



The KSIRC Report • Summer 2012

U OF KENTUCKY SPINAL CORD INJURY RESEARCH CENTER

2011 Bumper year of KSCIRC trainee graduates!

The KSCIRC had an outstanding year in 2011 of trainees receiving their degrees. Sarah Elizabeth Couch MSc, Mentor Jeffrey C. Petruska, Ph.D. (Sarah has gone on to teach at a community college with an eye on going on to medical school); Sean A. Trusty MSc, Mentor Jeffrey C. Petruska (Sean is a first year medical student at UofL's medical school); Sheila A. Arnold, Ph.D., Mentor Theo Hagg, M.D., Ph.D. (Sheila is a Postdoctoral Fellow in Dr. Hagg's lab); Daniela Terson De Paleville, Ph.D., Mentor Susan J. Harkema, Ph.D. (Daniela is assistant

professor in the Department of Exercise Physiology (Belknap campus) she will also be working at the Neuroscience Collaborative Center with Dr. Harkema working on neurophysiological assessments and the effect of locomotor training after SCI); Ruthie S. Fligor, MEng, Mentor David S.K. Magnuson; (Ruthie has been accepted to both UofL and UofK Medical Schools, she just has to decide whether she is Red or Blue. She came to KSCIRC as a collaboration between KSCIRC and the Speed School); Scott Carl Smith, Ph.D., Mentor Michael Hetman, M.D., Ph.D.

(Scott has taken a Postdoc position at Emory University); Toros A. Dincman, Ph.D., Mentor Scott R. Whittemore, Ph.D. (Toros, a student in the M.D./Ph.D. program completed his Ph.D. and has gone back to medical school to complete that degree).



New Appointment

Theo Hagg, M.D., Ph.D. has been named Associate Scientific Director of the KSCIRC.

KSCHIRT Symposium

*The 2011 KSCHIRT Symposium was held in Louisville, May 19-20, 2011. Seventeen speakers from all over the world gave lectures on their most recent research. **Front Row Left:** Akira Chiba, Ph.D., University of Miami; David O. Okonkwo, M.D., Ph.D., University of Pittsburgh; Victor F. Rafuse, Ph.D., Dalhousie University; Vittorio Gallo, Ph.D., George Washington University/Children's National Medical Center; Michael W. Salter, M.D., Ph.D., Hospital for Sick Children, Toronto. **Second Row Left:** John P. Svaren, Ph.D., University of Wisconsin; Warren M. Grill, Ph.D., Duke University; Stacy Elliott, M.D., University of British Columbia; Benjamin D. Philpot, Ph.D., University of North Carolina/Chapel Hill; James W. Grau, Texas A&M University; Timothy C. Cope, Ph.D., Wright State University; Charles J. Heckman, Ph.D., Northwestern University School of Medicine. **Third Row Left:** Timothy J. Brennan, M.D., Ph.D., University of Iowa College of Medicine; Jacek Jaworski, Ph.D., Intern. Institute of Molecular and Cell Biology, Poland; E. Paul*

Zehr, University of Victoria, Canada. Those not pictured: Bruce D. Trapp, Ph.D., The Ohio State University/Cleveland Clinic; Anthony DiMarco, M. D., University of Victoria, Victoria British

Columbia; Evan Snyder, M.D., Ph.D., Sanford-Burham Medical Research Institute, La Jolla, California.



Research is tedious. It is extensive, intrusive, and requires hours of repetitive experiments and constant review of collected data in hopes that results from an assumed hypothesis can be proven. Our researchers spend hours upon hours in labs, working with animals, working with patients, hoping for consistent results each time a test is performed. The commitment to research can be overwhelming, but the results are often rewarding.

It goes without saying that 2011 was an exciting year for research breakthroughs, and the spotlight on our department, our research facilities, our team, and our city has never been brighter. For those living with spinal cord injuries, for their family and friends, the name Rob Summers has become a beacon of hope. After a tragic hit and run accident that left Rob paralyzed in the summer of 2006, doctors told Rob that he would never walk again.

Rob begged to differ.

He moved from his home in Oregon to Louisville, joining Dr. Harkema's locomotor training rehabilitation program, a part of the Kentucky Spinal Cord Injury Research Center. Rob went through

a few years of extensive locomotor training, 80 sessions of working with rehab specialists who strapped him into a weight-bearing harness above a treadmill, moving his legs and his feet in repetitive walking motions. He also went through 80 sessions of rehab where he would move from a sitting to a standing position.

In December 2009, we implanted an epidural spinal cord stimulator. No more than a couple of inches wide, the stimulator and battery pack sits on the lower part of his spine. Just like a hearing aid magnifies sound for a hearing impaired person, the epidural stimulator does the same for the spinal cord by allowing it to be more aware of its environment. In other words – when on, the stimulator 'wakes up' the spinal cord so that signals are received.

As researchers, we always hope for the outcome we hypothesize when conducting our projects. With successful results comes grant funding and the desire to duplicate results to prove that we are right, that what we thought to be true is no longer a hope, but a fact. But then we have moments where not only do we find what we were hoping

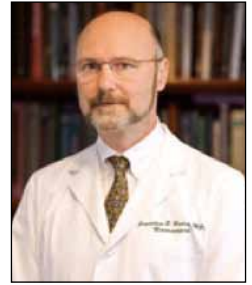
for, but we find something extra. Something no one anticipated. It was during Rob's spinal cord stimulation sessions seven months after implementation when we discovered 'the icing on the cake' of our research. When the stimulator device was on, Rob was able to somewhat control movement on his legs and wiggle his toes on command.

Today Rob resides in Los Angeles, where he continues to work on his rehab. His overall health has improved, and he continues to make progress.

With an assistive device at home he uses for rehab, he is able to pull himself upright, standing while bearing 100% of his weight as he practices his standing and stepping with the stimulator during the two hours a day he is allotted to use the device.

The response from the medical community, both at home and around the world, has been astounding. People wishing to participate in our trial have flooded our offices with calls and continue to do so to this day. Our physicians have been contacted to see VIP patients halfway across the world. People are interested in what we are doing at the University of Louisville, at Frazier Rehabilitation and Neuroscience Institute Center, and we are currently in the process of filling the remaining two open spots of this trial out of the thousands of people who have applied. Two patients since Rob have been going through the locomotor training and have had the stimulator implanted. We hope to have publishable results available to share with the public and our supporters soon. It is the support from groups such as the Christopher and Dana Reeve Foundation, University of Louisville, California Institute of Technology, UCLA, Jewish Hospital and St. Mary's Healthcare, and Frazier Rehabilitation and Neuroscience Institute that make these research breakthroughs in healthcare successful. We are already looking to the future, determined to create more success stories like Rob, and showing the world that here at the University of Louisville, the promise of a limitless future for those with spinal cord injuries is more than possible – but becoming a reality.

On behalf of our entire department, I thank you for your continued support as we look to the future.



Recipient Rob Summer after receiving the epidural stimulator

Pictured are left to right collaborators, V. Reggie Edgerton, Professor, UCLA, Susan J. Harkema, Professor, Univ. of Louisville, Rob Summers, Joel Burdick, Professor, Cal Tech, and Yuri Gerasimeknko, Professor, UCLA.

TRAINEE ACHIEVERS

The KSCIRC trainee program is outstanding. Mentoring students is paramount to both the current and future success of the KSCIRC research program. Our faculty take this endeavor very seriously which, in turn, shows up in the number of trainees who win top awards at UofL poster competitions.

2011 Research! Louisville



Aruna Vaishishta, Ph.D. Postdoctoral Associate and **Scott Smith, Ph.D. Candidate** and their Mentor Michal Hetman, M.D., Ph.D. was the first place co-winner in

the Postdoctoral category. The title of her poster was: "Enhancement of DNA damage neurotoxicity by pharmacological inhibition of histone deacetylases." This research focused on the effect of HDAC inhibitors (currently used as an anti-cancer drug as well as in the treatment of various neurodegenerative diseases) on forebrain neurons in the context with DNA damage that might be related with mild cognitive impairment.



Sujata Saraswat Ohri, Ph.D., Mentor: Scott R. Whittemore, Ph.D. was also first place co-winner in the Postdoctoral Fellow

Research Associate category. The title of her poster was: "Salubrin improves functional recovery after SCI by targeting the ER stress response pathway." This research identified a novel class of pharmacological agents, current in clinical trials for other diseases that may prove therapeutically useful in the treatment of CNS trauma and neurodegenerative diseases.



Scott C. Smith, doctoral basic science graduate student, Mentor: Michal Hetman, M.D., Ph.D. won third place in the graduate student category.

The title of his poster was "ATM is a novel regulator of nucleolar transcription".

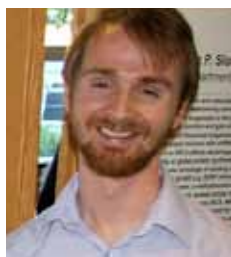
"ATM, (the protein ataxia-telangiectasia mutated – not your banking machine), a signaling molecule integral to the DNA damage response, also regulates the synthesis of the protein building machinery known as ribosomes in neurons. This work identified a previously undescribed intracellular pathway that may contribute to the CNS neurodegeneration.

2012 Neuroscience Day Trainee Winners



Nicholas J. Kuypers, Ph.D. candidate, Mentor: Scott R. Whittemore, was Co-2nd place in the graduate student category. The title

of his poster was: "Dynamically regulated oligodendrocyte precursor cell (OPC) microRNAs during cuprizone induced demyelination and remyelination." The research focuses on identifying cellular molecules that will aid in the development of therapeutic strategies to prevent functional loss and/or enhance the natural repair process following spinal cord injury and other demyelinating neurological diseases such as Multiple Sclerosis.



Matt Keasey, Ph.D., Mentor: Theo Hagg, M.D., Ph.D., first place in the postdoc category. The title of his poster was

"CNTF expression is suppressed by a specific Thy-1-integrin-FAK signaling pathway". This research identifies an important new signaling pathway that can be targeted with pharmacological drugs to increase CNTF, a neuroprotective molecule in the brain and spinal cord.



April Herrity, Ph.D. candidate, Mentor: Charles Hubscher, Ph.D. was Co-2nd place award winner in the graduate student category. Her

poster was "Body weight supported treadmill training decreases at-level allodynia following spinal cord injury in male rats." This research looks at locomotor training after SCI as a rehabilitative therapy that not only can enhance recover of walking, but shown here reduces the clinically important complications of post-SCI pain.

Student Collaboration in Biomedical Engineering Co-op Category



Ruthie Fligor, Co-op graduate student in Bioengineering, Mentor: David S.K. Magnuson Ph.D. won 1st place in the student collaboration

in biomedical engineering (Co-op) category for her poster titled "Quantifying overground locomotion in spinal cord injured rats and mice using engineering design concepts." The goal of this work was to design and test a device to measure ground reaction forces of the rat paws during overground stepping after SCI. Six Bioengineering Co-op students, (**Erik Seibt, Tim Chea, Ishita Jain, Nihit Bajaj, Katie Donaldson, Erin Smith**) contributed to this research.

FACULTY SPOTLIGHT Mary Ellen Buning, Ph.D., Assistant Professor of Neurological Surgery

Dr. Buning joined the faculty of KSCIRC just over two years ago. She is an occupational therapist and clinical educator/researcher with a specialty in assistive technology (AT) and a PhD in Rehabilitation Science from the University of Pittsburgh. AT is the term used to describe all of the ways that today's microprocessor technologies along with user-centered evaluation and the principles of biomechanics and universal design can be used to make full participation possible for individuals with spinal cord injury.

In the time she has been here, she has developed an AT program at Frazier Rehab Institute, which now includes wheelchair seating and mobility and alternative and augmentative communication services. Her next focus at Frazier is building the adaptive computer access program and

continuing in the process of developing an interdisciplinary rehabilitation engineering and assistive technology graduate certificate with colleagues in the Speed School of Engineering. As the neuroscientists work to translate laboratory findings into patient treatment and recovery, Dr. Buning has been quick to grasp the contribution of the right wheelchairs and seating technologies. They can support continued recovery in outpatient therapy while allowing the compensation that enables returning to work or school and participating with family and friends in the community. She stays current on research that supports best practice and prevention of secondary disabilities such as pressure ulcers, upper limb injury, and postural collapse. She has an interest in developing and testing of new technologies and

has also helped research engineers test concepts. A new project, about to begin will test user response to a power wheelchair equipped with changeable position for the drive wheels—a feature that will improve performance indoors and out. Her current funded research is focused on the contribution of crash tested wheelchairs when used by kids who sit in them on school buses.



Grants Acquired and Gifts Received for KSCIRC and Department of Neurological Surgery

Pictured here, President James Ramsey, Susan J. Harkema, Ph.D., Owsley Frazier Endowed Chair, Professor Department of Neurological Surgery and Frazier Neuroscience Collaborative Center, Rehabilitation Director, KSCIRC; and Jonathan E. Hodes, M.D., Chair Department of Neurological Surgery at the May 24, 2012, news conference where Dr. Ramsey announced the Helmsley Charitable Trust's, gift of \$2 million dollars to Dr. Susan Harkema. The funds will help researchers to continue their efforts in electrical stimulation which allows patients mobility.



New Neurosurgery Basic Research Grant Awards

January 1, 2011 thru June 30, 2012

Recipient	Sponsor	Total Award	Award Term
David S. K. Magnuson	KSCHIRT	300,000	3 Years
David S. K. Magnuson	NIH/NINDS	372,955	1 Year
Theo Hagg and			
Scott R. Whittemore	NIH/NINDS	2,214,411	5 Years
Scott R. Whittemore	NIH/NIGMS	5,521,551	5 Years
Scott R. Whittemore and	NIH/NINDS	2,201,754	5 Years
Michal Hetman			
Jeffrey Petruska	KSCHIRT	300,000	3 Years
Jeffrey Petruska	NIH/NINDS	411,250	2 Years
Alexander Ovechkin	KSCHIRT	300,000	3 Years
Alexander Ovechkin	Neilson Foundation	316,429	2 Years
Alexander Ovechkin	NIH/NINDS	1,235,017	5 Years
Maxwell Boakye	PRA International	143,199	1 Year
Susan Harkema	KSCHIRT	300,000	3 Years
Susan Harkema	Kessler	107,703	3 Years
Susan Harkema	Christopher Reeve Foundation	1,200,000	1 Year

Miracle Dancers

Pictured are the Miracle Dancers of Louisville, Kentucky who performed at the 2011 KSCHIRT Symposium. The director, Diane Moore has a very dynamic dance studio in Louisville. Among her students are those with special needs who love music and dance. Their disabilities range from spinal cord injury and spina bifida to name just a few. These are kids who want to dance and Ms. Diane has found a way to integrate these students with the help of physically able students in her studio to form the Miracle Dancers group. When the group performed at the 2011 KSCHIRT symposium there wasn't a dry eye in the room. After their show, one of the attendees standing with a group discussing the dancers said "I've been to a lot of symposiums, but I'll remember this one; and on Monday morning, I'm going to go to work a half hour early so I can work even harder to help these kids."



Michael Brent Resource Room at Frazier Rehab

The Michael Brent Resource Center at Frazier Rehab located on the 11th floor was dedicated April 2011 in memory of Michael Brent who sustained a spinal cord injury July 27, 1997 which left him a quadriplegic. The Center is a lending library for books, magazines, DVDs, and CDs. It also has computers in the room which are adapted to assist those with disabilities access to the internet. These resources are open to patients and their families with information regarding spinal cord injuries and other motor disabilities. It is also a room used for families to meet with the teams that work with their family member. The Center is supported by Friends For Michael, Inc. which is the non-profit organization founded for Michael to raise funds for spinal cord injury research, educational awareness of spinal cord injury and helping patients who have sustained spinal cord injuries. Michael passed away suddenly in 2007 but his legacy lives on through the group.

STUDENT SPOTLIGHT Krista Caudle, B.S.



Krista L. Caudle, born in Charlotte, NC, was an equestrian competitor as a child and young adult, and was confident that horses would influence her life and career path. Krista's mother was a rehabilitation horseback-riding instructor for Special Olympics in the 90's and Krista's plan was to become a professional horse show judge. She earned undergraduate degrees in Biology and Psychology at the University of North Carolina at Charlotte and studied spinal cord circuitry with a professor that helped her integrate the study of horses' movement with how the spinal cord directly controls locomotion in the central pattern generator (CPG).

UofL and KSCIIRC was Krista's top choice for graduate school because of the access to a unique combination of two professors, David Magnuson, Ph.D. and Susan Harkema, Ph.D., both working on the CPG and rehabilitation after SCI. The openness with which the professors foster collaboration and allow students to see science at the bench and in the clinic is ideal for achieving the greatest good for patients and advancing our field.

"It's the ideal scientific atmosphere to have Dr. Magnuson studying the CPG in the rat animal model right across the street from Dr. Harkema accessing the CPG using treadmill step training with patients in the Frazier Rehab clinic."

Since starting the Ph.D. program in 2006 with the Department of Anatomical Sciences and Neurobiology, Krista's dissertation topic has become focused in the findings of the Magnuson lab. The main idea is that locomotor movement of the hindlimbs should begin very soon after SCI in order to preserve and maintain function that can be rehab trained and

refined later. The use of wheelchairs, a necessity for SCI patients, is found to inhibit movement of the hindlimbs in the animal model, so her project tests the effects of immobilization by placing rats in wheelchairs after SCI. Krista's dissertation topic: ***Wheelchair immobilization alters functional recovery after SCI*** has been recognized at UofL poster competitions and she was recently awarded the opportunity to speak at the National Neurotrauma Society Annual Meeting.

Krista has roots in Kentucky; her mother's family is originally from Louisville and her grandparents retired to Hardin County. In her free time Krista enjoys outside activities on the family farm like hiking the cliffs and gardening. Krista has kept her passion for horses alive and taken advantage of living in the Blue Grass State by attending equestrian activities involving Churchill Downs and the FEI World Equestrian Games.

Krista is preparing to defend her thesis in the next few months.

Kentucky Spinal Cord Injury Research Center
University of Louisville
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Louisville, KY 40292



Kentucky Spinal Cord Injury Research Center

Yes, I want to help support research and education at the Kentucky Spinal Cord Injury Research Center so that we can find new treatments for these devastating injuries.

Enclosed please find my tax-deductible contribution of _____ \$ OR

I pledge a contribution of \$ _____ to KSCIRC over _____ years.

☐ Yes, please send me regular reminders

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My gift is in honor of/memory of (*circle one*):

If you would like to designate how your contribution will be allocated, please express your wishes below. If you do not specify an allocation, the funds will be used where there is the most need.

Please mail this form and your payment to:

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(502) 852-6486 or
ryan.coady@louisville.edu*

