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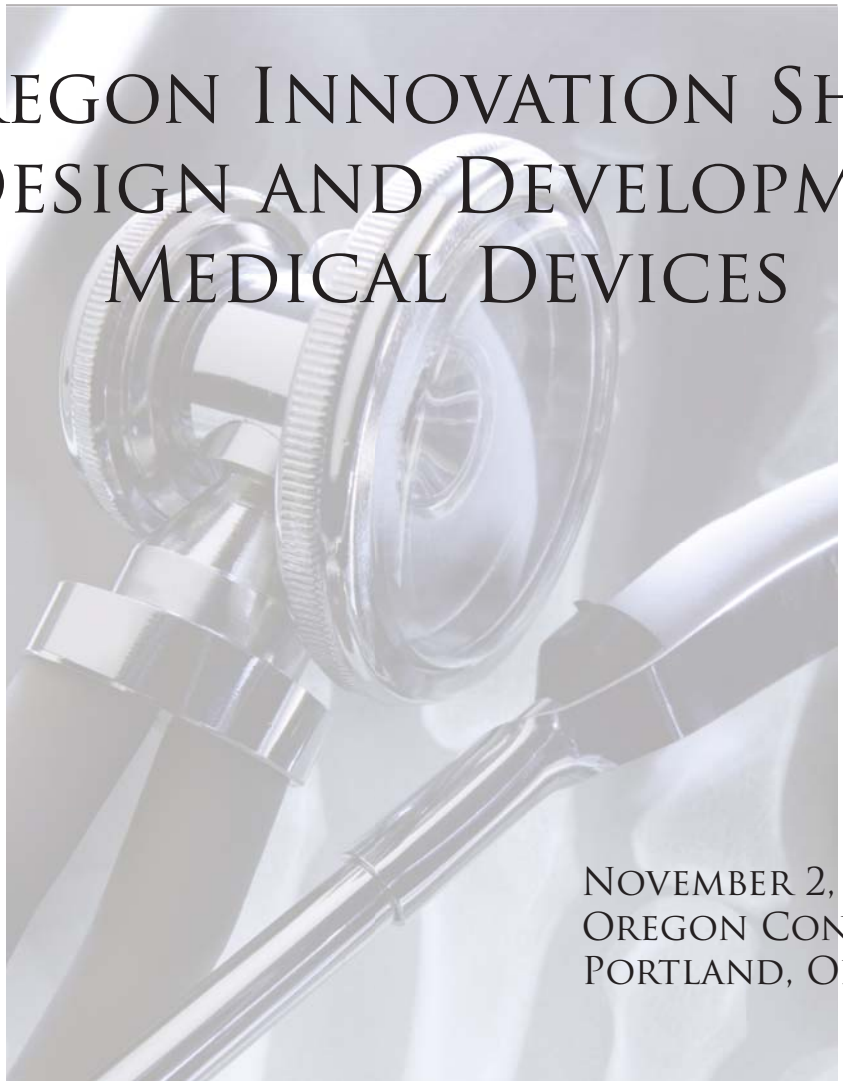
2010 Oregon Innovation Showcase: The Design and Development of Medical Devices



November 2, 2010
Oregon Convention Center
Portland, Oregon

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Innovation Showcase

Agenda

1:00 PM — Welcoming Remarks

Jonathan Fink, Vice President for Research and Strategic Partnerships
Portland State University

Presentation of Distinguished Inventor Award to Albert Starr, M.D.
Daniel M. Dorsa, PhD, Vice President of Research at OHSU

1:20 PM — Showcase Presentations

Home Dialysis Plus, Ltd.: Michael Baker - President & CEO

V. Pat Lombardi, PhD - University of Oregon
Can we trust 24hr ambulatory blood pressure monitors?

S-Ray Corporation: Steve Baird - CEO

Daniel Gareau, PhD - Oregon Health & Science University
Biophotonics for medical diagnostics

2:35 PM — Refreshment Break

3:00 PM — Keynote Presentation

Len Blackstone, CEO - Blackstone, Inc.
Inspiring Innovation: What it is, How to do it & Where to start

3:35 PM — Showcase Presentations

SAM Medical Products: Adrian Polliack, PhD - COO

Patrick Chiang, PhD - Oregon State University
Epoch: Electronics for Pervasive Monitoring of Cognitive Health

Bioject, Inc.: Ralph Makar - President & CEO

Raj Solanki, PhD - Portland State University
Electronic Biosensors: Path to low cost diagnostics

Closing Remarks

5:00 PM — Reception and Poster Session

Home Dialysis Plus, Ltd.

Home Dialysis Plus, Ltd.
Michael Baker, President & Chief Executive Officer

Home Dialysis Plus, Ltd. (HD+) is a privately owned company that is focused on providing innovative hemodialysis solutions to patients and their healthcare providers. Leveraging multiple, advanced micro-technologies, HD+ intends to develop a dialysis system that allows patients the ability to experience treatment in the comfort and privacy of their own homes. HD+ has an in-depth understanding of today's dialysis treatment needs. Working closely with patients, care providers and technical experts around the globe, their team is striving to meet those needs via innovation, strong design and advanced technology. This past year HD+ secured an investment of up to $50 million of capital funding from a top-five ranking global private equity firm to advance the commercialization effort.

Michael Baker has 27 years of executive management experience, including merger and acquisitions with Philips Medical, Lockheed Martin and GE. He has launched multiple entrepreneurial ventures in the medical device, medical IT and clean tech industries. Among these, most notable are the original picture archiving and communications system (PACS), an award-winning through wave acoustic holography system for non-radiation breast imaging and an ultra high-efficiency electric motor suitable for alternative energy application. Mr. Baker is currently the CEO/President of Home Dialysis Plus (HD+) where he is leading the team to commercialize an innovative home dialysis system, leveraging microtechnologies from Oregon State University and Hewlett Packard.

V. Pat Lombardi, PhD

V. Pat Lombardi, PhD
Research Assistant Professor, Department of Biology - UO
Can we trust 24hr ambulatory blood pressure monitors?

Dr. Lombardi is a Research Assistant Professor (Human Biology and Medical Physiology) in the Department of Biology at the University of Oregon. He sits on the American Heart Association's High Blood Pressure Research and Nutrition, Physical Activity and Metabolism Scientific Councils. His current research includes a collaboration with Don Pate in the University of Oregon's Neuroscience Department to develop an ambulatory blood pressure monitor which assesses posture and automatically adjusts sensor sensitivity based on alterations in Korotkoff (blood pressure) sound intensity.

Pat is a native of Atlanta, Georgia, and earned his bachelors degree from North Carolina with majors in Mathematics and Physical Education. He came to Oregon in 1980 to study cardiovascular, exercise, and environmental physiology with Dr. Eugene Evonuk, former Director of the Laboratory of Applied Physiology. Pat earned his PhD in 1984 with a major in physiology under Dr. Evonuk and minor in human anatomy under Dr. Edna Wooten. He has taught a variety of courses including medical physiology, human physiology, cardiovascular physiology, exercise physiology, nutrition, and anatomy. In 1999, he received the Thomas F. Herman Faculty Achievement Award for distinguished teaching.

S-Ray Corporation

S-Ray Corporation
Steve Baird - Chief Executive Officer

S-Ray Corporation has patented and is developing a method of using ultrasound as the basis for an imaging system that can detect carious lesions and cracks within teeth. The resulting image is a 3-D computed tomographic rendering of the tooth, which the dentist can rotate and view from any angle.

Steve Baird is an experienced executive with a proclivity towards startups, restarts and "challenged" companies. He has run a diverse range of companies including manufacturing, software, telecom and construction. As the CEO of S-Ray Corporation, his goal is to commercialize the technology as a product which can be used in dental offices as safer, faster, cheaper and better alternative to x-ray. Since starting the company in January, 2008, Steve has raised $6.5 million in capital, achieving a $35 million valuation.

In addition to S-Ray, Steve is also Chairman of Engenium, a venture that develops and markets high technology, high performance, high value waste water treatment systems. He is also an advisor to current and retired National Football League players, helping them with investments and career development as they leave professional sports. In addition to his professional work, Steve is also a founder and Board member of Northwest Adaptive Rowing, a Portland based non-profit. Steve went to school at California State University of Northridge where he studied tennis, sailing and a little finance. He is considering an MBA at one of the colleges in London with a focus on wine tasting.

Daniel Gareau, PhD

Daniel Gareau, PhD
Postdoctoral Fellow
Departments of Dermatology & Biomedical Engineering - OHSU
Biophotonics for medical diagnostics

Daniel Gareau, PhD received his bachelor of science degree from the University of Vermont in 1999, masters degree from the Oregon Graduate Institute of Science and Technology in 2001 and PhD from the Oregon Health & Science University in 2006, developing a confocal microscope for in vivo imaging of GFP and melanoma in mice. Dr. Gareau's postdoctoral training was completed at Memorial Sloan Kettering Cancer Center.

His past, present and future work involves the implementation of light to elucidate biological questions of form and function. He has been published in the Journal of Biomedical Optics, the British Journal of Dermatology, the Journal of Investigative Dermatology, Lasers in Surgery and Medicine, and the Journal of Microscopy. Dr. Gareau is currently a postdoctoral fellow at Oregon Health & Science University in the departments of dermatology and biomedical engineering. In addition to mentoring high school scientists who have taken top prizes at the international level, Dr. Gareau has received the 2005 student leadership award and the 2010 postdoctoral paper of the year award.

Keynote Presentation
Len Blackstone

Len Blackstone, CEO
Blackstone, Inc.

Inspiring Innovation: What it is, How to do it & Where to start

Len Blackstone is a master marketing strategist. During more than 30 years in marketing, he has worked with many of America's largest brands. Len is also a highly sought-after speaker and author. His unique life experiences enrich both audiences and consulting clients.

In addition to his three decades in marketing, Len is a former police officer, professional photographer, university instructor, and long-distance bicyclist (3,000 miles through the U.S. & Canada). He has traveled extensively and worked with gangs, prostitutes and heroin addicts in the inner cities of America and the poor, hungry and homeless of foreign countries.

Blackstone, Inc. is a management and marketing consulting firm working with some of America's most influential corporations, brands and institutions. The firm provides consulting, research and the execution of marketing tactics with a purpose to increase top-line revenue for clients. Their counsel is sought after by senior executives of organizations, from multi-billion dollar, international Fortune 500 companies to small entrepreneurial startups. As a speaker, his audiences are challenged, encouraged and motivated when they hear his stories and listen to his insights on business and reflections on life.

SAM Medical Products

SAM Medical Products
Adrian Polliack, PhD - Chief Operating Officer

SAM Medical Products is a developer and manufacturer of innovative medical products used for emergency, military, and hospital care. Their products include the widely used SAM Splint, SAM Pelvic Sling, Soft Shell Splint, CELOX line of hemostatic agents, BursaMed line of shear and friction relieving dressings, and Blist-O-Ban blister prevention bandages. For more than 25 years, SAM Medical Products has represented innovation and quality to the medical professional.

Adrian Polliack, PhD is COO of SAM Medical Products. His education includes an undergraduate degree in Chemistry from the University of Michigan, and a doctoral degree in orthopedic engineering from Oxford University, U.K. His doctoral research focused on the development of non-invasive methods to indicate the viability of mechanically loaded soft tissues via sweat analysis methods.

Since 2001, he has been part of SAM Medical Products where he has been integral in the development of the BursaMed technology used in the BursaMed line of shear and friction relieving dressings. Dr. Polliack is a published author and holds various patents. Prior to SAM Medical, Dr. Polliack was a R&D project manager at the Rehabilitation Engineering Program at Rancho Los Amigos National Rehabilitation Center in Los Angeles and an Adjunct Assistant Professor at the Department of Biomedical Engineering at the University of Southern California.

Patrick Chiang, PhD

Patrick Chiang, PhD
Assistant Professor
School of Engineering & Computer Science - OSU
Epoch: Electronics for Pervasive Monitoring of Cognitive Health

Patrick Chiang, PhD received his B.S. degree in electrical engineering and computer sciences from the University of California, Berkeley, in 1997, and his M.S. and Ph.D. degrees in electrical engineering from Stanford University in 2001 and 2007.

He is currently an assistant professor of electrical and computer engineering at Oregon State University, and leads a group of 14 people researching energy-efficient electronics. He has worked at various startups in Silicon Valley, and is a visiting professor at Tsinghua and Fudan Universities (China). Dr. Chiang's group investigates new wireless medical devices for researchers at OSU (Center for Healthy Aging Research), OHSU (ORCATECH), and EGI (Electrical Geodesics). He is the recipient of the 2010 Department of Energy Early CAREER award.

His interests are in the design and implementation of new architectures for mixed signal circuits in deep submicron CMOS.

Bioject, Inc.

Bioject, Inc.
Ralph Makar, RPh, MBA
President & Chief Executive Officer

Bioject Medical Technologies Inc. is an emerging drug delivery company developing the world's leading technology for needle-free injection of liquid medications. Bioject's technology works by forcing liquid medication at high speed through a tiny orifice held against the skin. This creates an ultra-fine stream of fluid that penetrates the skin, delivering medication in a fraction of a second. Bioject's systems are designed to deliver injected medications comfortably, accurately, and quickly - without the use of a needle.

Prior to joining Bioject, **Mr. Makar** was engaged in a number of entrepreneurial ventures, which included consulting services with a focus on specialty pharmaceuticals and technology. During 2007, Mr. Makar became a co-founder and Corporate Officer in charge of sales and marketing for Mesa Therapeutics, an emerging specialty pharmaceutical company, where he retains an advisor role. From 2003 to 2005, Mr. Makar served as Vice President and General Manager of the Therapeutics Business Unit at Berlex Labs, the U.S. Division of Schering AG, which later became Bayer Health Care. Before joining Berlex, Mr. Makar held a number of strategic and tactical marketing positions with increasing responsibility at Novartis and Parke-Davis. He earned a B.S. in Pharmacy from Rutgers College of Pharmacy in Piscataway, New Jersey, in 1983 and an M.B.A. from Columbia Business School in New York, New York, in 1990.

Raj Solanki, PhD

Raj Solanki, PhD
Professor - PSU
Departments of Physics & Electrical & Computer Engineering

Electronic Biosensors: Path to low cost diagnostics

Raj Solanki, PhD is Professor in the Department of Physics at PSU and has a joint appointment at Oregon Health & Science University.

His research has covered several aspects of optics and microelectronics, including flat panel displays and topics related to down-scaling of electronic devices. Current research in his lab includes electronic devices based on semiconductor nanowires, carbon nanotubes, and graphene and electrical devices for sensing biological molecules.

Innovation Showcase 2010: Poster Presentations

Academic Posters (Alphabetical by First Author's Last Name)

THE CTSA FOCI-OF-EXPERTISE (FOX) COLLABORATION SYNERGY BROWSER

Nathan Bahr1, Aaron M. Cohen1, Kate Marusina2, Dean Welsch3
1 Department of Medical Informatics & Clinical Epidemiology, OHSU, 2 Clinical and Translational Science Center, UC Davis School of Medicine, 3 Pharma Therapeutics Division, Pfizer Corporation

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With support from Pfizer and the UC Davis and OHSU CTSAs, we have developed a Foci-of-Expertise (FoX) Synergy Browser for the purpose of identifying productive research collaborations between CTSA scientists and pharmaceutical companies interested in developing and deploying novel therapies for the treatment of human diseases.

The FoX Synergy Browser is a graphical tool that allows users to explore relationships between researchers, diseases, and gene/protein targets. These connections are automatically extracted from MEDLINE, NIH Reporter grants, and gene-gene interaction information in Reactome. By exploring topics related to their interests, users can answer their questions about the current state of who is working on what at CTSA research institutions, and identify potential collaboration partners more efficiently.

DEVELOPING A PROTOTYPE COLLABORATIVE MEDICATION MANAGEMENT SYSTEM: ALTERNATIVE SOLUTIONS AND DESIGN CONSIDERATIONS

Nathan Bahr, Ravi Teja Bhupatiraju, Pamela Lam, Paul N. Gorman
Department of Biomedical Informatics & Clinical Epidemiology, OHSU

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A "medication list" is a moving target: antihypertensives are adjusted to achieve a goal; antibiotics added for infection; analgesics adjusted, stopped, resumed to control pain. Physicians, consultants, pharmacists, and patients track medications in systems tailored to individual tasks and organizational requirements. The result is medication lists which do not match, jeopardizing patient safety and increasing workload as clinicians re-enter data and resolve discrepancies among lists. We assume asynchronous, distributed activity by multiple users of diverse applications in separate organizations. Modeled after the Common Framework, we developed a prototype to support distributed, collaborative medication management. We reviewed different successful approaches used for collaboration in other domains and describe our use of a distributed versioning system as a platform to implement a shared medication list management system.

Innovation Showcase 2010: Poster Presentations

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UNOBTRUSIVE MONITORING OF SLEEP USING LOAD CELLS PLACED UNDER THE BED

Zach Beattie, Tamara Hayes, Chad Hagen, Misha Pavel
Department of Biomedical Engineering, OHSU

Tens of millions of Americans suffer from some type of sleep disorder. The medical costs for these sleep disorders is in the range of hundreds of billions of dollars each year. Sleep apnea is one of the most common sleep disorders and is associated with several serious conditions such as hypertension, myocardial dysfunction, coronary artery disease, and cardiac arrhythmias. The current standard of care for detecting and diagnosing sleep apnea is polysomnography, an obtrusive overnight sleep test that costs several thousand dollars.

We are developing a technology that utilizes load cells placed under the supports of a bed to monitor individuals while they sleep in their own beds. The load cells are sensitive enough to detect patient movements as well as their heartbeat and respiration. We are currently developing algorithms that use the heartbeat and respiration signals from the load cells to automatically detect sleep apnea. The load cell technology also has several other potential applications.

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A WEB-COMPONENT ARCHITECTURE FOR CLINICAL COGNITIVE SUPPORT SERVICES

Ravi Teja Bhupatiraju, Paul Gorman, Doug Rhoton, Pamela Lam, David Maier, Nick Rayner
Department of Medical Informatics & Clinical Epidemiology, OHSU

Clinicians making medication decisions can be better supported when their tools are able to assist with common information operations. When managing medications, activities such as determining side-effects, drug-to-drug interactions or finding reference information can be supported by automation. Since such services are now only available as part of larger and often proprietary systems, knowledge reuse and harmonization are difficult and independent enhancements cannot be incorporated.

We demonstrate a loosely-coupled, component-oriented approach that provides easily interchangeable and remotely-available medication services using web standards that makes reuse possible and can even allow the clients to compose their own system functionality. Since standard representations of medication information across different systems cannot be assumed as yet, we demonstrate prototype components that parse loosely structured medication information into structured form. We also demonstrate components that identify the medications against standard databases and allow classification that is meaningful to users.

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CARE MANAGEMENT PLUS: USING TECHNOLOGY TO IMPROVE THE CARE OF OLDER ADULTS

David A. Dorr1, Nima A. Behkami1,2, Kelli A. Radican1
1 Department of Medical Informatics & Clinical Epidemiology, OHSU, 2 Department of Engineering and Technology Management, Portland State University

CM+ is an innovative, evidence-based care model for older adults with chronic illnesses. Ten percent of older patients live with five or more chronic illnesses such as arthritis, diabetes, and heart disease. Two-thirds of Medicare dollars, including costly hospitalizations and emergency room visits, are spent on this frail fraction. Effective primary care can improve older adults' health and manage costs, but most practices are not organized to respond effectively to the broad range of medical, social, and psychological issues these patients present.

Developed by Intermountain Healthcare Medical Group with funding from The John A. Hartford Foundation, CM+ provides practices with tools to implement this innovative model. This package is currently available from OHSU and is already helping practices around the United States make improvements in care for older patients.

Innovation Showcase 2010: Poster Presentations

NOVEL-IMAGE NOVEL-LOCATION (NINL): DEVELOPMENT OF A COMPUTERIZED AND NON-COMPUTERIZED SPATIAL AND NON-SPATIAL MEMORY TEST

Krystle Edwards1, Alan Curtis1, Alia L. Yasen1, Brian J. Piper1, Anthony Linn1, Alex Chu1, Elizabeth C. Meyers1, Jeremy K. Miller1, Paige Cooper1, Gwendolen Haley1, Andrew S. Persichetti1, Jacob Raber1,2,3

1 Behavioral Neuroscience Department, OHSU, 2 Division of Neuroscience ONPRC, OHSU, 3 Department of Neurology, OHSU

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Object recognition tests have primarily been administered to evaluate the molecular, biochemical, and neuroanatomical underpinnings of working memory in rodents. The NINL test was designed to determine place and content memory in human participants. Performance on this test is sensitive to the memory retention interval and can be completed across a wide age range (6-86). Reliability and validity is good. Our NINL medical test provides: a) a quick and easily administered test; b) a link between preclinical and clinical research; c) the ability to predict age-related cognitive decline; d) a useful tool to detect and further understand brain dysfunction and to assess therapeutic interventions for neurological conditions.

INITIAL DESIGN OF AN AUGMENTATIVE COMMUNICATION DEVICE WITH NON-INVASIVE BRAIN-COMPUTER INTERFACE, ADAPTIVE LANGUAGE MODELING AND RAPID SERIAL VISUAL PRESENTATION (RSVP)

Melanie Fried-Oken1,2,3,4, Deniz Erdogmus5, Brian Roark3, Barry Oken1,6

1 Department of Neurology, OHSU, 2 Department of Pediatrics, OHSU, 3 Department of Biomedical Engineering, OHSU
4 Department of Otolaryngology, OHSU, 5 Biomedical Engineering, Northeastern University,
6 Department of Behavioral Neuroscience, OHSU

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We are designing a portable communication device that relies on a non-invasive brain-computer interface (BCI) with optimized language modeling for literate individuals who are functionally locked-in. We use single trial P3 detection for binary selection of single characters in a rapid serial visual presentation (RSVP).

The innovative BCI has three essential, unique features: (1) linguistic components ranging from letters to words to phrases that are presented on a computer screen one at a time in rapid succession; (2) a detection mechanism that employs multichannel electroencephalography (EEG) and/or other suitable response mechanisms that can reliably indicate the binary intent of the user and adapt based on individualized neurophysiologic data of the user; and (3) an open-vocabulary natural language model with a capability for accurate predictions of upcoming text. The collaborative nature of the proposed translational research is expected to yield new knowledge for both BCI development and clinical augmentative communication use.

BIOMEDICAL OPTICS FOR DIAGNOSTIC TECHNOLOGIES

Daniel Gareau

Department of Dermatology, OHSU

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Biomedical optics is a rapidly expanding field, which is ideal for commercial development due to the simplicity and effectiveness of the technology. Three recent inventions show promise to replace dated technologies currently in use. 1) Confocal microscopy produces noninvasive images with similar resolution to histopathology, the gold standard for melanoma detection. An automated computer-vision algorithm operates on the 3D digital image to yield a pathological diagnosis. 2) Multimodal mosaic microscopy (MMM) produces images that appear equivalent to hematoxylin and eosin-stained histopathology (H&E).

MMM is essentially free and takes about 5 minutes to produce versus H&E which takes at least an hour and costs $8 billion annually in the USA. 3) Fiber-optic spectroscopy (FOS) measures the oxygen saturation of blood in mixed arteriovenous micro vasculature. Currently available technologies such as pulsed oxymetry and laser-doppler flowmetry require flow in large vessels where FOS works on whole tissue.

Innovation Showcase 2010: Poster Presentations

μEPG ARRAY: A NEMATODE BASED DRUG SCREENING TECHNOLOGY

Manish Giri and Shawn Lockery
Institute of Neuroscience, University of Oregon, Nemametrics LLC

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There is a growing need for whole-organism (in vivo) assays to address the prohibitive cost of bringing novel drugs to market. Millimeter scale multicellular organisms could serve a unique purpose in the screening market as they fill the gap between cellular assays and experiments in mammalian systems. Such organisms can also provide relevant information at a reasonable throughput and comparatively low cost. We are developing a microfluidic assay system that uses the nematode worm C.elegans for screening the biological activity of a wide range of compounds. Our electrophysiology based assay technology has the potential to offer several advantages over existing solutions; it provides instantaneous readout with high specificity and selectivity, the instrument cost is lower and the technique works with unlabelled, wild type or parasitic nematodes.

NOVEL SPATIAL MEMORY TEST FOR HUMANS: MEMORY ISLAND

Gwendolen E. Haley1,2, Brian Piper1, Jacob Raber1,2,3
1 Behavioral Neuroscience Department, OHSU, 2 Division of Neuroscience ONPRC, 3 Department of Neurology, OHSU

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Reduced spatial memory is observed in healthy aging and neurodegenerative conditions such as Alzheimer's disease, as well as in the following environmental challenges such as traumatic brain injury, brain irradiation, chemotherapy for cancer treatment, in utero exposure to drugs of abuse such as methamphetamine or other environmental toxins. Traditionally, assessment of spatial memory has been part of behavioral tests for rodents but not for humans partly due to lack of an appropriate testing arena, making translational research difficult. Memory Island, a virtual reality maze, bridges the gap in research between species by creating an appropriate testing arena for human spatial memory, making cross-species comparisons possible and allowing assessments of spatial memory for diagnostic purposes and to assess treatment responses.

INNOVATION IN DEVELOPING THE HEALTH INFORMATION TECHNOLOGY WORKFORCE

William Hersh
Department of Medical Informatics & Clinical Epidemiology, OHSU

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The OHSU Graduate Program in Biomedical Informatics is recognized for its innovation in educating the workforce of future leaders at the intersection of health care, biomedical research, and information technology. The program has led its field not only in its identification of the need for such professionals to be trained but also in the implementation of that training, namely through the use of distance learning. The program was recently awarded two large grants from the Office of the National Coordinator for Health IT (ONC). The first of these grants will develop curricular materials for short-term training programs in health IT in community colleges. The second grant will fund training for 135 individuals over three years for clinical informatics roles in the OHSU biomedical informatics graduate program.

A NOVEL MULTIPHYSICS BIOREACTOR FOR CELL AND TISSUE ENGINEERING

Sean S. Kohles1, 2, Hank Y. Chiu1, Shelley S. Mason1, 3, Fay Gibson1, Thadeous C. Bamford1, Randy D. Zelick3, Shelley R. Winn4, Asit K. Saha5

1 Mechanical & Materials Engineering, Portland State University; 2 Department of Surgery, OHSU; 3 Biology, Portland State University; 4 Department of Molecular & Medical Genetics, OHSU; 5 Mathematics & Computer Science, Central State University

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Skeletal disease and trauma often result in extensive tissue damage beyond the body's reparative capacity. Millions of Americans suffer some form of tissue loss costing patients $400 billion annually. Engineering approaches have contributed to reparative options for regenerating lost tissue. Mechanical stimulation of three-dimensionally cultured constructs consisting of cells, biomaterials, and growth stimulants/inhibitors have shown promising results in the production of viable load-bearing tissues such as cartilage and bone. Ongoing efforts are validating the chemomechanical environment to support dynamic cell and tissue culture. This approach includes optimizing the scaffold biomaterial in a manner that supports cell, nutrient, waste, and other biomolecule transport concomitant with controllable mechanical properties.

Innovation Showcase 2010: Poster Presentations

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RADIATION MEDICINE TECHNOLOGY AT OHSU: AN OVERVIEW

Wolfram Laub
Department of Radiation Medicine, OHSU

The radiation oncology department has an active physics section on staff to support the departments complex technology. Three linear accelerators are used to provide external beam radiotherapy. Image guidance consists of onboard-imagers at all LINACs with both kV-kV and cone beam CT capabilities. Calypso radio frequency beacon localization, BrainLab ExacTrac fluoroscopy and optical guidance imaging is utilized as part of a full service image guidance program.

An in-room diagnostic quality CT scanner is located and mates with the NovalisTX table. The department has a Philips Brilliance BigBore CT scanner with respiratory gating capabilities for 4D CT based simulation. Multiple external beam treatment planning systems exist. These systems are used for CT-based 3D treatment planning, inverse modulated radiation therapy (IMRT), volumetric modulated arc therapy (VMAT), dynamic conformal arc therapy, stereotactic body radiotherapy, and Linac-based radiosurgery.

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THE OREGON CENTER FOR AGING & TECHNOLOGY (ORCATECH) LIVING LAB: FROM SMART HOMES TO SMART COMMUNITIES

Oregon Center for Aging and Technology (ORCATECH), OHSU

ORCATECH is committed to evidence-based research and development of smart-home technologies to meet the challenges of aging around key reasons for independence loss: impairment in mobility and decline of memory function. ORCATECH established a Living Laboratory, which is a community network of 35 volunteers (mean age 77.4 years) that allow scientists to assess aging-in-place through installation of in-home technologies, including passive infrared motion sensors, contact sensors, phone sensors, medication tracking devices, home computers (for tracking computer use, mouse movements, and inter-keystroke intervals), and bed sensors.

Participants receive semi-annual neuro-cognitive and clinical evaluations. Successes from the Living Laboratory confirm the value of this unique resource for evaluating emerging technologies in real-world environments.

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THREADED PIN FOR MINIMALLY INVASIVE FIXATION OF CLAVICLE FRACTURES

Robert M. Orfaly
Department of Orthopaedics & Rehabilitation, OHSU

Several studies over recent years have demonstrated that surgical stabilization of displaced clavicle fractures improves pain, healing times and functional outcome compared to conservative management. However traditional fixation with a plate typically requires a long incision and can itself be painful and associated with sensory nerve injury, hardware irritation and poor cosmesis. Previous intramedullary devices developed require fracture compression for stability and have an extra-osseous nut assembly that can cause significant irritation and must be removed with a second procedure.

This device aims to provide stable fixation of displaced clavicle shaft fractures while avoiding the common pitfalls. It rests fully intra-osseous and does not require routine removal. It can be inserted with small incisions in line with the grain of the skin to improve cosmesis and avoid nerve injury. Fracture compression is also possible but not required for stable fixation.

Innovation Showcase 2010: Poster Presentations

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PADDED BACKBOARD JACKET/PATIENT TRANSPORT DEVICE

Sue Powell and Mary Jane Best

Trauma ICU, OHSU

Pressure ulcers in hospital patients can significantly increase the length of stay and readmission, morbidity and mortality rates. A large percentage of these ulcers and subsequent infections occur in patients that are transported and left on rigid boards until diagnostic testing is finished. Using the Padded Backboard Jacket (PBJ) will greatly reduce the chance of pressure ulcers and increase the patient's comfort.

The PBJ is a padded, fluid resistant envelope with its own securement straps. It also has handles for ease of lifting and moving patients. The unique envelope feature allows medical personnel to safely and easily remove or change boards as needed. This product can stay with the patient until tests and final results are obtained. If these were made widely available through a commercial manufacturer, patient outcomes could be positively affected.

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DRAIN DANGLER FOR THE IMAGING SUITE

Sue Powell1 and Karen Ellmers2

1 Trauma ICU, OHSU, 2 Stroke Program, OHSU

Nosocomial infections in hospital patients with drainage tubes can significantly increase length of patient stay, readmission, and morbidity and mortality rates. A large percentage of these infections occur in patients with urinary tract catheters that drain passively by gravity, collecting urine in a receptacle that is placed in a location below the bladder to maintain the downward flow of fluid from the patient. Passive drains may also be used to drain fluids from other organs and body cavities, such as chest tubes.

Hospital beds typically have hooks designed to hold these drainage bags, but CT or MRI scanner tables do not. Therefore, a bag holder, dubbed the Drain Dangler, was designed specifically to hold urinary drainage bags and chest tube devices while the patient is in the imaging suite. The Drain Dangler is a simple, cost-effective device that fills a clear need in the imaging suite for hospitalized patients with drains.

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3D GOLD NANOGAP INTERDIGITATED ELECTRODES ARRAY (IDEA) BIOSENSOR FOR HIGHLY SPECIFIC AND SENSITIVE DETECTION OF BIOMOLECULAR INTERACTIONS

Kanwar Vikas Singh, Allison Whited, Gopichand Nandamuri, Dheeraj Bhura, Raj Solanki

Department of Physics, Portland State University

3D interdigitated electrodes (IDEs) were designed and device simulations were performed for electrical parameters i.e., Electric Field and Current Density, both crucial for biomolecular detection. It was observed that nanoscale spacing between the electrode digits improved the device characteristics. Nanogap IDEs were materialized using E-beam and UV-photo lithography. Different electrode digit gaps, width and height combination were made and characterized using SEM, AFM and Electrochemical Impedance Spectroscopy (EIS). A 3D gold IDEs array (IDEA) was designed in SD card format electrode configuration that can be incorporated into a small handheld microfluidic device.

The viability of 3D-IDEA for sensitive detection of biomolecular interactions was established for specific and sensitive detection of biomolecular interactions. The sensor was applied for detection of anti-Transglutaminase antibodies that are established biomarkers for Celiac Sprue (gluten allergy) disease.

Innovation Showcase 2010: Poster Presentations

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MONITORING TOXIC BIOLOGICAL THIOL LEVELS IN HUMAN PLASMA AND POST-TRANSLATIONALLY-MODIFIED PROTEINS

R.M. Strongin, J.O. Escobedo, M. Sibrian-Vazquez, S. Lim, M. Lowry
Department of Chemistry, Portland State University

The presence of homocysteine above certain levels in humans often indicates serious risk for disease. This useful amino acid biomarker has been studied for decades, but its role in disease is still not clear. We have created simple new methods and materials for homocysteine and cysteine detection.

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DIAGNOSING INBORN ERRORS OF PURINE BIOSYNTHESIS, MENTAL RETARDATION AND CANCER

R.M. Strongin, S. Lim, M. Lowry
Department of Chemistry, Portland State University

Devastating inborn errors of purine metabolism are very serious disorders that are generally under-diagnosed. Adenylosuccinate lyase deficiency is a rare (approximately 1 in 200,000) inborn error of purine metabolism first reported in 1984 in a group of children with mental retardation and seizure. We are developing simple, stable and selective reagents for detecting ADSL deficiency that will function in urine and not require separations.

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DEVELOPMENT OF NEW FLUORESCENT DYES FOR BIOMEDICAL RESEARCH

R.M. Strongin, M. Sibrian-Vazquez, M. Lowry, J.O. Escobedo
Department of Chemistry, Portland State University

A readily accessible new class of prototype near infrared (NIR) emitting molecular probes is being synthesized and evaluated by our group. Specific fluorophores in this dye series exhibit a combination of desirable characteristics including (i) relatively low molecular weight, (ii) aqueous solubility and (iii) dual excitation and emission from their fluorescent neutral and anion forms. Importantly, systematic changes in the regiochemistry of benzannulation and the ionizable moieties afford (iv) tunable deep-red to NIR emission and (v) enhanced Stokes shifts. Proposed studies include plans to synthesize and evaluate a new generation of improved xanthene NIR-active fluorophores to serve as indicator scaffolds in the most challenging biological media such as blood, plasma and urine and in imaging applications.

22

NEW INDICATOR REAGENTS FOR THE EARLY STAGE DETECTION OF OVARIAN CANCER

R.M. Strongin, J. Wang, J.O. Escobedo, S. Lim, M. Lowry
Department of Chemistry, Portland State University

Ovarian cancer is one of the most lethal cancers affecting women. This is due to the inability to detect it while still localized to the ovaries. Early detection would result in a 90% survival rate. LPA, a putative biomarker for early stage ovarian cancer, is the subject of our research. A simple new and high throughput method for detecting LPA and a fresh approach to validating LPA's reliability as an accurate biomarker is being developed in our labs.

23

A SOFTWARE APPLICATION PROTOTYPE TO ADDRESS FUNCTIONAL HEALTH LITERACY-RELATED NON-ADHERENCE TO MEDICATION REGIMENS

Yves Vimegnon
Department of Medical Informatics & Clinical Epidemiology, OHSU

A prescribed medication regimen is never intended to result in consequences that take a toll on senior adult patients. However, many of them do not always get the expected benefits from their prescriptions. With the object-oriented programming language C#, we developed a prototype application called MedP to help seniors identify and take medications as indicated. MedP presents medication regimens in an easy-to understand format through a combination of minimal amount of texts, pill pictures, verbal instructions, and reminder sounds. For this proof-of-concept, we used a Palm T|X® in lieu of a Smartphone. Our conceptual framework is based on the Dual Coding Theory and the pervasive role of health literacy and numeracy in non-adherence.

Innovation Showcase 2010: Poster Presentations

ARTIFICIAL PANCREAS PROJECT

W. Kenneth Ward1,2, Jessica Castle1, Joseph El Youssef1
1 Division of Endocrinology, OHSU, 2 Legacy Health

24 The Artificial Pancreas Project includes four major research areas:
1) The artificial pancreas for automated insulin and glucagon deliver for treatment of type 1 diabetes
2) The optimization of amperometric glucose sensors
3) Development of stable glucagon formulations and analogs
4) Evaluation of ultra-fast insulin formulations and analogs

MODELING AND ANALYSIS OF THE HILL OF VISION OF FULL-FIELD STATIC PERIMETRY

R. Weleber1, P. Francis1, E. Chegarnov1, S. Gardiner2, J. Dietzsch3, U. Schiefer3, C. Johnson4
1 Casey Eye Institute, OHSU, 2 Discoveries in Sight, 3 Centre for Ophthalmology/Institute for Ophthalmic Research, University of Tuebingen, 4 Department of Ophthalmology, University of Iowa

25 We have created a methodology for three-dimensional modeling of the static visual field into a volumetric construct called the Hill of Vision. This construct allows for the assessment of the magnitude and extent of the visual field for diagnosis, characterization, and staging of disease. The concept of the Hill of Vision allows the development of new endpoints for clinical trials. Information and examples are provided on the development of the model and its clinical utilization.

LABEL-FREE ELECTROCHEMICAL IMPEDANCE DETECTION OF C-REACTIVE PROTEIN

Allison Whited, Kanwar Vikas Singh, Raj Solanki
Department of Physics, Portland State University

26 C-reactive protein (CRP) is a stress related protein and an important biomarker for inflammation, cardiac disease risk indicator, postsurgical recuperation, diabetes and other stress disorders. A double antibody assay was designed to specifically capture CRP-Anti-CRP antibodies immune-complex (IC) from samples on the electrode surface. Electrochemical Impedimetric spectroscopy was used to monitor changes in binding signal in presence of increasing concentrations of CRP employing a fixed concentration of anti-CRP antibody in buffer and human serum. The electrode array chip is designed in a standard digital card format and can be incorporated into a small handheld microfluidic device. The sensor gave dynamic detection in the 1ng-1ug/mL range both in buffer and human serum spiked with CRP.

NOVEL SORBENT CARTRIDGES FOR REMOVAL OF GADOLINIUM-BASED CONTRAST AGENTS FROM BLOOD AND DIALYSATE: PREVENTIVE APPROACHES TO NEPHROGENIC SYSTEMIC FIBROSIS (NSF)

Wassana Yantasee1 and Glen E. Fryxell2
1 Department of Biomedical Engineering, OHSU, 2 Pacific Northwest National Laboratory

27 Gadolinium (Gd)-based contrast agents (GBCA) are used in MRI and magnetic resonance angiography (MRA) to help detect abnormalities of body organs, blood vessels, and other tissues. About 12 million Gd contrast MRI procedures are performed yearly in the US alone. GBCA have recently been linked to a debilitating and a potentially fatal skin disease called nephrogenic systemic fibrosis (NSF) in patients with acute kidney injury or chronic severe kidney disease who cannot clear GBCA in a timely manner. Recently, the FDA warned that three GBCA are inappropriate for use among these patients and the kidney dysfunction of all patients should be screened before GBCA administration. We have developed novel sorbent cartridges for effective removal of GBCA from blood and dialysate. This will provide an effective and predicable strategy for removing the GBCA from patients, thus allowing for the continued use of these important clinical procedures.

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Quantitative Home Assessment of Mobility in Parkinson's Disease

Cris Zampieri1,2, Arash Salarian2, Patricia Carlson-Kuhta2, John, G. Nutt2, Fay B. Horak2

1 Functional and Applied Biomechanics Laboratory, Rehabilitation Medicine Department, National Institutes of Health, 2 Department of Neurology, OHSU

Gait and mobility problems are a major cause of disability in Parkinson's Disease (PD). The goal of our study was to test the feasibility of measuring movement deficits in the home using inertial sensors. We used our instrumented Timed Up and Go test (iTUG) for comparison between the home and laboratory testing. We tested PD and healthy control subjects.

Subjects performed the iTUG in their home and the laboratory. Subjects wore a portable data-logger with 5 inertial sensors. The PD group had lower cadence, peak arm swing and turning velocity than the Control group in both the laboratory and home. Additionally, the PD group had slower stride length and stride in the home than the Control group. Our results showed that home testing is feasible, and people with PD were more affected by the procedures.

29

Clinical Testing of the Apnea Prevention Device

Mark H. Zornow
Department of Medicine, OHSU

Narcotic-induced respiratory depression is a major cause of perioperative morbidity and mortality. To address this problem, the author created the Apnea Prevention Device (APD) which is designed to detect the onset of hypoxia and instantly intervene to restore respiration and oxygen saturation.

The prototype APD consisted of a computer, a pulse oximeter, and a nerve stimulator.Oxygen saturation data were acquired by the computer and stimuli to the patient were delivered either by headphones or a nerve stimulator. The APD program analyzed oximetry data and when indicated, delivered stimuli of increasing intensity to arouse patients from narcosis. A total of 125 interventions were delivered by the APD to ten patients with a 97% success rate. The depth of desaturations was less when the APD was functioning. This study demonstrates that the prototype APD can successfully treat narcotic-induced respiratory depression in postoperative patients.

Industry Posters (Alphabetical by First Author's Last Name)

30

The Innovasa Stat*Seal-T Vascular Closure Device

Patrick J. Bergin and JP Wensel

Innovasa Corporation

A puncture tract insertion tool crafted so as to apply focal hemostatic pressure and pro-coagulant directly into a puncture tract. Illustrations and pictures will be supplied, as well as still photos of the device in use.

31

The Chipper Wedge Novel Cervical Distraction Instrument

Patrick J. Bergin and Robert J. Hacker

Chipper Medical

A novel configuration allows this surgical tool to restore physiological lordosis while distracting cervical vertebrae during anterior approach cervical spinal fusion procedures. Pictures of the device and x-ray images supplied.

Innovation Showcase 2010: Poster Presentations

A LOW COST ELECTRONIC DIAGNOSTIC PLATFORM FOR THE POINT-OF-CARE MARKET

Brian Clare, EJ Etherington, Kalani Cox, Jeff King

Flash Sensor Technologies, Inc.

32 Flash Sensor Technologies, Inc. (FST) has developed an electronic diagnostic platform for the point-of-care (POC) market. The market for protein bio-marker based POC diagnosis is predominantly through lateral flow and dipstick devices. These devices use color changes to indicate the presence of diagnostic markers. The assays are semi-quantitative at best and are limited in the number of markers that can be tested in a single device. The FST platform technology enables sensitive detection of specific molecules in complex samples such as blood, saliva, and food. The platform is currently being optimized for immunoassays with an emphasis on the detection of specific antibodies that will initially be able to facilitate the diagnosis of allergies. Prototype devices have been manufactured and are undergoing testing with serum samples from allergy patients.

TREATMENT OF SEVERE MOTOR IMPAIRMENT WITH AMES

Paul J. Cordo

AMES Technology, Inc.

33 Conventional rehabilitation medicine, as well as recently developed therapeutic robotic devices, can restore a modicum of physical function to motor-impaired individuals. AMES Technology, Inc. is bringing to market, in the next 1-1/2 years, a new robotic device that treats impairments and that is effective in treating low functioning stroke and spinal cord injured individuals. In its current state of evolution, the AMES rehabilitation device incorporates: (1) assisted movement of specific joints in the upper and lower extremities, (2) joint torque biofeedback and, for extremely low functioning patients, electromyographic (EMG) biofeedback, and (3) mechanical vibration to stimulate proprioceptively specific paretic and/or spastic muscles. Our results, to date, indicate that AMES is efficacious in individuals with chronic, severe motor impairments resulting from stroke and spinal cord injury.

DEVELOPMENT OF A CHROMOGENIC INDICATOR FOR TRICHOMONAS IVD TESTS

Brandy Erickson, Dan Holstein, Anthony Smith

Biomed Diagnostics, Inc.

34 Trichomoniasis is the number one non-viral STD domestically and worldwide and causes high rates of pre-term delivery, low birth weight, infant mortality and predisposition to HIV, AIDS and cervical cancer. The disease is caused by Trichomonas vaginalis, an anaerobic, flagellated protozoan parasite. To simplify diagnosis using our in vitro diagnostic tests, we designed a chromogenic indicator which gives an irreversable color reaction in response to a Trichomonas metabolite. Subsequent designs faired positively in demonstration of specificity, sensitivity and durability. Results showed that the indicator gives specific, reliable, sensitive performance in lab and basic field trials. Extended field testing and clinical trials are under way.

GAMMACOEUR™: A NOVEL CARDIOVASCULAR RISK ASSESSMENT ASSAY

David Farrell and David Eastman

Gamma Therapeutics, Inc.

35 Gamma Therapeutics is an Oregon class C corporation developing a novel class of products for cardiovascular applications based upon Gamma Prime Fibrinogen, a clotting protein in blood. The product line includes anticoagulants, surgical sealants and heart attack risk assays. The flagship product, GammaCoeur™, is a new cardiovascular disease risk assay. Traditional predictive tests do not identify all people at risk. Studies using GammaCoeur™ show that individuals in the top 25th percentile have a 7-fold increased odds of coronary artery disease compared to individuals in the lowest 25th percentile. Gamma Therapeutics has received a $1.46M SBIR grant from the NIH to develop GammaCoeur™.

Innovation Showcase 2010: Poster Presentations

THE MASON OPTICAL MICROSCOPE

Michael Mason

Mason Optical Inc.

36 The revolutionary new Mason Microscope is the easiest to use, most ergonomically designed and light-weight surgical microscope available anywhere in the world. Dr. Michael Mason has created a microscope that exceeds the inherent limitations of current microscope design (long eye-hand working distance and separation of the viewing and working areas). Utilizing this innovative optical layout, the body of the microscope is at or above the eyepiece level, which significantly reduces the eye-hand working distance to 10-12 inches (depending on the collimating lens used) as compared to other microscopes, which is 20 inches. This ensures the most ergonomic condition is present, allowing for comfortable long term use with less neck and eye strain.

A NOVEL DEVICE FOR THE TREATMENT OF HYDROCEPHALUS

Nathan Selden, Rachel Dreilinger, Liesl Close

Cerulean Neuromed

37 Dr. Nathan Selden, Campagna Professor Head of Pediatric Neurosurgery at OHSU, has developed a novel device for the treatment of hydrocephalus. Hydrocephalus affects people of all ages and is characterized by blockage of cerebro-spinal fluid (CSF) flow or absorption, resulting in increased intracranial pressure, brain damage, blindness and death. There are two standard treatments for this condition, the ventriculoperitoneal (VP) shunt and endoscopic third ventriculostomy (ETV). Both treatments have a 60% failure rate and revision surgeries are common. Dr. Selden's device is a self-expanding, bioabsorbable polymeric stent that can be used to improve outcomes of the established ETV procedure, potentially eliminating the need for multiple surgeries in many patients.

DEVELOPMENT OF SINGLE DONOR FREEZE DRIED PLASMA

Ervelyn Winata, Kelsey Culbertson, Aleksandra Egan, Alysha Wold, Clint Pepper, Simon McCarthy, Lisa Buckley

HemCon Medical Technologies, Inc.

38 Fresh frozen plasma (FFP) is used as a resuscitation fluid for trauma-induced coagulopathy. Use of FFP is limited by storage and administration difficulties associated with cold chain transport and storage as well as requirements for thawing before use. Freeze-dried plasma was used extensively during WWII; it was prepared from plasma pooled from thousands of donors, required no refrigeration and was easy to reconstitute. It was later withdrawn from use during the 1950's when the pooled plasma was found to be contaminated with hepatitis B virus. HemCon is developing single donor freeze-dried (lyophilized) plasma (LyP) in a ruggedized container in cooperation with the US Army. This approach overcomes logistical issues associated with use of FFP and use of screened single donor material addresses issues of contamination. A lyophilization process has been established to reproducibly manufacture lyophilized plasma derived from individual donors and demonstrates preservation of coagulation function.

SOMA, INC: HUMAN-CENTERED INNOVATION

Stevan Wittenbrock

SoMA, Inc.

39 SoMA, Inc. is a design and innovation consulting firm. We thoroughly understand product design and development – the front and back-end challenges, the nuances and the process. Our skills and experience have allowed us to deliver successful turnkey product development programs for start-ups and Fortune 50 companies in more than 40 industries. SoMA's creative team includes talented industrial designers, u/x designers, mechanical engineers, anthropologists, and project managers who have developed innovative solutions in the medical, consumer, aviation, industrial, and military fields. Our approach defines consumer archetypes and context-specific scenarios: goals and objectives that shape the subtleties of form and the structure of an experience framework. We aggressively pursue disruptive ideas that lead to compelling products, communications, and services that people choose to use. Our actions and their related results lead to unique intellectual property.

The Innovation Incentive

Oregon's public universities are idea incubators. In the past two decades, these dynamic institutions have developed a strong track record of translating those ideas into marketable products and processes. This translation of ideas from lab to market benefits faculty and students, who learn how to turn research and technologies into business opportunities; institutions, which have the potential to receive additional funds to further their research, education and outreach missions; and the Oregon economy, which grows with new products, companies and jobs based on university research.

However, translation of research into commercial application requires support. The risks associated with a new technology's early stages can deter outside investment. The University Venture Development Fund addresses this need, providing a significant state tax credit to donors who support new discoveries from Oregon universities.

To Learn More or Participate

More detailed information is available at www.ous.edu/venturefund

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Innovate | Collaborate | Oregon

About ICOregon (www.icoregon.net)

Innovate|Collaborate|Oregon is a partnership of Oregon's four premier research universities: Oregon Health & Science University, Oregon State University, Portland State University, and the University of Oregon. The universities have launched a website to promote interaction between industry and Oregon research universities. The Innovate, Collaborate, Oregon site incorporates a searchable technology portal allowing visitors to identify and learn more about promising discoveries and collaboration opportunities at Oregon's universities.

Oregon universities collaborate with entrepreneurs, companies and the business community to ensure that ideas generated by faculty, students and staff reach the private sector to create products and services which benefit the public. Innovate, Collaborate, Oregon will allow greater industry access to the latest advances in university research and enable the universities to generate resources to continue academic research. It also provides the public with an opportunity to learn more about world-class research in the State of Oregon.

Oregon's public research universities collaborate on initiatives in addition to Innovate Collaborate Oregon, including the University Venture Development Fund, The Oregon Innovation Showcase and participation in Oregon's Signature Research Centers (ONAMI, BEST, and OTRADI).