collaborate • innovate • educate

July 2015

NHHPC eNews

Your source of information created by NHHPC members, for NHHPC members

Welcome New Members

We are proud to announce that the NHHPC now has over 150 member organizations! Please welcome our newest members:

- Battelle
- Carlow International Incorporated
- Center for Smart Defense
- DB Consulting Inc.
- Delafield Solutions
- Jacobs
- KarEntertainment, Inc.
- Les Mills International
- Lockheed Martin
- UK Space Life and Biomedical Sciences Association
- Technology Collaboration Center of Houston
- Waitematat District Health Board

Next Workshop for NHHPC Members set for April, 2016, see p. 2 for details.

A Note from the Director

Dr. Jeffrey R. Davis - NHHPC Director

Welcome to the latest edition of NHHPC eNews! Here you'll read about recent accomplishments in advancing human health and performance innovations from our member organizations, our plans for a Spring 2016 workshop for NHHPC members, and a summary and links to information presented at our most recent workshop on Innovation through Co-development: Engaging Partners. I am also pleased to announce that we are joining forces with The Technology Collaboration Center of Houston to provide us with new options for advancing the NHHPC mission for the benefit of all member organizations—I'm excited about the expanded possibilities this effort offers for all. Please read on to learn more, and check the NHHPC website for updates and information on this collaboration and how you can participate when we launch the new and improved site this summer. I hope you enjoy this issue, and as always we encourage you to share your own member updates for future editions of the NHHPC eNews!

- *Jeff*

NHHPC News

Precision Medicine: Announcement of the Next Workshop for NHHPC Members

We are excited to announce that the next workshop and networking event for NHHPC members will be held April 20, 2016 in conjunction with the Technology Collaboration Center of Houston and hosted by Rice University at the BioScience Research Collaborative in Houston, TX. The topic of this interactive one-day event will be Precision Medicine, where we'll explore future changes in healthcare including genomics and health, data sharing, mHealth technologies, and other areas of interest relative to medical decisions and practices tailored to the individual. Stay tuned for more information coming soon!

If you weren't able to attend our last workshop on Innovation through Co-development: Engaging Partners that addressed ways to successfully engage partners and stakeholders, global strategies for collaborative innovation, and models for co-development, please visit our website for links to presentations from our keynote speakers and panel members on co-development successes and challenges, as well as summaries of the four interactive breakout sessions. Attendees had the opportunity to interact with each other one-on-one at the meeting and at the networking reception held the evening before the workshop. Thanks to all who participated for making this a compelling and productive event!

Daniel Kraft TalkMARS at NASA Johnson Space Center (JSC): "The Future of Health and Medicine: Where Can Technology Take Us?"

The Human Health and Performance (HH&P) Directorate Innovation Lecture Series was pleased to bring Daniel Kraft, MD to speak to the JSC community in conjunction with the JSC Innovation 2015: Mars Week. Dr. Kraft spoke about his vision of the future of health and medical technologies. Dr. Kraft has over 20 years of experience in clinical practice, biomedical research and healthcare innovation, and chairs the Medicine track for Singularity University. He is Founding Executive Director of Exponential Medicine, a program which explores convergent, exponentially developing technologies and their potential in biomedicine and healthcare. His various TEDTalks have over 1 Million Views. His talk kicked off Mars Week at JSC, inspiring the JSC workforce to think about the challenges of a #journeytoMars and why a human mission to Mars is so important.

We want your input!

How are you advancing human health and performance innovations? What are your success stories? Do you have suggestions for NNHPC eNews or workshop topics? Please e-mail at any time.

Member Highlight

NHHPC Joins Forces with the Technology Collaboration Center of Houston

The NHHPC welcomes new member The Technology Collaboration Center (TCC) of Houston, launched this year to facilitate the formation of new joint technology development partnerships. The center was formed with the support of industry, academic and government R&D organizations, with initial partners coming from the space, medical and energy technology sectors. The TCC's primary mission is to serve as a matchmaker – matching organizations with unmet technology challenges with a custom team of partners for jointly developing solutions.

The center is partnering with the NHHPC and other similar organizations, helping their communities solve problems through collaboration with an expanded pool of potential partners across multiple technology sectors.

The TCC launched two programs in 2015. The primary program is the Collaboration Concierge Service – a matchmaking program to establish new partnerships. Any organization with unmet technology challenges can submit Collaboration Requests to the TCC. The TCC will provide advice on each request, post a public Call for Collaboration Responses, review the responses with the requesting organization, and provide advice on forming a project team. In 2016, the center is planning to add a "Fast Launch" program for utilizing pre-arranged project templates with the center's members to reduce the amount of time required to contract new projects - accelerating the start of the projects. The TCC accepted its first round of Collaboration Requests through June 2, and issued the first public call for Collaboration Responses on June 30.

The TCC's second program is a series of Technologies Events, bringing together organizations with a common interest in specific technologies and the potential for working together.

The first event was conducted in March 2015 on Air Quality Technologies and the second event was held on June 9 at the NASA Johnson Space Center in Houston, TX on Knowledge Management Technologies. A fall event is being planned on Wearable Technologies—check our website for additional information in the upcoming months. Any organization with an interest in these technology areas can attend the event and request an opportunity to present their work or needs related to the technology area.

For more information on the Collaboration Concierge Service, Technology Event series, or joining the TCC's member community, please contact Bob Prochnow, Executive Director, at 281-979-7801, send e-mail to Bob.Prochnow@TCC-Houston.org, or visit the TCC's website at www.TCC-Houston.org.

NASA Human Risk Technology and Research Needs

Visit the NASA Human Risk Technology and Research Needs web page to view NASA's human risk needs and learn how you can engage in research and technology development projects to advance human spaceflight.

Member News

Three Experiments from Space Florida's Space Life Sciences Lab fly to ISS

SpaceX CRS-6, which launched April 14, 2015 to the International Space Station, was packed with a cargo of supplies and experiments. On board were three experiments aimed at advancing human health and performance innovations that were processed and prepared at Space Florida's 'Space Life Sciences Lab', Exploration Park, near Kennedy Space Center.

1. Merck Research Laboratories and CASIS investigate Human Diseases

The first experiment, sponsored by the Center for the Advancement of Science in Space (CASIS), is entitled "Microgravity Growth of Crystalline Monoclonal Antibodies for Pharmaceutical Applications". The payload name is Protein Crystal Growth (PCG)-3. The monoclonal antibodies in this investigation have been developed by the pharmaceutical company Merck Research Laboratories and are being used in drugs designed for the treatment of a variety of human diseases. Merck plans to grow high quality crystals in microgravity to improve drug delivery and purification methods and to determine protein structure.

The PCG-3 team preparing for flight at the SLSL is from left to right - Paul Reichert, Merck Principal Investigator, April Spinale, CASIS Payload Developer, and Ray Polniak, Dynamac Quality Assurance.

2. University of Florida's experiment will measure Bacterial Responses to Spaceflight Stress

Also aboard SpaceX CRS-6 to the ISS was an experiment directed by Drs. Wayne Nicholson and Patricia Fajardo-Cavazos from the University of Florida's Microbiology and Cell Science Department. This experiment will measure the global spaceflight stress responses of two different bacteria, Bacillus subtilis and Staphylococcus epidermidis.

Drs. Nicholson and Fajardo-Cavazos aim to measure how growth in spaceflight microgravity affects the global pattern of gene expression in the two bacteria using a technique known as Whole Transcriptome Shotgun Sequencing (also known as RNA sequencing or "RNA-Seq"). In addition, samples of the bacterial cultures will be screened for their levels of resistance to dozens of antibiotics. The data obtained will be compared to an identical control experiment performed on Earth. The experiments are being performed in hardware specifically developed at Kennedy Space Center for biological research in space, called Biological Research In Canisters, or BRIC. This experiment is the 21st BRIC experiment flown into space.

3. The University of Zurich (UZH), Otto-von-Guericke-University of Magdeburg (OVGU), Airbus, German Space Agency (DLR) and European Space Agency (ESA) partner in TRIPLE LUX A experiment – Studies in Gene, Immune and Cellular responses to single and combined space flight conditions

Member News

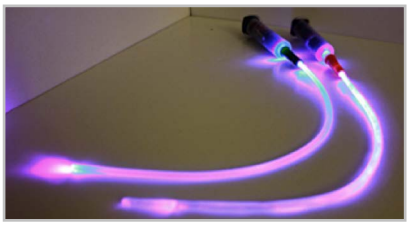
Three Experiments from Space Florida's Space Life Sciences Lab fly to ISS (Continued)

Professor Oliver Ullrich (UZH/OVGU) and Dr. Cora Thiel (UZH/OVGU) headed up preparations for the TRIPLE LUX A experiment, which investigates the oxidative burst reaction of mammalian macrophages during longer periods of microgravity, determines the gravitational threshold for the burst reaction, and will elucidate possible adaptation mechanisms. Phagocytes and the NADPH oxidase enzyme – triggered oxidative burst reactions are part of the ancient innate immune system, and represent the most important barrier for microbes invading the body. An NADPH oxidase enzyme in the early development of life was a success story: there is no evidence of multicellular life without these enzymes. Thus, it could be possible that the gravitational conditions on Earth were one of the requirements and conditions for development of the molecular machinery of the oxidative burst reaction.

Due to their exceeding sensitivity to gravitational changes, immune cells represent an ideal model system to understand how gravity on Earth is required for normal mammalian cell function. They contribute to clarify whether and to which extent gravity is involved in normal cell function, how cell function is impaired by altered gravity, and how cells adapt to the new situation. Knowing the cellular mechanisms of how gravity influences macrophageal cells is an invaluable requirement for the provision of therapeutic or preventive targets to keep the immune systems of astronauts fully functional during long-term space missions. Results can be used for a better risk assessment, development of in vitro tests for medical monitoring or to identify targets for preventive interventions.

NASA Sponsors Earth/Space HH&P Innovation Award at the Rice Business Plan Competition

For the eighth consecutive year, the NASA Human Health and Performance (HH&P) Directorate, along with Wyle, helped judge the annual Rice Business Plan Competition, the world's richest and largest graduate-level student start-up competition which boasts over 3,000 applicant each year.



Light LineTM Catheter

The HH&P team judged the first round of the competition in the life sciences/ biotechnology category. Veritas Medical, a medical device company from the University of Utah, won the HH&P Innovation award for its groundbreaking Light LineTM Catheter which uses high-intensity visible light to kill bacteria, leaving human cells unharmed, while remaining in vivo. The HH&P team saw additional applications for this technology including sanitation of surfaces and clothing for long duration spaceflight. Ultimately, Veritas Medical finished fourth in the overall competition out of the final 42 teams, taking home $137,100 in prize money.

Veritas Medical wins the RBP Innovation Award

Member News

Girlstart: Successful 2015 Girls in STEM Conference

This year's Girls in STEM conference was held on April 11, 2015 with over 600 4th-8th grade girls interested in future STEM (Science, Technology, Engineering and Mathematics) careers participating.

2015 marks the tenth anniversary of Girlstart's annual Girls in STEM event, and featured hands-on STEM education sessions led by 80 professional women working in STEM fields at Austin-area companies. Hanger, Inc. was the keynote presentation and showcased the prosthetic tail and liner it created for Winter -- the famous dolphin from the 2011 feature film Dolphin Tale. During the opening session, the girls were able to create their own prosthetic tails modeled after Winter's tail.

Sessions at this year's conference gave girls the opportunity to perform DNA isolation on strawberries, create an adhesive similar to what's used in tape, and build a city out of candy, to name just three of the fun, hands-on, creative activities that showed girls the range of experiences available in STEM careers.

Highlights from the conference may be viewed at www.girlstart.org/video.

MoSAIC Project

A range of needs exist for medications with extended shelf lives and minimal storage constraints to support space exploration and address unmet global needs on Earth. HESI is leading a collaborative multi-sector project with NASA called MoSAIC (Medicine StAbility Innovation Collaboration), aimed at identifying ways to modify medication to provide longer shelf lives to make them more appropriate for use during human space exploration and to meet global health needs in underserved communities. A feasibility study and potential framework for collaboration is currently under development.

Keep up-to-date on Twitter

Did you know the NHHPC is on Twitter? Follow us at @NASAHumanHealth for the latest member news, events, collaborative opportunities and updates. We have acquired over 1,000 followers over the last year! Don't miss out and stay up to date.

Member News

Battelle Technology Helps Paralyzed Patient to Use Own Thoughts to Move Hand

Researchers at Battelle, a large nonprofit research and development organization, have invented a multi-step process meant to help paralyzed people move their hands again with their own thoughts. Battelle's Neurobridge technology enabled a patient to use his own thoughts to move his fingers and hand for the first time ever. A team of surgeons and engineers from Battelle and the Ohio State University Wexner Medical Center demonstrated the technology at a special event to several dignitaries, including former NASA astronaut and Ohio senator John Glenn.

Ian Burkhart, a 23-year-old quadriplegic from Dublin, Ohio, was the first patient to use Neurobridge, an electronic neural bypass for spinal cord injuries that reconnects the brain directly to muscles, allowing voluntary and functional control of a paralyzed limb. The technology combines algorithms that learn and decode the user's brain activity and a high-definition muscle stimulation sleeve that translates neural impulses from the brain and transmits new signals to the paralyzed limb.

"It's much like a heart bypass, but instead of bypassing blood, we're actually bypassing electrical signals," said Chad Bouton, research leader at Battelle. "We're taking those signals from the brain, going around the injury, and actually going directly to the muscles."

During a three-hour surgery on April 22, 2014, Ohio State surgeons implanted a chip smaller than a pea onto the motor cortex of Burkhart's brain. The tiny chip interprets brain signals and sends them to a computer, which recodes and sends them to the high-definition electrode stimulation sleeve that stimulates the proper muscles to execute his desired movements. Within a tenth of a second, Burkhart's thoughts are translated into action. For more information, visit www.battelle.org

Battelle Research Leader Chad Bouton, left, and Ian Burkhart, front, show former NASA astronaut and Ohio senator John Glenn how Neurobridge allows Burkhart to be the first paralyzed patient to move his fingers and hands with his own thoughts.

Connecting with Fellow NHHPC Members

Are you interested in connecting with fellow NHHPC members? Any member organization can contact our NHHPC engagement team at nasa-nhhpc@mail.nasa.gov, and we will connect you with the identified point of contact from any other member organization. This will allow us to facilitate collaboration among members while ensuring the privacy of member information. When you contact the NHHPC, please state which member organization you represent and the purpose for your inquiry.

Member News

NASA Leverages Open Innovation to Address VIIP

When NASA started testing astronauts for vision problems after long duration space flight on the International Space Station (ISS), it found that 70% of crewmembers have some manifestation of visual impairment / intracranial pressure (VIIP) symptoms. However, the question remains whether intracranial pressure (ICP) is truly causing the vision impairment. Does the upward fluid shift in microgravity lead to increased pressure behind the eye or are other mechanisms at play? One way to find out would be to quantify ICP in flight —so NASA set out to find a novel technique to measure changes in ICP noninvasively.

VIIP project manager, Jennifer Villarreal, decided to test open innovation to address the issue, and put out a series of innovation challenges using platform providers InnoCentive and Yet.com – each with a different target audience and technique for crowdsourcing. The winning proposal was submitted by a team from UCLA/UCSF that designed an algorithm to mathematically predict ICP using inputs from transcranial Doppler, ECG, and continuous blood pressure waveforms. All of these measures can be collected on board ISS with existing hardware.

The team from UCLA/UCSF has since been incorporated into several VIIP studies sponsored by NASA's Human Research Program, winning two NASA solicitations including the International Life Sciences Research Announcement this year. A spin-off company also won a flight opportunity with NHHPC member CASIS, the ISS National Laboratory's Center for the Advancement of Science in Space, to further advance the algorithm's model using the astronaut population. NASA continues to monitor this technique which may offer tremendous benefits to space exploration and earthbound patients with elevated ICP.

Wyle Researchers Collaborate to Advance Cardiovascular Research

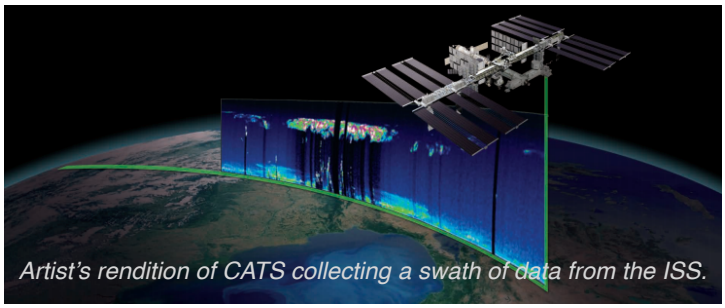
Wyle is engaged in two collaborative projects aimed at advancing cardiovascular knowledge to benefit life in space and on Earth. Wyle researchers have teamed up with University of Texas Medical Branch ophthalmologists to investigate the combined effects of head-down tilt and moderately elevated carbon dioxide exposure on vascular and ocular structural and functional measures. Their work is being funded by a recent NASA Human Research Program (HRP) Omnibus award.

In addition, the Wyle Cardiovascular Laboratory teamed with a genetics researcher group led by Dr. Brinda Rana at the University of California-San Diego to address HRP defined cardiovascular risks and knowledge gaps. This team was funded to conduct two Twins Studies to investigate the genomic, metabolomic, and proteomic aspects of the space flight-related cardiovascular disease risk and the vision impairment/intracranial pressure syndrome. The team was also selected last Fall to submit a Step II proposal for the current NASA Research Announcement solicitation.

Member News

Orion's Quest - Another Exciting Year

Entering its second decade of bringing STEM excitement into secondary school classrooms, Orion's Quest (OQ), a non-profit education outreach, has had another exciting year. We collaborate with NASA and NASA funded scientists whose research is currently on the International Space Station (ISS). OQ creates a short, 3 to 6 class period, curriculum bringing this research into classroom via our website. Just as the scientist does, students study, make observations and record data from video or photos downlinked from the ISS. Student data is then sent to the scientist through the OQ website for analysis and possible inclusion in the published results. The research is motivating, exciting and most importantly, authentic.



Artist's rendition of CATS collecting a swath of data from the ISS.

Our current "mission" on station is the research being done by Dr. Cheryl Nickerson of the Biodesign Institute at Arizona State University. In previous research, Dr. Nickerson has determined that Salmonella is more virulent in microgravity. (Not a good thing if you are planning long duration space travel.) In this current research, her team has infected C.elegans worms with Salmonella and will be studying the effect of three different additives to their growth media to determine if the virulence can be reduced. Much has been learned on Earth but the true test must come in the microgravity of the ISS. Orion's Quest students will be recording the death rates of the worms. With over 2,000 students already involved this spring, it is amazing to see how far technology has come in the classrooms where students using laptops or tablets make observations and record the data using video sent from space. In a decade we have come from moderate quality still photos to high quality video analysis.

Orion's Quest has an additional "mission" at this time based on the Cloud-Aerosol Transport System (CATS) that has been transported to the ISS. This mission is in support of the Michigan Aerospace Corporation who, in cooperation with Goddard Space Center, developed the optics for the CATS system. This project is intended for elementary and early middle school students and focuses on the launch, the delivery and the deployment of the system onboard the ISS. Our goal here is to increase the interest and excitement of younger students in space activities.

It's been a wonderful and fulfilling ten years for Orion's Quest and the 2015-2016 years promises to be just as exciting.

TEDx Featuring Hello Healthcare's York Zucchi

York Zucchi

One of the mandates of the NHHPC is to research ways to deliver healthcare services to space or difficult to access areas…York Zucchi, who founded the NHHPC member company Hello Healthcare, recently did a TEDx talk on the opportunity to make the delivery of healthcare services in difficult to reach areas (such as Africa) more sustainable if combined with entrepreneurial thinking. His talk is available on YouTube.

Member News

Space Florida and the German Aerospace Center (DLR), sign SOU

Space Florida and the German Aerospace Center (DLR), Microgravity Research and Life Sciences, recently signed a Statement of Understanding (SOU). The intent of this SOU is to enable Space Florida and DLR to collaborate in the goal of expansion of International Space Station (ISS) research technologies as well as international cooperation between Florida and Germany. The specific focus of the SOU will be in the areas of aerospace and microgravity research, sub-orbital and orbital space flights, research and development towards payload development to the ISS, small satellite launch services and support, student STEM support and related activities at the Space Life Sciences Laboratory (SLSL), and other facilities in Florida.

Space Florida has entered into this SOU with DLR in the light of DLR's financial support and collaboration with the University of Zurich (UZH), a tenant at the SLSL, as well as Aarhus University, Denmark.

To date, DLR has supported three ISS experiments which were processed at the SLSL:

1. The CELLBOX Experiment (PI Professor Oliver Ullrich), was processed and launched through a partnership between DLR, Airbus Defense & Space and NanoRacks LLC. CELLBOX set out to understand how the architecture and function of human cells is related to gravitational force. The experiment was launched aboard the SpaceX CRS-3 Mission to the ISS on April 18, 2014.
2. Aarhus University Denmark (PI Dr. Daniela Grimm MD) prepared the CELLBOX-Thyroid research study at the Space Life Sciences Laboratory (SLSL). The experiment was flown on SpaceX CRS-3, on April 18th 2014. In their investigations, Dr. Grimm and her team are seeking answers to questions about the nature of Thyroid cancer cells. With the Microgravity on Human Thyroid Carcinoma Cells (Cellbox-Thyroid) study, recently conducted in orbit on the ISS, the hope is to reveal answers that will help in the fight against thyroid cancer.
3. Professor Oliver Ullrich, Dr. Cora Thiel and their scientific team in the TripleLux experiment, are studying the long-term effects of the space environment of microgravity as well as the effects of space radiation, on astronauts. TripleLux was launched aboard the SpaceX CRS-6 Mission to the ISS on April 13, 2015.

Scientists know that long-term space missions present a number of risks for astronauts. Some effects of the space environment level appear to act at the cellular level and it is important to understand the underlying mechanisms of these effects.

ESA astronaut Samantha Cristoforetti working with ESA's Kubik centrifuge on the ISS for the Triplelux experiment.