



BioSynthesis

Volume 4, Issue 3 (April 2005)

BioSynthesis On-Line: <http://departments.bloomu.edu/biology/biosynthesis.html>

Spring Semester Dates & Special Events

- APRR 27:** Last day to submit proposal for summer and fall Research in Biology courses
- APR 28:** COST Research Day
- APR 29:** BU Research and Creative Activities Poster Session
- APR 28 & 29:** Reading Days, No Classes
- May 2—7:** Final Exams
- May 6:** Graduate Commencement
- May 7:** Undergraduate Commencement
- May 31-July 8:** Summer Session I



Look what's inside:

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Hats Off to BAHS Graduates!

Good luck and best wishes to all of our graduates! Please stay in touch and let us know how you are doing. To stay connected, remember that *BioSynthesis* is online.

May Graduates

B.S. Biology

- Alisa Badolato
- Lindsay Baglini
- Carla Botelho
- Kelly Bryant
- Ashley Bucher
- Robyn Carey
- Neema Chandel
- Marnie Cooper
- Terrina Dolin
- Tracy Harbaugh
- Amanda Hendricks
- Eric Horstick
- Bradley Hortman
- Michael Kaminsky
- Rebecca Kehler
- Janice Kutchinsky
- Heather Lentini
- Laura Marnin
- Mary Jo Melichercik
- Inna Nechipurenko
- Keri Ondrusek
- Benjamin Perez-Ringus
- Jordan Ward
- Olin Wood, III

B.A. Biology

- Samantha Kohlstock
- Misty Pickard

B.S. Secondary Education, Biology

- Robert Maurer, Jr.
- Amy Miller

B.S. Medical Imaging

- Kristin Gerhard
- Jennifer Myers
- Amy Reifsnnyder
- Leanne Stoner
- Melanie Snyder
- Elizabeth Kase



- ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★
- ★ **BAHS Honor Graduates** ★
- ★ Summa cum laude: **Inna Nechipurenko** ★
- ★ Magna Cum Laude: **Rebecca Kehler and Melanie Snyder.** ★
- ★ Cum Laude: **Kelly Bryant, Amanda Hendricks, Eric Horstick, Michael Kaminsky, Amy Miller, Leanne Stoner** ★
- ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

August Graduates

The following students are planning to graduate in August 2005.

B.S. Biology

- Kimberly Kushner
- Hilary Quarry
- Jill Remaley
- Robin Tracey

B.A. Biology

Malisa Bishop

B.S. Medical Imaging

- Joseph Andrulewicz
- Michelle Blandina
- Gina Bolinsky
- Kelly Boslego
- Stefanie Frymoyer
- Carrie Huffman

- Amanda Lukus
- Corinne Manny
- Tiffany Schnure
- David Simcox
- Kyle Snell
- Faith Warner



FURTHER TIPS FOR SCHEDULING WISELY for Summer 2005, Fall 2005, and Spring 2006



If you need a biology course which is closed, **talk to the instructing professor** for help!

SUMMER 2005: An additional section of **Anatomy and Physiology I** has opened during summer's first session. We anticipate (read "are working on") getting a second section of **Anatomy and Physiology II**. **Introduction to Microbiology (50.240)** has seats available for those of you in Medical Imaging. **Field Botany (50.263)** has two seats left; get them while they are open to have a fun summer in the field. **Limnology (50.452)** has one seat left at this time; please see Dr Rier, if you are interested. It will be lots of fun in the water.

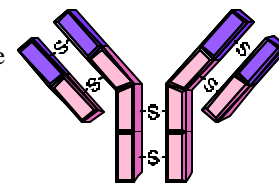
For those of you needing a "Values, Ethics, and Responsible Decision Making" general education course, we have **09.230 Human Sexuality** (sections 11, 12, 21, 22).

The Chemistry Department is opening a second section of **Chemistry for the Sciences I** for the summer. It should be listed on STINF soon.

THINKING of FALL 2005 & SPRING 2006: Read and note conflicts and pre-requisites.

BIOLOGY Majors:

If you are considering taking Immunology and Ecology during Fall 2005-Spring 2006, schedule Ecology for the fall semester and then Immunology for the spring. If you need Ecology this fall, see Dr Williams to get on the wait list for a seat.



If you are considering taking Bioinformatics and Ecology during Fall 2005-Spring 2006, schedule Ecology for the fall semester and then Bioinformatics in the spring. If you need Ecology this fall, see Dr Williams to get on the wait list for a seat.

If your option in biology requires **Physics and Genetics**, schedule the physics for your junior year. Physics' lectures (54.111 and 112) meet at the same time as Genetics and Cell Biology lectures.

CLINICAL LAB SCIENCE Majors: If you have not taken Immunology yet, be sure to complete Cell Biology before spring, so you can take Immunology. It will not be offered again (after Spring 2006) until Spring 2008. During the Spring 2007, you should take Medical Microbiology.

MEDICAL IMAGING Majors: During the Summer 2005 session, Dr Kipe-Nolt will offer **Introduction to Microbiology (50.240)** for those of you with a "Science Emphasis." Also, Dr Melnychuk will teach **Biology of Aging (50.231)** during the fall semester. Introduction to Nutrition will be available spring semester.

SECONDARY EDUCATION in BIOLOGY Majors: In the Spring 2006 semester, **Ornithology** will be offered. This is a **field biology course** which you are required to take for Pennsylvania Department of Education biology teacher certification.

Making Plans for SPRING 2006. The biology electives include Immunology (Cell Biology is the pre-requisite), Bioinformatics (Cell Biology and Biochemistry are pre-requisites and either Genetics or Molecular Biology), Ornithology (pre-requisite: Concepts of Biology 2), Methods in Biotechnology (pre-requisites: Molecular Biology or Biochemistry 2 and approved research proposal), and Current Topics in Biology: Global Change Biology.



OPPORTUNITY IS KNOCKING!

Summer Research Opportunities

Dr. Hranitz invites interested students to gain research experience this summer by assisting with two projects. Students willing to learn molecular techniques (DNA isolation, polymerase chain reaction (PCR), and DNA sequencing) may volunteer as lab assistants on genotyping projects. The two projects are investigating barnacle population genetic structure and lizard paternity analysis and mating systems. Another student is needed to sample fish and aquatic invertebrates in June, July, and August as part of a collaborative research stream ecology project. Tissue samples will be analyzed for stress proteins to study the tolerance of different aquatic organisms to acid mine drainage. Please e-mail Dr. Hranitz (jhranitz@bloomu.edu) or stop by his office at HSC 113C to discuss summer research.

Forensic Anthropology Course Offered Fall Semester

The Department of Anthropology is offering Forensic Anthropology (46.495), a special topics course, for Fall Semester 2005. Forensic anthropologists examine the human skeleton in cases of unexplained deaths to determine race, sex, age, stature, physique, and cause and time of death. The course instructor, Dr. Conrad Quintyn, is a new faculty member in the anthropology department. Dr. Quintyn has served as a forensic anthropologist with the Joint POW/MIA Accounting Command Identification Lab. The course will be taught using slides, videos, and lectures.

Student Research Funds Available

The Commonwealth of Pennsylvania Biologists (CPUB) is awarding grants of up to \$400 to undergraduate and graduate students to fund equipment and supplies for research. To apply, students must submit a cover letter, a detailed proposal, a resume, and a supporting letter from the faculty research mentor. Proposals must be written by the student and must include an introduction, materials and methods, references, and a budget. The deadline is September 9, 2005. See the CPUB website for application materials: <http://academics.sru.edu/cpub/>.

PSU: Internships/Summer Employment in Field Research

Meredith Murray, a 2004 biology graduate, informs *BioSynthesis* of internship or employment opportunities in field research this summer at Penn State University. Positions are available in the area of weed science, weed ecology, and entomology. Some of the diverse research projects that are being conducted include: managing weeds, evaluating herbicides, on-farm research, using cover crops in agricultural systems, conservation biology, evaluating genetically modified organisms, sampling long distance seed dispersal, monitoring invasive species, transitioning to organic crop production systems, collecting soil arthropods, and evaluating soil quality. Students will work closely with graduate students in a multi-disciplinary team. Responsibilities include data collection and analysis in the field, lab, and greenhouse. No experience is necessary. Students will be paid ~ \$8 per hour. Housing is not provided, but information is available for students to sublet apartments for the summer. For contact information, see the flyers on the department bulletin board.



News You Can Use

Deadline to submit an application and proposal for Undergraduate Research in Biology:

For Summer: Last day of classes in spring semester

For Fall: Last day of classes in spring semester

Deadline to sign-up for Internships:

For Summer: 2nd day of classes of chosen summer session:

For Fall: 5th day of classes, fall semester



Allied Health Updates

Allied Health Scholarship: Celebrating "A-HA!" Moments

Have you had an "A-HA!" moment? You know, those times when you experience that moment of clarity and understanding when wrestling with a difficult concept. Here is an opportunity to share your "A-HA" moment and win a \$1,000 scholarship. Benjamin Cummings, a publishing company, is awarding five \$1,000 scholarships to allied health students. To be eligible, you must currently be taking Anatomy & Physiology or Microbiology or have done so in the past two years. A poster describing the competition is on the bulletin board outside 114 Hartline Science Center. As part of the scholarship application you must submit 1) a brief description of your "A-HA!" moment and the concept or process that you mastered and 2) an illustration or demonstration of your moment in a creative format (powerpoint slide, song, collage, sketch, visual analogy, etc.). Application forms may be obtained from **Dr. Surmacz**, 105 Hartline. Deadline is November 1, 2005.

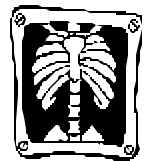


New Clinical Site Accepting Applications

Wyoming Valley's School of Medical Sonography has just been accredited. They are NOW accepting applications for a class to begin this fall. If you are interested please see Dr. Kipe-Nolt for the application materials.

Learn about Abington Memorial School of Radiologic Technology

The clinical instructor from Abington School of Radiologic Technology will be on campus to meet with students on April 29, 2005 at 10:00 a.m. in 142 HSC. We hope to see you there!



IMPORTANT NOTICE FOR MI AND CLS STUDENTS

ALL CLS and MI students who applied for clinical programs this year must see Dr. Kipe-Nolt this week if you have not yet done so. This includes those who have been accepted into clinicals and those who have not.

BAHS Students Accepted to Clinical Programs

Congratulations to the following students who have been accepted and who have signed up for the following programs:

Clinical Lab Science: **Amanda Ambrose**, Robert Packer/Guthrie Medical Center; **Christine Dry** and **Daniel Ehrat**, York Hospital/WellSpan; and **Paul Kremser**, Susquehanna Health System, Williamsport, PA.

Medical Imaging: **Megan Everly**, **Lindsey Grove**, **Kelly Pendergast**, **Megan Saner**, and **Eileen Wolf**, Johns Hopkins Hospital; **Chaz Loblein**, Rhode Island Hospital; **Rachyl Yanuskiewicz**, St. Joseph Medical Center; **Miranda Snarburg**, WCA Hospital; **Kristen Check**, Northampton Community College; **Emily Miller**, Reading Hospital; **Edward Hance** and **Jennifer Heiland**, Abington Memorial Hospital; **Lindsey Solovey**, College Misericordia; **Rachel Adu-Frimpong**, **Lindsey May**, and **Mary Plytage**, Wilkes Barre General Hospital; **Alison Lukjanczuk** and **Kristen Sweigart**, Thomas Jefferson University; **Kristy Bennage**, **Kelly Crawford**, **Melissa Gerst**, **Natalie Livelsberger**, **Joseph Miller**, and **Dawn Moyer**, Geisinger Medical Center.





Pre-Professional Committee Updates

Summer MCAT

The MCAT is a standardized exam required for admission to allopathic, osteopathic, and many veterinary schools. The exam assesses mastery in biology, general and organic chemistry, physics, scientific problem solving, critical thinking, and writing skills. The summer MCAT is scheduled for **August 20**. The registration deadline is July 15. To register go to: <http://www.aamc.org/students/mcat/start.htm>

Open House at the New York College of Podiatric Medicine

Interested in learning more about careers in podiatry? Then consider attending an open house at the New York College of Podiatric Medicine (NYCPM) on Saturday, June 8 at 9:00 a.m. The program includes breakfast with students and faculty, campus and housing tours, sessions on the profession on podiatry, and discussions with admissions officers. The NYCPM is located at 1800 Park Avenue, New York City, New York. For more information or to RSVP, call (800) 526-6966 X 8098 or see www.nycpm.edu

Ideas for summer

The committee wishes all pre-professional students a rewarding, relaxing, and rejuvenating summer. Remember summer is a great time to job-shadow. Many students also choose to do their volunteer work during the summer. Rising seniors are reminded to submit their completed application packets to the committee by the start of the fall semester.

Good News!



Lindsay Baglini will head to Drexel University to gain research experience in protein biochemistry.

Stephanie Benfer passed her Graduate Candidacy Exam on Friday April 15, 2005! Congratulations!

Kelly Bryant has been accepted into the Thomas Jefferson University's joint Ph.D. program with the Kimmel Cancer Center.

Neema Chandel will enter the Physician Assistant M.S. Program at Arcadia University after graduation.

Eric Horstick has been accepted into the doctoral program in Cellular, Molecular, and Developmental Biology at the University of Michigan.

Bradley Hortman has been accepted in the doctor of podiatry program at Temple University.

Inna Nechipurenko will attend Case Western Reserve University to pursue a Ph.D. in Neuroscience.

Alumni News

Emily Bray (B.S. Biology, 2004) has been accepted at The Philadelphia College of Osteopathic Medicine.

Meredith Murray (B.S. Biology, 2004) has begun her thesis work for her master's degree at Penn State University. Her thesis focuses on ecological weed management practices and weed seed predation by ground beetles. Meredith is delighted to work on a project that combines her interests in botany, ecology, and entomology.

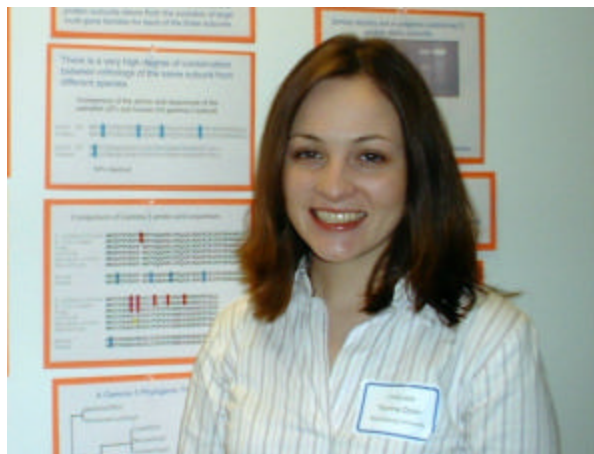
Andrew Leitzel, Danielle Faretta, and Carey McNeill have graduated from the Pennsylvania College of Optometry.

Unsure about what electives to take? Read on... Electives can help you explore new fields or strengthen an area of

Greetings from the Annual CPUB Meeting!

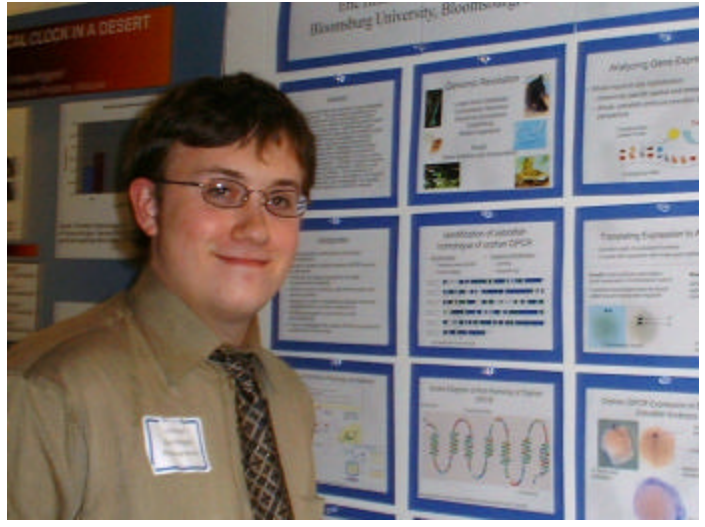
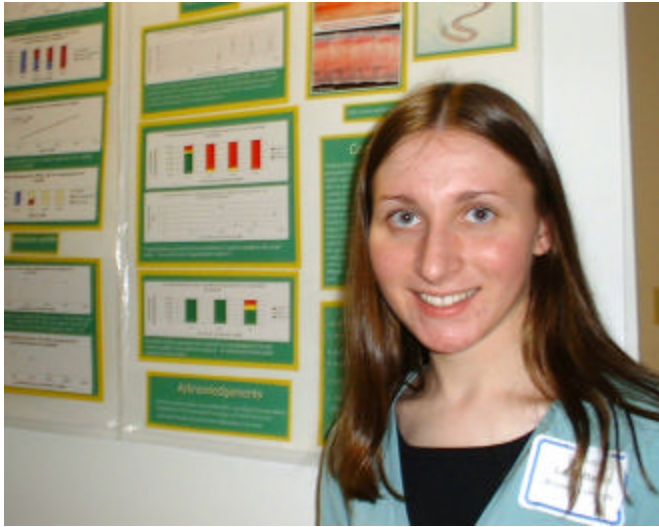
BAHS was well-represented at the 36th annual meeting of the Commonwealth of PA University Biologists at Millersville University on April 2, 2005. A lively contingent of student researchers accompanied by Drs. Williams, Brubaker, Hranitz, Nolt, Wassmer, and Surmacz joined with their counterparts from other universities in the PA State System of Higher Education for a day of research presentations, workshops, and meetings. The conference featured an excellent address by Dr. D. Holmes Morton entitled *Genes, Biology, and Disease: New Perspectives on Old Problems*. Dr. Morton specializes in the diagnosis and treatment of inherited metabolic diseases, particularly those that affect Amish children. Workshops were held on forensic entomology, botanical illustration using Adobe Illustrator and Photoshop, fluorescence microscopy, digital image analysis, and geographic information system. BAHS students took center stage and presented the results of their undergraduate research projects. **Marnie Cooper** and James Parsons presented a poster on "Antimicrobial effects of fungal extracts used as dietary supplements." **Nicole Dalessandro** and Cindy Surmacz displayed a poster entitled "Use of aquatic worms as a model system to test antibiotic toxicity." **Terrina Dolin, Eric Horstick**, Janet Robishaw and Carl Hansen presented "Cloning and sequencing of heterotrimeric G protein subunits from notothenioid fishes." **Eric Horstick** and Carl Hansen presented "Functional genomics: Translating nucleotide sequence into physiological function." **Bradley Hortman**, Gary Wassmer, C.A. Fuller², A.M. Alpatov³, T.M. Hoban-Higgins² ²) U of Calif, Davis, ³) Institute for Biomedical Problems, Moscow] shared their work on the "Effects of gravity on the stability of the biological clock in a desert beetle, *Trigonoscelis gigas*." **Michael Kaminsky** and Carl Hansen discussed a poster on "Heterotrimer G proteins in the eurythermal killifish, *Fundulus heteroclitus*." The poster by **Laura Marnin** and Cindy Surmacz described "The toxicity of three road de-icers in the aquatic worm, *Lumbriculus variegatus*." **Mary Jo Melichercik** gave a talk co-authored with John Hranitz on "The effective population size of a colony of collared lizards, *Crotaphytus collaris*: A look after three generations." **Tonia Zangari** presented a paper with co-authors Connie Wilson, Judith Kipe-Nolt, and Barry Nolt on "An evaluation of the effects of anaerobic digestion on odor and coliform counts in swine manure." Toni's research was conducted for her Honor's Independent Study project. **Jill Remaley**, Dr. Wassmer's research student, also attended the conference. The BAHS students did a great job in giving their poster and platform presentations. They received many of the student awards that were presented at the evening banquet (see box for award winners.) **Eric Horstick** was honored by receiving BU's outstanding student award. Most of the BU contingent even received door prizes! It was a great (but rainy!) day at Millersville University!

CPUB Award Winners: Ecology Platform Presentation 2nd place **Toni Zangari**; Ecology and Behavior Poster Presentation 2nd place **Laura Marnin**; Cellular, Molecular, and Organismal Biology, Poster Session 3 1st place **Eric Horstick**, 2nd place **Terrina Dolin**; 3rd place **Brad Hortman**. Cellular, Molecular and Organismal Biology, Poster Session 4 3rd place: **Michael Kaminsky**.



Terrina Dolin (left) and Michael Kaminsky (right) take time out to pose by their molecular biology posters.

BAHS Take On CPUB!



Upper Left: **Laura Marnin** shares her research comparing the toxicity of road de-icers. Upper Right: **Eric Horstick** presents his poster on functional genomics. Middle Left: **Marnie Cooper** explains the antimicrobial effects of fungal extracts to **Jill Remaley**. Middle Right: **Mary Jo Melichercik**, **Brad Hortman**, and **Tonia Zangari** look much more relaxed after their presentations! Bottom: BAHS students living it up at the CPUB banquet!

Dr. Parsons to Retire

Dr. James E. Parsons will retire from the Department of Biological and Allied Health Sciences at the end of spring semester after 24 total years of service. Dr. Parsons first came to BU 1982 and currently holds the rank of professor. Dr. Parsons' education and experience is in the area of clinical microbiology and he holds B.S., M.S., and Ph.D. degrees from The Ohio State University. Dr. Parsons has taught many classes during his tenure including Medical Terminology, Introductory Microbiology, Microbiology, Medical Mycology, Medical Parasitology, Medical Microbiology, and Health Care Leadership. He has taught Human Sexuality over 350 times! He has also taught several courses in the University Honors Program over the years. His research has recently focused on the screening "natural products" for anti-microbial effects. As part of these efforts, he has mentored many undergraduates in the Research Biology course. Dr. Parsons has been active in the National Association of Biology Teachers, has published laboratory manuals for his courses, and served for many years as the coordinator for our Medical Technology program (now called Clinical Lab Sciences.) When asked what he is most proud of, Dr. Parsons cites "the relationship I have had with many bright students. And the quality comment one student recently gave me -- 'You're hard, but you're fair!' Students seem to forget at times that neither the faculty or the students are here to be loved, but to teach and learn from each other." In the future Dr. Parsons plans to rest, then travel, and do "all the things I have postponed for nearly 1/4 of a century." Dr. Parsons points out that he will miss the students and some colleagues that he has known for many, many years. We will miss YOU Dr. Parsons! Stay in touch!



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BAHS Students Tune into CSI: Philadelphia

A full house was present at the Kehr Union Ballroom earlier this month for Dr. Gregory McDonald's presentation "CSI: Philadelphia." Dr. McDonald, the Assistant Medical Examiner for the City of Philadelphia and the medical director of Forensic Medicine at the Philadelphia College of Osteopathic Medicine, delivered his remarks as part of BU's Annual Health Sciences Symposium. Dr. McDonald discussed many aspects of forensic medicine including how time of death is determined, the use of insects to solve cases (forensic entomology), how the body changes post-mortem, and how his experiences differ from those seen on the popular CSI television shows. While some in the audience found Dr. McDonald's slides quite graphic, all agreed that this was a fascinating look at the field of forensic medicine. During Friday's concurrent sessions, **Dr. John Hranitz** gave a presentation on DNA Fingerprinting that traced its history and discussed its current applications in forensics and beyond. The symposium also included student posters and a health fair. Many BAHS students participated in the event. **Mike Kaminsky** introduced Dr. McDonald at the keynote address while **Neema Chandel** had the opportunity to join Dr. McDonald for breakfast. **Rebecca Kehler** and **Nicole Dalessandro** served as poster judges. Our cheerful poster set-up committee (even at 7 a.m.!) consisted of **Michelle Sienkiewicz, Kaylee Fisher, Becky Ames, Rachel Brous, Kelly Grella** and **Talia McAlister**. BAHS students who served on the facilities committee were: **Lindsay Karl, Signe Klinger, Matt Sterback, Michelle Sienkiewicz, Jeff Brannon, Matt Hertz, Jamie Willour, Nicole Nestico, Nicole Shambaugh, Lindsey Craig, Erica Hill, Kaylee Fisher, Laura Yost, and Kelly Grella**. The following winners of the student poster contest were members of the Anatomy and Physiology II class: First prize: Sleep Apnea, **Amanda Tobias, Nicole Shambach, Lindsey Craig, Tara Miller, and Nicole Nestico**. Second Prize: Baby Got Back Problems, **Jeffrey Brannon, Laura Primerano, Leah Redinski, and Katy Bodenber**. Third Prize: Don't Let Emphysema Burst Your Bubble: **Lauren Delp, Stacie Riley, Samantha Horvath, Holly Di Liberto**. Honorable Mentions: Keep S'Myelin: There is Hope: **Amy Dunkelberger, Ashley Falcone, Lauren Geiger, and Michael Ruff**; Marfan Syndrome: **Holly Seymour, Kristi Brinckman, Erin Yost, and Stephanie Tinna**; and Asthma: The Struggle to Breathe: **Robert Heim, Jordan Price, Maria Johns, and Erik Bower**.

College of Science and Technology Research Day



The College of Science and Technology will host its second annual Research Day on Thursday April 28 to showcase faculty and student research. The College of Science and Technology is composed of six departments: Biological and Allied Health Sciences; Chemistry; Geography and Geoscience; Instructional Technology; Mathematics, Computer Science and Statistics; and Physics. This special event coincides with Reading Day (no classes will be held). Everyone is welcome to attend. All events will be held in Hartline Science Center. The program features a variety of poster presentations and talks. The following students and faculty are participating:

- **Lindsay Baglini** and George Davis. "A molecular genetic analysis of the hardy kiwi (*Actinidia* sp)"
- **Kelly Bryant** and George Davis. "Isolation and characterization of a phytosiderophore transporter genes in *Setaria* sp"
- **Ashley Bucher** and Clay Corbin. "A comparison of the ontogenetics of gait in Indian Runner and Flighted Mallard breeds (*Anas platyrhynchos*)"
- **Nicole Dalessandro** and Cindy Surmacz. "Use of aquatic worms as a model system to test antibiotic toxicity"
- **Terrina Dolin, Eric Horstick, Janet Robishaw** and Carl Hansen. "Cloning and sequencing of heterotrimeric G protein sub units from notothenioid fishes."
- **Laura Halon***, **Valarie Van Cleef***, **Rebecca Rugg***, **Krissie Tofts**, John F. Barthell, George Yocum, Anna Stauffer, Kristen Brubaker, and John Hranitz Characterization of a Partial Sequence of HSP70 in Highly Thermotolerant Alfalfa Leaf Cutter Bees, *Megachile apicalis*."
- **Eric Horstick** and Carl Hansen. "Functional Genomics: Translating nucleotide sequence into physiological function."
- **Bradley Hortman**, Gary Wassmer, C.A. Fuller², A.M. Alpatov³, T.M. Hoban-Higgins² 2) U of Calif,Davis, 3) Institute for Biomedical Problems, Moscow]. "Effects of gravity on the stability of the biological clock in a desert beetle, *Trigonoscelis gigas*."
- **Michael Kaminsky** and Carl Hansen. "G protein signaling and temperature adaptation: Lessons from the killifish, *Fundulus heteroclitus*."
- **Laura Marnin** and Cindy Surmacz. "The toxicity of three road de-icers in the aquatic worm, *Lumbriculus variegatus*."
- **Mary Jo Melichercik** and John Hranitz. "Design and optimization of PCR techniques for the D-loop in collared lizards."
- **Inna Nechipurenko** and John Hranitz. "Characterization of HSP70 plasmid inserts and development of northern blot technique in an exotic leafcutter bee."
- **Amy Risen** and Cynthia Surmacz. "Sublethal and lethal responses to acute exposures of methyl tertiary-butyl ether (MTBE) in *Lumbriculus variegatus*."
- **Jordan Ward** and John Hranitz. "Evaluation of parentage analysis techniques in the collared lizard."
- **Tonia Zangari**, Barry Nolt, and Judith Kipe-Nolt. "The effects of anaerobic digestion on odor and coliform counts in swine manure."

We hope to see you at the COST Research Day!

The Reading Lamp: Current Topics in Evolutionary Biology

George Chamuris, Professor



Nothing in biology makes sense except in the light of evolution. – Theodosius Dobzhansky

It's elegant – it's economical – it's recruitment. As described by Wilkins (2002) and Futuyma (2005), recruitment refers to the evolution of novel functions from pre-existing developmental pathways and genetic systems. When broadly applied to the evolution of new characters, recruitment illustrates how natural selection can operate to generate novel and complex structures using existing structures and processes as a starting point. Contrary to claims made by intelligent design proponents, there is ample and accumulating evidence that novel and complex characters can be satisfactorily derived via evolutionary pathways involving recruitment, mutation, and natural selection (e.g. see Lenski et al., 2003).

A place to begin to build an understanding of recruitment is the evolution of enzyme cascades involving serine proteases of the chymotrypsin family. The blood coagulation cascade evolved from the complement cascade, which in turn evolved from developmental proteases (Krem and Di Cera, 2001). Another serine protease-mediated cascade controls the dorsal-ventral patterning in insect embryogenesis (e.g. Lemosy et al., 2001). Current models view these cascades as being assembled step-wise from the bottom up (Krem and Di Cera, 2002).

Thrombin is a key blood coagulation cascade enzyme that originally functioned in immunity (Adema et al., 1997). Thrombin is thought to have predated and served as the recruitment origin for the other vitamin K-dependent proteases (factors VIIa, IXa, Xa) which link the intrinsic and extrinsic pathways evolutionarily (Krem and de Cera, 2001). Thrombin itself plays multiple roles in a number of different processes (Di Cera, 2003). As we learn more about serine protease cascades, we are beginning to appreciate the role that recruitment played in adding levels of complexity step by step to these cascades.

In a more complex example, the antifreeze glycoprotein (AFGP) in notothenioid Antarctic fish has been recruited from the pancreatic trypsinogen gene (Chen et al., 1997a). This example is noteworthy because both coding and noncoding (intron) portions of the gene were recruited and amplified to result in the formation of a new gene, and a new protein! The authors hypothesized that the initial function of AFGP was to prevent freezing of the intestinal fluid. The antifreeze function then expanded into the circulatory system.

Similar characters may result from convergent recruitment episodes. For example, the recruitment of middle ear bones in monotremes and therians (marsupials and placentals) from reptilian jaw bones is thought to have arisen independently in each lineage (Rich et al., 2005).

Another example of convergence is the independent origin of some seventeen eye lens proteins called crystallins. Crystallins have been recruited from an array of genes, depending on the taxon (Piatagorsky and Wistow, 1991; Wistow, 1993). For instance, two common types of vertebrate crystallin, a and b, are derived from stress proteins. Other vertebrate crystallins were recruited from genes encoding enzymes such as lactate dehydrogenase (birds), alcohol dehydrogenase (camels), a-enolase (turtles), and aldehyde dehydrogenase (humans).

A third example of convergent recruitment takes us back to the antifreeze glycoproteins. The evolution of novel AFGP genes has taken place both in the Antarctic notothenioid fish and in the phylogenetically distant Arctic cod (Chen et al., 1997b). Although similarly recruited from pancreatic trypsinogen genes, there are sequence differences that reveal their independent origins.

There are many examples of recruitment at various levels of biological organization – molecules, genes, cells, tissues and organs can be recruited for novel function. Especially important are recruitment events that occur in conjunction with the duplication and change-in-function of developmental genes (such as the HOX genes; Wilkins, 2002), as well as changes in the function of transcription factors (e.g. the floral regulator LEAFY; Maizel et al., 2005).

Recruitment seems to be an important pathway by which novel form and function can arise. This is but another example of how our understanding of the mechanisms of evolution, particularly at the molecular-genetic-developmental level, is improving at an impressive rate.

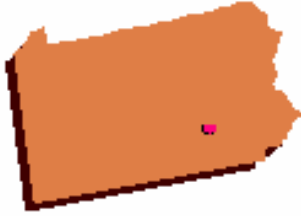
References:

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BAHS at PAS



Several BAHS faculty and students recently attended the annual meeting of the Pennsylvania Academy of Science (PAS) in Camp Hill, PA. **Mary Jo Melichercik** presented a paper with co-authors **Dr. Hranitz** and Troy Baird (University of Central Oklahoma) on “The effective population size of a colony of collared lizards, *Crotaphytus collaris*: A look after three generations.” **Laura Halon** and **Rebecca Rugg** presented a poster on the “Characterization of a partial sequence of HSP70 in highly thermotolerant Alfalfa Leaf Cutter Bees, *Megachile apicalis*.” Their work is co-authored by BU students **Valarie**

Van Cleef and **Krissie Tofts**, BU faculty members **Dr. Brubaker** and **Dr. Hranitz**, and John Barthell (University of Central Oklahoma), George Locum (Insect Genetics & Biochemistry Unit, Biosciences Research), and Anna Stauffer (Weis Center for Research, Geisinger Clinic). **Eric Horstick** gave a presentation on Functional genomics: Translating nucleotide sequence into physiological function. Eric’s co-authors are: Jasper Humber, Anna Stauffer, Tin Cheng Leung, and Janet Robishaw from the Weis Center for Research, Geisinger Clinic and **Dr. Hansen** (BU). **Dr. Hansen** presented “Comparative genomics of signaling proteins: The heterotrimeric G-protein subunit family of notothenoid fishes.” Co-authors include **Eric Horstick**, **Terri Dolin**, Jasper Humbert, and Janet Robishaw. **Dr. Corbin**, **Marie Malitsky**, and **Michelle Reiner** presented the poster, “Morphology predicts foraging behavior in a guild of Costa Rican tyrant flycatchers.”



Upper left: **Mary Jo Melichercik** takes questions at her talk on population size in collared lizards.



Upper right: **Dr. Hansen** and **Eric Horstick** presented their research on G-protein signaling pathways.

Lower right: **Laura Halon** and **Becky Rugg** present their poster for the “Leaf Cutting Bee Team.” Laura, Becky, and their co-authors have partially characterized a sequence in Heat Shock Protein 70 in a thermotolerant bee.

