



Ecology & Evolutionary Biology

Brown University, Providence, Rhode Island

Issue 4

May 2003

Letter from the Chair

By Mark Bertness

As this year draws to a close we have a lot to be excited about and to look forward to. We hired an outstanding new vertebrate morphologist, Tom Roberts, to strengthen our already excellent evolutionary morphology group. David Rand and Marc Tatar were enthusiastically promoted to Full Professor and Associate Professor, respectively. The University announced that the Environmental Change Initiative and the Brown/Marine Biological Laboratory, Woods Hole joint graduate program will be major areas of development over the next few years which will increase our faculty size and strengthen our presence in both environmental science and evolutionary biology. We have also been slated to move into the BioMed Building once the new Life Science Building is completed a few years down the road. We will be leaving Walter Hall, but have been promised enough space to bring our entire group together under the same roof for the first time, as well as space for growth of the graduate program and increased office space for postdocs. So the future looks bright. Here's to a productive and invigorating summer.



Biology awards & premiums, 2003

Five graduating seniors from our group will be recognized at commencement for their exceptional academic records and independent research.

Ian Carroll - Maria L. Caleel Memorial Prize for Academic Excellence

Benjamin Fogel - The James Kidwell Prize in Genetics and Population Biology

Miriam Goldstein - Biology Prize

Robin Hopkins - The James Kidwell Prize in Genetics and Population Biology

Alexis Weintraub - Richard J. Goss Biology Prize



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Undergraduate Honors Thesis Presentations



Margaret Allan: *Morphological variation in a salt marsh snail.*

Advisor: Mark Bertness

Ian Carrol: *Metabolic cross-feeding in two-species bacterial communities.* Advisor:

Jennifer Hughes

Benjamin Fogel: *The*

role of Triglochin maritimum as an ecosystem engineer in a northern New England salt marsh. Advisor: Mark Bertness

Miriam Goldstein: *Effects of algal habitat architecture on the primary settlement of the blue mussel (Mytilus edulis).* Advisor: Jon Witman

Lillian Hang: *Change-point analysis of physiology across a fine-scale time course reveals the gene-expression cascade in response to nutrition.* Advisor: Marc Tatar

Robin Hopkins: *Degrees of density: Neighbor sensitivity in Arabidopsis thaliana.* Advisor: Johanna Schmitt

Matthew Jackson: *Cost of resistance of genetically engineered cold resistance in Arabidopsis thaliana in variable environments.* Advisor: Johanna Schmitt

Joanna Kelley: *Exploring models of hard and soft selection.* Advisor: Johanna Schmitt

Kathleen Kenny: *Skin print patterns in Triassic theropod trackways.* Advisor: Steve Gatesy

Mihir Parikh: *Anoxia tolerance in three bivalve species of Narragansett Bay, Rhode Island.* Advisor: Jon Witman

Alexis Weintraub: *Salinity fluctuations and bacterial community structure.* Advisor: Jennifer Hughes

Melissa Zerofsky: *Reproductive trade-offs associated with the innate immune response in Drosophila melanogaster.* Advisor: Marc Tatar

In the Greenhouse

By Fred Jackson
Spring greenhouse plans for research have begun with grad student Yuko Toyonaga's ambitious



Arabidopsis thaliana experiment. With over 5,000 plants, Yuko is looking for quantitative trait loci of flowering in responses to fertilization of recombinant inbred lines. Schmitt lab grad student Eric von Wettberg has many plant projects on the burner. Project #1: Collection of new *Impatiens capensis* genotypes to see if ecotypes form consistently on a regional scale. Project #2: Greenhouse grown *Liatris borealis* seedlings for outdoor common garden at Haffenreffer. He will be examining responses to deer herbivory. Project #3: With *Arabidopsis thaliana* mutant plants, Eric will shine light emitting diodes on plants to see if different phytochrome genes have tissue specific functions.

The Conservatory has had quite a bit of excitement lately. Some of this has been caused by the flowering of previously unflowered specimens, some by pest invasions, some by the visits and enthusiasm of the visitors and a bit more from the magazine *People, Places and Plants*, where we were recently written up as one of the best public greenhouses in the Northeast. We have had some exciting donations recently, including a big boost to the orchid collection (thanks to Uconn Storrs) and a coconut from Bread and Circus.

The orchid collection has grown dramatically in the past several months. We have received generous donations from the University of Connecticut at Storrs as well as from several other benefactors. We now have over 22 genera represented, many with several different species and/or hybrids. We have also started raising money in our rare plant fund (the 'Scotty' Fund) for the purchase of a very rare *Paphiopedilum*. It is a rare day when there are no orchids in bloom.

Teaching News

New offerings in the Biology of Motion & Design

By Sharon Swartz

Why can kangaroos cross the Australian landscape more efficiently than any other mammals? Why do daffodil stems bend so much before they break? Why does a swimming bacterium that stops rotating its flagellum come to a stop in a distance smaller than the diameter of a hydrogen atom? These are the kinds of questions undergraduates grapple with in two new courses developed by Sharon Swartz, *Biological Design: Structural Architecture of Organisms*, and *Animal Locomotion*. Both of these courses tackle subject material that sits at the interface of biological and physical sciences, and use techniques and approaches developed and refined by physicists and engineers to answer fundamentally biological questions. A diverse group of Brown students are drawn to these courses: biology concentrators interested in ecology, evolution, cell biology and physiology, students in biomedical engineering interested in robotics and biomimetic technology, and students in history, architecture, music, and literature who hope to gain new insights into the biological world. In these courses, students explore the physical workings and constraints of biological structures and materials from all parts of life's diversity, with special attention to evolutionary & ecological issues. Instruction challenges them to solve problems, delve into primary literature, write (a lot!), and give presentations as individuals and as teams. One group of *Biological Design* students wrote a children's book on the relevance of fluid dynamics for aquatic animals; others produced exhibit designs on marine mollusks for the American Museum of Natural History in New York. *Animal Locomotion* students have written research proposals on topics including how maneuverability influences predator/prey relationships and animal-inspired robotics. I hope that many of my students leave my classes with a new appreciation for a bit of Walt Whitman's famous *Leaves of Grass*:

"Of physiology from top to toe I sing, of life immense in passion, pulse, and power, cheerful, for freest action form'd under the laws divine . . ."



B. Silliman with US Rep. (NC) Walter Jones & Dir. Of NOAA Oper. Vice Adm Lautenbacher.

News Update

Morphology postdoc, **Kevin Middleton** (Brown Ph.D. 2002), received Honorable Mention in the Romer Prize competition for Best Student Paper at the annual meeting of the Society of Vertebrate Paleontology in Norman, Oklahoma last October.

Christine Janis traveled to the University of Malaga in Spain to present a talk & further her collaboration with Spanish colleagues Mendozo & Palmqvist.

Jonna Hamilton will research the physiology & mechanics of diving birds in Iceland this summer with support of a Fulbright Fellowship.

Jennifer Hughes received the Woodrow Wilson Career Enhancement Fellowship for Junior Faculty. This award gives Jennifer a Junior faculty sabbatical for the academic year 2003-2004.

Former honors undergrad/ **Corinna Riginos** 2000 was awarded an NSF predoctoral fellowship to UC Davis.

Former Ph.D. student **Colin Purrington** was promoted to Assoc. Professor with tenure at Swarthmore College.

Brian Silliman received the Walter B. Jones Memorial & NOAA Award for Excellence in Coastal Marine Research.

Julie Ellis was awarded a McGill fellowship to pursue research at Shoals Marine Lab. in summer 2003.

Andrew Altieri received the Best Student Paper award for his oral presentation during the first day of the Benthic Ecology Meetings in March 2003. He also received a 1 yr graduate fellowship from the Luce Foundation in support of research on the economic value of upwelling & no-take sites in the

Galapagos Marine Reserve (GMR).

Amidst the worst winter in years, **Andrew Altieri**, undergrad. **Miriam Goldstein**, & **Jon Witman** traveled to the Galapagos in January to conduct research on the ecological effects of upwelling in the marine reserve.

Chris Siddon just landed a 2 yr post-doc with Dr. Terry Quinn at the University of Alaska Fairbanks to conduct research on causes of population decline in Stellar sea lions and in intertidal ecology.

Post-doc **Doug McNaught** will be moving to New Zealand in September to start a 3 yr Lecturer position in Marine Ecology at Victoria University in Wellington.

Post-doc **Jose (Kongo) Farina** is in Chile where he's working on marine-terrestrial nutrient subsidies to coastal food webs in the northern part of the country.

Marc Tatar received a 5 year research grant from NIH to study the regulatory systems of *Drosophila* aging, and in May, he gave the Ben Cohen Lecture at the Institute of Gerontology at the University of Michigan.

In the Field

Fly & snail guys collaborate to investigate the biology of coral reef fishes. By Brian Silliman



Thanks to the inspiration and opportunities provided by the department's bi-annual trip to Belize,

fellow graduate student Robert Haney and myself have greatly expanded our research horizons and managed to avoid a small bit of New England's cold winter by temporarily migrating to more temperature-friendly tropical regions. Taking advantage of frequent flyer miles, the bargain basement price of sleeping in tents on mosquito infested beaches, and an ingenious zip-lock bag, fish-capture technique devised and patented by our very own Andrew Altieri, Rob and I are collecting non-harvested, coral reef fishes from throughout the Caribbean and using DNA analysis to examine: (1) How self-recruitment affects the evolution of coral reef fishes; (2) Whether or not pelagic larval duration of reef fishes is a good predictor of genetic connectivity; (3) The phylogenetic relationship of fish species within ecologically important reef fish families (damsel fish: Pomacentridae and wrasse: Labridae); and (4) Whether or not the rest of the Caribbean is as ecologically phat as Belize.

The fish we grind up for genetic analysis are those which are most attracted to the yellow+blue=green stripes of ziplock bags and include the blue head wrasse, slippery dick, bi-color damsel, dusky damsel, and various gobies. Over the past year, we have collected reef fish from many sites throughout the Caribbean, including Belize and Cancun on the Yucatan peninsula, St. Croix, St. John, and St. Thomas in the USVI, Los Roques in Venezuela, Andros and San Salvador Islands in the Bahamas, and south Florida.

Rob, a professed fruit fly guy from David Rand's lab and I, a marsh snail man from the Bertness lab, have truly appreciated the opportunity to get out of our species-poor lab and mud environments and experience some of the most diverse fish and invertebrate assemblages in the world.

Although we have already submitted a few papers and have a few more in the hopper, we are reluctant to give up our sampling regime of Caribbean island hopping and are ever on the look-out for funding sources, whether monies are gathered from national or overseas accounts. We hope our efforts will convert others in the department to the study of marine fishes and have hired a professional lobby firm to argue for our inclusion on the next departmental trip to the tropics. For me, these fish studies have been the spring board for further collaborations with marine ecologists from Texas A&M and Alabama to explore the role of mangroves as nurseries for coral reef fishes in the Bahamas and the community ecology of understudied tropical rocky shore Research

Research Feature

By John Stinchcombe

What happens when you combine model genetic systems with old-fashioned ecological intuition and natural history? Along with former Brown EEB post-doc Cynthia Weinig we set to find out with a large sample ecotypes of the plant 'lab rat' *Arabidopsis thaliana* reared in raised beds outside the Brown University greenhouse. We discovered there is a relationship between ecotype geographic location and life history traits expressed in our common garden. Conceivably, this relationship is caused by geographic divergence at candidate genes known to effect the measured life history traits. However, sequence analysis of these candidates among the ecotypes, conducted by our collaborators at North Carolina State University, failed to find evidence for geographic divergence. We then tested whether traits observed in our Rhode Island common garden were associated with climatic features of ecotype origin. Strikingly, the traits expressed in our garden were strongly correlated to the winter annual behavior of *Arabidopsis*. Ecotypes from habitats with hot, unseasonable summer temperatures had accelerated development of early life history feature Research Ecotypes from habitats with warm, above-freezing winter temperatures were associated with delayed life history transitions. With this research we hope to show the potential benefits of studying life history evolution from multiple perspectives, including the use of macro-scale geographic patterns, quantitative genetics, and molecular genetics.

Graduate Student Research



Pat and Mark with the
2002 EEB Marsh
Manipulation Burn-out
Award

The Ecology of Northern New England Salt Marsh Plant Communities

By Patrick John Ewanchuk, Ph.D., Brown University, May 2003

After a many years of trips to Maine and busy summers in the marsh and the rocky intertidal, it's done! In September 2002, I defended my dissertation on the ecology of Northern New England salt marsh plant communities. My research examined the relative importance of plant competition, physical disturbance, and abiotic factors as the forces that regulate plant zonation patterns in these critical salt marsh habitats in coastal Maine.

Salt marsh zonation is usually described as a series of clonal turfs that replace each other by competition along the abiotic conditions of a tidal gradient. Northern New England salt marshes, in addition, contain unique

areas of a mixed species dominated by a high diversity of small annual and perennial flowering plants, called Forb pannes. The focus of my dissertation work was to understand the factors that maintain these areas. In particular I investigated how waterlogged sediments can influence abiotic factors such as salinity, redox, sulfide concentration, and nutrient availability, which in turn may structure the plant community. To examine how waterlogging affects marsh plant zonation, I conducted large-scale drainage experiments and monitored the communities across four years. I found that waterlogging maintains areas of high forb diversity by limiting the ability of the clonal turfs to invade the forbs. Careful study of the forb plants also showed that the hemiparasite *Agalinis maritima* contributes to the panne size and to the temporal dynamics of plant succession in the panes. Because *A. maritima* parasitizes the rhizomes of *Spartina patens* it reduces the rate of *S. patens* encroachment into the pannes, suggesting that *Agalinis maritima* may indirectly regulate panne species richness and diversity. The results of my work provide a new framework to understand the Northern New England salt marsh, as well as the latitudinal patterns of salt marsh community dynamics. Because the pannes have low vegetation density and the forbs lack the extensive roots and rhizomes, sediment and peat do not accumulate rapidly in these patches. With this soil structure, as sea level rises large areas of scarce coastal resource defined by forb pannes may be lost or converted to mudflats or subtidal habitat.



Work in the Rocky Intertidal:

As a postdoctoral researcher at Northeastern University I now study the impact of predator chemical cues in structuring the intertidal community. Our focus is on how water-borne cues from the predatory green crab (*Carcinus maenas*) can alter snail feeding and thus affect community structure. Our first experiments show that both an herbivorous snail (*Littorina littorea*) and a carnivorous snail (*Nucella lappilus*) reduce their feeding in response to cues from predators. And this change in feeding caused a dramatic increase in fucoid algae and barnacles. Trophic interactions in these communities, therefore, may be driven by predator-induced alteration of prey traits (e.g., feeding behavior) and these effects may be just as important as how a predator reduces prey density.

Finally, I would like to take this opportunity to thank all the past and current members of the EEB department for all their help and support. I really could not imagine a better place.

Thank you all!

Pat

Spring 2003 Seminars

Brown Bag Seminars

February 7. **Dr. Oded Galor**, Professor, Economics Dept., Brown University. *Natural selection and the origin of economic growth.*

February 14. **Jonna Hamilton**, Graduate Student, Brown University. *The descent of murrets: Swimming kinematics of a wing-propelled diver.*

March 7. **Melissa Lage**, Graduate Student, Brown University. *Do bacteria follow a species area relationship?*

March 14. **Julie Ellis**, Graduate Student, Brown University *The origin of feces: Effects of nesting seabirds on terrestrial communities.*

March 21. **Anne Rhoads**, Graduate Student, Brown University. *The role of multiple disturbances on the composition & structure of the northern hardwood forests with a focus on the role of past land use.*

EEB Monday Seminars

January 27. **Dr. Robin O'Keefe**, Assistant Professor, Dept. of Anatomy, New York College of Osteopathic Medicine. *Clade dynamics in the Plesiosauria.*

February 3. **Dr. Charles Driscoll**, Professor, Dept. of Civil & Environmental Engineering, Syracuse University. *Nitrogen pollution in the Northeastern U.S.: Sources, effects & management options.*

February 10. **Dr. Laura MacLachy**, Assistant Professor, Dept. of Anthropology, Boston University. *The early Miocene record from Uganda: A different window into primate evolution.*

February 20. **Dr. Eliot Drucker**, Postdoctoral Research Associate, Dept. of Ecology & Evolutionary Biology, University of California-Irvine. *Experimental hydrodynamics and evolution: interpreting the functional design of fishes.*

February 24. **Dr. Robert Jefferies**, Professor, Dept. of Botany, University of Toronto. *The embarrassment of riches: the ecological consequences of an over-abundance of geese on Arctic coastal ecosystems.*

February 25. **Dr. Matthew McHenry**, Postdoctoral Research Associate, The Museum of Comparative Zoology, Harvard University. *Swimming in sea squirts: biomechanics, phototaxis and evolution.*

February 27. **Dr. Thomas Roberts**, Assistant Professor, Dept. of Zoology, Oregon State University. *The economy and extravagance of biological springs in animal movement.*

March 3. **Dr. Peter Morin**, Professor of Ecology, Evolution & Natural Resources, Rutgers University. *Experiments on the causes and consequences of ecological complexity.*

March 10. **Dr. Kathleen Treseder**, Assistant Professor, Dept. of Biology, University of Pennsylvania. *A peek inside the black box of ecosystems: Fungal communities and soil dynamics.*

March 17. **Dr. Julia Clarke**, Frick Postdoctoral Fellow, Div. of Paleontology, American Museum of Natural History. *The evolution of birds from Archaeopteryx to Aves: New evidence from the fossil record.*

March 31. **Dr. Gaius Shaver**, Senior Scientist, The Ecosystems Center, Marine Biological Laboratory. *Biodiversity regulates biogeochemistry in Alaskan tundra ecosystems.*

April 7. **Dr. Raphael Sagarin**, Congressional Science Fellow, Geological Society of America. *Climate change, species change, and the power of the naturalist.*

April 14. **Dr. Clive G. Jones**, Scientist, Institute of Ecosystem Studies. *Ecosystem Engineers and biodiversity: How species create habitat for others.*

April 21. **Dr. James H. Brown**, Distinguished Professor of Biology, University of New Mexico. *The scale of life: Toward a metabolic theory of ecology.*



Jim Brown giving a lecture in Bio 42

April 28. **Dr. Mark Kirkpatrick**, Painter Professor of Genetics, Section of Integrative Biology, University of Texas. *Local adaptation and population persistence.*

May 5. **Dr. John Willis**, Associate Professor of Biology, Duke University. *The evolution of selfing and its consequences for speciation.*

May 12. **Dr. Theodore Garland, Jr.**, Professor of Biology, University of California, Riverside. *Phylogenetic comparison and artificial selection: Two approaches in evolutionary physiology.*

New Publications

- Bertness, M. D., G. Trussell, P. J. Ewanchuk, and B. R. Silliman.** 2003. *Testing for Alternate Stable States on Maine Rocky Shoals*. *Ecology* 83: 3434-3448.
- Dukas, R. and D. H. Morse.** 2003. *Crab spiders affect flower visitation by bees*. *Oikos* 101:157-163.
- Frolich, L. M.** 2002. *En donde está la línea de árboles? En donde está la gente? En que creen?*. Recuadro 10.15. p.314. En: Sarmiento, F (Editor). *Las Montañas del Mundo: Una prioridad global con perspectivas latinoamericanas*. Editorial AbyaYala: Quito. 669pp.
- Frolich, L. M. and F. O. Sarmiento.** 2002. *Impacto humano en los paisajes tropicales*. (Chapter 18: pp. 561-580). En: Sarmiento, F (Editor). *Las Montañas del Mundo: Una prioridad global con perspectivas latinoamericanas*. Editorial AbyaYala: Quito. 669pp.
- Heschel, M. S., K. Donohue, N. Hausmann, and J. Schmitt.** 2002. *Population differentiation and natural selection for water-use efficiency in *Impatiens capensis**. *Int. Journal of Plant Science* 163:907-912.
- Layman, C. A. and B. R. Silliman.** 2002. *Preliminary survey of the fish fauna in Fresh Creek, Andros, Bahamas*. *Bulletin of Marine Science* 70: 199-210.
- Mendoza, M., C. M. Janis and P. Palmqvist.** 2002. *Characterizing complex craniodental patterns related to feeding behaviour in ungulates: a multivariate approach*. *Journal of Zoology, London* 258: 223-246.
- Morse, D. H.** 2002. *Orientation and movement of wolf spiders *Pardosa lapidicina* (Araneae, Lycosidae) in the intertidal zone*. *Journal of Arachnology* 30:601-609.
- Rand, D. M., P. S. Spaeth, T. Sackton and P. S. Schmidt.** 2002. *Ecological genetics of the *Mpi* and *Gpi* polymorphisms in the northern acorn barnacle and the spatial scale of neutral and non-neutral variation*. *Integrative and Comparative Biology* 42:825-836.
- Sanford, E., M. Roth, G. Johns, J. Wares, G. Somero.** 2003. *Local selection and latitudinal variation in a marine predator-prey interaction*. *Science*: May 16 Issue.
- Sanford, E.** 2002. *Water temperature, predation, and the neglected role of physiological rate effects in rocky intertidal communities*. *Integrative and Comparative Biology* 42: 881-891.
- Sarmiento, F. O. and L. M. Frolich.** 2002. *Andean cloud forest tree lines: naturalness, agriculture and the human dimension*. *Mountain Research and Development* 22(3): 278-287.
- Silliman, B. R. and A. Bortolus.** 2003. *Underestimation of *Spartina alterniflora* production in Western Atlantic salt marshes*. *Oikos* 101:549-554.
- Tatar, M., A. Bartke and A. Antebi.** 2003. *The endocrine regulation of aging by insulin-like signals*. *Science*, 299: 1346-1351.
- Trussell, G. C., P. J. Ewanchuk and M. D. Bertness.** 2002. *Trait-Mediated effects in rocky intertidal food chains: Predator risk cues alter prey feeding rates*. *Ecology*, 84(3):629-640.
- Tu, M.-P., C.-M. Yin and M. Tatar.** 2002. *Impaired ovarian ecdysone synthesis of *Drosophila melanogaster* insulin receptor mutants*. *Aging Cell*, 2: 158-160.
- Weinig, C., M. C. Ungerer, L. A. Dorn, N. C. Kane, S. S. Halldorsdottir, Y. Toyonaga, T. F. C. Mackay, M. D. Purugganan and J. Schmitt.** 2002. *Novel loci control reproductive timing in *Arabidopsis thaliana* in natural environments*. *Genetics* 162:1875-1884.
- Weinig, C., J. R. Stinchcombe and J. Schmitt.** 2003. *QTL architecture of resistance and tolerance traits in *Arabidopsis thaliana* in natural environments*. *Molecular Ecology* 12: 1153-1163.
- Witman, J. D. and F. Smith.** 2003. *Rapid community change at a tropical upwelling site in the Galápagos Marine Reserve*. *Biodiversity and Conservation* 12:25-45.

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Feedback to the EEB Newsletter

We would like to hear from you!

Comments and information are welcome to:

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OR email information to:
Bernadette_Horta@Brown.edu



Name: _____ Undergraduate or Graduate – class Year _____

Advanced Degrees Date & Institution _____

Email Address: _____ Home Telephone _____

Home Address: _____

City _____ State _____ Zip Code _____ Telephone _____

Business Title: _____ Business Phone _____

Alumni Notes (___check if only for our files) _____

Can we contact you for further information about your activities in Biology? ___yes ___no