Senior Science Research Forum

Friday, April 20, 2007 • 2:00 P.M.
Melhorn Hall
THE INTERACTION OF ALCOHOL AND IRON-OVERLOAD IN THE IN-VIVO REGULATION OF IRON RESPONSIVE GENES

Callie Crist, Elizabeth Klein, John Gollan and Dee Harrison-Findik, Jonathan Frye
University of Nebraska Medical Center, Department of Internal Medicine

Patients with alcoholic liver disease (ALD) frequently exhibit iron overload but the molecular mechanisms of alcohol and iron interaction are still unclear. This study investigated the role of alcohol in the regulation of iron-responsive genes, hepcidin, hemojuvelin and leap-2 in both dietary and genetic mouse models. Ethanol significantly down-regulated liver hepcidin and hemojuvelin gene expression. However, leap-2 gene expression was increased in mice treated with 10% and 20% ethanol. We further studied the combined effect of alcohol and iron on the regulation of iron metabolism. Iron overload up-regulated the expression of hepcidin, hemojuvelin and leap-2 genes. Interestingly, ethanol reversed the effect of iron on hepcidin and leap-2 gene expression. This effect of ethanol was evident in both dietary and genetic iron overload models. However, further treatment with ethanol did not alter the effect of iron on leap-2 gene expression. Moreover, ethanol and iron together resulted in fatty liver, which was exacerbated with an increasing ethanol concentration. However, mice treated with alcohol or iron alone did not exhibit lipid vesicles in the liver. Collectively, these results suggest that alcohol alters the regulation of iron-responsive genes leading to abnormal iron homeostasis, which may play a role in the progression of alcoholic liver disease.
The purpose of this project was to determine whether or not health education had any sort of affect on whether or not a person becomes a long term patient with a [chiropractic] doctor. Health education is considered to be the reason to explain why people seek care, treatment, and prevention. It is the key in creating a health behavior; creating long term care. I researched 82 patients from Fox Chiropractic Center. I sought gender, age, appointment schedule, health education factors, and payment type. All of the data collected from each patient was then looked at and compared using a variety of tests. These tests consisted of t-Test, One Way Analysis of Variance (ANOVA), Linear Regression, and Chi Squared. I found that the only evidence that showed significance was in a Linear Regression Test; comparing Appointment Attendance percent and age. The P value was calculated at 0.004 and a R2 was .0984. With the numbers registering where they did, it showed that the older the individuals, the more consistent they were on following through. Also there was some correlation with very young patience, probably due to parents keeping track of schedules. In order for this project to have been more successful, more time and more patients to contribute are in order.
Saccharomyces cerevisiae is a species that is ideal for research. It is easy to obtain, grow and manipulate. The relatively fast life cycle makes it the optimal choice for inducing mutations. Benzo(a)pyrene is a polycyclic aromatic hydrocarbon. It has been labeled a cancer causing agent. The effects depend on dose, duration, pathway, other chemical exposure and individual characteristics. BaP is of special concern because contact with it is virtually unavoidable. It has been found in almost all environmental media and food ingested by humans and animals. A mutation that results from the exposure of a cell to exogenous DNA modifiers such as chemicals or radiation is termed an induced mutation. The objective for this experiment was to induce and observe mutations within the yeast genome. The yeast was grown and BaP was added to the experimental group. The diluted broths were plated on a plate containing a nutrient broth. After an incubation period, DNA was extracted from the colonies. The DNA was cut with restriction enzymes and the amplified with PCR. Then electrophoresis was run. Due to problem in the electrophoresis procedure, there were no results. The anticipated results were that there would be changes in the size of the DNA fragments in the gel. Had there been results, the rate of mutagenesis could have been found. Future studies should allow for more time to make sure that each step is successful.
Nanotechnology is one of the fastest growing fields in pharmaceutical science. In particular, the field of systematic drug delivery is one of the most promising. The goal of systematic drug delivery is to find alternative forms of cancer treatment. This has become very popular research due to the limited effectiveness of radiation and chemotherapy. The goal of systematic drug delivery is to find alternate means of getting the specific drug to the affected part of the body without the side effects on the other portions of the body it goes through. By using drugs with a specific affinity towards certain body parts, there will not be side effects on the body parts while passing through. In this study, nanoparticles (nanogels) loaded with DNA were assayed under a variety of conditions. One issue of importance is the protection these nanogels might provide to the pharmaceutical industry as it moves through the body to a specific target. DNA is used as a simple model for pharmaceuticals. Nanogel, nanogel 10%, and nanogel 15% were loaded with DNA, incubated with an endonuclease inhibitor, and assayed for their ability to protect the DNA complexed to the nanogel. Fluorescence spectroscopy, using a fluorescent indicator served as a basis for the assay. A loading ratio of 8:1 was found to be most effective and preserved near 90% of the complexed DNA with 1 hour complexation. A longer period of incubation resulted in a great loss of DNA. A 15:1 proved to be most effective to protect at the longer time.
Following the procedure for diamond synthesis, reported by J. Willard Hershey in 1929, verification of his methods were attempted in this research. A sample of soot in molten iron was generated and analyzed using Raman and Infrared spectroscopy. The soot was generated using an electric arc with carbon electrodes at 150Ampers with a DC± current for 50 minutes. The iron mixture was cooled in an ice bath followed by HCl digestion to free the iron from the mixture. Purification of the soot was done by liquid phase oxidation, air oxidation, and Soxhlet extraction. These purified and raw samples of the soot were tested and analyzed using Raman and Infrared spectroscopy. These methods of characterization showed no presence of diamond. However, the Infrared spectra showed a new product at 1090cm⁻¹, possibly representing carbon rings and ribbons. Soxhlet extraction showed an orange color, characteristic to fullerenes in solution. While this experiment showed no production of diamond, methods of characterization were established for future experiments.
Previous conclusions about the global methane budget have been proven incomplete with the discovery of large methane emissions coming from tropical rainforests during the dry season and by the findings of Frank Keppler and his colleagues, that certain plants are a source of aerobic methane production. Since methane is a greenhouse gas, these studies could have important implications for global warming. I studied methane emission from the leaf of a banana tree (Musa acuminata), a plant prevalent in the tropics, using gas chromatography with a flame-ionizing detector. Banana leaf samples were incubated in 22 mL glass vials, in the dark at 30°C. Banana leaf samples were also kept in 22 mL glass vials in the presence of 300 µmol/s•m2 light at 30°C. Methane concentrations in the vials were measured at T=0 and 24 hours. Using the paired t-test, the data from the experiments were analyzed. The results indicated that there was a statistically significant increase in aerobic methane production by the banana leaf samples incubated in the 300 µmol/s•m2 of light (P=0.00727) and not a statistically significant increase by the samples incubated in the dark (P=0.0959). The statistical significance of the samples incubated in the light improved when the mass of the leaf samples were accounted for (ng CH4/g of leaf), further justifying the results (P=0.00473). Mean (low/high) values of emission rates for the samples incubated in the light were 2.08 (-3.35/7.77) ng per g (dry weight) h-1. These values readily correlate with the emission rates found by Frank Keppler and his colleagues, which were stated as “typically ranging from 0.2 to 3 ng per g (dry weight) h-1”. My results suggest that the aerobic production of methane by plants may be more active with light. These results, along with the findings of other scientists may put more emphasis of the importance of the Kyoto Protocol and the global need to reduce greenhouse gases.
Microbial fuel cells use bacteria to produce electricity. A dual-chambered microbial fuel cell was used to harness electricity from Geobacter, with carbon fiber as the electrode. The peak current measured was 10.7 µA on the first day, and fell to zero within 5 days.

This result is comparable to a similar experiment using the carbon fiber electrode with a different bacteria, but less than typical results from Geobacter when different electrodes were used.
ABLE II was used to assess momentum generation by integrating user output force times time. Momentum generation is a new concept in measuring exercise effort, and is a better method than power output. Nine subjects were divided into one of two groups: a high-velocity group that would complete 24 repetitions per minute or low-velocity group that would complete 12 repetitions per minute. The subjects bench-pressed on ABLE II one day a week for 6 weeks, completing one set per workout session. The effort for each workout session was recorded and evaluated. The goals of this study were to evaluate the difference in momentum generation between low-velocity and high-velocity resistance training, and to provide a foundation for further studies.