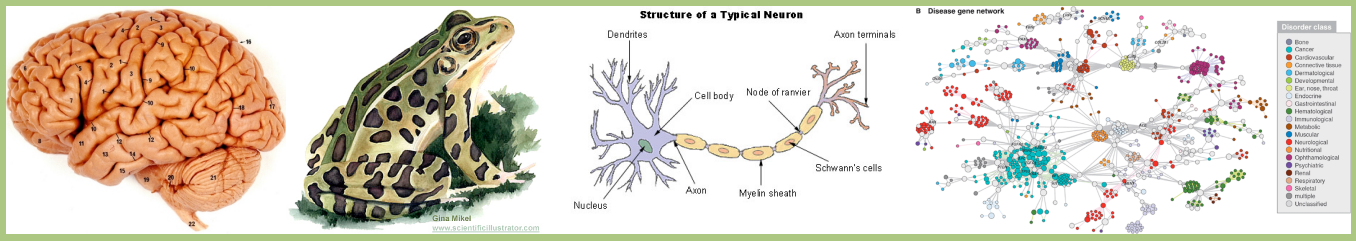
From Genome to Phenotype



Aura Soma Lava Conference Center, Lava Hot Springs, Idaho, October 15-18, 2009

The 2009 Idaho State University Bioinformatics Workshop

"From Genome to Phenotype" is ISU's 5th Bioinformatics Workshop, an annual meeting that focuses on emerging applications and approaches for complex, data intensive analyses. Join regional biologists in exploring perturbations of gene interactions networks involved in complex phenotypes, the connections of genomes to disease phenotypes and a special emphasis on neurological disorders.

The **Research Symposium, "From Genome to Phenotype"** will feature three oral presentation sessions that take advantage of the Workshop's informal setting and vibrant participants to highlight emerging research. The **Keynote talk** will be given by **Dr. Michael Pfrender** of Utah State University and University of Notre Dame.

The **Bioinformatics Training Workshops** will help researchers gain hands-on experience in new bioinformatics methods. Led by experienced researchers, topics will include methods for constructing gene interaction networks, advanced analysis of microarray gene expression data, and calibrating molecular clocks.

The **Education Breakout Sessions** will be structured discussions and demonstrations of integrating bioinformatics into the biology core curriculum. The Breakout Sessions are sponsored by a Tech Incentive Grant grant from the Idaho State Board of Education. This year, the Workshop is an integral component in the development of a unique set of bioinformatics-in-the-classroom modules.

The ISU Bioinformatics Workshops are held at the beautiful **Aura Soma Lava Conference Center** in Lava Hot Springs, Idaho. The facility includes access to Lava's world-class hot springs and provides an exceptional venue for our Workshop.

Quick Schedule

Thursday, 10/15: Registration & welcome reception
Friday, 10/16: Training & Education sessions, Research Symposium 1
Saturday, 10/17: Research Symposia 2 & 3, keynote talk & banquet
Sunday, 10/18: Training & Education sessions

Registration Information

Space is limited to 50 participants, so please register early! Cost for the workshop is $40 ($25 for students), which includes two excellent dinners. Some housing costs will be covered for presenters.

Register at pig.egg.isu.edu/workshop/
For more info, contact Mike Thomas at mthomas@isu.edu or 208-380-5259.

Schedule

Thursday, October 15, 2009

6:30 p.m.—8:00 p.m.: Check in and welcome reception (hors d'oeuvres), Riverside Inn Lounge

Friday, October 16, 2009

9:00 a.m.— Noon: Bioinformatics Training Session 1, Conference Center: *Cytoscape (& plugins)*

9:00 a.m.—Noon: Education Session 1, Riverside Inn Portneuf Room: *Intersections Between BIO 101 and Bioinformatics*

Noon—1:30 p.m.: Lunch, on your own

1:30 p.m.—5:30 p.m.: Research Symposium Session 1, Conference Center

6:00 p.m—7:00 p.m.: Light dinner, Grecian Key, Conference Center

7:00 p.m.—10:00 p.m.: Education Session 2, Conference Center: *Collaborative Design of the Portal-21 Modules*

7:00 p.m.—10:00 p.m.: Bioinformatics Training Session 2, Riverside Inn Board Room: *Gene Set Enrichment Analysis*

Saturday, October 17, 2009

9:00 a.m.—Noon: Research Symposium Session 2, Conference Center

Noon—1:30 p.m.: Lunch, on your own

1:30 p.m.—5:30 p.m.: Research Symposium Session 3, Conference Center

6:00 p.m.: Banquet, Riverwalk Thai, Conference Center

8:00 p.m.: Keynote presentation: Dr. Michael Pfrender, *Advances & Challenges In Arthropod Genomics,* Conference Center

Sunday, October 18, 2009

9:00 a.m.—Noon: Bioinformatics Training Session 3, Conference Center: *Molecular dating*

9:00 a.m.—Noon: Education Session 3, Riverside Inn Portneuf Room: *Transforming UG biology education*

Noon—1:30 p.m.: Lunch, on your own (leftover Thai!)

Info

The conference was painstakingly organized by ISU's Evolutionary Genomics Group: Michael A. Thomas (Workshop organizer), Moreen Carvan (Bioinformatics-in-the-classroom), Luobin Yang, Peter Hallock and Parag Joshi.

- Mike Thomas: 208-380-5259
- Moreen Carvan: 414-581-2595

Detailed programs:

- Research Symposium sessions: page 3
- Bioinformatics Training sessions: page 4
- Education sessions: page 5
- Logistics & info about Lava: page 6
- Attendee list and contact info: page 7

Beyond the Symposium

Still have a point to make? We've tried to include as much productive interaction time as possible. Please take the opportunity to join your colleagues at the Riverside Inn Lounge (lower level) or in one of the famous Lava Hot Springs. Also, there are a number of pubs and restaurants within easy walking of the conference center (see page 6 for some suggestions).

Sponsorship

The 2009 ISU Bioinformatics Workshop is made possible by the Idaho State Board of Education's Tech Incentive Grant (TIG) program, which promotes the creation and use of innovative methods of instruction.

Additional funding and support for the Training Workshops was provided by the Idaho Biomedical Research Institute (IBRI) and the ISU Molecular Research Core Facility. Please thank Chris Daniels and Erin O'Leary for their ongoing support for the Training Workshops.

Support was also provided by the Idaho INBRE program and NIH grant #P20 RR016454.

Symposium: From Genome to Phenotype

The Symposium is intended to take advantage of our informal setting and diverse group of researchers. Talks will be 15-20 minutes followed by 10 minutes, or more, set aside for discussion. This loose format is designed to facilitate discourse and debate by letting interesting discussions continue. Speakers have been asked to end their talks with possible open questions, ideas for future research or other discussion stimulants.

Session 1 — Friday, 1:30 p.m.

Session chair: Heath Ogden

- Heath Ogden: *The Evolution Of Flight In Insects: Insights From Mayflies And DNA*
- Michael Thomas: *Using gene set enrichment analysis to assess biological significance of toxins in aquatic systems*
- Aaron Duffy: *Simulating Population Genetics And Fern Lifecycles In A 3-Dimensional Virtual World*
- GongXin Yu: *Shifting Paradigm Of Bacterial Pathogenesis Studies: Genetic Heterogeneity Analysis Of Staphylococcus Aureus Using Solexa Sequencing Technology*
- Kelsey Metzger: *Maximum Likelihood Phylogeny Of Human Cc Chemokine Receptor Loci Reflect Cytogenetic Position Of Loci On Chromosome 3*

Session 2 — Sat., 9:00 a.m.

Session chair: Aaron Duffy

- Deborah Alongi: *Signatures Of Adaptive Evolution In Carbohydrate Transport And Metabolism In Contrasting Populations Of Arabidopsis Lyrata Ssp. Petraea*
- David Liberles: *Lineage-Specific Differences In The Amino Acid Substitution Process*
- Celeste Brown: *Beyond Sequence Databases: The Tale Of A Small Database*
- Karen Eilbeck: *Genome Annotation And The Sequence Ontology*

Session 3 — Sat., 1:30 p.m.

Session chair: Deborah Alongi

- Kevin Wanner: *Evolution Of The Sex Pheromone Receptor Family In The Peripheral Olfactory System Of Moths*
- James Foster: *Microbial Diversity Behind Retreating Glaciers*
- Mitch Day: *Artificial Selection Of A Rice Paddy Soil Community In A Sediment Battery*
- Mike Carvan: *Toxicogenomic Evaluation Of The Impacts Of Persistent Toxicants In The Diet Of Juvenile Rainbow Trout*
- Michael Walter, Michael Thomas & Marc Morais: *Bacteriophage Sbp8A Sequence, Bioinformatics & Structural Update*

Keynote — Saturday, 8 p.m.

Michael Pfrender

Associate Professor of Biology, Utah State University and University of Notre Dame

Dr. Pfrender's research group focuses on using combined molecular- and quantitative-genetic approaches to understand the evolution of complex characters in natural populations. In particular, they are interested in the limits to rates of adaptation in response to novel selection pressures and rapidly changing environments. They are also studying the genetic consequences of ecological speciation and the genetic basis of phenotypic plasticity. Projects in the lab span a variety of interests including phylogeography, and conservation genetics, and utilize empirical systems ranging from the freshwater invertebrate Daphnia to amphibians and reptiles.

Advances & Challenges In Arthropod Genomics: Sequence, Function And Ecological Genomics In The Zooplankton Daphnia

Our understanding of the genomic responses of organisms to ecologically relevant conditions is advancing rapidly with the growing availability of genomic tools across ecologically and phylogenetically diverse taxa. These advances build on an expanding pool of Arthropod genome sequences and recent advances in functional genomic tools, like whole-genome tiling path microarrays. The addition of ecologically well-characterized model species opens a window into the relationship between genome structure and function. One such organism, the waterflea *Daphnia*, has long been a model for investigating phenotypic plasticity and sensitivity to chemical stressors in the environment. I discuss the genome sequence of *Daphnia* in the context of other Arthropod taxa and highlight our ongoing efforts to examine the patterns of transcriptional activity in response to the environment. Studies of this kind, examining condition-dependent patterns of genome-wide transcription, are a central component of ecological genomic investigations linking genome function and phenotype to environmental context.

Training Workshops: "Bioinformatics beyond default settings"

This year's training session is sponsored by the ISU Molecular Research Core Facility (MRCF).

The training workshops will include short lectures, demonstrations and round-table discussions regarding planning of bioinformatics projects and implementing bioinformatics into your research. Bring your laptop. Each session is led by experienced researchers.

1. Cytoscape for gene network construction, visualization and analysis

Led by Pete Hallock, a third year ISU Ph.D. student in Biology studying physiological genomics of neurological disorders.

Friday morning 9 a.m.—noon, Conference Center.

2. Gene Set Enrichment Analysis (GSEA) for building and comparing microarray gene expression profiles

Led by Parag Joshi, a second year ISU M.S. student in Biology studying gene expression profiling in response to environmental pharmaceuticals.

Friday evening 7—10 p.m., Riverside Inn Board Room

3. BEAST for molecular dating of evolutionary divergence times

Led by Amanda Fisher, a fourth year ISU Ph.D. student in Biology studying plant phylogenetics.

Sunday morning 9 a.m.—noon, Conference Center

Beyond the Training Workshops

Want more? Each spring, a graduate Bioinformatics course is offered by ISU's Evolutionary Genomics Group (listed as *BIOL 659: Adv. Topics in Genetics*). In odd years, the course concentrates on bioinformatics applications and approaches for the study of **molecular evolution and phylogenetics**. In even years, the course concentrates on bioinformatics applications and approaches for **comparative and structural genomics**.

Bioinformatics Education Breakout Sessions: "Portal-21"

This year's Breakout Sessions are sponsored by the Idaho State Board of Education.

This year's Breakout Sessions revolve around a new project funded by the Idaho SBOE's Tech Incentive Grant program. The project, **Bioinformatics: A portal to 21st Century Biology Education (Portal-21)**, uses advanced, web-based resources to integrate human health and disease genomics into college introductory, high-enrollment Goal 4 biology courses. Breakout Sessions are led by **Moreen Carvan**, a science education researcher and teacher educator who has designed, implemented and evaluated science education program and reform efforts at the local, state and national level since 1987.

The Breakout Sessions are facilitated roundtable discussions designed to generate ideas and potential solutions for issues faced by educators wanting to integrate bioinformatics into the undergraduate curriculum. This integration is important for several reasons. First, bioinformatics approaches provide an excellent opportunity to illustrate key concepts in biology curriculum and experience with modern biology data analysis. Introducing bioinformatics as a legitimate aspect of biological inquiry and discovery helps prepare students for a changing job climate which continues to require proficiency in technology and newly developed approaches. Finally, including bioinformatics in the undergraduate curriculum helps attract talented students to this growing field.

1. Portal-21: What's the Big Idea? Mapping Key Intersections Between BIO 101 and Bioinformatics

Map key intersections between first-year UG Biology and Bioinformatics curriculum and decide on six to eight themes to develop into a common core of project-based modules. Key questions:

- What are the intersections between the "Big Ideas" of biology and those of bioinformatics?
- What would a common, project-based bioinformatics module for first-year biology look like?
- How do we work together to design and implement these modules?

2. Collaborative Design of the Portal-21 Modules: Designing Modules that Really Work!

We'll take our existing "success stories" and create the "common core" of project-based bioinformatics modules. A fully-developed Portal-21 module, then work in small-groups to "backward map" the design of some successful exercises posted on the INBRE Bioinformatics Community Portal. Key questions:

- Does 4-stage learning design support development of Portal 21 modules work?
- Will embedded, student-involved assessment and evaluation give us enough information to determine if the modules are successful?
- How do we best use instructional technologies and tools to address large class sizes in first-year courses?
- What other kinds of resources and support do we need to implement these kinds of modules?

3. The Ripple Effect: Portal 21 as a collaborative, grassroots effort to transform UG biology education.

In this session, we will examine the ripple effect that Portal 21 could have on UG Biology curriculum and course structure. Key Questions:

- How do we build and lead strong collaborations to support implementation of the Portal 21 modules?
- What role do I want to play in the Portal-21 Project?
- How can we use the Portal 21 project to leverage additional federal and state funding for bioinformatics education and application?

Beyond the Breakout Sessions

Eventually, Portal-21 will consist of a set of innovative instructional exercises that target introductory biology students to (1) enhance understanding of the nature of science and research, (2) teach core biology concepts through the lens of genome data and methods, and (3) teach basic skills in bioinformatics and computational biology. The exercises will be widely field-tested with extensive outcomes assessment, revision and ultimate publication as a stand-alone CD and workbook. Portal-21 is being developed in conjunction with the Instructional Technology Resource Center (ITRC) at ISU in consultation with Colorado Springs-based Biological Sciences Curriculum Studies (BSCS). Contact Moreen Carvan or Mike Thomas if you would like to get involved.

Activities in and around Lava Hot Springs

Lava Hot Springs is a year-round resort community located in a picturesque mountain setting, conveniently located between Salt Lake City, Utah and Yellowstone National Park. We think the intimate, resort-like setting suits the style of conference we host. There are a number of activities in Lava in which you can participate:

World famous hot springs: In addition to the hot spring pools associated with Aura Soma Lave Conference Center and the Riverside Inn (or your hotel), you can use the exceptional municipal facility located just east of the Conference Center: Bubbling out of natural underground springs and into the gravel-bottom pools, the hot water is laden with minerals but has no sulfur (and, therefore, no bad odor). Over 3 million gallons a day course through the springs and are diverted into the Portneuf River, keeping the pools ever-changing and clean. The spring's temperatures range from approximately 102˚ to 112˚ degrees. The facility is open until 11 p.m. and has a licensed massage therapist on staff. Passes are $6 (swimsuit & towel rental available).

Restaurants, bars:

- Blue Moon Bar and Grill, 100 S. 1st Ave.
- Riverside Restaurant, in Riverside Inn
- Johnny's Restaurant, 78 N. Main
- Chuckwagon Cafe, 211 E. Main
- Riverwalk Thai Restaurant, 695 E. Main
- Sweet Stuff, 34 E. Main

Other spots:

- Shawn's Market, Center & Main (groceries, sundries, beer)
- Idaho Outpost, 155 E. Main (clothing)
- Dempsey Creek Trading Company, 89 E. Main (gifts and souvenirs)
- Purple Moon and Merlin's Castle, 50 E. Main (gifts and souvenirs)

See www.lavahotsprings.org for information on tours, fishing, golfing, wagon and horseback riding.

About the ISU Bioinformatics Workshops

The Evolutionary Genomics Group at ISU has organized the annual ISU Bioinformatics Workshops to showcase bioinformatics approaches used by scientists in the region and to provide hands-on training for students and faculty interested in using these techniques. For each Workshop, we have arranged funding from a variety of academic and industry sources and hosted dozens of faculty and student participants. These interactions enhance regional collaborative interactions and research potential.

2008 **Symposium on Evolutionary Bioinformatics**
Featuring research talks on evolutionary research approaches and applications. Held in Lava Hot Springs at the Aura Soma Lava conference center. Organized in collaboration with Drs. Heath Ogden. Over fifty participants from 14 institutions participated in the Symposium.

2007 **Symposium on Biomedical Bioinformatics**
Featuring research talks on biomedical research approaches and applications with participants from five regional institutions. Held in Lava Hot Springs at the Aura Soma Lava conference center. Organized in collaboration with Dr. Heath Ogden. Over forty participants from six institutions participated in the Symposium.

2006 **Genome Annotation Jamboree**
Genome Annotation of *Acidophilium cryptum* using genome sequence generated by Dr. Tim Magnuson's lab). Held at ISU in the Plant Sciences Lecture Hall (on the ISU campus). Organized in collaboration with colleagues in the Magnuson lab.

2005 **Bioinformatics: Idahomics**
Training sessions for the use of standard bioinformatics approaches and highlighted research talks of users of those tools. Held at the ISU College of Pharmacy (on the ISU campus). Organized in collaboration with colleagues at the Aberdeen USDA-ARS.

If you would like to play a role in the organization of the 2010 Workshop, please contact Mike Thomas.