Fourth Annual Student Research Poster Symposium

May 12, 2000
1-4 p.m.
Holt Hall 225, 227, 235, 261

Department of Biological Sciences
California State University, Chico

Department of Biological Sciences
CSUC

Recipients of the
Tom Rodgers Outstanding Researcher Award

1997	*Ronald E. Loggins*
1998	*Maura Eagan*
1999	*Moaiad A. Kanaan*

Lower Division Class Projects – Holt 225

Vegetation growth caused by fire

Kevin Crowley, Tara Clune, Breanna Owens, George Stephenson, Kyle Connelly
Sponsored by Dr. William Derr – BIOL 6B

The purpose of the experiment was to study the vegetation growth on burnt and non-burnt areas. The areas we studied were affected by last September's fires in Butte County. Samples of vegetation in burnt and non-burnt areas were taken to measure growth. The results suggested that the previous year's fire did have an effect on the vegetation growth. The average weight (dried) for the burnt was 36.6g as compared to the non-burnt areas' dry mass of 19.3g. It was hypothesized that the above ground vegetation of burnt areas would have an increased dry mass to the non-burnt areas.

The effect of pH on bread and orange molds

Zulaikha Abdul Rahim, Colleen Cates, and Juanita Ortiz
Sponsored by Ms. Kelly Wood – BIOL 6B

Common molds are found everywhere in the household but individual species are often found on select foods. Black molds for instance are found on breads and *Penicillium* is typically found on oranges. There are many factors that could account for this selectivity, one being the pH of the nutrient source. Oranges are considered an acidic fruit whereas breads may be thought of as a neutral or alkaline food. We were interested to see if molds from each source would grow better in specific pH environments and hypothesized that the orange molds would grow better in an acidic environment whereas the bread would grow better in a neutral or alkaline environment. In our experiment we transferred molds found on bread and oranges to nutrient agar plates at a pH of 6.5 and allowed the plates to incubate at room temperature for one week. The molds were then transferred using sterile technique to agar plates at a pH of 5, 6.5, and 8 allowed to incubate for an additional week to determine which environment was optimal from each mold. As a result we found that both the bread mold and the orange mold grew best on pH 6.5 agar with a 50% growth for orange and 25% for bread. The pH 5 agar showed slightly lower growth rates with a 40% growth for orange and 10% for bread and the pH 8 showed the least amount of growth with orange at 20% and bread at 5%.

What's lurking in your next barbeque?

Rebecca Haagens, Holly Dippold, Joanne Gaines, and Karen Tandy
Sponsored by Ms. Kelly Wood – BIOL 6B

During the last few years, organic meat has become increasingly popular. Organic meat is from livestock fed free range and never exposed to precautionary antibiotics. We were interested to see if bacterial numbers on organically raised beef, pork, and poultry would be different from the antibiotic injected supermarket products. We hypothesized that a greater number of bacteria would exist on the naturally raised meats compared to conventionally raised meat due to the absence of antibiotic

exposure. In our experiment we transferred bacteria found on beef, pork and poultry obtained from organic suppliers as well as commercial suppliers using sterile technique and contact transfer to nutrient agar plates. The agar plates were incubated for two weeks at room temperature, then total colony numbers and individual colony types were counted then identified as being either gram-positive, gram-negative, cocci, or bacillus. In our results we showed that the organically raised meat did have higher counts of bacteria in pork and poultry but lower counts in beef. All samples showed both gram-positive and gram-negative cocci except for pork, which was only found to have gram-negative strains.

Does an excessive amount of copper affect sunflower growth, and does it accumulate in a specific plant pegion?

Andrea Casey
Sponsored by Dr. Ailsie McEnteggart – BIOL 9

The purpose of this experiment was to determine the effects of excess copper sulfate on sunflower plant growth. It also was to determine whether sunflower plants have the ability to accumulate copper, and if so, in which region the copper was accumulated. The experiment was conducted by exposing fifteen sunflower plants to varying amounts of copper sulfate. One group of five was given a 300 milligram dose of copper sulfate; the second, a 500 milligram dose; and the third set, a 750 milligram dose. A control group was also used. The plants were allowed to grow for three weeks in a hydroponic solution with their given amount of copper sulfate. Measurements and observations were made at the beginning and at the end of the experiment. At the end of the experiment it was determined that excess copper sulfate plays a significant role in inhibiting plant growth. It also was determined that sunflower plants have the ability to accumulate copper in their root system. Once the roots have been saturated, the copper will move up through the shoot system until the entire plant is saturated by which time the plant is dead.

Predation on an organic winter garden during vegetative growth

Wesley B. Davis
Sponsored by Dr. Ailsie McEnteggart – BIOL 9

Three small gardens in Chico, California were planted with broccoli, lettuce, peas, collard greens and chard. The gardens were grown using "organic" methods, without the use of chemical fertilizers or pesticides. Predation, in the forms of browsing and grazing, was monitored over a 31-day period. As the gardens possessed different characteristics, predation differed between gardens and even between individual plants. Overall, predation declined during the course of the study; however, plants that were significantly preyed upon during early growth never recovered, resulting in extremely low crop yield for those plants. The end result of this project is a "prescription" for organic pest management relevant to the home gardener in the Chico area.

What environmental factors most influence successful propagation of sandbar willows (*Salix exigua*)?

Ross Rowland, Mike Quinn, Lyrongala Houseal, and Jeannie Trizzino
Sponsored by Dr. Ailsie McEnteggart – BIOL 9

This experiment was conducted to determine the effect of sand versus soil as propagation substrates with respect to new root and shoot growth in sandbar willow (*Salix exigua*) clippings under various propagation conditions. The sandbar willow is an important riparian species, often relied upon to stabilize banks in riparian restoration projects. The results of the experiment showed that, as expected, clippings grown in sand proved to have better root productivity regardless of other propagation conditions.

Photoperiodism: effect of light on leaf retention

Bob Williams, Sonemany Salinthone, Eve Pace, Tim Grant, and Octaviano Cuevas
Sponsored by Dr. Ailsie McEnteggart – BIOL 9

With urban growth on the rise, and with the resulting increase in the number of artificial light sources comes the question: Does this alternate light affect leaf retention on trees? An investigation was done in and around Chico, CA to attempt to answer this question. The investigation covered a 30-day period in the fall of 1999 and included observations and a survey of pertinent literature. The results of the survey were found to be consistent with comparable research and indicated that trees exposed to continuous artificial light retained their leaves for a longer period of time than trees that were not.

Comparison of antibiotic resistance of *Staphylococcus epidermitis* colonies from children on and off antibiotics

Rachel Brock, Craig Cissel, and Michelle Crane
Sponsored by Dr. Larry Hanne – BIOL 11

Antibiotics today are seen by many as the answer to any ailment, and indeed can be very effective when properly used. Problems can arise, however, when antibiotics are overused or abused, allowing resistant strains of organisms to develop. We wanted to see if one cycle of antibiotics in children resulted in resistant strains of normal flora from the skin. Samples were obtained from six children, two taking the antibiotic Augmentin, and four taking no antibiotics. *Staphyloccus epidermitis* colonies were isolated and Kirby Bauer disc diffusion tests performed with tetracycline, gentamycin, carbenicillin, streptomycin, penicillin, and cephalothin. interestingly, all of the plates showed complete resistance to penicillin. Many also showed resistance to carbenicillin, a second-generation penicillin. The only significant difference (t-test) between isolates from the children was in susceptibility to cephalothin, another beta lactam. Isolates from children on antibiotics were less susceptible to cephalothin than isolates from children not on antibiotics. This result was opposite from what we expected. Although there was no difference in the susceptibility patterns for the two groups with the other antibiotics, these results show the presence of penicillin resistant *S. epidermitis* in a population independent of exposure to penicillin, and possibly the development of carbenicillin resistant *S. epitermitis*.

To cover or not to cover? The effect of covering foods on bacterial growth and contamination

Wendi Myers, Wendy Piemons, Brandi O'Brien, and Laurie Hansen
Sponsored by Dr. Larry Hanne – BIOL 11

Most people out of habit cover their food when they put it in the refrigerator. We wanted to know if covering the food had any effect on bacterial growth and contamination. Our hypothesis was that by covering foods, there would be a significantly lower colony per unit count (CPU). We stored soup for two weeks in various locations in a refrigerator. Half the samples were covered; the others were uncovered. We plated out .10 ml of the soup on TSA agar and incubated at 28 degrees for 48 hours. Conclusions were that the covered samples had a significantly lower CPU count. We concluded that this may have been due to the greater availability of oxygen as well as the uncovered sample had a greater opportunity for organisms to fall in.

The antibacterial effect of cranberry juice on *E. coli*

Julie Locke, Pham Saechao, Marietta Thomas, and Jennifer Parker
Sponsored by Dr. Larry Hanne – BIOL 11

It has been publicly claimed that cranberry juice acts as a remedy for Urinary Tract Infections (UTIs). *E. coli* is the primary bacteria that causes UTIs. Our group decided to test the effect of cranberry juice on the survival of *E. coli*. Our goal was to determine whether cranberry juice inhibits the growth of *E. coli*. To test this hypothesis, we inoculated *E. coli* into cranberry juice and into water as a control. Samples were removed at time 0,1, and 2 hours and viable bacterial counts were determined. Our results indicated that cranberry juice does have antibacterial properties, although the exact mechanism of inhibition is still unknown.

Upper Division and Graduate Class Projects
Holt 227

Is there a genetic difference between northern and southern populations of the California roach?

Carina S. Oltjenbruns
Sponsored by Dr. Jeffrey Bell – BIOL 199

The California roach, *Lavinia symmetricus*, is a small omnivorous fish belonging to the family *Cyprinidae* (minnows and carps). The roach's habitat is being encroached upon by human activities such as agriculture, urban development, and diversion of water (Moyle & Nichols, 1973). They reside in small streams, which go through episodic drying, and can lead to founder effects, genetic drift, and bottlenecks (Brown et al. 1992). Loggins (1997) measured the genetic variability within and between the California roach inhabiting four tributaries to the Sacramento River. Population comparisons were made both within streams and between streams. The fish sampled were from (northern populations) Zimmershed and Pine, and (southern populations) Big Chico and Butte Creeks.Using DNA sequencing Moalad Kanaan found that 3/7 minnows tested from Big Chico and Butte Creeks combined had a unique (mutant) DNA sequence, whereas Pine and Zimmershed Creeks had 0/7 mutant DNA sequences present. This suggests that there might be genetic differences between northern and southern populations of the California roach. 88 DNA samples were tested with a PCR assay to see if the genetic differences found between the 14 fish sampled from northern and southern roach populations were representative of the populations. P5 primer was designed and utilized to amplify the mutant DNA sequence. Mutant DNA was found in Big Chico (14/24) and Butte Creek (2/8) populations. Pine and Zimmershed Creeks combined had 0/23 mutant DNA, confirming Kanaan's 1999 results, that there is a difference between north and south roach populations

Degradation of substituted phenols by p-nitrophenol degrading soil bacteria

Chris Broberg, Emma Baca, Becky Wadlow, Robert Current,
Sponsored by Drs. Larry Kirk and Larry Hanne – BIOL 199

Nitrophenols and chlorophenols are highly toxic to plants and animals. These compounds are released into the environment as herbicides, insecticides, and as effluent from industrial processes. Our lab has previously isolated five actinomycetes that have the ability to degrade p-nitrophenol (PNP). PNP is degraded by these organisms following a 1 to 2 hour induction period. Studies were initiated to determine whether these organisms could break down other substituted phenols by measuring oxygen consumption with a Clark electrode. Each strain was grown overnight in minimal media, the test phenolic compound (0.1mM) added, and oxygen consumption measured. To determine whether induction with PNP was necessary for degradation, a second culture was induced with PNP 2 hours before the test phenolic compound was added. While constitutive enzymes degraded 1,2,4-benzenetriol, induction was

required for breakdown of PNP, p-chlorophenol, m-nitrophenol, catechol, 4-nitrocatechol, and nitrobenzene. The PNP monooxygenase was also shown to degrade 2,4-dinitrophenol and apparently p-chlorophenol. The release of chloride from p-chlorophenol, analogous to nitrite release in PNP degradation, was followed with a chloride ion selective electrode.

Litter arthropods in riparian restoration sites on the Sacramento River: using preliminary data from pitfall transects to examine community development and protocol design

John W. Hunt

Sponsored by Dr. David Wood – BIOL 199

Restoration ecology is a relatively new science. Monitoring site development after planting has become an important aspect of assessing the success of restoration efforts and the qualities of the developing system. In an effort to examine protocol design and obtain preliminary information regarding community composition, 3 pitfall transects were established on a 3-year old and 6-year old restoration site and in an adjacent, relatively natural riparian site along the Sacramento River. Sites were sampled on 3 separate occasions between October and November 1999. Arthropods were catalogued into a "morpho-species" collection for future species identification. Samples were then analyzed at a higher taxonomic level. Initial data analysis showed a distinct difference in abundance of Formicidea (ants), activity level of Collembola (springtails) and presence/absence of Acarina (ticks and mites) between the restoration sites and the older riparian site transects through time. Experienced gained from sampling efforts helped determine modifications in protocol, such as a change from linear to circular transects to reduce directional bias when collecting vegetation data and ensuring that little or no debris is present when traps are activated.

Characterization of two forms of a novel outer membrane protein from *E. coli*

Ezra Fraser and Heather Safford

Sponsored by Dr. John Mahoney – BIOL 199

Our lab has identified clinical isolates of *E. coli* that are a million-fold more virulent in the presence of iron in an experimental mouse peritonitis model. Preliminary investigations suggested a correlation between this iron-driven virulence and the expression of novel 21.5 kd outer membrane protein (Omp). The non-virulent strains of *E. coli* express an 18 kd Omp that has an identical gene sequence to the 21.5 kd Omp. We hypothesize that this difference between these two forms of the Omp protein is the result of differential post-translational modification. We purified the 18 kd Omp from bacterial outer membranes prepared with a French press. The outer membrane samples were electrophoresed on 15% polyacrylamide gel electrophoresis (PAGE) with molecular weight standards and previously purified 21 kd Omp. The edge of the gel was removed and stained using Coomassie R-250. The 18 kd band was identified and cut out from the unstained gel. The Omp protein was removed from this gel by electroelution. The eluted protein was then electrophoresed on 12% PAGE. Silver staining confirmed a single protein band corresponding to a mass of 18.5 kd. Characterization of the purified

21.5 and 18 kd Omp by GC/MS should allow us to determine the nature of the post-translational modification that accounts for the difference in mass between these two Omp.

College students are at nutrition related health risk

Libby Itanen, Vanessa Carpenter, and the Nutrition and Food Sciences Association

Sponsored by Drs. Cindy Wolff and Kathryn Silliman – NFSC 199

This cross sectional study assessed risk for nutrition related health problems among college students using blood cholesterol, anthropometric, and dietary data. Total cholesterol, body mass index (BMI), and body fat (skinfolds) were measured for 253 self selected students enrolled in a nutrition and fitness course. HDL cholesterol was measured for 45 of these students. Dietary fat (total fat, saturated fat, and cholesterol) was assessed using a 12-item questionnaire. Student's t-test and analysis of variance were used to examine relationships among variables. 54.2% of males were overweight with a BMI > 25.0 while 17.1% vs. 25.0% were obese using BMI > 30.0 and body fat > 20.0%, respectively. The low rate of overweight among females (21.8%) suggests a reluctance of overweight females to participate. Although mean(SD) total and HDL-cholesterol were 172.6l37.7 and 52.8□13.2 mg/ dL, respectively, 20.8% had a total cholesterol above 200 mg/dL and 22.2% had a total cholesterol:HDL ratio above 4.5. Of the 26 students over age 30, 46.1% had a total cholesterol above 200 mg/dL. Total cholesterol was significantly higher for obese vs. non-obese males ($p = .021$). Of the total sample, 41.4% had diets rated as low to moderate in fat, while 58.5% consumed high fat diets. The dietary fat score for males was significantly higher than females ($p = .001$). Higher dietary fat scores were associated with a significantly higher total cholesterol:HDL ratio ($p = .015$). Results are similar to those for the adult U.S. population and indicate that CSUC students are at risk for nutrition related health problems.

Ecology of geese and swans using high terrace grassland-vernal pool habitats of the Sacramento Valley, California, 1999-2000

John W. Hunt and Sabrina M. Wright

Sponsored by Raymond J. Bogiatto – BIOL 199

We conducted a baseline study of the geese and swans using grassland-vernal pool habitats on the Vina Plains, Tehama County, California from December 1999 through April 2000. Goals of our project were to determine species composition, and to generate data on temporal distribution, habitat utilization, and daily activity patterns for each taxon. The Canada goose (3-4 races documented) was the most common species on the Vina Plains during this field season, the first of a two-year study. Other less common taxa included the greater white-fronted goose, snow goose, and tundra swan. Daily activity patterns were typical of geese and swans, with foraging (grazing) in the early morning and late afternoon, and with roosting during the midday and nighttime hours. Percent occurrence figures for Great Basin, cackling, and Taverner's / lesser Canada geese peaked in February-March, January-February, and December-January, respectively. Percent occurrence values for greater white-fronted geese peaked in March-April, with lower values in January. Grazing and roosting activities for all Canada geese races occurred primarily on grazed (by cattle), unburned pastures and on stock

ponds, respectively. Other goose taxa also foraged mainly on grazed, unburned pastures, whereas these species as well as the tundra swan roosted primarily on vernal pools

The effect of pycnogenol on the *in vitro* degradation of vitamin C

Ricardo Paniagua
Sponsored by Drs. Larry Kirk and Kathryn Silliman – CHEM 199

Pycnogenol is an extract of the French maritime pine *Pinus pinaster*, a pine cultivated on plantations on the Atlantic coast in southwest France. One of the nutrition claims made by manufacturers of Pycnogenol is that this extract interacts with and helps preserve vitamin C in the body. Little research exists in the literature to support this claim so we conducted an in vitro experiment to test it. The research hypothesis is that Pycnogenol added to a solution of vitamin C will slow its degradation rate in a dose-dependent fashion. A 20 µg/ml vitamin C solution was prepared in 50 mM phosphate buffer (pH = 7.4) and added to a series of test tubes and allowed to degrade (at room temperature). Test tubes with vitamin C alone served as the control. Other test tubes had Pycnogenol added (200 µg/ml, 100 µg/ml, or 50 µg/ml). The concentration of vitamin C was measured at baseline (time zero) and every twenty minutes for 1 hour. Vitamin C was quantified using a paired ion-reverse-phase HPLC method at 266 nm. Results are expressed as percent degraded from baseline vitamin C concentration [(peak area at time 0 – peak area at time 20, 40, or 60) ÷ peak area at time 0 X 100]. Repeated measures analysis of variance revealed that all three doses of Pycnogenol significantly reduced the degradation of vitamin C compared to the control. There is also initial evidence that pycnogenol slows the degradation of C in a dose-dependent fashion. Our in vitro evidence seems to support the nutritional claim for Pycnogenol.

Different pigments caused by Ultra-Violet B radiation on *Arabadopsis* wild-type and mutant strains

Robin Vierra , Shawn Grant, Alex Parker , and Chris Ames
Sponsored by Dr. James Pushnik – BIOL 215

The depletion of the ozone layer is cause for concern especially because of the lack of filtration of Ultra-Violet B (UVB) radiation. UVB can cause skin cancer in humans and can cause severe damage or even death in plant tissues. This experiment was designed to study the different pigments that were produced in *Arabadopsis* because of the exposure to UVB radiation. *Arabadopsis* was grown for 2 months. Some plants were exposed to UVB radiation for 24 hours. The plants were left to grow for 2 more weeks. Different plants were exposed to UVB for one hour. A mutant strain of *Arabadopsis* was also exposed to UVB for one hour. After performing chromatography on the samples, there were different pigments produced due to the exposure of UVB radiation. As a consequence of this experiment, the mutant strain was discovered to be UVB resistant.

Western grey squirrels: When are they most active?

Gary Lechner and Leah Landes
Sponsored by Dr. Robert Schlising – BIOL 258

The question posed before us was at what time of the day is the Western Grey Squirrel (*Sciurus griseus)* more active. The significance of this information might help future researchers decide when to observe this species of squirrel. We choose to observe the squirrels during the mid-morning (for one hour) and mid-afternoon (for one hour) at the same location twice a week for six weeks. The location was in the Children's Park (behind the Physical Science Building), between the amphitheater and the Esplanade (~100 yds) and Big Chico Creek and the parallel footpath (~35yds). Our null hypothesis was that there would be no difference in the activity of the Grey Squirrels between mid-morning and mid-afternoon. Our alternate hypothesis was that there would be a difference in the activity of the Grey Squirrels between mid-morning and mid-afternoon. We only observed the squirrels when the temperature was between 60 and 75 degrees F so that bad weather would not affect the results. At the end of the six-week period we were able to reject our null hypothesis and accept our alternate hypothesis. The squirrels were more active in the mid-afternoon. These data could help future researchers decide what time of day to view the largest number of squirrels in other studies.

Inflorescences of sky lupin (*Lupinus nanus*) on two types of soil at Table Mountain

Tim Grant
Sponsored by Dr. Robert Schlising – BIOL 258

Over the course of 6 weeks the inflorescences of Sky Lupin (*Lupinus nanus*, Fabaceae) were studied on Table Mountain, north of Oroville, CA. Percentages of open vs. closed buds were recorded from plants on 2 distinct soil types, one with dense grass (grassy area), and the other with sparse grass (rocky area). The types of soil were found to have different mean amounts of moisture and organic material content (18.5 % water and 9.5% organic material in the grassy area, 9% water and 6 % organic material in the rocky soil). On the first day of observation (March 14, 2000) percent (mean + standard error) of flowers open of 20 Sky Lupin was 42.1 + 7.87 for the grassy area, and 80 + 6.46 in the rocky area. The second observation, with 20 new plants at each site, had a mean for the grassy area of 69.1 + 5.0, and the rocky area 90 + 6.47. Using a t-test, assuming unequal variances, the p value was calculated in a comparison of open flowers for each day (0.0007 for the first observation, 0.008 for the second observation). This strongly supports the conclusion that there is a difference in the percentage of open flowers of Sky Lupin in the two soil types on Table Mountain, probably due to the different amounts of organic matter and moisture content of the two soils.

Determining a positive correlation between root nodule mass and production of seeds in the common sky lupine (*Lupinus nanus*)

Christine Hantelman
Sponsored by Dr. Robert Schlising – BIOL 258

The conspicuous spring displays of blue in the grasslands of Butte County are made by the common sky lupine (*Lupinus nanus*). It is a member of the Fabaceae or legume family, characterized by their symbiosis with nitrogen-fixing bacteria that form root nodules. Although there is much research on nitrogen-fixation and nodules in crop legumes, relatively little has been done on this local wild species. This study asks the question. Is there a relationship between root nodule size and seed production of lupine plants? Ho = there is no correlation between nodule size and seeds produced. A large sample (n=109) of lupines was randomly dug from a plot 15 m by 15 m on annual grassland 15 miles north of Chico, California. Soil was removed from the roots and the entire plant was dried. Abovegound mass (g) and height (cm), root mass (g), and number of ovules (potential seeds) were measured. Using Spearman's rank correlation, a significant correlation for root nodule mass to ovules was shown (calculated rs = 0.841, critical rs = 0.197). Since calculated rs is > critical rs for n, the null hypothesis is rejected. However, the data also show significant correlations between aboveground plant mass and nodule mass and between plant height and number of ovules produced. This indicates that larger plants generally produce more seeds. Future research could focus on whether there is a causal relationship between nodule size and seed production.

Transplacental effects of AZT in mice

Carina S. Oltjenbruns
Sponsored by Dr. Robert Thomas – BIOL 289 – NIH Internship

3'-azido-2', 3'-dideoxythymidine (AZT) was the first nucleoside analog used for the treatment of Acquired Immunodeficiency Syndrome. By acting as a chain terminator, AZT blocks replication of the Human Immunodeficiency Virus - 1. Transmission of HIV-1 from mother to child reduced from 22% to 7.6% when AZT is administered to pregnant women during the last six months of pregnancy, and to their newborns for an additional six weeks. When administered to mice transplacentally on days 12-18 of gestation, fetuses were at risk for tumor development, and when administered to adult mice, over a lifetime, it was found carcinogenic. This study was designed to measure the incorporation of AZT into cDNA, mtDNA, and AZT effect on telomeric DNA length. Radioimmunoassays measured transplacental incorporation of AZT into the DNA of (CD-1) mice after exposure. 3 µg of DNA from AZT-treated and untreated mice tissues was quantified by measuring the absorbance at 260 nm. Preservation of telomeric repeats was accomplished upon digestion of DNA using SAU 3A I, Alu I, and Rsa I. Litter size was not different between exposed and unexposed mice, however litter size did influence measurable incorporation levels of AZT. A litter of 14 pups had the lowest incorporation levels, whereas a litter of 11 pups had higher levels of incorporation. When compared to untreated animals, telomeric DNA length of AZT-treated animals was found to be shorter. AZT incorporation was detected in the nuclear and mitochondrial DNA from multiple pooled organs of newborn CD-1 pups after transplacental exposure to 25.0 mg AZT/day.

The succession of *E. coli* and *Enterococcus* during decomposition and its relationship to the post mortem interval

Jenifer Vincent and Bill Powel
Sponsored by Dr. Larry Hanne – BIOL 298

Of the many tools that forensic experts use in determining the time since one's death or post mortem interval, none include the use of the endemic bacterial population that resides in the intestines. *Escherichia coli* and *Enterococcus* are two of the most easily isolated facultative microorganisms found in the colon. Preliminary studies have indicated that post mortem changes in enteric bacterial populations do occur. The purpose of this study was to determine if bacterial succession in the colon could be used as a tool for forensic science experts in determining the post mortem interval. By obtaining enteric samples from decomposing mice at regular intervals and by using selective and differential media we determined the concentrations of *E. coli* and *Enterococcus* in the descending colons of mice. Our results indicated an inverse relationship in the survival patterns of *E. coli* and *Enterococcus*. Additionally, studies were conducted to determine if any inhibitory substances were being produced by other organisms against *E. coli*, the results of which were negative. These combined results indicate that further studies need to be done to determine if the succession of bacterial communities on a decomposing body could be used to determine the post mortem interval.

Does grazing correlate with variations in the reproductive biology for two populations of *Triteleia laxa* (Liliaceae)?

G. Blosser, C. Boggs, L. Clark, and S. Ellberg
Sponsored by Dr. Robert Schlising – BIOL 352

The geophytic monocot, *Triteleia laxa*, persists as multiple populations in annual grasslands of grazed and ungrazed habitats in northern California. Studies were conducted (1998-2000) within two populations to elucidate some reproductive factors and attributes of floral composition that may correlate with the existence or absence of cattle grazing. The growth of leaves in *T. laxa* was found to be inversely related to the growth of the flowering scape. This represents a temporal change in resource allocation as the leaves wither. Scape height was significantly different (p=0.01) between sites. Reproductive output was emphasized between sites, with comparisons indicating no significant differences in the number of flowers per plant (p=0.10), fruits per plant (p=0.32), seeds per fruit (p=0.51), and seeds per plant. Previous studies at the sites indicate the corms of *T. laxa* vary in size and corm size is strongly correlated with fruit production. Comparative analysis between sites indicate a significant difference in corm volume (p=0.04). However, reproductive output was not significantly different. Quadrat occurrence counts, based on three years of associate data, were analyzed using the Sorenson Community Similarity Index (0.72, 0.60, and 0.62). In general, over the three year period, occurrence of native species was greater on the ungrazed site (range 70-53%), while occurrence of annuals was lower (85-74%).

Graduate Thesis Projects – Holt 261

The effects of subcytotoxic levels of the PMN oxidant hypochlorous acid on endothelial cell physiology in the isolated perfused rat heart model

Robert Angelito
Sponsored by Dr. John Mahoney

The polymorphonuclear neutrophil (PMN) is one of the most important cells of the immune system. In O_2-dependent killing, PMN's are able to reduce molecular oxygen into oxidants capable of eliminating infectious microbes. The oxidants generated by activated neutrophils are recognized for their ability to kill pathogens. However, these oxidants are also toxic to host cells. Hypochlorous acid (HOCl) is one such oxidant, which is effective at micromolar amounts. Low μM concentrations of HOCl have been found to cause contraction of cultured endothelial cells. It is possible that HOCl generated by PMN's in the heart vasculature may have similar effects. Using the Langendorff isolated perfused rat heart apparatus, we are able to study a functional heart outside of the body and the effects of HOCl addition. Past studies have shown that low concentrations of HOCl adversely affect myocardial function. We believe that HOCl causes endothelial contraction leading to edema and impaired function. This work in progress uses the isolated heart model to explore the hypothesis that HOCl has an adverse effect on endothelial morphology and function. We will attempt to measure edema through wet/dry weight measurements. Additionally, we will measure dye clearance through the heart as a measure of endothelial contraction. And histology of the coronary vasculature will provide visual support. This study will lead to an improved understanding of PMN-derived chlorine oxidants' role in eliciting physiologic response. Hopefully this knowledge may lead to the development of treatments for cellular damage associated with such oxidants including; ischemia reperfusion, hemorrhagic shock, and ARDS.

Regulation of cardiac neural crest cell migration by transcription factors Pax3 and Msx2

Valy Boulom
Sponsored by Dr. Jeffrey Bell

Congenital heart defects and other congenital abnormalities are among the top five causes of death in infancy and childhood. It is estimated that about a third of all birth defects are caused by genetic factors. Certain cardiac structures are derived from the embryonic cardiac neural crest. Previously, it was found that during early stages of mouse development, expression patterns of the transcription factors Pax3 and Msx2 overlap within the cardiac neural crest. The co-expression of these genes suggests they may be involved in a pathway which controls the development of cardiac neural crest derivatives. Mouse embryos with mutations in both copies of Pax3 die early during gestation with heart failure. However, if Pax3-deficient mutants lack expression of Msx2, embryos survive to the neonatal period with normal cardiac function. This result led to the hypothesis that Pax3 negatively regulates Msx2. In this study, we are

investigating the regulation of cardiac neural crest cell migration by Pax3 and Msx2. Method: An in vitro assay is used, in which the cardiac neural tube is isolated from the embryo and cultured in a tissue culture dish. At various time periods, the neural tube explants are stained with Heamatoxylin. A computer image analysis program is then used to determine differences in neural crest cell migration patterns. Based upon the hypothesis, the following results are expected: Pax3-deficient cardiac neural crest cells exhibit defects in migration; whereas Pax3- and Msx2-mutated cardiac neural crest cells migrate in a fashion more similar to wild-type cardiac neural crest cells.

Evaluation of a nutrition and psychology based weight management curriculum for use in an outpatient dietitian setting

K. Farrell, C.B. Wolff, B. Kirks, and M. Yamanoha
Sponsored by Drs. Cindy Wolff and Barbara Kirks

The purpose of this study was to develop and evaluate an eight-week weight management curriculum to treat obesity. Thirty-eight subjects completed the program and thirty subjects returned for a three-month follow-up. Weekly lessons provided nutrition and physical education with behavior modification tools. BMI, anthropometrics, blood pressure, blood glucose and lipids, and eating and exercise behaviors were measured at baseline, at completion of the eight week program, and after three months. Paired-sample t-tests, repeated measures of variance, and correlation analyses were conducted using SPSS version 9.0. Weight and BMI decreased significantly after completion of the program: mean weight change was -1.4 kg and BMI change was -0.5 unit. After three months, 50% (n=15) were still significantly below their baseline weight, 13 of whom (43%) maintained their weight loss or continued to lose weight. Anthropometric measurements decreased significantly by the completion of the program. Waist and hip measurements were still significantly reduced from baseline, but mean losses in inches were not maintained after three months. No statistically significant biochemical changes were noted. Diastolic blood pressure decreased (6.2 ± 12.88 mm/Hg) by completion of the program, and systolic and diastolic were both decreased at three months ($p<.05$). Eating and Exercise Behavior Questionnaire scores increased significantly from baseline through the three month follow up. This curriculum supports a reduction in blood pressure and improved eating and exercise behaviors. Results suggest that this weight management program is effective for use in an outpatient dietitian setting.

Investigations in the genus *Vaccinium* (huckleberry), including resolution of the taxonomic status of *Vaccinium coccineum* Piper by RAPD analysis

Loren Gehrung
Sponsored by Dr. James Pushnik

Vaccinium coccineum is very similar to *V. membranaceum*, from which it varies only in berry color, degree of pubescence, number of seeds per berry and seedling vigor. The question of the taxonomic status of *V. coccineum is* significant to the Plumas and Tahoe National Forests, where it has been found and protected as a rare plant. *V. coccineum* was collected throughout its range and compared to *V. membranaceum* and *V.*

deliciosum. The range of *V. deliciosum* was found not to overlap with *V. coccineum*. *V. deliciosum* had been confused with a glabrous variety of *V. caespitosum*. *V. caespitosum* does coexist with *V. coccineum* in the Klamath Mts., and the Sierra Nevada, so was considered as the other parent of the possible hybrid, *V. coccineum*. *V. caespitosum* was found to have a variety of forms, from short to tall, and glabrous to pubescent. These forms intergrade fully, making the identification of varieties or subspecies unwarranted. Leaf tissue was collected and frozen for RAPD analysis of the species in question; only *V. coccineum* and *V. membranaceum* were successfully amplified in the PCR process. Statistical analysis of the results of the RAPD showed these two species to be identical, with no evidence of hybridization in *V. coccineum*. It is therefore recommended that the name *V. coccineum* be regarded as a synonym of *V. membranaceum* and that the huckleberries of the Plumas and Tahoe National Forests be removed from Sensitive Plant Lists. *V. membranaceum*, as a species, was shown to have little genetic variation.

Characterization of JP-7 jet fuel degradation by the bacterium *Nocardioides luteus*

Carina M.Jung
Sponsored by Drs. Larry Hanne & Larry Kirk

In the fall of 1996 numerous bacteria capable of degrading JP-7 jet fuel were isolated from the soil of Beale Air Force Base (AFB) in northern California. The most prevalent bacterium was chosen for further study, and identified as *Nocardioides luteus* by sequence analysis of the first 500 bp of 16s rRNA. On solid media, *N. luteus* was capable of growth on JP-7 as the sole carbon source. Liquid media was used in order to monitor degradation of the JP-7 mixture and its main components; *n*-undecane (C11), *n*-dodecane (C12), *n*-tridecane (C13), or *n*-tetradecane (C14). The hydrocarbon components remaining in liquid media were analyzed by capillary gas chromatography. C11-C14 appeared to be degraded or modified by *N. luteus*. Growth rates in JP-7, C11-C14, and media without a growth substrate were identical during the first 10 hours of growth, suggesting the cells may use stored reserves for growth. Electron microscopic analysis of *N. luteus* demonstrated electron transparent vesicles. Differential staining of these cells showed that the vesicles contained poly-(D-hydroxybutyrate (PHB). Starvation studies were conducted in which the cells were incubated without a carbon source. PHB vesicles were noted to decrease by over 40% after 24 hours and 70% by 72 hours. The cells appear to store PHB when grown on glucose, and when shifted to JP-7 they appear to utilize PHB reserves and supplemental yeast extract nutrients within the media preferentially. This work has provided insight into the degradation of JP-7 by *Nocardioides luteus*. Although the degradation pathways have not been defined, we are developing an understanding of the substrates and basic regulatory mechanisms of degradation. Primarily, we have learned that *N.luteus* grows preferentially on glucose, yeast extract and PHB reserves before utilizing JP-7. It also appears that the actual component within JP-7 that is being utilized by the bacterium may be a volatile compound or one present in low concentration. This information may be important in designing strategies for remediating JP-7 contaminated soils.

Arthropod succession on exposed carrion in the Central Valley of Northern California

Rebecca A. O'Flaherty
Sponsored by Dr. David Kistner

Decomposition studies were conducted on pig carrion at two sites within the northern Sacramento Valley of California during three separate experiments: July - August 1998 (I), October - December 1998 (II), and July - August 1999 (III). The pigs were monitored for changes in internal temperature recorded in the mouth, abdomen, and anus, as well as for changes in biomass removal and insect succession. Elevated temperature readings from inside the carcasses reflected the locations of the largest maggot masses, exceeding the ambient air temperatures by as much as 31°C. The decay stage exhibited the greatest percentage of biomass loss for all three experiments. Seasonality significantly affected the numbers of species present in carrion, as well as the rates of decomposition. Two study sites within the same geographic region also yielded different species during the same season. This research effort has established a preliminary database of carrion-frequenting organisms and their colonization times in this area, which will aid local law enforcement officials during homicide investigations.

Old field succession and restoration of riparian forest communities along the Sacramento River, CA

Daryl Peterson
Sponsored by Dr. David Wood

Current models for recruitment of pioneer riparian species focus on the relationship between river hydrology and seed release phenologies. A program has been initiated to develop alternative restoration methods mimicking these relationships for revegetation of floodplain sites on the Sacramento River, Ca. This study reports the effects of physical and ecological processes on the establishment of pioneer riparian tree and shrub species following a large scale field experiment. Results indicate that forest establishment on the floodplain differs from within-channel nursery sites and that multiple successional pathways may exist. Additional evidence indicates initial floristic composition and previous land use may influence successional trajectories on floodplain sites.

Population and phylogenetic analysis of *Howellia aquatilis* (Campanulaceae)

Frances Phipps
Sponsored by Dr. Kristina Schierenbeck

Howellia aquatilis (common name-water howellia) is a federally listed threatened aquatic plant, once thought to be extinct in California. It is now known to occur with limited distribution in four states: California, Idaho, Montana, and Washington. There are no published studies on the population biology or genetics of the six known California populations or regarding their relationship to the northern populations. The work I propose will 1) identify any genetic variation within and among the six California populations and the other Northwest populations and 2) assess the phylogenetic

relationship of *Howellia aquatilis* to other western North American members of the subfamily Lobelioideae (aquatic Campanulaceae). The population genetics will include collection of leaf tissue, extraction of DNA, use of Amplified Fragment Length Polymorphisms, gel electrophoresis, and statistical analysis of genetic variation. The phylogenetic analysis will include PCR amplification and sequencing analysis of the ITS region of the nuclear genome, and the *mat*K and *trn*K intron on the chloroplast genome. The chloroplast and nuclear sequence data will be analyzed using PAUP.

Characterization and distribution of a putative IS element found in *p*-nitrophenol degrading *Arthrobacter*

Hiromi Sato
Sponsored by Drs. Larry F. Hanne and Jeffrey Bell

A 60 kbp plasmid in *Arthrobacter aurescens* strain TW17 is responsible for degradation of *p*-nitrophenol. DNA sequence analysis of cloned fragments from this plasmid showed that it contains five copies of a 408 bp sequence. The distribution of the 408 bp sequence on plasmids and chromosomes in three different strains of *Arthrobacter* was analyzed by Southern blot. In two strains, copies of this sequence were found only on plasmid DNA, copies were found on both plasmid and chromosome DNA in the third strain. No copies were found in nine other bacteria analyzed. Most insertion sequences have inverted repeat sequences at their termini. This 408 bp sequence does not have terminal inverted repeats, but contains an internal 15 bp inverted repeat. DNA sequence comparison between the 408 bp sequence and IS900 family of insertion elements revealed that the 408 bp sequence had 45.1-49.2% identity to regions of IS elements. The IS900 family from *Mycobacterium* does not have terminal inverted repeats. The 408 bp sequence had identical regions to other known IS elements: 44.1-49.1% to IS1473 from *Arthrobacter nicotinovorans*, 41.9-48.2% to known replicative IS elements, replicative single-ended transposons, and defective insertion elements. The insertion target site of the 408 bp sequence was compared to the insertion target sites of IS elements. The 5' end of the target site for this 408 bp sequence is AGGGAG, similar to the target site of IS 900. The 408 bp sequence we have characterized appears to belong to the IS900 family of IS elements.

A survey of nutrition education practices of elementary school teachers in Paradise, California

Jacqueline van den Akker
Sponsored by Dr. Cindy Wolff

Nutrition education in the elementary grades can be a useful tool for the improvement in the health status of children. The purpose of this study was to assess nutrition education practices in the elementary setting and to compare lower grades to upper grades. A random sample (n = 81) of teachers in the Paradise Unified School District were selected. Thirty-eight subjects, 24 lower and 14 upper grade teachers completed the study survey. Student's t-test was used to assess differences in hours of nutrition education between lower and upper grades. ANOVA was used to assess differences between teacher's level of interest and preparedness and number of hours taught and teacher perception of student competencies on key nutrition topics. Chi square was used to assess differences in teacher perception of student competency when grouped.

The average number of hours was 6.7 for lower and 5.9 for upper elementary grades. The effect of a teacher's level of interest and preparedness on the number of hours of nutrition education were not significant. Results for the effect of the number of hours of nutrition education on teacher perceived students' competencies were not significant. Statistical differences for content area competency between lower and upper grades for the following nutrition education content areas were observed: selecting nutritious meals, between meal snacking and food borne illnesses. Supportive strategies for facilitating nutrition education implementation include the use of newsletter series and short in-services which focus on how to implement the information rather than what to implement.

Identification of QTL influencing partial resistance to white pine blister rust in sugar pine

A. Willyard, D. Neale , B. Kinloch, and K. Schierenbeck
Sponsored by Dr. Kristina Schierenbeck

The identification of major-gene resistance to white pine blister rust in sugar pine (*Pinus lambertiana* Douglas) has resulted in selection for trees carrying this gene. Subsequently, a virulent race of rust that overcomes major-gene resistance has developed and spurred interest in the identification of other resistance mechanisms. Two traits described on older trees may be detectable in seedlings: low receptivity to infection and bark reaction. Both confer partial resistance to the virulent as well as wild-type races of rust, and they are important components of the long-term conservation strategy for sugar pine. In trees exhibiting low receptivity to infection, fewer lesions are visible after saturated exposure to spores. Bark reactions successfully wall off some infections when the fungal hyphae reach the bole. Inheritance of both traits is complex, but appears to be moderately strong. The goal of this study is to identify quantitative trait loci (QTL) that correlate with these two traits. We are using seedlings with well-developed secondary needles from a controlled cross (5038x5500) of parent trees that previously demonstrated relatively high inheritance for both traits. After inoculating 200 seedlings with spores of *Cronartium ribicola* Fisch, phenotypic data will be collected to segregate the sibs for both traits. DNA from seedlings with extreme phenotypes for each of the traits will be assayed with AFLPs and SSRs and the linkage maps will be used to identify putative QTL for each trait. Expressed Sequence Tags (ESTs) will be used to compare the linkage groups where QTL are identified with a loblolly pine reference map to search for synteny with genes known to be involved in disease resistance. In addition to contributing to the emerging knowledge of molecular genetics in forest trees, discrimination of these traits at the seedling stage would be an advancement with potential usefulness in sugar pine breeding programs.