animals, conspicuous male coloration is thought to function as an honest indicator of quality. In *Habronattus pyrrithrix* jumping spiders, females are dull and inconspicuous, while males have a brilliant red face, green leg tufts, and white pedipalps that they display to females during courtship. Our previous work suggests that the red coloration of males correlates with condition in a wild population, and thus has the potential to function as a quality indicator. When color is condition-dependent, it may be an honest signal of the nutritional condition and foraging ability of its bearer. If so, enhancing the quality of a male's diet should enhance his coloration. In Experiment 1, to understand how juvenile diet affects development of adult male coloration, we reared juvenile spiders on either high or low quality diets, and measured their coloration at maturity. In Experiment 2, to understand how adult diet affects the maintenance of coloration, wild caught adults were fed either high or low quality diets, and their coloration was measured after 45 days. In Experiment 1, male's faces were redder in the high quality diet group than the low quality group, suggesting that condition-dependence of red coloration may be mediated by juvenile diet. In Experiment 2, diet had no effect on red coloration, suggesting that adult diet is unlikely to be important in maintaining this coloration.

Phylogenetics of the eastern North American Phalangodidae (Opiliones: Laniatores): Higher-level phylogeny and phylogenetic diversity in the Southern Appalachians

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The evolutionary history of eastern North American Phalangodidae (Arachnida: Opiliones: Laniatores) was investigated using molecular phylogenetic data, complemented with morphological data. A sample of all described eastern genera, and almost all western genera, reveals that the eastern fauna forms a derived clade with respect to the western phalangodids. Generic diversity in the eastern fauna is probably not as high as currently proposed (i.e., the taxonomy is over-split). Patterns of genitalic evolution (assessed vis SEM imaging) are generally consistent with molecular phyogenetic data, and suggest that the *Bishopella laciniosa* complex is most derived. The molecular phylogenetic data support several independent invasions into cave habitats, concomitant with convergence in troglomorphic features. Within the *B. laciniosa* species complex, significant geographically-based genetic differentiation is found among southern Blue Ridge populations, in addition to frequent out-of-Blue-Ridge diversification, and, consequently, secondary contact with phylogenetically basal taxa. Analysis of phylogenetic diversity (PD) reveals several regional "hotspots" of diversity within what is perhaps a complex of many species.

Fluctuating asymmetry (FA) in sexually-selected traits of *Schizocosa ocreata* (Hentz) wolf spiders: Impact of a natural catastrophe and subsequent ecosystem-level stress

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Fluctuating Asymmetry (FA), a frequent consequence of developmental instability, may be greater in condition-indicating male sexual ornaments, as they are more costly to produce. The "FA-Sexual Selection hypothesis" predicts a negative correlation between FA and trait size. Foreleg tufts of male *Schizocosa ocreata* (Hentz) are a condition-indicating trait used by females in mate choice, and previous studies have shown both tuft size and asymmetry affect mate choice in this species. We measured FA of male tuft area using digital imaging of preserved specimens, and found that signed (R-L) FA was normally distributed with a mean of zero, indicating 'ideal' or 'true' FA arising from developmental instability. In all populations measured, a significant negative correlation between FA and tuft size was found, supporting the FA-sexual selection hypothesis. We used FA in assessing the impact of environmental stress from a major ecosystem disturbance (a tornado) on the first post-disturbance generation of *S. ocreata*. Tuft area FA was significantly higher in the disturbed site, suggesting that ecosystem-level stress may produce higher levels of developmental instability. There were no significant differences in body size (cephalothorax width) or in FA of a non-sexual trait (femur III length). However, a body condition index (residual of AW x CW regression) was significantly lower in the disturbed site. To our knowledge, this is the first study of FA in invertebrates associated with environmental stress from a major natural catastrophe, and demonstrates subtle, long-lasting impacts of ecosystem disturbance.

The distribution of the brown recluse spider, *Loxosceles reclusa* (Araneae: Sicariidae) in Georgia

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Georgia is on the southeastern margin of the native range of the brown recluse spider, *Loxosceles reclusa* Gertsch and Mulaik. The brown recluse is not a common Georgia spider, being submitted only rarely and is not widespread throughout the state. Using recent submissions and previously published records, we document the spider's presence in only 29 of Georgia's 159 counties, with almost all being found in the northern portion. If its occurrence is accurately portrayed by the data, then the spider's range includes the geologic provinces of the Ridge and Valley, the Blue Ridge and the Piedmont, all north of the dividing Fall Line with only two finds of specimens in the southern Coastal Plain province. There were two finds of the non-native world tramp species, *L. rufescens*, both found south of the Fall Line and are considered transported specimens. A 5-yr Georgia poison control database shows reports of *Loxosceles* spider bites throughout the state (from 64.8% of its counties) greatly outnumbering the verifications of brown recluse spiders. Unless additional research can uncover the existence of this spider in the southern half of Georgia, medical diagnoses of brown recluse spider bites there have virtually zero probability

of being correct. Bite diagnoses should be made with caution in northern Georgia given the spider's sporadic distribution with low frequency of occurrence.

An integrative investigation of species boundaries among Loxosceles of North America's Desert Southwest

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Understanding species boundaries is essential for the accurate naming of new taxa and for investigating evolutionary history. This is particularly important for spiders as a taxon with poorly known diversity patterns and high extinction pressures from habitat loss. We used morphological, molecular and behavioral characters to examine species boundaries among the closely related *Loxosceles* taxa of North America's Desert Southwest that are currently described as *L. arizonica, L. apachea, L blanda,* and *L. sabina*. We found that morphology of copulatory structures within taxa was simple and highly variable. Furthermore, variation in the morphology of *L. arizonica*, *L. apachea* and *L. blanda* often overlapped, making the identification of these specimens consistently depend on collection locality. However, interspecific vs. intraspecific pairwise genetic distances indicate monophyly of putative species, and percent divergence of CO1 "barcoding gene" sequences are above those proposed to delimit distinct species in spiders. Mating trials revealed the ability of interspecific pairs to copulate, produce egg sacs and viable F1 spiderlings. Together, these data suggest that the putative *Loxosceles* species that we examined in this study are currently independent monophyletic lineages, but question whether interspecific pairwise distances reflect the existence of valid species boundaries under potential secondary contact. This pattern is also consistent with divergence between these taxa occurring recently and in allopatry.

Developmental and inter-species differences in water retention in tarantulas

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Tarantulas are a wide spread and diverse group of arthropods, that inhabit a wide variety of climates. This study evaluates the differences in dehydration rates between 2 species of tarantula, *Lasiodora parahybana,* a tropical rain forest species, and *Brachypelma vagans*, a desert/scrubland species. Data were also collected comparing water retention among differing age groups within each species. Fully fed and hydrated spiders were placed into a temperature and light controlled environmental chamber, and fully dehydrated oxygen was introduced to the chamber. Measurements of the metabolic rate of the spider and absolute humidity of the outgoing gas were collected, and a mass-independent rate of dehydration was derived. Descriptive and inferential statistics were used to determine any significant differences in the results.

Phylogeny and biogeography of the subfamily Euophryinae (Araneae: Salticidae)

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As one of the largest subfamilies of jumping spiders (Salticidae), the Euophryinae currently contains at least 95 genera and more than 800 species. Its systematics is currently messy, and delimitations of many genera are not clear. Euophryinae is the only major group of jumping spiders to have diversified into many genera in both the Old and New World, which makes its historical biogeography particularly interesting. This project aims to clarify the phylogeny of the subfamily and its placement in jumping spider phylogeny. Five genes (mitochondrial DNA: COI, 16SrDNA, NADH1; nuclear DNA: 28S rDNA, Actin) were amplified and sequenced. 119 euophryine species (97 identified species of 42 genera and 22 unidentified species) and 35 outgroups are included in the phylogenetic analysis. The result strongly supports the monophyly of euophryines and confirms close relationships of some euophryine genera proposed by morphological studies, for instance, Cobanus and Sidusa. Mapping distribution on the phylogenetic tree shows that most euophryines from the New World are more closely related to each other than to those from the Old World, vice versa. This finding is consistent with other analyses that suggest much of salticid diversification occurred after the separation of the continents of the Old World and New World.

POSTER ABSTRACTS

***Indicates student competition**

Effects of temperature on activity and movement in a web-building spider (Araneidae)

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As ectotherms, spiders obtain their heat from the external environment and rates of activity are strongly influenced by temperatures differences. Thermoregulation includes movement to specific areas where temperatures match an organism's preferred body temperatures allowing for optimal efficiency and activity. We compared movement of web-building spiders (Araneidae) maintained at two different temperatures; 12°C and 20°C. Animals in the 12 °C environmental chambers were provided with temperature gradient using a heating pad placed at one end of the arena. Arenas from both groups were rotated 180° after two weeks. Observations and measurements were taken three times a day for four weeks to record daily movement and activities. We hypothesized that spiders in the 12°C environmental chambers would be less active than the spiders in the 20°C environmental chambers and would return to the warm area for their daytime refuge. Initially, there was no significant difference in movement between the two groups, however, after the arenas were rotated, the 12 °C group was more active. In addition, the majority of spiders maintained their original retreat site regardless of the temperature gradient.

Little things mean a lot: proposed project for Linyphiidae of the arid southwestern United States

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Linyphiids are strongly associated with mesic habitats; in the Western Hemisphere they are actively studied in Canada and the northern US, and Central and South America. However, linyphiids also occur in the arid southwestern US but are not well studied, although the region represents great variation in topography, including high elevations, isolated mountains, isolated springs and wetlands, river corridors, and grasslands. We plan to survey linyphiids from Arizona, New Mexico, and West Texas, building on the records from Richman et al. (114 taxa), adding specimens from our own collections and regional museums, and collecting fresh specimens that can be preserved for morphological or molecular research techniques. From this work we can better address ecological questions, including distribution patterns of species on isolated mountains and microhabitats, and along river corridors. We expect to discover new species and range extensions for some known species; our inventory will also form a base list of species expected from northern Mexico, whose desert systems also contain mountain and basin habitats. The list will serve as a partial foundation for future more geographically inclusive taxonomic revisions. New species and distribution information will be reported in the Richman et al. checklist and the Nearctic Spider Database. We will deposit material in our regional museums (the University of New Mexico houses type specimens and frozen tissues), where it will be available for systematics or ecological researchers.

Are *Pardosa sierra* Banks, 1898 epigynia morphs belong to the same species?

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Pardosa sierra was described by Banks in 1898 from Sierra de

la Laguna (epyginum morph A herein) and Barnes (1959) made a revision of the *lapidicina* species group of *Pardosa,* where he illustrated another epigynum morph; (B) from Sierra City, California. It is not clear if these two morphs are the same species. This uncertainty is due the distribution of the morphs is not complete known. In this study we collected morph (A) in nine oases of Baja California Sur and morph (B) in Chihuahua. A preliminary genetic distance (Kimura 2-parameter) analysis of the sequence fragment *COI* mDNA from each morph and other species of *lapidicina* and *milvina* groups, along with seven sequences of *Pardosa* from the Gen Bank, was conducted. This analysis reveled grater genetic distances between haplotypes of *P. sierra* morphs (genetic distance GD = 0.057) than other species of the *lapidicina* group. Moreover, morph (A) was closest to *P. vadosa* (GD = 0.055), and morph (B) was closest to *P. lapidicina* (GD = 0.031). Overall, morphological and genetic differences and disjunct distribution suggest that *P. sierra* morphs might be different species so far. Further collect efforts are needed to support this hypothesis.

Vampire spiders: The advantage of being smelly

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Jumping spiders (Salticidae) have unique, complex eyes, and vision based on spatial acuity that is unrivalled by other animals in their size range. They also have elaborate vision-based predatory strategies and often spectacular vision-based courtship displays. However, chemical cues are also known to play important roles in these spiders' predatory and mating strategies. *Evarcha culicivora* is a salticid from the Lake Victoria region of East Africa. This is a spider that indirectly feeds on vertebrate blood by actively choosing as prey female mosquitoes that have had recent blood meals, and this unusual diet appears to be driven in part by sexual selection. Males and females of this species are both active in courtship, both have distinctive mate-choice behaviour and both appear to use blood as perfume. By feeding on blood-filled mosquitoes, *E. culicivora* males acquire an odour that makes them more attractive to conspecific females and *E. culicivora* females acquire an odour that makes them more attractive to conspecific males.

Colorado Spider Survey and Denver Museum of Nature & Science arachnology collection – ten years later

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The arachnid collection at the Denver Museum of Nature & Science (DMNS) was established in 1998 and the Colorado Spider Survey (CSS) was initiated the next year. Here we present a summary of the holdings of this relatively young collection, an update on the findings of the CSS, publications and presentations that have resulted from the collection and the project. We also present information on the effective citizen science aspects of this project including the number of people trained, the number of volunteers that have remained active with the project, and some of the programs and projects these volunteers have spearheaded.

Pitfall trap designs to maximize spider richness and minimize amphibian by-catch

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Pitfall trapping is the most common collection method in arachnological research. The pitfall trap's ability to provide accurate richness estimates has been scrutinized, but little work has addressed the traps' significant problem of capturing non-target amphibians and small mammals. Common modifications to the basic spider trap design (e.g., funnels and raised lids) serve directly to protect the trap from rain and debris, while indirectly minimizing by-catch of large and medium-sized animals. But these methods do not prevent capture of smaller amphibians, and furthermore are not systematically employed by all practitioners. I investigated the effects of four pitfall trap modifications on spider richness and small amphibian capture in a mixed hardwood/conifer forest in central Massachusetts. Five randomized replicates of eleven trap designs (raised lids, interior funnels, mesh collars, and solid collars) were set in rows spaced 20 meters apart over two spring weeks—the first week dry (4mm of rain) and the second wet (33mm of rain). Analysis showed that total spider richness at the family level was unaffected ($p=0.07$) by the trap modifications. Salamander capture ($n=29$ from 110 traps) was affected by the trap modifications ($p=0.004$), with unlidded traps across designs more likely ($p=0.02$) to result in salamander mortality. Between the two collection weeks, there were also differences in spider richness ($p=0.003$) and salamander capture rates ($p=0.005$), suggesting that precipitation may be an important factor to consider when analyzing richness data collected from pitfall traps.

Assessing diversity of jumping spider's spectral sensitivity

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It was long believed that jumping spiders possessed color vision. Results of various electrophysiological studies showed that jumping spiders may have dichromatic, trichromatic and tetrachromatic visions. Because most jumping spiders are small, it used to be difficult to perform electrophysiological studies on their eyes. Recently, a non-invasive electroretinogram was used to investigate jumping spiders color vision. In this study, LED lamps of varies wavelengths were used for light stimuli, and the spectral range and sensitivity of jumping spiders can be easily measured. Preliminary results showed that all jumping spiders used in this study possessed UV vision, and were capable of detecting a wide spectral range from violet to red. An intraspecific variation in spectrum sensitivity was found and especially variable were responses to blue and green light. Spectral sensitivity pattern also differed among various salticid species, especially those of long wavelength light stimuli. Based on these preliminary results, we attempt to investigate more jumping spider's taxa, and try to answer the following questions: (1) is there difference in spectral sensitivity among conspecific jumping spiders? (2) do jumping spiders exhibit sexual dimorphism in spectral sensitivity? (3) do various species of jumping spiders differ in spectral sensitivity and spectrum ranges? Answers to these questions might bring opportunities to assess the color vision of jumping spiders in molecular, physiological and ecological aspects.

Host web relocation in response to a web-invading spider

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Argyrodes trigonum is a spider species that forages by invading other host spider webs and using multiple foraging strategies including kleptoparasitism and araneophagy. The purpose of this study was to determine the influence of the presence of *A. trigonum* on one of its hosts, *Pityohyphantes costatus*. In order to determine whether *P. costatus* relocates webs more often in the presence of *A. trigonum*, both field and lab experiments were performed. In field transects, where the density of *A. trigonum* was increased, host spiders relocated their webs less frequently compared to controls. A similar trend was seen in lab experiments where spiders were housed in 10 gal aquaria. Interestingly, in both the field and lab studies, these results were opposite to our expectations. It is possible that higher densities of *A. trigonum* in the field resulted in greater competition among them causing many to disperse from manipulated areas in search of uninvaded webs. Also, the presence of *A. trigonum* in host webs (especially in lab containers) may cause hosts to move less frequently in order to avoid detection by *A. trigonum*.

A new approach to examining scorpion peg sensilla: the mineral oil flood technique

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All scorpions possess jointed, ventral appendages called pectines, which have patches of ground-directed, chemosensory sensilla that detect substrate-borne chemicals as the scorpion moves in its environment. Previous electrophysiological tests show that these peg sensilla respond to a variety of chemical stimulants. The previous studies used indirect chemical stimulation of peg sensilla through near-range exposure to volatile organic compounds. To mimic the scorpion's natural contact chemical detection system, we have developed a way to deliver chemical stimulants directly to the terminal pore of individual sensilla. We introduced a polar, liquid substance directly to the peg tip while recording electrophysiologically under mineral oil. We used a peristaltic pump to deliver aqueous stimulants at low flow rates through fine silicone tubing connected to a microdi-

alysis cannula. We are evaluating the technique on peg sensilla of desert grassland scorpions (*Paruroctonus utahensis*). Preliminary results show value in this method as a more accurate and biologically relevant way to stimulate scorpion peg sensilla. Furthermore, we expect to quantify the concentration of the stimulant reaching the sensillar pore, which has not been possible with previous methods of chemical delivery. From early indications, we think the mineral oil flood technique offers an improved method of chemical stimulation for testing the hypothesis that peg sensilla are repeated units that function as a parallel sampling system in the detection of ground-based, chemical stimuli.

Orb-web allometry in *Herennia* and *Nephilengys* (Araneae, Nephilidae)

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Current phylogenetic evidence suggests that the ancestral nephilid spider web architecture is an arboricolous ladder-web with eccentric hub, similar to that found in extant species of *Clitaetra*. This suggests that round and aerial webs are derived in *Nephila*. To establish evolutionary trends across the phylogeny, we investigated juvenile and adult web architectures within two phylogenetically intervening nephilid genera, *Herennia* and *Nephilengys*. We compared two measures of ontogenetic allometric web changes in these spiders: web shape and hub eccentricity. Webs become increasingly ladder-like as spider size increases in both *Herennia* and *Nephilengys*, but the hub eccentricity only increases in heavy bodied *Nephilengys* females. The ontogenetic web shift from orb to ladder in tree dwelling nephilids enables the growing spider to enlarge its orb-web vertically more than horizontally to remain on a given tree. The lack of hub displacement in larger *Herennia* challenges the gravity hypothesis (Masters & Moffat 1983) and calls for a more complex (phylogenetic, ecological) explanation.

Urban impact on spider communities in the San Francisco Presidio

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A growing literature acknowledges the importance of investigating urban ecosystems. A recent review found 57 studies investigating species richness on rural to urban gradients for invertebrates, 6 of which were on spiders. However, these studies have been insufficient in detecting widely applicable explanations for how urbanization affects spider communities. We investigated urbanization on a smaller scale than has previously been done and teased out the differences between groups of species. Spiders were sampled at 13 sites within the San Francisco Presidio representing the diversity of habitats and urban impact. Collecting was done bimonthly from February-December 2007 using pitfall trapping, tree beating, brush sweeping, and hand collecting. We found that spiders with limited distributions (only found in regions of the Western United States) are significantly affected by proximity to roads while widespread species (found all over North America and other continents) are not. Distance from roads only varied between 27-201 meters, but it was enough to see a difference in spider community distributions. As urbanization increases and more roads are built, it is possible that we will lose more endemic species which will be replaced by widespread ones. This project not only further contributes to what is known about urban ecology and spider ecology in general, but it generates practical information for park and city managers to promote spider conservation.

A new Iranian spider species and four new genera from Isfahan Province

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Not many studies are performed on Iranian spiders. A total of 244 spider species from 33 families are reported in a checklist of Iranian spider fauna from the year 2006. That checklist reports only eight species from Dysderidae, Filistatidae, Lycosidae, Salticidae, Theridiidae and Thomisidae families found in Isfahan Province. Due to the variable local climate (west central Iran), a broader biodiversity of spiders is expected. This study was designed to make a more complete and accurate assessment of spider diversity in the province. The specimens were collected during a two-year period in various seasons from different areas of the province. Since no key for spiders of the region is published yet, the specimens were identified and illustrated using the four published keys and confirmed by a specialist. The genera *Microlinyphia*, *Tetragnatha*, *Uloborus* and *Xysticus* which respectively belong to the families Linyphiidae, Tetragnathidae, Uloboridae and Thomisidae are being reported for the first time from Isfahan Province. All four genera were previously reported from Iran but not from Isfahan. Interestingly, this is the first time that the Holarctic species *Microlinyphia pusilla* is being reported from Iran.

Spatial distribution of different size scorpions, *Centruroides vittatus* (Scorpiones, Buthidae) among microhabitats

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If a large scorpion, *Centruroides vittatus,* uses prickly pear cactus for a refuge, then an active central place forager should be near its cactus refuge and aggregated near other large scorpions using the cactus. If small scorpions are avoiding the larger scorpions and thus cacti because of the risk of cannibalism, then small scorpions should show spatial shifts away from large scorpions and thus cacti. The distribution of different size classes of scorpions was investigated by comparing the activity of scorpions in sites for three treatments (replicated six times): (1) site centered on prickly pear cactus, (2) site centered on strawberry cactus and (3) site with no cactus in the center. Data on the activity of different size classes of scorpions were collected on the campus of Texas A&M International University during many nights from January 28, 2006 to November 8, 2007. Scorpion size classes were class I (< 5 mm), class II (5-10 mm), class III (10-15 mm) and class IV (> 15 mm). The frequency of size classes were significantly different among treatments with size class IV scorpions highest in prickly pear cactus sites and high strawberry cactus sites. However, the proportion of the smaller size classes (I-III) did not show a shift to sites with no cacti. These results support the aggregation of large scorpions near cacti, but not smaller scorpions avoiding large scorpions by spatial shifts. Mapping of scorpions in each site will attempt to further test the above predictions.

Effects of food deprivation on feeding and resting metabolism in the tarantula *Grammastola aureostriata*

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Metabolic rates in ectotherms are influenced by intrinsic and extrinsic factors including food availability. Among arachnids in general, low metabolic rates are considered an adaptation for surviving periods of reduced prey availability. As sit-and-wait predators that remain within close proximity to their burrows, tarantulas may regularly face large fluctuations in prey availability. In this study, we compared resting and feeding metabolic rates of the tarantula, *Grammastola aureostriata,* to determine the influence of different prey deprivation periods. Resting metabolic rates were measured after tarantulas were deprived of food for 10-days and 60-days respectively. Similarly, feeding metabolic rates were measured during feeding after the deprivation period. Feeding metabolic rates were on average 716% higher than resting metabolic rates. Although there was no significant difference in either resting or feeding metabolic rates measured at 10 and 60 days, the feeding duration was significantly longer at 60 days compared to the 10-day feeding. In addition, a significantly smaller cricket bolus remained after the 60-day feeding.

Fine Structure of the Silk Spinning Apparatus in the Cribellate Spider, *Nurscia albofasciata* (Araneae: Titanoecidae)

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The fine structure of the silk spinning apparatus of the cribellate spider *Nurscia albofasciata* and its comb-like cribellum device were examined using the field emission scanning electron microscopy (FESEM). The silk spigots of the spider were classified into three basic types - ampullate, pyriform and aciniform glands. Two pairs of major ampullate glands send secretory ductules to the anterior spinnerets, and another pair of major ampullate glands supplies the median

spinnerets. In addition, the pyriform glands send ducutules to the anterior spinnerets, and the aciniform glands feed silk into the median and the posterior spinnerets. This titanoecidae spider also has a sieve-like plate just in front of the anterior spinnerets with numerous fine pores. The surface of the cribellum is covered by hundred of tiny spigots which producing numerous cribellate silk fibrils. He we demonstrate the fine structural characteristics of the spigots on the cribellum at the aspects of the functional relationship between non-sticky capture thread production and their silk usage to catch a prey.

Fine structural aspects of the silk spinning nozzle of the major ampullate duct in the spider *Nephila clavata*

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Among the several silk glands in the orb-web spider *Nephila clavata*, the major ampullate one is the most predominant type in both sexes, and has the most effective nozzle structure to make a fiber with high strength and elasticity. The total length of the duct region exceeds more than 27 mm in mature adult and loops back on itself to form an S-shape that is bundled in connective tissue. Therefore the duct is divided into 3 limbs that are lined with 3 superposed types of the layers which are inner cuticle, monolayered epithelium and peripheral connective tissue. The valve is located just prior to the spinneret, and is assumed to be involved in controlling the spinning process. In addition, the major procedure for the conversion of the liquid feedstocks into an insoluble silk strand believed to be accomplished in the last limb during polymerization. The secretions thereby growing progressively narrow towards the spinning nozzle of the last limb. High magnification electron micrographs also reveal that the spiral grooves on the surface of the exocuticle near the valve, is assumed to serve as a helical constriction pump for restarting the spinning process.

Postembryonic development of the silk spinning apparatus in the spiderings of *Araneus ventricosus* (Araneae: Araneidae)

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Fine structural changes of the silk spinning apparatus during the postembryonic development in the orb-web spider *Araneus ventricosus* were observed using the field emission scanning electron microscope (FESEM). The spinning apparatus of the 1st instar spiderling is the most primitive because they do not spin webs to catch a prey. Only a pair of ampullate spigots appeared at the anterior spinneret, however no additional spinning tubes are observed at both of median and posterior spinnerets. First functional spinning system which composing 3 complete pairs of spinnerets is just observed during the 2nd instar after first molting. Anterior spinnerets comprise 2 pairs of the ampullate spigots and 10 pairs of pyriforms. Another 2 pairs of ampullate spigots also appeared on the middle spinnerets. In addition, posterior spinnerets have 5 pairs of aciniforms and the triad spigots (1 flagelliform and 2 aggregate spigot) which have the function of sticky thread production in orb-web spiders. After the period of the 3rd instar, there are no conspicuous changes in their spigot structure, however total number of the spigots, especially in the pyrifoms and acinifoms are rapidly increased according to their progressive molting.

Spiders of the borderland of Hidalgo County, New Mexico

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Spiders were collected, mostly between 1991 and 1999, from the Gray Ranch (now the Diamond A Ranch), the Peloncillo Mountains, and the Animas Valley. A total of 80 species in 22 families have been identified from these collections. This is probably only about 20% of the spiders found there as over 363 species have been reported from the nearby Chiricahua Mountains. It is thus likely that at least 350 –400 species are found in the Animas and Peloncillo Mountains, and the associated mountains and valleys of the Hidalgo County/Mexico borderland area. The known fauna of the Chiricahua Mountains and the projected fauna of the Hidalgo County borderland each amount to 30-40% of the entire spider fauna currently known from Arizona, New Mexico and Trans-Pecos Texas.

Phylogeography of *Macrothele taiwanesis* (Hexathelidae) on Taiwan and Ryukyu Island Arc

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Macrothele taiwanesis is an endemic species on Ryukyu Island Arc, including Taiwan, the largest of these islands. These islands are continental islands along the western edge of the Pacific, which emerged via collision between the Eurasian and Pacific Plates. According to the history of tectonic events and glacial cycles, the isolation sequence started from northern Ryukyu Islands, Amami-Okinawa Groups, then Miyako-Yaeyama Groups and subsequently Taiwan. Taiwan finally was isolated from the Asian continent during interglacial periods. Continuous orogenesis on Taiwan has produced several mountain ranges up to >3000 meters high. The temperate areas of these mountain ranges could serve as the sky island retreats during warm interglacial periods. Tectonic history, sea-level fluctuation, and habitat subdivision are thought to have effects on the biota on these islands. This study aims to find the general biogeographic relationships of the fauna and flora on these islands and then determine if the populations of M. taiwanesis on these islands follow the same general pattern. We first used Brooks Parsimony Analysis (BPA) to test the general relationships of the fauna and flora on these islands. We hypothesize that if these continental islands and sky islands were sequentially isolated following glacial retreat, then the invading continental biota would go through fragmentation corresponding to the isolation sequence of these habitats. The phylogeographic relationships of relic populations of *M. taiwanensis* should be ((Amami-Okinawa),((Miyako-Yaeyama),(Taiwan, China))). The BPA result shows that the general biogeographic relationship is (Taiwan-lowlands,(Taiwan-highlands,(Yaeyama,(Amami-Okinawa))) and is opposite to the null hypothesis. This result suggests dispersal led to the biogeographic relationships of biota on these islands. However, the phylogeographic relationship of *M. taiwanesis* populations according to maximum parsimony and Bayesian analysis conforms to our hypothesis. Moreover, nested clade analysis also confirms the major operating processes of *M. taiwanesis* population subdivision is vicariance.

Behavior observations of an ant-mimicking Thomisidae, on Milman Island, Australia

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Observing spiders can reveal any number of interesting behaviors, but a spider that looks and behaves like an ant is even more fascinating. *Amyciaea albomaculata* very convincingly mimics the green tree ant of Northern Australia. Adults to juvenile spiders were observed hunting, capturing and feeding on green tree ants. Spider activities in and around an ant colony with multiple life stages result in fascinating imitations. Witnessing multiple mating behaviors capped observations of this Thomisidae spider. Check out the photos and descriptions on the poster.

Color morphs in *Centruroides vittatus* (Scorpiones, Buthidae) revisited- what phylogeographic analysis reveals about morphospecies

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Centruroides vittatus is a widespread scorpion that is typically associated with the Chihuahuan Desert. Historically, this species was once described as three species based on morphology (*Centruroides vittatus* (Say, 1821), *Centruroides chisosaurius* (Gertsch, 1939), and *Centruroides pantheriensis* (Stahnke, 1956)). Currently, these three species are all considered as color variants of *Centruroides vittatus*. A recent phylogeographic analysis supports the taxonomic grouping of these variants into *C. vittatus*. No genetic distinction exists for these morphospecies; instead, geographic substructuring is apparent in the mtDNA dataset. Interestingly, these morphospecies were described from the Trans-Pecos region of Texas. In this region, phylogeographic analyses indicate significant genetic distinctiveness among populations, especially those in the western Trans-Pecos.

Comparative microstructure of the cheliceral apparatuses in orb-web spiders

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Fine structural characteristics of the cheliceral apparatuses in three major orb-web spiders from Korea - *Araneus ventricosus*, *Argiope bruennichii* and *Nephila clavata* - were examined comparatively with aid of the field emission scanning electron microscopy (FESEM). All chelicerae of these spiders were labidognathous form that moves at right angles to the body axis, and had two segments similar to that of a folding jackknife. Each cylindrical fang has a specialized hinge joint that articulate with the cheliceral groove. In addition, each side of cheliceral groove contains numerous small protrusions, and each chelicera has more than seven cuticular teeth (promarginal and retromarginal teeth) in two rows. The lower margin of the cheliceral fang, especially on the edge is modified as a saw-like groove. This serrated substructure is developed in most spiders commonly at the posterior margin which parallel to retromarginal teeth. In addition, the surface cuticular pits are also distributed on the cuticular depressive area of cheliceral groove in all of the three spiders commonly. On the contrary, location of each venom pore has a species-related variation: the venom pores in both of *A. ventricosus* and *A. bruennichii* are located in accordance with the direction of retromarginal teeth, however *N. clavata* with the direction of promarginal teeth.

Field Guide to Spiders of North America

Help make it happen!

From President **Paula Cushing**:

Dear AAS Members and Arachnophiles:

I have excellent news to pass on about Rich Bradley's *Field Guide to the Spiders of North America* project. Rich has signed a contract with the University of California Press! We have also received a promise from the anonymous donor who contributed to the *Spiders of North America: an identification manual* project that he will contribute $45,000 to the AAS to pay the illustrator. The illustrator Rich has chosen for this project is Steve Buchanan, the artist who illustrated the US Postal Service's insect and spider stamp series (http://www.amazon.com/INSECTS-SPIDERS-cents-Postage-Stamps/dp/B00136F4LU). Steve has also signed a contract to do this work.

The artist has agreed to do this work for a total of $50,000. Thus, the society must raise an additional $5000. The AAS Executive Committee has agreed to launch a donation campaign to solicit donations and support for this worthy project. In fact, one member has generously agreed to provide matching funds in this campaign. For every dollar donated by an AAS member, the EC member will donate matching funds up to $1500!

With this message, **I officially launch this donation campaign!** For its support of this project, the society will receive prominent acknowledgment in the Field Guide. We will also be able to sell the Field Guide to AAS members for a discounted price.

If you would like to donate towards this fund, you can do so one of two ways:

1) Send a check clearly earmarked to the "Field Guide Project" to AAS treasurer, Karen Cangialosi; Department of Biology, Keene State College, Keene, NH 03435-2001 (kcangial@keene.edu).

2) Go to the AAS website at www.americanarachnology.org; click on "How to Become a Member"; click on "Use a Visa, Mastercard…" link; scroll down and click on the "Make a Donation to one of the AAS Research Funds or an unrestricted gift to the AAS" link; and click on the Field Guide project link to make your donation.

(**Please Note**: The online donation process is not yet in place. Keep checking, it will be established soon!)

Thank you in advance for support of this great project!

The Value of an A.A.S. Membership

Arachnologists ask, " What do I receive from being a dues-paying member of the American Arachnological Society?". This inquiry addresses an immediate and popular concern among arachnophiles... What does one "get" from being a member of the A.A.S.? ...

- Online access to the latest issue of the JOA.
- No page charges when publishing in the JOA.
- Access to the AAS and Roth Research grants.
- Lower registration fees for the AAS meeting.
- Grants supporting student travel.
- Lower prices for AAS-supported publications.

Not to mention all the other benefits available to anyone: the Newsletter, all the features and information on the Website, etc.

Furthermore, dues for the A.A.S. are just about the lowest anywhere! **What a bargain !**

2008 AAS Election

This year we elected a new Director.

Our newest Director is
Matt Persons
who replaces television star **Jason Bond**. (We thank Jason for two years of service!)

Alan Cady remains as Secretary.

This year (2009) we elect a new President-Elect and a Director. Look for your ballot this spring.

Student Paper Awardees

The Student Paper Competition at the Berkeley AAS Meeting produced many fine student presentations. The awardees were:

Podium Presentation—

First place was **Amy K. Stockman**, East Carolina University (with Jason Bonds) for " An integrative method to delimiting cohesion species: finding the population-species interface in trapdoor spiders with extreme genetic divergence and geographic structuring".

There were three runner-ups:

Ashley L. Bailey, East Carolina University (with Brent E. Hendrixson & Jason Bonds) for " Evolution of male genitalia in the trapdoor spider genus Myrmekiaphila (Araneae: Mygalomorphae: Cyrtaucheniidae: Euctenizinae)

Shira D. Gordon, University of Cincinnati (with George W. Uetz) for "Seismic communication in *Schizocosa ocreata* (Hentz) wolf spiders: Influence of substratum on mating success and behavioral compensation for environmental constraints".

Marjorie G. Weber, Lewis & Clark College (with Greta Binford) for "An integrative investigation of species boundaries among *Loxosceles* of North America's Desert Southwest".

Poster Presentation—

The winner was **Elizabeth D. Knowlton**, University of Oklahoma (with Doug Gaffin) for "A new approach to examining scorpion peg sensilla: the mineral oil flood technique".

Congratulations to the award recipients, and we look forward to the student presentations in Russellville!

NEW!!

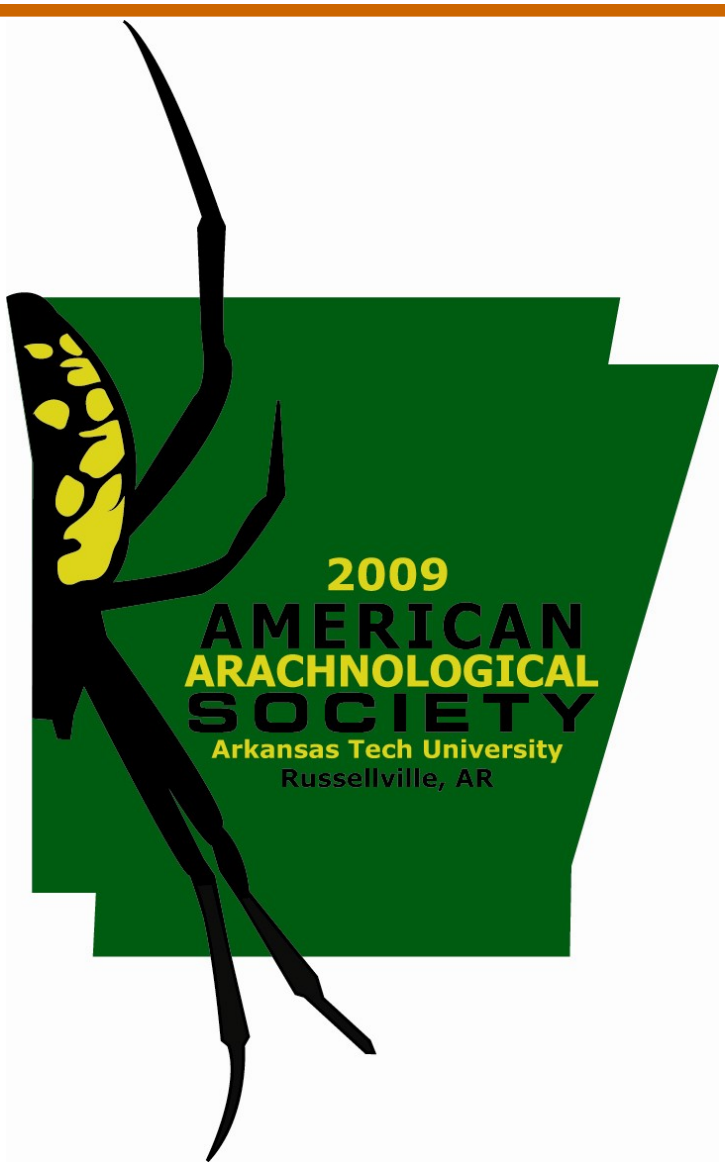
The OFFICIAL American Arachnological Society's LOGO

AMERICAN ARACHNOLOGICAL SOCIETY

After a far-reaching and exhaustive search, your hard-working Executive Committee, lead by the incredibly persistent Logo Search Chair, **Brent Opell**, has found a logo for The Society. The design is by Eric Parrish, winner of the logo contest.

Its spare, yet dynamic lines belie the strength and diversity of our Society. The modern styling accents the vibrant activity of our Members.

AMERICAN ARACHNOLOGICAL SOCIETY



2009 AAS
Annual Meeting

Arkansas Tech

Russellville, Arkansas

Friday, 26 June – Wednesday, 1 July

hosted by

Dr. Tsunemi Yamashita

The 2009 American Arachnology Society annual meeting will be hosted by T. Yamashita and Arkansas Tech University. The dates for this meeting are Friday, June 26th through Wednesday, July 1st.

The meeting will be held at ATU's Lake Point Conference Center on Lake Dardanelle in the Arkansas River valley (http://lakepoint.atu.edu/). The conference center contains all meeting amenities with meeting rooms, a dining room, a volleyball court, and housing. There are many opportunities in the river valley for outdoor recreation as two national forests and recreation sites are within an easy drive. In addition, several state parks surround the area as well as local wineries a few miles to the west.

The climate will most likely be typical of the south with a hot and humid summer environment. We expect an abundant blueberry and peach crop, so plan on seeing some area produce. We have initially planned the field trip into the Ozark mountains with a visit to upland and streamside habitats. Maps and other information will be provided for local collecting excursions.

The conference site is easily accessible from I-40, and two regional airports serve the area. The Northwest Arkansas Regional airport, located near Fayetteville, and the Little Rock Regional airport has daily flights from most metropolitan areas. We plan to offer a few shuttles to the Little Rock airport. Other shuttle arrangements can be made through a local provider.

We are planning an exciting and eventful meeting. I hope to all of you there!

As usual, registration and abstract submission will be primarily via the AAS website.

(http://www.americanarachnology.org/AAS_Meetings/index.html)

(information and forms also will be available in the next Newsletter (#79; distributed in mid-April).

Be watching for announcements pertaining to online meeting information and registration.

ANNOUNCEMENTS

Information about

THE JOURNAL OF ARACHNOLOGY

I wanted to pass on some news about the Journal of Arachnology. My seven year tenure as Managing Editor is came to a close at the end of 2008. **Doug Morse** has graciously agreed to take over as Managing Editor. Therefore, beginning January 1, 2009, please send all new submissions to:

Prof. Douglass H. Morse, Managing Editor

Hermon Carey Bumpus Professor of Biology Emeritus

Department of Ecology & Evolutionary Biology Box G-W Brown University

Providence, RI 02912 USA

Phone: 401-863-3152; Fax: 401-863-2166

E-mail: d_morse@brown.edu

All submissions must be submitted electronically. A new Instructions to Authors is posted at the AAS website: www.americanarachnology.org.

In addition to the change in Managing Editor, **Dr. Gail Stratton** is stepping down as Associate Editor of Behavior and **Dr. Soeren Toft** is stepping down as Associate Editor of Ecology. Many thanks to Gail and Soeren for their years of hard work for the journal and for the society!

Dr. Linden Higgins has agreed to take over as Associate Editor of Behavior and **Dr. Stano Pekar** has agreed to take over as Associate Editor of Ecology. Thanks to both these scientists for their willingness to join the editors of the Journal of Arachnology. These changes in the Associate Editors have already taken place.

You can find a full list of editors and editorial board members at www.americanarachnology.org

Paula E. Cushing, President, American Arachnological Society

From **Dmitri V. Logunov** and the BAS

The British Arachnological Society announces that from now on its Bulletin will accept electronic ms-submission (as MsWord/RTF or PDF-files; or both). Electronic versions of mss should be sent to Dr Dmitri Logunov <dmitri.v.logunov@manchester.ac.uk> of the Manchester Museum. For review purposes light copies of digital illustrations (250-300 dpi, as JPGs) are adequate, but it will be more efficient for the editor and reviewers if the figures are incorporated into a single MsWord/PDF-file (after the main text).

Authors of accepted manuscripts will be asked to provide a final MsWord/RTF file of the text and digital versions of their illustrations at least at 600dpi (TIFF format).

When the paper is published, all authors will be provided with a PDF-file of their paper.

The Bulletin continues to accept mss submitted by post (as three copies of the typescript), which should be sent, as previously, to the Editor, Dr P. Merrett, 6 Hillcrest, Durlston Road, Swanage, Dorset, BH19 2HS, UK.

From **Eileen Hebets**:

A summer camp at the University of Nebraska running through our 4-H Youth Development Extension is available. The camp runs from 7 - 12 June, is for 10-12th grade youth, and is open to any students from anywhere in the country. It is a residential camp that provides all food and lodging for a cost of $400 (if postmarked before 1 April). During the day, the students will be with myself and my graduate students/post docs participating in a variety of experiments, field collections, etc. There are activities for the campers every evening and the participants from all the different camps interact at night. I thought that many of you might know of potentially interested teenagers. More information can be found at the following link: http://bigredcamps.unl.edu/index.html

To look specifically at the description of the Spider Camp, go to '2009 Camp Offerings' and you will see "Spider Science". Let me know if you have any questions (ehebets2@unl.edu).

From **Paula Cushing**:

I have received a Research Experience for Undergraduates grant that allows me to offer a paid summer research job for an undergraduate student interested in assisting with an arachnological research project. If you are an undergrad and would like to apply, please see the job ad below. If you are a colleague, please pass the word to interested undergraduate students. This position pays about $12/hour up to a total of $7200 for the entire summer (May through August). The student must be a citizen of the United States.

Job Announcement – Undergraduate Paid Summer Research Assistant Position in Arachnology

An undergraduate student is sought to assist the Curator of Invertebrate Zoology at the Denver Museum of Nature & Science with field and laboratory research on arachnids. The applicant must be currently enrolled in an undergraduate program. The student will be responsible for conducting a research project on a group of camel spiders (Solifugae). The student will assist with fieldwork throughout the southwestern United States and California and will assist with molecular research.

Applications must include a cover letter explaining why the student is interested in this paid summer internship; a resume or curriculum vita, including any research-related experiences (paid or unpaid); a list of science-related courses taken and grades achieved (formal transcript not necessary); and two letters of recommendation, preferably from previous employers and/or from professors who know the student well.

Applications must be sent electronically to Paula.Cushing@dmns.org and must be received no later than **April 20, 2009**. The position will begin on May 1 or as soon as the student's spring semester ends, and will terminate on August 30 or prior to the start date of the student's fall semester.

American Arachnology

The Newsletter of the American Arachnological Society

Number 78 March 2009

American Arachnological Society Website

http://www.americanarachnology.org

Ken Prestwich has developed our website where one may find membership information, **Annual Meeting Info & registration**, announcements & Bulletin Board, officers, meeting minutes, instructions to JOA authors, an electronic JOA index, graduate study opportunities, a photo gallery, links to other arachnological sites, and **JOA OnLine** (electronic versions of the Journal of Arachnology; available to A.A.S. Members). Many, many thanks and kudos to Ken for applying his time and skill to the Website!! Thanks too to Holy Cross for sponsoring the site.

Arachnology in Cyberspace

International Society of Arachnology- WWW.ARACHNOLOGY.ORG;
The Arachnology Homepage – WWW.ARACHNOLOGY.BE
European Society of Arachnology—WWW.EUROPEAN-ARACHNOLOGY.ORG/
British Arachnological Society - WWW.BRITISHSPIDERS.ORG.UK/
Australasian Arachnological Society— WWW.AUSTRALASIAN-ARACHNOLOGY.ORG/
The Canadian Arachnologist—HTTP://CANADIANARACHNOLOGY.DYNDNS.ORG/

AMERICAN ARACHNOLOGY

is the official newsletter of the American Arachnological Society, and is distributed biannually to members of the Society. Items for the Newsletter should be sent to the Editor, Alan Cady, Dept. Zoology, Miami Univ.-Middletown, 4200 E. Univ. Blvd., Middletown, Ohio, 45042, USA,
Voice:(513)727-3258, Fax:(513)727-3450;
E-mail:CADYAB@MUOHIO.EDU.

All correspondence concerning changes of address and information on membership in the American Arachnological Society should be addressed to the Membership Secretary, Jeffery Shultz, American Arachnological Society, Dept. of Entomology, Univ. of Maryland, College Park, MD 20742; Voice:(301)405-7519, Fax:(301)314-9290, E-mail: jshultz@umd.edu.

Membership information may be found at the AAS website: http://WWW.AMERICANARACHNOLOGY.ORG. Members of the Society also receive the JOURNAL OF ARACHNOLOGY (published triannually) and have access to electronic resources (JOA OnLine).

Those who attended the AAS meeting at Berkeley may have noted the absence of Dr. Jason Bond. Those who wish to know what he was up to should follow this link.

http://www.comedycentral.com/colbertreport/videos.jhtml?videoId=174957&rsspartner=rssFeedfetcherGoogle

Spiders of North America — An Identification Guide

Spiders of North America: an identification guide is now in its 3rd printing with over 3000 copies sold! It can be purchased via any major online bookseller or through the AAS website.

ORDER AT:

HTTP://WWW.AMERICANARACHNOLOGY.ORG/SPIDER_GUIDE.HTML

July 12 – 18th: Spiders: Diversity, Ecology, and Biology

Matthias Foellmer is teaching a week-long course on spider biology at Eagle Hill on the eastern coast of Maine. Participants will be introduced to the biology of spiders, with an emphasis on the ecological roles of spiders and their incredible diversity. Other topics covered include the evolutionary relationships, functional morphology, behavior, and physiology of spiders. Lectures and discussions will not only cover the basics but will also highlight current frontiers of research and where research on spiders has been contributing to conceptual advances in biology. Practical work during excursions and labs will explore the diversity, ecology and behavior of spiders. The excursions will take us to various local habitats (e.g. old fields, forests, marshlands), where we will sample and observe spiders in their natural environments. During the lab sessions we will identify specimens to fully appreciate spider diversity in relation to environmental conditions and habitat. This excellent week-long seminar course costs $465 + lodging and meals. To find out more , go to **www.eaglehill.us** or call 207-546-2821.