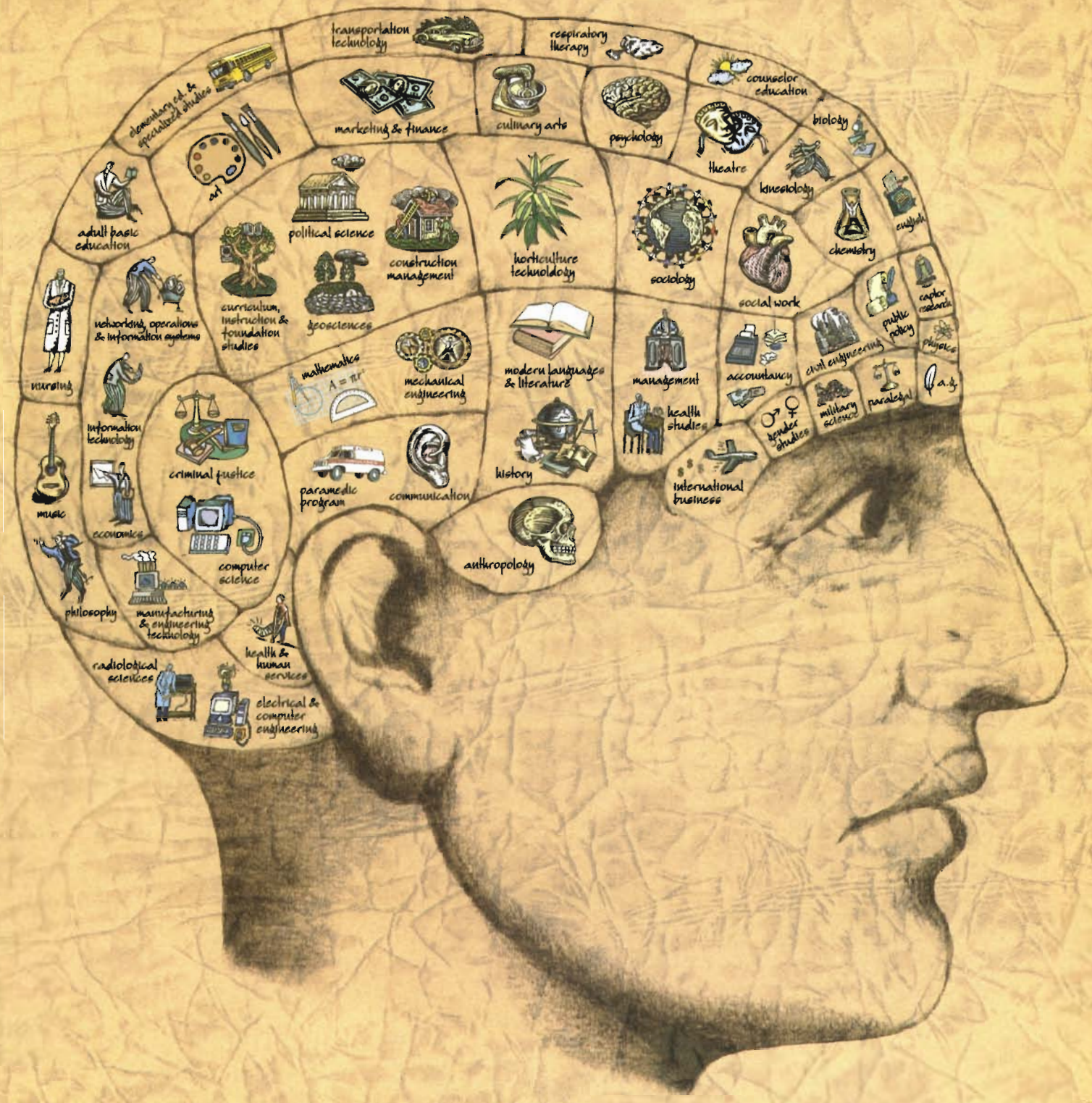
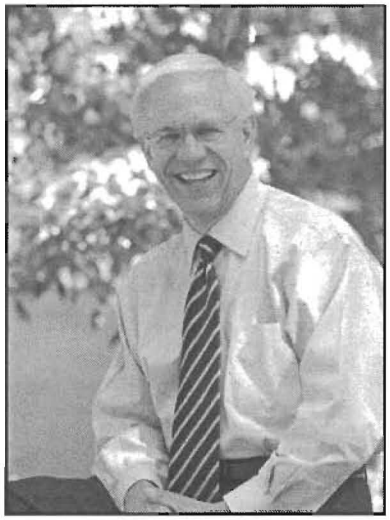
the First Annual

BOISE STATE UNIVERSITY

UNDERGRADUATE RESEARCH & PROFESSIONAL PRACTICE CONFERENCE



April 19, 2004, Student Union Building



Welcome to the First Annual Boise State University Undergraduate Research and Professional Practice Conference. This conference gives undergraduate students at Boise State an opportunity to share their research projects and be honored for their outstanding work.

Let me first congratulate the students who have been selected to be a part of this exciting event. The faculty sponsors who assist and support these students with their research have good reason to feel proud, and should also be commended for their commitment to learning and their dedication to the personal success of our students. The projects on display span a broad range of subjects and reflect the efforts of our students and faculty toward the betterment of our university, community, and state through academic research and exploration.

This year's conference marks the first of many achievements that Boise State will see in undergraduate research initiatives. As President, I am committed to research at all levels and will continue to encourage growth in research opportunities and activities as part of the undergraduate education experience at Boise State.

I hope you enjoy the conference, and thank you for your support of this premier event.

Warm regards,

Bob Kustra

the First Annual

BOISE STATE UNIVERSITY

NDERGRADUATE RESEARCH

First Annual Undergraduate Research and Professional Practice Conference

April 19, 2004

1:00-4:00

Program

Poster Presentations in the Jordan Ballroom 1:00–4:00

Hatch Ballroom Performances 1:30–2:45

- Anna Merkeley
- Jenessa Carson
- Lacey Rammell-O'Brian
- Allyson Wuenschell
- Carolina Gonzalez

Keynote Speaker, John Owens, Vice President for Research 3:00

Daryl Jones, Provost and Vice President for Academic Affairs 3:15

Presentation of Certificates/Awards

– Abstracts –

College of Applied Technology

Camp Perkins Lutheran Outdoor Ministries: The First Fifty Years

Zach Schuster (Department of Broadcast Technology) Lorin McArthur

Camp Perkins is a year-round camping and retreat destination that is supported by the Lutheran Church-Missouri Synod. Established in 1955, supporters will be celebrating its 50th Anniversary in July of 2005. *Camp Perkins Lutheran Outdoor Ministries: The First Fifty* Years is a one-hour video documentary exploring the history of Camp Perkins, its current programs as well as a look at the future of the camp. Research is being conducted via interviews of people involved with Camp Perkins over the years. Interviewees are providing historical footage. Idaho Public Television has provided some aerial footage and all other footage is shot by the student. Narration is conducted by the student and is to be replaced with professional voice talent. Final project will be approximately one hour in length. Project has been conducted with the permission of Camp Perkins Lutheran Outdoor Ministries.

College of Arts and Sciences

Protein Analysis of Type XI Collagen in the Vitreous Humor

Joeli Adriany (Department of Biology) Julia Oxford

Collagen fibrils constitute the primary structural components of all connective tissues including those present in the extracellular matrix of the vitreous humor. Type XI collagen in the vitreous humor may function to nucleate the formation of new collagen fibrils and limit their lateral growth. Post-translational modifications of the VIaV2 isoform of type XI collagen, resulting from proteolytic cleavages in the 1(XI) amino-terminal domain, seem to affect the embryonic organization of the fibrils and the resulting biophysical characteristics of the extracellular matrix. Subsequent removal of polypeptides may also influence specific molecular interactions occurring in the vitreous humor. The techniques of SDS-PAGE and Western blot were utilized to determine the amino acid sequence cleaved from the 1(XI) amino-terminal domain. The results of this study contribute to the understanding of type XI collagen function in normal vitreous humor and the pathogenesis of Stickler syndrome caused by mutations in the 1(XI) chain.

Over Expression and Optimization of Purification of Canine Cardiac Calsequestrin

Lou Bonfrisco & Tiffany Hopper (Department of Chemistry) Susan Shadle

Calsequestrin (CSQ) is a calcium binding protein that is housed within the Sarcoplasmic reticulum (SR) of cardiac muscle tissue. Large quantities of isolated, purified, and concentrated CSQ are needed in order study its interactions with chemotherapeutic agents, namely anthracyclines. Engineered strains of E. coli are induced to manufacture the CSQ protein. The protein of interest is then recovered through a series of centrifuge steps with the addition of several reagents. Ultimately CSQ is in a solution, along with several other proteins of similar weight. Through column chromatography, CSQ is separated from the other, unwanted proteins. The purified CSQ is then concentrated and its purity verified by running an SDS Page.

Investigation of the Effects of Anthracyclines on Calcium Dependent Calsequestrin Fluorescence

Stephen T. Broyles & Richard D. Olson (Department of Chemistry) Henry A. Charlier & Susan Shadle

Anthracyclines are a widely used to treat cancer. Their use has been limited by a potentially lethal cardiotoxicity. One possible mechanism for the cardiotoxocity may involve the disruption of cardiac calcium handling. Calsequesterin (CSQ) is a high capacity, low affinity; calcium-binding protein located in the sarcoplasmic reticulum (SR) and plays an important role in calcium handling. Addition

of calcium to CSQ, causes intrinsic protein fluorescence enhancement, which indicates that calcium alters CSQ structure. The effects of anthracyclines on calcium-dependent CSQ fluorescence enhancement were investigated. Trifluoperazine (TFP), a known inhibitor of CSQ function, was used for comparison. Calcium dependent fluorescence enhancement increased 286% with TFP, 195% with daunorubicin, and 160% with daunorubicinol (at 30 mM drug). These findings are consistent with drug-mediated changes in CSQ structure and support the hypothesis that CSQ is an anthracycline target. The interaction between CSQ and anthracyclines may be important to the mechanism of cardiotoxicity.

DAUNORUBICIN ALTERS THE CALCIUM BINDING PROPERTIES OF CALSEQUESTRIN

Nico Cantone, Dawn Muhlestein & Wendy Mercer (Department of Chemistry) Susan Shadle

Daunorubicin is one of a class of widely used chemotherapy drugs called anthracyclines, which are very effective antitumor agents, but are limited by a poorly understood cardiotoxicity. Evidence suggests that anthracycline cardiotoxicity involves disruption of sarcoplasmic reticulum (SR) calcium regulation. This study was designed to test the hypothesis that anthracyclines alter calcium binding to calsequestrin (CSQ), a calcium regulatory protein in the SR. Equilibrium dialysis was used to monitor CSQ-calcium binding in the presence of the anthracycline daunorubicin and, for comparison, the CSQ inhibitor trifluoperazine (TFP). Binding curves were then generated and fit to the Hill equation, from which were derived the CSQ-calcium binding capacity, affinity, and cooperativity. Results indicate that daunorubicin increases calcium binding capacity and decreases both affinity and cooperativity, while TFP had no significant effect.

KINETIC CHARACTERIZATION OF CARBONYL REDUCTASE FROM RABBIT HEART

Mark Cheney (Department of Chemistry) Henry Charlier

Anthracyclines are effective anti-tumor drugs that can lead to cardiotoxicity. Alcohol metabolites of the anthracyclines have been linked to the development of cardiotoxicity. The conversion of anthracyclines to these metabolites is catalyzed by carbonyl reductases (CR) found in heart tissue. Preliminary studies in our lab have identified several enzymatic activities in rabbit heart that have unique specificities on the anthracyclines, daunorubicin (DAUN) and doxorubicin (DOX). In an effort to further characterize the enzymes responsible for these activities, ion exchange chromatography was used to isolate the CR activities present in rabbit heart cytosol and these peaks were kinetically analyzed using several known CR substrates. Typically, two distinct peaks with menadione activity are observed using anion exchange chromatography. Estimates of Vmax, Km and Vmax/Km were determined for each of the activity peaks. This information may be useful in designing novel anthracyclines that have anti-neoplastic activity, but are not good substrates for CR.

ELECTROCHEMISTRY OF SOME NOVEL HOLE TRANSPORT MATERIALS

Nathan Davis (Department of Chemistry) Dale Russell

Electroanalytical methods have been used for characterization of solution-phase hole transport materials. These hole transport materials are relatively large organic molecules having functional groups that are readily oxidized or reduced. Cyclic voltammetric (CV) analysis has been demonstrated in this work as a quick, simple, inexpensive screening method to predict electron transport behavior of the materials when incorporated into polymer films. The electrochemical potential of the cyclic voltammetric waves and their peak currents are measured under different conditions of concentration and scan rate. From this data, fundamental information is obtained about the band gap of the molecules and the thermodynamics of their oxidation and reduction processes. A mechanism of the multistep solution phase electron transfer process is also derived, based on qualitative interpretation of the electron transfer kinetics. Finally these data are compared to measurements from polymer films prepared with the hole transport molecules.

– Abstracts –

MAXIMUM INFORMATION AND MINIMUM SEQUENCING: RESOLVING PHYLOGENETIC RELATIONSHIPS AMONG CLOSELY RELATED SPECIES OF *COLUMNEA* (GESNERIACEAE) USING MULTIPLE GENES.

Scottie B. Draper (Department of Biology) James F. Smith

Resolving phylogenetic relationships among closely related species using sequence data has been a challenge for many taxonomic groups. Regions that are often used because they are easily amplified and sequenced such as chloroplast genes and ITS often do not provide sufficient variability to resolve relationships, let alone provide strong support for relationships. Such is the case in the genus *Columnea*, which comprises an estimated 300 neotropical species. Examination of several genes that have provided utility for phylogenetic analyses at the species level in other taxa have not provided a strongly supported phylogenetic hypothesis for a sampling of *Columnea* species when used individually. A combination of genes is essential, and this study examines several regions from the chloroplast and nuclear genomes as a means of assessing the best combination of data to resolve among relationships in this genus.

THE EFFECTS OF DISTURBANCE FREQUENCY ON ALGAL BIOMASS IN A SMALL IDAHO STREAM

Starla D. Finke (Department of Biology) Peter Koetsier

We designed an experiment to test the potential effect that disturbance frequency may have on the biomass (standing crop) of benthic algal in a small stream ecosystem. We divided the stream into 9 segments. Each segment was assigned 1 of 3 stream bottom disturbance treatments: frequently disturbed (2x/month), moderately disturbed (1x/month), no artificial disturbance (control). We measured algal biomass (as Chlorophyll-a using a spectrophotometer) in each segment, and then manually disturbed the stream segments accordingly. We then measured algal biomass in each segment twice a month, for 3 months over the summer of 2003. Contradicting the Intermediate Disturbance Hypothesis, we found the highest levels of algal biomass in the most frequently disturbed segments. Possible explanations for these results may be: 1) the release of nutrients by the disturbance removal of senescent algal cells or, 2) the reduction of invertebrate herbivores as disturbance frequency increased; either one leading to an increase in algae biomass.

ANALYSIS OF CALSEQUESTRIN AGGREGATION BY SEC/MALS

Ethan Fry (Department of Chemistry) Susan Shadle

Aggregation of canine cardiac calsequestrin (CSQ) was studied using SEC/MALS. Ionic conditions for mobile phases used for analyses were 300 mM KCl, 70mM KCl/1 mM CaC12, and 70 mM kCl/1 mM CaCl2/200um TFP. 70 ul aliquots (0.7 mg CSQ/ml) were injected into system. CSQ with 300 mM KCl favored dimer over monomer, but both were observed. CSQ in 70 mM KCl/1mM CaCl2 formed tetramers in high concentration. TFP shifted CSQ to form mostly monomer, with some dimer formation. Results indicate that TFP inhibits CSQ aggregation.

IDAHO HISPANIC WELLNESS INITIATIVE: LA BUENA SALUD

Adriana Gomez, Alma Navarrete & Salvador Gil
(Department of Modern Languages & Literature) Bruce R. Swayne

We completed a professional practice internship (Spanish 493) with this federally funded project that places students from health professions on teams to provide wellness service to rural Hispanic farmworkers. We want to emphasize how much La Buena Salud has helped educate these families on their basic health as well as indicate how the La Buena Salud team interacted with children. The team attempted to motivate children to know more about how important physical activity is to their personal health. La Buena Salud sends a van equipped with medical resources to three rural communities. Operating out of this van student health professionals provide basic wellness exams to give the local residents a general idea of their health. This program assists people who are low income and use English as a second language. In Wilder, Marsing and Homedale there are a variety

of barriers to basic healthcare. These are mainly money and language skills. So, through La Buena Salud, Spanish-speaking farmworkers overcome these barriers with help from Boise State University students who have healthcare and language skills. During this internship we noted the critical role of interpreters who are bicultural as well as bilingual.

The Mexican-American Corrido: A Unifying tradition within a heterogeneous culture

Carolina Gonzales (Department of Music) Jeanne Belfy

Performance in the Hatch Ballroom

People of Mexican descent in the Southwest are as diverse as the regions in which they live. Mexican-American people have trouble identifying themselves as a cohesive group, and carry misunderstandings about each other, based on regional affiliations. Ever since the 1848 Treaty of Guadalupe Hidalgo, Mexicanos living in the areas sold from Mexico to the United States have been forced to develop a Mexican-American identity inside Anglo society. The *corrido* ballad tradition has roots going back to the Spanish ballad form, *romance*, brought by Hernan Cortez in 1519. The *corrido* evolved from the New Mexico decíma and surfaced along the U.S.-Mexican border, *la frontera*, during the 1911 Mexican Revolution. In the *corrido's* 150-year history, it has been an outlet for stories of love, deception, honor and revolution – the stories of the Mexican-American people. Within these *corridos*, Mexican-American identity can be explored; folkloristic study may lead to greater understanding among the people of the heterogeneous culture.

Room Temperature Ferromagnetism in Chemically Synthesized Sn1-xFexO2 Powders

Jason Hays (Department of Physics) Alex Punnoose

Semiconductors which exhibit ferromagnetism at room temperature are essential to develop novel spintronic devices. Room temperature ferromagnetism is observed for the first time in chemically synthesized powder samples of Sn1-xFexO2 with x = 0.01, 0.03, 0.05, and 0.15. High purity samples of Sn1-xFexO2 with $x \leq 0.15$ were prepared using sol-gel methods at temperatures of 200, 350, 450, and 600°C in air. Magnetic hysteresis loops are observed at 300K with coercivity Hc ~ 197 Oe, saturation magnetization Ms ~ 0.211 emu/g, and about 26% remenance. Analysis of the magnetization data shows an increase in Ms and remenance with increased iron doping for samples prepared at 600°C. A coercivity of 103 and 197 Oe is observed for x = 0.01 and 0.15 respectively. Analyses of paramagnetic Sn1-xFexO2 samples with $x < 1$ show antiferromagnetic interactions between the iron ions with a Curie temperature of 0.95K.

A Novel Anthracycline Analog Prevents CD40L Upregulation in T cells: Implications for the Treatment of Psoriasis

Mark Headley, Brandon Priebc & Sarah Perusich (Department of Biology) Denise Wingett

Here we report that a novel anthracycline analog may have utility in treating psoriasis, a common chronic inflammatory skin disorder. Although treatments are currently available, a need exists for improved modalities with higher therapeutic indexes, particularly those that inhibit the T cell role in inflammation. Cardiotoxic side effects have prevented the use of anthracylines (common chemotherapeutic agents) in the treatment of psoriasis. A new anthracycline analog, GPX-150, has recently been shown to potently inhibit T cell growth with negligible systemic and cardiotoxic side effects. In this study we evaluated the effects of GPX-150 on the expression of the T cell surface protein, CD40L, which plays a critical role in the initiation and regulation of the immune response and inflammatory disease. We observed that the parent anthracycline drug, doxorubicin, increased expression of CD40L eliminating its utility in psoriasis treatment. In contrast, GPX-150 prevents CD40L upregulation in activated cells. Although additional studies are required to evaluate global effects of GPX-150 on T cell activation and cytokine production, our findings are the first to suggest a potential role of this therapeutic agent in the treatment of psoriasis (funded by NIH grant P20RR16454).

– Abstracts –

Kinetic Characterization of Horse Liver Alcohol Dehydrogenase Mutant K228Q

Anna Hempill (Department of Chemistry) Henry Charlier

Horse liver alcohol dehydrogenase (ADH) reversibly oxidizes ethanol to acetaldehyde using nicotinamide adenine dinucleotide (NAD) as a coenzyme. The kinetic mechanism is ordered bi-bi, with NAD binding before ethanol, and NADH releasing after acetyaldehyde. NADH release is rate limiting. Lysine at position 228 is hypothesized to control coenzyme binding. Site-directed mutagenesis was used to test this hypothesis by substituting lysine with arginine (previously reported), alanin, glutamine or glutamate. The glutamine mutant (K228Q) was characterized for effects on kinetic constants through initial velocity studies. The catalytic rate constant and dissociation binding constant for NAD+ were increased 5-fold and 10-fold, respectively, over those of the native enzyme. The results indicate that coenzyme binding to ADH is significantly decreased when lysine at position 228 is changed to glutamine. (Supported by Boise State University Department of Biology Summer Premedical Fellowship and JNIH grant P20RR16454.)

Efforts Toward the Total Synthesis of an Aziridinomitosene: Synthetic Considerations for Aziridine Sensitivity

Amber Hibberd & Edwin Vedejs (Department of Chemistry) Don L. Warner

The total synthesis of aziridinomitosene analogs is essential for understanding the mechanistic details of aziridinomitosene-DNA interaction. A highly convergent route towards the synthesis of aziridinomitosene B entails coupling a C-5 unsubstituted oxazole with a highly functionalized aldehyde. Subsequent construction of the tetracyclic core of aziridinomitosene B employs an oxazolium salt/azomethine ylide cycloaddition approach. The methodology employed for *N*-methyl aziridinomitosene synthesis offers a viable means towards *N*-H aziridinomitosenes. However, the extreme sensitivity of aziridinomitosenes to various reaction conditions has hindered synthetic progress. The use of a modified tert-Butyldiphenylsilyl protecting group for the aziridine nitrogen potentially offers both the stability required for several transformations and facile removal at the appropriate stage in the synthetic sequence. These results as well as synthesis of all precursors will be reported.

Immunofluorescent Study of Type XI Collagen in the Pericellular Matrix of Neural Crest-Derived Cells

Katey Irwin & Sorcha Cusack (Department of Biology) Julia Oxford

Collagen type XI may play a dual role in sustaining the structure of cartilage by limiting fibril diameter, thereby maintaining the integrity and stability of proteoglycans and by contributing to the stability of the matrix by interacting with other matrix components. This study examines the localization and distribution of type XI collagen during the maturation of representatives of neural crest cells. Indirect immunofluorescence was used to determine the localization of collagen type XI during the differential stages of these cell models. Although XI is a minor component, we show that immunofluorescence is a useful technique for the study deposition of newly synthesized pericellular matrix. Immunofluorescent staining allows visualization of a collagen fibrillar network in the pericellular region as well as distinct localized accumulation of extracellular matrix in regions consistent with synapse formation.

– Abstracts –

Synthesis of Aziridinomitosene via Oxazole Precursors

Byron Knowles, Anna Block & Jennifer Spencer (Department of Chemistry) Don Warner

Aziridinomitosenes are related to the clinically used anti-cancer agent mitomycin C. It is believed that aziridinomitosenes are responsible for monoalkylation of DNA in the mitomycin C crosslinking cascade, although some evidence indicates that their role may be more substantial. Specifically, some aziridinomitosenes may be directly involved with DNA crosslink formation. The goal of this project is to provide synthetic routes to produce aziridinomitosenes that vary in their substitution patterns on the quinone ring. The slight modifications of the quinone ring significantly alter early synthesis steps. The various synthesis routes undertaken and their progress to date will be presented. Future synthetic steps to be preformed in order to obtain the desired azidinomitosene analogs will also be presented. Once completed, the analogs will be tested for the formation of DNA crosslinks.

Inhibitors of Carbonyl Reductase: Improving Cancer Treatment Through Intelligent Drug Design

Corianton Larson, Laurie Lee & Amanda Rogow (Department of Chemistry) Henry Charlier

Anthracyclines are a family of very effective anti-tumor drugs that can lead to congestive heart failure in many patients. Since these drugs are effective in treating cancer, it is important to understand the mechanism of the cardiotoxicity, so that anthracycline treatment can be improved. Alcohol metabolites of the anthracyclines have been linked to the development of cardiotoxicity. The conversion of anthracyclines to these metabolites is catalyzed by carbonyl reductase found in heart tissue. Since carbonyl reductase is responsible for production of a cardiotoxic metabolite, it is a target for pharmaceutical interventions aimed at reducing the formation of the metabolite. Our lab has found two compounds that inhibit carbonyl reductase activity. Also we have generated a structural model of the enzyme, which is being used to design novel anthracyclines and new inhibitors that could be used to reduce the risk of anthracycline cardiotoxicity.

Plant Colonization and Growth at an Abandoned Mine Site in Southwestern Idaho

Robert Lefler (Departments of Biology and Chemistry) Stephen Novak and Robert Ellis

Numerous abandoned mines are located throughout western United States. Such sites constitute environmental problems because they are contaminated by heavy metal discharge into the surrounding air, soil, surface water, and ground water. The Goldhill mine site, in southwestern Idaho, was in operation from 1864 to 1938; at which time it was abandoned. We assessed the pattern of plant colonization onto mine waste rock by identifying and characterizing all species present, combined with a comparison of uncontaminated habitats directly adjacent. Plant species diversity on waste rock is low: a total of 12 species were encountered on the waste, while 42 species were detected in the ancient vegetation. All plants on waste rock were detected in the surrounding vegetation, indicating that colonization of the pile probably occurs from local seed sources. *Pinus ponderosa* and *Pseudotsuga menziesii*, were found both on and off the waste rock. Growth ring analysis of *P. ponderosa* indicates that the growth rate of the trees from the surrounding vegetation is nearly double that of the trees on waste rock. Pseudotsuga menziesii trees on waste rock were generally younger than the trees in the surrounding vegetation, suggesting that this species has more recently colonized the mine site.

Equilibrium Dialysis of Calsequestrin in the Presence of Anthracyclines

Wendy Mercer & Nico Cantone (Department of Chemistry) Susan Shadle

Anthracyclines, such as daunorubicin (Daun), are chemotherapeutic drugs used extensively in the treatment of cancer. Their use is, however, limited by a potentially lethal chronic cardiotoxicity related to the total cumulative dose of drug administered. Previous studies indicate that Daun effectively inhibits Ca2+ release from the sarcoplasmic reticulum. This inhibition has been hypothesized to be the result of Daun and its metabolite, daunorubicinol (Daunol), binding to the SR protein calsequestrin (CSQ), which is involved in the regulation of SR Ca2+. We have investigated the effects of

anthracyclines on CSQ-Ca2+ binding using equilibrium dialysis. Ca2+ concentrations in each half-cell were determined by atomic absorbance spectroscopy and the difference, which is the amount of bound Ca2+, is plotted against total Ca2+ concentration. Data were fit to the Hill equation, from which can be derived the CSQ-Ca2+ binding capacity, affinity, and cooperativity. Comparisons of results obtained from experiments with varying concentrations of daunorubicin will be presented.

Synthesis of Monomer Units for Molecular Sensors

Jeff Multhaup, Cory Lindstrom, Sandra Stover & Tyler Wilson (Department of Chemistry) Dale Russell & Don Warner

Solid state molecular sensors are now capable of ultra sensitivities (~10 ppb and greater) and have found emerging environmental applications in chemical spill monitoring and heavy metal/chemical warfare agent detection systems. Molecular sensors rely on semiconductive thin film polymers for recognition and quantification of target analytes. Such polymers and copolymers are constructed from derivatives containing covalently attached coordinating sites designed to exhibit electrical conductance surface changes induced by analyte adsorption, with analyte sensitivity and distinctness enhanced by polymer symmetry and optimal coordinating sites. A cyclic dithiophene known as a cyclopentadithiophene, was selected as the foundation monomer of a universal molecular sensor film and is the compound of interest in this synthesis. Three synthetic routes and derivatization studies of this compound were investigated and will be presented.

Immunolocalization of cell wall components during dormancy break in adventitious buds of *Euphorbia esula*

Saro Pegg & Wun S. Chao (Department of Biology) Marcelo D. Serpe

Euphorbia esula (leafy spurge) is a perennial weed that produces underground adventitious buds. These buds remain dormant until the roots are separated from aerial portions of the plant. To identify biochemical mechanisms involved in the release from dormancy, we have analyzed the distribution of various polysaccharides in dormant and non-dormant buds. Dormancy break was associated with changes in pectins, which are complex polysaccharides. The level of a homogalacturonan epitope in pectins increased during the release from dormancy. Similarly, a (1Æ4)b-D-galactan epitope was absent from the apical portion of dormant buds, but it was present in all portions of non-dormant buds. In contrast to these epitopes, the other carbohydrate moieties investigated were present at similar levels in dormant and non-dormant buds. These moieties include a (1Æ5)a-arabinan epitope, a methyl-esterified homogalacturonan epitope, and callose. Overall, our results indicate that modification of pectins and synthesis of (1Æ4)b-D-galactan epitopes are highly regulated through bud development. This regulation may have an important role in the control of bud growth.

Nanophysics of Quantum-Well Capacitors

James Rodriguez (Department of Physics) Charles Hanna

The semiconductor revolution has been driven by the relentless miniaturization of electronic components. However, as semiconductor components reach the nanoscale regime, quantum-mechanical effects become increasingly important. In this work, we examine two effects that become increasingly important as feature sizes shrink. One is the effect of interactions between electrons, which are enhanced at low electron densities. The other is the enhancement of quantum effects that appear when feature sizes approach the scale of tens of nanometers. We focus here on a capacitive semiconductor device, equivalent to two back-to-back MOS capacitors, and calculate its electrical behavior. Such devices have been made using GaAs heterostructures, and we show that the models we develop, which incorporate electron interactions and quantum physics, are able to accurately model their physical behavior, which can be substantially non-classical.

– Abstracts –

Human Liver Carbonyl Reductase – Attainable at Last

Amanda J. Rogow (Department of Chemistry) Henry Charlier

Anthracyclines are a family of very effective anti-tumor drugs that can lead to congestive heart failure in many patients. Since these drugs are effective in treating cancer, it is important to understand the mechanism of the cardiotoxicity, so that treatment can be improved. Alcohol metabolites of the anthracyclines have been linked to the development of cardiotoxicity. The conversion of anthracyclines to these metabolites is catalyzed by carbonyl reductases (CR). Using a plasmid with the gene for Human Liver CR, and a bacterial expression vector, we can produce the enzyme for study. In an effort to characterize the enzyme responsible for this activity, ion exchange and affinity chromatography was used to isolate the human enzyme from the bacterial form produced by our vector. The enzyme was kinetically analyzed using several CR substrates. Estimates of Vmax, Km and Vmax/Km were determined for the CR substrates. This information may be useful in designing novel anthracyclines that have anti-neoplastic activity, but are not good substrates for CR.

The Role of Oncostatin M in Human Microvascular Endothelial Cell Proliferation

Lee Rooney, Adrian Pauw & Alex Ide (Department of Biology) Cheryl Jorcyk

Breast Cancer is the most common cancer in women in the U.S. with approximately 267,000 new cases diagnosed in 2003. Angiogenesis, the process of new blood vessel formation, is essential for tumor progression and metastasis. Blood vessels are comprised of endothelial cells, and our laboratory has selected human microvascular endothelial cells (HMVEC's) as a model system to study angiogenesis in vitro. Data from our lab suggests that cytokine Oncostatin M (OSM) may have a role in endothelial cell proliferation. OSM was once pursued as a treatment, but evidence now suggests that it could be a target for treatment because it causes an increase in cell proliferation through the production of vascular endothelial growth factor (VEGF). Currently we are treating HMVEC's with the conditioned media of breast cancer cells that have or have not been treated with OSM and are measuring the HMVEC proliferation. Our data will be used to demonstrate that OSM does indeed play a role in endothelial cell proliferation.

Synthesis of anthracycline affinity labels and their covalent binding to calsequestrin

Clinton Smith (Department of Chemistry) Susan Shadle

Antharcylines are chemotherapeutic drugs used extensively in the treatment of cancer, whose use is limited by a potentially lethal cardiotoxicity. The molecular basis for anthracycline cardiotoxicity is not well understood. One hypothesis is that anthracyclines disrupt calsequestrin(CSQ) function. CSQ binds and regulates Ca2+ release from the sarcoplasmic reticulum. Anthracyclines have been shown to bind to CSQ but the binding site(s) have not yet been defined. The known CSQ inhibitor trifluoperazine(TFP) has also been shown to bind to CSQ, but its binding sites have not been identified as well. To identify the binding site(s) an affinity label of the anthracycline Daunorubocin(Daun) and TFP have been synthesized. The TFP affinity label has been covalently linked to CSQ. The crosslinked sample has been purified and analyzed spectrophotometrically to verify binding and determine the stoichiometry of binding in preparation for LC-MS analysis to identify the amino acids in the binding site of CSQ.

Enantioselective Formation of Carbon-Carbon Bonds Through 1,2-Alkyl Migrations of Dihaloalkylsilanes

Eric A. Standley & Tyler W. Wilson (Department of Chemistry) Don L. Warner

The nucleophile induced migration reaction of α-haloalkylsilanes is well known, but little attention has been given to the stereochemistry of the reaction. The migration occurs through a trigonal bipyramidal intermediate, which requires the migrating moiety to be anti to the group it displaces. As

a consequence of this geometry, the synthesis of chiral quaternary carbon centers should be possible using a double migration reaction. In order to achieve enantioselectivity, our research has focused on controlling the rotamer population through the synthesis of chiral ephedrine and diamino silanes, as well as the use of intramolecular nucleophilic activation. The nucleophiles used to initiate the migrations are strong, and side products corresponding to substitution reactions are often observed. Developing reaction conditions that overcome the challenges of competing reactions and favor the migration step has been paramount to our research.

A Preliminary Phylogenetic Analysis of Piperaceae using Chloroplast and Nuclear Genes: Utility of the Low Copy Nuclear PEPC Intron within Sections *Enckea* and *Arctottonia* of *Piper*

Angela Stevens, Mindie Funke, Scottie B. Draper, Tatiana Zadorozhny, Christopher Davidson & Allan J. Bornstein (Department of Biology) James F. Smith

The Piperaceae are a species rich family occurring throughout the tropics. Interpreting taxonomic relationships has been challenging due to their small flowers that lack a perianth; molecular data may provide information not available from morphology. We investigated Piperaceae relationships by sampling taxa from new and old world clades and from several genera with an emphasis on the neotropical species. The results based on chloroplast genes *trn*L-*trn*F spacer and the *trn*L intron are congruent with a previous analysis using ITS data in that *Macropiper* and *Pothomorphe* are imbedded within an otherwise paraphyletic *Piper*. Support for several larger clades was found, indicating that the neotropical species sampled are monophyletic and distinct from old world species, but relationships within these clades are unresolved or poorly supported using the chloroplast genes. Therefore data from the PEPC intron are investigated to determine its utility within two closely related clades of *Piper*, sections *Enckea* and *Arctottonia*.

The Effects of Oncostatin M in Breast Cancer

Pernilla Stridh-Igo, Kencee Amyx, & Sheryl Hawkes (Department of Biology) Cheryl Jorcyk, Julie Oxford

Breast cancer is the most common form of cancer in women in the United States, with approximately 267,000 new cases diagnosed in 2003. Oncostatin M (OSM) is a cytokine produced by activated T lymphocytes and macrophages that has profound effects on proliferation and differentiation of breast cancer cells. New research from our laboratory suggests that OSM may have a role in breast cancer progression. By treating MDA-MB-231 human breast cancer cells with OSM, we can study which proteins are secreted by the cells and whether the proteins have an important role in tumor invasion and metastasis. Two-dimensional polyacrylamide gel electrophoresis (2D-PAGE) is being used to characterize proteins secreted by OSM-treated MDA-MB-231 breast cancer cells. 2D-PAGE has the ability to distribute proteins over pH and size gradients. The protein map is then analyzed by PD Quest software to identify proteins that are up- or down-regulated by OSM, to better understand OSM-related cellular changes.

Fetal Alcohol Syndrome in an Avian Model: Microarray Analysis of Gene Expression

Pernilla Stridh-Igo & Sorcha Cusack (Department of Biology) Julie Oxford

Fetal Alcohol Syndrome (FAS) results from prenatal ethanol exposure, and affects approximately 1 out of every 1000 children born in the United States [1]. FAS is characterized by abnormal facial features, growth retardation, and permanent and irreversible central nervous system damage [1]. Ethanol interferes with many molecular, neurochemical, and cellular events essential to normal development. These include cellular differentiation, cell migration, cell-cell interactions, growth factor signaling pathways, decreased proliferation, and increased apoptosis [2-13]. However, little is known about differential gene expression in FAS.

– Abstracts –

We investigate genetic effects of ethanol in an avian FAS model. Our purpose is to screen gene pathway changes in FAS, through microarray analysis of control and ethanol exposed chickens, to elucidate potential mechanisms for FAS-associated damage. Our long-term goal is to identify potential diagnostic markers to help devise new effective therapeutic strategies.

Effects of Distance Between Pollen Donors and Recipients on Fruit Production in *Lepidium papilliferum* (Brassicaceae)

Amy Ulappa (Department of Biology) Ian Roberston

Reproductive success is vital in any population and a controlling factor of this in plants is related to out-crossing pollen. The purpose of this study was to identify differences in fruit set percentages and success between plants with varying distances separating pollen donors and receptors. *Lepidium papilliferum*, slickspot peppergrass, is a prime subject for study on fruit set percentages and in turn, population viability, because if its tendency to grow in groups and to produce large numbers of flowers per plant. In this experiment five treatment groups with different distances separating donors and recipients were pollinated and fruit set counted. The results showed a significant difference between the fruit set of the control, self-pollinating, and nearest neighbor treatments with the between slickspot and between population treatments (distances of 100m to 2km). These results are important from a conservation standpoint because with fragmentation and habitat degradation the threat for inbreeding and out-crossing depressions is close.

Continuos *in Vivo* Monitoring of Plasma Amino Acids Levels in Rainbow Trout (Oncorhyncus mykiss)

Ryan Vanderlinden & Katie Bullen (Department of Chemistry) Brad Bammel

Differences in the digestibility of intact proteins, partially fragmented proteins, and free amino acids may lead to differences in the rate of uptake of various amino acids, and subsequent differences in the efficiency of deposition of these protein forms in tissue proteins. The rate of uptake is probably related to combinations of free amino acids present at some minimum level. Determination of rate limiting levels of particular amino acids would be very helpful in modifying partially fragmented protein sources to maximize uptake of all amino acids in the diet, and in selecting amino acid supplements to make up deficiencies associated with the use of plant protein sources in fish feed formulations. Micro dialysis is a technique capable of measuring small diffusible molecules such as amino acids *in vivo* for periods of up to 60 hrs or more. A small probe is inserted into the dorsal aorta of a fish restrained in a metabolic chamber. The dialyzing buffer is driven through one tube of the probe past the semi-permeable membrane and the dialysate containing the amino acids is returned through another tube in the probe. Sixty uL samples are collected in a refrigerated fraction collector and stored at – 80 C until they can be analyzed. The amino acids are separated on an Agilent 1100 series HPLC. The amino acids are derivatized and following separation, detected by fluorescence with a one hundredth micromolar (pmol/ uL) detection limit. A description of the physical set up and preliminary data obtained using rainbow trout will be presented.

Selection of Bach: Cello Suite No. 3 in C major

Allyson Wuenschel (Department of Music) Linda Kline Lamar

Performance in the Hatch Ballroom

The Six Cello Suites by Bach were written at the first quarter of the 18th century. For a long time these suites were seen as merely exercises of technique for the cello, but in the 1930's, famous cello virtuoso Pablo Casals interpreted these suites to a level that made them accessible and musically satisfying to an audience.

– Abstracts –

College of Business and Economics

Maynard Manufacturing and the Shades of GAAP

Ben Greenwood & Gretchen Sindler (Department of Accountancy) Kip Krumwiede

Reliable financial reporting is an important issue for all organizations. In recent years, there has been a crisis in ethical financial reporting in the United States. This video is based on the case of Maynard Manufacturing, a manufacturing company being pressured to meet earnings expectations. It uses a creative approach to portray CFO John Robbins' subconscious as Ms. White ("by the book" persona), Ms. Gray ("there is room to manage earnings"), and Mr. Black ("making money is all that matters"), to discuss 12 common ways of managing earnings. The presentation shows how a company can easily fall into the trap of reporting earnings using techniques that are outside the bounds of GAAP (generally accepted accounting principles) to meet market expectations. After an example of how one technique (i.e., overproduction of inventory) can affect earnings per share, recommendations are given to help companies avoid the temptation to report improper earnings.

Idaho Innovation Index

Ben Thill (Department of Management) Norris Krueger

In 1999 Governor Kempthorne appointed the Science and Technology Advisory Council to direct Idaho in developing the science and technology industry. The council completed the report with six strategies for growth. Idaho did not have an index to compare growth from year to year; therefore the purpose of this project was to develop an index with the hope of using it in future years. Metrics were determined to measure each strategy for yearly comparison. The project is useful for the state of Idaho to ensure a good science and technology industry, which gives strength to the economy.

These strategies were narrowed down and include:

1. Building and retaining a highly skilled workforce.
2. Invest in research and development in science and technology.
3. Build an entrepreneurial culture to allow for new firm formation.

Invest in an infrastructure needed to support science and technology.

The Contextual Application of Six Sigma and Other Quality Programs

Christopher Zampogna (Department of Networking Operations and Information Systems) Tom Foster

Historically, the academic and popular literature has examined the various aspects of individual quality management programs from theoretical and case review perspectives. More recently, relationships between different quality programs or concepts have been explored to some degree. This paper examines the context in which Six Sigma is implemented in relationship to other quality management programs. Specifically, in companies that have implemented Six Sigma, 1) which other, concurrent quality programs are utilized, and 2) what potential synergies could be exploited from deploying Six Sigma and other quality management programs.