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*The Division of Natural Sciences  
Welcomes  
You to the 2004 Academic Festival!*

This year marks the tenth anniversary of the Academic Festival, a Natural Sciences tradition since 1995. Each spring we celebrate academic accomplishments of the past year with posters and oral presentations representing the outcomes of independent investigative learning, which over the past decade has become a hallmark of our division.

Those of us who have attended the festival over the years have been struck by the steady increase in the professionalism of our students. In part this can be attributed to their mastery of technology that was not available in the early days of the festival. But in no small measure the quality of the products reflects the sophistication of our students and their willingness to engage challenging problems, as well as high expectations of faculty mentors.

This year, students from all six departments of the Natural Sciences Division, as well as students in the Environmental Studies Program, will present talks and posters. Included are many senior capstone presentations, as well as class projects. Naturally the presenters are key participants in the festival. The other key participants are those who attend and share in the excitement of a time devoted to celebrating scholarship.

A successful festival depends not only on student presentations and participation by the community, but also on careful planning and implementation. The Academic Festival Committee has worked for months to ensure that once again we will have a first-class celebration. We thank committee members Matt Smith (Biology), Myriam Cotten (Chemistry), Tosh Kakar (Computer Science and Computer Engineering), Rose McKenney (Environmental Studies), Jill Whitman (Geosciences), Jeff Stuart (Mathematics), Richard Louie (Physics), Matthew Hacker and Anita Wahler (both Natural Sciences), and Lindsey Yates (student assistant).

Have a wonderful time at the 2004 Academic Festival. Join with me in expressing your appreciation to our featured students and their faculty mentors, and to those who have so thoughtfully planned the festival.

Tom Carlson





Dean of Natural Sciences





# *Natural Sciences Academic Festival*

## *2004 Schedule*

### *Friday, April 30<sup>th</sup>, 2004*

- 10:30 AM to 2:30 PM.....Poster & Demonstration Check-In, *Rieke Science Center*
- 12:30 PM to 2:30 PM.....Oral Presentations
- 1:00 PM to 2:30 PM.....Summer Research Poster Presentations
- 2:30 PM to 3:30 PM.....Poster Presentations, Demonstrations, and Break
- 3:30 PM to 6:00 PM.....Oral Presentations

### *Saturday, May 1<sup>st</sup>, 2004*

- 8:30 AM to 10:30 AM.....Oral Presentations
- 10:30 AM to 10:45 AM.....Break
- 10:45 AM to 12:30 PM.....Oral Presentations
- 12:30 PM to 1:30 PM.....Lunch, *Rieke Science Center*
- 1:30 PM to 3:00 PM.....Oral Presentations
- 3:00 PM to 3:30 PM.....Break
- 3:30 PM to 5:30 PM.....Oral Presentations



## *Room Schedule*

<b>Friday, April 30<sup>th</sup></b>		
<b>Time</b>	<b>Room</b>	<b>Department</b>
12:30 PM to 2:30 PM	RCTR – 103 (Leraas)	CSCE
	RCTR – 109	Environmental Studies
	RCTR – 210	Mathematics
	RCTR – 220	Physics
2:30 PM to 3:30 PM	Posters and Demonstrations	
3:30 PM to 4:30 PM	RCTR – 109	Mathematics
3:30 PM to 5:30 PM	RCTR – 102	Biology
	RCTR – 122	Biology
	RCTR – 103 (Leraas)	CSCE
3:30 PM to 6:00 PM	RCTR – 109	Environmental Studies

<b>Saturday, May 1<sup>st</sup></b>		
<b>Time</b>	<b>Room</b>	<b>Department</b>
8:40 AM to 12:05 PM	RCTR – 102	Biology
9:00 AM to 10:30 PM	RCTR – 103 (Leraas)	CSCE
	RCTR – 109	Geosciences
	RCTR – 220	Mathematics
10:40 AM to 12:30 AM	RCTR – 220	Mathematics
11:00 AM to 12:30 PM	RCTR – 103 (Leraas)	CSCE
	RCTR – 109	Geosciences
12:30 PM to 1:30 PM	Lunch	
1:30 PM to 3:00 PM	RCTR – 109	Environmental Studies
1:30 PM to 3:30 PM	RCTR – 103 (Leraas)	CSCE
1:30 PM to 4:30 PM	RCTR – 220	Mathematics
3:30 PM to 5:30 PM	RCTR – 109	Environmental Studies



# *Oral Presentation Schedule*

## *Friday, April 30<sup>th</sup>*

### Biology

Friday ..... Rieke 102

Time	Student(s)	Class	Topic
3:30 PM	Kari Nordgren	499	Understanding Marine Viruses Beyond the Small Fish in the Big Ponds
3:50 PM	Katie Carper	499	Calcium Channel Structure and Regulation
4:10 PM	Kirsten Helleson	499	Factors Affecting Methanotrophic Bacteria's Ability to Degrade Trichloroethylene
4:30 PM	Hannah Thomas	499	Smallpox and Biological Warfare
4:50 PM	Christie Novak	499	High Altitude Living: A New Model of Human Adaptation
5:10 PM	Noah Frerichs	499	The Effects of Periodontal Disease on Cardiovascular Health

### Biology

Friday ..... Rieke 122

Time	Student(s)	Class	Topic
3:30 PM	Fredrick Larabee	499	<i>Rhagoletis Pomonella</i> and the Allopatric/Sympatric Speciation Debate
3:50 PM	Bryce Shaffner	499	Transgenic Plants: Do the Benefits Outweigh the Risks?
4:10 PM	GweLinda Johnson	499	Albuminuria and Diabetes Mellitus

# Biology

Friday ..... Rieke 122

Time	Student(s)	Class	Topic
4:30 PM	Matthew Harri	499	The Environmental Effects of Ecotourism in the Galapagos
4:50 PM	Stephanie Soriano	499	Indirect and Direct Roles of Estrogen in the Estrous Cycle of the Rat

# Computer Science and Computer Engineering

Friday ..... Rieke 103(Leraas Lecture Hall)

Time	Student(s)	Class	Topic
12:30 PM	Darrel Rohar	499	An Algorithm to Prioritize Search Engine Results Using User Selected Categories
12:55 PM	Andrew Black	499	Frankenstein
1:20 PM	Mark Anderson Cory Holcomb Aaron Lahman Laurie Smith	499	Introduction to Robotics Competition
1:25 PM	Mark Anderson Cory Holcomb	499	The LabRat
2:00 PM	Aaron Lahman Laurie Smith	499	Unaided Robot Navigation in Static Environment
2:30 PM	Break		
3:30 PM	Casey Gorham Dominic Jean Scott Taladay	131	Solar Energy Conversion
3:50 PM	Dan Russell Aaron Schrenk	499	Clue the Game

## Computer Science and Computer Engineering

Friday ..... Rieke 103(Leraas Lecture Hall)

Time	Student(s)	Class	Topic
4:20 PM	Dung Le Kathy Kellogg	499	The Evolution of Gates, from Bill Gates to Fredkin and Toffoli Gates
4:50 PM	Colin Dunn Chris Gray	499	PAM X

## Environmental Studies

Friday ..... Rieke 109

Time	Student(s)	Class	Topic
12:30 PM	Jewel Koury	499	Educating Children about the Natural Environment
1:00 PM	Ryan Nabors	499	Cleanup of PCBs in Hylebos Waterway
1:30 PM	Elizabeth Stone	499	Integrated Waste Management at Pacific Lutheran University
2:00 PM	Michael Henson	499	Sustainable Street Renovation at PLU
2:30 PM	Break		
3:30 PM	Heidi Lyman	499	Ecotourism: Conserving Biodiversity and Benefiting Local Communities
4:00 PM	Shelly Eisenbarth	499	Wet Soils Turn Up Dry
4:30 PM	Kate Dunlap	499	The Biological and Economic Effects of Water Loss in Clover Creek
5:00 PM	Lara Koger	499	Warm Springs and Cushman Hydroelectric Dams: An Ecofeminist Perspective
5:30 PM	Kim Swanson	499	Volunteerism and Local Urban Streams

## Mathematics

Friday ..... Rieke 210

Time	Student(s)	Class	Topic
12:40 PM	Andrew Callender	499	The Mathematics of Music
1:40 PM	Kirstin Singer	499	Investigating Mathematical Problem Solving
2:30 PM	Break		
3:30 PM	Matt Honstain	499	Categorical Data Analysis with Logistic Regression

## Physics

Friday ..... Rieke 220

Time	Student(s)	Class	Topic
12:30 PM	Cory Holcomb	499	Magnetorheological Fluid
12:45 PM	Chris Ellison Justin Lunday	499	Probabilities and Deterministic Models
1:15 PM	Harold Jensen III	499	Fundamentals of Electron Diffraction
1:30 PM	Benjamin White	499	Light Scattering in Necked Polymer Plastics
1:45 PM	Lindsey Olson	499	Nuclear Scattering Simulation with Non-Circular Targets
2:00 PM	Brad Oraw	499	Synchronization Response of Coupled Metronomes

# *Saturday, May 3<sup>rd</sup>*

## Biology

Saturday.....Rieke 102

Time	Student(s)	Class	Topic
8:40 AM	Jennifer Gustafson	499	Why Has the Incidence of Allergies Increased In Developed Countries?
9:00 AM	Eric Hessler	499	Memory: Consolidation's Implicit Neglect
9:20 AM	Amanda McCarty	499	Cetaceans and Anthropogenic Sound
9:40 AM	Ryan Schulz	499	Biology and Homosexuality
10:00 AM	Lindsey Worthington	499	HIV and Evolution
10:20 AM	Break		
10:45 AM	Brandon Kyriss McKenna Manion	491	Investigation of Bacteriocidal Properties and Molecular Cloning of the Antimicrobial Peptide Piscidin-3
11:25 AM	Elaine Lee	499	Calcium Signaling in Plants: The Role of Calcium-Dependent Kinases and Calmodulin
11:45 AM	Katie Thonstad	499	Wound Responses in Plants
12:05 PM	Frank Jackson	491	Role of Platelets in Atherosclerosis

# Computer Science and Computer Engineering

## Saturday.....Rieke 103 (Leraas Lecture Hall)

Time	Student(s)	Class	Topic
9:00 PM	Nima Nourozi	499	BREE Version 2
	David Birth Aaron Mast	499	Exploring Digital Video Using Net and DirectShow
10:00 PM	Carrie Larsen Jakob Perry Omar Sadiq Robert Van Gorkom	499	Facilis
10:40 PM	Break		
11:00 PM	Brad Oraw Jeremy Tinder	499	MARS: Modular Autonomous Robotic Snake
11:30 PM	Jacob Nelson	Alumni	An FPGA based Custom Computer
12:00 PM	Kenneth A. Perrine	Alumni	Interactions with Gigapixel Images on Parallel Computers
12:30 PM	Break		
1:30 PM	Michael Wright Nate Yocom	Alumni	pGina from Capstone to Open Source Success
2:00 PM	Bryce Bockman	Alumni	SNMP is not Simple
2:30 PM	Shane Hall	Alumni	The Do it Yourself Phone Company
3:00 PM	Keith Folsom	Alumni	Using Perl and PHP to Create PLU Online Web Services

# Environmental Studies

Saturday.....Rieke 109

Time	Student(s)	Class	Topic
1:30 PM	Stephen Vaughn	499	Identifying Areas of Ground Water and Surface Water Interaction in the Upper Reaches of the Yakima Basin through Thermal Profiling, and its Affects on Salmon Redd Building
2:00 PM	Patrick Grenko	499	The Effect of Environmental Management at McChord Air Force Base on Clover Creek
2:30 PM	Dawn Shaw	499	Golden Rice and the Philippines: Ethics, Politics, and Vitamin A
3:00 PM	Break		
3:30 PM	Leah Proctor	499	Human Interactions with the Fire Ecology of Western Forests in the United States
4:00 PM	Ryan Pozzuto	499	Pierce County Recycling: History, Comparison, Projections
4:30 PM	Erin Burgess	499	Physical Restraints to Economic Growth
5:00 PM	Jessie Ham	499	Conservation Tillage and Its Effects on the Palouse Region of Washington State

## Geosciences

Saturday.....Rieke 109

Time	Student(s)	Class	Topic
9:00 AM	Megan MacDonald	499	Puget Creek: The Future of an Urban Watershed
9:30 AM	Kimberly Fowler	499	Modification of the 1980 Mount St. Helens Tephra Deposit: The First 24 Years
10:00 AM	Courtney Johnson	499	Fault Lineations Between the Tacoma and White River Faults
10:30 AM	Break		
11:00 AM	Erica J. Litow	499	Tsunami Evidence at Lynch Cove and at Quilcene Bay Hood Canal, WA
11:30 AM	Collette Foley	499	Channel Change Analysis at Lacamas Creek Restoration Project
12:00 PM	Jody Phipps	499	Hydrothermal Vent Chemistry and Fluid Rock Interactions at Oceanic Spreading Centers

## Mathematics

Saturday.....Rieke 220

Time	Student(s)	Class	Topic
9:40 AM	Lindsey Olson	499	Risk Assessment Tools in Epidemiology
10:30 AM	Break		
10:40 AM	Kathy Kellogg	499	Time Series Analysis
11:40 AM	Dung Le	499	SET ®, The Mathematical Game of Trick or Treat?
12:30 PM	Lunch		

# Mathematics

Saturday.....Rieke 220

Time	Student(s)	Class	Topic
1:30 PM	Chris Ellison	499	A Survey of Differential Geometry
2:30 PM	Kevin Roberts	499	The Building Blocks of Math: Prime Numbers and the Riemann Hypothesis
3:30 PM	Charles Dorner	499	Pascal's Triangle and Fibonacci Numbers

# *Oral Presentation Submitted Abstracts*

## **BIOLOGY**

### **Katie Carper: Calcium Channel Structure and Regulation**

Calcium channels are found in both plants and animals and are found to be important in many cellular processes. These channels vary in their receptor types including stretch receptors, L-type receptors and ryanodine receptors and are found to be common among various organisms.

### **Matthew Harri: The Environmental Effects of Ecotourism in the Galapagos**

With over 500,000 visitors/year, conservation and protection are top priority and this talk will look into the effects tourism has already had on the islands' flora and fauna and what is being done about to protect this precious resource.

### **Kirsten Helleson; Factors Affecting Methanotrophic Bacteria's Ability to Degrade Trichloroethylene**

Trichloroethylene (TCE), an EPA priority pollutant and a potential carcinogen, has been shown to be degraded by methanotrophs, a type of bacteria that utilizes methane as its sole carbon and energy source. Factors affecting methanotrophic ability to degrade TCE will be discussed.

### **GweLinda Johnson: Albuminuria and Diabetes Mellitus**

My presentation will present an overview of the types of diabetes, kidney function and how it plays a role in the genesis of albuminuria, which then can lead to end stage renal disease.

### **Brandon Kyriess, McKenna Manion: Investigation of Bacteriocidal Properties and Molecular Cloning of the Antimicrobial Peptide Piscidin-3**

Piscidin-3 is an antimicrobial peptide found in Hybrid Striped Bass. Our goals were to clone the Piscidin-3 gene via degenerate RT-PCR, and to test its bacteriocidal properties against microbes of varying membrane lipid compositions.

### **Fredrick Larabee: Rhagoletis pomonella and the Allopatric/Sympatric Speciation Debate**

This talk will explore the Rhagoletis pomonella's sympatric host shift from hawthorn to apple fruit and how both allopatric and sympatric elements exist in this fly's divergence.

### **Kari Nordgren: Understanding Marine Viruses: Beyond the Small Fish in the Big Pond**

Marine viruses have far reaching effects on the ecosystem, and their interaction with microbes will be examined as well as their role in nutrient cycling, pollution, and algal blooms. Viruses in the water column will also be characterized in terms of their specificity, distribution, and diversity.

### **Stephanie Soriano: Indirect and Direct Roles of Estrogen in the Estrous Cycle of the Rat**

Estrogen operates as a feedback molecule that is secreted from the ovary to regulate reproduction. I will discuss two mechanisms by which estrogen appears to exert its effects.

**Hannah Thomas: Smallpox and Biological Warfare**

This presentation addresses the clinical and epidemiological features of the small pox virus as a mechanism of biological warfare. Several modes of transmission are addressed. Benefits of vaccination are examined including potential benefits of post infection vaccination

<b><i>COMPUTER SCIENCE AND COMPUTER ENGINEERING</i></b>
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**Mark Anderson, Cory Holcomb: The LabRat**

This autonomous robot uses a microprocessor along with infrared sensors and memory to solve mazes. Our own implementation of Tremaux's maze-solving algorithm along with precise servo motion controls will allow the LabRat to solve virtually any maze.

**Andrew Black: Frankenstein**

A (semi) comprehensive system for managing Computer Science and Computer Engineering Capstone projects, built around existing open source tools.

**Bryce Bockman: SNMP is not Simple**

The Simple Network Management Protocol (SNMP) is an ubiquitous standard for the management of networking and computing systems. I will present the protocol from an implementer's perspective, trying to translate a seemingly endless tower of RFCs into SIMPLE design.

**David Birch, Aaron Mast: Exploring Digital Video Using .Net and DirectShow**

This project focuses on exploring how digital video applications are created. We will explain DirectShow filter graphs, explore the .Net environment, and demonstrate the multimedia software we have built using these tools.

**Colin Dunn, Chris Gray: PAM X**

Implementing a uniform method of fine tuned authentication on Mac OS X, Windows®, UNIX™ through the use of Pluggable Authentication Modules. PAM X will increase integration of Mac OS X into larger, multi platform networks.

**Keith Folsom: Using Perl and PHP to Create PLU Online Web Services**

A look at the technology behind the current services available at <http://www.plu.edu/online>, as well as what is in development and planned for the near future.

**Casey Gorham, Dominic Jean, Scott Taladay: Solar Energy Conversion**

Our project focuses on solar energy as an alternative source of energy. Through research, we have compared different techniques of solar energy conversion. The results demonstrate the different efficiencies involved in the energy conversion process.

**Shane Hall: The Do it Yourself Phone Company**

A look at how VOIP can be used as an alternative to and in conjunction with traditional telephony services. Experiences with implementing a SIP based system utilizing Asterisk PBX software and ISDN PRI connections will be discussed.

**Kathy Kellog, Dung Le: The Evolution of Gates, from Bill Gates to Fredkin and Toffoli Gates**

We will present the research of a quantum network, which converts a plain text to cipher text and vice versa. The project uses the idea of a Substitution-Permutation (SP) technique. The SP network is made up of the combination of Fredkin and Toffoli gates, which implements the quantum phenomenon.

**Aaron Lahman, Laurie Smith: Unaided Robot Navigation in Static Environment**

Developing methods for autonomous robot navigation; producing a miniature robot able to navigate a maze in an efficient manner. Focused on designing for cost, ease of development and testing, and adaptability.

**Carrie Larsen, Jakob Perry, Omer Sadiq, Robert Van Gorkom: Facilis**

Facilis is a network based student information scheduling, and grading suite for schools created primarily in JAVA and MySQL. It allows teachers, counselors and administrators to perform their individual tasks in one easy application.

**Jacob Nelson: An FPGA- based Custom Computer**

In four months, a simple, extensible computer architecture for special-purpose embedded control applications was developed and implemented in an FPGA. Design tradeoffs and directions for performance improvement will be discussed.

**Nima Nourozi, Mike Reynolds: BREE Version 2**

We have created the Affiliations module that will integrate into The National Bureau of Asian Research's (NBR) Contact Resource Management (CRM) application, BREE. The Affiliations module is designed to help NBR manage member status, activities, and organizations in which they belong.

**Brad Oraw, Jeremy Tinder: MARS- Modular Autonomous Robotic Snake**

MARS is a 12 segment snake like robot that uses a novel joint design to facilitate non planar motion. Using sinusoidal undulation, the robot can move horizontally and vertically. Modular intelligence allows for easy expansion without having to redesign core components.

**Kenneth A. Perrine: Interactions with Gigapixel Images on Parallel Computers**

Pacific Northwest National Laboratory's recent research in large-scale image processing has employed the use of commodity parallel computing hardware, new interaction techniques, and fast feedback to the user.

**Darrel Rohar: An Algorithm to Prioritize Search Engine Results Using User-Selected Categories**

Queries to search engines can return result sets of tens of thousands of pages. We investigate Google's Page-Rank algorithm and propose an improvement that prioritizes results by topic-specific, user-selected categories.

**Dan Russell, Aaron Schrenk: Clue the game**

We have created a one player computer game modeled after the mystery themed game Clue. The player has a choice of two to five computer opponents. The game is written as an application and uses swing components.

**Michael Wright, Nathan Yocom: pGina: from Capstone to Open Source Success**

We will start with an overview of the pGina project, a comparison of where it was when we last spoke and where it is now. We will then discuss our reasons for choosing the GPL license for the project, why we believe it has worked for us, and where we plan on going in the future.

**ENVIRONMENTAL STUDIES****Erin Burgess: Physical Restraints to Economic Growth**

A more complete understanding of how the economic process depends upon the physical environment is crucial to the current sustainability debate. Physical growth limits are constrained by the sources of low entropy matter-energy available to humans

**Kate Dunlap: The Biological and Economic Effects of Water Loss in Clover Creek**

Over that past century human alterations to Clover Creek have resulted in water loss from the stream, thereby causing salmon populations to decline. Loss of salmon has adversely affected some industries, impacting the economy of the Clover Creek area.

**Shelly Eisenbarth: Wet Soils Turn Up Dry**

The relationship between the shallow aquifer and stream flow can provide insight into why Clover Creek is running dry. This study combines history, geology, and economics to explore the interdependent nature of the environment and the community.

**Patrick Grenko: The Effect of Environmental Management at McChord Air Force Base on Clover Creek**

This project concerns environmental management at McChord Air Force Base. Land use and zoning are examined with emphasis on wetlands, namely Clover and Morey Creeks, native species and ecosystems, and how the base budgets its environmental program.

**Jessie Ham: Conservation Tillage and Its Effects on the Palouse Region of Washington State**

Conservation tillage is becoming a popular option for soil erosion control in the Palouse region of Washington State. This developing technology involves environmental, economic, social implications.

**Michael Henson: Sustainable Street Renovation at PLU**

Arguments for a sustainable street renovation project at PLU are based on the ethical norm of sustainability. Discussion includes David Orr's vision of campus sustainability, analysis of campus geology, and comparison to a similar renovation project.

**Lara Koger: Warm Springs and Cushman Hydroelectric Dams: An Ecofeminist Perspective**

Hydroelectric dams often affect Native American resources and rights. Cushman and Warm Springs hydroelectric dam relicensing negotiations are analyzed using ecofeminist theory.

**Jewel Koury: Educating Children about the Natural Environment**

An educational plan focused on the metamorphosis of butterflies and grasshoppers was developed for the Tahoma Audubon Tacoma Nature Center. The plan seeks to teach children raised in urban settings to value the natural environment.

**Heidi Lyman: Ecotourism: Conserving Biodiversity and Benefiting Local Communities**

Ecotourism is a concept that implements principles that benefit local communities and conserves biodiversity. The Galapagos Islands, Monteverde Cloud Forest reserve, and Rio Blanco are examples that characterize successful ecotourism projects.

**Ryan Nabors: Cleanup of PCBs in Hylebos Waterway**

Current PCB levels in Hylebos waterway require cleanup. Current cleanup activities and future cleanup plan include sealing and dredging. The impact of cleanup on economic development of the area is explored.

**Ryan Pozzuto: Pierce County Recycling: History, Comparison, Projections**

Residential recycling in Pierce County has changed throughout its history and will further evolve in the future. Approaches are analyzed for effectiveness, i.e., increased resident participation, reduced waste, environmental benefits.

**Leah Proctor: Human Interactions with the Fire Ecology of Western Forest in the United States**

Human interaction with fire ecology of western forests has altered these forest ecosystems. Prescribed burning and fire suppression help save forests from devastating fires and protect humans, while allowing fire to rejuvenate the forest communities.

**Dawn Shaw: Golden Rice and Philippines: Ethics, Politics, and Vitamin A**

A breakthrough in genetic engineering, Golden Rice could potentially provide sufficient levels of Vitamin A to people in developing nations where Vitamin A deficiency is a major health concern, but long-term risks may outweigh benefits.

**Elizabeth Stone: Integrated Waste Management at Pacific Lutheran University**

PLU plans to add composting to its integrated waste management. Successful institutional composting projects incorporate sound science, significantly reduce waste, and educate the public.

**Kimberley Swanson: Volunteerism and Local Urban Streams**

Many Puget Sound streams are heavily impacted by urbanization. Small volunteer organizations such as Pierce County Stream Team are fighting to reserve the effects of urbanization on these streams.

**Stephen Vaughn: Identifying Areas of Ground Water and Surface Water Interaction in the Upper Reaches of the Yakima Basin Through Thermal Profiling, and its Affects on Salmon Redd Building**

Thermal profiling data for the Yakima Basin River reaches in the eastern Cascades are analyzed to determine if salmon select redd sites based on temperature. This data will help manage salmon, which are important to the Yakima Tribe.

***GEOSCIENCES***

**Collette Foley: Channel Change Analysis at Lacamas Creek Restoration Project**

Stream restoration methods are evaluated to determine if channel changes conducive to salmon habitation are occurring. Stream cross-section and pebble counts were performed at several areas of the creek before and after restorative measures.

**Kimberly Fowler: Modification of the 1980 Mount St. Helens Tephra Deposit: The First 24 Years**

Less than 50% of the tephra from the 1980 Mt. St. Helens eruptions remains. It has been modified by human interaction, bioturbation, and climate. Traces or layers are found in undisturbed, flat areas in Eastern WA where more than 7mm was deposited

**Courtney Johnson: Fault Lineations Between the Tacoma and White River Falls**

Fault lineations based on aerial photos and light distance and ranging (lidar) model analysis are examined to determine if the two faults connect. Potential seismic damage in the Pacific Northwest would be far greater than what is now believed.

**Erica J. Litow: Tsunami Evidence at Lynch Cove and a Potential Tsunami Deposit at Quilcene Bay, Hood Canal, WA**

Known and potential tsunami deposit locations along Hood Canal, WA are compared. Types of data analyzed for this study include a GIS map, channel morphology, stratigraphic cross-sections, grain size and composition.

**Megan MacDonald: Puget Creek: The Future of an Urban Watershed**

The status of an urban watershed in Tacoma is assessed using GIS, hydrograph, and pebble count analyses. Potential restoration methods are evaluated

**Jody Phipps: Hydrothermal Vent Chemistry and Fluid-Rock Interactions at Oceanic Spreading Centers**

Hydrothermal vent chemistries and fluid rock interactions, including phase separation of hydrothermal vent fluids, are compared from the TAG hydrothermal field, Mid-Atlantic Ridge; Axial Volcano, Juan de Fuca Ridge; and 9-10°N, East Pacific Rise.

***MATHEMATICS***

**Andrew Callender: The Mathematics of Music**

Why are there 12 notes in an octave? Why do musical instruments sound different from each other? Studying music from a mathematical perspective transforms music into a logical system that obey certain rules and principles, allowing such questions to be answered.

**Charles Dorner: Pascal's Triangle and Fibonacci Numbers**

After examining these well known patterns, we develop a collection of multi-dimensional recursively defined sequences, including Fibonacci's Triangle. A few qualities of the sequences are explored and closed forms are determined.

**Chris Ellison: A Survey of Differential Geometry**

Differential geometry is the study of curves and surfaces using calculus, differential equations, and vector analysis. This presentation examines geodesics and curvature on various surfaces.

**Matthew Honstain: Categorical Data Analysis with Logistic Regression**

We investigate logistic regression as a tool for studying categorical data, including discussion of odds and logarithms of odds. We also fit data exhibiting naturally categorical tendencies to a suitable logistic regression

**Kathy Kellogg: Time Series Analysis**

Time series analysis is the analysis of experimental data that have been observed at different points in time. Since time series data has noise the idea is to find a perfect model which suppress the noise

**Dung Le: SET ®, The Mathematical Game of Trick or Treat?**

The word “set” in mathematics implies a set that contains the element(s) that satisfy certain rules, conditions or definitions. SET ® is a game that can be used as an excellent way to introduce the fundamentals of set theory. In this project, the game SET ® will be presented as a mathematical game of trick and treat at the same time.

**Lindsey Olson: Assessment Tools in Epidemiology**

Various risk assessment tools commonly used in epidemiology will be discussed to determine how certain diseases can be attributed to multiple risk factors under levels of stratification. A real case study will be used for illustration.

**Kevin Roberts: The Building Blocks of Math: Prime Numbers and the Riemann****Hypothesis**

An exploration of the properties and distribution patterns of prime numbers. We will examine the zeta function developed by Euler and the complex variation developed by Riemann in his attempt to define pattern in the sequence of primes.

**Kristin Singer: Investigating Mathematical Problem Solving**

What is involved in the problem-solving process? What affects performance? How can we teach students to be accurate problem-solvers? This presentation gives answers to these and other questions as well as highlights a local study of problem solving.

**PHYSICS****Chris Ellison, Justin Lunday: Probability and Deterministic Models**

The probability of a fair die landing on any side is  $1/6$ . Now, suppose the die was no longer cubical. How does the probability distribution change? Using cylindrical dice and rectangular blocks, this study investigates if probabilities can be predicted from deterministic computer models.

**Cory Holcomb: Magnetorheological Fluid**

An investigation into the creation and properties of Magnetorheological Fluid. This fluid is created by suspending iron particles in oil, and the viscosity of the fluid is dependent upon an applied magnetic field

**Harold Jensen III: Fundamentals of electron diffraction**

Electrons accelerated through a thin graphite screen diffract, and appear as concentric rings on a target screen. Measuring the ring diameters allows DeBroglie’s particle wavelength relationship to be combined with the nature of waves in order to measure the lattice spacing of the graphite.

**Lindsey Olson: Nuclear Scattering Simulation with Non-Circular Targets**

By simulating nuclear scattering of atomic particles with mechanical and mathematical models, target dimensions can be determined by the scattering pattern of balls that are deflected from their path and strike the perimeter of the cylindrical basin.

**Brad Oraw: Synchronization Response of Coupled Metronomes**

During synchronization, nearly identical oscillators (such as metronomes), started with different initial conditions, will progress toward a 0 degree phase difference. This presentation will discuss the relationship between the rate of synchronization and the natural frequency of the metronomes.

**Benjamin White: Light Scattering Necked Polymer Plastics**

This research focused on necking polymer plastics, specifically on its effect on the scattering of light. By analyzing the relative intensities of light transmitted through the plastic as it stretched, I studied the process of how necking enhances the scattering incident light.

## *Poster Presentations*

<b><i>BIOLOGY</i></b>
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Poster #	Student(s)	Class	Topic
1	Brandon Kyriss McKenna Manion	491	Molecular Cloning of the Antimicrobial Peptide Piscidin-3
2	Brandon Kyriss McKenna Manion	491	Studies on the Bacteriocidal Properties of the Antimicrobial Peptide Piscidin-3
3	Jennifer Huffman Jeremy Hutchins Terfawna Watts	403	Effects of Bisphenol A on Fidelity of Chromosome Segregation During Mitosis
4	Andrea Gabler Jennifer Ironside Erin Wiggins Andrea Wold	403	Protein Populations in Mung Bean Seedlings Grown in the Dark in Comparison with those Exposed to Light
5	Kendall Blair Andrea Cox Lori Curran Erin Ham	403	Glycoprotein Populations as Manifestations of Gene Expression During Frog Embryo Development
6	Megan Hockert Andrew Holloway Sara Perry Jenny Schlies	403	Protein Population in Mung Bean Seeds and Seedlings
7	Erik Bishop Lisa Boullioun Consetta Hunt GweLinda Johnson Yeuk Hung Wu	403	Acid Phosphatase Activity in Tadpole Tail Tips and Regenerating Tail Tips
8-13	Microbiology students	328	Microbiology Laboratory Investigations

**CHEMISTRY**

<b>Poster #</b>	<b>Student(s)</b>	<b>Class</b>	<b>Topic</b>
14	Bethany Carter	338	Spectrophotometric Analysis on Iron in Protein Bars
15	Bethany Carter Daniel Seetin	336	Preparation of Fmoc-Glycine
16	Daniel Seetin	338	Spectrophotometric Determination of Iron in Centrum Tablets
17	Steve Erbey Tighe Stuart	336	A Palladium-Catalyzed Coupling of an Aryl Group to a Terminal Alkyne
18	Kirsten Forseth	338	Analysis of Fluoride Concentration in Toothpaste
19	Kirsten Forseth Allison Kanarr	336	Synthesis of a Diphenylethene
20	Allison Kanarr	338	Analysis of Iron Using ICP
21	Erik Helleson	338	Spectrophotometric Analysis of Caffeine and Benzoic Acid in Mountain Dew
22	Erik Helleson Joey Meszaros	336	Synthesis of N-Z-L-Aspartic Acid alpha-Benzyl Ester
23	Joey Meszaros	338	Spectrophotometric Determination of Fe in Fe Supplements
24	Jeni Hoffert	338	Analysis of Well Water
25	Jeni Hoffert Justin Simons	336	Synthesis of Fmoc-Lys-Boc
26	Justin Simons	338	Determination of Iron Concentration in Well Water via ICP-OES
27	Jessica Patrick	338	A Spectrophotometric Analysis of Caffeine in Mt. Dew and Sprite

Poster #	Student(s)	Class	Topic
28	Jessica Patrick Amanda Pokourny	336	Synthesis of Styrene-Butadiene-Styrene Triblock Copolymers by Ring Opening Metathesis Polymerization and Atom Transfer Radical Polymerization
29	Amanda Pokorny	338	Fluorometric Determination of Riboflavin Content
30	Amanda Pokorny	Summer Research	Phase Separation Behavior of a Polymer Blend Modified by Triblock and Graft Copolymer Additives
31	Megan Schleif	338	Using Titration to Determine the Amount of Citric Acid in a Tomato
32	Megan Schleif Karisa Walker	336	Synthesis of Optical Brighteners
33	Paul Clark	405	Triose Phosphate Isomerase: Examination of the Link Between 3-D Structure and Function
34	Paul Clark	Summer Research	Synthesis of Polystyrene/ Polybutadiene Block Copolymers through Novel Termination of Anionic Polymerization, Facilitating Subsequent Polymerization via Atom Transfer Radical Polymerization
35	Paul Clark Valerie Landwehr Ken Daugherty	344	Comparison of Density Functional Theory and Hartree-Fock Calculated Peak Wavelengths to Laboratory Measured Peak Wavelengths of Varying Length Conjugated Diphenylpolyenes
36	Valerie Landwehr	435	Determination of Copper in Breakfast Drink Mix via ICP-AES
37	Valerie Landwehr	Summer Research	The Effect of Copolymer Architecture on Polymer Blends: A Microscopy Study
38	Ken Daugherty	435	UV-V absorption analysis of cobalt (II) and nickel (II) nitrate
39	Ken Daugherty McKenna Manion	Summer Research	Synthesis, Purification and Solid State Nuclear Magnetic Resonance Study of the Antimicrobial Peptides Piscidin-1 and Piscidin-3
40	Alesya Vlasenko	338	Gravimetric Determination of Ni with Dimethylglyoxime

Poster #	Student(s)	Class	Topic
41	Alesya Vlasenko	405	Cytochrome C Oxidase
42	Randi Luchterhand	405	Rubisco
43	Randi Luchterhand	435	COSY NMR analysis of Verbenone
44	Yelena Nikolayeva	338	Determination of Iron in Food by Atomic Absorption (ICP)
45	Yelena Nikolayeva	405	Phosphofructokinase
46	Yelena Nikolayeva	435	Complete Assignment of Proton Chemical Shifts in Myrtenal
47	Erin Hoge Kjersta Larson	344	Vibrational-Rotational Analysis of Ammonia Using Gaussian Hartree-Fock Computer Modeling and FT-IR Spectroscopy
48	Erin Hoge Kjersta Larson	Summer Research	Holding It Together: Four Self-Assembling Capsules in Polar Solvents
49	Patrick Bennett	338	Caffeine Levels in Starbucks Brand Coffee vs. other Brands
50	Austin Egert	338	Potassium Content in Bananas
51	RaeLynn M. Endicott	338	Isolation of Aluminum and Zinc in Deodorants
52	Corey Fish	338	Quantitative Determination of B-carotene in Young Chickpea Leaves ( <i>Cicer arietinum</i> )
61	Shannon Hayes	338	Comparison of Calcium Supplements Using ICP-AES
62	Andrea Higdon	338	Gravimetric Analysis of Caffeine in Hot Beverages
63	James Jennings	338	Analysis of Octane in Gasoline
64	Kristen Kuehl	338	Determination of Vitamin C in Fruit
65	Emily O'Leary	338	Analysis of Ca, Mg, and Zn in Dietary Supplement Tablets using ICP
66	Helen Rickey	338	What is in the PURE Water You Drink? Analysis of Drinking Water Using ICP-OES

<b>Poster #</b>	<b>Student(s)</b>	<b>Class</b>	<b>Topic</b>
67	Payton Thompson	338	Fraction of Ultraviolet Radiation Transmitted Through Sunscreen
68	Kathryn Walker	338	Iodine Content in Kelp Dietary Supplement
69	Lindsey Worthington	338	Iron Content in Children's Vitamins
70	Lam Nguyen	405	The Molecular Interactions of the Biotin-Binding Domain of Pyruvate Carboxylase and the Conversion of Pyruvate to Oxaloacetate in Gluconeogenesis Pathway
71	Gary Jensen	435	Identification of Unknown Analgesic Using Raman Spectroscopy

### ***ENVIRONMENTAL STUDIES***

<b>Poster #</b>	<b>Student(s)</b>	<b>Class</b>	<b>Topic</b>
53	Somer Goulet Kit McGurn	350	Clover Creek Watershed: Economic Activity
54	Bryce Robert Joel Zylstra	350	Clover Creek Watershed: Land Use
55	Sarah Larson Julie Locke Beth Stone	350	Clover Creek Watershed: Population
56	Aaron Highlands Jewel Koury	350	Clover Creek Watershed: Resources
57	Jennifer Catlett Jennifer Halaas	350	Clover Creek Watershed: Biology
58	Erika Helm Michelle Stark	350	Clover Creek Watershed: Chemistry
59	Nicole St. Amand Mandy Heimbuch	350	Clover Creek Watershed: Geology/Physical
60	Susan McPartland Stephanie Puhl	350	Clover Creek Watershed: Methods Comparison

# *Poster Presentation Submitted*

## *Abstracts*

### **BIOLOGY**

**Jennifer Huffman, Jeremy Hutchins, Terfawna Watts: Effects of bisphenol A on fidelity of chromosome segregation during mitosis**

Exposure to bisphenol A, an environmental pollutant, results in an euploidy in rat oocytes undergoing meiosis. Bullfrog tadpoles were exposed to a sub-lethal level of bisphenol A to determine if this pollutant might also lead to aneuploidy in mitotically- active tissues.

**Andrea Gabler, Jennifer Ironside, Erin Wiggins, Andrea Wold: Protein populations in mung bean seedlings grown in the dark in comparison with those exposed to light**

In plants, expression of some genes occurs in response to light. Polyacrylamide gel electrophoresis was used to compare protein populations (manifestations of gene expression) of mung bean seedlings grown in the light with those of mung bean seedlings grown in the absence of light.

**Kendall Blair, Andrea Cox, Lori Curran, Erin Ham: Glycoprotein populations as manifestations of gene expression during frog embryo development**

Gene expression changes during animal embryogenesis. Polyacrylamide gel electrophoresis was used to assess changes in gene expression as revealed by different glycoprotein populations in oriental fire bellied toad embryos at several different developmental stages.

**Megan Hockert, Andrew Holloway, Sara Perry, Jenny Schlies: Protein Population in Mung Bean Seeds and Seedlings**

When seed germinates, storage proteins are depleted, and new proteins are synthesized as cells differentiate. Polyacrylamide gel electrophoresis was used to compare the protein populations of non-germinated mung bean seeds with those of tissues in mung bean seedlings.

**Eric Bishop, Lisa Boullioun, Consetta Hunt, GweLinda Johnson, Yeuk Hung Wu: Acid phosphatase activity in tadpole tail tips and regenerating tail tips**

Regeneration features formation of a blastema consisting of cells that are embryonic in nature. To compare regenerating tissue with its differentiated counterpart, enzyme assays were done to determine acid phosphatase levels in tail tips and regenerating tail tips of bullfrog tadpoles

**Microbiology Students: Microbiology Laboratory Investigations**

After learning basic microbiology lab techniques, microbiology student groups have designed and implemented experiments of their own choosing and will report on these experiments

## ***ENVIRONMENTAL STUDIES***

### **Environmental Methods of Investigation (ENVT 350) Students: Clover Creek: A Watershed Assessment**

We assessed the health of Clover Creek watershed using human activity and data from the creek. Chemical, physical, and biological data for the creek as well as population, land use, economic activity and resource data in the watershed are presented.

## ***Chemistry***

### **Bethany Carter, Daniel Seetin: Preparation of Fmoc-Glycine**

The addition of the Fmoc protecting group to glycine is useful in the solid phase synthesis of peptides by preventing reaction with the amino group of amide. Once the desired peptide synthesis is completed, removal of the protecting group to obtain the desired product is simple

### **Paul Clark: Triose Phosphate Isomerase: Examination of the Link Between 3D-Structure and Function**

Triose Phosphate Isomerase, a 'kinetically perfect' enzyme, catalyzes the interconversion of two products of glycolysis. In this report, the focus will be examination of the significance of the 3D structure for the mechanism and activity of the enzyme, revealing the critical link between structure and function.

### **Paul Clark, Ken Daugherty, Valerie Landwehr: Comparison of Density Functional Theory and Hartree-Fock Calculated Peak Wavelengths to Laboratory Measured Peak Wavelengths of Varying Length Conjugated Diphenylpolynes**

Chemical structures were analyzed using UV-Vis to acquire the energy gap between the HOMO and LUMO energy states. The values were compared with computational methods using Spartan and Gaussian programs.

### **Ken Daugherty: UV-Vis absorption Analysis of Cobalt(II) and Nickel (II) Nitrate**

UV-Vis was the method used to elucidate the concentration of cobalt (II) and nickel (II) nitrate in a mixed solution using a standard mixed solution.

### **Ken Daugherty, McKenna Manion: Synthesis, Purification and Solid State Nuclear Magnetic Resonance Study of the Antimicrobial Peptides Piscidin-1 and Piscidin-3**

Piscidin-1 and Piscidin-3 are antimicrobial peptides found in Hybrid Striped Bass. Fmoc-solid phase synthesis, HPLC purification, Mass Spectroscopy and Solid State Nuclear Magnetic Resonance (NMR) were used to study their structure.

### **Steve Erby, Tighe Stuart: A Palladium-Catalyzed and Coupling of Aryl Group to a Terminal Alkyne**

A terminal alkyne, tetrahydro-2-(2-propynyloxy)-2H-pyran, was coupled with an aromatic iodide, 4-iodonitrobenzene, via a common palladium-catalyzed reaction. The procedure gave yields ranging from 13-135%, consisting primarily of the desired product.

### **Kirsten Forseth, Allison Kanarr: Synthesis of a Diphenylethene**

Diphenylethene is a diblock molecule used as a linker molecule in anionic polymerization. It is formed through a Friedel-Crafts reaction using cumene and acetyl chloride followed by a Grignard reaction.

**Erik Helleson, Joey Meszaros: Synthesis of N-Z-L-Aspartic Acid alpha-Benzyl Ester**

We synthesized N-Z-I-aspartic acid alpha-Benzyl Ester, a process in the synthesis of I-histidine, an amino acid with possibly helpful pharmacokinetic properties that have currently been studied with limited success

**Jeni Hoffert, Justin Simons: Synthesis of Fmoc-Lys-Boc**

The purpose of this experiment was to synthesize Fmoc-Lys(Boc). This was done by reaction of Lys-HCl with NaHCO<sub>3</sub>, CuSO<sub>4</sub>, and Boc<sub>2</sub>O. The product was reacted with Fmoc-OSu, acidified and isolated. Analysis was done using MALDI-TOF, and NMR.

**Erin Hoge, Kjersta Larson: Holding It Together: Four Self-Assembling Capsules in Polar Solvents**

Recent work in the field of supramolecular chemistry has shown that molecular complexes can form capsules used in drug delivery systems. The energies of 4 computer-modeled complexes were analyzed to determine the interactions causing “capsuleness.”

**Erin Hoge, Kjersta Larson: Vibrational-Rotational Analysis of Ammonia Using Gaussian Hartree-Fock Computer Modeling and FT-IR Spectroscopy**

The vibrational-rotational IR spectrum of gaseous ammonia was analyzed for the bond angle and length, and for the stretching and bending force constants.

**Valerie Landwehr: The Effects of Copolymer Architecture on Polymer Blends: A Microscopy Study**

High molecular weight polystyrene and polybutadiene copolymers of varying structures were studied as to their interactions on a PS/PB critical composition binary blend. Transmission electron microscopy (TEM) was used to study the effect of the copolymer architectures on the blend for two different annealing times. The copolymer structures of interest were diblock random, and two-arm graft, all PS/PB copolymers.

**Valerie Landwehr: Determination of Copper in Breakfast Drink Mix via ICP-AES**

ICP-AES was used to determine the amount of Cu in Carnation Instant Breakfast-Strawberry drink mix, via the method of standard addition. The result was then compared to the amount reported in the nutrition chart of the product.

**Randi Luchterhand: Rubisco**

The effect of temperature, carbon dioxide levels and mutations on plant enzyme ribulose 1,5-bisphosphate carboxylase/oxygenase active sites will be reviewed.

**Randi Luchterhand: COSY NMR Analysis of Verbenone**

The structure of a compound can be determined using COSY, <sup>1</sup>H, and <sup>13</sup>C NMR. Specifically, data analysis used a ring compound Verbenone.

**Lam Nguyen**

Pyruvate carboxylase is a member of the biotin-dependent enzyme family that catalyzes the conversion of pyruvate to oxaloacetate. Here, the three-dimensional structure of the

biotin-binding domain is analyzed in order to understand the mechanism behind the conversion of pyruvate to oxaloacetate.

**Yelena Nikolayeva: Phosphofructokinase**

The focus is on the structure and allosteric regulation of PFK. Analysis of the structure with use of Kinemage will be featured.

**Yelena Nikolayeva: Complete Assignment of Proton Chemical Shifts in Myrtenal**

An experimental combining 2D NMR spectroscopy with molecular modeling will be modified.

**Yelena Nikolayeva: Determination of Iron in Food by Atomic Absorption (ICP)**

For analysis of the data, the standard addition method will be used.

**Jessica Patrick, Amanda Pokorny: Synthesis of Styrene-Butadiene-Styrene Triblock Copolymers by Ring-Opening Metathesis Polymerization and Atom Transfer Radical Polymerization**

A polystyrene-polybutadiene-polystyrene (SBS) triblock copolymer was synthesized by the above methods. Successful synthesis was confirmed by both chromatography and spectroscopy.

**Megan Schleif, Karisa Walker: Synthesis of Optical Brightners**

Two different aldehydes were reacted with ethanol to produce their respective chalcones. Each chalcone was then refluxed to produce 1,3-diphenyl-5-(3,4-methylenedioxyphenyl)- $\Delta$ -2-pyrazoline and 1,3-diphenyl-5-(3-nitrophenyl)- $\Delta$ -2-pyrazoline.

**Alesya Vlasenko: Cytochrome C Oxidase**

Cytochrome C Oxidase is a large transmembrane protein found in the inner membrane of mitochondria. The enzyme is the terminal electron acceptor in the electron transport chain of cellular respiration. This poster will explain how cytochrome C Oxidase catalyzes the reduction of molecular oxygen to water. In the process, it translocates protons, and contributes to the chemiosmotic potential ATP synthesis.