

## RIDING THE WAVE: HOW ENDOTHELIAL CELLS DETECT DIFFERENT FREQUENCIES OF BLOOD FLOW January 28

**Jonathan Pace**, Humboldt State University. Endothelial cells line blood vessels and play an important role in the body's response to blood flow. We introduce a model that describes the main ion channels and the membrane potential of endothelial cells. We will discuss our plan to extend this model to study how endothelial cells can discern between different frequencies of blood flow.

## BOSWARMS February 4

**John Blattner**, Emeritus Professor of Mathematics, California State University Northridge. A "BoSwarm" is a stream of bosons of the same frequency. (Photons are the most familiar bosons.) A significant feature of BoSwarms is their "distribution," which is quantified by the Bose-Einstein function, which I call "*BEf*." The *BEf* specifies *something* about the "distribution," but what is it? In this talk, I shall tell you what it is, and I shall offer two quite different and insightful derivations of the *BEf*. Infinite series and differential equations are the mathematical prerequisites.

## COMBINING LIFE HISTORY THEORY, EXPERIMENTS, AND FIELD STUDIES IN SETTING RIVER FLOWS FOR CALIFORNIA STEELHEAD (Special Place: Goodwin Forum) February 11

**Marc Mangel**<sup>††</sup>, Distinguished Professor of Mathematical Biology, UC Santa Cruz. Virtually every river system in California containing steelhead trout is managed for flow and many populations are listed as endangered or threatened under the ESA. There is thus great need to improve the situation of these fish. I will describe a project that involves life history theory, laboratory growth experiments, and field studies that aims to provide advice to management agencies on setting river flows. The life history theory extends previous work on Atlantic salmon (a similar kind of species) and seeks to predict when a fish will prepare for migration to the ocean or remain resident another year, as a function of its size and environmental conditions. Growth is a key component in the life history model and we use laboratory experiments to understand individual variation and local adaptation in growth. Field studies on small coastal streams and large inland rivers, using marked fish, allow us to link growth studies in the laboratory to those in the natural systems and to determine the relationship between time, flow, and food. I will compare the predictions of the theory with empirical results and discuss how the theory can lead to a management tool for setting river flows.

## STATISTICAL AND COMPUTATIONAL ASPECTS OF PARENTAGE-BASED TAGGING OF SALMON February 18

**Eric C. Anderson**, Research Geneticist, Southwest Fisheries Science Center, and Adjunct Professor of Applied Mathematics and Statistics, UC Santa Cruz. Parentage based tagging (PBT) is a newly-proposed way of keeping track of the origin of hatchery salmon by using genetic data to identify who their parents were. I will discuss a number of statistical and computational challenges arising in the application of PBT. Specific topics we will investigate include Monte Carlo simulation and importance sampling, hypothesis testing and likelihood ratio tests, correcting for multiple comparisons using the false discovery rate procedure, and efficient algorithms for inference and simulation from hidden Markov chains.

## EXCELLENT MATHEMATICS February 25

**Ken Yanosko**, Emeritus Professor of Mathematics, Humboldt State University. The word "excellent" in the title refers not to the quality of the mathematics involved, but to its source. I will use the spreadsheet program Excel to help do some counting, some conjecturing, and maybe even some proving.

## MONITORING SYSTEM FOR THE CAMEROON RAIN FOREST March 4

**Howard Stauffer and Larry Fox**, Professor of Statistics and Emeritus Professor of Forestry, Humboldt State University. The speakers will describe their trip to Cameroon this past December to develop the monitoring system for their rain forest. The system is based upon a stratified multiphase random sampling system for image processing change detection analysis of satellite imagery. In the future, Cameroon plans to benefit from carbon count offset funds by preserving their rain forests that will be monitored with this system.

## MATHEMATICAL METHODS IN ORIGAMI DESIGN (Special Place and Day: SciB 133, Tuesday) March 9

**Robert J. Lang**<sup>†</sup>, [Langorigami.com](http://Langorigami.com). The last decade of this past century has been witness to a revolution in the development and application of mathematical techniques to origami, the centuries-old Japanese art of paper-folding. The techniques used in mathematical origami design range from the abstruse to the highly approachable, and tap into diverse mathematics ranging from Euclid up to the latest developments in computational geometry. In this talk, I will describe how geometric concepts have led to the solution of a broad class of origami folding problems, including the problem of efficiently folding a shape with an arbitrary number and arrangement of flaps, and new geometric forms known as "origami tessellations." Along the way, mathematical methods have enabled origami designs of mind-blowing complexity and realism, some of which you'll see, too. As often happens in mathematics, theory originally developed for its own sake has led to some surprising practical applications. The algorithms and theorems of origami design have shed light on long-standing mathematical questions and have solved practical engineering problems. I will discuss examples of how origami has enabled safer airbags, Brobdingnagian space telescopes, lifesaving medical advances, and more.

## HOW EXPERT ARE "EXPERT" WINE JUDGES? March 11

**Robert Hodgson**, Emeritus Professor of Oceanography, Humboldt State University. For the past six years, with consent from the California State Fair, Professor Hodgson secretly served replicate wine samples to judges during the Fairs commercial wine competition. Using a simple statistical analysis, he was able to reveal that most "expert" wine judges were, in fact, quite inconsistent in their evaluation of wine quality. In a second study, Hodgson examined the medals awarded some 4000 wines that were entered in 13 major U.S. wine competitions, indicating that the likelihood of winning a gold medal could be predicted by chance alone. The results of both studies were published in the *Journal of Wine Economics*, (available as PDF, Vol3:2 and Vol4:1) and was the subject of a recent article in the *Wall Street Journal* (Nov 20,2009). The results of this work will be discussed. An elementary knowledge of statistics will be useful but not essential.

## TOWERS OF POWERS March 25

**Walden Freedman**, Professor of Mathematics, Humboldt State University. The hyperpower function defined by  $f(x) = x^{x^{x^{\dots}}}$  has intrigued mathematicians such as Euler, Bernoulli, and Cantor. Some basic questions arise: What are the domain and range of  $f$ ? Is  $f$  is 1-to-1? If so, what is  $f^{-1}$ ? In this talk, Dr. Freedman will introduce this function and its properties. The main tools will be mathematical induction and convergence of sequences.

## MODELS AND ENDANGERED SALMON IN THE COLUMBIA April 1

**Rollie Lamberson**, Emeritus Professor of Mathematics, Humboldt State University and Member of Independent Science Advisory Board for the Columbia River Basin. At the time of Lewis and Clark about 15 million salmon were returning to spawn in the Columbia Basin each year. Current returns are about one million with most of those resulting from artificial hatchery production. In this presentation, I will give an overview of the COMPASS Model, the major model used to study salmon dynamics in the Columbia River System and then look at a more specialized model which examines the impact of hatchery management practices on the timing of salmon spawning.

## EFFECTS OF UNKNOWN IMMUNITIES FROM THE HPV VACCINE ON INFECTION RATES IN A POPULATION April 8

**Angela Gallegos**, Professor of Mathematics, Occidental College. [Joint work with Aaron Steinberg and David Uminsky.] The vaccine against the Human Papillomavirus promises a great decrease in the cervical cancer incidence rates in the United States. Given that the vaccine is still relatively young, it has some effects that are not yet understood: for example, how much immunity does an individual carry if she does not successfully finish the vaccine sequence? We propose a markov based model to consider some of these unknown effects on the HPV infection and cervical cancer rates in a population.

## THE PROBLEM OF THE LONGITUDE AND THE INVENTION OF THE SEXTANT April 15

**Richard Paselk**, Professor of Chemistry, Humboldt State University. Regular transoceanic voyages of commerce and exploration made the determination of longitude a necessity to avoid loss of life and property essential after the 15th century, resulting in the "Longitude Prize" offered by the British Parliament. I will discuss the solution of this problem based on angular measurements of celestial distances, which engaged the greatest mathematicians and mechanics of the age.

## MATHEMATICAL MODELS OF THE BIOLOGICAL CLOCKS OF INTERTIDAL ORGANISMS April 22

**Chris Dugaw**, Professor of Mathematics, Humboldt State University. I will present simple mathematical models that provide evidence to settle a long standing dispute about the nature of biological clocks of crabs that live in the intertidal zone.

## MULTIPLYING NUMBERS April 29

**Brad Ballinger**, Professor of Mathematics, Humboldt State University. We consider a few alternatives to the algorithm most commonly taught in U.S. schools. Faster, clearer, or more magical, some of these alternatives might help our students grasp advanced mathematics.