



# BIOrhythms

Washington University Biology Department Newsletter

February 2010

*"The capacity to blunder slightly is the real marvel of DNA. Without this special attribute, we would still be anaerobic bacteria and there would be no music."*

*~Lewis Thomas, American Physician and Writer, 1913-1993*

## Helpful Links

[Biology Home Page](#)  
[Biology Course Listings](#)  
[Faculty Listings](#)

*BIOrhythms is a publication of the Washington University Biology Department for Undergraduate Majors*

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## Faculty Spotlight: Dr. Sarah Elgin—Viktor Hamburger Professor of Arts & Sciences; Professor, Department of Biology



Dr. Sarah (Sally) Elgin is always interested in expanding and enriching the educational experience for students at Washington University and in the larger community. She was a major player in starting the WU Science Outreach program (benefiting students at the university and K-12 students and teachers from the St. Louis area), and in developing new hands-on lab courses in genomics for undergraduate students. Her aim is to provide opportunities for students to be engaged in doing science, if possible leading to co-authorship on publications. She is a lifelong learner herself, always interested in understanding technological advances by attending seminars and courses at other institutions,

such as Cold Spring Harbor Laboratory. She also sees the value in refreshing knowledge, and is currently sharpening her math skills by auditing calculus with the aim of learning more statistics and computer science, areas that have changed drastically since she was an undergraduate student.

Originally from Oregon, Dr. Elgin completed her undergrad work at Pomona College in southern California as a Chemistry major. She earned her Ph.D. in Biochemistry under plant biologist James Bonner and completed her postdoc under biochemist Leroy Hood at Caltech. Dr. Hood, founder of Applied Biosystems (ABI), developed the first successful automation for sequencing proteins and nucleic acids. The focus of Elgin's Ph.D. and postdoc was on chromatin structure, how DNA is packaged with proteins and how the packaging controls gene expression.

Her first faculty appointment in biochemistry and molecular biology ran eight years at Harvard before she joined the Wash U. Department of Biology. There has been a continuing shift over the years in the tools we use to study biological —*cont'd on page 2*

## Genomics & Computational Biology Track

### Recommended Advanced Biology Electives

- \* Biol 3191 Molecular Mechanisms in Development (major area A)
- \* Biol 324 Human Genetics
- \* Biol 334 Cell Biology (major area A)
- \* Biol 349/1 Microbiology with Microbiology Laboratory (major area A)
- \* Biol 437 Lab on DNA Manipulation
- \* Biol 4181 Population Genetics (major area C)
- \* Biol 4183 Molecular Evolution (major area C)
- \* Biol 4202 Evolutionary Genetics (major area C)
- \* Biol 4810 General Biochemistry I (major area A)

Advanced Laboratory Requirement, one of the following:

**Biol 3492 Laboratory Experiments with Eukaryotic Microbes:** An introduction to diverse molecular and cell biology techniques used in model experimental organisms to explore fundamental biological questions.

**Biol 4342 Research Explorations in Genomics:** A collaborative laboratory investigation of a problem in genomics, involving wet-lab generation of a large data set (either genomic sequence or microarray analysis of gene expression) and computer analysis of the data.

For more info visit the course pages on the [NSLC website](#)

To declare or change your major to the Genomics & Computational Biology Track, pick up a form at the College Office (205 S. Brookings) and bring it to Student Affairs (Plant Growth 105).

## Faculty Spotlight Elgin cont'd—

questions. Approaches that used to be found exclusively in departments of chemistry are now routinely used in biology; experimental approaches of biology are now used by psychologists, etc. A major shift has been access to information on DNA sequences. Dr. Robert Waterston, who was Professor and Chair of Genetics at WU for many years, was very important to that progression. He was a prime mover in creating the vision of sequencing whole genomes, using the nematode worm as his first subject. The genome of Elgin's favorite subject for study, *Drosophila melanogaster* (the fruit fly), became available shortly thereafter. Her work on chromatin structure led to her interest in genome organization. To get started in genomics she took a course at Cold Spring Harbor in 2001 on how to sequence and annotate a genome. People from twelve different countries attended the course, mostly younger professors and research associates.

### New Courses for Biology Undergrads

In 1992, Dr. Elgin was appointed Program Director of a Howard Hughes Medical Institute (HHMI) grant that supported undergraduate research, curriculum improvement, and science outreach at Washington University. An HHMI Professorship grant in 2002 provided funds that allowed development of new course materials in genomics, and led to the creation of a research lab course for upperclassmen, BIO 4342: Research Explorations in Genomics, jointly taught with Dr. Elaine Mardis of the Genome Sequencing Center and Dr. Jeremy Buhler of the Computer Science Department. The collaboration of biology, technology and computer science is key to the study of genomics because of the massive volume of data that needs to be organized and analyzed. In this course, students join a research team to study the dot chromosome of different species of *Drosophila* in a comparative genomics effort. Each student gets a chunk of a dot chromosome, carefully analyzes, finishes and checks sequence data, and annotates this region, finding genes and other sequence features of interest, comparing species, looking at overall conservation and evolution, how it functions and how it's changed. There is currently a paper up for publication that 26 students helped co-author. There are many people behind the scenes of this course, including Genome Center staff and Wilson Leung and Chris Shaffer from Elgin's Lab, who are critical to the computer science aspect of BIO 4342, managing and analyzing those massive amounts of data.

Two new HHMI-sponsored courses for freshmen, BIO 191: Phage Hunters and BIO 192: Phage Bioinformatics, allow students to dig for phages in the dirt and analyze their genomes using computer-based tools. Six genomes have been sequenced at the Genome Center this year, and the students are now working on checking the sequencing and annotating those phage. Some students will get to be co-authors on resulting publications on their phage as well. These courses are taught by instructors Sally Elgin, Douglas Berg, Petra Levin, Kathy Hafer, and Chris Shaffer.

### Putting Flesh on the DNA Skeleton

The Major Track of Genomics and Computational Biology and Minor in Bioinformatics were created recently within the Biology Department to help prepare students for a future in genomics, an increasingly important field of biology. The next generation of DNA sequencing technologies, as with all technologies, will become increasingly less expensive. Within the next few years, sequencing a human genome may cost as little as \$1000. (Phage sequencing is currently \$5000 for 6-12 genomes.) Sequencing will be a routine bench tool, providing opportunities for all kinds of experiments studying health issues, mapping patterns of chromatin structure and gene expression, and more. Future scientists in this field have to be able to organize and analyze massive amounts of data, making the discipline of computer science crucial to their education. —cont'd on page 3

*Faculty Spotlight Elgin cont'd*— In terms of job opportunities, genomics is a major growth area of science with huge implications in medical practice. Students will need language from both areas, Biology and Computer Science, in order to facilitate analyses, understand data being generated and extract information that provides new insights, resulting in a richer and more complex picture of genome function and evolution. Dr. Elgin calls it “putting flesh on the DNA skeleton”.

### The Future of Genomics Education

In her role as a professor, Elgin feels it's important to create opportunities for students to be involved with real hands-on research, getting good data that is publishable and having ownership of that. The next grant applications to HHMI propose a variety of ways to interface Computer Science with the curriculum of the School of Arts & Sciences to meet the changing needs of students as they go forward with their careers in the new world of computer-assisted research. The university is always looking for ways to bring more to the educational experience by collaborating between departments; for example, Dr. Ron Cytron of Computer Science is looking at ways of making the introductory courses (CSE 131/132) more user-friendly for biology students and possibly offering them in summer to help suit busy schedules. Dr. Jeremy Buhler of Computer Science is the faculty advisor for the Bioinformatics minor along with Elgin, and both Dr. Buhler and Dr. Michael Brent teach upper-level courses in bioinformatics that are open to undergraduates who have completed intro CS and statistics (Math 3200). We will no doubt see an increase in crossover between departments over the coming years.

Wash U has the depth of resources to provide staffing and support for lab-style vs. lecture-style courses. Many people from different disciplines have shared their knowledge to develop the BIO 4342 curriculum. This is now being shared with smaller, primarily undergraduate institutions through the Genomics Education Partnership, 60 institutions across the country joined on the web, all studying the *Drosophila* dot chromosomes. Thanks to the HHMI grant of 2006, the Partnership makes it possible to train faculty in the use of the needed software, and then manage the collaborative research at partner institutions online. The research opportunity can be distributed to diverse faculty and students, and the resulting new knowledge shared by all.

Why, you ask, would an accomplished scientist and professor such as Dr. Elgin need to take courses in computer science and statistics? Without access to the relevant tools of the ever-changing technology of science, one can miss exciting opportunities. Elgin uses this metaphor—“All the new data that's out there is like a huge banquet table loaded with goodies. Out of hundreds of biologists looking at the table, only a small fraction may have a knife and fork”. She is dedicated to being one of those who partake of the feast!



### Summer Field Research Internships

Are you interested in gaining field research experience and learning about the evolution and ecology of plants and plant-animal interactions in fragmented prairie? We are looking for 3-5 summer field researchers for an NSF-funded project on habitat fragmentation of the tallgrass prairie. We are investigating how small plant population size influences inbreeding, demography, pollination, and herbivory in the purple coneflower, *Echinacea angustifolia*. This is a great summer internship or co-op for those interested in field biology or conservation research.

No experience is necessary, but you must be enthusiastic and hard-working. You will survey natural plant populations, measure plant traits in experimental plots, hand-pollinate plants, observe & collect insects, and assist in all aspects

—*cont'd on page 5*

### Undergraduate Clubs

The Bio Club is an outlet for the WU community to share its interest in biology. Our goal is to expose members to academic and career opportunities in Biology through fun and relaxing club events. For event alerts, simply send your name and email to [wubioclub@gmail.com](mailto:wubioclub@gmail.com).

College Student Interest Group in Neuroscience (CO-SIGN), as the name suggests offers an opportunity for students who are interested in Neuroscience to gather and learn. The club has an intellectual yet fun atmosphere where students interested in medical and graduate schools can mingle. The Physician Shadowing Program is a unique experience that CO-SIGN offers. The club organizes the opportunity for them to shadow doctors in the fields of neurology, neurosurgery, and psychiatry.

CO-SIGN also offers an opportunity for students to give back to the community through the recently established outreach program, Synapse. Other events that CO-SIGN offers in the spring are graduate school students panel, dinner with SIGN group (the club's medical school counterpart) and a visit to Wash U's anatomy lab, where students will be given a tour of the facilities as well as a chance to see cadavers! For info email: [ywange@WUSTL.EDU](mailto:ywange@WUSTL.EDU).—*Yan Wang, Vice President*

WU Biology Major Wins the 2010 *Jeopardy!* College Championship and \$100,000 Cash Prize



Yozamp with *Jeopardy!* host Alex Trebek

Junior Nick Yozamp, a Biology major in Arts & Sciences, is the first WUSTL student to win the *Jeopardy!* College Championship.

“I’ve watched hundreds of contestants being introduced on *Jeopardy!* from home, but to actually be one of those contestants was simply amazing,” Yozamp said. “Seeing Alex Trebek in person walk through the set’s glass doors and greet each of us was a moment that has been permanently etched in my mind.”

As for the cash prize, Yozamp plans on going to Nice, France, this summer as part of a study-abroad program. “My winnings will certainly pay for this trip,” he said. “I intend to save the rest of my earnings for medical school; the \$100,000 will go a long way in paying for the tuition.”...

....Read more at [Student Life](#) or the [Record](#) websites

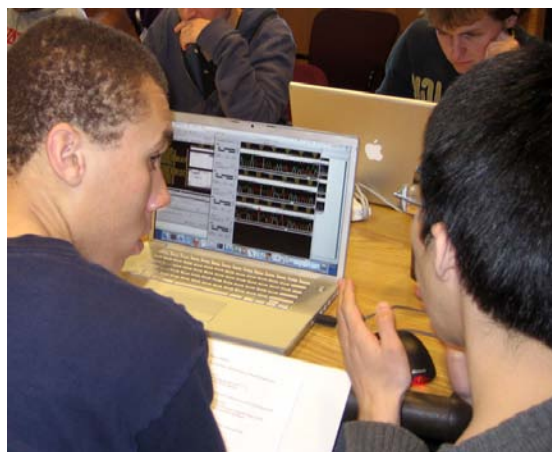
## A Day in the Classroom, BIO 4342: Research Explorations in Genomics

Instructors Sally Elgin and Chris Shaffer with assistance from Wilson Leung of the Elgin Lab and GSC employees Neha Shah and Lee Trani



Juniors and Seniors meet for this lab course at the Genome Sequencing Center (GSC) at Wash U’s Medical School for the first half of the semester to do finishing work for sequencing data the computer compiles for *Drosophila* genomes. Each student gets a portion of a genome to work on. They finish the data and order finishing reactions at the end of class. The students do not do the actual pipetting; this is done through the Genome Sequencing Center. The second half of the course is spent on the Danforth Campus doing computer analysis and annotation. This course is very detail-oriented and precise.

Technological advances (shorter, faster sequencing through computer analysis) have made it possible to dramatically increase the volume of data compiled for genome research. For instance, it once took months to pinpoint the locations of mutations on a gene, but now computers make it possible to do the same amount of work in just one



day! Unfortunately the computer is still confused by some things, such as repeat or inverted sequences. The students’ job in the lab is to “finish” the data. This work entails finding gaps in the genome caused by the computer’s inability to assemble the genome completely. Students sit patiently in front of laptops using software that finds these gaps in their allotted portion of the genome. They then fix all of the gaps, sometimes tearing apart the work of the computer in order to do so.

Student Ruth Howe highly recommends the course because it is a comfortable size and atmosphere for hands-on learning and working closely with the professors. She explains that the course not only educates on exciting new directions and advances in genomics but also allows the student to play an important role in real research by analyzing sequencing data. This analysis is key to understanding how almost everything works from the perspective of the gene and lays the foundation for future research in many fields; every genome sequenced adds to the list of organisms researchers can use as models in experiments for disciplines ranging from molecular biology to tissue engineering and behavioral psychology. Ruth also talks about the potential of a new field of metagenomics in which the collective genomes of whole habitats can be sequenced. She uses the example of studying coral reefs. A scientist can explore what makes a healthy environment vs. a sickly one by studying the differences —cont’d on page 5



## Summer Job Opportunity Through Science Outreach

The Bernard Harris Summer Science Camp is a free, two-week, academic, residential camp that emphasizes increasing students' mathematics/science skills, introducing them to college life, and stimulating their interest in science and engineering as a potential career path. It is targeted at current 5th, 6th, and 7th

graders from underrepresented communities, and with at least a B-average in science and math. Each day, campers will attend classes that include problem solving, study, research, writing and communication skills incorporated with biology, chemistry, physics, design concepts, and field excursions. Classes will be taught by certified classroom teachers and university faculty.

There are 8 day-counselor positions available for the BHSSC at Washington University, and 8 night-counselor positions (4 male and 4 female for each shift). All counselors will be selected from an applicant pool of graduate or undergraduate students, preferably with science, math, or engineering majors, and with previous experience working with K-12 students. As most of the 48 campers will come from underrepresented minority communities in St. Louis, it is desirable that the camp counselors reflect the ethnic diversity of the campers.

Application materials are available for download from the Science Outreach website: <http://www.so.wustl.edu/harriscamp.html>. All application materials are due March 26, 2010. Refer all questions to either: Chris Mohr, Camp Director, [mohr@wustl.edu](mailto:mohr@wustl.edu), (314) 935-4217 or Andrea Holmes, Camp Director, [aholmes@wustl.edu](mailto:aholmes@wustl.edu) (314) 935-8138.



**For Volunteer Opportunities:** subscribe to the Community Service Connection, an email newsletter: <http://www.communityservice.wustl.edu/csconnection/>.

### Do You Have...

An announcement you'd like to make?

An interesting story or fun fact you'd like to share?

A professor or course you'd like to suggest for a spotlight?

We want your input! Send ideas and information to: [gerrity@biology2.wustl.edu](mailto:gerrity@biology2.wustl.edu)

*Course Spotlight BIO 4342 cont'd*—in DNA composition between both types of reefs. Using the sequencing technology, one can quantify the health of the environment. The implications for this field are huge, painting a larger and more complex picture of the interrelation of different organisms in a habitat, and it all comes back to genomics. Furthermore, genomics is rewriting our approach to taxonomy—that is, the way we view the evolutionary relationships between organisms. The addition of computer science to this field has dramatically sped up the process of analysis and increased the scope of sequencing projects, allowing projects like those of BIO 4342 to fit comfortably within a semester.

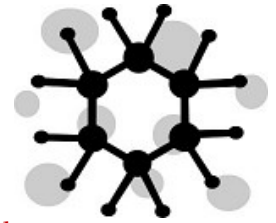
At the end of today's class, students submitted their orders online for finishing reactions. The orders are submitted through the Genomics Education Partnership, a nationwide group of 60 institutions joining forces to make this type of learning experience affordable by sharing accounts and information. Instructor Chris Schaffer noted that the economy of scale is crucial to the success of the course and the university's ability to provide it.



*Summer Internship Opportunities cont'd*—of research. Housing is provided and there is a stipend. Undergraduate students have the opportunity to do an independent project as an REU participant.

If you want more information or wish to apply, please visit this website <http://echinacea.umn.edu/> or contact Stuart Wagenius at [stuart09@echinaceaproject.org](mailto:stuart09@echinaceaproject.org). Applications due March 5, 2010.

# Biology Department Calendar



## Links to General Calendars and Regular Events:

Washington University Record Calendar: <http://record.wustl.edu/calendar>

Bioforum, alternating Fridays, 4:00pm, McDonnell 361, check the website for topics/schedule:  
<http://wubio.wustl.edu/events?tid=5>

Evolution, Ecology, & Population Biology Seminars, usually on Thursdays, 4:00pm, Rebstock 322, check the website for topics/schedule: <http://wubio.wustl.edu/events?tid=3>

History and Philosophy of Science Seminars, varying Wednesdays at noon, check the website for topics: <http://wubio.wustl.edu/events?tid=12>

Plant Lunches: most Tuesdays at noon (1st Tuesday of month @ DDPSC, others @ McDonnell 212). Contact Professors Tuan-hua David Ho or Mark Running for topics/schedule.

Donald Danforth Plant Science Center (DDSPC), Weekly Seminar Series—Wednesdays, 3:45pm, AT&T Auditorium, check the website for topics: <http://www.danforthcenter.org/opportunities/seminars.asp>

Division of Biology & Biomedical Sciences (DBBS), lectures/seminars: <http://dbbs.wustl.edu/dbbs/website.nsf/SDN>

## March 2010

3rd SURF Applications Due, Check the website for info: <http://www.nslc.wustl.edu/Research/HHMI/surf.html>

8th SPRING BREAK, NO CLASSES— March 8th-12th

29th Honors Theses Due

## April 2010

17th Undergraduate Research Symposium, Check the website for registration info: <http://ur.wustl.edu/>

20th Fall 2010 Online Registration—April 20th-23rd

30th Last day of Spring 2010 Classes

## May 2010

3rd Spector Prize Seminar, 4:00pm

6th Final Exams Begin

19th Biology Honors Reception, 3:30pm

24th First Summer Session Begins