

Book of Abstracts

Posters Presenting Research
and Educational Partnerships between
the Health Care Industry and
Consortium Institutions



Research Showcase

Wednesday, April 11, 2007

4 - 7 p.m.

Abbott Laboratories
Worcester, MA

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Showcase Theme: *“Research and Educational Partnerships in the Health Care Industry”*

Health science, health care and related industries are an increasingly vital part of the central Massachusetts economy. The population as a whole is looking for more effective diagnosis and treatment of disease; an aging baby boomer population is demanding services that will prolong active and healthy lives; novel technologies are being developed to monitor and treat patients in their own homes. Although the standard of health care is continually improving, costs have soared. Many are interested in ways to improve the efficiency of and access to health care, and more generally, to promote healthy communities.

This year’s Research Showcase focuses on the wide variety of health-related projects and research being undertaken by faculty and students from our member institutions in collaboration with leading health care industries in the area.

Featuring poster displays of ongoing faculty, student and institutional research projects and panel presentations from higher education and industry leaders, the Showcase highlights existing partnerships between higher education and health care industries. The aim is to inform the local community about recent developments and how they may have positive impact on the daily lives of our citizens. Strong potential exists for further new collaborations to form among Consortium institutions, local biotech and pharmaceutical companies, and the health service industry as a result of this event.

The Research Showcase is a project of the Chief Academic Officers Committee of the Colleges of Worcester Consortium, Inc.

Introduction

For several years, we have invited residents of and visitors to the region to “Discover the Intellectual Capital of Central Massachusetts” that is found at the member institutions of the Colleges of Worcester Consortium, Inc.

One aspect of this “intellectual capital” is the capacity of students, faculty and staff from Consortium colleges and universities to use their knowledge and experience for the betterment of the community. That capital, for example, is “invested” when students volunteer or are hired to work in public, private or third-sector organizations; when administrators serve on community boards, commissions and task forces; and when faculty employ their research and analytic skills to address community needs.

Today’s Research Showcase – summarized in this guide – illustrates how faculty and student intellectual capital is being focused on research and educational partnerships in the health care industry of central Massachusetts and especially the City of Worcester.

The purposes of the showcase and this guide are to educate about research already underway and to stimulate thinking about new opportunities patterned after current projects. It is our intention that this event and its book of abstracts inspire community interest and inter-institutional interest in more effective use of the region’s substantial intellectual capital. This event aligns with the Colleges of Worcester Consortium’s vision:

“To position Worcester and the region as a premier destination for undergraduate and graduate students as well as college and university faculty and staff.”

In coming years, we anticipate symposia and reports that will focus on other types of needs in the community. Meanwhile, we hope you will browse this book of abstracts and use the contact information provided to learn more about how the intellectual capital of our campuses can best serve our community. The contact information listed with each abstract is provided to help you get more information about a specific research project. To contact a campus about a potential research project, please use the list of chief academic officers that appears at the back of this guide.



Susan C. Wyckoff, PhD
Vice President for Academic Affairs
Colleges of Worcester Consortium, Inc.

Poster Abstracts

Biomedical (Laboratory) Research

1. Template-based fabrication of protein nanocapsules for drug delivery

Worcester Polytechnic Institute: Shelley Dougherty, PhD candidate; and Jianyu Liang, Assistant Professor

Bionanomaterials have recently begun to attract a great amount of interest and could potentially revolutionize biomedical research. In particular, nanotubular structures are a very attractive option due to the high degree of success of carbon nanotubes (CNTs) in drug delivery and gene therapy research.

The use of CNTs for biomedical applications relies upon surface fictionalization to enhance the solubility, biocompatibility, and biochemical functionality. This adds to the complexity of the fabrication considerably. In addition CNT based biomedical technologies are still under great scrutiny due to inconclusive results concerning their cytotoxicity. Despite these drawbacks, preliminary CNT studies have yielded very promising results and have led to an increased interest in fabricating nanotubes from purely biological materials such as proteins, peptides and liposomes.

In this study, glucose oxidase (GOx) nanocapsules were fabricated using an alternate immersion method. Initially nanotubes were formed within AAO templates fabricated in-house with pore diameters ranging from 20 nm to 80 nm. The fabrication process utilized binding agents to covalently immobilize GOx molecules on the inner walls of the nanopores. This immobilization process was repeated to achieve the desired wall thickness of the nanotubes. The nanotube ends were then sealed through a cleaving process which occurred during the dissolution of the template, resulting in the liberation of GOx nanocapsules. To ensure that the GOx maintained its biochemical activity throughout the fabrication process, the activity of the nanocapsules was analyzed both before and after liberation. The activity was quantified using a colorimetric method via UV-vis spectrophotometry. The length, wall thickness, and overall morphology of the nanocapsules were examined using SEM and TEM. In conclusion we were able to fabricate protein nanocapsules using a template assisted nanofabrication technique. In the future these protein nanocapsules will be investigated as potential drug and gene therapy delivery vehicles.

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2. Identification of fungal virulence factors using *C.elegans* as a model host organism

Worcester Polytechnic Institute: Charu Jain, graduate student; Reeta Prusty Rao; Sam Politz; Linsley Kelly; and Brendan O'Brien

Fungal pathogenesis is one of the biggest problems in the medical world as fungi infect humans, plants and animals and, because of its eukaryotic nature, which is similar to the host, it has been difficult to develop novel drugs to fight it. To identify the factors involved in virulence and use them as targets for novel drug development, we have come up with a host-pathogen interaction system. Several human pathogens – like *Pseudomonas*, *Salmonella* etc. – have been known to infect *C.elegans*; thus it has been used as a model organism to study the virulence factors of these pathogens. On that basis, we were able to establish an infection between *C.elegans* as host and *S.cerevisiae* as pathogen, which will allow us to screen the entire yeast genome for virulence factors because of the rapid growth and short generation time of *C.elegans*. As a result of this interaction the worms showed tail swelling or deformed anal region (Dar) phenotype. As a proof of concept we show here that mutations in *yap1*, a fungal transcription factor, fail to produce the Dar phenotype. We also show this loss of phenotype is not random by using other mutants like *pdr1*, *pdr15* involved in pleiotropic drug resistance and *osr5*, involved in osmotic stress. We have also developed a working model in which we think the worms are producing reactive oxygen species (ROS) in response to the fungal infection, and yeast has to counteract it before it is completely able to establish an infection. So we used *sod1* mutant and showed that oxidative stress is involved during virulence as the *sod1* mutant fails to induce the Dar phenotype.

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3. A remote and non-contact method for obtaining the blood-pulse waveform with a laser Doppler vibrometer

College of the Holy Cross: Candida Desjardins, student; and Dr. Edward Soares, Associate Professor

Naval Undersea Warfare Center: Dr. Lynn Antonelli

The use of lasers to remotely and non-invasively detect the blood pressure waveform of humans and animals would provide a powerful diagnostic tool. Current blood pressure measurement tools, such as a cuff, are not useful for burn and trauma victims, and animals require catheterization to acquire accurate blood pressure information. The purpose of our sensor method and apparatus invention is to remotely and non-invasively detect the blood pulse waveform of both animals and humans. This device is used to monitor an animal's or human's skin in proximity to an artery using radiation from a laser Doppler vibrometer (LDV). This system measures the velocity (or displacement) of the pulsatile motion of the skin, indicative of physiological parameters of the arterial motion in relation to the cardiac cycle. Tests have been conducted that measure surface velocity with an LDV and a signal-processing unit, with enhanced detection obtained with optional hardware including a retro-reflector dot. The blood pulse waveform is obtained by integrating the velocity signal to get surface displacement using standard signal processing techniques. Continuous recording of the blood pulse waveform yields data containing information on cardiac health and can be analyzed to identify important events in the cardiac cycle, such as heart rate, the timing of peak systole, left ventricular ejection time and aortic valve closure. Experimental results are provided that demonstrate the current capabilities of the optical, non-contact sensor for the continuous, non-contact recording of the blood pulse waveform without causing patient distress.

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4. Synthesis of estrogen receptor probes

Massachusetts College of Pharmacy and Health Sciences: Carolyn Friel, Associate Professor of Medicinal Chemistry; and Lesley Caldwell, Sheila McKeivitt, Candy Nguyen, Kathleen Nguyen and Valentine Nunyi, PharmD candidates

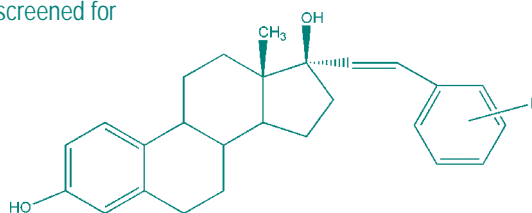
The objective of the project is to synthesize novel chemical entities to be screened for antagonist activity at the estrogen receptor.

The project will describe the 5-step chemical synthesis of novel 17 α substituted estradiols.

Reaction yields and analytical results will be presented for each of the steps.

The Suzuki reaction has successfully been used to synthesize novel chemicals with potential use for the treatment of Breast Cancer. Ongoing efforts to improve reaction yields are currently being conducted.

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5. Site-directed mutagenesis as a probe of the structure of lysyl oxidase

Clark University: Frederick T. Greenaway, Professor of Chemistry; and Karlo M. Lopez

Lysyl oxidase (LOX, EC 1.4.3.13) is a 30kDa copper-dependent quinone-containing amine oxidase that catalyses the essential step in collagen and elastin cross-linking. For this reason, LOX plays a key role in the morphogenesis and repair of connective tissues of the cardiovascular, respiratory, skeletal, skin and other systems of the body. In recent years LOX has also been implicated in a variety of cellular processes, including differentiation, development, motility and reversion of *ras*-transformed cells leading to interest in LOX as a tumor suppressant. The structure of LOX is not well established, in large part because the enzyme is difficult to produce in large amounts, and is rather insoluble. To obtain enough LOX to fully characterize this enzyme, a protocol was devised to increase the yield of LOX obtained from *E. coli* culture. The method uses glycyglycine as a chemical chaperone and yields nearly five-times the amount of LOX previously reported in the literature, albeit in the form of insoluble aggregates that must be refolded. Refolding to properly connect the ten cysteines involved in the five disulfide crosslinks is about 75% efficient and is done in the presence of copper, which allows spontaneous formation of the LTQ cofactor with recovery of activity. Using this technique for protein expression, site-directed LOX mutants were generated to investigate the role of Cu(II) in the enzyme. Since it is known that binding of copper is essential in the formation of the lysyltyrosyl quinone (LTQ) cofactor, five

histidine residues, three of which are believed to be involved in chelating copper, were mutated using site-directed mutagenesis. These mutants were tested for the presence of LTO using a redox cycling assay and also for enzymatic activity. Spectroscopic (UV-visible, fluorescence, CD, EPR) characteristics of the enzyme have been monitored as an indication of conformational variations amongst the mutants.

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6. Influence of antioxidant on melanotoxicity of 4-teriatry butylphenol (4-TBP)

Massachusetts College of Pharmacy and Health Sciences: Rangaprasad Sarangarajan, Assistant Professor of Pharmacology & Toxicology; and Christine Chaplin, Sharon Condon, William Cho and Naila Karim, Pharm D candidates; and Stephen Kerr

4-TBP is a melanocyte specific toxin, the sensitivity of which is enhanced in the presence of butylated hydroxytoluene (BHT), an antioxidant found ubiquitously in commercial preparation to enhance life-span of formulations. Although the exact mechanism of BHT-4TBP synergism is unclear, cellular antioxidant status appears to be involved. The current study focused on determining whether reduced glutathione (GSH) and its precursors influence BHT-4TBP toxicity. Immortalized melanoma cell lines were used as experimental model, cytotoxicity was measured using commercially available kits to determine rates of cell proliferation/survival. Results demonstrate that GSH and its precursors differentially regulated BHT-4TBP cytotoxicity in melanocytic cells.

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7. On the folding of islet amyloid polypeptide in water

Clark University: Noel Lazo PhD, Assistant Professor; and Darryl Aucoin, student

Pancreatic β cells secrete insulin that is needed by the body for sugar metabolism. If these cells die or lose their function, sugar levels in the blood become abnormally high, causing type 2 diabetes. A 37-residue polypeptide named islet amyloid polypeptide (IAPP) is co-secreted by the β cells with insulin. This polypeptide is highly hydrophobic and aggregates to form assemblies that are toxic to the insulin-producing cells. The formation of the toxic assemblies requires monomer folding. We hypothesize that IAPP monomer contains structured regions that facilitate the initial intra- and intermolecular contacts. To test this hypothesis, we used limited proteolysis, a powerful method for the study of conformational transitions in proteins that aggregate. Using thermolysin and elastase as enzymes, we identified a 15-residue region (Arg11-Ala25) in human IAPP which does not contain an initial cleavage site. We synthesized the corresponding peptide (RLANFLVHSSNNFGA) and then determined its structure by circular dichroism and solution-state nuclear magnetic resonance spectroscopy. Our preliminary results indicate the presence of a turn-like region in the peptide. We propose that this region facilitates the initial intramolecular and intermolecular contacts in the folding and aggregation of IAPP and, thus, could be an attractive target for the design of drugs that inhibit IAPP oligomerization.

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8. Cranberry juice as a natural defense against urinary tract infections (UTIs): Investigation of molecular mechanisms

Worcester Polytechnic Institute: Terri Camesano, Associate Professor of Chemical Engineering; Yatao Liu and Paola A. Pinzon-Arango, graduate students

Escherichia coli bacteria are predominately responsible for urinary tract infections, which affect >11.3 million women in the U.S. each year. Concerns over antimicrobial resistance necessitate that researchers find alternative therapies. The American red cranberry has long been recognized for benefits to urinary tract health. However, a detailed understanding of the underlying molecular mechanisms of this process is still lacking. We utilized atomic force microscopy (AFM), a nanotechnology-based tool, to investigate bacterial cell surface structures and directly measure the adhesion forces between bacteria and host cells. We found that cranberry juice affected the ability of *E. coli* to attach to kidney epithelial cells by compressing proteins on the bacteria, and that nanoscale adhesion forces were reduced by more than an order-of-magnitude when cranberry juice was introduced to the solution. The effective concentration, active components within cranberry juice, and the time threshold for benefits to occur were also explored.

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9. Investigating the mechanism of bacterial adhesion and viability on self-assembled monolayers: A Strategy toward prevention of implant-related infections

Worcester Polytechnic Institute: Terri Camesano, Professor; Yatao Liu, graduate student; and Joshua Strauss

Implant-related infections remain a major concern in the utilization of catheters and artificial organs. Due to biofilm formation on implanted medical devices, antibiotics cannot treat the infections. Removal of the implanted device is the only guaranteed treatment. A practical approach is to inhibit the establishment of biofilms by preventing the initial bacterial adhesion process. We focused on one of the most common and serious bacterial pathogens, *Staphylococcus epidermidis*, and selected self-assembled monolayers (SAMs) presenting a uniform layer of molecules with the same terminal group and points of orientation. The attachment and viability of bacteria on the SAMs was characterized, and the presence of serum proteins on bacterial behavior was also investigated. Atomic force microscopy (AFM) was employed to characterize substrata and bacterial surface properties and to measure the adhesion forces. The intermolecular forces between bacteria and biomaterials depend on the SAM chemistry, as well as the type of protein in the system. These results are being used to design improved antibacterial biomaterials that will minimize patient infections.

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10. The HPS mouse and biomarkers for early detection of lung fibrosis

Clark University: Lingyan Wang and Tim Lyerla, Professor of Biology

NucelaBiomarkers LLC: Pat Muraca

Hermansky-Pudlak Syndrome (HPS) is a rare, genetically heterogeneous disorder that affects lysosome related organelles, including melanosomes, platelet dense bodies, and alveolar type II cells. Some eight different types of HPS are now recognized, each with mouse mutant model, and all inherited as simple, autosomal recessive disorders. The most serious consequence for individuals inheriting the disease, especially HPS1, is progressive pulmonary fibrosis that is fatal in the 4th or 5th decade of life. The objective of this study is to assess early detection methods for diagnosis of lung fibrosis using an HPS double mutant mouse model. Previous studies have shown that this mouse model is susceptible to development of pulmonary fibrosis between 1 and 2 years of age when raised in an open colony. The animals are highly sensitive to bleomycin, which induces lung fibrosis in those that survive a single, low dose intratracheal instillation. Also, they have increasingly higher levels of hydroxyproline in their lungs during aging, indicative of a propensity for development of pulmonary fibrosis with advancing age. Importantly for the objective of this project, these double mutant mice possess highly activated alveolar macrophages that develop post-natally within the first month, and have high levels of TGF- β 1 within 3 months of age. As both of these characteristics are indicative of lung inflammation, which often precedes the development of pulmonary fibrosis, it is concluded this model will be useful for examining other possible biomarkers for early detection of lung fibrosis.

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Prevention, Treatment and Health Care Delivery

11. Understanding respiratory diseases: Improving therapy

Massachusetts College of Pharmacy & Health Sciences -Worcester/Manchester: Alice Gardner PhD, Assistant Professor of Pharmacology/Toxicology

The intention of this project was to develop a research partnership between a pharmaceutical company and a local academic institution to understand the mechanisms by which newly designed drugs used to treat chronic respiratory conditions function with an aim to improving therapy.

Asthma is an inflammatory disease associated with bronchospasm. The occurrence of this condition is high in the Western world. In the U.S. it is the third highest cause of hospitalization in children under 18 years of age (Eder; 2006). Presently asthma can only be treated and controlled with medications that prevent bronchospasm and decrease lung inflammation. Some of the current medications used to treat asthma are bronchodilators known as β_2 -agonists. These drugs are formulated as racemic mixtures. There is evidence to suggest that racemic β_2 -agonists promote adverse effects with longterm therapy.

Studies with single-isomer β_2 -agonists have suggested they can cause bronchospasm and inflammatory effects and thus worsen symptom control. A research partnership has been initiated to study the mechanisms by which single-isomer β_2 -agonists signal inside human lung smooth muscle with an aim to improving therapy.

In the present study, the effect of single-isomer β_2 -agonists on the release of the signaling molecule, cAMP, was tested in cultured human smooth muscle cells (HASM). cAMP is the second messenger responsible for preventing bronchospasm in human bronchial smooth muscle. To determine the acute and chronic effects of single-isomer β_2 -agonists on intracellular signaling cAMP levels were measured over a 24-hour period.

Single-isomer β_2 -agonists were each shown to have differential effects on cAMP levels both acutely and chronically inside human bronchial smooth muscle.

These data suggest that initiation of the pro-bronchospasmodic signaling mechanisms by specific, single-isomer β_2 -agonists may be a potential mechanism leading to exacerbation of asthma conditions upon continued exposure to this drug.

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12. Health care delivery process improvements and EHR implementation: A pilot study

Worcester Polytechnic Institute: Sharon Johnson, Associate Professor/Operations and Industrial Engineering, Department of Management; Isa Bar-On; Professor Diane M. Strong; Lori Pelletier, graduate student; and Research Assistant Shilpi Mittal

Fallon Clinic: Lawrence Garber MD and Srinivas Emani

The use of Electronic Health Records (EHR) holds the promise of delivering improved quality of care, reducing errors, eliminating costly chart pulls and transcription, streamlining workflows, and increasing productivity. Because health care delivery is complex and rife with variation, achieving these benefits requires a detailed understanding of the processes of delivering care, the factors that influence quality, and how these might be affected by EHR – issues that are not well understood now.

In collaboration with Fallon Clinic researchers, a team of researchers from Worcester Polytechnic Institute (WPI), from both management and engineering disciplines, is carrying out a year-long pilot project at the Fallon Clinic to examine the effects of the EHR system on the care delivery process. The team will study process and productivity changes and their implications on service quality and physician/staff and patient satisfaction at selected Fallon Clinic locations, resulting from the implementation of the EpicCare EHR in examination rooms. Prior to implementation of the full EHR in Spring 2007, the team will interview physicians and staff to establish a baseline for describing care delivery processes. After implementation, the team will conduct a second set of interviews to understand the immediate effects of implementation on the process of health care delivery and any resulting changes in productivity, satisfaction and quality measures. After several months, a third set of interviews will be conducted to understand and document the differences between the immediate post-implementation effects and the longitudinal effects of EHR implementation. This project will assist Fallon Clinic in understanding the effect of the Epic EHR and to identify areas that require improvements.

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13. Functional effects of a modified constraint-induced movement therapy intervention with chronic stroke

Worcester State College: Jacqueline Brennan PT, MA, MS, OTR/L, Assistant Professor

Rehabilitation Hospital of Rhode Island, Brown Medical School and Roger Williams Medical Center: Stephen T. Mernoff MD

The project objective is to determine if a research model for Constraint-Induced Therapy could be modified for a “typical” clinical setting and still deliver positive/significant outcomes. Subjects are randomized into intervention and delayed-intervention groups and receive direct activity-related programming 2 times/week for 4 weeks in sessions lasting 1 hour (typical outpatient protocol). Subjects are also expected to wear a protective hand mitt for 5 hours daily. Subjects receive intervention which utilizes coaching, shaping and positive reinforcement for use of the involved hand while the stronger hand is restrained by the mitt. Subjects are evaluated pre-intervention, at 4 weeks and 3 months following initial evaluation. Preliminary quantitative results reveal the following trends: subjects demonstrate increased speed in response to subtests of manipulation but no change in quality of movement in these same subtests compared to the ‘control/delayed intervention’ group. In additional testing, subjects are able to achieve higher levels of dexterity (grip, pinch) than pre-intervention. Subjects report an increase in the amount of time they use

the involved limb during activities of daily living in the home (as compared to during intervention sessions), but standardized testing reveals an increase in only low-demand leisure with no significant change in instrumental ADLs, high-demand leisure or social activities. Qualitative findings confirm that although subjects are pleased with all aspects of the study, it is very difficult to maintain use of the mitt outside the intervention sessions and eventually it/the mitt is either discarded or used less than the required 5 hours daily. Recruitment of subjects continues as the study is ongoing at time of presentation.

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14. Fondaparinux vs. enoxaparin; Eligibility and potential role at a teaching hospital

Massachusetts College of Pharmacy and Health Sciences-Worcester/Manchester: Lenore Tominna PharmD, Drug Information Fellow; Abir O. Kanaan PharmD; Linda M. Spooner PharmD, BCPS; Karyn M. Sullivan BS Pharm, MPH; and Sheila M. Seed BS Pharm, MPH

Saint Vincent Hospital-Worcester Medical Center: George Abraham MD, MPH, FACP

Fondaparinux is indicated for treatment of venous thromboembolism (VTE) and prophylaxis of VTE in orthopedic patients. Although clinical trials have expanded the use of fondaparinux to medically ill and cardiac patients, physicians are reluctant to add it to hospital formularies due to renal function, patient weight, and cost concerns. Since the financial component can be bypassed with discounts, we evaluated eligibility for fondaparinux therapy based on individual clinical parameters for treatment and prophylaxis of VTE, and treatment during percutaneous intervention for unstable angina and non Q-wave myocardial infarction. We hypothesized that >80% of patients prescribed enoxaparin are eligible for fondaparinux therapy and that the above concerns may be exaggerated.

Retrospective chart reviews were conducted in 100 patients at a teaching hospital to evaluate eligibility of fondaparinux therapy in patients prescribed enoxaparin during study period April 2005 through March 2006. Eligibility criteria for fondaparinux therapy were based on renal function, weight, platelet count and presence of bacterial endocarditis. Patients were considered eligible for fondaparinux if age ≥ 18 years, creatinine (Scr) < 2 , or CrCl > 30 ml/min, weight > 50 kg, and platelet count $> 50,000/\mu\text{L}$. Patients were excluded if bacterial endocarditis was suspected or diagnosed, or if the admission was due to Q-wave myocardial infarction.

One hundred fifty charts were reviewed and 100 patients were included. Sixty-three patients were eligible for fondaparinux therapy. Twenty-eight patients did not meet eligibility criteria due to CrCl < 30 ml/min or Scr > 2.5 , presence of bacterial endocarditis, weight < 50 kg, or no recorded weight or Scr. Furthermore, nine patients were not eligible as enoxaparin as given as a bridging therapy for atrial fibrillation.

Eligibility for fondaparinux therapy can be increased to 73% with proper documentation of weight and Scr, making fondaparinux a viable option to add to hospital formularies.

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Disabilities, Assistive and Protective Technology

15. Difference vs. disorder? Language acquisition in international adoptees

Worcester State College: Dr. Susanna Meyer, Communication Sciences and Disorders Departments; and Linda Larrivee

Worcester Public Schools: Suzanna Resendes, Speech-Language Pathologist

Lowell Public Schools: Bethany Vinal, Speech-Language Pathologist

Can the age at time of adoption and/or length of immersion in English provide evidence of a language difference versus a language disorder?

We examined the phonological and morphological development of a child adopted at 14 months of age after 35 months of English immersion. The subject was 48 months. Her MLU was 3.8 (expected + 4.0 - 4.99), she was in Brown's Stage V (expected Late V), and her PCC was 89% (normal development). In addition, an articulation test and a phonological analysis

revealed the presence of some age appropriate substitutions and phonological processes. She showed adequate English phonological development. However, because she was slightly delayed in morphological development, speech-language pathology services were recommended.

To further examine the question of age at time of adoption and length of English immersion, we examined Subject 2. After 35 months of English immersion, Subject 2 was 81 months of age. His MLU was 4.34 (expected post 5.99), he was in Brown's Stage V (expected post V++), and his PCC was 72% (mild to moderate disorder). In addition, an articulation test and phonological analyses revealed many errors and numerous non-age appropriate phonological processes. He was not showing adequate English morphological or phonological development.

Internationally adopted children's ability to learn a second language may depend on age at the time of adoption. Second, length of exposure to the first language may have an effect on adoptees' ability to proficiently acquire the second language.

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16. Designing assistive technology devices to aid persons with disabilities

Worcester Polytechnic Institute: Allen H. Hoffman PhD, Professor of Mechanical Engineering; Holly K. Ault PhD; Michael J. Scarsella, Graduate Student Manager; and Steven P. Toddes

The Assistive Technology Resource Center (ATRC) was founded in 1999 with a grant from the Fairlawn Foundation of Worcester, MA. The mission of the ATRC is to foster the use of assistive technology through collaboration with clinical, educational, governmental and social service agencies that serve persons with disabilities. A major focus of the ATRC is to involve undergraduate and graduate students in the solution of problems solicited from these organizations. The problems may be used in one of 3 undergraduate design courses where 2-3 groups, of 3-4 students each, develop a design to solve a particular problem and as a minimum build a working prototype. Refinements to these course prototypes are often made by other students affiliated with the ATRC. More advanced problems are used as senior design projects where a group of 2-4 students spend 1/3 of their time over an entire academic year developing a working design. Sophisticated problems of a more generic nature are used as graduate research topics. Successful projects have included wheelchair attachments, mobility devices, orthoses, sports equipment and aids to daily living. Recent projects include a glide control device for a manual wheelchair, a posterior walker for persons who are blind and use a white cane, simplified remotes for persons with cognitive disabilities, a laptray computer mounting system for a manual wheelchair, a powered arm orthosis to aid in daily living activities and development of a powered wheelchair training program. Our experience demonstrates that integration of assistive technology design projects throughout the engineering curriculum is a viable means of delivering useful devices and solutions to persons with disabilities.

Web site: <http://www.me.wpi.edu/Research/ATRC/>

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Pre-Health and the Health Professions

17. Biomedical applications of chemically modified materials

Worcester Polytechnic Institute: Grant McGimpsey, Director, WPI Bioengineering Institute; and Christopher R. Lambert, Peter F. Driscoll, Nantanit Wanichacheva and Eugene Douglas

The objective of this project is to demonstrate the biomedical applications of chemically modified materials. These materials include metals, semiconductors and polymers and are being used in our laboratory to fabricate biosensors, and surfaces with switchable wettability for the control of liquid flow. The modification of the surface is achieved using self-assembly and is characterized using electrochemistry, fluorescence, ellipsometry, contact angle goniometry and surface plasmon resonance. We have developed sensors that are sensitive and selective for electrolytes including sodium, potassium and ammonium ions, therapeutic levels of lithium ions as well as certain nucleic acids and proteins. We have also demonstrated a simple strategy for the stepwise fabrication of highly ordered thin films with wettability that can be switched from hydrophobic to hydrophilic. These technologies promise to yield highly complex, lab-on-a-chip systems in which the flow of analyte solution and reagents can be precisely controlled at sub microliter levels offering improved throughput and sensitivity over current technologies.

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18. Central Massachusetts STEM Pipeline Network

University of Massachusetts Medical School: Sandra Mayrand, Director, Regional Science Resource Center

The Central Massachusetts STEM (Science, Technology, Engineering, Mathematics) Pipeline Network, established in 2005 with funding from the Board of Higher Education's Pipeline Fund, provides a structure for its members to share pertinent information and build on one another's successes, access research on K-16 STEM education to inform next steps, connect to workforce needs and opportunities, develop working relationships across and within all partnering subgroups and vigorously pursue the goals of the STEM Pipeline. The goals of the Pipeline Fund are to increase the number of qualified STEM teachers, increase the number of STEM educational offerings in schools and increase the number of Massachusetts students who participate in programs that support careers in fields related to mathematics, science, engineering and technology.

The Central Massachusetts STEM Network over the past two years has grown to include 20 districts, 7 higher education institutions, 6 businesses, 5 nonprofit organizations and 5 smaller, role-specific networks and boards with representation from over 65 districts. Through ongoing conversation and analysis of regional needs and resources, the Network has developed a two-pronged approach to address the three Pipeline Fund goals. While there is overlap between the two initiatives, the first one, "Growing STEM from the Ground Up" will focus more on the longterm strategic STEM planning in the region. "Assessing and Addressing Physical Science Misconceptions" is a professional development project designed to improve science education in grades three to eight by delving deeply into science concepts about which students and adults often have strongly held misconceptions.

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19. Assessing pharmacist knowledge and attitudes about dispensing emergency contraception without an advanced prescription

Massachusetts College of Pharmacy and Health Sciences-Worcester: Assistant Professors Anna Morin PharmD, Courtney Jarvis PharmD, and Ann Lynch PharmD

Faculty at the Massachusetts College of Pharmacy and Health Sciences (MCPHS), in conjunction with the Massachusetts Department of Public Health (MDPH) and Massachusetts Board of Pharmacy, developed and delivered an approved live training program for pharmacists interested in participating in this new statewide initiative of dispensing emergency contraception (EC). The purpose of this project was to evaluate the characteristics of participating pharmacists as well as their perceptions of EC and their experience dispensing EC.

Pharmacists were surveyed before and 6 months after attending the MCPHS training program. Survey data collected included participants' background information and characteristics, their pre-training perception of EC, their satisfaction with the training program, their interactions with other providers in the provision of EC, their experiences with the delivery of EC services, and any unique experiences encountered that can be used in future training programs. The pre- and post-survey data was collected and analyzed.

To date, 70 pharmacists were surveyed prior to attending the training program. The pre-survey data is being analyzed. Post-training surveys have been distributed and will be collected and analyzed for comparison. Final results will be presented at APhA 2007.

The implementation of this training session and the distribution of surveys have shown an impact on pharmacist knowledge and attitudes about dispensing EC without an advance prescription and the role of the community pharmacist in providing access to emergency contraception.

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20. Human resource applications at Charles River Laboratories

Nichols College: Patricia Cody, student

This poster describes the experience of an intern with Charles River Laboratories, applying human resources principles to projects in the bio-medical industry.

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21. Fostering cultural sensitivity among nursing students at Worcester State College

Worcester State College: Robyn Leo MS RN, Associate Professor, Department of Nursing; and Ellen Rearick MS RN, instructor

Due to rapidly growing diversity within the U.S., nursing programs are beginning to develop educational experiences promoting and addressing culturally competent nursing care. Multicultural care is one thread of the Department of Nursing baccalaureate program philosophy at Worcester State College. Worcester's varied population with diverse health care needs lends itself to rich educational and clinical experiences for our nursing students.

Using local immigrant population trends, coordinating faculty selected appropriate cultural groups from within the greater Worcester County area. Groups of 5 to 7 junior-level nursing students conducted research on an assigned culture, including literature reviews, personal interviews, and observation experiences. Each group created a public multimedia presentation highlighting specific aspects of the culture: health care beliefs, behaviors and practices; experiences and biases of local health providers; and nursing interventions tailored to provide culturally sensitive health care. The projects were showcased at Worcester State College at semester's end.

Students gained proficiency in research and study of various cultures. Moreover, students gained knowledge and sensitivity concerning the unique health care issues among cultures within the Worcester County area.

Implementation of this teaching/learning strategy fosters cultural sensitivity among nursing students which may enhance culturally competent care to those populations which they serve.

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22. Preparing nursing students for writing in their profession

Quinsigamond Community College: Amy Beaudry, Assistant Professor of English

This poster demonstrates what Prof. Beaudry learned while completing an externship at three Worcester County health care facilities, where she observed the types and style of writing used by nurses and interviewed appropriate staff members. She concluded that completing this kind of project allows instructors to tailor English composition classes to their particular student body and better meet the students' needs. Also, subject-specific composition courses can have a positive impact on students, helping them understand and forge connections between what they are learning in composition courses and the necessary skills for professional success.

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23. Science to Go

University of Massachusetts Medical School: John LeBlanc, Science Kit Coordinator

The objective of Science to Go is to provide quality curriculum materials from a centralized location to teachers from kindergarten through grade six. This material will enable teachers to guide their students through the "hands-on" learning process.

Our material is purchased in the most cost-effective way possible to keep our prices at a minimum. Material is bought in bulk via the Internet, store sales, coupons, clearance, contracts and local business. We will do the leg work for teachers in order to afford them the time to teach.

Our customer base has grown from five districts in the year 2000 to 24 in 2007. Districts are telling us that Science to Go is actually serving an outsourcing function for materials management. Teachers are elated with the one-stop/shop approach as their needs are quickly served, often the same day.

We believe, and history shows, that a centralized replenishment facility for districts implementing standards-based, inquiry-based science instruction is crucial to the viability of systemic K-6 science education reform. Children learn science most effectively through experiential activities. Furthermore, children learn best, when the activities are taught in an environment that allows them to actively investigate scientific phenomena using concrete materials. Science to Go will provide you with all your material needs.

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24. Is participation in undergraduate scientific research a predictor of success in applying to medical and graduate schools?

Clark University: David Thurlow, Associate Professor of Chemistry

The intrinsic pedagogic value of experiencing active learning in the research environment will be investigated together with its potential impact on pursuing graduate studies in biomedically related programs, including both medical and graduate schools. Enrollment and other curricular records, participation in university-wide research symposia (e.g., Academic Spree Day), citations from the scientific literature, and other sources will be examined to identify the extent to which Clark chemistry and life-science majors engage in research. Approximately 1050 undergraduate students have graduated from Clark University since 1985 with majors in biology, biochemistry and molecular biology (BCMB) or chemistry. Over 450 participated in some sort of independent research projects, either as part of a directed study on campus or as an internship at another local research institution. Many of these research projects were biomedically related. Of these students, 155 received departmental honors and at least 60 were coauthors on articles published in peer reviewed scientific journals. During the same period of time, 166 of these students applied to U.S. allopathic medical schools, and 139 were accepted. The relationships among participating in research, receiving departmental honors, being a coauthor in scientific journals, and success in applying to allopathic medical schools (and other doctoral programs related to medicine) will be examined.

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Mind, Brain and Behavior

25. Synthesis of the ER-beta selective agonist diarylpropionitrile

College of the Holy Cross: Toni Mahowald, student; Daniel Bitran PhD, Department of Psychology; and Richard Herrick PhD, Department of Chemistry

Estrogen receptor beta (ER-beta) and ER-alpha are members of the nuclear receptor (NR) family that shows an evolutionary and functionally conserved structure. Other members of this family include the receptors for testosterone, progesterone, thyroid hormone, vitamins A and D. It has been hypothesized that the action of estrogen on either or both of these receptors can influence anxiety and reference memory. However, in several tests of anxiety and reference memory we found estrogen to have no effect. One possible explanation for these results is that the effects of ER-beta and ER-alpha activation are opposite, thus leading to a net lack of efficacy by estrogen administration. Diarylpropionitrile (DPN) is a full agonist at the ER-beta and has a 70-fold relative binding affinity for ER-beta over ER-alpha, which makes it a good option for exploring ER-beta's influences on reference memory and anxiety. It is much more cost-effective to synthesize DPN than to purchase it, which prompted the development of this project. 4-(methoxyphenyl)-acetonitrile and 4-(methoxybenzyl)-chloride were combined with sodium hydroxide, tetrabutylammonium chloride and water to produce an intermediate. The intermediate's hydroxyl groups were then deprotected using boron tribromide. The resulting product was determined to be DPN by using proton and carbon NMR, and its purity was estimated to be about 90%. The DPN was then encapsulated for subcutaneous implantation into ovariectomized mice to be used in tests of anxiety and reference memory.

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26. Estradiol decreases acoustic startle response and pre-pulse inhibition: Relative roles of estrogen receptor subtypes, ER α and ER β

College of the Holy Cross: Lesley Russell, Toni Mahowald and Daniel Amante, students; Daniel Bitran PhD, Department of Psychology

The acoustic startle response (ASR) has been used experimentally as a construct for anxiety and a basis for measuring prepulse inhibition (PPI), a measure that reflects sensorimotor gating mechanisms and one that is found to be reduced in schizophrenia (Koch, 1998). It has also been noted that PPI is generally reduced in women and varies across the menstrual cycle, with PPI being most reduced in the luteal phase when estrogen and progesterone levels are both high (Swerdlow, 1997; Jovanovic et. al, 2004). This study sought to analyze the effects of chronic estrogen administration on the ASR and PPI. Additionally, this study used the selective estrogen receptor agonists PPT (ER α agonist) and DPN (ER β agonist) to parcel out

the roles of the receptors subtypes in mediating estrogen's effect on ASR and PPI. Ovariectomized mice were implanted with one 90-day capsule that released 8 µg per day of 17β-estradiol (E₂), PPT, DPN, or placebo. E₂ decreased the ASR to pulse intensities of 113 or 123 dB, with no effect on lower pulse intensities of 94 or 103 dB. Neither DPN nor PPT replicated the effect of estrogen. In a PPI paradigm in which the prepulse was held constant at 10 kHz, E₂ treatment was found to decrease the amount of PPI to a 103 dB pulse, but not to pulses of 113 or 123 dB. Similarly, when the pulse intensity was held constant at 123 dB, E₂ decreased PPI to a 6 kHz prepulse, but not to a 10 or 12 kHz prepulse. Importantly, DPN treatment mimicked the effects of E₂ on PPI, whereas PPT treatment did not. These results suggest that stimulation of ERβ, but not ERα, is important in mediating the effects of estrogen on PPI. The results are discussed in light of the previously suggested beneficial effects of estrogen in schizophrenia.

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27. The relative roles of estrogen receptor (ER) subtypes, ERα and ERβ, in estradiol-induced anxiolytic-like and anti-depressant-like effects in the ovariectomized mouse

College of the Holy Cross: Daniel Amante, Toni Mahowald and Lesley Russell, students; Daniel Bitran PhD, Department of Psychology

Estrogen levels in postmenopausal women have been linked to such emotional disturbances as increased anxiety and depression and that these symptoms decrease with estrogen replacement therapy (Sherwin, 1998). The recent discovery of estrogen's receptor subtypes, ERα and ERβ, has led to investigations of the role of these receptors in such psychotropic effects of estrogen. Recently, anxiolytic and antidepressant effects of estradiol have been attributed to the activation of ERβ (Walf and Frye, 2005). Whereas earlier experiments used acute administration of ER selective ligands, this experiment sought to determine the effects of chronic administration of estrogen and selective estrogen receptor agonists PPT (ERα agonist) and DPN (ERβ agonist) in a number of animal models of anxiety-related and depression-related behavior. Ovariectomized mice were implanted with one 90-day capsule that released 8 µg per day of 17β-estradiol (E₂), PPT, DPN, or placebo. Anxiety-related behavior was examined in the novel open field, elevated plus-maze, the light-dark (L/D) transition test, and the fear-potentiated startle (FPS) test. The putative antidepressant effects of these treatments were examined using the Porsolt forced-swim test. E₂ treatment produced significant anxiolytic effects in the L/D transition and in the FPS tests. In every case, the anxiolytic-like effects were replicated by DPN treatment, but not by PPT exposure. Thigmotaxis in the novel open field and behavior in the elevated plus-maze were unaffected by any of the treatments. A robust antidepressant-like effect was also observed in E₂-treated mice in the Porsolt forced-swim test; however, this effect was not seen in either PPT- or DPN-treated animals. These results suggest that ERβ receptor activation is solely responsible for the anxiolytic effect of estrogen, whereas stimulation of either ERα or ERβ alone is insufficient to elicit the antidepressant-like effects of estrogen.

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28. fMRI in the pre-frontal cortex after a single dose of Ecstasy (MDMA)

Clark University: Jessica Shields, student

UMass Medical School: Josie Harder PhD, Marcelo Febo PhD, Tara Messenger and Praveen Kulkarni PhD

The object of this project was to study the pharmacological activation profile of MDMA in the pre-frontal cortex of drug naive, non-human primates using fMRI.

Nineteen (19) drug naive marmoset monkeys were scanned in a 4.7T Bruker MRI scanner and were given one of 3 doses of MDMA (1, 3.3, and 10 mg/kg). All data was then analyzed using MIVA.

There are significant differences in both positive and negative BOLD in the PFC when comparing MDMA doses. The percentage of the PFC activated negatively increases in a dose-dependent fashion, with the highest dose negatively activating an average of 25% of the cortex, while the positive activation remains fairly constant without dose affecting about 5% of the voxels in the PFC.

MDMA creates a negative BOLD effect in the PFC of non-human primates as measured by fMRI.

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Public, Community, Environmental and Organizational Health (and Well-Being)

29. Strengthening vulnerable communities in the Worcester built environment

Clark University: Timothy Downs, Assistant Professor; Laurie Ross, Professor; Deb Sinha, graduate student; Erin Anderson; Rebecca Dezan and Donna Wysokenski

Family Health Center: Suzanne Patton and Sarah Rulnick

Regional Environmental Council: Peggy Middaugh and Jim Oldham

Worcester Youth Center: Denise Calderwood and Xavier Johnson

Low-income people living in depressed neighborhoods of Worcester, MA are disproportionately exposed to environmental stressors: 1) a major toxic chemical pollution burden, 2) unhealthy physical features like brownfields and lack of greenspace, and 3) pervasive social violence and insecurity. Compounding their vulnerability is limited adaptive capacity rooted in socio-political and economic stress. Approaches that focus on single problems will be ineffective. Our working groups of local community representatives, researchers, city health and environment agencies, the Worcester Youth Center and Regional Environmental Council, plan an inclusive, systems-based approach to improve adaptive capabilities in Worcester's Piedmont and Main South neighborhoods. Worcester was once the heartland of the American industrial revolution, and its built environment now bears a significant historical and ongoing pollution burden. Similar conditions are found in many medium-sized cities across industrial America. The project has four stages, all neighborhood-based: 1) Strategic Assessment – detailed descriptions of the baseline; 2) Strategic Planning - identification of priority stressors and opportunities; 3) Implementation – making priority interventions and developing capacity; and 4) Performance Monitoring - measurement to detect significant changes (post- vs. pre-policy values). Products will include: neighborhood-centered databases, planning documents, and evaluation reports; a practitioner's manual; and research reports of observations and findings. Two hypotheses are tested: a) Primary built environment stressors of a physical, chemical and socio-economic nature conspire together to create vulnerability in Worcester's Main South and Piedmont neighborhoods; and b) this vulnerability system can be described and improved through a participatory process that fosters experiential learning, builds community ownership, strengthens adaptive capacity of those at risk, and makes environmental and health promotion policies responsive to those most in need.

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30. Current issues in the economics of health care

Nichols College: Cassie Blake and Joshua Girard, students; and Louise Nordstrom PhD, Professor

The objective of this poster is to draw the viewer's attention to today's major public policy issues in health care economics. These issues include the provision of universal health care, inflation in the health care industry, the impact of an aging population on health care costs and providers, the increasing portion of GDP devoted to health care, problems for the pharmaceutical industry, and the shortage of organs, among many other major and minor issues. The students responsible for this poster are enrolled in an upper-division independent study class in Health Care Economics taught by Louise J. Nordstrom PhD using the case-study approach. The project analyzes various public policy options and assesses the economic consequences of these options.

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31. Abbott Laboratories – human resources internship

Nichols College: Stephanie Jacques, student

Phase Forward: Jason Monteiro, Nichols graduate

This poster presents examples of human resources projects on which the authors worked as interns at Abbott Laboratories, such as organizing new hire/exit interview procedures, scheduling interviews for candidates, preparing offer letters, tracking performance evaluations, etc. This internship polished their skills and helped prepare them for the "real world."

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32. Commonwealth medicine – applied knowledge in public service

University of Massachusetts Medical School: Rosemary E. Heinold MA, APR, National Director of Marketing and Communications, Commonwealth Medicine Division; Jane Coken Ryan MBA, Director, Community Case Management; Timothy P. Cummins RPh, MBA, Executive Director Clinical Pharmacy Services; and Roger B. Eaton PhD, Director, Newborn Screening

Our objective is to apply the knowledge base within the Medical School to improve health outcomes for those served by public health and human service programs. This poster highlights the work of three programs that exemplify the fulfillment of this objective. The Community Case Management Program helps medically complex children live safely at home by authorizing continuous nursing and other community longterm care services for them. Clinical Pharmacy Services provides comprehensive, quality prescription drug management services while closely monitoring prescription practices not only for compliance and clinical effectiveness, but for opportunities to control spending. The Newborn Screening Program seeks to maximize the potential of a life by employing technology and medical knowledge in analyzing a blood specimen obtained in the first days of life to prevent or minimize the morbidity and mortality of disorders of newborns.

Community Case Management provides rapid response to providers and families so children are better served, families are happier and more nursing hours are filled resulting in high quality care for medically complex children and severely chronically ill children in their homes, instead of in nursing facilities.

Clinical Pharmacy Services promotes best practices in formulary and drug utilization management for Medicaid and managed care organizations.

The Newborn Screening Program identifies newborn babies with disorders and quickly informs their physicians and families so that available intervention can begin.

By applying the clinical knowledge base within the Medical School, the programs provided by its Commonwealth Medicine Division deliver improved health outcomes for those served by public health and human service programs.

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33. Celebrating college and community collaborations: A description of the ongoing relationship between Worcester State College and the Massachusetts Department of Environmental Protection

Worcester State College: JoAnne Maynard PhD, Assistant Professor; and Nancy Brewer PhD

Our organizations bring together a wide variety of skills and perspective. Linking our diverse natures makes us stronger and more capable of implementing the systems change necessary to address poor health in communities. As innovative partners for change, we strive to move beyond our individual areas of comfort and work together for a more effective community-based system.

We have completed a project entitled, "Lead in Drinking Water – Massachusetts Daycare Evaluation Pilot Project," and are currently planning additional work in this area. We are developing an Environmental Academy where students, public health workers, teachers and interested members of the community can receive education about a range of environmental topics and earn credit toward certification. We worked toward this goal with the DEP by sponsoring and contributing to a community emergency planning conference for professionals.

In February 2007, we participated in a DEP-sponsored Water Quality Testing Kit train-the-trainer workshop. In March, we participated with the DEP in the conference, "Women in Science," a combined event with the University of Massachusetts Medical School and the Worcester Ecotarium. In the summer of 2007 we will co-teach an experiential undergraduate course with the DEP entitled, Land, Water and Health. Another state agency, the Massachusetts Water Resources Authority (MWRA) will be involved. We have gathered information to improve our collaborative efforts and provide feedback to each other by focusing our evaluation efforts using a formative method.

Because health education is an integral part of the college's mission and because the college is dedicated to promoting cooperative efforts, we believe we are in a unique position to affect change. We begin from a place of strength. The partnership we have developed between government agencies and our academic institution is unique. We are proud of our efforts and want to share this vision and accomplishment with others.

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34. Undergraduate internship in municipal environmental health

Worcester State College: Steven Rice DC, DABCO

Watertown Health Department: Gerard Cody RS, Chief Environmental Health Officer

Funded with a grant provided by the Massachusetts Environmental Health Association (MEHA), Steven Ward, director of the Watertown Board of Health and Gerard Cody, chief environmental health officer, supervised five students from Worcester State College in an internship in public health. The pilot program is an initial step in establishing a model approach to education, training and practical experience in local health agencies. The goal is to have a program that can be replicated and established across the Commonwealth within the community and state college system.

Selected students received pertinent reading material, attended the annual MEHA meeting and participated in orientation seminars for local public health at the Boston University School of Public Health and the Watertown Health Department. Students received instruction on tanning establishment, swimming pool, food establishment and nuisance regulations, as well as conducted field inspections in the presence of Watertown sanitarians. Concurrent with environmental training, interns received instruction and updates on state and local emergency preparedness activities. Interns were provided with an overview of CDC deliverables from 2004 to present, reviewing current year deliverables. Interns reflected on their experience and offered insight into the field of local public health as it pertains to environmental health and EP. Students selected relevant topics for review and additional study (May-August 2006).

The program resulted in

- development of PowerPoint presentations on tanning, hazardous materials, avian flu, emergency preparedness, and internship in public health;
- interns performing 12 swimming pool, 18-25 low-risk food and 54 hazardous materials inspections;
- receiving training in Incident Command System, Medical Reserve Corps and participating at an EDS exercise for pandemic flu;
- obtaining positions of employment in public health offices;
- constructing the internship as an independent study or practicum, earning college credits.

Participating interns developed knowledge and practical skills in regulatory affairs and emergency preparedness training that allowed them the necessary tools to be able to assist local boards of health during the internship program. Upon the completion of the internship, students expanded their knowledge base on a diversity of public health programs and developed skills through field training which proved to be an advantage when seeking a career in public health. Due to the inherent success of the pilot program and the continued work of the participants, a more formal curriculum is being developed for the state college system.

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