

Department of Biological Sciences

Biology and Environmental Studies Senior Research 2007



Amy Stoesz *Gene expression patterns of primary BALB/c and C57BL/6 murine peritoneal macrophages in response to in vitro treatment with lipophosphoglycan and interferon-gamma.*

Leishmaniasis, found primarily in subtropical and tropical regions, is caused by an intracellular protozoan parasite of the genus *Leishmania*. Once a host organism is infected, the immune system undergoes one of two possible responses. A T_H2 response, which activates humoral responses, can be fatal to the organism because it allows the infection to become chronic and progressive due to inflammation; while a T_H1 response, which initiates cell-mediated defenses, often results in spontaneous recovery. The BALB/c mouse strain characteristically undergoes a T_H2 response, and the C57BL/6 mouse strain typically exhibits a T_H1 response. Lipophosphoglycan (LPG), a major cell surface component of the *Leishmania* parasite, was used along with interferon gamma to stimulate primary peritoneal macrophages from both strains of mice. Their mRNA products were collected and analyzed via reverse transcriptase-polymerase chain reactions. I found some slight differences in expression but overall, LPG and INF-gamma alone are not sufficient to show a consistent difference in the cross-regulation patterns between the two strains.



Daniel Einerson *The Effects of Overexpression of Nkx2.1 on Lung Specific Genes SP-C and SP-B in Xenopus laevis.*

Lung development is controlled by many different factors. Among these factors, genes play an integral role in initiating and coordinating lung development. Specifically, Nkx2.1 is a transcription factor that has been shown to be integral in the initiation of lung development. When Nkx2.1 is absent in mice and rats, the organisms have died at birth. Much research with Nkx2.1 has been done on mice or rats however; the effects of gene are still largely unknown. This study attempted to gain further knowledge into the role of Nkx2.1 through the process of overexpression of the gene in our new model organism, *Xenopus laevis*. The results of the Real-Time Polymerase Chain Reactions (PCR) showed that when Nkx2.1 was overexpressed in *Xenopus* embryos the expression of lung specific genes SP-C and SP-B also increased. This suggests that Nkx2.1 has an effect on lung development and specifically other genes that are involved in lung development. It also suggests that when Nkx2.1 is increased in an organism other genes in that pathway are also increased.



Francis Rogosienski *The Contractile Effects of Red Raspberry Leaf (*Rubus idaeus*) extract on Mouse Uterine Smooth Muscle in vitro.*

The uterus is an essential organ for reproduction in mammals. Despite the importance of the uterus for the fertility and health of women and their offspring, relatively little is known about the effects of natural remedies on this tissue. The objective of this study was to investigate the effects of Red Raspberry Leaf (*Rubus idaeus*) extract on isolated uterine tissue of mice (*Mus musculus*) suspended in a smooth muscle bath. The isolated tissues were hung under 1g of tension and bathed in DeJalons buffer. Two main questions were addressed in this project: (1) Does *Rubus* extract alone cause a contractile response in isolated mouse uterine tissue? And if so, is it dose dependent? (2) Does an extract of *Rubus* potentiate the contractile response of a) acetylcholine b) electrical field stimulation? Results indicate that *Rubus* extract alone elicited a contractile response however; there is no dependency between doses given and response elicited. *Rubus* extract did significantly potentiate contractile responses evoked from the acetylcholine and electrical field stimulation suggesting that *Rubus* may indeed help to facilitate a normal contractile response in the uterus. This suggests that *Rubus*, an herbal remedy, can induce uterine smooth muscle contractions involved in the labor process.



Jennifer Hansen *The Effect of Carbachol and Electrical Field Stimulation on Contractile Force of Isolated Diabetic Rat Duodenu.*

Previous research has found that diabetes mellitus impairs gastric motility, leading to a condition called gastroparesis. In order to determine the effect of Type I diabetes on duodenal motility, isolated strips of proximal small intestine from 11 control rats and 11 alloxan-induced diabetic rats were dissected out and placed in a muscle bath. Duodenal strips were subjected to either increasing doses of carbachol (10^{-7} - 10^{-5} M) or to electrical field stimulation (EFS). Maximal contractile forces in response to carbachol were significantly higher in control than in diabetic rats when the baths were not flushed between each dose. When the baths were flushed between doses, the mean contractile forces were slightly higher in control than in diabetic rats, but the differences were not significant. In response to EFS, contractile forces were significantly higher in control rats. These findings support my hypothesis that Type I diabetes hinders duodenal motility. Although the mechanism behind this change is not known, the decreased response to carbachol suggests that cholinergic receptors are altered in the diabetic intestine. The change in response to EFS may suggest that either the interstitial cells of Cajal (ICC) or the gap junctions are impaired.



Jetter Robertson *Sequencing and expression of FGF-10 gene in *Xenopus Laevis* development*

During mammalian lung and limb development, epithelial and mesenchymal interactions govern the branching of the lung and limb, respectively. The Fibroblast Growth Factor (FGF) gene family has been shown to play an intricate role in regulating these interactions. The FGF-10 gene, in particular, has been shown to play an essential role in these communications and its deficiency results in the inability for the lung to branch out from its initial bud in mice. The FGF-10 gene was isolated from *Xenopus laevis* and its entire open reading frame sequence was obtained using fragments of the sequence from previous studies in our lab. In addition, expression patterns of the FGF-10 gene were analyzed in various stages of *X. laevis* development.



Jessica Swanson *Finding The Optimum Environment of Crayfish (*Orconectes immunis*) For Long-term Survival and Use In High School Biology Classrooms.*

Maintaining live organisms in biology classrooms can be beneficial in helping students learn about life sciences. The purpose of this experiment was to determine the optimal artificial environments for crayfish (*Orconectes immunis*), a common experimental material for long-term use in high school biology classrooms. Due to budget cuts in schools, supplies for labs in classrooms have been greatly reduced, therefore keeping organisms alive is important. It was found that in artificial conditions, crayfish that were fed with tuna and pellet food lived longer than those fed with plants and worms as well as those crayfish that had more than one hiding spot in their tank.



Michelle Y. Perry *Quantification and Comparison of Trabeculae in Human, Canine, and Swine.*

Differing degrees of trabeculation exist in large mammalian heart. Yet, this will be important information to know for it will affect the choice of a given animal model for cardiac device testing, but may also relate to physiological functions as well (i.e. cardiovascular disease). This study was aimed at determining the relationship between the trabecular width and density to ventricular volume in human, canine, and swine heart models. A total of 30 hearts (10 human, canine, and swine) were used in the study. A 6 mm endoscope and a 2.45 mm catheter were inserted in the apex, free wall, and outflow tracts of both the right and left ventricles in isolated hearts. Image analysis was used to enumerate trabecular width and density. Trabecular density in the free wall of the right ventricle (RV) was significantly correlated ($p < 0.05$) with RV volume in human and swine hearts. In humans more prominent, yet fine trabeculae were observed in the left ventricle while swine and canine hearts showed a more coarse arrangement of trabeculae.



Caryn Daas *Heritable Disorders of the Connective Tissue: the Overlapping Significance of Marfan, Loeys-Dietz, and Vascular Type IV Ehlers-Danlos Syndromes.*

At least three genetic diseases with vascular involvement are severe enough to be potentially fatal, often without forewarning. Marfan, Loeys-Dietz, and Vascular Type IV Ehlers-Danlos syndromes, are three conditions whose overlapping symptoms are numerous. These inherited connective tissue disorders can leave patients with aortas so delicate that they can rupture in pregnancy or in even lesser activities. Certain genetic mutations galvanize patients to aggressive and widespread vascular disease. The severity of the clinical presentation is predictive of the end result, and precise diagnostic distinctions are critical. This investigation reviews the literature surrounding the three syndromes, and sets out to paint a clearer picture for diagnosis of the most severe of these disorders: Vascular Type IV Ehlers-Danlos syndrome.



Jessica Patton *The Effects of the Hormone Leptin on Obesity, Metabolism, Body Temperature, and Feeding Behaviors, Using Normal, *ob/ob*, and *db/db* Mutant Mice.*

Why is obesity or being overweight such a battle for some people and not others? A way to address this question is to look at how the body utilizes the hormone leptin, which is derived primarily from adipocytes. Leptin, the product of the obese (*ob/ob*) gene plays a major role in maintaining the balance between the regulation of food intake, hunger, satiety and metabolism. The purpose of this experiment was to determine if the lack of leptin or the leptin receptor (as found in mutant mice, *Mus musculus*) affects normal metabolism, body temperature, and feeding behaviors. Eighteen mice were used in this experiment: 6 controls, 6 mutant *ob/ob*, and 6 mutant *db/db*. The *ob/ob* mice had a defective leptin gene and *db/db* mice had a defective leptin receptor gene. The variables that were tested in these mice were basal metabolic rate, body temperature, food intake, water intake, and cage waste. Results demonstrated that normal mice had a statistically higher metabolic rate and body temperature than the *ob/ob* and *db/db* mice. Although the normal mice ate more than the others, the effect was insignificant. The water intake was statistically higher in the *db/db* mice compared to the *ob/ob* and control mice. The cage waste was statistically higher in the *db/db* mice (from high urine output) and in the control mice (they had large amount of food debris) when compared to the *ob/ob* mice. These results suggest that mutations in the genetic expression of leptin or the leptin receptor may contribute to obesity and lower metabolic rates in the mouse model.

