

Ecology & Evolutionary Biology

Issue 14
May, 2008
Brown University
Providence, RI.



Letter from the Chair

By Mark Bertness



Greetings from an EEB under siege from University construction projects. This semester Walter Hall has been a constant cacophony of jackhammers, dust-covered desks, gaping holes in the building and construction workers wandering around the basement. The conference room has been all but abandoned and my basement lab has been rendered entirely useless. In spite of these conditions we have forged ahead to new heights. Leading the charge, Annie Schmitt was elected to the National Academy of Science, EEB's first, and the first woman at Brown to achieve this rarified distinction. This

recognition of Annie's career accomplishments is the most palpable evidence to date that EEB at Brown is having a large national and international impact. Congratulations Annie, and thanks! Congratulations also to MBL colleague, John Hobbie, former director of the Ecosystem Center, who was elected to the American Academy of Arts and Sciences along with EEB alum Michael Dickinson of Cal Tech.

There have been other EEB successes as well. Steve Gatesy and Joe Bahlman's research on dinosaur flight was featured on PBS's NOVA in January, Casey Dunn's *Nature* paper reevaluating invertebrate phylogeny was the lead feature on the National Science Foundation's web page last month, and Sharon Swartz's group work on the kinematics of bat wings was showcased in *Science*. In addition, this spring Jon Waage won Brown's teaching technological

innovation prize and Christine Janis won the Elizabeth Leduc Award for teaching excellence in the Biological Sciences. So we are cooking.

When the dust settles, not all has been bad on the space front as well. Renovated EEB labs in the BioMed Center are being completed and are heating up and we are finalizing plans for a Conservation Biology wing in Metcalf Laboratory, an expansion that will build bridges between EEB, Environmental Science and Environmental Studies. Congratulations to Tom Roberts for his richly deserved promotion to associate professor and a special thanks to Adella, Trina, Shannon, Sandy and Boss Carol, for helping us put up with all the construction noise, fumes and daily annoyances of being in the middle of someone else's job site. We appreciate your spirit every day. Here's to a happy, productive and well-deserved summer.



Johanna Schmitt elected to National Academy of Sciences

On April 29th we received the exciting news that Annie Schmitt had been elected to the National Academy of Sciences. Annie was one of the first recruits to our group, then the Section of Population Biology and Genetics, fresh from her Ph. D. at Stanford and postdoc at Duke. Although her doctoral work focused on plant-pollinator relationships, much of it at the wonderful Rocky Mountain Biological Field Station, it didn't take her long to begin to focus toward the evolution of life history and physiological traits in wild plant

populations, most recently into the nascent field of ecological genomics. This work, of course, has received a lot of attention and doubtless accounts largely for her most well-deserved election to the NAS. You probably recall reading about some of her exciting new directions in last spring's newsletter. However, those of us in the Department realize that there is a lot more to Annie's career than her own research. She has been a standout in the classroom, offering courses in plant diversity and plant ecology. These have served as conduits into her research program, and most people probably wouldn't believe Annie was old enough to have had the impact as a mentor that she has – at the

undergraduate, graduate and postdoc levels. Those former students are now in select positions as graduate students, postdocs and tenure-track faculty, and still more are entering the pipelines. One of the things that I have appreciated most has been Annie's level of contributions to big department-level projects. As a single example, every few years we are inevitably expected to write major vision statements that require months of effort – to justify our existence, so to speak. These travel to the Division or to University Hall as departmental reports, signed by the chair. However, more often than not it has been Annie's pen that has anonymously (up until now, that is!) drafted the greater parts of these documents. Thanks for everything, Annie!

In the Greenhouse



By Fred Jackson

With recent additions to the EEB department of new professors, graduate students and post-docs, there also has been a rise in greenhouse experiments. Two new invasive plant experiments have commenced, both of which could prove to have exciting future results.

Matt Heard (EEB Graduate Student) is putting a new twist on an interesting and invasive plant, the water hyacinth. Water Hyacinth is an aquatic weed with rapid growth rates and often forms dense monocultures on the surface of waterways. Although its high levels of productivity can make management of this species problematic, its abundant biomass has also been shown to be a potential resource for phytoremediation (using plants to clean up contaminated water sources). Currently, Matt is pursuing two

areas of research; first, the ability of water hyacinth to accumulate lead, more specifically, in how lead accumulation rates vary across the geographic range of water hyacinth. His preliminary investigations have shown that survival and uptake rates



vary between source populations and that adaptation may be necessary to cope with high levels of lead.

Additionally, he is interested in examining how temperature may influence accumulation of lead in water hyacinth; this may be a possibly important step for phytoremediation in light of global change. Ultimately, Matt hopes to tie his research into the work being conducted by Juliet Simpson (Post-Doctoral Associate) and Kate Smith (EEB Assistant Professor) who have a larger ongoing project related to water hyacinth.

The Bertness lab is continuing its investigation of physical and biological factors influencing the invasion of marsh reed, *Phragmites australis* in New England salt marshes. This project, which evolved out of Christine Holdredge's (Brown '07) senior thesis, targets the role of arbuscular mycorrhizae in native and exotic *Phragmites* growth dynamics, which they believe may be impacting competitive interactions between *Phragmites* and other plants of the high marsh.

Undergraduate Honors Thesis Presentations

Max Rubinstein

Mitochondria, munchies, mating and mortality: how does mtDNA alter dietary effects on longevity and fecundity in *Drosophila*?

Advisor: David Rand

Emily Josephs

Natural variation in the ability of cold to break and reinduce dormancy in *Arabidopsis thaliana* seeds

Advisor: Johanna Schmitt

Kaya Schmandt

Natural variation in *Arabidopsis* seed response to dehydration during germination

Advisor: Johanna Schmitt

William Krimmel

Host-size tradeoffs for a parasitoid wasp

Advisor: Doug Morse

Gregory Halenda

Mechanical properties of the aponeurosis in wild turkeys

Advisor: Tom Roberts

Rohan Maddamsetti

Studying standing genetic variation effects on adaptation to novel environments

Advisor: Dan Weinreich

Megan Dawson

Skeletal kinematics of upper bill movement during feeding in mallard ducks

Advisor: Beth Brainerd

Albert Lin

The dynamics of bilateral pig mastication

Advisor: Beth Brainerd

Youssef Garcia-Bengochea

Substrate choice by *Misumena vatia* spiderlings

Advisor: Doug Morse

Timothy Savage

Life after death? Dead *Phragmites australis* stems facilitate current and future expansion

Advisor: Mark Bertness

Alina Garbuzov

Hormone regulation and downstream targets of *Drosophila* microRNA let-7 and mir-125

Advisor: Marc Tatar

News Update

News Update

Keryn Bromberg gave a seminar on the history and future of human impacts on New England salt marshes in April at the Gulf of Maine Research Conference at Bowdoin College.

Erika Edwards traveled to Madagascar and South Africa in February and March to initiate collaborations for a research project on succulent lineages of plants that are endemic to arid regions of those countries.

Stephen Gatesy and **Joseph Bahlman** appeared on a recent NOVA program, “The four-winged dinosaur”.

Christine Holdredge gave a featured talk on Cape Cod salt marsh die offs at the Cape Cod Natural History and Conservation Meeting in March.



Thomas Flatt has accepted a tenure-track faculty position in functional evolutionary genetics at the Veterinary Medical University (VMU; Institute for Animal Breeding and Genetics) in Vienna, Austria. He will probably be moving in Winter 2008/2009.

He is also co-organizing a symposium on molecular mechanisms of life history evolution at the Evolution meetings in Minneapolis in June.

Christine Janis has been on sabbatical at Bristol University, doing a project on relating herbivore jaw morphology to digestive strategy with Emily Rayfield. Also, she reports that she has submitted final proofs for her huge volume, 10 years in the making, of the Evolution of Tertiary Mammals of North America (Vol. 2: Small mammals, marine mammals, and xenarthrans). Quote from Christine: “This isn’t a usual “in press” comment”!

Heather Leslie organized two marine symposia for the annual meeting of the American Association for the Advancement of Science (AAAS) in Boston in February 2008. The first featured cutting-edge approaches for synthesizing information about the ecology and economy of ecosystem services provided by ocean ecosystems, including food production and protection from coastal storms. The second highlighted findings

from Ecosystem-Based Management for the Oceans, a forthcoming book from Island Press that she is co-editing. This book is an instructive guide to address the diverse challenges posed by marine ecosystems and the human communities that depend on them, and provides the “bricks and mortar” from which practitioners can build management strategies appropriate to their circumstances.

R. Matt Ogburn won the Midwestern Association of Graduate Schools Distinguished Master’s thesis award.

Dan Weinreich was an invited speaker at the Gordon Conference on Molecular Evolution in Ventura, CA. 2 Feb - 8 Feb.

Tom Roberts was promoted to Associate Professor. Congratulations, Tom!

EEB Graduate



Pedro Flobaum,
Ph.D. 9/21/07

The Role of Biodiversity on Ecosystem Functioning: The Patagonian steppe as a model

Alan Bergland

EEB Graduate Student



It is unquestionable that the environment varies and that environmental variation affects

organisms in some way or another. Often, environmental variation affects the ability of organisms to survive and reproduce – in other words, environmental variation affects fitness. My research, in Marc Tatar's lab, examines how nutrition during larval growth affects adult reproduction, and consequently fitness, in the fruit fly (*Drosophila melanogaster*). I am approaching my research from three perspectives: ecological, evolutionary and genetic.

I know what you might be thinking: "Sure, you can study evolution and genetics in the fly, but ecology? No way!" I seem to get this response from ecologists who think that flies aren't real organisms and from *Drosophila* aficionados who can't seem to imagine that flies live outside the lab. Well, of course they are real and they live out of the lab! As an experiment, leave a peeled banana on the counter for a few days and see what shows up. Flies will start to congregate there and females will lay eggs on the (now rotten) banana. The larvae will spend a few days on the banana, mostly eating yeasts that grow on the rotten fruit, and then develop into adults.

Now, what is very interesting is that fly larvae that happen to occur on more rotten fruit develop faster and become larger adults than larvae on less rotten fruit. This phenomenon is likely a consequence of higher yeast concentrations on the more rotten fruit that, in turn, provide better nutrition for the developing larvae. These larger flies are also able to lay more eggs as adults than the smaller flies. As part of my research this summer, I will be examining the extent of environmental variation in 'rotteness' in natural settings like orchards and how this environmental variation translates into variation in body size.



Bigger flies have bigger body parts, and body part size is often a direct determinant of survival and reproduction. Larger female flies have larger ovaries, and ovary size is positively correlated with fecundity. This correlation makes sense from a morphological perspective. Fly ovaries are composed of discrete units called ovarioles. A set of germline stem cells (GSCs) resides at the tip of each ovariole, and

these GSCs divide and differentiate into eggs. Given proper adult nutrition, each ovariole can simultaneously mature about an egg a day. Thus, the number of ovarioles sets the upper limit on fecundity. Much of my research over the past year has involved quantifying the relationship between larval nutrition, body size, ovariole number, development time, fecundity and fitness within a semi-natural population of flies. This work has led to a simple prediction. Selection will be more efficient at acting on the response of ovary and body size to a high quality environment than a low quality environment because of the large fitness difference between these environments. Presently, I am working on models that explore this prediction.

These models rely heavily on quantitative genetic experiments that Marc and I have performed over the last three years. One of these experiments identified genomic regions that are responsible for variation in the response of ovary and body size to larval nutrition. In total, we identified ~40 genomic regions responsible for this variation and are presently working to identify causative genes within some of these regions. By identifying the precise genes controlling variation in the responses of ovary and body size to the larval environment, we can assay genetic variation and the selective effect of alternative alleles at these loci. In other words, we can tie together ecology and evolution at a genetic level.

Well, that's the hope anyway. Stay tuned!

Walter Hall As an Island

By Doug Morse



Although those of you in the know may recognize island biogeography theory to be somewhat passé, and you certainly know that one should never draw conclusions from an *N* of 1 (it's anecdotal!), Walter Hall's plight has brought back all those remembrances clearly to mind.

It all began last May (2007 – a whole year ago!) when parts north of our bailiwick were blocked off by a chain-link fence, part of a \$46M project to upgrade the University heating system, which has now struck (literally) our part of the campus. It is probably our misfortune that a major trunk of the heating pipes goes under Walter Hall, although we've been assured as a result that Walter Hall will never disappear (we didn't inquire about being blown sky-high....). However, maybe the current Walter Hall could disappear to be replaced by the gentle one we knew a year ago, or perhaps be wafted away to a saner corner of campus. That would be OK. How-

ever, the fence, which arrived weeks before anyone showed up to work, was merely the prelude to eventual incessant but still increasing encroachment.

Construction is now taking place on three of our four sides, with the fourth blocked off except for a winding pathway leading from the back door through the Am Civ garden or to the walkway behind the UEL. Since important stuff is going on under us, these people have to be in the basement, but it would be presumptuous to suggest that they not leave everything wide open so that anyone could



enter Walter Hall at any hour – to date we've had no holdups and no street people sleeping in, but keep posted. It doesn't seem to have dawned on these folk that running compressors under our windows, or next to those perpetually opened basement doors can, not to mention the sound, allow carbon monoxide to enter buildings just as easily as into automobiles with leaky mufflers.

Fortunately, we've been able to call our friends in Environmental Health and Safety to get a reading now and then. Of course, all this says nothing about the level of racket that assaults us on a daily basis (jackhammers, chainsaws, compressors, heavy equipment perpetually backing up (beep, beep, beep.....). You've got the picture – its multisensory! Meanwhile, we can't use our front door, and they've cut down the tree in front of our building. The tree wasn't that spectacular, but, hey, it was a tree, and it did have leaves in season.

All the while, J. Walter Wilson has been undergoing renovation, since MCB moved in October to its glamorous new digs in Sidney Frank Hall. Actually, it usually resembles demolition more than renovation (for Student Services). That too, contributes its share of heavy equipment, with walls being blasted out, windows shattered,

huge cranes moving things off the roof, moving things onto the roof, and then maybe.... We understand that a new, enlarged, better than ever student services will eventually occupy that building. We have absolutely no sense whatsoever of when all this will end, though we understand that in July they'll be digging next to the President's office. Now maybe that will speed matters up a bit! The pictures decorating this little essay tell it all.

2008 Spring Seminars

Brown Bag seminars usually catch up on research and work in progress within EEB, and the more formal colloquium series features speakers from outside the University.

Brown Bag Seminars

- FEB 1** **Johanna Schmitt**, Professor, Adventures with *Arabidopsis* in the real world.
- FEB 8** **Regan Early**, Postdoctoral Research Associate, Brown University. The development of population-based conservation strategies for spatially dynamic species.
- FEB 22** **Amity Wilczek**, Postdoctoral Research Associate, Brown University. Variation at a single locus leads to changes in life history and climate space in *Arabidopsis*.
- FEB 29** **Nickolay Hristov**, Postdoctoral Research Associate, Brown University. The science of numbers: Colony size and population decline of Brazilian free-tailed bats using thermal imaging.
- MAR 7** **Joseph Bahlman**, Graduate Student, Brown University. 3-D glide kinematics of northern flying squirrels.
- MAR 14** **Shelby Hayhoe**, Graduate Student, Brown University. The sustainability and biogeochemistry of the soy industry in the Brazilian Amazon.
- MAR 28** **Gregory Sawicki**, Postdoctoral Research Associate, Brown University. Tendon elasticity influences the mechanics and energetics of muscle contraction: Insights from walking humans and isolated frog muscle-tendon.
- APR 4** **Patrick Flight**, Graduate Student, Brown University. Intertidal microhabitats influence patterns of selection in the acorn barnacle.
- MAY 2** **Douglass Morse**, Professor Emeritus, Brown University. In Patagonia.

Monday Colloquia

- JAN 28** **Olivier Rieppel**, The Field Museum. The history of evolutionary thought: Evolutionary theory and the problem of change.
- FEB 4** **Taylor Field**, University of Tennessee, Knoxville. The ecophysiology of early angiosperms.
- FEB 11** **Les Kaufman**, Boston University. The emperor's new wet suit: Science in marine conservation and ecosystem-based adaptive management.
- FEB 25** **Kiisa Nishikawa**, Northern Arizona University. Neuromechanics of ballistic movements.
- MAR 3** **Adrien Finzi**, Boston University. Nitrogen limitation and carbon sequestration in temperate forests exposed to rising concentrations of atmospheric carbon dioxide.
- MAR 10** **Kathleen Donohue**, Harvard University. Season: What it means to a seed.
- MAR 17** **Noel Michele Holbrook**, Harvard University. Foraging strategies of sessile organisms: how variation in hydraulic properties contributes to resource uptake in plants.
- MAR 31** **Stacey Combes**, Harvard University. The biomechanics of fight and flight in orchid bees: Aerial jousting and turbulent foraging in pursuit of the perfect scent.
- APR 7** **Mike Kaspari**, University of Oklahoma. Toward a biogeography of brown webs.
- APR 14** **Brad Seibel**, University of Rhode Island. Extreme animals, extreme environment: The biology of the giant squid, *Dosidicus gigas*, in the oxygen minimum layer.
- APR 21** **Jon Harrison**, Arizona State University. Proximate and evolutionary effects of atmospheric oxygen level on the body size of insects.
- APR 28** **Marisa Baskett**, National Center for Ecological Analysis and Synthesis. Rapid evolution and marine conservation.
- MAY 5** **Stanislav Gorb**, Max Planck Institute. Biological attachment systems and biomimetics: What can we learn from evolution?

New Publications



Publications

Alberti, J., M. Escapa, P. Daleo, O. Iribarne, B. R. Silliman & **M. Bertness**. 2008. Crab herbivory regulates plant facilitative and competitive processes: Argentinean salt marshes. *Ecology* 89:155-164.

Azizi, E., E.L. Brainerd & T.J. Roberts. 2008. Variable gearing in pennate muscles. *PNAS* 105:1745-1750.

Bazterrica, M.C., B.R. Silliman, F.J. Hidalgo, C.M. Crain & **M.D. Bertness**. 2007. Limpet grazing on physically stressful Patagonian rocky shores. *Journal of Experimental Marine Biology and Ecology* 353: 22-34.

Bertness, M.D., C.M. Crain, C. Holdredge & N.Sala. 2008. Eutrophication triggers consumer control of New England salt marsh primary production. *Conservation Biology* 22:131-139.

Cid, M. S., C. M. Ferri, M. A. Brizuela & **O.E. Sala**. 2008. Structural heterogeneity and productivity of a tall fescue pasture grazed rotationally by cattle at four stocking densities. *Grassland Science* 54:9-16.

Cipriotti, P. A., **P. Flombaum, O.E. Sala** & M. Aguiar. 2008. Does drought control emergence and survival of grass seedlings in semi-arid rangelands? An example with a Patagonian species. *Journal of Arid Environments* 72:162-174.

Crook, T.C., **T. Flatt**, & P.T. Smiseth. 2008. Hormonal modulation of larval begging and growth in the burying beetle *Nicrophorus vespilloides*. *Animal Behaviour* 75:71-77.

Daleo, P. Alberti, J., O. Iribarne, B. R. Silliman & **M. Bertness**. 2007. Fungal mediated crab facilitation of marsh plant production in Argentinean salt marshes. *Ecology Letters* 10: 902-908.

Dunn, C.W., et al. 2008. Broad phylogenetic sampling improves resolution of the Animal Tree of Life. *Nature* 452:745-749.

Edwards, E. J. & C. J. Still. 2008. Climate, phylogeny and the ecological distribution of C4 grasses. *Ecology Letters* 11: 266-276.

Giribet, G., **C.W. Dunn**, G.D. Edgecombe, & G.W. Rouse 2007. A modern look at the Animal Tree of Life. *Zootaxa* 1668:61-79.

Hamburg, S.P., D.Pryor & M.A. Vadeboncoeur. 2008. Nitrogen inputs to Narragansett Bay: an historical perspective. In: Desbonnet, A. and B. Costa-Pierce, eds. Science for ecosystem-based estuarine management: Narragansett Bay in the 21st century. Springer: New York, pp. 177-210.

Hidalgo, F.J., Silliman, B. R., M.C. Bazterrica, & **M.D. Bertness**. 2008. Predation pressure on rocky shores of Patagonia. *Argentina Estuaries and Coasts* 30:886-894.

Hughes, T.P., **H. Leslie**, et. al. 2007. Adaptive management of the Great Barrier Reef and the Grand Canyon World Heritage Areas. *Ambio* 36:586-592.

Knapp, A. K., J. M. Briggs, D. L. Childers, and **O.E. Sala**. 2007. Estimating above-ground net primary production in grassland and herbaceous dominated ecosystems. In: T. J. Fahey and A. K. Knapp, eds. Principles and standards for measuring primary production. Oxford University Press, Oxford, pp.27-48.

Lee, K-S., **M. Tatar** et al. *Drosophila* short neuropeptide F signaling regulates growth by ERK mediated insulin signaling. *Nature Cell Biology* 10:468-475.

Leslie, H.M., A. R. Rosenberg & J. Eagle. 2008. Is a new mandate needed for marine ecosystem-based management? *Frontiers in Ecology and the Environment* 6:43-48.

Leslie, H. M. & K. L. McLeod. 2007. Confronting the challenges of implementing marine ecosystem-based management. *Frontiers in Ecology and the Environment*. 5:540-548.

Min, K.J, **R.Yamamoto**, S. Buch, M. Pankrat & **M. Tatar**. 2008. *Drosophila* lifespan control by dietary restriction independent of insulin-like signaling. *Aging Cell* 7:199-206.

Morse, D.H. 2007. Hunting the hunters: spatial and temporal relationships of predators that hunt at the same sites. *Journal of Arachnology* 35:475-480.

O'Brien, D., K.J. Min & **M. Tatar** 2008. Use of stable isotopes to examine how dietary restriction extends *Drosophila* lifespan. *Current Biology* 18: R155-156.

Rand, D.M. 2008. Mitigating mutational meltdown in mammalian mitochondria. *PLoS Biology* 6(2):e35.

Sage, B.T., M.D. Wu & A.K. Csink. Interplay of developmentally regulated gene expression and heterochromatic silencing in trans in *Drosophila*. *Genetics* 178:749-759.

Satake, A., **H. M. Leslie**, Y. Iwasa & S. A. Levin. 2007. Coupled ecological-social dynamics in a forested landscape: spatial interactions and information flow. *Journal of Theoretical Biology* 246: 695-707.

Smith, S.A. & **C.W. Dunn**. 2008. Phyutility: a phyloinformatics tool for trees, alignments, and molecular data. *Bioinformatics* 24:715-716.

Yahdjian, L. & **O.E. Sala**. 2008. Do litter decomposition and nitrogen mineralization show the same trend in the response to dry and wet years in the Patagonian steppe? *Journal of Arid Environments* 72: 687-695.



BROWN

Ecology & Evolutionary Biology

Box G-W

Providence, RI 02912

Feedback to the EEB Newsletter:

We would like to hear from you!

Comments and information are welcome to:

EEB Newsletter

Brown University

Box G-W

Providence, RI 02912

or Email information to: Trina_Pappadia@brown.edu

To view this and previous newsletters in color visit our website at:

<http://www.brown.edu/Departments/EEB/>

Name: _____ Undergraduate or Graduate-class year _____

Advanced Degrees _____ Date & Institution _____

Email Address: _____ Telephone _____

Address: _____

City _____ State _____ Zip Code _____

Alumni Notes: _____

Can we contact you for further information about your activities in Biology? yes no