PhD Program in Public and Community Health

Goal

To enhance the breadth and depth of research expertise in public and community health with an emphasis on training the next generation of research scientists in population health.

Background

The Medical College of Wisconsin (MCW) developed a doctoral program in public health to enhance training opportunities for public health professionals.

To further MCW's fourth mission of community engagement, the program was developed with a special focus on community-based participatory research to provide students with opportunities and experience engaging with the community to develop and implement health improvement research projects.

Award Summary

Once MCW's PhD Program in Public and Community Health developed its curriculum, the project staff worked to establish its academic reputation and community engagement focus in order to attract highly-qualified candidates. So far, four students have completed their doctoral degree in the program.

Once the program was ready to graduate its first cohort in 2012, project leaders and staff conducted a self-study to identify areas for future growth. A faculty retreat was held in early 2013 so that faculty could discuss results from the self-study and determine how to implement the suggestions for future development. One such suggestion focused on enhancing the curriculum with new courses, and in 2013 the program offered one of the new courses developed in response to the self-study. Another strategic direction involved the recruitment of additional qualified faculty from around MCW to teach and serve as dissertation advisors. All of the identified changes supported the continuation of the PhD Program's mission of educating individuals who work to improve the health status of the residents of Milwaukee and Wisconsin.

Dina Garcia, MPH, is a doctoral candidate in Public and Community Health at the Medical College of Wisconsin.

Also at this time, the new cohort of students took initiative to create new partnerships and become involved in more projects both within MCW and within the greater Milwaukee Community. Several students served as facilitators for the Medical Ethics and Palliative Medicine course for second year medical students. They each lead small group discussion sessions for the medical students. Two students taught undergraduate public health courses at Carroll University gaining invaluable experiences.

Faculty members and students have worked to maintain existing community partnerships and develop new partnerships. In addition, program faculty members, staff and students have emphasized the submission of research and training grants, which led to two Ruth L. Kirschstein National Research Service Awards for Individual Predoctoral Fellows and a Robert Wood Johnson Foundation Public Health Services and System Research award.

Relevance

The fourth mission of the Medical College of Wisconsin is to improve the health of the communities that the institution serves.

This project seeks to advance that mission by training new experts with an emphasis on community-based participatory research.

Significance to Science and Health

Students graduating from this doctoral program will improve the level of expertise in Wisconsin's public health workforce and increase the Medical College of Wisconsin's involvement in community-based participatory research in Milwaukee and throughout the state.

Laura Cassidy, MS, PhD,
Institute for Health and Society

This award was funded by the Advancing a Healthier Wisconsin endowment of the Medical College of Wisconsin.

Program in Regenerative Medicine: New Faculty Recruitment

Goal

To recruit two faculty members into the Regenerative Medicine program at the Medical College of Wisconsin (MCW) to develop a program that will be a national leader in stem cell biology.

Background

Scientists affiliated with the Regenerative Medicine program study stem cell biology to better understand how stem cells develop into the myriad of different cells, tissues, and organs that comprise the human body.

Through this understanding, the program's researchers seek to contribute to better treatments for Crohn's disease and spinal muscular atrophy, as well as a wide range of other diseases in need of more effective treatments.

Stephen A. Duncan, DPhil, Marcus Professor of Human and Molecular Genetics; Vice-Chairman of Cell Biology, Neurobiology and Anatomy; Director of MCW's Program in Regenerative Medicine and Stem Cell Biology

Relevance

According to the Crohn's and Colitis Foundation of America, an estimated 700,000 Americans may suffer from Crohn's disease.

Also, between 10,000 and 25,000 children and adults suffer from spinal muscular atrophy, a group of diseases in which the muscular system weakens over time.

Significance to Science and Health

The results from these studies may lead to better treatment for intestinal disorders like Crohn's disease, and for the group of deadly pediatric diseases that cause spinal muscular atrophy.

Award Summary

Between 2008 and 2011, Michelle A. Battle, PhD, Associate Professor of Cell Biology, Neurobiology and Anatomy, and Allison D. Ebert, PhD, Assistant Professor of Cell Biology, Neurobiology and Anatomy, joined MCW and the Regenerative Medicine program. Dr. Battle is an expert on diseases afflicting the gastrointestinal system, whereas Dr. Ebert studies diseases of the nervous system.

The Battle lab studied intestinal development. In addition to using rodent models, the researchers also utilized an innovative system in which normal cells are induced by a laboratory technique into becoming stem cells, and then are directed to develop into small structures resembling intestines called intestinal organoids. Stem cells produced with this technique are called induced pluripotent stem cells.

This work including describing the role of a cell adhesion protein, E-cadherin, in the development of the tissue that lines the intestines. Dr. Battle disseminated her findings by publishing five manuscripts in academic journals, including Nature Medicine and Journal of Hepatology. Dr. Battle also shared her work by presenting at local, national and international conferences and meetings, including the 2011 meeting of the Society for Developmental Biology.

Four local and national funders awarded Dr. Battle approximately $1.4 million to continue her research, including the National Institutes of Health's National Institute of Diabetes and Digestive and Kidney Diseases.

Not long after joining the Regenerative Medicine program, Dr. Ebert found abnormal properties in astrocytes, the support cells of the nervous system, which may contribute to the nerve cell loss implicated in a fatal, pediatric genetic disease called Spinal muscular atrophy (SMA). Dr. Ebert generated data suggesting that an insufficient amount of proteins and hormones supporting cell growth, known as growth factors, may directly influence loss of nerve cells. Another direct influence may come from changes in the ways the support cells use calcium ions to send signals to other cells.

Dr. Ebert is also conducting a number of research projects that use induced pluripotent stem cell technology to study Parkinson's disease, amyotrophic lateral sclerosis (ALS, or Lou Gehrig's disease) and muscular dystrophy. To share the results from these various studies, the Ebert lab published three manuscripts in scholarly journals including Stem Cell Research and American Journal of Human Genetics. Dr. Ebert also shared her work by presenting at local, national and international conferences and meetings, including the International Society for Stem Cell Research.

This work was funded by the Advancing a Healthier Wisconsin endowment of the Medical College of Wisconsin.

Identifying Novel Synaptic Targets

Goal

To better understand the ability of nerve connections to vary in strength depending on the volume and intensity of messages being transmitted, a phenomenon involved with learning and memory.

Background

Synaptic plasticity is the ability of nerve connections to vary in strength over time in reaction to changes in their activity level.

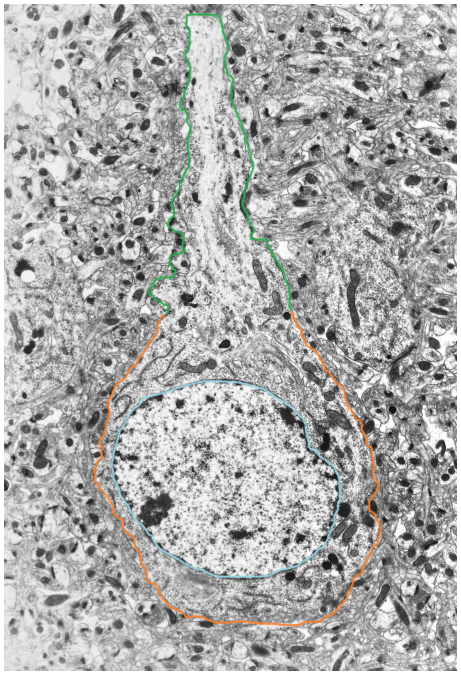
Award Summary

In the first two years, the researchers identified two different genes likely to be involved in the process of varying nerve connection strength, or synaptic plasticity.

Dr. Gerges and his colleagues studied the proteins produced by these genes, and also looked at the effects of relevant mutations on the genes' expressed proteins. The results indicate that the proteins expressed by these two genes are essential for proper nerve connection function and are likely crucial for learning and memory.

One of the two genes was found to be associated with X-Linked Intellectual Disability, a condition experienced by an estimated 16 percent of males with an intellectual disability, which is defined as a deficit in intellectual functioning, determined by an IQ test, and also in social, conceptual and/or practical skills.

The Gerges lab also found that a specific molecule works in nerve connections to regulate two opposing processes that are essential for synaptic function.



A nerve cell is outlined in this magnified image. The cell body is outlined in orange, the nucleus in sky blue. and the axon in green. Image by Dr. Kirsten M. Harris. Available under a Creative Commons 2.0 Generic license at http://commons.wikimedia.org/wiki/File:The_nerve_cell.png.

These processes are the placement and removal of amino acid receptors called AMPA receptors. A proper balance in these two processes is known to be crucial for proper learning and memory.

The researchers found that intellectual disability caused by mutations in this gene is due to the mutations interfering with the body's ability to remove receptors from nerve connections. Nerve cells expressing these mutations end up with an abnormal synaptic plasticity balance.

This finding is an important step toward understanding X-linked Intellectual Disability and may lead to the discovery of new treatment approaches. The study's results are also an important advance in scientific knowledge of the function of the brain in health and in disease.

Relevance

An estimated 11 percent of Wisconsin residents aged 65 or older have Alzheimer's disease. Many others experience difficulty with memory due to a condition called mild cognitive impairment, which involves worse-than-normal declines in memory and increases the risk of developing Alzheimer's disease.

Significance to Science and Health

Synaptic plasticity, the ability of nerve connections to vary in strength over time, is known to be important for learning and memory. A better understanding of this characteristic may lead to the discovery of new treatments for memory deficits.

Nashaat Gerges, PhD,
Cell Biology, Neurobiology and Anatomy

This work was funded by the Advancing a Healthier Wisconsin endowment of the Medical College of Wisconsin.

Support for New Faculty in the Center for Infectious Disease Research

The Center for Infectious Disease at the Medical College of Wisconsin focuses on research into the progression of infectious disease at a molecular level. The Center's scientists study a wide variety of microorganisms, viruses, fungi and parasites.

Goal

To recruit an expert in the critical area of innate and acquired immunity to *Mycobacterium tuberculosis*.

Background

Richard Robinson, PhD, Microbiology and Molecular Genetics, joined the Medical College of Wisconsin (MCW) faculty in 2011. Dr. Robinson is an expert on the innate immune response to tuberculosis (TB).

Award Summary

After joining the MCW faculty, Dr. Robinson and his laboratory have made a number of important advances in understanding how the immune system responds to TB-infection. Dr. Robinson's team discovered a gene, IL12RB1, which must be expressed by immune cells to contain TB-infection. The team shared these findings in a manuscript published in Infection and Immunity, which also reported the results of the first study to show that the gene must function through immune cells called T-cells to generate this control.

The researchers further determined that human immune cells express the IL12RB1 gene as 13 different proteins. Previously, the scientific community had believed that only one protein was encoded by this gene. The Robinson lab reported this discovery in an article in The Journal of Immunology.

Each of the 13 different proteins, called isoforms, potentially has a different function in protecting humans from infection. Dr. Robinson will explore the function of these isoforms through an award leveraged from the National Institutes of Health's National Institute of Allergy and Infectious Diseases. In total, the Robinson lab leveraged more than $300,000 from federal and private sources to further explore different aspects of innate immunity to TB in the hopes of developing new methods of diagnosis or treatment.

In a third publication, in Tuberculosis, Dr. Robinson presented new data showing that the protein (IL-12) which activates the TB control gene is produced by different types of immune system cells throughout the various stages of infection. Given the importance of the IL12RB1 gene to TB control, the production of IL12 could be targeted as a potential TB therapy.

Relevance

Tuberculosis is a serious, highly communicable disease that infects approximately nine million people globally and results in nearly two million deaths each year.

Currently there are few cases in Wisconsin, but trends show an increase in cases that are resistant to several drugs.

Significance to Science and Health

MCW has a focused research effort to develop new immune-based methods for treating TB.

These treatments are also intended to restrict the development of antibiotic resistant strains that are recalcitrant to first-line drugs, which are the most safe and effective drugs that are prescribed first.

Second- and third-line drugs are only used when a patient does not respond to the first-line drug.

Dara Frank, PhD,
Microbiology and Molecular Genetics

This award was funded by the Advancing a Healthier Wisconsin endowment of the Medical College of Wisconsin.