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Undergraduate student(s) : Amanda Buck; Melissa Calvillo
Other -- specify(s) : Kristin Algmin
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High school student(s) : Sara Sligar
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Partner Organizations:
Illinois Natural History Survey: Financial Support; Facilities; Collaborative Research
Schlinger Foundation: Financial Support; In-kind Support; Collaborative Research
The Schlinger Foundation has been a strong and continuing partner of the therevid PEET project, providing funds for personnel (students, scientific illustrator, data loggers, curatorial assistant) and expeditions, including the purchase of supplies, to gather unknown and important taxa from targeted areas around the world.

CSIRO Division of Entomology: In-kind Support; Facilities; Collaborative Research

University of Illinois at Urbana-Champaign: Financial Support; In-kind Support; Facilities

North Carolina State University: Financial Support; In-kind Support; Facilities
NC State College of Agriculture and Life Sciences (CALS) are providing matching funds to support graduate student Hilary Hill. The university also employs co-PI Brian Wiegmann and the NCSU-based staff.

USDA Systematic Entomology Laboratory: Collaborative Research

Smithsonian Institution Museum of Natural History: Collaborative Research

North Carolina Agric. Research Service: Financial Support
The North Carolina Agricultural Research Service is providing matching funds to support graduate student Hilary Hill.

Australian Biological Resources Study: Financial Support
PI’s Irwin and Yeates have been awarded a grant to contribute to the costs of field expeditions by ABRS for 2001 and 2002.

Naturhistoriska Riksmuseet (Stockholm): Collaborative Research
Hosting NSF Postdoctoral Fellowship holder, Dr. Kevin C. Holston.

Ashoka Trust for Research in Ecology and the Environment: Collaborative Research
Collaborating with Michael Irwin on dipteran biodiversity project in the Western Ghats of India. Contact is Dr. Priyadarsanan Dharma Rajan, Center for Insect Taxonomy and Conservation, Bangalor, India.

Universidade Federal de Bahia, Brazil: Collaborative Research
Collaboration with Michael Irwin on dipteran biodiversity project in the Caatinga of Brazil; Luiz Auguso Mazzarolo is primary contact.

Other collaborators:
The Therevid PEET project has borrowed therevid specimens from over 100 collections from around the world. A number of collaborators, worldwide, are servicing Malaise traps and capturing therevid specimens for our studies. Among these, we highlight the following: Gerardo Barria, Roberto González, Carlos Quiroz, Patricia Larrain, Hernan Vasques [Chile]; Tim Maggs, Ray Miller [South Africa]; Erick Yabar [Peru]; Karl Spitzer [Czech Republic] Frank Parker [Utah]; Evert Schlinger, Sally Regan, Saul Frommer [California]; Joseph Maddox [Missouri].
With this grant, specific contacts have been made with the following researchers: Dr. Christian Schmid-Egger (Germany/Berlin); Dr. Peter Tschorsnig (Germany/Stuttgart) Museum for Natural History, Stuttgart (SMNS); Fritz Geller-Grimm (Germany/Frankfurt) Museum for Natural History Wiesbaden; Stephan Blank (Germany/Eberswalde) DEI Deutsches Entomologisches Institut; Dr. Joachim Ziegler (Germany/Eberswalde) DEI Deutsches Entomologisches Institut; Dr. Manfred Niehuis (Germany/Albersweiler); Dr. Leif Lyneborg, emeritus, Zoological Museum, Copenhagen; Dr. Karel Spitzer (Czech Republic); Dr. Jean Chazeau (New Caledonia); Dr. Frank Parker; Dr. Steve Goodman, World Wildlife Fund (Madagascar); Dr. Patricia Wright (Madagascar); Drs. Brian Fisher and Charles Griswold (California Academy of Sciences); Rasolondalao Harin’Hala Hasinjaka (Schlinger Foundation, Madagascar); Evert I Schlinger (Schlinger Foundation); F. Christian Thompson (USDA-SEL, Smithsonian Institution); and Scott J. Robinson (Beckman Institute, UIUC, Urbana, IL).

The following people have been added to list of collectors and collection curators with whom we have collaborated: Ben Brugge (Natural History Museum, Amsterdam, Netherlands); Dr. Fritz Gusenleitner (Landesmuseum, Linz, Austria); Menno Reemer (Nationaal Natuurhistorisch Museum, Leiden, Netherlands); Tony van Harten (General Department of Plant Protection, Sana’a, Yemen); Mohamed El Habib Ben Jamaa (INRGREF, Ariana, Tunisia); Dr. Karl Adlbauer (Landesmuseum, Graz, Austria); Bernhard Merz (Museum d’Histoire Naturelle, Geneva, Switzerland); Jeanne Charbonnel (Museum National d’Histoire Naturelle, Paris, France); Dr. Jens-Hermann Stuke (Leer, Germany); Dr. Franco Mason (State Forestry Corps, Verona, Italy); Prof. Dr. sc. nat. Bernhard Klausnitzer (Dresden, Germany); Dr. Amnon Freidberg (Tel Aviv University, Israel); Dipl.-Biol. Joerg Weipert (Institut fuer biologische Studien, Plaue, Germany); Claus Claussen (Flensburg, Germany); Juergen Wiesner (Wolfsburg, Germany); Dr. Wolfgang Schawaller (Naturkundemuseum, Stuttgart, Germany); Dr Ante Vujic (Institute of Biology, Novi Sad, Yugoslavia); Dr. Oleg G. Gorbunov & Prof. Dr. Sergei Golovatch (Institute for Problems of Ecology & Evolution, Russian Academy of Sciences, Moscow, Russia); Prof. Dr. Horst Aspoeck (Vienna, Austria); Jose A Rafael (INPA - Entomologia, Manaus, Amazonas Brazil); Dr. Diego Medan (Buenos Aires, Argentina); Dr. Matthias Buck, (University of Guelph, Ontario Canada ); Weston Opitz (Kansas Wesleyan University Department of Biology, Salina, Kansas); Luciana Musetti (Ohio State University, Columbus, Ohio); Magdi S. A. El Hawagy (Entomology Dept. Cairo University, Giza, Egypt); Wolfgang Schacht (Zoologische Staatssammlung Munic, Germany); Uwe Kallweit (Staatliche Naturhistorische Sammlungen, Dresden, Germany); Dr. Karla Schneider (Institut fuer Zoologie der Martin-Luther-Universitaet, Halle, Germany); fuer Zoologie der Martin-Luther-Universitaet, Halle, Germany); Claudio José Barros de Carvalho (Universidade Federal do Paraná, Brasil); Helmut Heider (Orchidarium Villa Tunari, Bolivia); Noel Starick (CSIRO, Canberra, Australia); Roger Buttermore (Tasmanian Museum & Art Gallery, Hobart, Australia); Andras Szito (Western Australian Depart. of Agriculture, Perth, Australia); Keith Arakaki (Bishop Museum, Honolulu, USA); Gavin Dally (Museum & Art Gallery of the Northern Territory, Darwin, Australia); John Donaldson (Queensland Depart. of Primary Industries, Brisbane, Australia); Terry Houston (Western Australian Museum, Perth, Australia); Susan Wright (Queensland Museum, Brisbane, Australia); Catriona McPhee
(Victorian Museum, Melbourne, Australia); Murray Fletcher (Agricultural Scientific Collection, Orange, Australia); Jan Forrest (South Australian Museum, Adelaide, Australia); Greg Baker (SARDI, Adelaide, Australia); John Chainey (Natural History Museum, London, England); Margaret Schneider (University of Queensland Insect Collection, Brisbane, Australia); John Marris (Lincoln University, Canterbury, New Zealand); Trevor Crosby (Landcare, Christchurch, New Zealand); Daniel Bennett (The University of Washington Fish Collection, Seattle, Washington); Yoshizawa Kazunori (Systematic Entomology, Hokkaido University, Japan)

Added in Year 3:
Dr Ken Green (Australian Institute of Alpine Studies, Jindabyne, NSW, Australia); Emily Sherbrooke (Southwest Research Station, Portal, Arizona); Rustem Hayat (The Ataturk University, Erzurum, Turkey); Alvaro Herrera (INBio, Costa Rica); Manuel Zumbado (INBio, Costa Rica); Christel and Hans Werner Hofféins (Hamburg, Germany); Augusto Henriques (INPA, Manaus Brazil); J. Hutto (INHS, Champaign, IL); Jeff Cumming (CNC, Ottawa, Canada); Drs Arkady Lelej and Sergey Storozhenko (Russian Academy of Sciences, Department of Entomology, Institute of Biology and Pedology, Vladivostok, Russia); Mikhail B. Mostovski (Paleontological Institute, Russian Academy of Sciences, Moscow); Thomas Pape (Swedish Museum of Natural History, Stockholm)

Added in Year 4:
Margaret Humphrey (Macleay Museum, Sydney University, Sydney, Australia); Dan Bickel (Australian Museum, Sydney, Australia); Marion Kotrba (Zoologische Staatssammlung Munchen, Munich, Germany); Peter Sehnal (Naturhistorisches Museum Wien, Vienna, Austria); Dr. Joachim Ziegler (Humboldt-Universitaet zu Berlin, Museum fuer Naturkunde, Berlin, Germany); Dr. Werner Barkemeyer (Museum Flensburg, Germany); Andy Deans (Champaign, Illionis) donated several Therevidae he collected in Australia in 2003; Andrew Ross (Curator in the Natural History Museum, London) sent us 2 interesting amber fossils and one Florissant compression fossil with Therevidae; Carsten Groehn (Glinde, Germany) gave us several amber Therevidae on loan; Herbert Meyer (Colorado) helped with the work on Florissant fossils; Dr. Stephan Blank (Eberswalde, Germany) donated several Therevidae from his collecting trip to Argentina; Dr. Jeff Skevington (CNC, Ottawa) sent us new unidentified Therevidae material; Hilary Hill (US Environmental Protection Agency, Arlington, VA); Shaun Winterton (Department of Entomology, NCSU; current affiliation, California Department of Agriculture); J. Kevin Moulton (Department of Entomology, NCSU; current affiliation, Dept. of Entomology and Plant Pathology, The University of Tennessee, Knoxville); Dov Sax (University of California at Santa Barbara), working with biodiversity and global distribution of species.

Added in Year 5:
Jeffrey Thorne (Departments of Genetics and Statistics, North Carolina State University); Michelle Trautwein (Department of Entomology, North Carolina State University); Dr. Priyadarsanan Dharma Rajan (Center for Insect Taxonomy and Conservation, Ashoka Trust for Research in Ecology and the Environment (ATREE), Bangalor, India); Luiz Auguso Mazzarolo (Universidade Federal de Bahia, Brazil).
Activities and findings:

Research and Education Activities:

Evolution of the Therevidae

Phylogenetic relationships among the Asiloidea

Relationships of Apioceridae and Mydidae. In 2001, Irwin and Wiegmann examined the relationships of the Apioceridae and Mydidae to test previous hypotheses based on morphology and to resolve the familial placement of the genus Tongamya, a rare and odd group of mydids from southern Africa. They sequenced 28S rDNA for 16 taxa including 5 apiocerid species, 8 Mydidae, and 3 outgroup taxa from Scenopinidae and Therevidae.

Phylogenetics of Brachycera. In 2001, the Wiegmann lab sequenced two genes not previously examined for use in phylogenetics of orthorrhaphous Brachycera, opsin and CPSase. Opisin is a multicopy nuclear, protein-encoding gene that is well-characterized in Drosophila, Papilio, Apoidea and crayfish. To reconstruct phylogenetic relationships among the families placed with the Therevidae in the dipteran superfamily Asiloidea, by 2001 Wiegmann and Yang had sampled 2404 nucleotide sites from 28S ribosomal RNA gene (28S rDNA) sequences from 44 species covering 22 families, with a focus of fly families within the Asiloidea. By 2003, the group had sequenced 680 bp of CPSase in Brachycera, including the therevid, Agapophytus bicolour.

Discovering a new Family of Flies. Yeates, Irwin, and Wiegmann, using morphological and molecular data, have demonstrated that a species of fly, subsequently named Evocoa chilensis, captured by us on various expeditions to west central Chile belongs to a heretofore unknown family within the dipterous superfamily Asiloidea. Gene sequences were obtained for selected brachyceran taxa to examine the position of a newly discovered Chilean fly of uncertain family affinity. Combined morphological and molecular data were used to estimate relationships and gene-based divergence times for brachyceran lineages. This new family, the Evocoidae, was described and published 2003.

Higher level relationships within the Therevidae

Supertree construction. Lambkin has developed and analyzed a supertree for the family Therevidae, which puts into perspective the various phylogenetic works of this project to produce the first overall phylogeny for the family. Between this conglomerate phylogeny and others that have been produce through efforts of this project, a rather robust hypothesis is emerging that the family Therevidae is 1) monophyletic and 2) consists of four subfamilies: Phycinae, Xestomyzinae, Agapophytinae, and Therevinae.

Higher level phylogenies. Gene sequences were obtained for Therevidae from nuclear 28S ribosomal DNA, rh1 opsin, and CAD, and mitochondrial 16S ribosomal DNA and cytochrome oxidase genes. By 2001, the Wiegmann’s lab sequenced two genes not previously examined for use in phylogenetics of orthorrhaphous Brachycera, opsin and
CPSase. Opsin is a multicopy nuclear, protein-encoding gene that is well-characterized in Drosophila, Papilio, Apoidea and crayfish. They obtained sequences to characterize the opsin genes of Therevidae to assess their utility in therevid and brachyceran phylogenetics. By then, Wiegmann and Yang had also completed the phylogenetic analysis of elongation factor -1a and 28S ribosomal DNA genes to assess phylogenetic relationships within the Therevidae. Separate and combined analyses of these genes and with morphological data were used to test competing hypotheses of relationships. Within the Therevidae, 43 taxa were included in a data matrix comprising nucleotide sequences for 28S rDNA and EF-1a. In 2003, particular emphasis was placed on sampling taxa from New Caledonia and increasing taxon sampling for Xestomyzinae and Therevidae. In 2004 and 2005, emphasis was placed on sampling taxa from Australia, Madagascar, Fiji, and Chile, and increasing taxon sampling for the subfamilies Phycinae, Xestomyzinae and Therevidae. Laboratory and computational work was conducted to build sequence datasets, alignments and perform phylogenetic analyses. These data were added to existing therevid datasets.

To reconstruct phylogenetic relationships among the families placed with the Therevidae in the dipteran superfamily Asiloidea, by 2001 Wiegmann and Yang had sampled 2404 nucleotide sites from 28S ribosomal RNA gene (28S rDNA) sequences from 44 species covering 22 families, with a focus of fly families within the Asiloidea. They also examined the potential of CPSase, or carbamoyl phosphate synthetase, a gene component of the rudimentary locus of Drosophila. The enzyme is important in the pyrimidine biosynthetic pathway. They had sequenced 680 bp of CPSase in Brachycera, including the therevid, Agapophytus bicolor.

Divergence time estimates. In 2004 and 2005, using MulDivTime software, Lambkin worked with Yeates, Wiegmann and Jeff Thorne (North Carolina State University) to estimate the divergence times of Australian Therevidae.

Phycinae. In 2001, Hauser extracted DNA from the Old World genus Salentia, which added greatly to the dataset for constructing a phylogeny of that subfamily. To this dataset were also added at least one additional species per phycine genus.

Xestomyzinae. Relationships among the Old World Xestomyzinae. For the first time DNA from members of the Old World Xestomyzinae was extracted and analyzed by Hauser during his stay in the Wiegmann lab from Feb-April 2001. These taxa (Hemigephyra atra, Hemigephyra braunsi, Microgephyra brinki, Microgephyra sp. nov. (Madagascar) ) were mainly collected during the Schlinger Foundation sponsored 1996 and 1999 expeditions to South Africa and the 1999 expedition to Madagascar. These data will help to clarify the position of the New World genus Henicomyia and the basal radiation of the Therevidae. Furthermore the data will help resolve the relationships among the genera in the tribes Phycini and Xestomyzini, especially because Hauser was able to add the genus Salentia to the Phycini data set and for the already sequenced genera at least one additional species per genus.
Agapophytinae. Lambkin continues work on the phylogenetics of the Australasian *Taenogera* genus-group. The genus *Ectinorhynchus* has been divided and the descriptions of a new genus and several new species are in progress.

Therevinae.
The Monophyly of the Higher Therevinae. In 2003, Metz completed phylogenetic analyses of adult morphological characters to assess the relationships among the *Anabarhynchus* genus group genera endemic to the Australian region; those taxa putatively placed within the *Anabarhynchus* genus group but not endemic to the Australian region; and the monophyletic clade of Therevinae not found in Australia. The morphological matrix included 31 taxa from every biotic region and 54 characters.

Molecular phylogeny for Therevinae. In 2005, Holston submitted a paper to report results from molecular analyses of Therevinae conducted in collaboration with Wiegmann and Irwin. Building on datasets and taxonomic samples from his dissertation, several key taxa were added as well as additional 28S sequence. One of his studies showed that the speciose genus *Thereva* is monophyletic.

Relationships Among the Genera of the Higher Therevinae. Metz completed phylogenetic analysis of adult morphological characters to assess the relationships among the genera within the putatively monophyletic group, the higher Therevinae. The morphological matrix included 100 taxa and 74 characters.

New tribe proposed within the Therevinae. From the phylogenetic analyses of the higher Therevinae, several genera related to *Pandivirilia* represented a monophyletic group that could be defined as a new tribe (Pandivirilini).

Monophyly of the species constituting the genus *Pandivirilia*. Webb and Metz completed phylogenetic analyses of adult morphological characters to assess the monophyly of the species in the genus *Pandivirilia*. The morphological matrix included 28 species representing eight genera.

Phylogenetics of Brachycera. Nucleotide sequences from 28S rDNA and CAD were obtained for 50 species of Bombyliidae to add to datasets focused on resolving relationships of asiloid Diptera. CAD sequences were also generated for multiple brachyceran taxa to contribute to previously collected datasets. Phylogenetic analyses were carried out using parsimony, Bayesian and Maximum likelihood approaches.

Biogeography of the Therevidae
Biogeography of Therevinae based on New World taxa. A phylogenetic analysis of the species with the New World *Brachylinga-Lysilinga* complex was completed in 2003. The biogeography of the included species was examined, with particular reference to the plate tectonics of the Caribbean Region.

Biogeography of the Therevidae and Dispersal of the higher Therevinae. Metz proposed an hypothesis of the origin of Therevidae and the basal radiation events that occurred
within the family during the late break up of Gondwana. He used the analyses within the Therevinae, geological evidence, independent biogeographic evidence, and the fossil record.

Biogeographical analyses and ecological modeling of Holarctic therevid genera. Holston has submitted a proposal to the Swedish Research Council to perform biogeographical analyses and ecological modeling for Holarctic stiletto fly genera. These analyses will investigate correlations between climate associations and genetic divergences among Holarctic taxa. Holston will be the principal investigator and will work in collaboration with Wiegmann, Anders Bignert (Swedish Natural History Museum), and Isabel Sanmartin (Uppsala University). Species distributions, sequence divergences, and phylogenetic hypotheses suggest that Holarctic stiletto fly genera radiated in response to Northern Hemisphere climate change. Tests of this hypothesis are facilitated by extensive molecular and geospatial datasets compiled during NSF-PEET funded revisionary research and makes these Holarctic stiletto fly genera excellent case studies for examining large-scale diversity patterns. This project would provide one of the first tests of phylogenetic niche conservatism/evolution across a diverse monophyletic group and applies a multidisciplinary approach to reassessing general patterns of Holarctic biogeography. Results from this study would also provide a descriptive and predictive framework for investigating the effects of climate change on a macroevolutionary timescale, assist conservation efforts for threatened stiletto fly species, and encourage investment of resources toward the growing field of biodiversity informatics.

Biogeography of the Brachylinga-Lysilinga complex. A phylogenetic analysis of the species with the New World Brachylinga-Lysilinga complex was initiated in 2003 by Metz and Webb. It was published in 2006.

Classical biogeography study initiated because of a well populated database. In August 2004, Dov Sax (University of Georgia), Irwin, and Kampmeier, began a collaborative effort, utilizing specimen data accumulated within the therevid Mandala database to examine classical biogeographic patterns of therevid distribution. This remains an ongoing activity.

Ecology of the Therevidae

Association of Parasitic Mites and Brachyceran Diptera. In 2003 Metz completed a study analyzing the ecological associations between parasitic mites and adult brachyceran Diptera collected from a dry ravine in New Mexico. Thirty nine families of Diptera represented by 4,178 specimens were compared by frequency of parasitization and position of parasites on specimens. This study is now published.

Emergence patterns of Australian Therevidae. Lambkin will co-author two papers with Honours student, David Carlisle, on the phylogenetic signal from the male genitalia in Australian Therevidae
Diversity and flight activity patterns. Irwin studied and published on the flight activity and diversity of therevids in the dune area of Namibia. He is continuing this study in Madagascar with six years of data for some areas.

Taxonomic Activities.

Fossil Therevidae. Hauser and Irwin described *Peratrimeria mexicana*, a new genus and species of fossil Therevidae from Mexican amber. The publication was published in *Zootaxa*. In addition, Hauser and Irwin revised the fossils from Florissant, Colorado, which were previously described as Therevidae, removing three species from the family Therevidae (placing one into the order Trichoptera, and two into the fly families Apsilocephalidae and Asilidae). The remaining species was placed in the subfamily Phycinae in a new genus, *Palaeopherocera* Hauser and Irwin. A poster about fossil Therevidae was prepared by Hauser for the PEET V meeting in Urbana in September 2004. The same poster was presented in Pretoria, South Africa, at the Fossils X3 (3rd International Congress of Palaeoentomology) in February 2005.

Keys to Therevidae. Winterton and Skevington began collecting images and scoring character states for an interactive key to Therevidae using Lucid http://www.cdfa.ca.gov/phpps/ppd/Entomology/Lucid/Therevidae/Austherevid/key/Aust herevid/Media/Html/opening_page.html.

Agapophytinae. Lambkin prepared a dichotomous key to the Australasian genera of Therevidae, which will be published with a monograph of the Australian Therevidae with Winterton, Jeff Skevington and Irwin. Lambkin will describe a new genus, describe a second species for another genus, and provide new diagnoses for 6 genera. Lambkin and Jacque Recsei have revised the genus *Johnmannia*. Winterton and Hill described a new monotypic genus of therevid from Australia, *Acraspisoides*, now published in *Zootaxa*.

Therevidae.

Revision of *Ozodiceromyia*. Gaimari continued revising the New World genus *Ozodiceromyia* between 2003 and 2006. There are 100 recognized species, 72 of which are new to science, with an additional 12 new species known only from females. A data matrix of 94 characters is complete, and parsimony analyses have yielded trees with high resolution into distinct species groups. Addition of characters and further analyses are on-going. Descriptions for many of the species are finished, two manuscripts are published, and yet several species remain to be formally described.

Revision of the *Brachylinga-Lysilinga* complex. Webb and Metz began a revision of the species putatively belonging to the *Brachylinga-Lysilinga* complex in. Numerous new species were described, with redescriptions of previously describe species, keys to the genera and species, a maps outlining distributional patterns. This moderately sized group contained a significant amount of the remaining undiscovered New World therevid species diversity and the publication of this study has contributed significantly towards furthering the knowledge of the New World Therevidae.
Revision of the European Thereva fauna. Kevin Holston is completing a revision of the European *Thereva* fauna which includes the description of nine new species. New species will be described in this revision from Spain, Corsica, Greece, and Hungary. Dichotomous keys and figures for the male genitalia and female frons will be provided for all species, and the nomenclature and distributions will be updated in an annotated checklist format.

Pandiviriliini. A journal article by Webb defining the new Tribe Pandiviriliini included a review of the Nearctic species of *Cliorismia*, *Dichoglena*, *Psilocephala*, and *Spiriverpa*.

Databasing and Electronic Dissemination of Information

Therevid PEET Website: During the course of this second therevid PEET project, the therevid website http://www.inhs.uiuc.edu/cee/therevid/ was updated with a fresh look by Kristin Algmin. Kristin has also spent a significant amount of time working on assembling information for the upcoming debut of species pages, including going through primary literature and cataloging images in the Mandala database, which were associated with taxa and specimens in the literature, as well as photographing the type specimens and their labels, which were on loan from museums from around the world.

Mandala: Databasing of specimens collected during the project as well as of loans of specimens from museums from around the globe continues. Over 134,000 specimens have been databased from nearly 18,000 localities from all over the world in over 37,000 collecting events. The data are available to the public for searching http://www.inhs.uiuc.edu/cee/therevid/mandala/TherevidWebMandala.html and a php interface is under development, which will be integrated in the GBIF portal http://www.gbif.org/ later in 2007.

Mandala was significantly overhauled in 2005, all layouts, scripts, field definitions, value (pick) lists, and relationships were examined, renamed in a more uniform and logical manner, and brought in compliance with DarwinCore 2. Version 7 of Mandala was released in early 2006. The current version distributed for free to the taxonomic community, with a newly developed license through the University of Illinois, for non-commercial use, is 7.2 (Jan. 2007; see http://www.inhs.uiuc.edu/cee/therevid/mandala/). Mandala was chosen by Agriculture Canada and the Canadian National Collection for use by its collections. They are modifying the user interface for their collections and will be using Oracle to link Mandala to DiGIR (http://www.gbif.org/serv/gbif-tools). This will be the first enterprise-wide use of Mandala. Mandala's biodiversity inventory features were also boosted by modifications made for the NSF Terrestrial Arthropod Survey of Fiji http://www.inhs.uiuc.edu/cee/fijimandala/.

Museum Visits

This “therevid PEET II” grant is a continuation of a five-year PEET that began in 1995. For that reason, much of the preliminary museum visits and borrowing of material had occurred during the first grant period.
During 2003, Lambkin borrowed fragile 19th century type material from various European institutions and returned existing type loans, examined further holdings of Australian Therevidae, and borrowed types from several museums in Europe, as follows: Muséum National d'Histoire Naturelle, Paris France (Dr. Christophe Daugeron), for Kröber and Macquart types; Institut fuer Systematische Zoologie, Museum fuer Naturkunde, Humboldt-Universitaet zu Berlin Germany (Dr. Joachim Ziegler), to examine Erichson type specimens; International Research Institute for Entomology, Naturhistorisches Museum, Vienna Austria (Dr Peter Sehnal), find Schiner type specimens.

During August 2003, Hauser visited several museums in Europe and took pictures of many type specimens. The first destination was the Natural History Museum in Brussels, Belgium (http://www.naturalsciences.be/). Martin Hauser spent two days going through the collection and was able to loan some interesting specimens. The second stop was the Royal Museum for Central Africa in Tervuren, Belgium (http://www.africamuseum.be/), where many interesting Therevidae from Africa are housed. There, he checked through the many drawers of unidentified insect material to find the unsorted Therevidae. The next museum visited was the collection in Swedish Museum of Natural History in Stockholm (http://www.nrm.se/en/welcome.html.en). During this visit he met with Kevin Holston and Thomas Pape and exchanged ideas about ongoing and future projects. Together with Kevin Holston, Martin Hauser visited the Zoological Museum in Copenhagen (Denmark). Lars Vilhelmsen prepared for and facilitated their visit. Hundreds of specimens from the collection were brought to Illinois so they could be entered into Mandala.

In February 2004, Martin Hauser, Mike Irwin, and Gail Kampmeier visited the Smithsonian Institution. During the visit Martin Hauser photographed all Therevidae types in the collection, examined and photographed the fossil Florissant Therevidae, and was able to borrow several Scenopinidae with pupal exuvia for the comparative study of pupal morphology in Therevidae and their sistergroup Scenopinidae.

Shaun Winterton visited the Australian National Insect Collection in Canberra during June 2005 to work on Australian Therevidae and Scenopinidae for the publication of monograph (‘Revision of Australian Therevidae genera’) coauthored with Christine Lambkin, Michael Irwin, and Jeff Skevington.

Martin Hauser together with Dr. Jens Hermann Stuke visited the Muséum National d'Histoire Naturelle, Paris France (Dr Christophe Daugeron) in Jan. 2005 to borrow type material and specimens. While there, he discovered several types previously assumed lost.

Hauser and Stuke subsequently (Jan. 2005) visited the amber collection of the Geological Institute in Goettingen Germany to study what is left of the important Koenigsberg collection, which was almost completely destroyed during World War II.
Hauser visited the South African Museum (Iziko Museums) of Cape Town (Margie Cochrane) in September 2004 and examined and photographed several Therevidae types that were too fragile to ship.

Hauser visited the insect collection of the department of Entomology in Antananarivo in November 2004.

In June 2001, Metz visited the University of Central Florida Arthropod Collections and its curator, Stuart Fullerton. In addition to working on the fly family Therevidae, he sorted several thousand fly specimens to the family level. In the process he added seven new families to the collection. Besides this museum work, he also spent time in the field collecting and observing the behavior of live specimens.

Laboratory Exchanges.

One of the strengths of the therevid PEET was the built-in laboratory exchanges, especially for graduate students, to learn new techniques, take advantage of expertise in various laboratories, and cement working relationships among students and colleagues on the project. Many of the exchanges of graduate students between labs occurred during the first of the therevid PEET grants.

Holston and Hauser spent April/May 2002 in Wiegmann’s lab at NCSU. They worked on sequencing taxa germane to their dissertation research. Lambkin visited the Irwin lab for a month in August/September 2001 to obtain an understanding of the placement of the Australian therevids in the world fauna. Chris examined and borrowed Australian and some closely related New World material for her revisionary work of *Ectinorhynchus*, part of the *Taenogera* genus-group. Many undescribed Australian genera and others close to the *Taenogera* genus-group were also examined and borrowed. She shared ideas on multistate characters, character scoring, phylogenetic methods, and incongruence between data partitions caused by convergent evolution with Hauser, Metz, and Holston. Also Kampmeier taught Lambkin how to conduct efficient searches for specimen information, literature references, and data entry in Mandala. Hauser visited Wiegmann's lab in April 2005 for 10 days to further analyze DNA data. Irwin visited Yeates' lab at ANIC Canberra in Sept 2004 after attending the International Congress of Entomology. Lambkin visited Kampmeier, Hauser, and the Irwin therevid PEET lab, 22-26 June 2004, during which she helped work out how to remotely access the Mandala database and how to import data from CSIRO's BioLink database. Lambkin visited Wiegmann’s lab in July 2004. Wiegmann visited Yeates’ lab at CSIRO ANIC in September 2004 prior to attending the International Congress of Entomology. Winterton and Jeff Skevington (Canadian National Collection, Ottawa) visited Irwin’s lab in Sept 2004 to photograph flies and begin scoring character states for an interactive key to Therevidae using LUCID software. Winterton visited Irwin’s lab again in Feb 2005 to work on Australian therevids, and borrowed specimens for the start of a revision of the species-rich genus *Parapsilocephala*. Yeates visited Wiegmann’s lab in North Carolina in Feb 2004, followed by Greg Courtney’s lab at the University of Iowa, Ames, Iowa.
Collecting Expeditions

PALEARCTIC REGION
India. Two expeditions were undertaken by Irwin to the Western Ghats during this reporting period. The first occurred in November 2004 and lasted about a month. The second occurred six months later, in April 2005 and lasted about two weeks. Both were efforts to initiate an arthropod survey of the Western Ghats with Dr. Priyadarsanan Dharma Rajan of the Center for Insect Taxonomy and Conservation, Ashoka Trust for Research in Ecology and the Environment (ATREE), #659, 5th A main, Hebbal, Bangalore - 560 024, India. This extensive survey is being initially funded through the Schlinger Foundation and will potentially last several years. Permits are being obtained at present and all of the national parks and other protected areas have been established and are eager to begin the survey effort. Local “green” clubs will conduct much of the survey effort once it is underway. A more long-term approach to monitoring insects across a wide gradient in the mountains has been developed. A proposal to fund this has been sent to NSF and it is currently awaiting panel review. Thus far, the two year effort has produces a few therevid flies, but nothing that appears extraordinary in nature.

Kazakhstan. In May/June 2001 Martin Hauser joined an international expedition to Kazakhstan, which was very successful in bringing back many species conserved especially for DNA analysis. The data from this material will be an important contribution to the ongoing studies of Kevin Holston and Martin Hauser. A subsequent expedition to Tunisia also yield several new taxa, some specimens of which are preserved specifically for DNA studies.

Israel. A two week expedition to Israel was undertaken by Mike Irwin in May 2005. The main purpose of this trip was to help develop a biodiversity inventory of the Nizzanime Nature Reserve, but included an effort to place malaise traps in strategic areas of southern Israel, especially the Negev Desert, during the two week period. Some very interesting therevid specimens were obtained and are now being curated at Illinois.

Spain. Holston conducted collecting trips for Therevidae during May 2004 and June 2004. These trips were conducted in support of his NSF International Research Fellowship at the Swedish Natural History Museum, Stockholm, to collect poorly known Thereva species in southern Spain. Collecting along the southwest coastal dunes yielded male and female specimens of T. hispanica, a species for which the type specimens have been lost and only one male specimen had been located. This species was collected as adults and reared from larvae, which will allow larval and pupal morphology to be described and used in further characterizations of this endemic Iberian species. In June 2004, T. laufferi, another Thereva species known from few specimens and whose type series has been lost, was collected at a southwestern riparian locality. Morphological study of European species suggests that T. laufferi represents the Iberian member of a lineage with four uncommon European species. Specimens of T. hispanica and T. laufferi were identified as high priorities for improving the taxonomic sample for the worldwide phylogenetic analyses of Thereva in progress, and specimens in alcohol are now available as a result of these collecting trips.
The first females of the enigmatic genus *Iberotelus* were collected by Holston during the June 2004 trip to Spain, a remarkable find with profound implications for phylogenetic research on Therevinae. Male morphology initially suggested that *Iberotelus* has a close phylogenetic relationship with genera in Cyclotelini, but this tentative link could not be rigorously examined due to the lack of specimens. The two species of this genus were described in 1989 from two male specimens, and no additional specimens were available for study. Holston collected over 50 specimens of *I. inexpectatus* where *T. laufferi* was found; this site is over 180 km west of the type locality for *I. inexpectatus*. Female specimens and specimens in alcohol allow the phylogenetic placement of *Iberotelus* to be re-examined using morphological and molecular data. The relationship of *Iberotelus* with cycloteline genera can now be examined with reference to female morphological characters, which provide unambiguous synapomorphies for Cyclotelini.

AFROTROPICAL REGION
South Africa. Hauser, Irwin and Frank Parker went on a collecting trip to the southern Cape Province of South Africa between the 27.Sept. and 7.Oct.2005 and set up more than 50 malaise traps. During this expedition Hauser was able to photograph the enigmatic therevid genus *Stenogephyra* for the first time alive in its natural habitat.

Madagascar. Irwin and Schlinger spent the month of January 2001 on an expedition to the northern corner of Madagascar. More than fifty malaise traps were set up and monitored during their stay. These same traps were monitored afterwards by Rasolondalalo Harin’Hala Hasinjaka (Rin’ha), who had been hired to maintain and service the traps and curate the material generated by them. These traps produced a large quantity of specimens, particularly flies. The project is being co-developed by the California Academy of Sciences and material generated by the traps will be housed there. The project has developed to the point where Irwin and Schlinger are now responsible for determining which taxonomists will be working up the various taxa within the Order Diptera.

Madagascar. In October 2001, another month-long Madagascar expedition was launched, this time focusing on the southwestern corner of the country. Irwin and Frank Parker were joined in Madagascar by Rin’ha. All of the traps from the northern part of Madagascar were taken down, cleaned and repaired in Antananarivo, and then redeployed, along with a number of additional traps to the southwest. Some 60 malaise traps were in place for several years, and they produced a prodigious quantity of virtually unknown material. Most of the traps are now down and the material formerly collected is being sorted and curated.

Madagascar. There is currently an on-going intensive and extensive survey of Diptera of Madagascar. It has been ongoing for about four years. Irwin visited Madagascar for three weeks in June 2003 to extend the survey effort into the central western portion of the country. The material is producing, among other exciting new taxa, many new genera and species of therevids, including a subfamily only previously found in southern Africa.
Madagascar. The on-going intensive and extensive survey of Diptera of Madagascar is winding down. Hauser, Irwin and Frank Parker visited Madagascar from the 7 October through 7 November 2004 (Irwin and Parker left on the 20 Oct). to extend the therevid survey effort into the northern and southern portions of the country. The material is producing, among other exciting new taxa, many new genera and species of therevids, including a subfamily only previously found in southern Africa. Hauser also trained the sorting team in Antananarivo in identifying of insect orders and families, databasing and general curation of insects.

AUSTRAL-PACIFIC REGION
New Caledonia. Irwin, Schlenger and Webb, supported by the Schlinger Foundation, searched for therevids, acrocerids and other Diptera in New Caledonia (November-December 2000).

Fiji. The Schlinger Foundation provided funds to initiate a survey of Diptera of the Fijian Islands. This was in cooperation with Dr. David Olson, Director of South Pacific operations of the Wildlife Conservation Society. About 40 malaise traps are currently in operation, producing a prodigious amount of Diptera material in very good condition, much of which is new to science. An NSF project developed from this initial thrust. Irwin participated on three of the early expeditions to the islands. About six specimens of a therevid were found, and they represent a genus and species new to science. Based on these few specimens it appears as though the species seems most closely related to taxa in central Africa and Asia.

Australia, Northern Territory. Yeates, Lambkin, Irwin and Schlinger spent six weeks (June-July 2001) in the isolated Keep River and Gregory River regions of the Northern Territory, Australia, to observe the ecological and behavioral characteristics of therevids in their environments, fill taxon and geographic gaps in extant therevid material, and provide well-preserved material for molecular studies. The group sampled 54 sites using malaise traps, flight intercept traps, hand nets, and soil sieving. Thousands of therevids, with many new species and several new genera were collected.

Western Australia, Pilbara. Yeates, Jacquie Recsei, Noel Starick, and Lambkin were part of a large group from ANIC that spent six weeks in the field in April and May 2003 in the isolated Karijini and Millstream National Parks in the Pilbara region of Western Australia to observe the ecological, and behavioral characteristics of therevids in their environments, fill taxon and geographic gaps in extant therevid material, and provide well-preserved material for molecular studies. Several thousand therevids were collected using malaise traps, pan traps, hand nets, and soil sieving. While the main expedition concentrated on two national parks in the area, Irwin and Frank Parker ranged widely, setting over 60 malaise traps across the landscape, joining the ANIC crew on occasions. Many thousands new and rare species were collected by the Irwin/Parker team during that expedition, and specimens are currently being curated.

Australia, Victoria. Lambkin, accompanied by CSIRO staffer, Noel Starick, spent two weeks in September malaise trapping through the semi-arid desert of western Victoria,
including Wyperfeld, Hattah-Kulkyne, Murray Sunset, Grampians, and Little Desert National Parks.

Australia, Queensland. Yeates, Jo Hamilton, Noel Starick, and Lambkin mounted a three week expedition to Black Braes National Park in north Queensland in November. This isolated new National Park is about 300 km north of Charters Towers, and situated on a high plateau. 25 malaise traps were set and serviced at Black Braes and at Undarra Volcani

Findings:

Relationships among the Asiloidea
Monophyly of the Asiloidea. Parsimony and maximum likelihood analyses of 44 species covering 22 families of the dipteran superfamily, Asiloidea, indicate that the 28S rDNA is informative for inferring evolutionary relationships at this level. Analyses using these two methods with the same data set yielded an identical tree topology. Our result supports the monophyly of the Asiloidea, and a sister-group relationship between Asiloidea and Eremoneura. The monophyly of Nemestrinoidea, Eremoneura, Empidoidea, Cyclorrhapha, and all sampled families except the Mydidae and Empididae, are also confirmed. Similar to recent morphological studies, Mydidae were found to be closely related to Apioceridae, and Empididae are paraphyletic with respect to Dolichopodidae. In Asiloidea, the family status of the Hilarimorphidae and Apsilocephalidae are also supported by the 28S rDNA. Bombyliidae are placed as the basal lineage of Asiloidea and forms the sister group of the remaining asiloid families. Hilarimorphidae are placed between the Asilidae and Mydidae + Apioceridae.

Timeline for the origin of Brachycera and Therevidae. Bayesian divergence time estimates based on 28S ribosomal DNA and combined morphological and molecular phylogeny indicate that the Brachycera originated in the late Triassic or earliest Mesozoic and that all major lower brachyceran fly lineages had near contemporaneous origins in the mid-Jurassic. The Therevidae + Scenopinidae are estimated to have originated approx. 170 mya, with the split between the two families occurring at approx. 135 mya.

Relationships of Apioceridae and Mydidae. Parsimony and maximum likelihood analysis of 16 taxa including 5 apiocerid species, 8 Mydidae, and 3 outgroup taxa from Scenopinidae and Therevidae, supported monophyly and a sister-group relationship for the Apioceridae + Mydidae. Tongamya was placed as sister to the Chilean genus Megascelus, and these together form a clade with Rhaphiomydas at the base of the Mydidae.

Apsilocephalidae. Our combined analysis strongly supports the previously published view that Apsilocephala and Clesthentia represent a separate asiloid family, Apsilocephalidae, and our data place this group as the sister group of the Therevidae + Scenopinidae.
Evocoidae and other therevoid families. Parsimony analysis of 28S ribosomal DNA for 16 species of from 6 asiloid and empidoid families and the newly discovered Chilean “Ochoa-fly” support a sister-group relationship between the “Ochoa-fly” and Scenopinidae +Therevidae. These results suggest that this fly represents a significant new lineage of asiloid Diptera, heretofore unknown to science.

Sister-group of the Therevidae. A sister-group relationship between the Scenopinidae and Therevidae is strongly supported by separate and combined parsimony-based phylogenetic analyses.

Relationships within the Therevidae

Fossil Therevidae. All known fossil Therevidae have now been examined and reclassified. Beyond the revisions of the Florissant, Mexican and Baltic amber species, the compression fossils from Karatau in Kazakhstan and Germany are under investigation. The correct classification and dating of these fossils are crucial for estimating divergence times, which could provide reasonable dates for the age of the family Therevidae and its included subfamilies and genera.

Monophyly of Therevidae. Separate and combined parsimony-based phylogenetic analyses strongly support the monophyly of the family Therevidae, excluding the controversial genera, Clesthentia and Apsilocephala. A sister-group relationship between the Scenopinidae and Therevidae is also strongly supported. When used in combination, the two sampled genes are found to contain sufficient phylogenetic signal to relationships among the major groups of Therevidae. Analysis of morphological data for these same taxa differed most with the nucleotide data in placing Apsilocephala and Clesthentia inside the Therevidae. Partition homogeneity tests indicate that the two gene-based data sets are sufficiently congruent to be combined in a single analysis, but there is significant heterogeneity between molecular and morphological data for the same taxa.

Basal branching of Therevidae. When used in combination, the 28S and EF-1 alpha DNA datasets were found to contain sufficient phylogenetic signal to relationships among the major groups of Therevidae. Partition homogeneity tests indicate that the two gene-based data sets are sufficiently congruent to be combined in a single analysis, but there is significant heterogeneity between molecular and morphological data for the same taxa. Simultaneous analysis of all available evidence yields a highly resolved phylogenetic hypothesis for nearly all of the major clades of the Therevidae and outgroups. Several near most parsimonious alternatives have also explored in light of the current evidence. A phylogenetic classification of the Therevidae is proposed to divide the family into four subfamilies, Xestomyzinae, Phycinae, Agapophytinae, and Therevidae.

The phylogenetic analysis of these genes confirmed that the subfamily Phycinae is the sister to the rest of the Therevidae and the subfamily Xestomyzinae is the sister to the rest of the Therevidae except the Phycinae. This contradicts the former hypothesis that the Phycinae and the Xestomyzinae form a monophyletic group. The Phycinae fall into two
clades, one with only New World taxa and one Old World group, which has some representatives in the New World. A strong sister relationship between the New World genus *Pherocera* and the African genus *Stenogephyra* is postulated from the DNA data. This relationship was previously never taken into consideration. The Xestomyzinae can also be divided into a New World *Henicomyia* clade and an Old World Xestomyzinae clade. This separation is strongly supported by both molecular and morphological data.

Placement of New Caledonian therevid clades. Parsimony and maximum likelihood analysis of 28S rDNA data place five newly discovered New Caledonian therevid species as a monophyletic group near the *Taenogera*-group of Australian Therevidae. Combined analysis with elongation factor-1alpha leaves these taxa unplaced at the base of the Australasian clades.

Monophyly of the Higher Therevinae. Analyses support the monophyly of the *Anabarhynchus* genus group taxa from both the Australian region and non-Australian region. The therevine taxa not present in Australia, the higher Therevinae, are part of a monophyletic clade sister to the *Anabarhynchus* genus group.

Relationships among the genera of Higher Therevinae (excluding the *Anabarhynchus*-group). Analyses support five basal species and five internal genus groupings within the higher Therevinae. The basal species are currently part of the genera *Stenopomyia*, *Schoutodenomyia*, and *Lindneria*, mainly tropical or subtropical species in Africa or South America. The *Litolinga* group, *Chrysenthemia* group, *Thereva* group, Cyclotelini, and *Pandivirilia* group were resolved as monophyletic assemblages of genera. The tribe Cyclotelini was found to be monophyletic with the *Brachylinga* group of genera and the tribal definition is being expanded to include them.

Monophyly of *Thereva* and a molecular phylogeny for Therevinae. The phylogenetic analyses of 28S, EF 1-alpha, and 16S for 39 therevine genera by Holstom in collaboration with Wiegmann provide strong evidence for the monophyly of *Thereva* and the monophyly of a second clade that includes the other genera with Holarctic distributions. The derived position of *Thereva* and the Holarctic genera suggests parallel evolutionary radiations of these clades across the Holarctic Region and supports assertions that particular genitalic characters have phylogenetic importance. Two Afromontane species groups of *Thereva* are well-supported as members of clades outside *Thereva* sensu stricto, with the remaining Afromontane group retained in *Thereva*. One Afromontane species group is paraphyletic with respect to the apomorphic genus *Caenophthalmus* and the other is part of the most species rich Afrotropical therevine genus, *Irwiniella*. *Notiothereva* is the genus proposed for Chilean-Argentinean species classified as *Thereva* until 2003, and appears to represent a monophyletic group. The patterns of continental endemism in therevine clades and the basal position of the Austral-Chilean therevine genera suggest initial Gondwanan diversification, with Laurasian and Palearctic diversification dominated by the Holarctic genera. The placement of *Iberotelus* in Cyclotelini indicates that cycloteline relationships and, especially, biogeography must be revised. Inclusion of endemic Neotropical and Afrotropical genera is likely to improve
basal resolution and facilitate identification of monophyletic groups on which a classification of Therevinae could be based.

Palearctic Thereva. Thereva is the most species rich and widespread genus of Therevidae in Europe, making its revision relevant to a wide range of studies on the European stiletto fly fauna. Thereva is now restricted to 41 species in mainland Europe and the Canary Islands due to the recognition of 17 junior synonyms. The highest diversity of Thereva is in central Europe and results from distribution overlap between western and eastern species within the Alpo-Carpathian highlands. These highlands mark the northern limit of many southern European Thereva species although most northern European species can be found south of this boundary. The most distinct faunal break is between the western Mediterranean and the rest of mainland Europe and the eastern Mediterranean. Several Iberian species are now known to occur in North Africa, and limits of central European species have been more clearly defined within the Middle East and Eastern Asia.

Nearctic Species of Pandivirilia. The monophyly of the genus Pandivirilia was supported and two new species were described. Two North American species were newly combined with Pandivirilia. North American species formerly placed within Pandivirilia were found to be monophyletic with species in the genera Dichoglena or Cliorismia. The placement of the North American species in Cliorismia expands the generic distribution to a Holarctic one.

Biogeographic Patterns. Gondwanan breakup influenced therevid clade distributions. Lambkin analyzed a combined EF1-alpha, 16S, and 28S molecular data set of 56 taxa (35 Australian), aligned by Wiegmann. Jeff Thorne's divergence time estimates show that while most of the Australian genera were established by the break-up of Gondwanaland, at least some of the radiations within the species rich genera were consistent with the aridification of Australia.

Because the Xestomyzinae occur in Madagascar and the southern part of Africa as well as South America and the southern part of North America, they were thought to have a Gondwanan distribution. The fossils of Xestomyzinae in Baltic amber and in Mexican amber as well as the relatively young divergence time estimate for this group, suggest that the distribution pattern of the Xestomyzinae can not easily be explained as Gondwanan. It seems that the clade is younger than the split between South Africa and South America, and that despite the already separated continents it was able to disperse.

Madagascar Xestomyzinae. Hauser calculated a divergence time estimate, using molecular data of Therevidae and Therevidae fossils for calibration. The results revealed that the splits between the African mainland species and the Madagascar taxa of Xestomyzinae, the Phycinae genus Ruppellia, and the Therevinae genus Stenopomyia are less than 40 million years and therefore must have dispersed at least 3 independent times to Madagascar from mainland Africa.
Biogeography of the Therevidae and Dispersal of the higher Therevinae. Analyses of the higher Therevinae support a basal split of this subfamily subsequent to the split between Africa and South America, but after the split between East and West Gondwana. Although the origin of Therevidae could still be Pangaean, the radiation of the subfamilies seems to have occurred during the late break up of Gondwana. The lack of phycine therevids in the Australian region suggests a much later origin of therevids, probably mid-Cretaceous. The presence of basal higher Therevinae in the tropical parts of Africa and South America suggest an origin of the higher Therevinae prior to the separation of Africa and South America. The remaining distribution of higher Therevinae is explained by northward dispersal through Africa then Laurasia and through South America, Central America, and across Beringia.

Ecology.
Associating parasitic mites and Brachyceran Diptera. Parasitic mites were found to be significantly more prevalent on therevids and tachinids than on other families of brachyceran Diptera being parasitized. Mite loads were also significantly different among families of brachyceran Diptera. Mites preferred to attach to sites of membranous cuticle. Within Therevidae, females were attacked by mites at a higher frequency, but the number of mites per individual were similar.

Flight phenology. Irwin completed a one-year study of the diversity, flight timing, and abundance of therevids in a dune-riparian system in Namibia, Africa. The results suggest that few species of therevids inhabit this area and that the timings of adult activity are discrete but overlap among species.

Therevid larvae and soil ecology. David Carlisle, Lambkin, and Graham Teakle have completed the first ecologically based study that suggests prevalence of the various therevid species within a locality may be influenced by soil ecology. They erected 24 emergence traps and 6 Townes Malaise traps in Tallaganda National Park, New South Wales, involved twice-monthly sampling of therevids by trapping from the soil in three different environments. Nearly 100 therevids from 11 species in 9 genera were collected from the emergence traps, and over 100 in the malaise traps, over the 5 month study. This study suggests the presence of more than 70,000 therevid larvae/hectare, with high alpha diversity.

Training and development:
Training and development of participants involved in PEET projects is one of the primary pillars of this program. Over the life of the therevid PEET project, six students have received Ph.D. degrees, two have received Masters, two honors students projects have been based on therevids, and everyone involved, down to the hourly workers, interns, and volunteers have learned skills and knowledge to carry them into further jobs or projects thanks to the time spent on this Therevid PEET project. Particular accomplishments follow:
Michael E. Irwin, PI, University of Illinois at Urbana-Champaign, was elected to two boards that involve biodiversity issues: the All Species Advisory Board, and the Discover Life in America Governing Board.

David K. Yeates, Co-Principal investigator on the therevid PEET team, relocated to CSIRO Entomology in Canberra where he took a position as Principal Research Scientist and Head of the Australian National Insect Collection (ANIC), the world's largest collection of Australian insects (See http://www.ento.csiro.au/research/natres/anic.htm). David will also continue his systematics research in Diptera at ANIC as part of the Natural Resources and Biodiversity Program.

Longlong Yang was awarded a Ph.D. at NCSU at the end of the earlier PEET award (DEB 9521825). He had been supported by matching funds from NCSU College of Agriculture and Life Sciences. Longlong successfully defended his dissertation entitled, 'Molecular phylogenetics of the Therevidae and their position among the families of the Asiloidea (Insecta: Diptera)' under the direction of co-PI Wiegmann. Dr. Yang accepted a postdoc in Bar Harbor, Maine at the Jackson Institute.

Hilary Hill, masters student at NCSU with Wiegmann, began coursework and laboratory research on Therevidae at NCSU. Her assistantship was supported from matching funds provided by the North Carolina Agriculture Research Service and NC State College of Agriculture and Life Sciences (CALS). Ms. Hill took classes toward the MS degree in entomology, including ENT502 (Insect Systematics in Fall 2000), ENT503 (Insect Morphology and Physiology in Spring 2001) and ENT 591O (Molecular Systematics in Spring 2001). Her MS research involved molecular characterization and sequencing of the opsin gene in Therevinae. Her laboratory training has included DNA extraction and purification, PCR, automated sequencing, molecular cloning, sequence data editing, alignment and phylogenetic analysis. Her graduate committee at NCSU consisted of 3 Entomology faculty members, B. Wiegmann, L. Deitz, E. Vargo. Hilary Hill successfully defended her MS in Entomology at NCSU in March 2003, and was awarded the degree in May 2003. Her MS thesis was entitled, “Investigation of the Phylogenetic Utility of Two New Nuclear Genes, Opsin and CAD, within the stiletto flies (Diptera: Therevidae).

After graduating, Dr. Winterton held a postdoctoral position in the Wiegmann lab on the molecular phylogenetics of the orthorrhaphous brachyceran family Acroceridae. He was funded through a postdoctoral research fellowship to NCSU from the Schlinger Foundation. He also worked with USDA-APHIS on Lucid keys for pest species.

In 2003, Winterton accepted a position as Associate Insect Biosystematist with the Plant Pest Diagnostics Branch of the California Department of Food and Agriculture. His primary responsibilities were diagnostics/identification of Auchenorrhyncha (leafhoppers, etc.) and Neuroptera as well as his own research program. He accepted the position of Principal Entomologist at the Queensland Department of Primary Industries & Fisheries in Indooroopilly, Queensland and moved in early 2007.
Kevin Holston has a postdoctoral position with the Swedish Museum of Natural History and is working on the systematics and phylogeny of the Palearctic species of *Thereva*.

Martin Hauser currently has a postdoctoral position under former graduate student, Steve Gaimari, with the California Department of Food and Agriculture, and is working on the systematics of Tephritidae while, at the same time, putting out papers from his Ph.D. dissertation.

Jeffrey Thorne, Associate Professor, NCSU, Department of Statistical Genetics, is developing methods for inferring divergence times from molecular phylogenetic data without the assumption of a molecular clock. These methods are being used to develop a time scale for major events in brachyceran fly evolution based on data generated in the Wiegmann lab for therevids and other Brachycera.

Christine Lambkin recently accepted a curatorial position with the Queensland Museum of Natural History, Brisbane, Australia. Prior to that, she had joined the therevid PEET team as a Postdoctoral Fellow at CSIRO Entomology Section, Canberra, Australia, to continue the classification of Australian stiletto flies begun by Shaun Winterton. Christine completed her doctorate at the University of Queensland in Brisbane, which comprised a systematic revision of a tribe of bee flies (Diptera: Bombyliidae: Asiloidea), a close relative of the Therevidae. Chris, who has provided some technical assistance to the therevid team in the past, continues the work on the phylogenetics the Therevidae, concentrating on the genus *Ectinorhynchus* and its allies, in arid and semiarid environments of Australia. Chris is also investigating the web-based dissemination of interactive keys, data, and monographic work. She examines the systematic methods that we use in phylogenetic analysis and is heavily involved in the training and development of scientific knowledge in this area in Australia, America, and Europe.

Ann Coddington Rast was an intern working on scientific illustration with J. Marie Metz. She worked on Diptera illustrations for the therevid PEET project primarily for the experience and knowledge she could gain by illustrating fly images. Ann was an assistant professor in the Department of Fine and Applied Arts at UIUC. She was learning to produce professional illustrations of Diptera using both traditional and digital means.

Mark A. Metz, in year 1 of the therevid PEET II grant, advanced to candidacy of his Ph.D. by passing his oral examinations in the department of entomology; thereafter, he transferred to the department of Natural Resources and Environmental Sciences. In 2001, Mark was listed among the teachers rated outstanding by their students and received an award for his teaching of Entomology 301, General Entomology, for which he was a teaching associate and guest lecturer during the summer of 2000. Mark obtained his Ph.D. from the Dept of Natural Resources & Environmental Sciences at UIUC in May 2002, after successfully defending and depositing his dissertation on Systematics within the Therevidae. He published his second therevid article (Env. Ent. 30: 903-908), published a revision within Syrphidae (Studia Dipterologica 8: 225-256) in collaboration with F. Christian Thompson, published a co-authored manuscript on the revision of the
therevine genus *Pandivirilia* in collaboration with D. W. Webb, along with another publication reviewing the species of *Psilocephala*. He contributed as a post-doctoral fellow with Mike Irwin studying the homology of the male genitalia in the therevids. He has published several therevid articles covering a wide range of disciplines, from systematics to paleoentomology, to ecology, and to phylogenetics. He has now taken a position with the USDA, Systematic Entomology Lab in Washington D.C. and has devoted his time to curation activities.

Martin Hauser gave an invited presentation about the use of the environmental electron microscope for entomologists at a symposium on scientific illustration in Montreal, in December 2000 (see Invited Presentations). At NCSU in 2001, he analyzed the DNA data to create a phylogenetic tree with the emphasis on the basal members of this family, the Phycinae and Xestomyzinae using genes ef1 and 28S were used. In April Martin participated on a field trip to Nags Head (NC) to collect a species of *Tabuda*. In May/June 2001 he was part of an international expedition to the Republik of Kazakhstan and in June/July he led a collecting expedition to Tunisia.

During year 2 of the therevid PEET, Martin visited the collections of the Zoological Museum in Moscow and St. Petersburg in December 2001-January 2002 where he met amongst others the most important Russian therevid worker, Prof. Vladimir Zaitzev. In April, Martin Hauser successfully defended and deposited his Masters thesis on the ‘Revision of the genus *Ammonaios* and will receive his diploma in May 2002. He presented his work at the Evolution meetings in Champaign, IL in July 2002 and the 5th International Congress of Dipterology in Brisbane in September 2002.

Kevin Holston traveled to Stockholm, Paris, Berlin, St. Petersburg, Vienna, and Copenhagen from August-December 2000 to examine type specimens of the family Therevidae, particularly those in the genus, *Thereva*. Although he was fortunate enough to see numerous Kröber types in Berlin, Kröber’s types stored in Hamburg were destroyed during WWII. Kevin’s Copenhagen trip was supported by the American Scandinavian Society and the Schlinger Foundation. While in Copenhagen, he worked with Leif Lyneborg and expanded the character matrix for the genus *Thereva* from 77 to more than 160 characters. From February-April 2001, he used molecular techniques and applied them to the analysis of the genus *Thereva* to create a phylogenetic tree of this speciose genus.

During year 2 of the therevid PEET grant, Kevin Holston, graduate student at UIUC, focused on developing molecular and morphological datasets for phylogenetic analyses of the genus *Thereva* Latreille. Collecting trips (see Expeditions in Activities) between May and August, 2001, substantially increased the taxonomic scope of his phylogenetic work. His dissertation will include a higher-level molecular analysis of therevine genera using 28s rDNA, EF 1-alpha nDNA, and 16s mtDNA. Morphological characters and mitochondrial DNA sequences will be used in a combined analysis of the worldwide *Thereva* fauna and will allow Holston to address trans-continental biogeographic questions concerning this genus. A chapter of his dissertation will be devoted to a revision of the North American species of *Thereva*.
Gail Kampmeier took the FAST3 (at UIUC) beginning and advanced workshops on DreamWeaver 4.0, the webpage design software [July 2001]. She is Chair of the INHS WebTeam and helps supervise hourly web designer’s activities and interactions with INHS WebTeam. This training and work with a designer will help in improving the therevid PEET site.

J. Marie Metz received her Masters in Art Education in May 2001. As the scientific illustrator based at UIUC, she has progressed rapidly in the rendering of computerized images over the past year. Her rapid progress made it possible for her to take the place of George Venable (Smithsonian Institution) in an invited talk about computerized rendering of scientific illustrations in Montreal (see Invited Presentations under Activities), when he was forced to cancel. Six months earlier, this would have been inconceivable. She was subsequently invited to present this talk at the annual meeting of the Guild of Natural Science Illustrators in August 2001, in Bar Harbor, Maine.

Don Webb worked on a revision and phylogeny of the genera *Pandivirilia* and *Dichoglena* and a revision of the genus *Spiriverpa*. In a related project, he is also describing the genus *Chrysopillus* (Rhadionidae), which has 15 new species from New Caledonia.

Kristin (Mrozinski) Algmin, a recent graduate in Biology at the University of Illinois (UIUC) and former student hourly worker on the database team, worked full-time as an Academic hourly in the Irwin lab. She continued to work on the database team, but learned more in depth functioning of Mandala and FileMaker Pro, and spends more time troubleshooting problems, training new students, and working to assure data integrity. Kristin is also taking care of curatorial needs in the collection, pinning of specimens from alcohol samples and identifying therevid flies to genus level.

Joanna Hamilton, Technical Officer employed by CSIRO, worked for David Yeates curating and labeling the Therevidae collected from expeditions and testing a key to Australian genera developed by Chris Lambkin.

Beryl Reid, Australian National Insect Collection Volunteer since November 2001, spent 2-days per week assisting Chris Lambkin with the curation of the Therevidae.

Steve Gaimari led a 7-week expedition to Bolivia in April 2001 to the Andean foothills north of La Paz, to the towns of Mapiri, Guanay, Coroico, and Chulumani; and also to the Cochabamba area. The expedition was partially funded by another grant from NSF. The other participants were Wayne Mathis (PEETster from the Smithsonian Diptera group), Amnon Freidberg, Frank Parker, Allen Norrbom, Brian Brown, and Giar-Ann Kung. In July 2001, Steve Gaimari accepted the position of Associate Insect Biosystematist (Dipterist) for the California State Collection of Arthropods, California Department of Food and Agriculture, Sacramento.
F. Christian Thompson (USDA-ARS-SEL at the Smithsonian) visited Gail Kampmeier and the therevid PEET group at UIUC 17-21 October, collaborating on database and web issues, upcoming publications, and plans for therevid PEET II.

YEAR 3 Additions: The Wiegmann lab continued data collection and phylogenetic data analyses in collaboration with student projects of Hauser, Holston, and Hill.

Martin Hauser received his MS in May 2002 and since then he worked on his PhD about the phylogeny of the basal therevid groups Phycinae and Xestomyzinae. Martin Hauser's assistantship was supported by Schlinger Foundation funds.

Kevin Holston completed his dissertational research on Thereva and received his degree from the University of Illinois at Urbana-Champaign (Department of Entomology) in May 2003. Holston was a collaborator on the Fauna Europaea project, contributing an annotated checklist of European Therevidae. He was also a student delegate to the 5th International Congress of Dipterology, University of Queensland, Brisbane, Australia. Dr. Holston was awarded a postdoctoral fellowship in the NSF’s International Research Fellowship Program. He is revising the European species of Thereva and building species pages for the web. Holston is based in Stockholm, Sweden and worked under the supervision of Thomas Pape. The fellowship was for two years starting June 2003.

Mark Metz finished a 6-mo post doc in the Irwin lab working on the homologies in the male and female genitalia of the therevoid families of Asiloidea, the Therevidae of New Caledonia, and the functional morphology of the genitalia of Prorates ballmeri Nagatomi and Liu (see Metz et al. 2002 in publications list). In October 2002 he accepted a post doc at the Pennsylvania State University’s Frost Entomological Museum. He continued to work with the therevid PEET project, primarily collaborating with Don Webb on papers and research. He was a co-PI along with other therevid PEET graduates in the ambitious proposal to the NSF Planetary Biodiversity Inventory, “Crossing the Finish-Line: A World Monograph of the Therevidae (Insecta: Diptera).

Hilary Hill completed her masters project in the Dept. of Entomology at North Carolina State University in March 2003. Her assistantship was supported as matching funds provided by the North Carolina Agriculture Research Service and NC State College of Agriculture and Life Sciences (CALS). Her work evaluated the phylogenetic utility and information content of nuclear protein coding genes, opsin rh1 and CAD in the Therevidae and among their closest relatives. Hilary became a Research Associate with USDA/APHIS/PPQ in Raleigh NC.

During PEET IV at Berkeley, CA (June 2002), J. Marie Metz collaborated with illustrators working with the PEET project of Dr. James (Steve) Ashe at Kansas State University. She was subsequently invited to Kansas in August to continue this collaboration, which resulted in improved methodologies for producing digital illustrations. Ms. Metz subsequently taught these improved methodologies in invited workshops that she was invited to present in St. Paul, MN and Sacramento, CA.
The workshop in Minnesota also sprung out of interactions at PEET IV, where J. Marie Metz taught workshops in digital illustration. She was asked by fellow PEETster, Ralph Holzenthal of the University of Minnesota, to conduct a 3-day workshop in November 2002, teaching digital illustration techniques to entomology students.

Therevid PEET collaborator Dr. Stephen Gaimari (California Department of Food & Agriculture, Sacramento), funded a visit to California by J. Marie Metz in December 2002 to give a one-week workshop on rendering digital illustrations.

Jacqueline Recsei worked for David Yeates sorting, specimen curation, labeling, and databasing the Therevidae collected from expeditions, participating fully in field work, and testing a key to Australian genera developed by Chris Lambkin.

Erica Leslie, a Australian National Insect Collection (ANIC) Volunteer, spent 2-days per week assisting Chris Lambkin with the return and assimilation of *Anabarhynchus* material into Australian collections following publication of the revision. Through the experience gained, Erica obtained a part-time position databasing Australian fruit flies in ANIC into the CSIRO BioLink.

Brad Metz obtained his B.S. in Biology at UIUC in 2002 and worked half time with the Irwin lab in 2003, learning to curate flies, enter specimens in the Mandala database, retrospectively obtain geographic coordinates and verify locality information for specimens in the database so that they may be mapped, electronically archive illustrations created by traditional means, and do minor database troubleshooting. Brad enjoyed being able to transfer the knowledge he gained in the Irwin lab working with Photoshop and engaging in discussions about science and other computer applications to other jobs in his life. Brad attended graduate school in entomology at Texas A&M starting in fall 2003 with a one-year fellowship.

Year 4 additions: Hilary Hill successfully defended her MS in Entomology at NCSU in March 2003, and was awarded the degree in May 2003. Her MS thesis is entitled, “Investigation of the Phylogenetic Utility of Two New Nuclear Genes, Opsin and CAD, within the stiletto flies (Diptera: Therevidae).” Two manuscripts were in preparation from this work.

Hilary Hill, Brian Cassel, and Shaun Winterton gained valuable laboratory and analytical training in molecular genomics techniques applied to the successful amplification, sequencing and analysis of nuclear protein encoding genes for insect systematics.

Year 5 additions: Martin Hauser and Brian Cassel gained valuable laboratory and analytical training in molecular genomics techniques applied to the successful amplification, sequencing and analysis of nuclear protein encoding genes for insect systematics.
Martin Hauser was selected to participate in the phylogenetics workshop, “Bayesian and Likelihood Inference of Phylogeny: Organisms to Genomes” held on the campus of the University of Illinois 22-31 May 2005.

Gail Kampmeier took advantage of opportunities to broaden her knowledge about FileMaker 7, the new version of database engine that will underlie Mandala’s next major upgrade, due summer 2005. She attended the FileMaker Magnificent 7 Tour at Le Meridian in Chicago on 25 May 2004; spent four days in intensive FileMaker Pro 7 database training provided by the Support Group in Reston, VA 5-8 Oct 2004; and continues self-paced training in FileMaker Pro 7 from ISO Magazine (http://www.filemakermagazine.com/) video articles.

Kampmeier attended the annual UIUC Webmasters Forum (4 May 2005), the noontime brownbags, and occasional workshops on specialized topics such as CSS and website accessibility, which are sponsored by this group.

Michael E. Irwin, PI, University of Illinois at Urbana-Champaign, retired from the University of Illinois in September 2005, maintaining an Emeritus status, and has joined the faculty at the University of Arizona as a visiting Professor, where he continues his studies on therevids. He has been elected to the Board of the Schlinger Foundation, where, as CFO, he has a say in how some of the funds that are allocated to research are directed. He has become involved with biodiversity issues and ways to document the status and worth of arthropod diversity in remote and threatened parts of the world, including Madagascar, the Western Ghats of India, and the tropical dry forests of southern Sonora, Mexico.

Outreach Activities:

The Therevid PEET group has seen their involvement in outreach as a key component of helping to create a more scientifically literate public and helping to give them an appreciation for aspects of the world of science and entomology. Although many of the outreach activities are conducted on a volunteer basis during non-working hours, those involved feel very committed to the importance of sharing their knowledge, expertise, and an appreciation for science and art with members of the community, particularly the youth.

Great Smoky Mountains National Park ATBI. Co-PI Wiegmann is a co-organizer of the Diptera TWIG for the All Taxon Biotic Inventory of the Great Smoky Mountains National Park. Wiegmann has worked to build support for the project among dipterists and other entomologists through presentations at the Entomological Society of America National Meeting, Entomological Collections Network Annual Meeting, ESA- South Eastern Branch Meeting, and North American Dipterists Society Meeting. The Wiegmann lab at NCSU has been collecting and sorting Diptera collected in the park as part of the ATBI.
Gail Kampmeier participated in the ACES Open House at the booth promoting the upcoming Biodiversity Blitz at Allerton Park in June 2001. The display encouraged visitors to match the identifications in a list with a large photo collage display of Illinois biota.

David Yeates and the therevid PEET team in Australia are organizing the 5th International Congress of Diptero,ology, Brisbane Australia 30 Sept-5 Oct 2002

J. Marie Metz and Carie Nixon (Illinois Natural History) were invited to area junior high schools to work with young women in the GEMS (Girls in Engineering, Math, & Science) program and introduce them to scientific illustration through the medium of Beatrix Potter. The students then have a chance to try their skills at drawing from natural objects.

Marie Metz and Carie Nixon have also taught two 6-week short courses, 'Beginning to Picture Nature' (2000) and 'Drawing in Colored Pencil' (2001), as part of the Illinois Wilds Institute for Nature. These courses were open to the public and Kampmeier overcame her fear of putting pencil to paper in the first course.

Year 2: Gail Kampmeier served on the Allerton Biodiversity Blitz organizing committee; organized database component, modifying Mandala for use in the Biodiversity Blitz at Allerton Park, June 29-30; she trained and supervised 12 volunteers and participated in data entry, management, & reporting.

In April 2002 J. Marie Metz traveled back to her hometown to give two presentations on Digital Illustration Techniques at John Glenn High School and Urey Jr. High. She was asked to present her work as a result of having received the Connie Verkler Scholarship in Art when a senior at John Glenn High School. She prepared a presentation for upper level art students and science students at the high school and 300 students at the jr. high teaching digital illustration in the sciences. Junior high students at Urey Middle School were especially interested in understanding how microscopes they have available in their classes can aid in biological illustration.

Gail Kampmeier has participated on listserves for TAXACOM, TDWG (Taxonomic Databases Working Group), and UIUC-WebMasters and distributes pertinent information to others at INHS, UIUC, the Entomological Collections Network, and in our PEET project.

Gail Kampmeier and J. Marie Metz helped interpret entomological exhibits in the Illinois Natural History Survey’s Mobile Science Unit at the Agricultural, Consumer, and Environmental Sciences (ACES) Open House on the campus of the University of Illinois. (March 2002)

An article was published in the latest issue of the ABRS journal Biologue (No 26, April 2002, pp. 14-15) on the grant entitled 'ABRS, NSF, CSIRO Entomology and the Schlinger Foundation: A partnership for the discovery of Australia's Insect Fauna'
In conjunction with the outreach team at the Illinois Natural History Survey, J. Marie Metz spoke to grade school students about entomological illustration and introduced students to live insects from the tropics.

J. Marie Metz served two years as President of the Illinois Prairie Chapter of the Guild of Natural Science Illustrators, a local chapter that she organized, of this internationally-based group. The Prairie Chapter’s main goals are in promoting art and science education and preserving archived biological illustrations. The group holds monthly meetings and sponsors workshops in scientific illustration, including an opportunity to learn techniques of sketching in the field at a local prairie (June 2002).


Martin Hauser presented insects together with May Berenbaum to children at the Orpheum children’s science center in Champaign (http://www.microroads.org/orpheum/).

Martin Hauser began working as an entomological advisor with the UIUC BugScope <http://bugscope.beckman.uiuc.edu/> in May 2003. He interacts with school children, answering questions and explaining functions of insect body structures that they see from photos taken with the ESEM (environmental scanning electron microscope).

Gail Kampmeier talked with visitors at ACES Open House (March 2003) to the Illinois Natural History Survey’s Mobile Science unit, which featured entomological exhibits.

Gail Kampmeier was invited to participate in a dinner at the Florida Avenue Residence Hall with WIMSE (Women in Math, Science, & Engineering) students and share her experiences as a scientist. Female undergraduate students may choose this housing option, which features extra activities and support in the sciences (October 2002)

Gail Kampmeier participated with other members of the Illinois Natural History Survey as a PBS phone volunteer at WILL-TV’s Winterfest fundraiser on 6 December.

Gail Kampmeier was interviewed by phone with Patricia Murphy of Pattycake Productions for a children's' book on entomologists and their careers. (March 2003)

Gail Kampmeier was invited to participate in the 1st annual Building a Presence for Science Institute sponsored by the Illinois Science Teachers Association. She dined with K-12 educators from all over the state who had been selected as Key Leaders that were working toward building a 'community of learners' for the improvement of science education. (July 2002)

Gail Kampmeier was a judge for the student poster competition at national Entomological Society of America meeting in Ft. Lauderdale, FL (November 2002)
An exhibit of several of J. Marie Metz’s stiletto fly and acrocerid habitus drawings was on public display at the Verde Gallery in Champaign (May-June 2003).

As one of five founding members of the Prairie Chapter of the Guild of Natural Science Illustrators, J. Marie Metz keeps the Guild’s mission in mind in many facets of her work: furthering education in natural scientific illustration as well as enhancing understanding of the importance of illustration in the sciences. Due to her efforts and those of the group, the chapter recently received a grant of $1,000 for mounting an exhibition at Allerton House in Monticello, IL. The historic house and grounds of Allerton Park were a legacy to the University of Illinois and are widely visited. Plans are being made for a traveling show that can be used by schools to help educate youth not only in natural science illustration, but also to emphasize the importance of conservation, ecology and species identification within the sciences.

Therevid PEET collaborator Dr. Stephen Gaimari (California Department of Food & Agriculture, Sacramento), funded a visit to California by J. Marie Metz in December 2002 to give a one-week workshop on rendering digital illustrations.

Following interactions at PEET IV in Berkeley, CA in June 2002, where J. Marie Metz taught workshops in digital illustration, she was asked by fellow PEETster, Ralph Holzenthal at the University of Minnesota, to conduct a 3-day workshop in November 2002 teaching digital illustration techniques to entomology students.

As an adjunct Professor at Parkland College, J. Marie Metz used parts of the PowerPoint presentation designed to teach “PEETsters” illustration, for her community college students. In addition, while working with the Parkland College for Kids Program Marie has passed on information garnered during her therevid PEET experiences about insects, ecology, conservation, and species identification.

Year 4 additions: Martin Hauser assisted in the 21st annual Insect Film Fear Festival, which was organized by May Berenbaum at UIUC.

Even though (as of August 2003) a professor in the Dept. of Art & Design at Lincoln Land Community College (LLCC), J. Marie Metz drew on her experiences and training with the therevid PEET to give a workshop on scientific illustration using digital media (Illustrator and Photoshop) to high school students and participating parents (from the surrounding area in Springfield, IL) attending the Technology Fair at LLCC. Ms. Metz has also made three 1/2-h presentations to Chatham Junior High students for their career day, talking about many possible careers in the arts and detailing possibilities in the field of scientific illustration.

Marie Metz also made two 1.5-h presentations for the Scholastic Art Award Winners at Springfield College, Scholastic Art Competition, Personal Visions 2004. These presentations detailed the interconnections between science and art and drew on scientific illustrations by Beatrix Potter as inspiration. Ms. Metz also was a regional judge for the
Scholastic Art Competition Personal Visions 2004. Winners of regional competitions compete at the national level for scholarships and monetary awards.

Brian Wiegmann participated in BugFest at the NC Museum of Natural Sciences, Aug 2003. Wiegmann was part of the “Ask the Experts” display and demonstrated wonders of fly diversity to the public.

Brian Wiegmann presented a demonstration “Flies, Flies, Flies” to K-12 students and their families during Science Night at Wiley Elementary School in Raleigh NC, 4 March 2004.

Gail Kampmeier was one of several research scientists invited to attend the C Synergy conference dinner of Illinois teachers of math and science at the Holiday Inn in Urbana. The theme was a closer integration of these two disciplines in the classroom. Each scientist each spoke briefly to the entire group and then interacted with the teachers at their table, July 14.

Year 5 additions: Brian Wiegmann participated in BugFest at the NC Museum of Natural Sciences, Aug 2004. Wiegmann was part of the “Ask the Experts” display and demonstrated wonders of fly diversity to the public.

Brian Wiegmann presented a demonstration to Kindergarten students at St. Mary Magdalene Catholic School in Apex NC, 4 May 2005.

Martin Hauser assisted in the 22nd annual Insect Film Fear Festival (http://www.life.uiuc.edu/entomology/egsa/ifffhistory.htm) which was organized by May Berenbaum at UIUC.

Martin Hauser gave a demonstration of rain forest insects in the Urbana Middle School in February 2005.

Martin Hauser assisted in the National Science Olympiad in May 2005 in Urbana, IL http://www.news-gazette.com/localnews/story.cfm?Number=18264.

Gail Kampmeier and Martin Hauser participated in the Biodiversity Blitz at Busey Woods, Urbana, IL 24-25 June 2005, honoring the 25th anniversary of the Anita Purvis Nature Center. Mandala was used to track species counts and observations made during the blitz. http://www.inhs.uiuc.edu/~gkamp/downloads/24hrs_BWBB.pdf

Journal Publications:
Winterton, S. L., L. Yang, B. M. Wiegmann, and D. K. Yeates, "Phylogenetic revision of the Agapophytinae subf.n. (Diptera: Therevidae) based on molecular and morphological
Irwin, M.E., "Species composition and seasonal flight periodicity of stiletto flies (Diptera: Therevidae) occurring along the Kuiseb River, Gobabeb, Namibia", *Cimbebasia*, vol. 17, (2001), p. 169. Published
Irwin, M.E., "Species composition and seasonal flight periodicity of stiletto flies (Diptera: Therevidae) occurring along the Kuiseb River, Gobabeb, Namibia", *Cimbebasia*, vol. 17, (2001), p. 169. Published
Holston, K.C. and M. Niehuis, "Stiletto flies (Diptera: Therevidae) from a xerothermic locality in the Middle Rhine Valley (Rhineland-Palatinate)", *Fauna und Flora in Rheinland-Pfalz*, vol. 9, (2002), p. 1193. Published


Papoucheva, E., Proviz, V, Lambkin, C.L., Goddeeris, B. and Blinov, A., "Phylogeny of the endemic baikalian *Sergentia* (Chironomidae, Diptera)", *Molecular Phylogenetics and Evolution*, vol. 2003, (2003), p. 120. Published


Yeates, D.K., Irwin, M.E., B.M. Wiegmann, "Ocoidae, a new family of asiloid flies
(Diptera: Brachycera: Asiloidea), based on *Ocoa chilensis* gen. and sp. nov. from Chile, South America", *Systematic Entomology*, vol. 28, (2003), p. 417. Published


Romig, T. & M. Hauser, "*Copestylum melleum* (Jaennicke, 1867) (Diptera, Syrphidae) is an established neozoon on the Canary Islands", *Volucella*, vol. 7, (2004), p. 185. Published


Yeates, D.K., M.E. Irwin, & B.M. Wiegmann, "Evocoidae (Diptera : Asiloidea), a new family name for Ocoidae, based on *Evocoa*, a replacement name for the Chilean genus

Book(s) of other one-time publication(s):


Yeates, D.K., Bickel, D.K., McAlpine, D.K., Schneider, M., Cranston, P., and Marshall,


Kampmeier, G.E. and Irwin, M.E., "Meeting the interrelated challenges of specimen, nomenclature, and literature data tracking in Mandala.", bibl. XXII International Congress of Entomology, Brisbane, Australia., (2004). abstract Accepted


Data or databases
Information from >134,000 therevid specimens found in over 17,800 collecting localities representing over 37,300 collecting events has been entered into the therevid Mandala database. The taxonomic names datafile contains over 5,100 entries and the histories of all of the therevid names are being catalogued. Over 9,300 records have been created that dissect and index the over 800 entries of therevid literature. Over 7,450 images have been catalogued and associated with taxonomic names. Over 7,600 people are listed as collectors, illustrators, authors of taxonomic names, lenders or borrowers of material from collections or museums, authors of literature, and determiners of taxonomic names attached to specimens, and copyright holders of illustrations. Many apparently duplicate names exist due to misspellings and different name formats given under various circumstances and a system was established to designate junior synonyms and senior synonyms where appropriate.

Data can be entered and shared over the internet (TCP/IP connection) from the live Mandala database on a server to those with Filemaker Pro 7/8 and who are cleared by password. Otherwise, static data may be searched and browsed by anyone from the WebMandala website the WebMandala website http://www.inhs.uiuc.edu/cee/therevid/mandala/ [note, with the upgrade to a new FileMaker structure (with FileMaker 7), the proprietary web language previously used to search Mandala was no longer available. A new web interface is under construction using php and will be available in 2007 from the link above. Meanwhile, users can view an overview PowerPoint demonstration of the completely revamped database structure for Mandala 7.]

Software (or netware)
Mandala is a database system for systematics and biodiversity research. It catalogs specimens, batches of specimens (in v5), nomenclatural history, tracks loans by specimen and by batch, and tracks and dissects taxonomic literature. It has context sensitive help at the field and file level, it tracks user questions and their answers, and tracks changes to the database structure over time. It was originally developed under the first NSF PEET project 9521925, and the first year of this current project has seen two substantial upgrade releases, Mandala 4.0 in November 2000, and Mandala 5.0 in April 2001. Mandala 4.0 was a major upgrade using FileMaker 5.0 and also represented a major facelift to the user interface. It also provided a time for major housekeeping of fields, layouts, scripts, that were no longer in use. Mandala 5 became a more viable tool for biodiversity studies that may need to deal with batches of specimens, and in so doing also became a more valuable tool to collections curators who must track loans. Increased flexibility in the format of unique specimen numbers, as well as the ability to record and
track batches of specimens, has improved Mandala as a tool in managing loans of specimens and data from biodiversity studies. Loan management layouts aid in the tracking and details of shipping of loan requests and receipts. Literature records may be linked to illustration records (e.g., taxa, habitats, and distribution maps), records of specimens examined, and taxonomic names records so the relevance of literature citations answering a database query may be evaluated. Detailed referencing of digital illustration archives has also been recently added to Mandala. Georeferenced data associated with specimens may be exported to generate distribution maps. Many specialized layouts and scripts within each datafile simplify data entry, searches, exports, and printing. Customized calculated fields facilitate export of concatenated data. Several auxiliary datafiles, such as the museum collections, journals, people (as collectors, authors, etc), and biogeographic regions datafiles, organize additional sets of data related to each of the three main datafiles, thereby improving the sophistication and accuracy of queries and reducing data entry errors.

In 2005, Mandala underwent a complete revision in preparation for bringing into FileMaker 7/8.x. The last version of Mandala compatible with FileMaker 5/6 was Mandala 6.62, which was frozen in September 2005. This version included all of the renaming (with a renaming (with a solid convention denoting field function) of fields (making sure that the DarwinCore fields were all represented), layouts, value lists, scripts, and a reduction in the number of tables from 27 to 23. All of the features that were renamed were also examined for relevance and use within the current Mandala structure, and unneeded features were pruned. The user interface was updated as well. In late 2005, beta versions of Mandala 7 were introduced and tested, with an official release in March 2006. The current (11/06) release is Mandala 7.11.

A fully functional and open demo of Mandala is free for the asking and can be modified for use with many different types of organisms. Contact Gail Kampmeier at gkamp@uiuc.edu for more information or see the WebMandala site at http://www.inhs.uiuc.edu/cee/therevid/mandala/. A non-exclusive research/internal business use license is now provided with the software.

**Journal cover**

Illustration shared with all subscribers to the journal Systematic Entomology in 2001.

**Software (or netware)**

Available from Griffith University on CD-ROM
**website with Lucid3 interactive key**
The website includes a Lucid3 interactive key to genera and taxon pages for all Australian genera of the Therevidae including biology, systematics, and numerous digital images of live flies. The website includes the first interactive key for Therevidae, for which Chris Lambkin completed morphological scoring.


**website**

Available on the WWW.

**website**
FLYTREE Building the Dipteran Tree of Life: http://www.inhs.uiuc.edu/cee/FLYTREE/ (linked with Therevid PEET website; debuted 3/04)

Available on WWW

**Software (or netware)**
The Anatomical Atlas of Flies was developed by Australian entomologists (D.K. Yeates, A. Hastings, J.R. Hamilton, D. H. Colless, C.L. Lambkin (CSIRO Entomology); D. Bickel, D.K. McAlpine (Australian Museum); M.A. Schneider, G. Daniels (University of Queensland); and P. Cranston (University of California-Davis) to support ABRS and NSF research and aid in teaching fly anatomy. Common synonyms for terms are provided as well as discovery of parts by name or location. The atlas has a foundation of high resolution digital images with unique 1X, 2X, and 3X magnifiers allowing users to view anatomical structures in great detail. Four different fly types are illustrated, including a therevid (Anabarhynchus ornatifrons) under the Lower Brachycera tab.

Available at http://www.ento.csiro.au/biology/fly/fly.html. The atlas requires a broadband connection. Also linked from the NSF Diptera AToL site http://www.inhs.uiuc.edu/cee/FLYTREE/flymorphology.html

**Internet Dissemination:**
http://www.inhs.uiuc.edu/cee/therevid/
This site chronicles the activities of the therevid PEET team, including reports, meetings, outreach, expeditions, interactive keys to newly revised genera, team member profiles, databasing efforts and WebMandala, and background information for users of all ages. It was begun in 1996 with DEB 95-21925 and continues with the current award.

**Contributions:**

**Contributions within Discipline:**

Our phylogenetic research provides an historical context on which hypotheses can be tested concerning the evolution and diversification of flies and other insects. Our characterization and analysis of gene sequences is critical to many research programs in molecular systematics, entomology, and evolutionary biology that will apply these genes in tests of phylogenetic hypotheses. Development of methods of estimating divergence times from nucleotide sequence data can be used to infer ages for many groups of organisms. This research contributed to the NSF Assembling the Tree of Life for Diptera grant, for which Brian Wiegmann is lead PI (http://www.inhs.uiuc.edu/cee/FLYTREE/).

Mandala. Systematics research on stiletto flies (Diptera: Therevidae) has been facilitated by the creation during this project of the cross-platform database, Mandala <http://inhs.uiuc.edu/cee/therevid/mandala/>, a fully working demo of which is available upon request from Gail Kampmeier (see website). Mandala is a relational database that supports three major realms of data acquisition and management for systematics and biodiversity studies: specimens, literature, and taxonomic names. In the taxonomic names datafile, this relational framework allows the automatic display of homonyms as well as a full synonymic list of names linked to any valid name, which may be exported for nomenclatural catalogues. Increased flexibility in the format of unique specimen identifiers, as well as the ability to record and track batches of specimens, has improved Mandala as a tool in managing loans of specimens and data from biodiversity studies. Loan management layouts aid in the tracking and details of shipping of loan requests and receipts. Literature records may be linked to illustration records (e.g., taxa, habitats, and distribution maps), records of specimens examined, and taxonomic name records so the relevance of literature citations answering a database query may be evaluated. Detailed referencing of digital illustration archives was also added to Mandala. Georeferenced data associated with specimens may be exported to generate distribution maps. Many specialized layouts and scripts within each datafile simplify data entry, searches, exports, and printing. Customized calculated fields facilitate export of concatenated data. Several auxiliary datafiles, such as the museum collections, journals, people (as collectors, authors, etc.), and biogeographic regions, organize additional sets of data related to each of the three main datafiles, thereby improving the sophistication and accuracy of queries and reducing data entry errors. Mandala underwent significant revision and upgrading in 2005 as all parts of this then 10-year old database were examined, renamed in a consistent manner, and brought up to DarwinCore 2 standards. Therevid data are searchable by guests at http://www.inhs.uiuc.edu/cee/therevid/mandala/TherevidWebMandala.html.
Yr 4: The successful development and use of nuclear genes, opsin and CAD, for therevid phylogenetics allows these genes to be used in other molecular systematics laboratories. We have contributed primers and made recommendations to more 10 laboratories that are now using these genes in projects in Diptera, Hymenoptera, Neuroptera, Coleoptera, Lepidoptera, and Trichoptera.

Divergence time estimation in Brachycera and the estimates for therevoid radiations are providing baseline data for similar studies of insect and dipteran evolutionary history.

Steve Gaimari is Subject Editor for all of Diptera for the journals Annals of the Entomological Society of America and the Pan-Pacific Entomologist. Subject editors are responsible for sending papers out for peer review and working with authors to make manuscripts publication-ready.

Martin Hauser and visitor from the Netherlands (by way of Nebraska) Wouter van Steenis curated the syrphid (Diptera: Syrphidae) collection at the Illinois Natural History Survey (October 2003).

Year 5 additions: Christine Lambkin organized the CSIRO Taxonomy Biodiversity Seminar Series in ANIC for 2004-5 including many Australian and international speakers such as Adriana E. Marvaldi from the Instituto Argentino de Investigaciones de Zonas Aridas, Mendoza, Argentina; Brian Wiegmann from North Carolina discussing the ‘Multigene Phylogenetics of Flies’; and Felix Sperling from the University of Alberta, Canada speaking on ‘Accessing collection information - can we break the logjam?’

Yeates co-organised two symposia at the XXII International Congress of Entomology, Brisbane in August 2004 (with Dr Lyn Cook, ANU, and Dr Thomas Pape Sweden). He was invited to organize two workshops (one on Supertrees, and another on Interactive Keys) at the biennial Partnerships Enhancing Expertise in Taxonomy conference in Champaign, Illinois in September 2004. He is currently chair of the organizing committee of the combined conferences of the 7th Invertebrate Biodiversity and Conservation Conference, Australian Entomological Society, Society of Australian Systematic Biologists, and other groups, in Canberra in December 2005 (http://www.invertebrates2005.com).

Lambkin has accepted a position as Member of Editorial Advisory Committee of Invertebrate Systematics. Chris continues to work for the Council for International Organization for Systematic and Evolutionary Biology (IOSEB) and the Council for the Society of Australasian Systematic Biologists (SASB).

A large group of Therevid PEET participants and collaborators met at Tangalooma, Moreton Island, Queensland from the 22-26 August 2004 for a combined Therevid PEET and FLYTREE Conference. Mike Irwin, Brian Wiegmann, David Yeates, Chris Lambkin, Gail Kampmeier, Shaun Winterton, Jeff Skevington, Ev Schlinger, and Chris Thompson spent two days discussing the Therevidae catalogue, PEET V conference planning, and the Therevid PEET endgame.
Gail Kampmeier worked with Leah Brorstrom of the World Spider Parasitoid Laboratory on updating the Schlinger database of acrocerid flies in Mandala (August 2005).

Gail Kampmeier worked with Christine Lambkin on import/export from Mandala to BioLink and back. BioLink is the database used at CSIRO in Canberra.

D.K. Yeates co-organized and taught in the Entomology undergraduate subject at the Australian National University (BIOL 3115).

Chris Lambkin co-supervised an Honours student, David Carlisle, at the Australian National University, enrolled July 2004 to May 2005. Two papers on the spatial and temporal emergence patterns of therevid larvae and the phylogenetic signal from the male genitalia in Australian Therevidae (with the description of a new genus of Therevidae) are planned from this work.

Martin Hauser trained the sorting team in Tana, Madagascar in identification of insect orders and families, databasing and general curation of insects.

Contributions to Other Disciplines:

One important contribution our therevid PEET II project has made to other disciplines is a robustly populated database that can be queried from numerable perspectives (http://www.inhs.uiuc.edu/cee/therevid/mandala/TherevidWebMandala.html). This database, containing label and name information of well over 134,000 species, was envied by a group of classical biogeographers and has as been used to provide important information on areas within Madagascar where diversity and rareness is greatest. It is being used by other classical biogeographers to provide information on patterns of diversity along latitudinal gradients in both the northern and southern sectors of our planet.

Contributions to Education and Human Resources:

A major contribution of our project is training the next generation of systematists. In the first year of our project we added to the systematics and dipterological communities the through the graduation of a student with his doctoral degree (LL Yang), employment of two postdocs trained in the PEET project (S. L. Winterton at NCSU and Christine Lambkin at CSIRO) and employment of a new masters student (Hilary Hill). In the summer of 2001, Steve Gaimari became an Associate Insect Biosystematist (Dipterist) for the California State Collection of Arthropods, California Department of Food and Agriculture, Sacramento. He is currently Program Supervisor in the systematics of Diptera research program. In year 3, Mark Metz accepted a postdoctoral position in the fall of 2002 at the Frost Entomological Museum at the Pennsylvania State University. Dr. Metz is currently a research scientist at the USDA-Systematic Entomology Laboratory. After finishing her MSc. at North Carolina State University in March 2003, Hilary Hill became a Research Associate with USDA/APHIS/PPQ in Raleigh NC and later accepted a position in the Environmental Protection Agency. Kevin Holston was
awarded a 2-year NSF postdoctoral fellowship to work on European therevids beginning in June 2003 at the Swedish Museum of Natural History under the mentorship of Dr. Thomas Pape. He continues to work at the Swedish Museum with grant support. J. Marie Metz taught digital illustration and design both in workshops to other PEET groups and at two local colleges. She is currently a scientific illustrator based at the Smithsonian Institution employed by USDA-SEL. Martin Hauser is a postdoc at the California Dept. of Food and Agriculture, working in their Diptera unit.

This project saw the rapid advancement in computerized rendering of illustrations by scientific illustrator, J. Marie Metz. Having only begun this technique of rendering in January 2000, Ms. Metz's work is admired among her peers in the Guild of Natural Science Illustrators, and among those most highly respected in the field. She obtained her Masters in Art Education in May 2001, started the Prairie Chapter of the Guild of Natural Science Illustrators in East Central Illinois, and mentored an intern in scientific illustration, Ann C. Rast, a faculty member in the Department of Fine and Applied Arts at the University of Illinois at Urbana-Champaign.

The therevid PEET project has also provided opportunities for undergraduate students (http://www.inhs.uiuc.edu/cee/therevid/pastdbers.html) to learn about databases while working with data entry in Mandala (http://www.inhs.uiuc.edu/cee/therevid/mandala/). We nominated our top student, Amanda Buck, for the campus-wide award of Student Employee of the Year, and she won one of six of these awards in 2001.

In year 2 of this grant:

Over 20 students and scientists from all over Australia attended a weekend illustration workshop in Melbourne run by Chris Lambkin in collaboration with Ken Walker the invertebrate curator from the Victorian Museum. The majority of attendees were able to achieve a complete scientific illustration of a specimen of interest in the time available.

In year 3 of this grant:

Members of the therevid PEET team have volunteered at local open houses, bugfests, a children's museum, and the UIUC BugScope, spreading knowledge and enthusiasm about science, nature, and entomology to school aged children and the general public. Further mentoring opportunities with the WIMSE (Women in Math, Science, and Engineering) group on the UIUC campus, opportunities to interact with science teachers, all provide avenues for sharing experiences and enthusiasm for the sciences.

J. Marie Metz taught digital illustration and design both in workshops to other PEET groups and at Parkland College and later at Lincolnland College in Springfield, IL. As an adjunct Professor at Parkland College, she used parts of the PowerPoint presentation designed to teach “PEETsters” illustration for her community college students. In addition, while working with the Parkland College for Kids Program Marie passed on information garnered during her therevid PEET experiences about insects, ecology, conservation, and species identification. She also had the opportunity with contacts
made at PEET IV to collaborate with other scientific illustrators and to use techniques
developed in that collaboration in the teaching methods presented at the illustration
workshops in Minnesota and California.

Year 4: In Year 4, D.K. Yeates co-organized and taught an undergraduate course in
Entomology at the Australian National University (BIOL 3115).

Irwin spent three-and-a-half months at the Instituto Nacional de Investigaciones
Agropecuarias (INIA) stations in Vicuña and La Serena, Chile. During that time, he
worked with entomologists at INIA on projects concerning pepper virus epidemiology.
His main focus, though, was on collecting stiletto flies in the northern third of Chile and
in neighboring parts of Argentina for the PEET project.

Year 5 additions: D.K. Yeates Co-organized and taught in the Entomology undergraduate
subject at the Australian National University (BIOL 3115).

Chris Lambkin co-supervised an Honours student, David Carlisle, at the Australian
National University, enrolled July 2004 to May 2005. Two papers on the spatial and
temporal emergence patterns of therevid larvae and the phylogenetic signal from the male
genitalia in Australian Therevidae (with the description of a new genus of Therevidae)
are planned from this work.

Martin Hauser trained the sorting team in Tana, Madagascar in identification of insect
orders and families, databasing and general curation of insects.

The website http://www.cdfa.ca.gov/phpps/ppd/therevidopen.htm, Stiletto Flies of
The website includes a Lucid3 interactive key to genera and taxon pages for all
Australian genera of the Therevidae including biology, systematics, and numerous digital
images of live flies. The website includes the first interactive key for Therevidae, for
which Chris completed morphological scoring. The website is featured on the CSIRO
Divisional website and the ANIC website, and was written up in the CSIRO Divisional
Bulletin ‘Gnatter’, and was submitted for inclusion in the CSIRO Board Report. The
innovative, web-based interactive anatomical atlas developed for the key was featured in
Science magazine’s Netwatch segment in 19 November 2004
(http://www.sciencemag.org/content/vol306/issue5700/netwatch.shtml; Volume 306:
1269).

Contributions to Resources for Science and Technology:

Through the efforts of J. Marie Metz and Carie Nixon (Illinois Natural History), young
women from three local junior high schools in the GEMS (Girls in Engineering, Math, &
Science) were introduced to scientific illustration. By teaching illustration through the
life of Beatrix Potter, students are motivated to learn how to draw. Training children in
aspects of scientific illustration teaches them to hone their observational skills and
translate their observations to a rich visual medium.
http://www.inhs.uiuc.edu/cee/therevid/GEMS.html

The database system, Mandala, was used in the Biodiversity Blitz at Allerton Park at the end of June 2001. Volunteers were trained by Gail Kampmeier to input data from this 24-h exercise to identify as many species as possible within the confines of the park. The data were reported during the Blitz on a special website. In 2005, Mandala was once again used in the Busey Woods BioBlitz, which was compared to the bioblitz conducted at Allerton in an article in Illinois Natural History Survey Reports, available as a pdf at http://www.inhs.uiuc.edu/~gkamp/downloads/24hrs_BWBB.pdf

Chris Lambkin contributed training at the PEET IV meeting in 2002 by coordinating a workshop on ‘Character Incongruence between Data Partitions’ and contributed to the workshop on Morphological Character Analysis. J. Marie Metz coordinated and presented the workshop on Digital Rendering of Scientific Illustrations, which was repeated 4 times during the conference and included hands-on training for participants. Gail Kampmeier presented information on ITIS (Integrated Taxonomic Information System) in the workshop on the Tree of Life and PEET that was organized by Co-PI David Yeates. This workshop will included presentations on the All Species Foundation <http://www.all-species.org> and related international initiatives.

Chris Lambkin organized an all day symposium ‘Incongruence, Data Partitions, and Phylogenetic Signal’ for the Sixth International Congress for Systematic and Evolutionary Biology VI in Patras, Greece on the 9-16 of September.

J. Marie Metz mentored the three graduate students in the Irwin lab on digital illustration techniques that they can use to create their own drawings for publication. These drawings now appear in their publications. Ms. Metz was also invited to return to her hometown to give presentations on Digital Illustration Techniques to John Glenn High School and Urey Jr. High.

David Yeates developed and delivered a final year undergraduate course on Entomology (code BIOL3115) in collaboration with colleagues in CSIRO Entomology and the Australian National University.

David Yeates was Chair of the organizing committee of the 5th International Congress of Dipterology (Brisbane, Sept 29-Oct 4, 2002).

Building scientific infrastructure and collaborations in Madagascar. An offshoot of the therevid PEET project is the collaboration with MICET and the California Academy of Sciences (CAS) in Madagascar. Supported by the Schlinger Foundation, a 7-year inventory of the higher Diptera (Brachycera) of Madagascar was initiated in 2000. Rasolondalao Harin'Hala Hasinjaka, 'Rin'ha', checked up to 60 Malaise traps at selected localities around the island, and with a team of three trained Malagasy students, has been sorting the contents of those traps. The sorted material, usually to the family level, has been and continues to be sent to the CAS, with the therevids being sent to our project.
directly. Two resource activities were initiated through expeditions to that biologically diverse island continent in 2001. The first was to utilize our Therevid PEET informatics databasing activities to help develop the databasing prospects for Ranomafana National Park. To this end, we have worked with Patricia Wright, Director of Institute for the Conservation for Tropical Environments, Stoney Brook, and had the park's research director, Razafindratsita Tiana, join our laboratory for two months during the summer of 2002 to gain first hand knowledge of our Mandala database and how to use and modify it to suit the purposes of the park. The second was to help develop an entomological research laboratory at the Centre ValBio, partly funded through NSF and currently being constructed adjacent to the Ranomafana National Park. Irwin has been the consultant to the development of the entomology lab and has been working with architect Peter Ozolins of Blacksburg, VA. This was to be the third phase of building, and, to date, the building is in its second stage of construction.

Irwin was elected to the Board of Directors of Discover Life in America and has participated in the evaluation of over 40 proposals to discover the biodiversity of the Great Smoky Mountains National Park. He is also a member of both the Science and Informatics Committees. Lately, he has been working with the Board to broaden the scope of DLIA, from a single focus on the Smokies, to a nation-wide clearing house for ATBI studies in national parks and other protected areas.

Irwin was a member of a US panel evaluating crop protection proposals submitted to the Binational Agriculture and Research Development (BARD) program, which links US and Israeli agricultural research initiatives.

Irwin and Yeates were appointed to the All Species Foundation advisory committee. This committee establishes the operational procedures for making all life on earth known within the next generation. Unfortunately, this effort failed to attract sufficient funds to remain active.

Irwin is a member of the Illinois Natural History Survey (INHS) Collections Committee; Kampmeier is a member of the INHS Web Committee and chair of the Information Technology Committee.


J. Marie Metz won first prize for her Henicomyia sp. habitus illustration at the 5th International Congress of Dipterology held in Brisbane Australia (Oct. 2002).

The Guild of Natural Science Illustrators selected both of J. Marie Metz’s entries for their 2003 GNSI Annual juried exhibition for their international meeting in July 2003 in Denver. Selected were H. Fly Habitus and the study, Tongamya Head. Both works were rendered digitally using Adobe Illustrator and Photoshop.
Michael E. Irwin was appointed to the Advisory Board (March 2003- ) of the Archbold Tropical Research and Education Consortium (ATREC), at Clemson University's Springfield Biological Research Station, Dominica. He has been helping to strengthen the infrastructure of that station so that it will be more useful to biologists in the future.

Stephen Gaimari was elected a Fellow of the Linnaean Society of London (Feb. 2002)

Gail Kampmeier was elected to the Governing Board of the Entomological Society of America (2004-2006) and elected to its Executive Committee in 2006.

Year 5 additions: The website http://www.cdfa.ca.gov/phpps/ppd/therevidopen.htm, Stiletto Flies of Australasia (Winterton, S.L, Skevington, J.H., and Lambkin, C.L.) debuted in early 2005. The website, includes a Lucid3 interactive key to genera and taxon pages for all Australian genera of the Therevidae including biology, systematics, and numerous digital images of live flies. The website includes the first interactive key for Therevidae, for which Chris completed morphological scoring. The website is featured on the CSIRO Divisional website and the ANIC website, and was written up in the CSIRO Divisional Bulletin ‘Gnatter’, and was submitted for inclusion in the CSIRO Board Report.

The innovative, web-based interactive anatomical atlas developed for the key was featured in Science magazine’s Netwatch segment in 19 November 2004 (http://www.sciencemag.org/content/vol306/issue5700/netwatch.shtml; Volume 306: 1269).


**Contributions Beyond Science and Engineering:**

Irwin was asked by ANGAP, the national parks authority for Madagascar, to help develop an outreach program that would attract more ecotourism. This effort for Madagascar's National Park system involved considerable effort on the part of Irwin and Schlinger in 2001-4. Two activities were initiated through expeditions to that biologically diverse island continent during the 2001 year and through discussions with ANGAP. The first is to help enhance visitor awareness of the natural history in selected Madagascar national parks through interpretive center displays and activities. To this end, and working with Dr. Frank Parker and through Rin'ha Harinhala, Irwin and Schlinger are helping to make known for the ecotourists some of the fascinating but
smaller wildlife (i.e., arthropods) in the parks. We have begun to put together our thoughts on a butterfly house and on some static displays. A second endeavor is to help develop bioprospecting activities so that the local population living in the buffer areas around Ranomafana National Park can make a living utilizing the resources of the park in a sustainable way. Irwin has located a bioprospecting firm from France, Entomed, that is extremely interested in a collaborative arrangement. The head of research of that firm visited the University of Illinois during April 2002 to discuss the possibilities and arrangements. These will have to be negotiated with ICTE and ANGAP, but, if successful, should go a long ways towards stabilizing the economy of the local population in the buffer zone around the park.

A similar effort was initiated in the Western Ghats of India in 2005. Working with ATREE, Bangalore, Irwin has been encouraging the 'Green Clubs' of the various national parks in the area to educate ecotourists and grade school students about the diversity and functionality of arthropods in the environment. To that end, at least one of these clubs has begun to hold special training sessions in the park on a regular basis and has begun to work with elementary school children. In another offshoot of this project, some schools have taken up the planting of butterfly gardens and have now begun planting other species that are attracting different pollinators such as bees. These activities are helping to focus learning on nature and diversity, and are encouraging young students to begin to understand something about how important arthropods are to the health of the earth.