Future work includes the characterization of the recommended alloys and that incorporation of this data into TCNF2®.

**Ultrasonic Testing of High Attenuation Materials with Pulse Compression Techniques.** *LISA DEIBLER (Washington State University, Pullman, WA 99164) BRIAN TUCKER (Pacific Northwest National Laboratory, Richland, WA 99352).* Homeland security and industry widely employ ultrasonic non-destructive evaluation (NDE) because of sound's ability to non-invasively characterize a variety of materials. However, the capabilities of conventional ultrasonic NDE are severely limited in many materials due to high attenuation and scattering of ultrasound. In addition, most ultrasonic techniques require contact with the specimen either by immersion or direct coupling, which can present issues for moisture-sensitive materials and/or materials in a high-speed process line. Recent advances in air-coupled transducers have enabled the efficient transmission of broadband ultrasonic (between 20 kHz and 1.5 MHz) waveforms through air, eliminating the need for specimen contact. Additionally, pulse compression, a technique commonly used in RADAR applications, provides a higher signal-to-noise ratio (SNR) for accurate measurements. Combining air-coupled transducers with pulse compression shows great promise for characterizing ultrasonically difficult materials without the need for specimen contact. Comparison of two pulse compression techniques, cross correlation (XCorr) and swept frequency multiplication (SFM), by computer simulations and experimental testing revealed a more robust and accurate response from XCorr. Using air-coupled transducers and the XCorr pulse compression method, SNRs up to 28.3 dB (increase of 26 times in signal strength) over conventional ultrasound were observed. This method was used to successfully detect a defect in a thick (10mm) carbon fiber laminate without the need for direct specimen contact. Combining advanced signal processing techniques with the capabilities of broadband electrostatic transducers is shown to be a highly promising non-contact method for characterizing difficult materials in air.

**X-ray Photoelectron Spectroscopy of GaP(1-x)N(x) Photocorroded as a Result of Hydrogen Production Through Water Electrolysis.** *MARIE MAYER (University of Illinois at Urbana Champaign, Urbana-Champaign, IL 61801) ANDERS NILSSON (Stanford Linear Accelerator Center, Stanford, CA 94025).* Photoelectrochemical (PEC) cells produce hydrogen gas through the sunlight driven electrolysis of water. By extracting hydrogen and oxygen from water and storing solar energy in the H-H bond, they offer a promising renewable energy technology. Addition of dilute amounts of nitrogen to III-V semiconductors has been shown to dramatically increase the stability of these materials for hydrogen production. In an effort to learn more about the origin of semiconductor photocorrosion in PEC cells, three samples of p-type GaP1-xNx (x = 0, 0.002, 0.02) were photocorroded and examined by X-ray Photoelectron Spectroscopy (XPS). GaPN samples were observed to be more efficient during the hydrogen production process than the pure GaP samples. Sample surfaces contained gallium oxides in the form of $Ga_2O_3$ and $Ga(OH)_3$ and phosphorus oxide ($P_2O_5$), as well as surface oxides from exposure to air. A significant shift in intensity from bulk to surface peaks dramatic nitrogen segregation to the surface during photoelectrochemical hydrogen production. Further investigations, including using a scanning electron microscope to investigate sample topography and inductively coupled plasma mass spectroscopy (ICP-MS) analysis for solution analyses, are under way to determine the mechanism for these changes.

**X-ray Reflectivity Characterization of Structural Damage Induced by $Xe^+$ Bombardment in Thin Film EUV Collector Mirror Optics.** *DOUGLAS DETERT (University of Wisconsin–Madison, Madison, WI 53711) JEAN-PAUL ALLAIN (Argonne National Laboratory, Argonne, IL 60439).* $Xe^+$ ion bombardment produced by extreme ultraviolet (EUV) plasma-based sources degrades the surface and limits the operational lifetime of single layer and multilayer thin film collector optics used in 13.5 nm wavelength EUV lithography. The objectives of this experiment are twofold: to use specular Cu Kα1 (α=1.54 Å) X-ray reflectivity (XRR) analysis to characterize and quantify the structural damage induced by $Xe^+$ bombardment in multilayer mirrors, and to predict the 13.5 nm wavelength (EUV) reflectivity performance of both single layer and multilayer mirrors using traditional 1.54 Å wavelength XRR. Si/Mo multilayer films were subjected to 1 keV $Xe^+$ fluences ranging between $10^{16}$ to $10^{16}$ $Xe^+/cm^{-2}$ at temperatures of 294 and 473 K. In addition, both EUV and Cu Kα1 wavelength XRR analyses were performed on non-irradiated Ru/Ti single layer films. A systematic comparison of XRR simulations using IMD software and measured XRR data at a wavelength of 1.54 Å reveals that while the simulations provide useful insight into the interaction of thin films and X-rays, the specific scheme used may be inadequate for obtaining accurate structural information about the irradiated mirrors or reflectivity behavior at 13.5 nm. The behavior of single layer mirror reflectivity at Kα1 scales well in IMD simulations to predict the measured EUV reflectivity performance at 13.5 nm. This work is part of an ongoing study that seeks to understand the EUV reflectivity performance of thin film collector mirrors and the combined effects of damage in EUV lithography optics from energetic ion-bombardment, thermal deposition of neutral particles, and off-band radiation produced by $Xe^+$ and $Sn^+$ plasma-based light sources.

## Medical and Health Sciences

**A Noninvasive Method to Assess Left and Right Ventricular Fractional Area Change in Genetically Altered Mice.** *MEAGAN GREEN (La Salle University, Philadelphia, PA 19141) HELENE BENVENISTE (Brookhaven National Laboratory, Upton, NY 11973).* The techniques which allow a comprehensive assessment of cardiovascular performance in small animals are still limited. The development of a noninvasive cardiac MRI- based method to facilitate the analysis of both right and left ventricular function in a mouse heart is essential in a cardiac study. The use of animals with genetic modifications, which lacks the ability to produce vasointestinal peptide (VIP), and important cardiovascular regulatory factor. The use of these animals with genetic modifications allows for a more precise assessment of cardiovascular failure development. Changes in myocardial VIP concentration or with alteration of physiological responsiveness of VIP receptors have been links to the development of severe cardiovascular disorders, such as myocardial fibrosis, heart failure, cardiomyopathy and pulmonary hypertension. The goal of this study was to compare the left and right ventricle to see if they are both equally involved in the development of cardiomyopathy in VIP-deficient mice. The cardiac imagine was performed in five anesthetized animals using several different Flash_movie sequences in a 9.4T MicroMRI system. Once the images were obtained Amira Imaging software was utilized to make outlines of the left and right ventricular cavities and areas for each ventricle were obtained during different phase of the cardiac cycle. A transactional view through the midpapillary level was used for analysis. Functional ventricular assessment was performed by calculating the fractional area change (FRAC) during systole. Data showed that there was not a significant difference between the left ventricle (53.87 +/- 13.66%) and the right ventricle (52.90 +/- 15.01%) FRAC. Both sides developed significant hypertrophy of the myocardial wall. In summary, the VIP- deficient mouse, the development of cariomyopathy was shown to similarly affect both the left and right ventricular function. We were able to develop a noninvasive method for advanced characterization of cardiac function in the murine model. This will help to facilitate longitudinal study of the heart disease process. The long term goal of this study is to map the development of heart disease.

**An Examination of Perseveration in Cocaine Abusers.** *TANYA LUKASIK (Stony Brook University, Stony Brook, NY 11794) RITA GOLDSTEIN, PH.D. & PATRICIA WOICIK, PH.D. (Brookhaven National Laboratory, Upton, NY 11973).* Drug addiction is associated with executive deficits that are typically attributed to dysfunction in prefrontal brain regions (e.g., the ventromedial region of the orbitofrontal cortex and dorsolateral prefrontal cortex). Cocaine-addicted individuals exhibit mild performance deficits on neuropsychological tasks that require set shifting, instead, perseverating on previously rewarded behavior. However, the research reported is inconclusive possibly due to the heterogeneity among cocaine-abusing populations. In the current study, cocaine abusers were compared to healthy control subjects on the Wisconsin Card Sorting Task, (WCST); a classical neuropsychological task that assesses concept formation, cognitive flexibility and set shifting. Cocaine abusers were grouped according to their ability to complete all categories on the WCST (high functioning versus low functioning). Compared to higher functioning cocaine subjects, lower functioning cocaine abusers were associated with more positive urine screens. Lower functioning cocaine subjects also scored lower on indices of general intelligence and traditional indices (total scores) of the WCST as compared to higher functioning cocaine subjects and controls. In contrast, higher functioning cocaine abusers scored similarly to controls on total scores of the WCST, however, an examination of performances at the category level suggests a different pattern of learning, specifically a tendency to perseverate in the first sequence of the task. Results suggest two patterns of executive dysfunction in cocaine abusers; one associated with lower functioning cocaine abusers that is more severe and possibly related to acute withdrawal (recent cocaine use) and another associated with higher functioning cocaine abusers characterized by mild perseverative deficits.

**Analysis of Sharps Safety Procedures and Injury Prevention Methods at Lawrence Livermore National Laboratory.** *NICOLE SADLER (University of California–Davis, CA 95616) LESLIE HOFHERR (Lawrence Livermore National Laboratory, Livermore, CA 94550).* Today's hazardous world demands safe work practices. An employee's risk of injury and infection increases significantly when he handles sharps. To assess sharps use and compliance with correct safety controls and practices, the author generated a survey form. This form was based on current safety standards and used to conduct face-to-face interviews of Lawrence Livermore National Laboratory (LLNL) personnel who were using biological materials and sharps in research projects. At LLNL, current safety standards are summarized in what is known as the Environmental Safety and Health (ES&H) Manual. Close scrutinization of the ES&H manual confirmed consistency with the current sharps use standards. The Occupational Safety & Health Administration (OSHA) Bloodborne Pathogens Standard mandates that employers maintain a sharps injury log. The survey was designed to determine if any discrepancies between the number of sharps injuries sustained and those reported existed. However, the LLNL sharps injury log was not currently available but will be available in the future, and therefore such comparisons were not performed as part of this analysis. Twenty percent of the facilities using sharps at LLNL were evaluated. During the assessments, almost sixty percent of the labs had an observable sharps safety hazard. These safety breaches fell into one of the following three categories: improper recapping technique, presence of an exposed or improperly discarded sharp, or overfilled sharps container. Nearly twenty percent of the individuals interviewed either had injured himself with a sharp or knew of someone affiliated with his particular lab that had been injured. Seventy-five percent of the reported injuries occurred in a BSL-2 lab. Most researchers at LLNL use scalpels and needles. Half of the researchers reuse their sharps, a practice that should be avoided. The statistical results of the surveys alerted safety personnel to the need for sharps training and further evaluation of sharps use at LLNL.

**Analyzing Intensive Care Unit (ICU) and Emergency Room (ER) Unit Records.** *LAKEISHA MELTON (Texas Southern University, Houston, TX 77004) JONATHAN YOUNG (Pacific Northwest National Laboratory, Richland, WA 99352).* By analyzing Intensive Care Unit (ICU) incident reports and Emergency Room (ER) Unit medical records using data analysis, data mining, and cluster analysis, a statistical representation and a data visualization of the analyzed data can support the discovery of complex and unanticipated relationships extant in the data. The primary focus of this project is to identify potential weaknesses and systematic problems throughout the datasets of patient medical records and potential unanticipated process behavior in order to potentially sustain improvements in the reduction of patient medical errors and the enhancement of healthcare facility performance. A tool called IN-SPIRE TM, is used to explore each type of data (incident reports and medical records) individually and thoroughly to find the complex relationships in the records. The analysis tools were also used to analyze clusters of records, categorize and group those records in order to potentially produce data visualizations and statistical representations of the analyzed data.

**Detection of Cocaine-Induced Cerebral Hemodynamic and Neuronal Function Changes in vivo Using Laser Doppler Flowmetry.** *MELISSA TULLY (Stony Brook University, Stony Brook, NY 11794) CONGWU DU (Brookhaven National Laboratory, Upton, NY 11973)*. Cocaine abuse increases the risk of life-threatening neurological complications such as stroke, seizures and transient ischemic attacks. Further, chronic intake leads to long lasting cognitive and behavioral changes. Cocaine has vasoconstrictive properties and also decreases the cerebral metabolism. However, the exact pathophysiological mechanisms underlying cocaine's neurotoxic effects remains incompletely understood. In this study, Laser-Doppler flowmetry (LDF) was used to characterize the effects of cocaine on the cerebral blood flow (CBF) in the rat brains in vivo and compare these changes with CBF changes elicited in the same animal in response to forepaw electrical stimulation before and after the acute cocaine challenge. The rats were anesthetized, intubated, mechanically ventilated, and catheterized to monitor the physiological parameters. The rats were then positioned in a stereotaxic frame and a craniotomy was preformed above the left somatosensory cortex. The LDF probe was then mounted upon the exposed brain surface in the somatosensory cortex area, and the changes in the local cerebral blood flow (LCBF) along with the changes in the red blood cell concentration and speed were recorded using the LDF. Electrical stimulations were then administered to the right forepaw subcutaneously to induce a neuronal activation in the left somatosensory cortex with the various stimulation frequencies (1, 2, 3, 5 & 8 Hz). Cocaine (1mg/kg) was then injected via the venous catheter and the series of stimulations was repeated 5 minutes after the injection until a neuronal response was obtained and LCBF was continually recorded during the experiment. Our preliminary results indicate that cocaine has different effects on the amplitude of response to forepaw electrical stimulation depending upon the stimulation frequency. There was a 25% increase in CBF immediately following the cocaine administration. The mean arterial blood pressure (MABP) also increased to 115 mm Hg from a baseline of approximately 95 mm Hg. The CBF as well as the MABP increase induced by cocaine were transient and recovered to baseline 5 minutes and 8 minutes, respectively after cocaine. However, a neurological response was not obtained until 40 min after the injection. After this time had elapsed, cocaine did not appear to affect the neuronal response at a stimulation frequency of 3 Hz. The present results elucidate the time course of cocaine's acute cerebrovascular and neurological effects and provide a better understanding of the etiology of cocaine-related stroke and transient ischemic attacks.

**Developmental Assesment of the D4 Receptor Mice: Part I — Locomotor Activity.** *NATALIA LONDONO (Stony Brook University, Stony Brook, NY 11794) DR. PANAYOTIS, PETER K. THANOS (Brookhaven National Laboratory, Upton, NY 11973).* Dopamine, a neurotransmitter that regulates cognition, movement, pleasure, and motivation, is related to the physiological and behavioral changes that are important aspects of aging, such as the loss of independence because of the deterioration of motor functions. This study investigated the relationship between locomotor activity and development in dopamine D4 receptors mice that were either single or group housed. Wild-type, Heterozygous, and Knockout D4 mice were used for this experiment (from age 10–100 weeks). Group housed mice were provided with an enrichment environment and single housed were in standard conditions. Their locomotor activity was recorded weekly. While the results are still in progress, the study will examine the change (if any) in locomotor activity across D4 genotype and in single versus group housed mice. These results will also examine the interaction of the D4 genotype with environment and locomotor activity. Future experiments will compare these findings in other dopamine receptors in mice.

**Effect of Inhibitors on bFGF Signal Transduction Pathways in Human Endothelial Cells.** *AMANDA VREELAND (State University of New York at Stony Brook, Stony Brook, NY 11794) LOUIS A. PENA (Brookhaven National Laboratory, Upton, NY 11973).* Ionizing radiation, such as that used in radiation therapy, causes cells to undergo apoptosis or programmed cell death. Basic Fibroblast Growth Factor (bFGF) has been shown to inhibit irradiated cells from undergoing apoptosis. bFGF promotes cell growth through several signal transduction cascades: Mitogen Activated Protein Kinase/ Extracellular-Signal Regulated Kinase (MAPK/ERK), Protein Kinase C (PKC), and Protein Kinase B (AKT/PKB) pathways. Conversely, the p38 MAPK pathway, which signals for a cell to undergo apoptosis, is activated when cells are placed under stressful conditions such as those experienced after a dose of ionizing radiation. When bFGF is added to Human Umbilical Vein Endothelial Cells (HUVEC), the level of radiation-induced apoptosis is reduced. If inhibitors of these signaling pathways are added, they will block the protective bFGF effect and restore the high levels of radiation-induced apoptosis. However, before these experiments can be performed, the effective dose range of the inhibitors and bFGF in HUVECs must be established. To determine this, we employed a reliable bioassay in a convenient format: cell proliferation measured by XTT cleavage in a 96-well plate. Cells are seeded and changed to low serum medium. The AKT/PKB pathway can be blocked with LY294002 hydrochloride which inhibits the activity of Phosphatidylinositol 3-Kinase (PI3K). The PKC pathway can be inhibited with U73122, which blocks the activation of phospholipase C-gamma (PLCα). SB202190 inhibits the alpha and beta isoforms of p38 and induces apoptosis. bFGF is effective in the range of 5-10 ng/mL for this cell type. The IC50 for LY294002, U73122, and SB202190 are 3.3 μM, 1.0 μM and 33.0 μM, respectively. The goal of this study was to optimize the dose of inhibitors that may block the proliferative and protective effects of bFGF in HUVECs. The results of this study are being used in ongoing radiation induced apoptosis assays, where the effects of inhibitors to bFGF radioprotection are being quantified.

**Efficacy of Sub-Chronic Low-Dose S-gamma-vinyl GABA (GVG) in Inhibiting Methamphetamine-Induced Increases In [18F]Fluoro-Deoxyglucose Uptake.** *JESSICA PAI (New York University, New York, NY 10003) STEPHEN DEWEY (Brookhaven National Laboratory, Upton, NY 11973).* In previous studies, gamma-vinyl-GABA (GVG, vigabatrin) has been shown to effectively inhibit methamphetamine-

induced increases in nucleus accumbens dopamine, demonstrating that GVG could serve as a potential treatment for methamphetamine (METH) addiction. In this study, the effect of sub-chronic low-dose S-GVG was examined to determine if a sub-chronic treatment schedule could successfully reduce [18F]fluoro-deoxyglucose (18FDG) uptake in brain regions where elevated metabolic activity is due to METH administration. Male Sprague-Dawley rats (n=10) received a static scan following a 45 minute awake 18FDG uptake using an R4 microPET imaging (Concorde Microsystems). Animals received a baseline scan (scan 1; mean weight = 136.6 ± 10.8g) and then after two days (scan 2) following an acute METH challenge (1 mg/kg). Over the course of the next 11 days, rats received METH and/or saline (5 pairings) intraperitoneally (I.P.) on alternate days. Animals (206.5 ± 17.9g) were again imaged (scan 3) following a METH challenge. Next, a sub-chronic low-dose GVG (75 mg/kg) schedule was administered I.P. for five consecutive days, then animals (238.6 ± 20.2g) received their final scan (scan 4) following a METH challenge. Results show global increases (18.9 ± 2.7%) in 18FDG uptake in specific brain regions of the brain previously demonstrated to respond to an acute METH challenge. Following the sub-chronic METH administration, increases in 18FDG uptake appeared to be regionally specific, with the greatest increase in the primary motor cortex (5.6%) and decreases occurring in the thalamus (7.9%) and cerebellum (6.4%). Images obtained following the 5-day S-GVG treatment showed global decreases (13.2 ± 4.3%) in 18FDG uptake in specific brain regions. These results indicate that sub-chronic low dose S-GVG effectively inhibits METH-induced increases in 18FDG uptake as seen by the hypometabolism in brain regions activated by METH administration. These findings support the potential use of S-GVG for the treatment of METH addiction.

***Functional Somatosensory Activation in Control and Wild Rats.** *JOEL URENA (State University of New York at Buffalo, Buffalo, NY 14260) HELENE BENVENISTE (Brookhaven National Laboratory, Upton, NY 11973).* For the past decade, scientists have studied rodent somatosensory (SS) function and have been able to localize external physical stimuli, such as electrical stimulation, to specific regions of the brain, particularly the SS cortex. One method of measuring SS activation is by using Blood-Oxygen-Level-Dependent (BOLD) functional Magnetic Resonance Imaging (fMRI). Neural activation corresponding to electrical stimulation results in a significant change in blood perfusion levels that can be measured via BOLD fMRI. The aim of this study is to measure and compare SS cortex activation elicited by forepaw and hind paw electrical stimulation between wild and laboratory Norway rats via BOLD fMRI. Because the common wild rat found in the North American region is of the Norway strain, SS activation in laboratory-housed Norway rats will be investigated to allow for comparison. It is hypothesized that SS activation in wild rats will be smaller and sharper because wild rats have to adapt to various environments, avoid predators and search for their own food. The rats were first anesthetized with isoflurane followed by a continuous IV infusion of a-chloralose. Electrodes were inserted in both forepaws and the left hind paw. One paw was stimulated at a time with the following paradigm: 69 seconds of rest, 30 seconds of stimulation, and 90 seconds of rest while MR images were acquired. Data was analyzed using the software STIMULATE. A Student's t-test was used to construct statistical activation maps. The average increase in BOLD signal corresponding to left forepaw stimulation among six control rats was 4.7%. The average increase in BOLD signal corresponding to right forepaw stimulation among five control rats was 5.6%. Recent attempts have been made to capture wild rats. However, the attempts were unsuccessful due to the small wild rat population on the Brookhaven National Laboratory campus. Plans will be made to capture wild rats off-campus.

**Imaging Nanoparticles in Living Systems.** *JOSEPH CARRION (The City College of New York, New York, NY 10034) WYNNE SCHIFFER (Brookhaven National Laboratory, Upton, NY 11973).* Nanotechnology and Quantum Dots in particular hold much promise for biomedical engineering since, by virtue of their size, nanomaterials can permeate many of the body's natural barriers. It is not, however, known how these nanometer-sized particles will disperse within living systems, nor has it been established what physiochemical properties such as size, surface modification, and core material will alter this in-vivo dispersion. In this study we use in-vivo imaging to look at the effects of [$^{11}$C] Cadmium Selenide/Zinc Sulfur (CdSe/ZnS) and [$^{11}$C] Gold nanoparticles (Au). Ten Swiss-Webster (SW) mice were injected with an intravenous bolus of thiol conjugated [$^{11}$C] Cadmium Selenide/Zinc Sulfur quantum dots (QDs) at two concentrations, both coated and uncoated with the surfactant Tween 80. Five of these mice were sacrificed immediately, and five were sacrificed after 6 weeks as part of the comprehensive imaging studies. All mice organs harvested were placed in a 4% Formaldehyde/1% glutaraldehyde in phosphate buffer with 5% Sucrose added for Transmission Electron Microscopy visualization. The kidney and liver of the mice were cryosectioned and nanoparticle distribution at a light microscope level was visualized using the fluorescent properties of QDs to estimate accumulation. There appears to be a concentration dependent distribution in the mouse kidney and liver: animals injected with smaller concentration of QDs show less fluorescence at 470nm in kidney compared to animals receiving higher concentrations. High Performance Liquid Chromatography (HPLC, computer automated BAS System) with electrochemical detection was used to estimate concentration of CdSe/ZnS nanoparticles of 2 nanometer and 10 nanometer sizes. These studies used in-vivo imaging together with light microscopy to explore the effect of variations in size and surfactant coating on the dispersion of these particles in living systems. Image-guided localization with Micro-PET allows the modeling of distribution of [$^{11}$C] CdSe/ZnS nanoparticles of 2nm and 10nm size in a living system.

**Parallel Changes in Behavior and Neurochemistry Resulting From Surgical Implantation into the Brains of Rats.** *DAVID FRUMBERG (Cornell University, Ithaca, NY 14853) WYNNE SCHIFFER (Brookhaven National Laboratory, Upton, NY 11973).* Surgical implants into the brain can cause long-term behavioral and functional deficits in vivo. Using a routine surgical procedure, intracerebral stylets were stereotaxically inserted into the right striatum of anesthetized rats. Novel object recognition (NOR) tests were administered to subjects 3 days prior to and 3, 7, 14, and 56 days after surgery to assess intellectual performance. Metabolic imaging with 18F-fluorodeoxyglucose (18FDG) occurred 28 and 57 days after surgery. Behavioral deficits significantly appear 3 days post-injury, where performance has decreased by 17.3%; performance decreased by 24.3% after 7 days, 38.0% after 14 days, and 41.7% after 56 days. Subjects that did not receive implants devoted a mean of 57.1% of their investigation time with the novel object, while the mean for subjects that received implants was 50.2%. This observation suggests that animals with implants failed to recognize the familiar object as such. Normalized PET analyses demonstrated a significant decrease in glucose uptake after surgery in the entire hemisphere ipsilateral to the implant relative to the contralateral hemisphere. Greatest metabolic deficits occurred in the motor cortex (-16.4%; p=.0005), sensory cortex (-10.3%; p=.009), dorsal striatum (-13.7%; p=.007), and thalamus (-9.2%; p=.006) of the side of implantation compared to the intact side. Metabolic deficits in the motor cortex significantly correlated with a decline in general locomotion observed three days following the surgical implant ($R^2$=0.63). No metabolic recovery was observed over the two-month period. These results imply that the window for treatment of open head injury in humans is much shorter than previously believed.

**Rehabilitation and Implementation of Scintimammography Gamma Camera Integrated into a Stereotactic Core Biopsy Digital X-ray System.** *CLARISSA FREEMAN (Hampton University, Hampton, VA 23606) STAN MAJEWSKI (Thomas Jefferson National Accelerator Facility, Newport News, VA 23606).* Biopsies are used to accurately confirm the presence of breast cancer when suspicious lesions are found. A biopsy is a small sampling of tissue that can be tested to determine whether there is malignancy. Approximately three out of every four women still have unnecessary biopsies. A scintimmamography gamma camera integrated into a stereotactic core biopsy digital x-ray system may be used to reduce unnecessary biopsies. The scintimmamography gamma camera is a custom-built mini gamma camera with an active area of 5.3 cm by 5.3 cm. It is based upon a 2 by 2 array of position-sensitive photomultiplier tubes made by Hamamatsu. The system obtains dynamic scintimammographic data by performing dynamic radiopharmaceutical uptake studies; these images can confirm or negate the need for a biopsy, leading to fewer unnecessary procedures. The objective of the project was to remove the system out of its clinical setting for repair and calibration. It has a primary detector head for most clinical settings, as well as a second detector to be used as an auxiliary. A new crystal map was created for the system, detector head energies were calibrated, and corrected images were taken. In addition, electrical components were replaced and appropriately labeled. For optimal stability, calibrations were performed using Kmax Sparrows NT development package. A dynamic energy range for detector head one was found to be 540 volts, and the second detector range was found to be 580 volts. The system was tested once all repairs were complete and calibrations were finalized. In the coming months, the system will be put into a clinical environment so that its performance can be tested against traditional detector systems.

**The Efficacy of the National Ignitions Facility's Ergonomic Program.** *NAOMI SHAH (University of California–San Diego, La Jolla, CA 92092) STEVEN MCCONNELL (Lawrence Livermore National Laboratory, Livermore, CA 94550).* Ergonomic injuries have become an increasing concern for office workers and their employers due to the rise in computer-based work. These injuries, as with all chronic injuries, are most prevalent in the older members of the work force due to a longer exposure to chronic insults to their bodies. In 2005, over half of the recorded illness/injury cases at the National Ignitions Facility (NIF) at Lawrence Livermore National Laboratory (LLNL) were ergonomic cases. In order to reduce the number of such cases and their associated costs, NIF has implemented an ergonomic program in which the goal is to evaluate their 1,200 employees. The current process of creating a list of employees who need an evaluation, making an appointment with the employees, performing the evaluation, and following up afterwards proved to have some problems which inhibit efficiency. To enhance the process of forming a list of employees for evaluations, a new database has been developed and is being tested. This allows the evaluator to receive daily updated lists. In order to easily set up appointments and yield a larger response rate, it was found that a Meeting Maker proposal followed by an Email works the best. The evaluator uses the NIF Comfort Survey to help asses the employee's work space; this survey proves to be sufficient in identifying the needs of the employee. Overall, the ergonomic program has made a good start in preventing further ergonomic injuries, and with implementation of the new recommendations, will prove to be an efficacious program.

***Tolerance of Rat's Spinal Cord to Dose-Fractionated Irradiation with Arrays of Parallel X-ray Microbeams.** *SASHEEN FERGUSON (Stony Brook University, Stony Brook, NY 11794) AVRAHAM DILMANIAN (Brookhaven National Laboratory, Upton, NY 11973).* It has been shown that single-exposure to arrays of parallel, synchrotron-generated x-ray microbeams is well tolerated by normal tissues in laboratory animals at doses up to several hundred Gy. The tissues studied include the brain and spinal cord of the rats. We examined such a tolerance to dose-fractionated irradiations with microbeam arrays. Rats were irradiated daily for four days with microbeam arrays made of 27-μm beams spaced 200 μm on-center. The daily in-beam incident dose was 400 Gy. The angles of the irradiations were 45° apart from each other. The animals were monitored by weighing and the behavioral test of "Open Field" to evaluate any potential loss of sensorimotor performance, and the results were compared to those in unirradiated controls. As of 15 days after the last irradiation the rats are gaining weight and performing normally in the Open Field test. They will be kept for one year. Afterwards these animals will be euthanized for histology.

## Nuclear Sciences

**Analysis of the Infrastructure That Will Support a Transition to a Hydrogen.** *TROY MITCHELL (Roane State Community College, Harriaman, TN 37748) JUAN FERRADA (Oak Ridge National Laboratory, Oak Ridge, TN 37831).* The transition to a hydrogen economy is assumed to begin in 2020 with a total of 2.5 million hydrogen cars in seven cities including: Atlanta, Miami, San Francisco, Detroit, Houston, Chicago, and Los Angeles. Factors that affect the transition to a hydrogen economy are production, delivery, storage, and dispensing the hydrogen. Using data from the Department of Energy's Hydrogen Analysis (H2A) models, FLOW©, a simulation program developed at Oak Ridge National Laboratory, can simulate the entire hydrogen economy for each one of the cities used in the analysis. Sensitivity and uncertainty analysis are applied to determine the affects of fluctuating feedstock prices and demand for hydrogen. According to the results of the H2A models, trucking of gaseous hydrogen was not a practical method of delivery. During this research it was found that Python™ is a user friendly object-oriented programming language. In terms of unit cost, natural gas reforming was found to be an effective production method at lower demands for hydrogen, and coal gasification was found to be more effective with higher demands of hydrogen. Steam methane reforming is an effective method of production and distribution, in terms of unit cost. Piping is an effective method to distribute hydrogen at low demands. Trucking is more cost effective when hydrogen demand is higher. Results of the analysis will be used to provide recommendations for the required infrastructure that will provide a better transition to a hydrogen economy from the current fossil fuel economy.

**Candidates for New Transitions in $^{254}$No.** *DAVID GRAYSON (University of Illinois at Urbana Champaign, Urbana, IL 61801) TENG LEK KHOO (Argonne National Laboratory, Argonne, IL 60439).* Several candidates for transitions in $^{254}$No have been observed in an experiment performed at Argonne National Laboratory. The reaction $^{208}$Pb($^{48}$Ca,2n)$^{254}$No was used at beam energies of 219 and 223 MeV. In this report, gamma-gamma matrices were examined to find candidates that were coincident with previously known transitions in the ground state band of $^{254}$No. The candidates found were only evident at 223 MeV, which suggests that they come from parent states with high energies that are not populated at the lower 219 MeV beam energy. The strongest candidate was 469 keV. If this transition feeds in to the top of the previously observed ground state band, then it breaks the pattern of transition energies, which implies a change in structure at that energy. This would have implications for the width of a specific neutron "magic gap", and would help test theories of nuclear structure.

**Development of a Beam Profile Diagnostics Device for the VENUS ECR Ion Source Beam Line.** *CARY PINT (University of Northern Iowa, Cedar Falls, IA 50614) DANIELA LEITNER (Lawrence Berkeley National Laboratory, Berkeley, CA 94720).* This work describes the design and development of the instrumentation for a beam profile diagnostics unit for the low energy beam transport line of the superconducting Electron Cyclotron Resonance (ECR) ion source VENUS (Versatile ECR ion source for Nuclear Science). VENUS is currently being commissioned at LBNL and serves as the prototype ECR injector source for next generation heavy ion accelerators. In order to enhance simulations of beam transport from extraction in VENUS, a measurement device (called a harp) consisting of a grid of thin conducting wires is placed into the beam line, directly downstream from extraction, to measure the beam profile. Utilizing the diagnostics unit developed and described in this work, the first measurements of the beam profile for a simple helium beam are presented. By changing the Glaser current to focus the ion beam onto the harp, the helium beam profiles illustrate that the extracted beam has the same symmetry as the plasma surface from which they are extracted, and not the uniform circular symmetry that is assumed in most simulation models. These results give quantitative insight into the enhancement of initial conditions needed for using simulations to give a physically accurate description of beam transport from extraction of an ECR source.

**Directed Long Range Thermal Neutron Detection System.** *JEFFREY MAGEDANZ (Oregon State University, Corvallis, OR 97333) DR. RAYMOND KLANN (Argonne National Laboratory, Argonne, IL 60439).* A long range thermal neutron detection system could be useful for determining whether a suspected location contains a neutron source. At long ranges, the flux of neutrons from the source becomes small compared to the flux of background neutrons. A bundle of collimator tubes made of a neutron absorbing material could be used to minimize the effect of background neutrons by only allowing neutrons coming from the direction of the source to reach the detector. Monte Carlo N-Particle transport code (MCNP) version 4c was used to simulate a detector with such a collimator bundle in order to study its potential and optimize the design. The simulations determined the response to a moderated californium-252 source at several distances as well as the response to background neutrons. It was determined that cadmium was not an adequate shielding material while materials containing boron, particularly enriched boron, performed well. A 100 cm$^2$ detector with a collimator was found to be reasonably certain to detect a source producing 105 neutrons per second at 30 meters in less than a half hour. However, for greater distances, the time required for detection becomes large. Further research will compare the simulation results to experimental results.

**Gamma-Ray Spectroscopy of Dysprosium-152.** *JASON KOZEMCZAK (Greenville College, Greenville, IL 62246) ROBERT V. F. JANSSENS (Argonne National Laboratory, Argonne, IL 60439).* Nuclei at high excitation energy and spin go through shape deformations, which are a result of interplay between collective and single-particle effects, as they decay to their ground states. Of particular interest are the super-deformed (SD) bands in the A~150 region. In order to assign correct excitation energy, spin, and parity to these SD bands, linking transitions must be observed between the SD bands and the lower-lying normal deformed (ND) bands. $^{152}$Dy is one of only a few nuclei where these linking transitions have been observed. The GAMMASPHERE group at Argonne National Laboratory wishes to map the complete decay process of this isotope so that it can be used to develop a realistic model of this process that will give good predictions of the spins and excitation energies of SD bands where linking transitions have not been observed. To correctly model the decay, the single-particle spectra in $^{152}$Dy have been analyzed to map out the yrast line to the highest angular momentum state possible. The fusion reaction $^{108}$Pd($^{48}$Ca,4n)$^{152}$Dy with a beam energy of 191 MeV was used to populate the ND and SD bands in $^{152}$Dy, and the single-particle level scheme was constructed using triple and quadruple coincidence events.