

Ontario Ecology & Ethology Colloquium



2004

University of Toronto



May 10-12

www.oeec.ca

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General INFORMATION

Registration

The registration desk will be located in the main foyer of the South Building except for during the social mixer.

Mon, May 10: Early registration at Social Mixer,
Blind Duck Pub, 17.00-24.00

Tues, May 11 South Building Foyer, 07.00-18.30

Wed, May 12: South Building Foyer, 08.00-17.00

Registration fees include the conference program, lunches, coffee breaks, and two drink tickets for use during the mixer, poster session, and/or banquet.

Please be sure to bring your own coffee mug, water bottle, pen, and notebook.

Notice to Session Moderators

Please report to the designated room a few minutes prior to the start of the session. Use this time to confirm that the speakers are present. Since there are multiple concurrent sessions it is very important that we adhere to the scheduled times. Speakers are allotted 14 min in total. Please signal the speakers at 10 min, and at 12 min. At 14 min please ask the speaker to leave the podium.

Notice to Oral Presenters

Please hand in your presentation on CD when you register. This will be returned to you. We recommend that you bring a backup CD of your presentation. CDs must be compatible with Windows XP and PowerPoint 2000. Please verify your presentation on this platform (especially Mac users) using a different computer than the one that you burned it on. Please use your last name as the file name for your talk (e.g. Darwin.ppt).

Please report to the room where you will be speaking 15 min prior to the start of your session. Each speaker will be allotted 14 min (12 min talk + 2 min questions) with one minute for movement between rooms. You will be asked to leave the podium if you exceed this time limit. You will not be permitted to use your own computer. Slide and overhead projectors will not be available. A room will be available for practicing your talk.

Notice to Poster Presenters

We encourage you to put up your posters during the first coffee break. You are only required to stand by your poster during the poster session that will be held on Tuesday, May 11 from 17.30-18.30 in Spigel Hall prior to the banquet. Poster boards are 120 cm x 120 cm. Please do not use pins or tacks on the poster boards - velcro tape will be provided for you.

Parking

Daytime parking for conference attendees will be available in Lot 4. If you will be staying overnight on campus please use Lot 6. Parking passes are available for pickup at the OEEC registration desk. Please see the map on the back of the program for the location of the lots.

Meals

Formal breakfasts will not be provided; however, various baked goods such as bagels, muffins, and Danishes will be served during the coffee breaks. Lunches will be provided on Tuesday, May 11 and Wednesday, May 12. All coffee breaks, lunches, and the banquet will take place inside Spigel Hall or on the patio just outside Spigel Hall. Vegetarian options will be available during coffee breaks, lunches, and the banquet. Vegan food will be available at the banquet for those who indicated this on their registration form.

During the summer, on campus food services are limited to Tim Horton's, Pizza Pizza, Williams Coffee Pub, and several vending machines. These are all located in the main foyer of the South Building.

Banquet

The banquet will be held in Spigel Hall on Tuesday May 11th at 18.30 following the poster session. There will be limited numbers of tickets for sale at the OEEC registration desk (\$15 each). Banquet tickets will be collected – please be sure to bring yours. We are pleased to feature the funk/soul music of LMT Connection (www.lmtconnection.com). We thank the Old Credit Brewing Company for providing beer for the poster session and banquet.

Local Restaurants

Mississauga boasts a wide variety of ethnic restaurants within a 10 min drive from the UTM campus. These include East Indian, Thai, Lebanese, Caribbean, Japanese, Chinese, Vietnamese, Greek, and many others. Concentrations of restaurants are found around the following intersections: Dundas & Hurontario, Dundas & Winston Churchill, and Burnhamthorpe & Erindale Station (walking distance from UTM).

On-Campus Housing

You will be staying in McLuhan Court (see map on back of program or on OEEC website). Keys to your rooms will be available at the OEEC registration desk. Each unit consists of four lockable bedrooms. Please park your cars in Lot 6.

Computer Access

Email and internet access will be available in the library located in the main foyer of the South Building. The library summer hours are 08.45-17.00.

Emergency

911:	9.911
Campus Police:	905.828.5200
Campus Police Emergency:	905.569.4333
Ambulance:	905.844.4242
Fire Department:	905.279.2311
Peel Police:	905.453.3311

T-Shirts

T-shirts ordered on the web prior to the conference will be available at the OEEC registration desk. There will be some t-shirts available for purchase for \$13.

Book/Prize Draw

This will take place during the closing remarks on May 12. There will be an opportunity to see the books and prizes during the banquet.

Bookstore

The UTM bookstore will be open during the conference from 08.45-17.00. Pens, notebooks, University of Toronto souvenirs, coffee mugs, and water bottles can be purchased at the bookstore.

Nature Walks

The UTM campus is fortunately located beside the beautiful Erindale Park which contains a number of walking trails and the Credit River. Access to Erindale Park is available at the southwest corner of parking Lot 4 or via the main entrance off of Dundas St. The UTM campus itself is heavily wooded with several walking trails. It is not uncommon to see deer, foxes, and various other wildlife on campus.



Office of the Vice-President & Principal

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April 13, 2004.

Dear OEEC Participants:

Welcome to the University of Toronto at Mississauga, one of the three campuses of the University of Toronto. University of Toronto at Mississauga, or UTM, as it is known, is located on 225 bucolic acres nestled against the Credit River Valley. Designated as a campus for expansion to accommodate an increased demand for university places in Ontario, UTM is being transformed from a student population of about 6,000 to well over 11,000 by 2006-2007, with over \$100M of building projects providing increased residence spaces, research, teaching, and student activity space. By September of 2006, we will have opened the Communication, Culture and Information Technology building, a new Academic Learning Centre to house our library, a new Wellness Centre with a 25 meter swimming pool, double gym and indoor running track, and a new 400 bed residence. We have hired over 50 new faculty members over the past three years and have 67 new faculty positions available over the next five years.

Thanks to a legacy of careful stewardship, much of the campus' land mass remains undeveloped. That sense of stewardship continues, with the UTM community designating existing undeveloped green space as "protected, naturalized, research space" and all measures are aimed at preventing further encroachment thereon. As a microcosm for the pressures of urban growth, UTM is determined to prove that rapid expansion and development can be accomplished in an environmentally sensitive and responsible manner. *Grow Smart, Grow Green* is the banner under which UTM's comprehensive, multi-faceted initiative has been launched. Indeed, with the support of students, Grounds staff and other campus stakeholders, the City of Mississauga and the Credit Valley Conservation Authority, UTM partnered with the Evergreen Foundation in the first ever Evergreen/University partnership. The UTM/Evergreen partnership received the 2003 Credit Valley Stewardship Award of Distinction. I hope you will find time to explore our wonderful campus, and the banks of the Credit River.

Once again, welcome to UTM and best wishes for a successful conference.

A handwritten signature in black ink, appearing to read 'Ian Orchard'.

Ian Orchard, Professor of Biology
Vice-President and Principal
University of Toronto at Mississauga



DEPARTMENT OF BIOLOGY



**Robert Baker, Chair
Professor of Zoology**

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E-mail: rbaker@utm.utoronto.ca

April 19, 2004

Dear Colleagues:

I am delighted to welcome you to UTM and to OEEC 2004. The organizers of the colloquium could not have picked a more exciting time for you to visit our campus. We have recently entered a period of unprecedented growth at UTM, growth that brings exciting new infrastructure and a dramatic increase in the number of faculty.

Research in the Department of Biology at UTM is very strong. We have focused on three major areas of research: Evolution & Ecology; Neuroscience & Physiology; and Developmental, Cell & Molecular Biology and have used recent developments in these areas to inform and steer our direction. Our current complement includes 21 tenure-stream faculty members, 37 graduate students, 8 postdoctoral fellows/research associates, 7 research technicians and 26 senior undergraduate students pursuing research projects. As we grow, we expect to add several new faculty positions, many of which relate to research in ecology, evolution and behaviour.

The relatively small size of UTM, coupled with the physical layout of the buildings and a very collegial atmosphere, does much to promote interdisciplinary programs and our three research areas align nicely with our partners in cognate disciplines at UTM. Our faculty in Evolution and Ecology have strong and growing ties to the Physical Geographers; we have cooperated on research programs involving mercury in the environment and are working together to establish a series of experimental wetlands and large scale mesocosms at UTM. Faculty in Neuroscience & Physiology have partnered with some of our colleagues in Psychology to form a new interdisciplinary cluster: The Genes, Environment, Nervous System and Behavior Cluster (GENAB). This research cluster uses cutting-edge genetic, molecular, and neuroscience technologies to understand how gene-environment interactions produce individual variations in behaviour. Faculty in Developmental, Cell & Molecular Biology interact strongly with both GENAB and the biologically minded Chemists and Physicists at UTM and have collaborative research programs dealing with detection of pathogenic microbes in the environment.

Focusing on specific research areas allows us to develop as a cohesive, research-intense group, increases the depth and strength of interactions with cognate research groups and helps us attract stellar faculty. We are extremely excited about the future of research and teaching in ecology, evolution and behaviour at UTM and trust we can impart some our enthusiasm to you during your stay.

Have a wonderful conference and please ask about our plans for the future!

Robert Baker
Chair, Department of Biology



THE ORGANIZING COMMITTEE

When our respective supervisors discovered that we had agreed to organize the OEEC they understandably expressed some trepidation. However, they visibly relaxed once we had assembled this wonderful group of committee chairs. Their hard work and dedication to OEEC 2004 has been inspirational. We obviously could not have done it without them. This has been an amazing experience. Thank you.

Sincerely,



Kevin Judge & Mark Fitzpatrick
Co-chairs, OEEC 2004 Organizing Committee

Account Organizer

Carolyn Moon

Logo

Clint Kelly

Registration/Logistics

Chairs: Anne Cordon, Janet Koprivnikar

Members: Sapna Sharma

Website

James Burns, Nicola Chong

Program & Schedule

Chairs: Erin Dunlop, Stephanie Kamel

Food/Social

Chairs: Lisa Clark, Michael Rennie

Members: Vanessa Bonanno, Chad Jankowski

Fundraising

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Chair: Travis Clark

Members:

Housing/Parking

Fernando Montealegre Z.

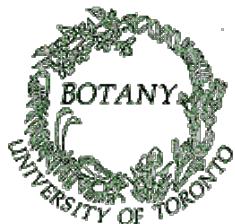
SPONSORS

We gratefully acknowledge the generous donations that we received from the following organizations and companies. The financial donations allowed us to reduce the registration costs, and to subsidize the travel costs of the plenary lecturers. We thank Old Credit Brewing Company for supplying beer for the poster session and UTM for donating the use of the lecture theatres and A/V equipment. Special thanks to Richard Alexander for generously donating the likeness of his cricket drawing as the basis for our logo.

Thank you for your support,

The OEEC 2004 Organizing Committee

Financial



GRADUATE STUDENTS' UNION
UNIVERSITY OF TORONTO
LOCAL 19, CANADIAN FEDERATION OF STUDENTS

Association of Graduate Students at Erindale, UTM

Psychology Department, UTM

Biology Union of Graduate Students, UTM

Botany Graduate Students Association

Zoology Union of Graduate Students

Prizes & Food



UNIVERSITY OF TORONTO PRESS INC.



SCHEDULE

Monday, May 10

17:00 - 24:00	Early Registration & Social Mixer	The Blind Duck Pub (Student Centre)
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Tuesday, May 11

07:00-08:30	Registration	South Building (SB) Foyer
08:30 - 09:00	Opening Remarks	SB 2072
09:00 - 10:00	Plenary 1: Michael Ruse, Florida State University	SB 2072
10:00 - 10:30	Coffee Break & Poster Setup	Spigel Hall
10:30 - 12:00	Sessions 1-3 (6 talks x 3 rooms) Evolutionary Ecology, Sexual Selection, Plant Ecology	SB 2068/80/82
12:00 - 13:00	Lunch	Spigel Hall
13:00 - 13:45	Plenary 2: Maydianne Andrade, University of Toronto at Scarborough	SB 2072
13:45 - 14:00	Break	
14:00 - 15:00	Sessions 4-6 (4 talks x 3 rooms) Communication 1, Conservation Biology 1, Evolution 1	SB 2068/80/82
15:00 - 15:30	Coffee Break	Spigel Hall
15:30 - 17:00	Sessions 7-9 (6 talks x 3 rooms) Host-Parasite Interactions, Community Ecology 1, Ecology 1	SB 2068/80/82
17:00 - 17:30	Break	
17:30 - 18:30	Poster Session & Cocktails	Spigel Hall
18:30 - 24:00	Banquet	Spigel Hall

Wednesday, May 12

08:45 - 09:00	Announcements	SB 2072
09:00 - 10:00	Plenary 3: John Alcock, Arizona State University	SB 2072
10:00 - 10:30	Coffee Break	Spigel Hall
10:30 - 12:00	Sessions 10-12 (6 talks x 3 rooms) Evolution 2, Behavioural Ecology, Community Ecology 2	SB 2068/80/82
12:00 - 13:00	Lunch	Spigel Hall
13:00 - 13:45	Plenary 4: Anurag Agrawal, University of Toronto	SB 2072
13:45 - 14:00	Break	
14:00 - 15:00	Sessions 13-15 (4 talks x 3 rooms) Communication 2, Conservation Biology 2, Evolutionary Genetics	SB 2068/80/82
15:00 - 15:30	Coffee Break	Spigel Hall
15:30 - 17:00	Sessions 16-18 (6 talks x 3 rooms) Predator-Prey Interactions, Mating Systems, Ecology 2	SB 2068/80/82
17:00 - 17:30	Closing Remarks & Book/Prize Draw	SB 2072
17:30 - 18:30	OEEC 2005 Organizational Meeting	TBA

ORAL PRESENTATIONS

Session 1	Evolutionary Ecology 10:30-12:00 May 11	SB 2068 (moderator: John Ratcliffe)
10:30	Individual Optimization of Litter Size in <i>Peromyscus leucopus</i> Monika Havelka* & John S. Millar , University of Toronto at Mississauga	
10:45	Inter- and Intra-Population Variation in Snapping Turtle Development Rate Sarah M. Holt* & Ronald J. Brooks , University of Guelph	
11:00	Physiological Aging in Free-Ranging Red-Backed Voles Quinn E. Fletcher* & Rudy Boonstra , University of Toronto at Scarborough	
11:15	Adaptive Significance of Diapause in the Turtle Family Kinosternidae Melissa A. Cameron* & Ronald J. Brooks , University of Guelph	
11:30	The Evolution of Specialization: Increased Genetic Differentiation and Reduced Genetic Variation in Specialist Bees Amro Zayed* & Laurence Packer , York University	
11:45	The Role of Assortative Mating in Sympatric Polyploid Populations of <i>Chamerion angustifolium</i> Holly A. Sabara* & Brian C. Husband , University of Guelph	

Session 2	Sexual Selection 10:30-12:00 May 11	SB 2080 (moderator: Paul Williams)
10:30	Evidence for Humour as a Sexually-Selected Trait Eric R. Bressler* & Sigal Balshine , McMaster University	
10:45	Sexual Selection on Age- and Condition-Dependent Traits in the Ambush Bug <i>Phymata Americana</i> David Punzalan*, Locke Rowe & F. Helen Rodd , University of Toronto	
11:00	Female Ornaments and Predation Risk in a "Role-Reversed" Swarming Dance Fly Darryl T. Gwynne*, Luc Bussière & Tracie Ivy , University of Toronto at Mississauga	
11:15	What Do Interpopulation Crosses Reveal about Sexual Conflict and its Role in Speciation? Tristan A. F. Long*, Bob Montgomerie & Adam K. Chippindale , Queen's University	
11:30	Pleiotropy and the Genomic Location of Sexually Selected Genes Mark J. Fitzpatrick , University of Toronto at Mississauga	
11:45	Bateman's Principle Refined - Fitness Implications of Sexual Conflict over Mating Rate Julia Davidson-Arnott* & Adam K. Chippindale , Queen's University	

Session 3	Plant Ecology 10:30-12:00 May 11	SB 2082 (moderator: Marc Johnson)
10:30	Does Escape from Natural Enemies Contribute to Plant Invasions? Tests Using Congeneric Pairs Peter M. Kotanen , University of Toronto at Mississauga	
10:45	Diversity of Fungi in a Hemlock Forest: Above-Ground Versus Below-Ground Views Terri M. McLenon* & Jean-Marc Moncalvo , University of Toronto	
11:00	Effects of Above- and Belowground Cues of Neighbours on Root/Shoot Allocation Susan A. Dudley* & Lisa A. Donovan , McMaster University	
11:15	Inflorescence Architecture in Grasses and the Consequences for Pollination Jannice Friedman , University of Toronto	
11:30	Macrophyte-Flow Interactions in Bladed, Whorled and Dissected Leaved Plants Julianne Trelenberg* & Josef Danile Ackerman , University of Northern British Columbia and University of Guelph	
11:45	Influence of Specificity in Induced Plant Responses on the Population Size of Herbivores Danush V. Viswanathan* & Jennifer S. Thaler , University of Toronto	

Session 4	Communication 1 2:00-3:00 May 11	SB 2068 (moderator: Joel Levine)
2:00	Does a Male Field Cricket Reveal His Age when He Sings? Kevin Judge , University of Toronto at Mississauga	
2:15	Does the Acoustic Parasitoid, <i>Ormia ochracea</i> , Show Selective Attention to Multiple Competing Sound Sources? Norman Lee* & Andrew C. Mason , University of Toronto	
2:30	Female Pheromonal Influence on Ejaculate Size in the Fish <i>Carassius auratus</i> Drew J. Hoysak* & Norm Stacey , Carleton University	
2:45	Pheromone Based Communication Between Bark and Ambrosia Beetles (Coleoptera: Scolytidae) Stuart A. Campbell*, R. Gries & J.H. Borden , Simon Fraser University	
Session 5	Conservation Biology 1 2:00-3:00 May 11	SB 2080 (moderator: Pamela Rutherford)
2:00	Sentinel Mice Detect Heritable DNA Mutations Induced by Air Pollution Christopher M. Somers & James S. Quinn , McMaster University	
2:15	Population Genetics of the Black Rhinoceros (<i>Diceros bicornis</i>) in Etosha National Park Michael H. Kim*, C.A. Scott, J.C. Morales, D. Melick, P. Erb, C. O'Ryan, P.T. Boag & P.J. van Coeverden de Groot , Queen's University	
2:30	Potential Effects of Zebra Mussel Invasion of Benthic Invertebrate Communities and Whitefish in Lake Huron Gordon G. McNickle* , W. Gary Sprules & Michael D. Rennie , University of Toronto at Mississauga	
2:45	Can Single Factor Remediation Recover Fish Species at Risk in a Complex System? Mark Poos* , N.E. Mandrak & R.L. McLaughlin , University of Guelph	
Session 6	Evolution 1 2:00-3:00 May 11	SB 2082 (moderator: Steve Walker)
2:00	Using Neural Network Classifiers to Estimate the Degree of Morphological Similarity Between Mimics and Models Arash Rashed*, R.S. Bain, V. Cowper, F. Gilbert, & T.N. Sherratt , Carleton University	
2:15	Success in the Face of Tragedy: Can a Population Recover from the Effects of a deleterious Mutation? Alison Pischedda* , & Adam K. Chippindale , Queen's University	
2:30	Are There Reputational Benefits for the Altruistic Punishment of Free-Riders in a "Tragedy of the Commons"? Pat Barclay , McMaster University	
2:45	Testing the "Bird Perch Hypothesis" in the Cape Endemic <i>Babiana ringens</i> Bruce Anderson, William W. Cole* & Spencer C.H. Barrett , University of Toronto	

Session 7	Host-Parasite Interactions 3:30-5:00 May 11	SB 2068 (moderator: Tony Volk)
3:30	Spatial Effects and Evolution in Host-Parasite Systems Paul D. Williams , University of Toronto	
3:45	Does a Parasite Help Balance the Cost of Sex in <i>Phoxinus</i> spp.? Jon Mee* & Locke Rowe , University of Toronto	
4:00	Specialization is Not a Cul-De-Sac for Phytophagous and Parasitic Taxa Marc J. Lajeunesse , University of Toronto	
4:15	The Effects of Parasitic Protozoa and Tracheal Mites on the Foraging Behaviour of Bumble Bees Michael C. Otterstatter*, Sheila Colla, Robert J. Gegear & James D. Thomson University of Toronto	
4:30	Infection by an Intestinal Parasite Impairs the Ability of Bumble Bees to Learn Flower Handling Skills Robert J. Gegear*, Michael C. Otterstatter & James D. Thomson University of Toronto	
4:45	Effect of Wind Speed on Mate Location in the Potato Aphid <i>M. euphorbiae</i> and its Primary Parasitoid, <i>A. nigripes</i> Seyed Goldansez, David Marchand & Jeremy N. McNeil* , University of Western Ontario	
Session 8	Community Ecology 1 3:30-5:00 May 11	SB 2080 (moderator: Michael Rennie)
3:30	Impacts of Roads on Reproductive Success and Breeding Habitat of Lapland Longspurs, <i>Calcarius lapponicus</i> Sean K. Male* & Erica Nol , Trent University	
3:45	Marine Nutrients and Terrestrial Flora: Testing the "Subsidized Island Biogeography Hypothesis" Jennifer D. Whittard* & Dennis E. Jelinski , Queen's University	
4:00	Genotypic Diversity in Plant Populations Affects Arthropod Community Composition Marc T. J. Johnson* , University of Toronto	
4:15	Fish Habitat Assessment in the Eastern Lake Erie Basin Sapna Sharma*, Donald A. Jackson & E. Todd Howell , University of Toronto	
4:30	A Neutral Theoretical Analysis of Diversity in Size-Structured Pelagic Communities Steve C. Walker , University of Toronto	
4:45	Correlates of Insect Community Structure in Decaying Pine Logs Mark C. Vanderwel*, Jay R. Malcolm & Sandy M. Smith , University of Toronto	
Session 9	Ecology 1 3:30-5:00 May 11	SB 2082 (moderator: Monika Havelka)
3:30	Divergence of Life History Traits in Two Introduced Populations of Smallmouth Bass Erin S. Dunlop*, Brian J. Shuter, F. Helen Rodd & Mark S. Ridgeway , University of Toronto	
3:45	Moon Phase and Nocturnal Density of Atlantic Salmon Parr in the Sainte-Marguerite River, Québec Istvan Imre* & Daniel Boisclair , Université de Montréal	
4:00	Do Introduced Populations Really Harbour Fewer Enemies? The Case of the European Starling Robert I. Colautti* , University of Toronto	
4:15	The Impact of Solute Leaching on the Salt Tolerance During Germination of a Roadside Plant <i>Dipsacus sylvestris</i> Laura L. Beaton* & Susan A. Dudley , McMaster University	
4:30	Individual Variation in Nest-Site Choice and its Consequences for the Hawksbill Sea Turtle Stephanie J. Kamel* & Nicholas Mrosovsky , University of Toronto	
4:45	Variation in the Behaviour of Pumpkinseed Sunfish (<i>Lepomis gibbosus</i>) Ecomorphs Under the Risk of Predation Jens C. Koblitz* & Beren W. Robinson , University of Guelph	

Session 10	Evolution 2 10:30-12:00 May 12	SB 2068 (moderator: Michael Kasumovic)
10:30	The Evolution of Ecological Niche Width Rowan D.H. Barrett* & Graham Bell , McGill University	
10:45	Evolution of Self-Fertilization in <i>Camissonia</i> : Relationship Between Floral Morphology and Mating System Colleen Inglis*, Sara Dart*, Emily Austen & Christopher G. Eckert , Queen's University	
11:00	The Evolution of Brook Trout Population Genetic Structure Following Drainage Rearrangement Jocelyn Poissant*, Thomas W. Knight & Moira M. Ferguson , University of Guelph	
11:15	Selection for Resistance to an Antimicrobial Peptide Gabriel G. Perron* & Graham Bell , McGill University	
11:30	Species Delineation in the <i>Phrynocephalus versicolor</i> Complex Agnes Gozdzik* & Jinzhong Fu , University of Guelph	
11:45	Evolution of Species Geographic Range Limits: an Empirical Test of Model Assumptions Karen E. Samis* & Christopher G. Eckert , Queen's University	
Session 11	Behavioural Ecology 10:30-12:00 May 12	SB 2080 (moderator: Darryl Gwynne)
10:30	Relatedness and Dispersal Patterns in the Communitarily Breeding Smooth-Billed Ani Gregory Schmaltz* & James S. Quinn , McMaster University	
10:45	Social Behaviour of <i>Xylocopa virginica</i> in Southern Ontario Sean Prager* & Miriam H. Richards , Brock University	
11:00	Risk-taking, Testosterone and Player Behaviour in the Ultimatum Game Daniel Brian Krupp* & Deborah M. Saucier , McMaster University	
11:15	cGMP-Dependent Protein Kinase (PKG) Regulates Food Intake in <i>Drosophila melanogaster</i> Karla R. Kaun* & Marla B. Sokolowski , University of Toronto at Mississauga	
11:30	Non-Fisherian Sex Ratios and Sexual Selection: a Case Study on Painted Turtles (<i>Chrysemys picta</i>) Elinor J. Hughes* & Ronald J. Brooks , University of Guelph	
11:45	Adjustment of Offspring Sex Ratios in Cooperatively Breeding White Winged Fairy Wrens Bob Montgomerie* & Melanie Rathburn , Queen's University	
Session 12	Community Ecology 2 10:30-12:00 May 12	SB 2082 (moderator: Sapna Sharma)
10:30	The Effects of Herbivore-Induced Plant Responses and Plant Genotype on Herbivore Performance Rosanna McGuire* & Marc T.J. Johnson , University of Toronto	
10:45	Novel Indices of Marine Zooplankton Community Structure Based on Electronic Sensor Data Karla L. Krupica* & W. Gary Sprules , University of Toronto at Mississauga	
11:00	Environmental Fluctuations from Internal Waves and Benthic Algal Community Structure Shelley K. McCabe , University of Toronto	
11:15	Counterintuitive Fitness Effects of Nectar Robbing in <i>Linaria vulgaris</i> Daniel A. Newman* & James D. Thomson , University of Toronto	
11:30	A Comparative Analysis Between Abandoned Limestone Quarry Floors in Ontario and <i>Alvars</i> on the Bruce Peninsula Shannon D. Tomlinson* & Doug W. Larson , University of Guelph	
11:45	Top-down Effects on the Food Web of a Fish-Less Temporary Freshwater Pond: A Field Manipulation A. Katarina Magnusson* and Dudley D. Williams , University of Toronto at Scarborough	

Session 13	Communication 2 2:00-3:00 May 12	SB 2068 (moderator: Drew Hoysak)
2:00	Seismic Signalling in Jumping Spider Courtship Displays Damian O. Elias & Andrew C. Mason* , University of Toronto	
2:15	High Ultrasonic Singing by a Neotropical Katydid (Orthoptera: Tettigoniidae: Listroscelidinae) Fernando Montealegre-Z.* & Glenn K. Morris , University of Toronto at Mississauga	
2:30	Influence of Infant and Child Facial Cues of Low Body Weight on Adoption Preference Anthony A. Volk*, Janeen M. Kukjanczuk & Vernon L. Quinsey , Queen's University	
2:45	Comparative Study of Sound Generation in the Genus <i>Cyphoderris</i> Nada Elfeki*, Fernando Montealegre-Z. & Glenn K. Morris , University of Toronto at Mississauga	
Session 14	Conservation Biology 2 2:00-3:00 May 12	SB 2080 (moderator: Stephanie Kamel)
2:00	Canada's National Parks in Peril? Julia A. Esrom , York University	
2:15	Vulnerability of Frog Species to Hydroperiod: Inferences from Mesocosm Experiments Pamela L. Rutherford*, Mark R. Forbes & Oluwayemisi K. Dare , Carleton University	
2:30	Single Nucleotide Primer (SNP) Development in the Black Rhinoceros Subspecies <i>Diceros bicornis bicornis</i> Candace A. Scott*, Peter T. Boag & Peter J. van Coeverden de Groot , Queen's University	
2:45	Parentage Assignment Bias Due to Microsatellite Genotyping Error Jessica A. Enright*, Peter J. van Coeverden de Groot, & Peter T. Boag , Queen's University	
Session 15	Evolutionary Genetics 2:00-3:00 May 12	SB 2082 (moderator: Bob Montgomerie)
2:00	Variation of MHC class II B genes in the red-billed gull (<i>Larus novaehollandiae scopulinus</i>) Nicola L. Chong*, Alessandro Grapputo, James A. Mills & Allen J. Baker , Royal Ontario Museum and University of Toronto	
2:15	Dikaryons of the Basidiomycete Fungus <i>Schizophyllum Commune</i> : Evolution in Long-Term Culture Travis A. Clark* & James B. Anderson , University of Toronto at Mississauga	
2:30	The Importance of the Y Chromosome to Male Fitness in <i>Drosophila melanogaster</i> Sarah P. Fulton* & Adam K. Chippindale , Queen's University	
2:45		

Session 16	Predator-Prey Interactions 3:30-5:00 May 12	SB 2068 (moderator: Erin Dunlop)
3:30	The Evolution of Aggregation in Profitable and Unprofitable Prey Christopher D. Beatty, Roderick S. Bain & Thomas N. Sherratt , Carleton University	
3:45	Fear, Food, Sex and Turf in Redback Spiders: the Role of Behavioural Syndromes J. Chadwick Johnson*, Ramez Hanna, Melissa Hestick & Maydianne C.B. Andrade , University of Toronto at Scarborough	
4:00	Monocular Vision and the Effects of Prey Movement and Size During Prey Choice by Veiled Chameleons Benjamin W. Lindsey , University of Guelph	
4:15	Claw Morphology, Prey Size Preference and Feeding Efficiency in <i>Pachygrapsus crassipes</i> and <i>Hemigrapsus nudus</i> Marie-Pierre Schippers* & Elizabeth G. Boulding , University of Guelph	
4:30	Cues Used for Toxic Prey Discrimination in the Gleaning Bat, <i>Myotis septentrionalis</i> John M. Ratcliffe* & James H. Fullard , University of Toronto at Mississauga	
4:45		

Session 17	Mating Systems 3:30-5:00 May 12	SB 2080 (moderator: David Punzalan)
3:30	Spatial Distribution of Females Determines Opportunity for Sexual Selection in the Wellington Tree Weta, <i>Hemideina crassidens</i> Clint D. Kelly , University of Toronto at Mississauga	
3:45	Perceived Male Quality and Variation in Nuptial Gift Size in Black-Horned Tree Crickets, <i>Oecanthus nigricornis</i> Vanessa Bonanno , University of Toronto at Mississauga	
4:00	Fumbling for Females: Male Life History Shifts in Response to Female Cues Michael M. Kasumovic* & Maydianne C.B. Andrade , University of Toronto at Scarborough	
4:15	Does it Pay to be Choosy? The Effects of Mate Discrimination by Male Convict Cichlids (<i>Cichlasoma nigrofasciatum</i>) Chad M. Jankowski , University of Toronto at Mississauga	
4:30	Haemolymph Loss as a Mating Cost for Male Sagebrush Crickets Scott K. Sakaluk, Mark T.H. Campbell, Andrew P. Clark*, J. Chadwick Johnson & Peter Keorpes , McMaster University	
4:45	Social Modulation of Androgen Levels in a Cooperatively Breeding Cichlid Fish from Lake Tanganyika Julie Desjardins*, Glen van der Kraak & Sigal Balshine , McMaster University	

Session 18	Ecology 2 3:30-5:00 May 12	SB 2082 (moderator: Jon Mee)
3:30	Song and Male Quality in Savannah Sparrows (<i>Passerculus sandwichensis</i>) Ha-Cheol Sung* & Paul Handford , University of Western Ontario	
3:45	Spatial Memory and Movement Rules of Bumblebees at Intermediate Spatial Scales James G. Burns* & James D. Thomson , University of Toronto	
4:00	Spatial Use Strategies of Bumble Bees Foraging on Renewable Resource Patches Kazuharu Ohashi* & James D. Thomson , University of Toronto	
4:15	Histological Response of Fish Gills to Abnormal Ion Balance in the Kenti River System (Kostomuksha Area, Russia) Victoria Tkatcheva*, I.J. Holopainen & H. Hyvärinen , University of Joensuu	
4:30	Density-Dependent Growth of Young-of-the-Year Atlantic Salmon in Catamaran Brook, New Brunswick Istvan Imre*, James W.A. Grant & Richard A. Cunjak , Université de Montréal	
4:45	Effects of Population Size Reduction on Genetic Variability of Reintroduced Southern Flying Squirrels Ewa Bednarczuk*, Teresa J. Crease, Thomas D. Nudds & Tom Linke , University of Guelph	

PLENARY LECTURERS

(listed alphabetically)



Anurag Agrawal

Department of Botany
University of Toronto

"Phyloecology: A New Generation of Ecology that Employs Phylogenetics"

Wednesday, May 12, 13.00-13.45, SB 2072

Abstract: Recent rumblings in the literature and at international meetings characterize the emergence of phyloecology: a new sub-discipline that allows scientists to address classic and novel questions in ecology by applying phylogenetic approaches. Phyloecology allows for 1) a critical control for comparative ecology, and 2) a tool to compare the importance of evolutionary history vs. ecology. In this talk I will present new data that bears on each of these two advances. In the first, I will present a test of the Enemy Release Hypothesis, which posits that invading species benefit when they lose their predators and pathogens during the invasion process. Phylogenetically controlled comparisons of multiple native and introduced plant species in a common habitat demonstrate how escape from diverse enemies (viruses, fungi, insects, soil microbes) can facilitate plant invasions. In the second part of the talk, I will present evolutionary patterns of defensive traits in 24 species of milkweed plants (*Asclepias* spp.). Here I will explicitly test for the presence of "defense syndromes," which indicate convergent evolution, and which I will hypothesize are driven by common communities of herbivorous guilds. The discovery of convergent plant defense syndromes can be used as a starting point to ask questions about how abiotic environments, communities of herbivores, and biogeography generate particular defense strategies of plants. These two research programs, although seemingly divergent, represent a trend towards using phylogeny to address important ecological questions.



John Alcock

School of Life Sciences
Arizona State University

"In Defense of the Adaptationist Programme"

Wednesday, May 12, 09.00-10.00, SB 2072

Abstract: Twenty-five years after publication of Stephen Jay Gould and Richard Lewontin's famous spandrels paper, the article continues to be used by critics of adaptationism. I shall review the nature of Gould's critique, which carries a fundamentally negative, anti-research message. Gould sought to restrict adaptationist research first by defining "adaptation" in a highly limiting way. Having tried to reduce the biological phenomena suitable for adaptationists to explore, he then attacked their work as unscientific. One way to defend adaptationists against these attacks is to examine Darwin's writings and research. Although Gould claimed that Darwin's views paralleled his own, Darwin was in reality a rabid adaptationist, which can be seen in his treatment of orchid pollination devices. Another way to defend adaptationists is to examine their work on topics that Gould declared off-limits. Both lines of defense indicate that adaptationism has offered a wonderfully productive research approach ever since Darwin.



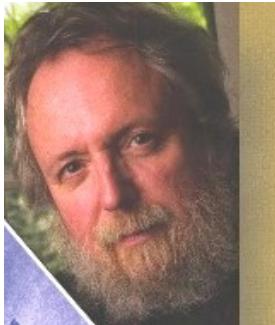
Maydianne Andrade

Department of Zoology
University of Toronto at Scarborough

"What Can We Learn From Extreme Systems? Sexual Selection and Male Mating Strategies in Cannibalistic Spiders"

Tuesday, May 11, 13.00-13.45, SB 2072

Abstract: Males of some cannibalistic spiders engage in terminal investment: explosive mating effort that leads to death during or after a single copulation. These extreme systems provide unique opportunities to test theory for the evolution of mating strategies for several reasons: each mating is extremely valuable for males; many of these systems show extreme reversed sexual size dimorphism (females larger than males) which reduces male investment to gametes and increases female control over copulation; and male strategies are expected to be based solely on costs and benefits of a single interaction (with no trade-offs for future reproduction), which simplifies the collection of field data for critical tests of hypotheses. I outline the utility of these systems using the self-sacrificial Australian redback spider as an example in two contexts: (1) male mate choice and (2) female-imposed constraints on male competitive strategies.



Michael Ruse

Department of Philosophy
Florida State University

"Evo-Devo - Is This the New Paradigm Replacing an Exhausted Darwinism?"

Tuesday May 11, 09.00-10.00, SB 2072

Abstract: Enthusiasts for evo-devo now claim that darwinism is a theory that has had its day. Can this really be so? I look at the claims and fit them into a historical pattern going back to Aristotle and forward to Stephen Jay Gould.

ORAL PRESENTATION ABSTRACTS

(listed alphabetically by first author)

Are There Reputational Benefits for the Altruistic Punishment of Free-Riders in a "Tragedy of the Commons?"

Pat Barclay
McMaster University

In order for altruism to evolve, individuals must be able to be selective about who they are altruistic towards. In situations where this is not possible, altruism usually declines and selfishness increases (a "tragedy of the commons") unless there are opportunities to punish people who free-ride on group cooperation. Past studies show that people will pay to punish free-riders, and this reduces selfishness. However, non-punishers benefit from the sanctions imposed on free-riders, making the sanctioning of free-riders an altruistic act. In order for such altruistic punishment to evolve, punishers must have had some selective advantage to counteract the cost of sanctions. I will present the results of a series of experiments testing whether or not punishers gain social benefits for their punitive behaviour. Undergraduate participants played cooperative group games in which there were free-riders, and they were given the opportunity to punish free-riders. Participants did rate punishers as being more trustworthy, group-focused and worthy of respect than non-punishers. I also tested whether punishers receive monetary benefits in subsequent cooperative games, and these findings will be discussed in relation to the current debate over whether one should invoke group-selection models to explain the existence of altruism and altruistic punishment. **(EVOLUTION 1)**

The Evolution of Ecological Niche Width

Rowan D.H. Barrett* and Graham Bell
McGill University

All environments vary in complexity. In the absence of genetic constraints, the breadth of adaptation should evolve to match the amount of environmental variation, leading to the evolution of specialists in simple environments and generalists in complex environments. We studied the importance of environmental complexity in determining the evolution of niche width in an experimental system. We propagated replicate lines of *Pseudomonas fluorescens* in environments of varying complexity for 800 generations. We controlled environmental complexity through the number of carbon resources present. We then assayed growth of evolved lines and the ancestor in all environments. Evolved lines grew better than the ancestor in all environments and best in the environments that they were selected in, showing both direct and correlated selection. We found evolution of generalists in complex environments. Lines that evolved in environments with multiple carbon resources did not show trade-offs in performance between different carbon resources. There were no significant costs of adaptation detected. It was thereby possible to select a generalist type on mixed resources that was as well adapted to each individual resource as the lines selected on only that resource. **(EVOLUTION 2)**

The Impact of Solute Leaching on the Salt Tolerance During Germination of a Common Roadside Plant *Dipsacus sylvestris*

Laura L. Beaton* and Susan A. Dudley
McMaster University

Seed composition, which is determined by the maternal plant, can have a significant impact on the fitness of germinating seeds. In a previous study, we found that *Dipsacus sylvestris* seeds collected from roadside plants have higher salt tolerance during germination than seeds collected from old field plants, with higher salt tolerance associated with high seed Na⁺. In this study, we tested the hypothesis that the salt tolerance was a maternal environmental effect transmitted by the sequestering of Na⁺ in the seeds. We assessed the impact of leaching seeds, which removes solutes, on salt tolerance of maternal families. Leaching had no impact on the salt tolerance of old field families. Interestingly, the leaching results indicated that roadside populations may possess two salt tolerance strategies. Families from two of the roadside populations lost their salt tolerance following leaching, suggesting that the seed composition allowed them to tolerate high salinity; however, these families did not have higher Na⁺ levels than old field families. The salt tolerance of several families from the third roadside population, which grew in the highest salt, was unaffected by the leaching treatment, suggesting that a halophytic physiology was responsible for their salt tolerance. **(ECOLOGY 1)**

The Evolution of Aggregation in Profitable and Unprofitable Prey

Christopher D. Beatty*, Roderick S. Bain and Thomas N. Sherratt
Carleton University

The relationship between aggregation and the evolution of aposematism has been the subject of much debate. While previous researchers found that predators learn to avoid aposematic prey faster when they are aggregated, no experiment has investigated the influence of *profitable* prey configuration on unprofitable prey predation. Here we investigate the response of human "predators" to profitable and unprofitable prey in a computer version of the "novel world" experiments that address these issues. When all prey types were cryptic and all profitable prey were solitary, then aggregated unprofitable prey had higher per capita survivorship than solitary unprofitable prey. By contrast, when profitable and unprofitable prey could be distinguished in terms of their conspicuousness, then aggregation did not confer a benefit to unprofitable prey. When profitable prey were simultaneously presented in solitary and aggregated configurations, aggregated profitable prey consistently had a lower per capita survivorship than solitary profitable prey, regardless of the configuration of unprofitable prey. We conclude that while aggregation can serve as a signal of unprofitability, it may not be required for the evolution of warning signals. We suggest that the common association between aggregation and distastefulness may primarily arise for a "negative" reason: the vulnerability of aggregated palatable prey. (**PREDATOR-PREY INTERACTIONS**)

Effects of Population Size Reduction on Genetic Variability of Reintroduced Southern Flying Squirrels

Ewa Bednarczuk*, Teresa J. Crease, Thomas D. Nudds, and Tom Linke
University of Guelph

Demographic bottlenecks, or reductions in population size, are predicted to result in loss of genetic variability. However, the genetic consequences of demographic bottlenecks, such as those that may occur during translocations, are poorly studied in nature. In 2000/1, we analyzed four microsatellite and one mitochondrial DNA marker to test whether a genetic bottleneck occurred in a population of southern flying squirrels, *Glaucomys volans*, reintroduced to Point Pelee National Park (PPNP), Ontario, in 1993/4. The established population was compared to its source population in Haldimand-Norfolk (HN) region, about 250 km away. The mark-recapture estimate of population size in PPNP was 591 individuals; a six-fold increase from 99 founders over seven years. No signatures of a genetic bottleneck were identified. These findings are inconsistent with the widely accepted hypothesis that population bottlenecks result in the loss of genetic variability and population viability. Longer-term genetic and demographic monitoring of more translocated populations is required to clarify the role of genetic variability with respect to population viability. (**ECOLOGY 2**)

Perceived Male Quality and Variation in Nuptial Gift Size in Black-Horned Tree Crickets, *Oecanthus nigricornis*

Vanessa Bonanno
University of Toronto

In species where males engaged in parental investment it is expected that females will prefer males that provide the best or greatest investment. It has been reported however that in certain species preferred males actually invest less in offspring than poorer quality conspecifics. It has been shown that when male Black-horned crickets (*Oecanthus nigricornis*) encounter a female-biased operational sex ratio based on encounter rates that they adaptively reduce the size of their nuptial gift in anticipation of multiple future matings. In this study the effects of a male's environment were examined to determine if males can determine their gift size in response to probability of future matings. Males were exposed to one of two treatments; high-frequency calling song, characteristic of smaller males, and low-frequency calling song, characteristic of larger males, and were allowed to mate. Males exposed to the high-frequency treatment were predicted to decrease their gift size in anticipation of increased mating due to their perceived superiority over rival males and males exposed to the low-frequency treatment were predicted to decrease their gift size. It was concluded that males do not differentially manipulate gift size based on changes in their acoustical environment (feeding duration $t=0.370$, $p=0.36$; weight loss $t=-0.0127$, $p=0.45$). (**MATING SYSTEMS**)

Evidence for Humour as a Sexually-Selected Trait

Eric R. Bressler* and **Sigal Balshine**
McMaster University

It has been argued that humour is a sexually selected trait that indicates individuals' quality. As errors in mate choice are more costly for women than men (due to women's greater obligatory parental investment), we predict that women will be more discerning in mate choice than men. Therefore, women's mate choice should be more influenced by the use of humour than men's mate choice. We investigated this hypothesis by experimentally manipulating how funny target individuals appeared to be, and then measuring male and female participants' perceptions of their desirability. We found that women rated humorous men as more desirable, but that men's mate choice was not influenced by women's use of humour. Further, we provide evidence against several alternate interpretations of these results. (**SEXUAL SELECTION**)

Spatial Memory and Movement Rules of Bumblebees at Intermediate Spatial Scales

James G. Burns* and **James D. Thomson**
University of Toronto

Foraging bees use movement rules such as area-restricted search, which involves short flights and increased turning rate when in good patches and the opposite when in poor patches, at small spatial scales (e.g. a flower inflorescence). However, it is not clear whether area-restricted search is an accurate description of movement patterns at larger spatial scales. For instance, at intermediate scales bumblebees sometimes use a systematic foraging strategy called traplining, the tendency to visit a set of plants in a repeated sequence. I have attempted to determine if and when bumblebees switch from area-restricted search to the use of spatial memory to increase their utilization of rewarding patches. Bumblebees in the laboratory foraged on a 4 x 4 array of artificial flowers with treatments at distances ranging from 10 cm to 80 cm between flowers. The array was divided into two halves, one side containing rewarding flowers and the other side non-rewarding flowers. The proportion of visits to the good patch was monitored for 400 flower visits, after which the rewarding and non-rewarding patches switched locations for 100 flower visits. The results of these 'mirror-image' tests discriminate between the use of area-restricted search and spatial memory use at each treatment distance. (**ECOLOGY 2**)

Adaptive Significance of Diapause in the Turtle Family Kinosternidae

Melissa A. Cameron* and **Ronald J. Brooks**
University of Guelph

The turtle family Kinosternidae is distributed from central Ontario to northern Brazil. Within the Kinosternidae, timing of egg-laying and hatching, and length of embryonic development, are highly variable, thought to be due in large part to different developmental strategies. One strategy, embryonic diapause, where embryos undergo a prolonged state of developmental arrest despite favourable external conditions for development, is suggested to be an adaptation to extreme seasonal environments. For example, the Sonoran Mud Turtle (*Kinosternon sonoriense*) embryo is able to avoid hatching during the 10-month period of drought and/or cold in the Sonoran Desert (September-June) by preceding active development (3 month duration) with 7 months of diapause. We are testing the assumption that diapause is an adaptation to extreme seasonal environments by using the comparative method of phylogenetic independent contrasts. Specifically, we are asking: 1) What is the interspecific variation in incidence and length of diapause in Kinosternidae; 2) How is the incidence and variation in length of diapause related to local climate (specifically monthly temperature and rainfall); and 3) Does maternal investment in the form of yolk lipid vary with incidence and length of diapause. (**EVOLUTIONARY ECOLOGY**)

Pheromone Based Communication Between Bark and Ambrosia Beetles (Coleoptera: Scolytidae)

Stuart A. Campbell*, R. Gries and J.H. Borden

Simon Fraser University

Bark and ambrosia beetles have different patterns of host colonization, with bark beetles developing within the phloem, and ambrosia beetles consuming fungal associates within the sapwood. However, both groups employ pheromones for colonization and mating, and often colonize the same host species. Based on these patterns, we hypothesised that the ambrosia beetle *Trypodendron lineatum* might utilize sympatric bark beetle pheromones during host selection. We assayed an array of bark beetle pheromones for electrophysiological (antennal) activity, and field-tested the active compounds for behavioural responses. *Trypodendron lineatum* was attracted to ipsenol and ipsdienol, and repelled by MCH and seudenol. This supports the hypothesis that this species may use bark beetle pheromones to select hosts; the attractive pheromones are released primarily by a generalist bark beetle genus with the greatest spatiotemporal host overlap with *T. lineatum*, while the repellent pheromones are associated with specialist bark beetles, and could indicate a host that has been rendered unsuitable by the actions of these bark beetles and their pathogenic fungi. Lineatin, the pheromone of *Trypodendron* ambrosia beetles, was detected by the mountain pine bark beetle, which may avoid this pheromone for similar reasons, and we are investigating the responses of other bark beetles to lineatin. (**COMMUNICATION 1**)

Variation of MHC class II B genes in the red-billed gull (*Larus novaehollandiae scopulinus*)

Nicola L. Chong*, Alessandro Grapputo, James A. Mills and A.J. Baker

Royal Ontario Museum and University of Toronto

The major histocompatibility complex (MHC) encodes proteins involved in the adaptive immune response of vertebrates. The MHC has recently become of interest to ecologists and evolutionary biologists due to the extreme polymorphism, long persistence of alleles and possible role in mate choice and kin selection. The avian MHC has been best studied in the chicken (*Gallus gallus*). The chicken MHC has been termed "minimal-essential" as it is extremely compact compared to its mammalian counterpart. Recent work on other taxa suggests that this compact organization is not typical of all species, but analysis of MHC variation has been restricted to taxa representing only a few families. To investigate the polymorphism and gene organization in a natural population, MHC class II B genes of the red-billed gull (*Larus novaehollandiae scopulinus*) were characterized using SSCP, cloning and sequencing techniques. Eleven alleles were found in 9 sequenced individuals. The pattern of segregation and pattern of amino acid substitution suggests that two functional loci have been isolated. The gull MHC alleles form a monophyletic group in the neighbour-joining analysis, similar to other avian taxa but unlike the pattern of trans-species polymorphism seen in mammals. Gene organization is similar to that seen in other taxa but the complexity of the region appears to be intermediate between that of the chicken and passerine birds. (**EVOLUTIONARY GENETICS**)

Dikaryons of the Basidiomycete Fungus *Schizophyllum Commune*: Evolution in Long-Term Culture

Travis A. Clark* and James B. Anderson

University of Toronto

The impact of ploidy on adaptation is a central issue in evolutionary biology. While many eukaryotic organisms exist as diploids, with two sets of gametic genomes in the same nucleus, most basidiomycete fungi exist as dikaryons in which the two genomes exist in separate nuclei that are physically paired and that synchronously divide. To determine if haploid monokaryons and dikaryons adapt to novel environments under natural selection, we serially transferred replicate lines of each ploidy state on minimal medium for 18 months (~13,000 generations). Dikaryons responded to selection with increases in growth rate, while monokaryons did not. To determine if the haploid components of the dikaryon adapt reciprocally to one another's presence over time, we recovered the intact haploid components of dikaryons at different time points (without meiosis) and mated them with nuclei of different evolutionary histories. We found evidence for co-adaptation between nuclei in one dikaryotic line, in which a dominant deleterious mutation in one nucleus was followed by a compensatory mutation in the other nucleus; the nuclei that evolved together had the best overall fitness. In other lines, nuclei had equal or higher fitness when paired with nuclei of other histories, indicating a heterozygote advantage. To determine if genetic exchange occurs between the nuclei of a dikaryon, we developed a 24-locus genotyping system based on SNPs to monitor somatic

exchange. We observed genetic exchange and recombination between the nuclei of several different dikaryons. We are now comparing the evolutionary potentials of isogenic dikaryotic and diploid strains. (**EVOLUTIONARY GENETICS**)

Do Introduced Populations Really Harbour Fewer Enemies? The Case of the European Starling

Robert I. Colautti
University of Toronto

The 'enemy release hypothesis' (ERH) is the latest predilection to explain patterns of increased abundance or dominance of nonindigenous species (NIS). In particular, several recent, high-profile studies have suggested that bottlenecks during the invasion process limit the number of enemies that are co-introduced with their host, possibly resulting in increased vigour or fitness for the host in its introduced range. Using data on helminth parasite species of the European starling, I show how range size, research bias, and subsampling of hosts from the native range (i.e., founder effects), have likely biased previous estimates of 'enemy release' in the starling. After correcting for these factors, the number of enemies in the starling's native range (Eurasia) does not appear to differ from its introduced range (North America). Particular helminth species are indeed absent from the introduced range, but this is compensated by a number of helminths in the native range to which the starling is probably naïve. These results suggest that comparisons of species richness at large biogeographical scales are likely to be biased estimates of 'enemy release'. (**ECOLOGY 1**)

Testing the "Bird Perch Hypothesis" in the Cape Endemic *Babiana ringens*

Bruce Anderson, William W. Cole* and Spencer C.H. Barrett
University of Toronto

Bird-pollinated plants usually position their flowers above ground level to facilitate foraging access. However, the South African Cape endemic *Babiana ringens* (Iridaceae) displays its showy red flowers with exerted sexual organs at ground level. The inflorescence axis of *B. ringens* forms a cylindrical upright structure that has been suggested to function as a bird perch. We observed Malachite Sunbirds visiting flowers of *B. ringens* and conducted a field manipulative experiment to test the perch hypothesis. At two populations near Mamre, Western Cape we measured the seed set and outcrossing rate of control plants and those in which the inflorescence axis was removed. We predicted that if the inflorescence axis functions as a bird perch, its removal would change foraging patterns, reducing female fertility and/or increasing the selfing rate of manipulated plants. Our experimental results indicated reduced fertility (~25%) and increased selfing in the plants that had the perch removed (multilocus estimate of the selfing frequency in Pop A, control $sm \sim 0.75$; perch removed $sm \sim 0.90$). These data support the bird perch hypothesis, however the significant selfing in the control plants is somewhat of a paradox given the large floral display. (**EVOLUTION 1**)

Bateman's Principle Refined - Fitness Implications of Sexual Conflict over Mating Rate

Julia Davidson-Arnott* and Adam K. Chippindale
Queen's University

Sexual conflict models suggest that opposite selection on mating rate has a detrimental effect on female fitness in a polygamous system. Here we investigate the additive genetic variance in both total fitness and mating rates of female *Drosophila melanogaster* under comparable conditions to those in which they have evolved. Fitness was found to vary significantly with genotype, nutrient conditions and the interaction between the two. Mating rate also varies across genotypes and we continue to investigate its complex relationship to fitness. (**SEXUAL SELECTION**)

Social Modulation of Androgen Levels in a Cooperatively Breeding Cichlid Fish from Lake Tanganyika

Julie Desjardins*, Glen van der Kraak and Sigal Balshine

McMaster University

The degree and intensity of aggressive behaviour varies widely among species and individuals. The causes of this variation are still poorly understood. We used *Neolamprologus pulcher*, a cooperatively breeding cichlid fish from Lake Tanganyika to examine the relationship between sex, position in the dominance hierarchy, aggression and androgen levels. *N. pulcher* lives in groups consisting of a breeding pair and 1-14 additional individuals known as helpers all within a dominance hierarchy. All group members provide care for young, as well as defend and maintain the territory. In this study, we experimentally manipulated the need for territory defense by challenging groups of *N. pulcher* with a simulated territory intrusion by a conspecific. Behavioural observations and a number of physiological measures were compared to androgen levels assayed from blood plasma. Male helpers had the highest level of 11-ketotestosterone. Testosterone was highest in the female breeders and lowest in male helpers. Most aggressive fish had the highest levels of testosterone. These findings suggest that in *N. pulcher*, female breeders appear to play an important role in territory defense. And finally, in contrast to other fish studies, testosterone (but not 11KT) plays an important role in territory defense.

Effects of Above- and Belowground Cues of Neighbours on Root/Shoot Allocation

Susan A. Dudley* and Lisa A. Donovan

McMaster University

Plants compete for resources both above and belowground. Plants perceive their neighbours aboveground through changes in the colour of the light, and respond by producing a more competitive morphology, elongating to grow taller than their neighbours. Such elongation often comes with an apparent cost of reduced allocation belowground. Recent studies have shown that plants perceive and respond to the presence of root neighbours, often by allocating more to roots at the cost of fitness. In nature, though, both cues should be important. We imposed both the light and the root neighbour cues independently in *Chenopodium album*, at two different nutrient levels. We found that each cue elicited an independent suite of responses. The response to low R:FR was the expected stem elongation. However, plants exposed to root neighbours increased allocation to leaf area and shoot at the expense of roots. This response, which should increase aboveground competitive ability, was more pronounced at high nutrients than scarce nutrients. We need to look both above- and belowground to understand how plants compete in nature. (**PLANT ECOLOGY**)

Divergence of Life History Traits in Two Introduced Populations of Smallmouth Bass

Erin S. Dunlop*, Brian J. Shuter, F. Helen Rodd and Mark S. Ridgeway

University of Toronto

Variation in growth and maturation were studied in two populations of smallmouth bass that were introduced in the 1920's, likely from the same source population. Since their introduction the two populations, from Opeongo Lake and Provoking Lake, have diverged in several key life history traits. To determine if the present differences are plastic or genetic we estimated probabilistic reaction norms. The relative position of the 5 year old maturation reaction norm was similar for both populations, indicating that differences are likely a plastic response to population density and food availability. The second portion of the study involved an analysis of the patterns in growth and maturation that occurred on Opeongo Lake from the 1930's through to the 1980's using data from a creel survey. Results indicate that although the mean size of newly matured 5 year old males has decreased dramatically and stabilized, the position of the maturation reaction norm has shown no clear trend. This suggests that a significant component of the differences in growth and size at maturation that have occurred since introduction is likely a plastic response to changing population abundances. (**ECOLOGY 1**)

Seismic Signalling in Jumping Spider Courtship Displays

Damian O. Elias and Andrew C. Mason*

University of Toronto at Scarborough

Jumping spiders are well-known for elaborate visual courtship displays and male ornamentation. Spiders of the genus *Habronattus* show this typical pattern and also represent a highly diverse group (over 100 species) with a striking diversity of male ornaments and visual displays. We demonstrate that the complex courtship displays of male *Habronattus* are not restricted to the visual modality, but include an equivalent elaboration of seismic components. Seismic signal components are produced by multiple independent mechanisms and are precisely synchronized with visual signals to produce a variety of species-specific "song-and-dance" courtship displays. We show that for one species, *H. dossenus*, seismic components are vital to male mating success, but that their transmission is highly substrate-dependent. This may provide an explanation for the high diversity within the group through the heterogeneity of substrates available for seismic communication. **(COMMUNICATION 2)**

Comparative Study of Sound Generation in the Genus *Cyphoderris* (Orthoptera: Ensifera: Haglidae): Correlation of Morphological Features of the Stridulatory File with the Type of Sound Generated

Nada Elfeki*, Fernando Montealegre-Z. and Glenn K. Morris

University of Toronto at Mississauga

Males in the suborder Ensifera (Orthoptera) stridulate with their forewings, using membranous wing-cell regions excited by a scraper and file. *Cyphoderris* is a genus of relict orthopterans (Haglidae). As with crickets, the calling song generated by haglid males is a high-Q, musical sound; but the songs of *Cyphoderris* occur at much higher frequencies (12-15 kHz) than crickets. Like crickets, haglids have bilaterally symmetrical forewings; but *Cyphoderris* can stridulate using either wing overlap, left over right or right over left. Two species of *Cyphoderris* were studied, *C. monstrosa* and *C. buckelli*; the former produces sounds at a lower frequency than the latter. The cause of this frequency difference was investigated using morphometric measurements and digital sound analysis. We determined the variation in frequency during a pulse. Inter-tooth distances, tooth density and mass were measured for both wings. There are differences in the stridulum of these species, but these differences do not conform to the expected model for frequency differences. Mechanical differences between grylloid and haglid stridulation may give clues to an understanding of the independent evolution of the stridulatory apparatus in these two taxa. **(COMMUNICATION 2)**

Parentage Assignment Bias Due to Microsatellite Genotyping Error

Jessica A. Enright*, Peter J. van Coeverden de Groot and Peter T. Boag

Queen's University

Parentage assignment is very important to many biological studies. However, parentage assignment using microsatellite genotype information is subject to error from various sources, including mutation, lab error, and biochemical error. Therefore, even with parentage assignments generated by software, there remains the possibility that the assignments do not reflect biology, but are instead a manifestation of assignment bias due to incorrect assumptions regarding the underlying error model for the system. There are a number of mutation models for microsatellites which can be extended to model selected types of lab and biochemical error, as well as mutation error, collectively referred to as mutation-like error. In this project, computer simulations were constructed and run to produce simulated offspring genotypes from real parental genotypes of walleye (*Sander vitreum*) individuals. These offspring were then assigned to the parent pairs using PAPA software under a number of error assumptions in order to test the sensitivity of PAPA to assumptions of underlying mutation-like error model.

At reasonable error assumptions there was no evidence of assignment bias. One can therefore view assignments of real offspring calculated by PAPA with reasonable confidence. (**CONSERVATION BIOLOGY 2**)

Canada's National Parks in Peril?

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The credibility of Canada's national parks depends on the assumptions that all areas are protected, that there is no conflict between ecosystem protection and recreation, and that the Canada National Parks Act is implemented successfully. Pacific Rim National Park Reserve (PRNPR), British Columbia, serves as a case study in which these assumptions are challenged. The interactions between migrating shorebirds, human visitation with and without pets, law enforcement, and indigenous peoples were investigated to see whether shorebirds were displaced by human activity, to determine conflicts between recreation and ecosystem protection, and to assess how well the leash-regulation of the Canada National Parks Act was implemented at Long Beach. Shorebirds were displaced locally from areas adjacent to the parking lot, especially during times of high human activity resulting in a conflict between recreation and ecosystem protection. The leash-regulation is ignored by 62% (spring) to 80% (late summer) of visitors who bring their pet to the park. PRNPR relies on voluntary compliance, that is, no tickets were given out and no beach patrols were observed. Experiments showed that the speed and direction of an approach by a human or dog determined birds' escape behaviour, not the presence of dogs. (**CONSERVATION BIOLOGY 2**)

Pleiotropy and the Genomic Location of Sexually Selected Genes

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Sexual selection drives the evolution of traits involved in the competition for mates. Although considerable research has focused on the evolution of sexually selected traits, their underlying genetic architecture is poorly resolved. Here I address the pleiotropic effects and genomic locations of sexually selected genes. These two important characteristics can impose considerable constraints on evolvability and may influence our understanding of the process of sexual selection. Theoretical models are inconsistent regarding the genomic location of sexually selected genes. Models that do not incorporate pleiotropic effects often predict sex-linkage. Conversely, sex-linkage is not explicitly predicted by the condition-dependent model (which considers pleiotropic effects). Evidence largely based on reciprocal crosses supports the notion of sex-linkage. However, although they infer genetic contribution, reciprocal crosses cannot identify the genes or their pleiotropic effects. By surveying the genome of *Drosophila melanogaster*, I provide evidence for the genomic location and pleiotropic effects of 63 putatively sexually selected genes. Interestingly, most are pleiotropic (73%) and they are not preferentially sex-linked. Their pleiotropic effects include fertility, development, lifespan, and viability, which may contribute to condition and/or fitness. My findings may also provide evidence for the capture of genetic variation in condition via the pleiotropic effects of sexually selected genes. (**SEXUAL SELECTION**)

Physiological Aging in Free-Ranging Red-Backed Voles

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Aging is defined as an age-related increase in mortality rate that results from physiological deterioration. Past research has demonstrated an increased mortality rate with age, but the physiological causes are unknown. The purpose of our research is to examine physiological aging using the northern red-backed vole (*Clethrionomys rutilus*), as a model species. We assessed the hypothesis that aging results from a deterioration of the components that control the "fight or flight" stress response by repeatedly exposing male voles to stress challenge tests over the summer and into the fall. Counter to our prediction, the ability to recover from stress improved with age. We attribute this result to stress response being more responsive to short term perturbations than age-related changes. (**EVOLUTIONARY ECOLOGY**)

Inflorescence Architecture in Grasses and the Consequences for Pollination

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Wind pollination is a derived condition in the angiosperms and has arisen independently in several families. The grass family (Poaceae), which is almost entirely wind pollinated, is one of the largest families of angiosperms in number of species and genera. Inflorescence architecture and floral morphology vary extensively within the Poaceae, but the biological and functional significance of this variation remains largely unknown. Given the potential for an intimate relation between form and function in wind-pollinated plants, I consider the association between inflorescence architecture and other aspects of reproductive morphology. Manipulative studies that constrained the motion of inflorescences, revealed that compact and diffuse inflorescences employ different mechanisms to facilitate pollen removal and pollen receipt. Furthermore, aggregation of the inflorescence in two diffuse species reduced pollen removal, and had contrasting consequences on pollen capture between the species. Overall, pollen-removal failure and pollen-transfer efficiency for six wind-pollinated species fell within the range observed for animal-pollinated plants. (**PLANT ECOLOGY**)

The Importance of the Y Chromosome to Male Fitness in *Drosophila melanogaster*

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As the isolated genetic material of the male, the Y chromosome is expected to attract male benefit genes. Previous attempts to elucidate its role in male *Drosophila melanogaster* have been limited to the discovery of genes involved in spermatogenesis. No evidence of additive (consistent) variation has been found, however epistatic (interaction) effects have been observed. My work explored two questions: does the Y have a generic effect on male mating success, and do interactions between the Y and the rest of the genome have significant implications for male fitness. First, I used connected-X females to experimentally remove the Y chromosome and tested the mating success of XO and XY males in 6 genetic backgrounds. Second, I generated 6 lines each containing a single Y, and observed whether the genome was able to coadapt by tracking the relative fitness of these lines over time. I found a strong effect of the Y chromosome on male fitness in both cases. XY males were significantly more successful at securing mates than XO males. Populations containing a single Y chromosome improved their fitness by 20% on average in 9 generations. These results confirm that there is much yet to learn about this enigmatic chromosome. (**EVOLUTIONARY GENETICS**)

Infection by an Intestinal Parasite Impairs the Ability of Bumble Bees to Learn Flower Handling Skills

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Although the capacity to learn how to manipulate flowers plays an integral role in the foraging behaviour of bumble bees, little information exists on the effects of parasitic infection on the motor learning and memory abilities of host bees. In the laboratory experiment reported here, we examined whether infection by the intestinal protozoan *Critchidia bombi* affected the ability of bumble bees (*Bombus impatiens*) to learn the specialized motor pattern (handling method) of a novel flower type. Using videotaped records of foraging behaviour, we related the motor performance of bees to their intensity of *C. bombi* infection (number per host). Low intensities of infections had no effect on the ability of bees to learn the flower-handling method; however, a high intensity of infection significantly reduced both motor learning rate and maximum handling proficiency. In addition, highly infected bees showed a 200% increase in the amount of time and the number of visits required to learn how to efficiently manipulate flowers, indicating that the effect of *C. bombi* infection on bumble bee foragers was ecologically significant. These results are discussed in the context of flower choice by bumble bees. (**HOST-PARASITE INTERACTIONS**)

Effect of Wind Speed on Pheromone Mediated Mate Location in the Potato Aphid *Macrosiphum euphorbiae* and its Primary Parasitoid, *Aphidius nigripes*

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The generally accepted paradigm for pheromone mediated mate location in insects is that the responding sex flies upwind to the source. However, this is based on studies using strong flying insects, such as moths and beetles, while little consideration of pheromone communication in weak flying species. To address this question examined the effects of wind speed on the behaviour associated with pheromone emission by oviparae (sexual females) and flight propensity of males in the potato aphid, *Macrosiphum euphorbiae*, in a wind tunnel and under field conditions. The results from these experiments, together with those obtained with the aphid's primary parasitoid, *Aphidius nigripes*, indicate that while oriented flight is of importance for weak flying insects, walking may be of greater importance in the location of receptive females than previously recognized. **(HOST-PARASITE INTERACTIONS)**

Species Delineation in the *Phrynocephalus versicolor* Complex

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Delineation of species boundaries remains a problem in systematics. Populations of toad-headed lizards of the *Phrynocephalus versicolor* complex from northern China, provide an ideal model organism to study species delineation. Not only are its members ubiquitous, the lizards are found in a highly variable environment with many possible barriers to gene flow such as the Yellow River and the Helan Mountain Chain. The systematics of the group remains controversial, although differential habitat preferences and unique morphology have been described for each species member. Using three levels of analysis: mitochondrial (mtDNA) sequencing, morphometrics and microsatellite loci electrophoresis, we hope to delimit species boundaries within this complex. Gene trees constructed from mitochondrial ND2 sequences reveal a relatively deep divergence between the clades of *P. frontalis*, *P. przewalskii* and *P. versicolor*, but certain populations have members in two different clades. Morphometric analysis demonstrates that *P. versicolor* appears to be a different species; however, there is limited evidence to support differences between *P. przewalskii* and *P. frontalis*. Current work with microsatellite loci hopes to test hypotheses of gene flow between members of the mitochondrial clades. **(EVOLUTION 2)**

Female Ornaments and Predation Risk in a "Role-Reversed" Swarming Dance Fly

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Sexually-selected ornaments are very rare in females and there have been no studies on the cost of these secondary-sexual characters in females. Females in a swarming dance fly, *Rhamphomyia longicauda* (Empididae) have feathered legs and inflate their abdomens to attract males carrying nuptial prey (Funk & Tallamy 2000. Anim. Behav., 59, 411-421). Previous work demonstrated that females are more likely than males to die in spider webs (Gwynne & Bussière 2002. Behaviour, 139, 1425-1430). We hypothesized that this sex-biased mortality is a cost of female ornaments. In trials allowing individual males and females to fly into the webs of either a (dry) cob web spider or a (sticky) orb weaver, we found that females were more likely than males to become entangled in orb webs but not in cob webs. Inflated females were just as likely to be entangled as uninflated females. This may indicate that feathered legs are the greater burden to sexually competitive females. Finally, as mating males and females take long flights after leaving the all-female swarm, they may also be at risk. We used orb webs adhered to insect net hoops to entangle pairs. We found that after capture females were entangled longer than their mates. **(SEXUAL SELECTION)**

Individual Optimization of Litter Size in *Peromyscus leucopus*

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We examined patterns of juvenile growth, recruitment, and eventual reproduction, as well as maternal age, somatic condition, and future fecundity relative to litter size to test alternative hypotheses concerning the evolution of litter size in the white-footed mouse, *P. leucopus*. Modal litter size was 5, but was less productive than larger litters (6-9 offspring). Offspring mass, growth rate and survival were not compromised in large litters, and females that produced large litters suffered no cost of reproduction in terms of reduced survival or subsequent fecundity. We introduce a novel method of assessing somatic condition in relation to age, rather than to structural size. Maternal somatic condition (mass adjusted for age) was positively correlated with mean number of recruits per litter. Although litter size did not differ between females that were heavy or light for their age, heavy females recruited almost twice as many offspring per litter than did light females. Heavy females improved their reproductive success by producing large litters, while light females did not. Females born into large litters experienced greater lifetime reproductive success than females born into small or medium-sized litters. These results strongly support the individual optimization of litter size in this population. (**EVOLUTIONARY ECOLOGY**)

Inter- and Intra-Population Variation in Snapping Turtle Development Rate

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Based on previous studies, development rate within a turtle species was suspected to increase in populations which have shorter and cooler summers (Ewert 1985). Over the summers of 2002 and 2003, the embryonic development rate of snapping turtles was modeled in six populations from Wildsville, LA (91°730'47" W, 31°730'37" N), to Algonquin Park, ON (78°730'35" W, 45°730'32" N). In Algonquin Park, the embryonic development rate was also compared among clutches belonging to 10 females. No significant difference in development rate was observed among females. Results of the interpopulation variation in development rate analysis were not as expected. Of the six populations analyzed, development rate did not vary significantly among four. Embryos from the most southern population (Wildsville, LA) developed significantly slower than all but the Kentucky population, whereas the development rate of embryos from Rondeau Provincial Park, ON, developed more rapidly than those from any other population, even those from a much cooler environment in Algonquin Park. These results suggest that natural selection does not act on development rate in such a way as to decrease incubation time in northern populations of reptiles. (**EVOLUTIONARY ECOLOGY**)

Female Pheromonal Influence on Ejaculate Size in the Fish *Carassius auratus*

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Female fish are known to release a number of pheromones that influence male behaviour, sperm production, and sperm activity. However, the effect of pheromones on the number of sperm released during spawning has not been investigated. In this study we examined the effect of a female pheromone on ejaculate size in the fish *Carassius auratus*. We exposed some males to the pheromone 4-pregn-17a, 20B-diol-3-one while others were not exposed. We then placed each male in an aquarium with a reproductively active female. After a predetermined number of spawnings, we collected a sample of aquarium water. We filtered this water and counted sperm under a microscope. The median number of sperm in first ejaculates of pheromone-exposed males was more than 65 times that of unexposed males while there was only a five-fold difference in the number of sperm available. A pheromonal effect on ejaculate size persisted for at least 20 spawning events. These results have implications for sexual conflict and sperm competition. While females always benefit from large ejaculate size, males may participate in hundreds if spawning events over the period of a few hours and their overall success is likely to be maximized by economical use of sperm. (**COMMUNICATION 1**)

Non-Fisherian Sex Ratios and Sexual Selection: a Case Study on Painted Turtles (*Chrysemys picta*)

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The Fisherian sex ratio model predicts that at equilibrium the primary sex ratio will be even. TSD sex ratio models predict that the hatchling sex ratio will be even, if sex-specific fitness differences in survival only influence embryogenesis. Primary (nest) and hatchling sex ratios in species with TSD are generally reported as even or female-biased. Adult sex ratios, however, can be female-biased, even, or male-biased. Adult sex ratio may reflect differences in primary sex ratio--due to climate, or, adult sex ratio may reflect differences in hatchling sex ratio--due to sex-specific hatching success. Adult sex ratio may also reflect sex-specific differences in hatchling and juvenile survival. One consequence of a skewed adult sex ratio is that sexual selection may be more profound in a population with a larger proportion of males. I propose to study two populations of painted turtle, *Chrysemys picta*, one in Algonquin Park, Ontario (adult sex ratio ~3females : 1male) and the second in the E.S. George Reserve, Michigan (adult sex ratio 1 female : ~3males) and investigate two questions: why are the adult sex ratios so different between the two populations, and, what are the effects of sex ratio on sexual selection and mating behaviour? (**BEHAVIOURAL ECOLOGY**)

Moon Phase and Nocturnal Density of Atlantic Salmon Parr in the Sainte-Marguerite River, Québec

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Université de Montréal

We examined the influence of moon phase on the number of Atlantic salmon *Salmo salar* parr visible on or above the substrate at night in Sainte-Marguerite River, Québec. We predicted that, to avoid predators, Atlantic salmon parr should be more active during new moon than full moon. In order to test this prediction, nocturnal underwater counts of Atlantic salmon parr were conducted on four consecutive occasions at four 40 m long sites in Sainte-Marguerite River between 30 June and 14 August 2003. Contrary to the expectation, Atlantic salmon parr counts did not differ significantly between moon phases. There were significantly more Atlantic salmon parr in the near shore than in the midstream areas. The findings of this study suggest that the sampling strategy of studies aimed at assessing population abundance or developing habitat quality models can be designed without taking moon phase into consideration, but it should account for the lateral shift of Atlantic salmon parr populations into near shore areas of streams. (**ECOLOGY 1**)

Density-Dependent Growth of Young-of-the-Year Atlantic Salmon (*Salmo salar*) in Catamaran Brook, New Brunswick

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Université de Montréal

Increasing intraspecific competition in populations of stream-dwelling salmonids often leads to density dependent mortality and emigration. However, density dependent growth is less frequently detected. We examined the relationship between average fork length and population density of young-of-the-year (YOY) Atlantic salmon using a 10 year data set, to investigate (1) whether growth rate decreases with increasing population density, (2) whether the shape of the relationship follows a negative power curve or a straight line, (3) the effect of spatial and temporal scale on the ability to detect density dependent growth. Our study found a strong negative relationship between the average body size and population density of YOY Atlantic salmon, that was best described by a negative power curve. Most of the variation in body size was explained by YOY density, with year, location and density of 1+ and 2+ salmon accounting for a minor proportion of the variation. Density dependent growth was detected equally well within and across years. The strength of the density dependent response was not affected by spatial scale. Our results suggest that populations of YOY Atlantic salmon are regulated by two different mechanisms: density dependent growth at low densities and density-dependent mortality at high densities. (**ECOLOGY 2**)

Evolution of Self-Fertilization in *Camissonia cheiranthifolia*: the Relationship Between Floral Morphology and Mating System

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The shift from predominant outcrossing to predominant selfing is one of the most common transitions in the evolution of flowering plants, and is often accompanied by predictable changes to floral morphology. Our research addresses the relation between floral morphology and mating system among geographically distinct populations of *Camissonia cheiranthifolia* (Onagraceae), a coastal dune endemic distributed from northern Baja, Mexico to southern Oregon, U.S.A. Variation in floral traits among *C. cheiranthifolia* populations have led to the taxonomic distinction of two subspecies that differ markedly in flower size, although variation in neither floral morphology nor mating system has previously been quantified. Geographic range wide surveys of natural and greenhouse grown populations demonstrated a strong correlation between corolla width and herkogamy, which suggests a mating-system shift in large- and small-flowered populations across the range. However, a greenhouse pollination experiment revealed unexpectedly high levels of autofertility, based on fruit and seed set among all but one large-flowered population. Therefore, both greenhouse and field experiments will be used to determine which selective factors have influenced the maintenance of the large-flowered phenotype, despite the potential for selfing. (**EVOLUTION 2**)

Does it Pay to Be Choosy? The Effects of Mate Discrimination by Male Convict Cichlids (*Cichlasoma nigrofasciatum*)

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In species where both parents invest substantially in offspring, both sexes are expected to discriminate between potential mates. The convict cichlid, *Cichlasoma nigrofasciatum*, is a monogamous species exhibiting biparental care. Females possess ornamentation in the form of orange colouration on their ventral surface and fins. A previous study found that males prefer brighter females to dull females. Male preference was evaluated by presenting males with bright and dull females and measuring the amount of time spent in association with each. Males discriminated in five of nine trials, preferring bright females in three cases and dull females in two cases. To test whether male discrimination results in increased fitness males were mated to preferred or non-preferred individuals and male fitness correlates were measured. The number and weight of eggs produced, the number and size of fry surviving to the age of independence and the percent survivorship of fry were not significantly influenced by male preference or female brightness however trends in the data suggest that female colouration may be an indicator of female quality as it relates to male fitness. (**MATING SYSTEMS**)

Fear, Food, Sex and Turf in Redback Spiders: the Role of Behavioural Syndromes

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Studies of behavioural ecology routinely specialize on one context of behaviour (e.g. parental care or mating or foraging or avoiding predators) and, as a result, focus exclusively on a limited range of the organism's life history. When the interaction between two or more of these behavioural contexts is considered (e.g. foraging under high and low predation risk) different animals are typically used across treatments to satisfy assumptions of statistical independence. However, recent work suggests that individual variation may carry over across different behavioural contexts yielding suites of correlated behaviours, recently dubbed "behavioural syndromes". Here we put this behavioural syndromes hypothesis to the test using the Australian Redback spider (*Latrodectus hasselti*) as our study animal. We report behavioural correlations among the following contexts: territorial (aggression towards conspecific intruders), foraging (voracity towards prey), anti-predator (boldness/shyness towards predators), and mating (sexual cannibalism). We conclude by discussing the power of a behavioural-syndromes approach, and argue that such an approach should be viewed as complementary to, rather than mutually exclusive with, traditional, context-specific adaptationism. (**PREDATOR-PREY INTERACTIONS**)

Genotypic Diversity in Plant Populations Affects Arthropod Community Composition

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Research on the community genetics of plant-arthropod interactions has led to the hypothesis that genetic variation in plant resistance is an important determinant of arthropod community composition. In 2003, I examined whether the number of plant genotypes (genotypic diversity) within populations affects arthropod diversity and abundance. I created small populations of *O. biennis* in the field by planting patches of eight plants containing one, four, or eight genotypes. Across the entire season, arthropod richness was 18% greater in patches with the highest genotypic diversity compared to monocultures, while patches with four genotypes were intermediate in arthropod richness between the two. Genotypic richness also affected the abundance and evenness of arthropod communities, particularly once plants began to flower in mid-summer. The variance between replicate plant populations significantly decreased as genotypic diversity increased for several herbivore species and a fungal pathogen, and increased genotypic diversity resulted in increased population fitness for *O. biennis*. These results demonstrate that the diversity-stability concept can extend to the intraspecific level and the preservation of genetic diversity in plant populations may affect the conservation of communities. (**COMMUNITY ECOLOGY 1**)

Does a Male Field Cricket Reveal His Age when He Sings?

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Many studies have documented a female mating bias towards older males. A good demonstration of this mating bias is in the fall field cricket, *Gryllus pennsylvanicus*, and work by Zuk (1987) suggests that information about a male's age is present in his calling song. Previous attempts to correlate calling song with age suffered from low statistical power and did not measure song parameters that are predicted to be directly related to age. As insects age, they add daily layers of chitin to their exoskeletons. In stridulating species, these layers are predicted to cause directional changes in spectral song parameters. I recorded the calling songs of 107 lab-reared males (offspring of wild-caught individuals). Each male was recorded only once, so that the entire range of male ages found in the wild was represented. I also recorded the calling songs of 24 males early and late in life. I measured a variety of spectral and temporal song parameters, including those that are predicted to increase with mating effort (e.g. duty cycle). I correlated these song parameters with male age and body size. Here I will present the results of these analyses in the context of female mating biases and sexual selection. (**COMMUNICATION 1**)

Individual Variation in Nest-Site Choice and its Consequences for the Hawksbill Sea Turtle

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Where an animal places its nests has important consequences for its reproductive success, most often through the survival of its offspring. For sea turtles, the environment in which the nest is laid greatly influences the probability of a successful reproductive outcome. With so much dependent upon the choice of a nest site, it is likely that this behaviour is or has been under strong selection. As little is known about nest site choice in sea turtles, we investigated individual nest placement patterns for female hawksbills nesting at Trois-Ilets, Guadeloupe. In addition, the thermal consequences of the nesting patterns were determined. The nesting patterns revealed that hawksbills nest in thermally diverse habitats. This is of particular relevance as sea turtles display temperature-dependent sex determination, with females being produced at warmer temperatures. Evolutionary and conservation implications in the context of current environmental changes are discussed. (**ECOLOGY 1**)

Fumbling for Females: Male Life History Shifts in Response to Female Cues

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Adaptive behavioural variation in response to variables that affect adult reproductive success is well documented. When reliable cues of future conditions are available to juveniles, selection may also favour life history shifts that maximize the probability of adult success under similar conditions. We examined the influence of female density and food abundance on male development patterns in the Australian Redback spider (*Latrodectus hasselti*)—a species where female distribution may interact with male condition to affect male success during mate search. We predicted that a juvenile male's perception of female density might trigger a shift in development to favour traits that would maximize competitiveness under adult conditions. We reared juvenile males in three different feeding treatments in the presence or absence of females. We show that adult male size and development speed depends on food availability. Moreover, in the presence of females, males trade-off size and condition for a faster development rate, yielding scramble competition benefits. Males reared without females take longer to mature, but grow larger and are in better condition, facilitating long distance travel during mate search. These results show that juvenile sampling of current environmental variables allows adaptive modification of development, and thus adult phenotype, maximizing reproductive success. (**MATING SYSTEMS**)

cGMP-dependent Protein Kinase (PKG) Regulates Food Intake in *Drosophila melanogaster*

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The *foraging* (*for*) gene in *Drosophila melanogaster* is a rare example of a single major gene underlying a naturally occurring behavioural polymorphism. *for* encodes a cyclic-GMP dependent protein kinase (PKG). Allelic variation at the *for* locus accounts for differences in PKG activity with variants of the rover allele, *for^R* having higher PKG activity than variants with the sitter allele *for^S*. *for* also accounts for differences in path length of *D. melanogaster* larvae on a yeast paste. Rovers move significantly more within a single patch of food and from food patch to food patch while feeding, whereas sitters tend to move less and feed within a patch. However, rover and sitter locomotion does not differ on non-nutritive substrates, nor do the variants differ in developmental time or body size when food is not limiting. We examined how *for* may regulate foraging behaviour by determining whether differences in locomotion during foraging correlate with differences in food intake. We measured food consumption in the natural rover and sitter variants, a natural rover made into a sitter variant through gamma mutation (*for^{S2}*), and a natural sitter made into a rover variant through leaky overexpression of *for* transcripts in transgenic flies. The results show that larvae with high levels of PKG eat less than natural sitters and *for^{S2}* larvae. Preliminary results suggest that these food intake differences are in part related to differential regulation of acidity in the gut by rovers and sitters. Thus, the *foraging* gene plays multiple roles in foraging behaviour in *D. melanogaster*. (**BEHAVIOURAL ECOLOGY**)

Spatial Distribution of Females Determines Opportunity for Sexual Selection in the Wellington Tree Weta, *Hemideina crassidens*

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Mating system theory suggests that the opportunity for sexual selection is governed by the spatial and temporal distribution of sexually receptive females. When sexually receptive females are clumped at resource patches single adult males are able to defend these groups and increase their reproductive success. Intraspecific variation in the opportunity for sexual selection should arise if resource patches vary in quality, and thus vary in their degree of female clumping, either within or among populations. I tested this prediction using the Wellington tree weta, *Hemideina crassidens*, an orthopteran insect native to New Zealand. In this sexually dimorphic, dominance polygynandrous species males use their enlarged mandibles in intense male-male competition for control of tree cavities used by females for diurnal refuge. In the field on Maud Island, NZ I sampled repeatedly for two months during each of three years the distribution of breeding aggregations (one or more females with single adult male) in artificial cavities in three similar but isolated sites. Each site comprised of small, medium or large cavities that could accommodate approximately three, six and 12 adult tree weta, respectively. I compare the slopes

generated by the correlation between female mean crowding (measure of female clumping) and the opportunity for sexual selection for each site. The slopes should differ significantly with the site with the largest cavities having the highest slope (greater opportunity for sexual selection) and the site with the smallest cavities having the lowest slope (reduced opportunity for sexual selection). (**MATING SYSTEMS**)

Population Genetics of the Black Rhinoceros (*Diceros bicornis*) in Etosha National Park

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Widespread poaching throughout the latter half of the 20th century has led to a marked decline in black rhinoceros (*Diceros bicornis*) populations; however, some populations of these animals have begun to recover. The largest endemic population of black rhinos (*D.b. bicornis*) is in Etosha National Park, Namibia (N=~450). To assist in the conservation of this population we: 1) characterize microsatellite variability in Etosha National Park and 2) determine if genetic structure exists within this semi-arid 22,270-km² park. We determined microsatellite polymorphism at 9 dinucleotide loci for 126 individuals. Observed heterozygosity ($H_o=0.415$) was lower than expected ($H_e=0.464$), and lower than previously published reports found in *D.b. minor* and *D.b. michaeli* subspecies. In a fixed model analysis using 7 aggregates of individuals, we found some groups were genetically valid, contradicting previous observations that individuals are solitary. For example, individuals sampled from groups 2, 3 and 4 were assigned correctly; however, individuals sampled from putative groups 1, 5, 6 and 7 were not assigned to their subpopulation of origin. Thus, we conclude that 1) a lower amount of genetic variability exists in individuals found in Etosha National Park compared to other subspecies and 2) population genetic structure exists for some clusters assessed. (**CONSERVATION BIOLOGY 1**)

Variation in the Behaviour of Pumpkinseed Sunfish (*Lepomis gibbosus*) Ecomorphs Under the Risk of Predation

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In lakes without bluegill sunfish (*Lepomis macrochirus*), pumpkinseed sunfish (*L. gibbosus*) can diversify into littoral and pelagic ecomorphs. While morphological differences have been well researched, little is known about behavioural differences between the ecomorphs. We tested for behavioural variation of the pelagic and littoral ecomorphs under risk of predation (during visual exposure to a walleye, *Sander vitreus*). Because each ecomorph group was split, half raised with and half without a walleye predator, we also tested for differences in the plastic responses of the two ecomorphs with these different historical exposures to predation. Behavioural response to predation risk depended on the history of prior exposure to predation, indicating considerable plasticity in anti-predator behaviour. However, the plastic behavioural responses were different between the two ecomorphs, indicating that ecomorphs have genetically diverged with respect to their plastic anti-predator responses. This is the first evidence that predation contributes to polymorphism in this sunfish system. (**ECOLOGY 1**)

Does Escape from Natural Enemies Contribute to Plant Invasions? Tests Using Congeneric Pairs

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In order to test whether exotic plants escape their natural enemies during invasion, a series of field and laboratory experiments was conducted using 34 herbaceous species of Ontario old fields. For each experiment, exotics were paired with native congeners to investigate whether they benefit from relatively lower levels of damage. In all experiments, there was considerable interspecific variation in rates of attack. Comparisons of congeners detected no evidence that seeds of exotics were less likely to be attacked by pathogens than seeds of natives. Foliar herbivores attacked exotics more severely than natives in the first year, but this pattern was reversed in the following year: exotics were less attacked than natives, despite apparently higher palatability. Finally, exotics suffered less negative feedback from soil organisms than did natives. Together, these results suggest that exotics often do escape enemies during invasion. However, attack by different enemies (seed pathogens vs. foliar herbivores vs. root pathogens) is not necessarily correlated, and patterns of attack can vary between years. Escape from natural enemies thus may function differently for different groups of enemies, and may contribute to the stochastic nature of the invasion process. (**PLANT ECOLOGY**)

Novel Indices of Marine Zooplankton Community Structure Based on Electronic Sensor Data

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The Atlantic Zone Monitoring Program (AZMP) is a long-term study designed to assess variability in the oceanographic environment of the Canadian NW Atlantic shelf region. The strategy includes seasonal and opportunistic sampling to quantify the spatial and temporal variability of biological, chemical and physical zones. Zooplankton was sampled at fixed stations with vertical profiles of an optical plankton counter (OPC) and plankton nets, and physical properties of the water column were measured with simultaneous casts of a CTD. Zooplankton data attained from the OPC are currently being analyzed to produce 'standard' indices of zooplankton community structure for quantifying variability from the seasonal to interannual to ecosystem scale. There are a variety of indices being explored including mean size, parameters of a quadratic model fitted to the normalized zooplankton biomass size spectrum, and parameters of the Pareto distribution. Changes in zooplankton community structure across the time and space scales of the Scotian Shelf data can be revealed by such indices. **(COMMUNITY ECOLOGY 2)**

Risk-taking, Testosterone and Player Behaviour in the Ultimatum Game

Daniel Brian Krupp* and Deborah M. Saucier

McMaster University

Organisms of a wide variety of species engage in competitive risk-taking behaviours, wherein individuals may incur severe costs for choosing a poor option. Current research suggests that risk propensity is a heritable trait, and that such traits may have fitness consequences. Researchers in the behavioural sciences, particularly psychologists and economists, have been concerned with risk-taking for some time, but often rely on socially irrelevant risk-taking paradigms (e.g., gambling, foraging) to measure risk propensity. Recent interest in experimental economic games has created opportunities for testing hypotheses regarding socially relevant risk-taking behaviour in controlled, laboratory settings. Using one such game, the Ultimatum game (UG), the current study investigated the relationship between self-reported risk-taking, testosterone, and behaviour in humans. We hypothesized that the amounts offered by participants in the UG (an assay of risk propensity) would be negatively related to both self-reported risk-taking behaviour and to concentrations of testosterone. We found support for the first hypothesis (p values $< .05$ for several risk subscales), but not for the second. The current study demonstrates that the UG can be used to experimentally assay risk-taking behaviour between two individuals with conflicting goals. **(BEHAVIOURAL ECOLOGY)**

Specialization is Not a Cul-De-Sac for Phytophagous and Parasitic Taxa

Marc J. Lajeunesse

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Herbivorous insects and other parasitic organisms are extremely diverse, and the process of specialization has been proposed as a key factor in the success of these lineages. However, long-term interactions with particular host species may lead to losses of variation for the ability on alternate hosts, perhaps irreversibly constraining specialists to use these hosts at the expense of others. Losses in variation may restrict the ability to respond to changes in hosts or environmental conditions, which has lead to the prediction that specialists may more prone to extinction, and thus appear more phylogenetically derived (e.g., near tips of phylogenetic trees). Using a meta-analysis on published phylogenies of phytophagous and parasitic taxa, I compared the strengths of correlations between the degree of specialization (defined by number of hosts utilized) and speciation events to gauge the generality of this phenomenon. With a preliminary set of phylogenies, I found that specialists were not more likely to be phylogenetically derived than generalist species, and that this pattern remained consistent across and between different taxonomic groupings of parasites. These results suggest that the evolutionary persistence of a parasitic species may not be strongly influenced by its degree of specialization. **(HOST-PARASITE INTERACTIONS)**

Does the Acoustic Parasitoid, *Ormia ochracea*, Show Selective Attention to Multiple Competing Sound Sources?

Norman Lee* and **Andrew C. Mason**

University of Toronto at Scarborough

The acoustic parasitoid fly *Ormia ochracea* locates its cricket host by detecting the calls of singing males. Flies are able to localize a single cricket call with high accuracy. I examined the ability of flies to perform accurate phonotaxis when there are multiple simultaneous cricket calls. Previous studies examining this question have used tethered flies responding on a treadmill. Under these open-loop conditions, flies fail to accurately localize the sources of overlapping stimuli. I used freely walking flies, and tested the orientation of phonotactic responses when two identical stimuli were presented at a range of inter-stimulus delays (from perfectly simultaneous to completely separate in time). Results were similar to open loop experiments in that overlapping stimuli both contribute to response direction with the result that the flies orient to a compromise angle between the two sources. However, the degree to which one source dominates depends on the delay, spatial separation and locations of the two sounds. (**COMMUNICATION 1**)

Monocular Vision and the Effects of Prey Movement and Size During Prey Choice by Veiled Chameleons (*Chamaeleo calyptratus*)

Benjamin W. Lindsey

University of Guelph

To determine the visual cues responsible for the prey choice behaviour of a sit-and-wait forager, the veiled chameleons (*Chamaeleo calyptratus*) ($n = 6$), the current study examines the influence of prey movement and size cues. This was tested by presenting veiled chameleons with pairs of intraspecific prey items (southern brown crickets, *Acheta domesticus*) during prey selection. Predictions were that prey movement and large size would be dominant visual characteristics, as have been demonstrated by many other visual predators. Three treatments were utilized: simultaneous introduction of (1) mobile vs. stationary prey, (2) large vs. small prey, and (3) sequential introduction of large vs. small prey. The results of treatment 1 showed a strong preference towards mobile prey items. Treatments 2 and 3 both demonstrated a significant preference for large prey items, whether encountered simultaneously or sequentially. In addition, treatment 3 gave some evidence that chameleons may be able to rapidly switch from a less profitable to a more profitable prey item, even following fixation on an initial prey item. These results indicate that veiled chameleons discriminate between two prey items of the same species by utilizing visual criteria, movement and size, to assess prey profitability. (**PREDATOR-PREY INTERACTIONS**)

What Do Interpopulation Crosses Reveal about Sexual Conflict and its Role in Speciation?

Tristan A.F. Long*, Bob Montgomerie and Adam K. Chippindale

Queen's University

Conflict between the sexes over reproductive decisions has been suggested as an important "engine of speciation": a sexual arms race that results in rapid co-evolution of the sexes, leading to population divergence, and ultimately reproductive isolation between allopatric groups. We present results of experimental crosses between six replicate, parallel lines of *Drosophila melanogaster* that have been cultured under identical conditions for over 550 generations. We found strong divergence between lines had occurred. Contrary to the predictions of sexual conflict theory, however, female fitness was not consistently reduced by mating with males with which they had not coevolved. Indeed, strong population interactions had no directionality suggesting highly specific signal-receiver coevolution. (**SEXUAL SELECTION**)

Top-Down Effects on the Food Web of a Fish-less Temporary Freshwater Pond: A Field Manipulation

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University of Toronto at Scarborough

We tested whether invertebrate predators influence community structure in a habitat in which abiotic factors prevail. This experiment was carried out using large metal enclosures in a small, temporary pond (Ontario, Canada), in which beetle and dragonfly larvae were the main predators. In two enclosures, a total of 30 beetle and 120 dragonfly larvae were added during nine of the thirteen weeks the pond held water. Aerially colonizing insect predators were excluded using a fine mesh screen in two other enclosures, and two enclosures served as controls. Phytoplankton abundance rapidly doubled in the predator-addition enclosures, and preliminary data indicate that predator-additions resulted in a 70% lower macroinvertebrate density compared with the controls, due to decreased bivalve (-86%) and chironomid (-82%) abundances. Total invertebrate abundance was lower also in the enclosures in which aerial colonization was prevented, primarily due to 62% fewer beetles and 97% fewer chironomid larvae. These preliminary data suggest a potentially important top-down effect influencing temporary pond community structure. (**COMMUNITY ECOLOGY 2**)

Impacts of Roads Associated with North America's First Diamond Mine, the Ekati Diamond Mine, Northwest Territories, on Reproductive Success and Breeding Habitat of Lapland Longspurs, *Calcarius lapponicus*

Sean K. Male *and Erica Nol

Trent University

Since the first mine opened in 1998, the diamond-mining industry in the Canadian arctic has been undergoing steady growth. Our understanding of environmental impacts of these operations is restricted to hydrological and landscape effects. To address whether ecological impacts may also exist, I examined effects of roads associated with the Ekati Diamond Mine™, NWT on reproductive success and breeding habitat of Lapland Longspurs by comparing habitat and breeding success on study sites located directly beside and at least 5 km away from roads. No significant differences between roads and reference sites were detected for first egg dates, clutch size, average nestling mass, or daily nest survival. Recorded frequencies of male song overlapped substantially with harmonics of heavy truck noise. Snow water equivalent and percent moss cover were significantly higher on reference sites, while soil moisture, and dust deposition were higher on road sites. Dust suppressant applied mid-way through the breeding season significantly reduced dust deposition. Currently, there appears to be no measurable effect of roads associated with the Ekati Diamond Mine™ on Lapland Longspurs. Observed differences in habitat characteristics between reference and road plots suggest that long-term changes in the vegetative community may occur that could affect Longspur nest-site selection. (**COMMUNITY ECOLOGY 1**)

Environmental Fluctuations from Internal Waves and Benthic Algal Community Structure

Shelley K. McCabe

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Theoretical models and laboratory experiments show that fluctuations of abiotic factors may influence the biomass and composition of communities. In lakes, the regimes of temperature variability differ between upwind and downwind littoral sites. These temperature fluctuations are linked to physical disturbance from the internal waves and possibly to fluctuations in nutrients from sediment resuspension. In this study we test whether there is a difference in benthic algal biomass, species richness, and community composition with different regimes of environmental variability at upwind and downwind sites in a 6

km long basin. We set out tiles at four upwind and four downwind sites in Lake Opeongo, Ontario. There was no difference in biomass or richness, but the Shannon Diversity Index was higher at downwind sites. Environmental variability may have a subtle effect on the structure of benthic algal communities. (**COMMUNITY ECOLOGY 2**)

The Effects of Herbivore-Induced Plant Responses and Plant Genotype on Herbivore Performance

Rosanna McGuire* and Marc T.J. Johnson

University of Toronto

Community ecologists investigate factors that affect the abundance and distribution of species. In this study we examined how intraspecific genetic variation in evening primrose (*Oenothera biennis*), as well as intra- and inter-specific herbivore interactions affect herbivore performance. In a field experiment, we detected genetic variation in damage from early season herbivores—a generalist spittlebug (*Philaenus spumarius*) and the specialist weevil (*Tyloderma foveolata*). We then selected and grew four plant genotypes from the field experiment that represented a range in resistance, and applied one of three damage treatments: undamaged control, spittlebug, or weevil. We conducted choice and no-choice assays using the same specialist weevil and a generalist caterpillar (*Spodoptera exigua*), and we quantified resistance as the amount of leaf damage (and caterpillar survivorship). Weevil performance was largely unaffected by plant genotype, while genotype had strong affects on caterpillar resistance. In no choice assays, weevil damage induced resistance to both weevils and caterpillars. In the choice assay, spittlebug damage resulted in induced susceptibility to weevils. In conclusion, we found that both plant genotype and prior damage are important factors in affecting herbivore performance, although the relative importance of these factors varies with herbivore identity. (**COMMUNITY ECOLOGY 2**)

Diversity of Fungi in a Hemlock Forest: Above-Ground Versus Below-Ground Views

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University of Toronto

Complex life history stages, hyperdiversity, and “cryptic” species complicate the identification and detection of fungi in nature. When studying basidiomycete fungi that produce conspicuous “mushrooms” during the sexual stage of their life cycle, identifications are possible using a number of unique morphological characters that can be seen with the naked eye or with a light microscope. There is a filamentous asexual stage, however, that occurs below-ground or within a substrate that makes the fungi in this stage of their life cycle difficult to identify because of a paucity of distinct morphological characters. It is already known that the use of culture-based methods to isolate and identify fungi from nature biases the types of fungi detected towards those that are amenable to growth in culture. I will discuss the molecular phylogenetic methods I have used to assess the diversity fungi from soil and present preliminary results of two fruiting-body surveys conducted in a hemlock forest plot. (**PLANT ECOLOGY**)

Potential Effects of Zebra Mussel (*Dreissena polymorpha*) Invasion of Benthic Invertebrate Communities and Whitefish (*Coregonus clupeaformus*) in South Bay, Lake Huron

Gordon G. McNickle*, W. Gary Sprules and Michael D. Rennie

University of Toronto at Mississauga

Invasive species in the Great Lakes have become an increasing concern in recent decades. Arguably one of the most well studied exotic is the zebra mussel (*Dreissena polymorpha*), which has been implicated as the cause of dramatic changes in Great Lakes ecosystems. To test the hypothesis that there have been changes in benthic invertebrate communities of Lake Huron since the invasion of zebra mussels, data on benthic communities in South Bay, Lake Huron for 1980-81 (pre-invasion) were compared to data from 2002-03 (post-invasion). If present, the potential implications of these changes for whitefish (*Coregonus clupeaformus*), a commercially important benthivore in the Great Lakes, were examined. Of the 8 groups

identified only *Diporeia* and oligochaetes were shown to have changed in density since the invasion of the zebra mussel, and only *Diporeia* and chironomids changed in relative abundance. Based on literature on whitefish diet I predict that the effects of these changes on whitefish diet should be similar to those previously observed. Observed changes include a loss of *Diporeia* as the main prey and a higher reliance on chironomids, oligochaetes and Molluscs as prey. However, these shifts in available prey may have serious and unpredictable consequences for lake whitefish energy budgets. (**CONSERVATION BIOLOGY 1**)

Does a Parasite Help Balance the Cost of Sex in *Phoxinus spp.*?

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University of Toronto

The use of sex in reproduction comes with a number of inherent costs. The vast majority of species use sex to reproduce. Despite an abundance of theories explaining how species balance the costs of sexual reproduction, the widespread occurrence of sex is rarely viewed as anything short of a paradox. The variety introduced in each generation by sex can present an evolutionary challenge to parasites. Slowly evolving asexual lineages are an easy target for parasites. The hybrid dace, *Phoxinus eos-neogaeus*, is an all-female, asexual species that usually coexists with redbelly dace, *Phoxinus eos*, which reproduces sexually. Both species are parasitized by a Gyrodactylid ectoparasite. Contrary to prediction, there does not appear to be a difference in infection by *Gyrodactylus spp.* between *P. eos* and *P. eos-neogaeus*. There are plans for further empirical work in this system to get a clearer understanding of the role of parasites in balancing the costs of sex and allowing the coexistence of sexual and asexual species. (**HOST-PARASITE INTERACTIONS**)

High Ultrasonic Singing by a Neotropical Katydid (Orthoptera: Tettigoniidae: Listroscelidinae)

Fernando Montealegre-Z* and Glenn K. Morris

University of Toronto

Male katydids generate calling songs by rubbing their forewings together. One wing bears a vein modified into a series of teeth (stridulatory file) while the other has its anal margin altered as a sharp-edge (scraper) that is drawn along the file. Calling song frequencies of different species range from the low audio to beyond the (arbitrary) human limit of 20 kHz. In most species, sound is generated during the closing stroke of the wings; and its fundamental frequency is determined by the speed of the closing stroke, which in turn determines tooth-contact rate. An undescribed species and genus of predaceous katydid (Listroscelidinae) found recently in the western rainforests of Colombia, generates its principal calling sounds at a carrier frequency of 130 kHz. This animal cannot be contacting file teeth at a rate of 130,000 per second. Based on high speed video recordings of wing movements and the analysis of recorded calling songs, tooth contact occurs in this species at a very low rate, which does not match the song fundamental frequency. The forewings are apparently tuned at the fundamental, which is a high value multiple of the tooth contact rate. The forewings in this species apparently serve as mechanical filters. (**COMMUNICATION 2**)

Adjustment of Offspring Sex Ratios in Cooperatively Breeding White Winged Fairy Wrens

Bob Montgomerie* and Melanie Rathburn

Queen's University

We examined sex allocation patterns in island and mainland populations of cooperatively breeding white-winged fairy-wrens in western Australia. The marked differences in social structure between island and mainland populations, in addition to dramatic plumage variation among males both within and between populations, provided a unique situation where we could investigate different predictions from sex allocation theory in a single species. We used molecular sexing techniques to assess total offspring sex ratios of 86 breeding pairs over two years. Both offspring and first brood sex ratios were correlated with the pair-male's body condition such that females increased the proportion of males in their brood in relation to the body condition (mass corrected for body size) of their social partner. We argue that this finding is consistent with the male quality (attractiveness) hypothesis with respect to male condition. There was no support for the repayment hypothesis; the presence of helpers had no effect on offspring sex ratios. There was weak support for both the male quality (attractiveness) hypothesis with respect to plumage colour and the maternal condition hypothesis, but their influence on offspring sex ratios was negligible after controlling for the effects of pair-male condition. (**BEHAVIOURAL ECOLOGY**)

Counterintuitive fitness effects of nectar robbing in *Linaria vulgaris*

Daniel A. Newman* and James D. Thomson

University of Toronto

Nectar robbers are often assumed to be plant antagonists, although the results from empirical studies vary widely from system to system. Most studies have focused on the indirect fitness effects of robbers on plants via changes in pollinator behaviour. However, nectar robbing may also affect other animals that interact with plants. In subalpine Colorado, we investigated the effects of nectar robbing on the interactions between a plant, butter-and-eggs, and its arthropod community. We hypothesized that nectar-seeking ants would recruit to plants that have been robbed, and then prey upon the flower- and seed-eating beetles that are known to attack butter-and-eggs. Artificial nectar robbing increased ant recruitment to plants in a paired-plant experiment. In a full factorial experiment manipulating ant access and nectar robbing, ant exclusions had a significant negative impact on many components of plant fitness and a significant positive effect on the number of beetles. Ant-by-robbing interactions were found for some variables, although most were not significant. To our knowledge this is the first reported case of ant recruitment to floral nectar made available by a third species, as well as the first report of a plant benefiting from nectar robbing due to changes in herbivory. (**COMMUNITY ECOLOGY 2**)

Spatial Use Strategies of Bumble Bees Foraging on Renewable Resource Patches

Kazuharu Ohashi* and James D. Thomson

University of Toronto

Spatial use is an important aspect of animal foraging behaviour; spatial use strategies are especially interesting when foragers are pollinators because they affect plant mating systems. Pollinators forage on renewable resources such as floral nectar and pollen, so that natural selection may have equipped them with abilities to optimize their foraging routes in terms of return time or route distance to the same patches. Optimization of foraging routes can be achieved by simple movement rules between successively visited patches (choices of distance and angle). If pollinators can learn locations of patches and choose among possible routes, however, their performance may increase. Bumble bees seem to learn the locations of plants within their feeding areas, and often repeatedly visit these plants in a predictable order ("traplining"). We tested whether and how bumble bees can optimize their foraging routes in laboratory experiments with artificial flowers. With increasing experience, foraging routes of bees became more repeatable and efficient than expected from simple movement rules. On the other hand, bees preferred short distance over straight moves even when it was not optimal. Thus geometry of feeding patches would be a key factor to determine if the bee could optimize its foraging route. (**ECOLOGY 2**)

The Effects of Parasitic Protozoa and Tracheal Mites on the Foraging Behaviour of Bumble Bees

Michael C. Otterstatter*, Sheila Colla, Robert J. Gegear and James D. Thomson

University of Toronto

Parasites can alter ecologically important aspects of host behaviour. We assessed the effects of parasitic infection by an intestinal protozoan (*Cryptosporidium bombi* Lipa and Triggiani) and a tracheal mite (*Locustacarus buchneri* Stammer) on the foraging behaviour of bumble bees (*Bombus impatiens* Cresson). Using an experimental array of equally rewarding yellow and blue artificial flowers, we measured foraging efficiency (flower handling time and flight time) and flower constancy (the tendency to sequentially visit flowers of one colour) among bees with varying intensities of parasitic infection. Overall, bees with *L. buchneri* infection showed higher degrees of flower constancy and somewhat lower foraging efficiencies than uninfected bees. In contrast, infection by *C. bombi* had no effect on flower constancy but dramatically reduced flower handling time and

flying efficiency of bees. The implications of these results for the success of bumble-bee colonies and the transmission of parasites under natural conditions will be discussed. (**HOST-PARASITE INTERACTIONS**)

Selection for Resistance to an Antimicrobial Peptide

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McGill University

A novel range of antibiotics based on the antimicrobial properties of peptides of all multicellulars innate immunity is attracting increasing interests as a major weapon to counteract the ubiquitous resistance to all antibiotics currently in use. It is claimed that the bacteria will be unable to evolve the resistance because of the target of the antimicrobial peptides. However, recent theoretical and experimental evidences suggest that this claim is doubtful. Here we show the experimental evidence that resistance to an antimicrobial peptide has evolved *in vitro* in response to continuous selection. (**EVOLUTION 2**)

Success in the Face of Tragedy: Can a Population Recover from the Effects of a Deleterious Mutation?

Alison Pischedda* and **Adam K. Chippindale**

Queen's University

Once fixed in a population, a deleterious mutation can precipitate a number of evolutionary responses. One possible response is compensatory evolution, in which the population is able to ameliorate its fitness by selecting at other loci in order to minimize the harmful effects of the mutation. We experimentally introduced and fixed a wing mutation (nubbin) into a wild-type genetic background of *Drosophila melanogaster* using backcrossing techniques to test the effect of the mutation and the potential for compensatory evolution. We found that, initially, the mutation dramatically reduced juvenile viability, female fecundity and male mating success. The effects of the mutation, however, became much less pronounced over time, as we saw significant increases in all fitness measures, providing evidence for compensatory evolution in both sexes. (**EVOLUITON 1**)

The Evolution of Brook Trout Population Genetic Structure Following Drainage Rearrangement

Jocelyn Poissant*, Thomas W. Knight and Moira M. Ferguson
University of Guelph

We combined phylogeography and landscape genetics approaches to study the evolution of spatial genetic structure in a stream-dwelling salmonid (brook trout, *Salvelinus fontinalis*) in an area that has likely been affected by drainage rearrangements (Gros Morne National Park, GMNP, Newfoundland). GMNP is characterized by lowlands and highland plateaus often delimited by steep cliffs. Due to the presence of numerous impassable waterfalls, it is unlikely that fish colonized the headwaters of individual drainages through available contemporary waterways. We tested the hypothesis that highland aquatic systems were colonized through historical temporary connections among highland water bodies rather than upstream migration through contemporary available waterways. The distribution of microsatellite alleles suggested that physically isolated but proximate highland sub-catchments were colonized by brook trout in a linear stepping-stone fashion through historical drainage rearrangement. Contemporary barriers apparently preserved historical patterns of population structure by inhibiting contemporary gene flow. Finally, we found that putative historical landscape features (historical waterway distances and sums of altitudinal differences) were better predictors of population differentiation than contemporary landscape features. (**EVOLUTION 2**)

Can Single Factor Remediation Recover Fish Species at Risk in a Complex System?

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University of Guelph

We used the Sydenham River as a test case to identify and examine the challenges of applying the species at risk act (SARA) to complex systems with multiple species at risk (SAR). Past recoveries have focused on single factor remediation where a habitat feature or abundance of another species was altered to assist in the recovery of a single species at risk. This paradigm has been useful in simple systems with relatively few species or anthropogenic stresses. It is less clear how SARA can meet its mandate by implementing the traditional approach in a complex system (many anthropogenic stresses, species and SAR). In the case of the Sydenham River, successful application of SARA requires that SAR are found in similar types of habitat and react similarly to changes in key habitat characteristics (e.g. turbidity). SAR including the eastern sand darter (*Ammocrypta pellucida*) and the spotted sucker (*Myngtremia melanops*) were found with differing, and often contrasting, habitat requirements in the Sydenham watershed. We demonstrate that implementing single factor remediation would have a detrimental effect to at least two SAR, regardless of the factor chosen. Alternative recovery strategies, such as preserving the most SAR and maximizing biodiversity, were placed into the current model and did not fair much better. In complex systems, management to protect SAR will need to consider multiple species and potential trade offs amongst recovery strategies that arise from interspecific differences in habitat preferences. (**CONSERVATION BIOLOGY 1**)

Social Behaviour of *Xylocopa virginica* in Southern Ontario

Sean Prager* and M.H. Richards

Brock University

Xylocopa virginica, the only species of large carpenter bees in Ontario, exhibits unusual colony social behaviour. Egalitarian bees live communally, they work and share reproduction. Foundresses do equal work and have similar reproductive rates. In caste-based colonies, one foundress dominates reproduction. In caste-based colonies, most females (workers) have little reproduction, but do significant work. A few females (queens) will have reduced work but high reproduction. *Xylocopa virginica* is not egalitarian, but is not traditionally caste-based. Excavation of nests, and measures of wear and reproductive rates, indicate that *X. virginica* lives in societies where one or more foundresses dominate both reproduction and work. This results in a situation where the same individual does the most work, and also has highest reproductive rates. This social environment is in contrast to egalitarian and classical caste based societies. (**BEHAVIOURAL ECOLOGY**)

Sexual Selection on Age- and Condition-Dependent Traits in the Ambush Bug *Phymata americana* (Heteroptera: Phymatidae)

David Punzalan*, Locke Rowe and Helen Rodd

University of Toronto

The ambush bug *Phymata americana* exhibits sexual dimorphism in colour pattern; though some components of colour are expressed by both sexes, some components are limited to males. The evolutionary significance of this dimorphism is unclear. We conducted a series of studies to determine the strength of selection on components of colour pattern, as well as the ontogeny of these traits. The first part of the study measured phenotypic selection on several morphological traits (including colour pattern) in both sexes, during two (early vs. late season) sampling periods. We detected significant directional selection on the male-limited trait, but only late in the season. No selection was detected on any other male traits, in either sampling period. For females, reproductive condition (residual body mass) was a good predictor of female mating status in both early and late sampling periods. There was no significant phenotypic selection on any other female trait during either sampling period. The second part of the study investigated the effects of age and condition (larval food availability) on the expression of colouration. Consistent with the predictions of the genic capture model, the sexually selected components of

male colour pattern exhibited strong condition-dependence while the non-sexually selected components did not. In addition, colour pattern (area), in both sexes increased asymptotically with age. These studies suggest that sexual dimorphism in *P. americana* is the result of sexual selection on an honest indicator of male condition and possibly, age. (**SEXUAL SELECTION**)

Using Neural Network Classifiers to Estimate the Degree of Morphological Similarity Between Mimics and Models

Arash Rashed*, Roderick S. Bain, Verity Cowper, Francis Gilbert and Thomas N. Sherratt
Carleton University

One of the problems in the study of mimicry is the lack of a quantitative and objective means of assessing the degree of similarity among mimics and potential models. In this presentation we describe the use of a feedforward neural network classifier to estimate the degree of similarity between selected species of hoverflies (Diptera: Syrphidae) and their potential hymenopteran models. The neural network was first trained to distinguish between non-mimetic flies and wasps, based on their morphology. By entering the morphological characteristics of test specimens, we used this trained network to: i) generate a measure of a specimen's similarity to both flies and wasps, ii) identify salient variables important in predicting the classes. We found that the nature of the training data could affect the performance of the neural network; in much the same way as a natural predator might be expected to behave. Indeed, to test whether our results correlated with that of birds, the classification of the neural network was formally compared with that of pigeons given the same training data. The advantages and disadvantages of the neural network, as a research tool for estimating the degree of similarity, are discussed. (**EVOLUITON 1**)

Cues Used for Toxic Prey Discrimination in the Gleaning Bat, *Myotis septentrionalis*

John M. Ratcliffe* and James H. Fullard
University of Toronto

As caterpillars, some arctiid moth species consume and sequester the toxins of host plants. As caterpillars and moths, many of these species have warning colouration. When moths, some also produce high frequency clicks in response to the echolocation calls of bats. Multi-modal cues in dangerous prey have two plausible explanations: (1) cues are tailored to specific predators or (2) cues have an additive or catalytic effect and must be experienced as a suite to be effective. To test the prediction that gleaning northern long-eared bats use visual or acoustic cues or both to discriminate toxic arctiid moths, we used six bats as subjects. Using a fluttering moth as a lure, each bat was individually and randomly presented with twelve freshly killed moths: four palatable and four unpalatable arctiids, and four palatable noctuids. Some unpalatable arctiids were paired with playbacks of arctiid clicks. Contrary to expectation, bats took 95% of all categories of moth. We suggest three possible explanations. One, visually and acoustically aposematic moths are rarely encountered. Two, a multi-modal suite of cues is necessary (i.e. playback not recognized). Or, three, visual cues are not effective against bats and clicks function as phantom echoes and are ineffective against gleaning bats. (**PREDATOR-PREY INTERACTIONS**)

Vulnerability of Frog Species to Hydroperiod: Inferences from Mesocosm Experiments

Pamela L. Rutherford*, Mark R. Forbes and Oluwayemisi K. Dare
Carleton University

Amphibian populations have been declining worldwide, predominantly as a result of habitat loss and degradation. One proposed approach to mitigate these declines is to create wetland habitat. Success of species in modified or new habitats should depend on the natural history of species under consideration and the degree to which the new wetland habitat has hydrological properties differing from natural wetlands. We investigated whether a representative ephemeral pond species (*Rana sylvatica* or the wood frog), and a representative congener that breeds in semi-permanent to permanent ponds (*R. pipiens* or the northern leopard frog), were vulnerable to water level regimes differing from those experienced typically during their larval development. We assessed vulnerability following separate rearing of tadpoles of both species in drawdown (drying) versus stable water levels, using artificial mesocosms. Mesocosms can emulate natural and degraded habitats and can help researchers prioritize problems or species for further consideration. Northern leopard frogs were affected greatly by the drying regime with only 5% of tadpoles completing metamorphosis and thus surviving. In contrast, wood frogs

accelerated development in the drying regime and ca. 80% reached metamorphosis. However, wood frogs subjected to stable water levels showed a 20% reduction in survival, even in the absence of larval predators. Our results, in the context of other research, caution that loss of ephemeral wetlands will not be mitigated by creation of permanent wetlands, even under conditions of reduced abundance or absence of larval predators. (**CONSERVATION BIOLOGY 2**)

The Role of Assortative Mating in Sympatric Polyploid Populations of *Chamerion angustifolium*

Holly A. Sabara* and Brian C. Husband

University of Guelph

Genome duplication (polyploidy) theoretically results in instantaneous reproductive isolation between polyploids and their progenitors as a result of strong postzygotic barriers. However, triploid hybrids have been found in nature, suggesting reproductive isolation may be incomplete. In this study we assessed the role of assortative mating as an important prezygotic barrier in limiting gene exchange between different cytotypes. In the Canadian Rockies, fireweed (*Chamerion angustifolium*) is variable for chromosome number, with cytotypes occurring both sympatrically and allopatrically. In 2002, I sampled seed from ten mixed cytotype populations throughout Kananaskis and Banff, Alberta, ranging in cytotype distribution from 3-90% tetraploid, with four populations reporting triploids. Seeds from plants in each population were grown in the greenhouse, and their ploidy inferred from estimates of DNA content using flow cytometry. We found only 4% of the resulting offspring were triploid, compared to 31% hybrids expected from random mating based on the proportion of each parental cytotype in the population. Inferred parental cytotypes were not significantly different from those reported in the field populations, with the largest proportion of triploids (45%) resulting from diploid mothers. These results suggest that assortative mating does play a role in strengthening reproductive isolation between cytotypes in sympathy. (**EVOLUTIONARY ECOLOGY**)

Haemolymph Loss as a Mating Cost for Male Sagebrush Crickets

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During mating, female sagebrush crickets, *Cyphoderris sttepitanus*, chew on males' fleshy hind wings and ingest haemolymph that seeping from they wounds they inflict. Males that have previously mated have a lower probability of remating than virgin males have of mating for the first time. This virgin-male mating advantage apparently arises because sexually fatigued non-virgin males are less able to sustain the costly acoustical signals required to attract additional females. This fatigue could stem either from the costs of manufacturing a new spermatophore or from the costs of replenishing haemolymph lost through female wing-feeding. To distinguish between these alternatives, we depleted virgin males of varying amounts of haemolymph to mimic haemolymph loss of non-virgin males without the attendant costs of spermatophore production. These males were then released in the field and recaptured over the course of the breeding season to monitor their mating success. Control males mated significantly sooner than did males depleted of 5 or 10 L of haemolymph. We conclude that the loss of haemolymph is sufficient to diminish a non-virgin male's ability to secure another mating, acting as a brake on the operation of sexual selection in this species. (**MATING SYSTEMS**)

Evolution of Species Geographic Range Limits: an Empirical Test of Model Assumptions

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Recent theory predicts that local adaptation in peripheral populations may be constrained by gene flow from a species' range centre. A critical assumption of the gene-flow selection balance model is that a species distribution follows a geographic abundant centre hypothesis with central populations occurring at higher frequency and density and with greater reproductive output than marginal populations, such that gene flow is asymmetric from central to marginal populations. However, despite theoretical validation of the model, there has been little empirical evidence to support its assumptions or predictions. As a

case study to test the underlying assumptions of this model, I have selected two West Coast dune endemic plant species, *Camissonia cheiranthifolia* (Onagraceae) and *Abronia umbellata* (Nyctaginaceae) whose geographic ranges follow the one-dimensional environmental gradient assumed by the model. Range-wide surveys of population abundance, demography and reproductive output; seem to suggest patterns of variation that follow at least some model assumptions. (EVOLUTIONARY ECOLOGY)

Claw Morphology, Prey Size Preference and Feeding Efficiency in *Pachygrapsus crassipes* and *Hemigrapsus nudus*

Marie-Pierre Schippers* and Elizabeth G. Boulding

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Claw morphology varies globally among crab species. Warmer water crabs are generally more specialized for crushing hard-shelled prey than crabs living in temperate waters. In the last few years, the distribution of *Pachygrapsus crassipes* has extended northward, up to the Canadian Pacific coast in habitats where *Hemigrapsus nudus* was the only grapsid crab present. *P. crassipes* may thus have claw characteristics that allow more efficient feeding behaviour on hard-shelled prey than *H. nudus*, its temperate water counterpart. Claw morphology (mechanical advantage and sarcomere length of closer muscle), prey-size preference and feeding efficiency on mussels (*Mytilus edulis* complex) were therefore compared between *P. crassipes* and *H. nudus*. No significant difference in mechanical advantage was observed between the two species. Closer muscle sarcomere lengths, on the other hand, were longer in *H. nudus* than in *P. crassipes*. Both *H. nudus* and *P. crassipes* preferred small mussels even though their most profitable prey were medium and large mussels, respectively. *H. nudus* were found to be more efficient at breaking open *M. edulis* because its shell breaking times were lower than *P. crassipes* for medium mussels. *H. nudus* thus have more specialized claws and are consequently feeding more efficiently on mussels than *P. crassipes*. (PREDATOR-PREY INTERACTIONS)

Relatedness and Dispersal Patterns in the Communally Breeding Smooth-Billed Ani

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McMaster University

Smooth-billed Anis (*Crotophaga ani*), family Cuculidae, are communal joint-nesters. Anis live in groups of up to 17 adults in our 2 field sites in southwest Puerto Rico. Group females typically lay eggs in the same nest and compete for representation in the incubated clutch of eggs by burying each others' eggs under leaves and nesting material. Males or females may also toss eggs out of the joint nest. Nonetheless, group members co-operate after the egg tossing/burial stage and share incubation, territory defense, and care of young, though not evenly. Here, we examine relatedness and patterns of dispersal using microsatellite analyses and field observations. In the majority of groups, most adult group members were not considered closely related ($r = 0.5$). Two groups however were made up of highly related members. Overall, only about 25% of adult dyads from the same group were considered close relatives and most of this effect can be explained by the two highly related groups. Taken together with field observations, these results suggest different patterns of dispersal in anis where most males and females disperse to join unrelated individuals while in a minority of groups many young remain on natal territories with their relatives. (BEHAVIORAL ECOLOGY)

Single Nucleotide Primer (SNP) Development in the Black Rhinoceros Subspecies *Diceros bicornis bicornis*

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We are engaged in ongoing conservation genetics of the Black rhinoceros from Etosha National Park in Namibia. Our recent work and have recently completed a survey of polymorphism at 9 microsatellite loci in 126 of these animals (Kim et al. this conference). The relatively low polymorphism $H_{obs}=0.415$ at these markers motivated development of potentially more variable single nucleotide polymorphisms (SNPs). Here we describe our progress in the development of multiple SNP loci for this species. After conducting a series of genome complexity reduction amplifications (GCR-PCR) using various DOP (degenerative oligonucleotide priming sites) we report GCR conditions that produce consistent fragment patterns across 3 Black rhino samples. From this PCR we selected amplicons between 300-1500 base pairs to clone. An initial 500 clones

representing a full spectrum of fragment sizes were chosen to sequence. Primers were designed for most of these sequences after low quality and duplicate sequences as well as those with highly repetitive elements of DNA such as VNTRs were discarded. Here we report polymorphism data on 5 optimized loci from this set and evaluate them as Black rhino SNP's. (CB2: CONSERVATION BIOLOGY 2)

Fish Habitat Assessment in the Eastern Lake Erie Basin

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Lake Erie has experienced extensive changes in water quality conditions and community structure over the past decade. As a result, there has been a substantial decline in the walleye (*Stizostedion vitreum vitreum*) population, an important sport and commercial fish in the region. Environmental monitoring surveys were conducted in the eastern basin of Lake Erie over a nine month period in 2001 to acquire a detailed assessment of water quality conditions by collecting near-continuous and discrete measurements of selected water quality and physical parameters over a survey track extending the nearshore and lower reaches of tributaries. Additionally, nearshore fish community data were gathered across the same region. Using these data, an assessment of habitat and fish community composition was possible on both a spatial and temporal scale. Impairments to walleye habitat were assessed and modeled using water quality conditions (for example, temperature and light intensity) in order to identify suitable regions for walleye in different life stages. Therefore, the relationships between physical habitat, water quality and chemistry can be associated with the nearshore fish assemblages to evaluate environmental remedial options in order to enhance the production of the target fish species. (COMMUNITY ECOLOGY 1)

Sentinel Mice Detect Heritable DNA Mutations Induced by Air Pollution

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Germline mutation screening at minisatellite DNA loci in Great Lakes herring gulls showed higher mutation rates in colonies nesting near integrated steel mills than those at rural sites. These DNA changes were likely induced by chemical contaminants, but the route of exposure, airborne or aquatic, could not be determined. To address this issue, we exposed sentinel laboratory mice to ambient air for 10 weeks at a site near two integrated steel mills, and simultaneously at a rural site removed from point sources of pollution. We then bred the mice and compared heritable mutation rates at expanded-simple-tandem-repeat (ESTR) DNA loci. We found a near doubling in mutation frequency in steel mice, primarily through the paternal germline, indicating that air pollution exposure in industrial areas can cause trans-generational genetic effects. In a follow-up experiment, we exposed mice at the same locations, but included additional groups of animals that received only HEPA filtered (particles removed) ambient air. Genetic analyses revealed that HEPA filtration reduced ESTR mutation frequency in male mice exposed to polluted air. Our results suggest that humans and wildlife living in urban / industrial environments may be at risk of elevated heritable mutation rates through exposure to airborne particles. (CONSERVATION BIOLOGY 1)

Song and Male Quality in Savannah Sparrows (*Passerculus sandwichensis*)

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In this study, we investigated whether song can be used as a signal of male quality in a three years field study of a London population of Savannah Sparrows, *Passerculus sandwichensis*. Song rate and song structure (measured by temporal and frequency attributes) were examined as possible cues of male quality, and then were related to attributes of males reproductive activity (males' mating and breeding success, male parental effort, and territory size) and morphological characteristics. Significant correlations between male reproductive performance and song characters were found in several song features, in which the duration of song played an important role. Males possessing longer duration songs established a territory earlier, held the larger territory, paired more quickly, and fledged more chicks. The results suggest that important aspects of male quality may be signalled by song attributes. (ECOLOGY 2)

Histological Response of Fish Gills to Abnormal Ion Balance in the Kenti River System (Kostomuksha Area, NW Karelia, Russia)

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University of Joensuu

The production operations of the mining company Karelian Pellet affect the environment by air pollution and wastewater emissions to lakes downstream from the factory. The toxic effects of the mining effluents on gills of perch (*Perca fluviatilis*) and roach (*Rutilus rutilus*) were studied. In the water course below Mining Plant, the concentrations of essential ions and lithium were abnormally high. In areas close to the mining plant, heavy metal concentrations were normal, even though the metal content in sediment was elevated. The electron-microscopical structure of the gills was changed. The numbers of mucus cells, the sizes of the chloride- and pavement cells and the length of the open area in the chloride cells had increased. Lipid composition changes seasonally and an proportion of triglycerides had increased during the cold season. Changes in gill cholesterol and phospholipid proportions increase the fluidity of membranes and possibly strengthens their protective qualities, counterbalancing the adverse changes in chloride cell structure. The structural changes found in gills are probably caused by high levels and abnormal ratios of the main water ions. The bioavailability and toxic effects of metals on fishes are depressed by the hardness and high pH of water discharged by the plant. (**ECOLOGY 2**)

A Comparative Analysis Between Abandoned Limestone Quarry Floors in Southern Ontario and Alvares on the Bruce Peninsula and the Effects of Seed Bank and Seed Rain Communities on the Vegetative Composition in Quarries

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Quarrying can alter or remove communities of native plants, but restoration ecology offers tools to repair this damage. Very little rehabilitation has been carried out in abandoned quarries despite legislation that requires extraction companies to restore the land. A possible restoration goal is to rehabilitate abandoned limestone quarry floors to alvar habitat. Alvares consist of large areas of flat limestone pavement and patches of thin, alkaline soils. The goal of this research is to determine the degree of ecological difference between alvars and limestone quarry floors in Ontario. The results from the biological and physical survey of alvars on the Bruce Peninsula will be compared to those from abandoned quarries throughout Southern Ontario. A second part of this research will include a seed bank and seed rain analysis to determine which seeds are present and to compare the results to the composition of the vegetative community. Once the results from the survey and the seed bank and seed rain analysis are known, effective guidelines can be applied to the restoration of quarry floors. (**COMMUNITY ECOLOGY 2**)

Macrophyte-Flow Interactions in Bladed, Whorled and Dissected Leaved Plants

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Similar leaf morphologies (e.g. bladed, whorled, and dissected) occur convergently in aquatic plants. It is likely that fluid dynamics have had an effect on plant morphology, by acting on exchange processes at low flows and drag forces (e.g. dislodgment) at higher flows. Bladed (*Vallisneria americana*), whorled (*Elodea canadensis*), and dissected (*Ceratophyllum demersum*) leaf morphologies were examined using flow visualization at five velocities (1 - 11 cm/s) in a recirculating flow chamber. Photographs taken of Fluorescein dye show that the transition from laminar to turbulent flow occurred at 2 cm/s for *Vallisneria*, 2-5 cm/s for *Elodea*, and 5-9 cm/s for *Ceratophyllum*. Von Karman vortex streets occurred only on the bladed and whorled morphologies at 5 and 9 cm/s, respectively. In *Vallisneria*, the flow moved along the blade

and recirculated under the leaf; in *Elodea* the flow separated around the whorls and recirculated behind the stem; and the flow in *Ceratophyllum* separated through the mesh-like leaf structure. Statistical analysis showed that the area of dye coverage increased with velocity in *Vallisneria* and *Elodea*, but the rate decreased in *Ceratophyllum*. It appears that aquatic plants alter the flow in ways that maximizes flow across leaves, thus enhancing mass transfer. (**PLANT ECOLOGY**)

Correlates of Insect Community Structure in Decaying Pine Logs

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Coarse woody debris supports a rich and diverse insect fauna that carries out many important ecological functions within forest ecosystems. In spite of a long history of research on insects associated with dead and decaying wood, our present understanding of these communities and the factors affecting their composition remains fragmentary. In this study, I reared and collected insects emerging from pine logs in Algonquin Park, Ontario. My objectives were 1) to describe the community structure of Diptera, Coleoptera and Hymenoptera families emerging from pine logs in various states of decay; and 2) to relate patterns of community variation to major decay-related log characteristics. Principal components analysis (PCA) showed that these insect communities were clearly structured along a gradient in log decomposition, with most families associated with logs in either early or late stages of decay. Different combinations of log characteristics could explain the observed patterns of community variation, however, making it difficult to identify specific variables driving successional community dynamics. It appears that insect community structure is either responding to other unmeasured variables associated with log decay, or is simply a function of the general state of wood decomposition. (**COMMUNITY ECOLOGY 1**)

Influence of Specificity in Induced Plant Responses on the Population Size of Herbivores

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Recent studies have found that induced plant responses to herbivory can cause changes in herbivore population size. Here we further examine whether specificity in plant responses to separate early-season attackers can differentially affect herbivore populations. We created an experimental landscape of 60 *Solanum dulcamara* patches each with one of three different early season herbivory treatments: *Psylliodes affinis*, *Plagiometriona clavata*, or mechanical damage. Following the initial damaging phase, four individually marked adult *P. clavata* were introduced into each patch, and their movement between patches was regularly assessed over the growing season. We also determined the abundance of each *P. clavata* life stage, along with final population size of second-generation adults. Marked *P. clavata* adults generally remained in the same patch between weeks, suggesting that the distance between patches was a barrier to movement. Surprisingly, herbivory by either *P. affinis* or *P. clavata* produced larger final population sizes than mechanical damage. Chemical analyses of plant tissues suggests that induction in mechanically damaged patches was initiated by the introduced, marked *P. clavata* adults 1-2 weeks after it had begun in other patches, causing strong late-season resistance in only this patch type. (**PLANT ECOLOGY**)

Influence of infant and child facial cues of low body weight on adoption preference

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Konrad Lorenz hypothesized that infant facial features may have evolved to evoke parental care from adults. Infant and child facial cues have been shown to influence decisions and perceptions associated with parental care in adults. Low body weight reflects health problems in infants and children that were present in our ancestral environment. Therefore, infant and child facial cues associated with low body weight may influence evolved adult cognitive processes associated with parental care and investment. Facial images of infants and children were digitally manipulated to simulate cues of low body weight, and were presented to adults using a hypothetical adoption paradigm. Participants' ratings of adoption preference, cuteness, and health were significantly lower for the digitally manipulated low body weight facial images than their normal, unaltered counterparts. These findings support the hypothesis that infant and child facial cues of poor health negatively influence adults' responses to infants and children. (**COMMUNICATION 2**)

A Neutral Theoretical Analysis of Diversity in Size-Structured Pelagic Communities

Steve C. Walker

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S.P. Hubbell's (2001) neutral theory asserts that many observed patterns in biogeography and community ecology can be explained by assuming that all individuals, regardless of species, are demographically identical. Given several additional assumptions, the neutral theory predicts that the diversity of a community (as measured by Fisher's alpha index) should be directly proportional to the density of individuals. However, since the density of individuals is known to vary as a power law of geometric mean body size (exponent = -0.99), diversity should also vary as body size to a similar exponent. Pelagic lake communities are model systems with which to test this hypothesis since the variability in body size between phytoplankton, zooplankton and fish communities is much greater than the variability within each community type. Using published data sets ($n = 25$), it was found that diversity does decrease with body size but with a less negative exponent (= -0.07) than predicted. This result has implications for current theoretical debates in macroecology. (**COMMUNITY ECOLOGY 1**)

Marine Nutrients and Terrestrial Flora: Testing the "Subsidized Island Biogeography Hypothesis"

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Contrary to classical island biogeographic theory, small islands often do not fit the standard species-area curve. Recently, a "subsidized island hypothesis" was proposed to more accurately predict and describe patterns of species richness on small islands. This new conceptual model synthesizes island theory with the unimodal curve often used to describe the productivity-diversity relationship. It suggests that small islands, due to their greater perimeter to area ratio, may support enhanced productivity and subsequently, greater species diversity. We test this hypothesis on a suite of small islands in Barkley Sound, British Columbia. During the summer of 2003, preliminary vegetation surveys were undertaken to ascertain island floral diversity. TWINSPAN analysis identified eight vegetation communities, and ordination methods were used to identify gradients in species composition. Future work will ascertain floral productivity and levels of marine nutrient enrichment using isotopic ratios of ^{15}N to ^{14}N . Patterns of productivity and marine derived nutrient enrichments for select species will be analyzed and among and between island comparisons made. This work may demonstrate why the species-area relationship premise of island biogeographic theory does not always adequately explain diversity patterns on small islands. (**COMMUNITY ECOLOGY 1**)

Spatial Effects and Evolution in Host-Parasite Systems

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Perfectly adapted pathogens would be expected to induce no host mortality (zero virulence) and to possess maximal transmissibility. Similarly, perfectly adapted hosts would be expected to mount completely effective immune responses. Explaining the absence of such perfect adaptation in host-pathogen interactions has been the focus of a large body of literature. Functional constraints have provided the mechanistic basis for understanding these patterns and have influenced much of the host/parasite (co-) evolutionary modeling work. From this perspective, non-zero virulence arises due to a positive genetic correlation with transmissibility, while imperfect resistance results from conflicts of resource allocation to competing host life history traits. Indeed, models of host/parasite evolution that invoke mean field approximations, where the entire host population is an invading parasite's local environment, require the existence of such trade-offs to account for the evolutionary stability of intermediate levels of virulence. An alternative (though not mutually exclusive) approach is to explicitly model the spatial arena within which host-parasite interactions take place, without a priori trait correlation assumptions. In these kinds of models, host population viscosity (limited offspring dispersal) and small infection

neighbourhoods can lead to spatial correlations such that hosts of the same infection status tend to form clumped distributions. By this mechanism, the forces of group and kin selection become important determinants of evolutionary outcomes. The research that I will be presenting is an analysis of how these kinds of spatial correlations can influence selective pressures in such a way as to generate host (parasite) trait correlations. (**HOST-PARASITE INTERACTIONS**)

The Evolutionary Genetics of Specialization: Increased Genetic Differentiation and Reduced Genetic Variation in Specialist Bees

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Oligolectic bees collect pollen from one or a few closely related species of plants, while polylectic bees visit a variety of flowers. Because of their more restricted range of host plants, it may be expected that specialists exist in more isolated populations, with lower effective population sizes (N_e) than do generalists. We tested this hypothesis by examining levels of genetic variation in five phylogenetically independent oligolectic/polylectic species pairs. Within each pair, the oligolectic member had fewer polymorphic loci, lower allelic richness, and lower expected heterozygosity than its polylectic relative. This pattern of reduced genetic variation in specialists was statistically significant. We also tested the hypothesis of greater isolation of specialist populations by comparing levels of genetic differentiation in one species pair. Populations of the specialist species had significantly higher levels of genetic differentiation than those of the generalist over identical geographic distances. Our data support the hypothesis of greater isolation and lower N_e in specialist populations and suggest that they may be more extinction prone as a result. Our results also shed light on the peculiar biodiversity patterns of bees worldwide. (**EVOLUTIONARY ECOLOGY**)

POSTER ABSTRACTS

(listed alphabetically by first author)

Phylogenetic and Protein Motif Analysis of the CBF/DREB1 Gene Family

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CRT-binding factors (CBFs) or drought-responsive element binding1 factors (DREB1s) belong to the APETALLA2 (AP2) superfamily of transcription factors. Expression of CBF/DREB1 genes is enhanced upon exposure to low non-freezing temperatures, and their protein products are responsible for the induction of a number of cold-regulated (COR) genes necessary for freezing tolerance. Bayesian and Parsimony phylogenetic analyses of CBF/DREB1 genes reported thus far suggest that the ancestor of the CBF/DREB1 gene family arose before the evolutionary divergence of monocots and dicots. Genes representing the entire CBF/DREB1 gene family of *Arabidopsis thaliana* and *Oryza sativa* form three distinct clades within the dicot and monocot clades respectively, suggesting that at least three gene duplication events gave rise to three different CBF/DREB1 types in each species. Analysis of the amino acid sequences of these proteins with the Multiple Em for Motif Elicitation (MEME) programme resulted in the identification of a number of dicot- and monocot-specific motifs including two in the activation domain and one monocot-specific N-terminal motif. These results are a good beginning to classification of the CBF/DREB1 gene family, analysis of its evolutionary diversification, and predictions of functionally important protein motifs suggested by their conservation.

Orange Ornaments and Choosey Males: First Evidence of Male Mate Choice Based on Female Ornaments in a Fish Species Exhibiting Biparental Care

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Most animal mating systems are characterized by female mate choice since their investment in eggs and parental care is greater than the male's investment. However, male mate choice is expected when males invest considerable energy in the production or care of offspring or when sexually viable males are limited. High energy costs associated with egg production and parental care also seem to explain the rarity of female ornaments, since acquiring ornamentation requires energy that could otherwise be allocated to egg production. Our study on convict cichlids, *Cichlasoma nigrofasciatum*, is the first evidence of male mate choice based on female ornaments in a species providing biparental offspring care. We conducted mate choice experiments by offering males a choice between courting two females. The females were matched for size and activity levels and varied in the amount of orange colouration expressed in their ventral patches. Our experimental design also eliminated female behavioural response to male courtship that may bias male choice. We found a strong male preference for brightly ornamented females. Our study suggests that female ornaments may be expected if males take advantage of such cues in choosing potential mates and if variation in female quality is correlated with variation in female ornaments.

Should I Jump or Should I Glide? Locomotory Performance in the Mottled Grasshopper *Myrmeleotettix maculatus* Relative to Sex and Temperature

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In most animals, active movements are essential when looking for several resources. Patterns of locomotion may directly or indirectly depend on the morphology of an animal, total size being one of the major foci. In grasshoppers, sexual body size dimorphism is common, females being the larger sex. Due to isometric scaling one thus may expect females to jump less far than males. In these ectothermic insects, locomotory performances are affected by environmental conditions (e.g. ambient temperature). Here, we addressed the following questions: 1) Do males jump larger distances than females? and 2) Does an individual jump further under sunny than under shaded conditions? We performed a field experiment in which males and females *Myrmeleotettix maculatus* were triggered to jump in full sun or full shade. Average maximum jumping distance of males was significantly further than in females. At the intra-individual level, jumping distance was further in direct sunlight than in the shade. Interestingly, jumping distance could be increased considerably by spreading the wings. Males adopted gliding flight more frequently. Furthermore, gliding occurred more frequently under sunny conditions. In conclusion, jumping

performance in *M. maculatus* was improved by means of a behavioural adaptation (wing-use) rather than by size or temperature conditions.

Interval Timing in Bumble Bees, *Bombus impatiens*

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Animals use temporal information in different ways. In a foraging context, this might mean remembering times during the day when food is available or measuring elapsed time intervals between encounters with food. Unlike circadian timing, little is known about interval timing abilities in bees or other invertebrates. Indeed, investigations of interval timing have focused primarily on pigeons and rats. We investigated interval timing in bumble bees using fixed-interval (FI) 12 sec and 24 sec schedules. On an FI schedule, animals are rewarded for the first response that follows a fixed interval since the last reward. Bumble bees withheld responding immediately following reward on both FI schedules, with a longer period of pausing on the FI 24 sec schedule. Mean rates of responding varied with time elapsed in the interval, with peak rates occurring at or very close to the FI values. This pattern is qualitatively similar to those from birds and mammals. To our knowledge these are the first data to suggest that bumble bees, or any invertebrate, may be capable of timing brief intervals.

Salt Marsh Snails: Mendelian Inheritance at Microsatellite Locus Lsub 62

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Mate choice preference is currently under investigation for the salt marsh snail, *Littorina subrotundata*, using the Lsub microsatellite primers. The study was conducted in order to determine whether the microsatellite locus Lsub 62 conforms to Mendelian inheritance expectations. Wild, sexually mature *Littorina subrotundata* snails were collected off the coast of B.C. near the Bamfield Marine Science Center and allowed to lay eggs, which were reared to shell length of 2mm. Females and their offspring were analyzed for Mendelian inheritance at the Lsub 62 locus. DNA was extracted using the Chelex (InstageneTM Matrix) DNA extraction protocol. PCR amplifications were carried out using the Lsub 62 polymorphic microsatellite primer and products were electrophoresed on 2% agarose gels and later, on 5% non-denaturing silver-staining acrylamide gels. The Chi-square Goodness of Fit Test determined that offspring inherited a minimum of one putative maternal allele, and therefore Lsub 62 conformed to Mendelian inheritance expectations ($p > 0.05$) and may be used in paternity studies. Multiple paternities were observed in the snail family B, supporting previous findings.

Reflective Environment and Socialization Influence Exploratory Behaviour in *Procambarus clarkii*

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The present study examined a role for visual input and effect of socialization on spontaneous exploratory behaviour in intact crayfish, *Procambarus clarkii*. The predominant elements of crayfish locomotor behaviour were determined by observing the activity of adult crayfish in glass aquarium. Individual crayfish were observed for 20 minute periods. Five discrete behavioural patterns were observed and classified: lifting, turning around, cornering, backward movement, and crossing. We tested whether the reflection from the glass of the aquarium influences these behaviours. Conditions that reduced reflection decreased the occurrence of lifting, cornering and turning-around behaviours. These conditions included the presence of black paper on the inside of the aquarium, the presence of black paint on the outside of the aquarium and the presence of translucent, non-reflective plastic on the inside of the aquarium. In a tank containing mirrors and non-reflective plastic, crayfish cornered, lifted, and turned around more in front of the mirrors. Additionally, socialization also influenced crayfish ability to respond to mirrors. Crayfish that were housed in pairs for two weeks had all of their behavioural responses enhanced. Thus, the reflective environment of a glass aquarium and prior socialization or isolation can influence the exploratory behaviour of crayfish in an empty tank.

Nestedness in Vascular Plant Communities: Examining the Effects of Non-Native Species in Nested Subset Detection

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Analyses of nested patterns lead to hypotheses about the processes that create these non-random species distributions. Nestedness is useful for elucidating environmental or anthropogenic variables that might be shaping the distribution of a particular taxon in an archipelago or "fragmented landscape". However, although fragmentation is a documented cause of species decline, non-native species are also worrisome and becoming much more problematic and widespread globally. Despite the relative importance of non-native species on an ecosystem, no studies of nestedness have considered its consequence. We examined the effects of non-native vascular plant species while calculating community nestedness for 50 forest fragments in Ontario, Canada. Nestedness was calculated for natives alone, non-natives alone, and natives and non-natives combined. Non-native species were more nested than natives (11.27° and 23.74° respectively) or the whole data set combined (23.29°). Our results suggest that the influence of non-native species in the calculation of nestedness is negligible. The causative factors shaping the nested vascular plant native and non-native communities are explored and discussed, although we suggest that the factors shaping most other taxa, such as heterogeneity and fragment area, are different than those shaping plant communities.

Morphological Analysis of Two Species of Blacknose Dace

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Inconsistencies between two studies examining the morphological differentiation between the two species of blacknose dace (*Rhinichthys atratulus* and *R. obtusus*) led to the present morphological analysis of the two species in Canada, with a focus on the sympatric zone. A previous study conducted in Virginian populations, in which included one sympatric zone, concluded that the two species could be differentiated. While, a similar study conducted in Canadian allopatric populations found that the species could not be differentiated morphologically. If character displacement was causing the greater differentiation seen in Virginia than morphological and meristic characters will be more variable in sympatric Canadian populations than in allopatric Canadian populations. Six morphological and four meristic characters were measured for 20 populations across the blacknose dace's Canadian range. Seven of these populations were assumed to be sympatric. Variance between individuals in allopatric and sympatric zones were compared both univariately and multivariately. Only in the multivariate analysis did individuals appear to be more variable in sympatry. Thus, only weak support is given to the character displacement hypothesis, which is therefore unlikely the cause of the discrepancy between the two studies.

Dietary Cu Uptake by Rainbow Trout - Interactions with Sodium

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Cu, an essential element, is toxic at high levels but necessary in trace amounts to maintain normal cell function; therefore, it is tightly regulated in most organisms, including fish. Fish can take up Cu via two routes: gills and gut. In the gills, Cu can enter the body via the same cellular pathway as that involved in uptake of Na from the water. Therefore, increased water [Na] reduces Cu uptake through the gills by a competitive effect, and increased dietary [Na] reduces Cu uptake by down-regulating the activity of the Na uptake pathway. Quantitatively, the gut is normally the more important pathway for Cu uptake, so we attempted to determine whether mechanisms in the gut were similar to those in the gill. Our results suggest that the situation at the gut differs from that at the gills. In vivo, elevated dietary Na did not reduce the accumulation of Cu from the diet under normal or high dietary [Cu] conditions. In vitro tests indicated a Na-sensitive component to intestinal Cu uptake, but one that is manifested as a stimulation of Cu uptake by high Na levels. From a health perspective, excess or deficiency in dietary Na may be a significant risk factor in Cu homeostasis.

Understanding the Role of P53 in the Radiation-Induced Adaptive Response in the Mammalian Germ Line

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Adaptive response has been clearly demonstrated in many model systems; however its impact on heritable effects in the mammalian germline has never been studied. Expanded Simple Tandem Repeat (ESTR) loci have been used as markers demonstrating that induced heritable mutations in mice follow a dose-response relationship; however, the relationship between ESTR mutation and biological risk is unknown. Recent data in our laboratory show evidence of low dose radiation-induced adaptive response suppressing high dose radiation-induced germline mutations at ESTR loci in wild type mice. In order to determine what function p53 has in adaptive response for heritable mutations, we have mated irradiated Trp53^{+/-} male mice (C57Bl) to unirradiated, normal females. Using DNA fingerprinting, we are investigating the rate of inherited radiation-induced mutations radiation-treated gametocytes by examining mutation frequencies in offspring DNA. We currently see no significant difference in germline mutation rates in irradiated and unirradiated treatment groups. The reasons for this are not clear, but if this trend holds this may indicate that p53 homozygosity in the paternal germline is necessary for ESTR mutation induction. This research is significant in that it is able to provide insight to understanding the mechanism behind induced ESTR mutations and/or induced adaptive response in the mammalian germline.

Possible Factors Determining the Biogeographical Distribution Patterns of *Littorina* Species Along the Pacific Coast of North America

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The biogeographical distribution patterns of marine invertebrates are influenced by biological factors, such as population genetics/genetic diversity, mode of development, demographic characteristics, and ecophysiological traits as well as by physical factors including Sea Surface Temperature (SST). Five indigenous and one non-indigenous *Littorina* species are known to exist on the Pacific Coast of North America. Three species (*L. plena*, *L. scutulata*, *L. keenae*) have a free-swimming larval stage that facilitates long range dispersal, while three others (*L. subrotundata*, *L. sitkana*, *L. saxatilis*) have direct development into miniature adults. The overall objective of our proposed study is to determine which factors have major effects on the biogeographical distribution patterns of *Littorina* species. This study will attempt to relate the population genetic structure of these species to their mode of development, using the mitochondrial cytochrome b gene in addition to a nuclear DNA marker, an intron of aminopeptidase N gene (APN54). We will also attempt to examine if there is a positive correlation between local genetic diversity and local population density. In addition, we will investigate if there is variation or clines in desiccation and temperature tolerance of these species with latitude. Finally, we will apply climate envelope models to predict shifts in species' geographical ranges in response to global warming.

Plant Species Diversity, Abundance and Distribution Along a Heavy-Metal Pollution Gradient

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Plant species diversity, abundance, and distribution were studied along a 20-km transect running NE from a copper-nickel smelter in Falconbridge, ON. Long-term accumulation of heavy metals along this transect has severely degraded plant communities. Ordination by PCA indicated that the floristic composition was differentiated in response to the pollution level.

The total coverage and the number of plant species increased with increasing distance from the smelter. Cover and diversity of vascular plants was limited by high concentrations of Cu, Ni, As, and Pb; bryophyte species, however, were commonly found growing in soils containing elevated levels of these metals. Vascular species tolerant of the phytotoxic conditions were, generally, restricted to sub-canopy locations under sparsely distributed trees, creating 'islands' of vegetation. In contrast, bryophyte species were present in exposed areas between trees. A comparison with earlier studies suggests plant diversity has increased in response to decreased annual emissions; most noteworthy, the colonization of several graminoid species and *Betula papyrifera* within 1.23 km of the smelter. The colonization of *B. papyrifera* has created favourable, sub-canopy,

microhabitats for the colonization of several shrub, herb, and pteridophyte species and will likely play an important role in further recovery of this degraded landscape.

Predation Risk Influences Feeding but Not Substrate Use in Round Gobies

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The round goby, *Neogobius melanostomus*, is a newly invasive species in the Great Lakes and was first caught in Lake Ontario in 1998. Recent work has suggested that round gobies have had deleterious effects on native fish species and that the round goby has become a new food source for a number of aquatic birds. This study was conducted to evaluate how perceived predation risk influences food and substrate preferences in round gobies. Using a model avian predator (double-breasted cormorant, *Phalacrocorax auritus*), we found that gobies employ one of three anti-predatory tactics: burying themselves in the substrate, freezing and darting away. In addition, predation risk elevated breathing rates but reduced feeding rates and movement. However, we did not find a change in substrate preference as predation risk increased. These laboratory results will be discussed in relation to goby and cormorant habitat density data collected from Hamilton Harbour in Lake Ontario.

Rapid Evolution During Biological Invasion: Genetic Differentiation Among Introduced Populations of Purple Loosestrife (*Lythrum salicaria*)

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Queen's University

Although the ecological impacts of biological invasions have been well studied, the evolutionary changes that occur within a species during invasion are not well understood. It is believed that during invasion, non-indigenous species can rapidly evolve both due to stochastic effects such as founder effect and genetic drift and in response to new selective pressures, which can lead to changes in morphology and life history strategies. It is believed that the evolutionary changes occurring within an invading species can contribute to its invasive potential and thus an understanding of the evolutionary consequences of biological invasion is important for management and control of these species. I am investigating the evolutionary consequences of invasion by Purple Loosestrife (*Lythrum salicaria*) into North America by comparing 26 populations along a latitudinal transect of eastern North America for genetic differentiation in a common environment. Populations along the transect will be compared for clinal variation in morphological and life history traits such as germination time and flowering phenology that may be indicative of rapid adaptation.

Female Laughter as a Signal for Mate Choice Copying

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Mate choice copying is believed to be a strategy employed by females to reduce costly mate sampling. A number of theorists have argued that humour production is an indicator of genetic quality and therefore should increase attractiveness. In addition, laughter has been shown to be a strong predictor of a woman's interest in a man. Hence, we investigated whether laughter from men versus women affects mate choice and is a cue for copying. In our study, men who elicited laughter from females were preferred and considered more attractive than men who elicited laughter from other males. Women preferred such men who made other women laugh across a range of relationship types from short term dates to long term exclusive relationships. In contrast, men did not broadly choose the women who made other men laugh as more desirable. Interestingly, the use of humour increased overall ratings of attractiveness for both sexes equally. To the best of our knowledge this is the first demonstration of same-sex conspecific cueing in humans.

The Use of Molecular Pedigree Analysis to Study Reproductive Success and Selection on Body Size in a Natural Population of Brook Charr (*Salvelinus fontinalis*)

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Molecular markers can currently be used both as genetic tags and to infer pedigree relationships between individuals in wild populations. This application of genetic information allows several aspects of the biology of natural populations to be studied from perspectives that were not possible a decade ago. The use of molecular markers as tags allows very young or small (<1g) individuals to be recognized and tracked, allowing processes such as selection and dispersal to be directly studied. The use of markers to infer pedigree relationships can allow more advanced selection analyses to be applied, can allow reproductive success to be evaluated, and also provides the opportunity to study the genetic architecture of fitness related traits in the wild. I am currently reconstructing pedigree relationships in the 2002 cohort of brook charr (*Salvelinus fontinalis*) from the Freshwater River on Cape Race, Newfoundland, using microsatellite markers. We are using data from this exercise to study reproductive success, selection on body size, the genetic architecture of growth and body size, and juvenile dispersal. We will be presenting potential strategies for analyzing molecular data such as that which we are currently collecting, as well as some applications of these techniques of our preliminary data.

Variable Damage to *Lobelia siphilitica* by a Pre-Dispersal Seed Predator, *Cleopmarius hispidulus*, and its Implications for Floral Evolution

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Pre-dispersal seed predators that oviposit within buds or flowers of outcrossing, animal-pollinated plants depend on pollinators for seed production. Therefore, foraging females are expected to choose flowers most likely to set fruit (i.e. flowers attractive to those pollinators) providing a mechanism by which seed predators could impose selection on floral traits. Relatively few studies have examined selection by seed predators and more research is needed to assess the relative importance of selection by seed predators and pollinators and identify the targets of selection. Here, we present survey data of damage to *Lobelia siphilitica* (Lobeliaceae) fruits by the weevil *Cleopmarius hispidulus* (Coleoptera: Curculionidae) from six populations in New York, Iowa and Ontario. High and variable damage within and among populations shows potential for this seed predator to exert selection pressure on floral traits in *L. siphilitica*. Specifically, earlier fruits had greater damage than later ones, suggesting that phonological traits may be a target of selection. We also present the experimental design of our upcoming field season, in which we will manipulate phenology to assess whether this and other floral traits are under selection by pre-dispersal seed predators and the relative importance of phenotypic selection by seed predators and pollinators.

Selection and the Evolution of Integrated Plastic Responses During Early Adaptive Divergence

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Colonization of a novel environment can result in adaptive divergence when selection favours a new phenotypic optimum. When the novel environment induces substantial phenotypically plastic responses and genetic variation exists in the form of these responses, then selection may initially favour the accumulation and integration of appropriate plastic responses. We show that sunfish ecomorphs that have recently colonized the open water habitat of lakes show a greater coordination and a similar form of plastic responses, that is, distinct from coexisting and ancestral shallow water ecomorphs. Convergence on more coordinated plastic responses by open water ecomorphs across different populations suggests that selection has promoted its evolution. Genetic variation in the coordination of plastic responses exists between ecomorphs within and among populations. In two populations, the greater coordination of plastic responses by open water ecomorphs results from stronger

plastic responses to the environmental gradient compared to the local shallow water ecomorph. This indicates that some of the earliest evolutionary changes that can occur during adaptive divergence involve changes in the magnitude and coordination of phenotypically plastic traits. The genetic assimilation of these plastic responses could result in the further divergence of such populations.

Natural vs. Assisted Vegetation Recovery in the Great Lakes-St. Lawrence Forest, Ontario

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The industrially damaged forest ecosystems of Sudbury, Ontario have undergone a multi-stage revegetation program that involved liming, fertilizing, grassing, and tree planting. A combination of native and non-native legume and tree species were planted under the assumption that non-native species would serve as "nurse" plants to create a hospitable environment for native species. Current complex systems theory and methodology were applied to explore the species composition and dynamics of present and future states of the restored areas. Emphasis was placed on the effects that initial conditions and time have on the assisted recovery process. Restored sites were chosen to reflect varying lengths of time since restoration. Understorey and overstorey vegetation abundance and structure data were collected from these restored sites and from unrestored reference sites. Multivariate analytical techniques were used to compare assisted (restored) with unassisted (unrestored) recovery pathways. Direct measurement of abiotic factors such as soil moisture, canopy cover, distance to continuous forest, and distance to point sources of pollution were measured at each site to tease apart effects contributing to plant species composition. Results will be presented and will help to establish governing rules for the complex nature of the recovery process to help guide future restoration efforts.

Establishing a Graduate Student-Based Science Outreach Program at an Ontario University

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Technological advances in the last half-century have resulted in increased use of scientific language in the general media and in language directed at consumers. However, this increase has not been accompanied by an improvement in the delivery of science curricula within most public education systems, and has only served to emphasize the intellectual distance that exists between current scientific concepts and the public's understanding of these concepts. To help bridge this distance, organizations have been founded which dedicate themselves to science outreach, such as the Let's Talk Science Partnership Program. Universities, and particularly the graduate students who attend them, are in a unique position to deliver science outreach programs. Graduate students are scientists on the front line of scientific research, and possess resources available at universities that are not typically available elsewhere. Here, I present information collected during the establishment of a graduate student-based science outreach program at the University of Toronto at Mississauga, to provide useful information for graduate students interested in participating or establishing outreach programs at their institutions. Also, I identify post-secondary institutions both in Ontario and across Canada whose graduate students and communities (and therefore the institutions themselves) might benefit from this type of program.

Where Do Asexual Populations Acquire Genetic Variation? A Test Using Geographic Variation of Reproductive Mode in *Antennaria parlinii*

Tracy-Lynn Reside* and Christopher G. Eckert

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It has been repeatedly observed that asexual populations exhibit striking amounts of genetic variation. Geographic variation in reproductive mode of dioecious *Antennaria parlinii* offers an opportunity to study the role of sex in creating and maintaining genetic variation in asexual populations. Populations of apomictic females vary greatly in their distance from sexual populations containing male plants and therefore in the opportunity for engaging in sex. The relative contribution of sex in creating genetic variation may be evident by comparing the level of genetic diversity between populations where the potential for sex varies. We used Intersimple Sequence Repeat (ISSR) markers to assay genetic variation in sexually reproducing populations, along with populations of apomicts that differ in the opportunity for sex. We found that sexual populations were more variable than either group of apomicts and that isolated apomicts had the lowest level of genetic variation. However, the difference between apomicts of different regions was small for most measures of diversity and there was a considerable

amount of variation even in strictly asexual populations. While preliminary results may support low-level sporadic sex contributing to genetic variation in asexual lineages, the contribution is likely minimal.

Patterns of Richness at Various Taxonomic Levels in Bee Communities

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For some taxonomic groups, such as bees (Hymenoptera: Apoidea), identification skills take many months to develop. For some groups (eg. *Dialictus sp.*), members of the same subgenus are lumped together since identifications at the species level are nearly impossible to achieve. Problems of identification combined with inadequate sampling have made understanding the patterns and processes that shape the diversity of communities difficult. However, when estimates of various taxonomic richnesses are considered, a remarkably consistent pattern emerges: higher level taxonomic groupings (at least at the level of genus) can accurately predict species richness. This comes as great relief for scientists as it provides some assurance that patterns of richness are consistent at higher levels of taxonomy. If identifications are incorrect at the species level but correctly identified to genus, then there is a great deal of valuable information in these data sets. Moreover, this means that studies can move forward in their research programs with identifications at a higher taxonomic level if highly skilled taxonomists are required but unavailable. It is also interesting that taxonomic organization reflects some ecological relationships in bee communities.

A Comparison of Learning and Memory Abilities in Male and Worker Bumble Bees (*Bombus impatiens*)

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Learning and memory skills of worker and male bumble bees were compared on two tasks: 1) acquisition of novel handling methods on simple and difficult artificial flowers and 2) recall of the spatial location of a previously rewarding patch of flowers. Because worker foragers spend most of their time searching for and collecting food supplies for the colony, while males search for mates in addition to meeting their own food requirements, workers were expected to be more efficient foragers than males. Workers handled (sec/fl) their first difficult flower 1.7 times faster than males and on simple flowers had learning rates 1.3 times faster than those of males; after 20 visits handling times stabilized but workers still handled difficult flowers 2.2 times and simple flowers 1.7 times more quickly than males. After bees had fully learned how to handle the two flower types, worker foraging rates (fl/min) were still about 2 times faster than those of males. On the spatial learning and memory test, workers relocated a previously rewarding patch 4.3 times faster than males. These findings support the hypothesis that workers are more efficient foragers than males partly due to their superior learning and memory skills on foraging-related tasks.

Body Temperatures in Males and Female Colour Morphs of the Damselfly, *Enallagma cyathigerum*

Hans Van Gossum*, Jessica Bots and Raoul Van Damme

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Female-limited colour polymorphism is common in damselflies, with one female morph (androchrome) coloured like the male, while the other morphs (gynochromes) are different. Generally, darker individuals warm up more rapidly and attain higher body temperatures compared to paler individuals. Differences in thermal capacities between morphs may have substantial effects on fitness, through its effects on activity periods, energy budgets, escape capability and fecundity. Studying the damselfly *Enallagma cyathigerum* we examined whether males and/or different female colour morphs differ in their thermal capacities. First, differences in body temperature were studied in model males and females using standardised laboratory conditions. Second, we determined environmental and body temperature for approximately 300 individuals, both males and females, under field conditions. The study was performed both under cold and hot environmental conditions, and for inactive/active individuals. Together, our data will learn whether damselflies of the studied species regulate their body

temperature. Furthermore, potential differences in thermal capacities between males and the differently coloured female morphs will be detected.

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