

# Southwestern University

DEPARTMENT OF BIOLOGY

**SPECIAL ISSUE:**  
**The Biology Department**  
**succeeds in having a**  
**productive and fun**  
**summer of undergraduate**  
**research (see this issue**  
**for results from each lab)!**



## **What students had to say about the BSRP:**

- **"The BSRP gave me exposure to real-life research and science that would be too hard to find anywhere else. Getting to know fellow students and biology faculty on a more personal level, I have realized that a career in science might be right for me."**
- **"BSRP has meant closer faculty relationships with a stronger foundation in research."**
- **I was always afraid of doing research just because I didn't know where to start, but fortunately the faculty has really given all of us the right direction and confidence to work into a project. This has been a very rewarding experience and BSRP will always mean 10x learning and growing experience for me."**
- **"I have gained a huge appreciation for research, reading and writing skills, and learning in general. Because I have always been a fan of my biology, I feel that I justified that interest after gone through this research experience. In other words, conducting your own research really puts you in the driver seat of what you get out of biology."**
- **"I have learned that research is 50% lab work and 50% thinking. If you miss one, then your experience won't turn out well. I've also learned how slow research can be and how important it is to plan your time."**
- **"Well, I was hoping for more results, but like in real scientific research, I have more questions now than answers."**
- **"The BSRP completely met and far exceeded my expectations. I did have to put tremendous amounts of work and effort into it, but like all experience, you get out what you put into something. Again, I did not realize how rewarding a research experience really was. "**

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## ***From the Lab of Dr. Romi L. Burks***

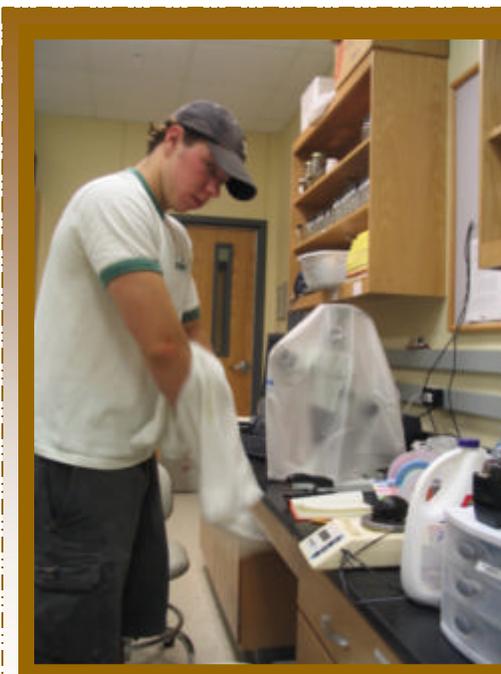
### ***Matt Barnes***



### ***Exploration of the Life History Traits of Exotic, Invasive Applesnails***



Invasive species often demonstrate prolific rates of reproduction and tolerance of a wide range of environments, which can lead to environmental devastation as they spread quickly and overrun new ecosystems. This summer, we investigated the exotic freshwater applesnail *Pomacea canaliculata* which has recently invaded the US. We monitored the hatching of eggs and growth of hatchling snails in the presence of different predator cues and salt levels. We found that the threat of a shell-crunching fish has significant effects on both the rate at which eggs hatch and the rate of hatchling growth. Over the next year, the results gathered during the BSRP will serve as the basis for an honors thesis. Understanding egg clutch and hatchling characteristics may lend insight into management efforts of the applesnail and other invasive species.



### ***Brandon Boland***

My research focuses on the food preference of the invading applesnail, *Pomacea sp.*. We spent the first part of the summer research program constructing a larger habitat for our applesnails. We can now comfortably house over 80 adult applesnails. Two major experiments took place during the summer; one that investigated the food preference of applesnails in the presence of predator and crushed conspecific cues and another that examined if the structure of their food plays a role in consumption. Future research involves investigating whether the defense molecules in plants deter feeding. In December, we will travel to Uruguay to replicate our work with native species of applesnail.

## ***From the Lab of Dr. Maria E. Cuevas***

### ***Anti-cancer Drugs & Impacts on Breast And Endometrial Cancer Cell Lines***

#### ***Carolina Boet***



The objective of this study was to determine the cytotoxic effect of effective anticancer drugs, anthracyclines, on human endometrial and breast cancer cells. Cells were treated with different concentrations of drugs (0.5-5mM) for one hour and fifty percent survival of the population was determined. We evaluated whether apoptosis, programmed cell death, was induced in treated cells by looking for the activation of death proteases, caspase 3 and 8. In both cell lines these proteins remained inactive suggesting that activation of apoptosis did not occur. Future experiments involving different concentration will be preformed in order to supplement our findings.

#### ***Tracey Einem***



This summer, under the Merck Research Program, we began looking at the effects of a breast cancer drug, tamoxifen, on human endometrial cancer cells. Women who take tamoxifen to treat breast cancer are more susceptible to developing endometrial cancer. My project this summer focused on using different concentrations of tamoxifen on a specific endometrial cancer cell line. Preliminary results showed high levels of tamoxifen promoted endometrial cancer cell death. This fall, we will be continuing my work using lower concentrations of tamoxifen to see if the response is the same and the mechanism involved. Overall, I highly recommend the opportunity to conduct research to any aspiring biology major at Southwestern.

## ***From the Lab of Dr. Martín Gonzalez***

### ***Regulation of the Prokaryotic Mutagenic Response***

***E. coli*** has a DNA replication method that it uses only under high stress conditions (i.e. UV exposure). This mechanism, SOS mutagenesis, is a last resort because it is error-prone (putting in bases at random during DNA replication). The cell must regulate SOS mutagenesis to avoid excessive mutations; *E. coli* regulates the SOS complex using the Lon protease (protein eater). Lon recognizes a subcomponent of the SOS complex called UmuC. After comparison with homologs of the UmuC protein, a 67 amino acid long chain within the UmuC protein was hypothesized to contain the Lon recognition site. My work this past summer focused on making deletions to the 67 amino acid long chain in UmuC to determine a more exact region that Lon might recognize.

### ***Liz Williams***



### ***Ian Bothwell***

I spent my summer working with Dr. Gonzalez in the field of molecular microbiology. Together, we analyzed the breakdown of the mutagenic MucA/A' proteins in *Escherichia coli*. Over the course of the study, we were able to create a new strain of *E. coli*, design a novel plasmid capable of controlled expression of the MucA/A' proteins, and make a startling discovery of how these proteins interact with each other. Future experiments will include further protein degradation analysis and reaffirmation of prior results. Overall, my summer experience was not only enlightening, but also extremely enjoyable. It gave me a much improved perspective for what it means to perform scientific research and I look forward to continuing this project during the next year.

## ***From the Lab of Dr. Rebecca Sheller***

### ***Stress Proteins in Crayfish Ventral Nerve Cords Exposed to High Temperature, Severance, Ethanol & UV Exposure***

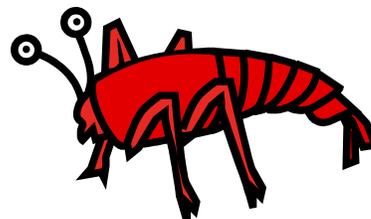


### **Angela Nordin**

We studied a family of stress proteins in samples of the crayfish central nervous system by exposing the nervous tissue to various stressors such as high temperatures, ethanol, severance, or ultraviolet light. We found that crayfish are able to survive temperatures up to 37°C for at least 2 hours. The overall level of total protein in the nervous tissue did not change dramatically due to exposure to the various stressful conditions. When we used monoclonal antibodies to probe for levels of stress proteins (ubiquitin and HSP 70), HSP 70 was abundant in all samples. This family of proteins seems to serve a protective role for cells and therefore helps the entire organism survive temporary stressful events.

### **Manjah Fernandez**

We severed the entire central nervous system (Ventral Nerve Cord) of the crayfish and studied the protein content to be able to better understand degenerative and regenerative events associated with nerve injuries. Nerve cords were severed, *in vivo*, and animals were allowed to survive for shorter (5 hours) and longer (9 days) periods of time before the nervous tissue was dissected and analyzed for the presence of ubiquitin and HSP 70. We confirmed that cells (neurons) within the severed nervous systems survive severance for unusually long periods of time. The synthesis of HSP 70 may increase in nervous tissue after severance. HSP 70 is abundant in the crayfish ventral nerve cord and may help neurons survive trauma and stress.

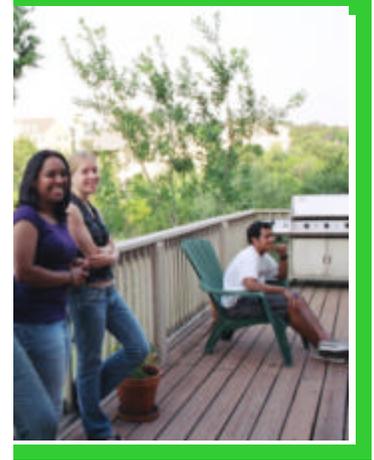


## ***From the Lab of Dr. Max Taub***

### ***Plant Physiological Responses To Salt and Herbivory Stresses***

#### ***Sheeba Varughese***

Because soil salinization limits agricultural productivity, better understanding of how plants cope with this kind of stress may improve productivity. We sought out to determine how a certain group of grasses dealt with salts in their soil. After growing 7 different species of grasses, there was clear evidence of variation in salt tolerance between the different species. Preliminary results suggest that we can detect glycine betaine (an organic compound sometimes produced when plants are under osmotic stress) in extracts from these grasses. Further research will focus on determining the concentrations of glycine betaine and salt ions in plant tissues and possibly finding a correlation between this and salt tolerance.



This study examines the effects of simulated herbivory and wounding on the growth and reproduction of an *Amaranthus hypochondriacus* X *A. cruentus* hybrid. Patterns of simulated herbivory include small and large perforations, leaf tip and base defoliation, and slicing. These treatments were performed at 2 levels of overall plant damage: 6% and 12%. Treatments were performed on the 4 youngest fully expanded leaves closest to the terminal inflorescences of 155 plants that were grown in the Southwestern University greenhouse. due to time constraints.

#### ***Sara Huie***



Variables related to plant fitness were compared among treatments, including plant and inflorescence heights, number of leaves and seeds produced, rate of leaf senescence, and plant biomass. Preliminary results for net leaf increase over time do not identify a pattern of defoliation or level of wounding that was more detrimental than any other treatment. More extensive data analysis has yet to be performed

## ***From the Lab of Dr. Maria C. Todd:***

### ***Kristen Meerbrey***



### ***Mechanisms of Cell Cycle Deregulation In Breast and Ovarian Cancers***

**Most human cancers have been found to have defects in key regulatory cell cycle proteins that result in uncontrolled cellular proliferation.**

**Our studies of an ovarian cancer cell line, NIH-OVCAR-3, revealed that it expressed abnormally elevated levels of a protein, cyclin E, that promotes cell cycle progression. We hypothesize that overexpression of cyclin E plays a role in ovarian cancer development and that suppression of cyclin E expression may inhibit cancer cell proliferation. To test this hypothesis, we have successfully reduced the level of cyclin E protein expression by approximately 70% in NIH-OVCAR-3 cells and plan to assess the effects of this inhibition on the growth and tumorigenic properties of this ovarian cancer cell line.**

### ***Jay Gupta***

**We conducted research, with the objective of identifying the mechanisms of cell cycle deregulation in breast and ovarian cancer cells. Using modern molecular biological techniques including PCR, tissue culture, and western blot analysis, we analyzed the cancer cells for defects in the expression of cell cycle regulatory proteins. In one ovarian cancer cell line, PA-1, we found differences in the expression of 2 key G1/S cell cycle proteins, BRG1 and E2F1. It is likely that these defects play a role in the uncontrolled cellular division characteristic of this cell line.**





*8 weeks allows for great friendships too.*



***The BSRP also focused on making connections through dinners, "teas" as research meetings, workshops, a field trip & informal discussions.***



*BioCharades at Dr. Todd's*



*Sara and Sheeba with imaginative snacks for research meeting*



*Dinner at home of Dr. Gonzalez*



*Matt discussing his research*

***In between lab work , the BSRP participants explored the scientific world of geology right here in Texas!***



### ***Summary of talk "A Thirst for Research"***

- ***Engaging in research provides one with many benefits.***
- ***Being able to do research requires training, knowledge, creativity, and money.***
- ***Undergraduate students are capable of doing professional level research.***
- ***Undergraduate students gain in special ways from doing research.***
- ***Research is fun, fun, fun.***

***In his talk, BSRP Speaker Dr. Chris Barney also described: Things that you could learn from research:***

- ***Research is challenging.***
- ***Research is exciting.***
- ***Research is boring.***
- ***Research requires hard work.***
- ***Research requires hard thinking – but you don't have to be a genius.***
- ***Research is rewarding.***
- ***Experiments often fail. What can go wrong will go wrong.***
- ***Hypotheses are often not supported.***
- ***Answers to questions.***
- ***You are good at or not good at research.***
- ***You like or dislike research.***
- ***You can solve problems.***
- ***You can think critically.***
- ***You are creative.***
- ***You can learn on your own.***
- ***You can communicate complex ideas to others.***
- ***You can persevere in the face of disappointment.***
- ***You like to have fun.***

## **BSRP BANQUET & PRESENTATIONS**

