



Stem Cell & Regenerative Medicine Center

UNIVERSITY OF WISCONSIN-MADISON

2020 Update

Dear Colleagues and Friends,

None of us planned to have 2020 unfold the way it did with the COVID-19 pandemic, but it has been inspirational to see how Stem Cell and Regenerative Medicine Center (SCRMC) members and our UW community responded. From developing novel testing technologies for COVID-19 to contributing to the clinical care of COVID-19 patients, SCRMC members have shown the same dedication and resilience that fosters success in more ordinary times. Despite major disruptions in the way that we do research requiring socially distanced experiments and communications primarily by videoconferencing, the remarkable progress continues. Please read on as we highlight just a few of the accomplishments of 2020.

We invite you to join us for [The Single Cell Revolution in Stem Cells: Function from Heterogeneity on April 14, 2021](#) (our 15th Wisconsin Stem Cell Symposium).



*Dr. Timothy Kamp, MD, PhD,
SCRMC Director*

The Symposium is coordinated by the University of Wisconsin–Madison Stem Cell & Regenerative Medicine Center and the BTC Institute. The presentations will not only highlight the approaches to evaluate gene expression and regulation, cellular metabolism, and spatial organization in single cells, but will also describe the computational tools to decipher the biology from these measurements.

Find more details about the presenters, our sponsors and the specific topics on the website. [Registration](#) is open.

*Timothy Kamp, MD, PhD,
SCRMC Director*

**The Single Cell Revolution
in Stem Cells:**
Function from Heterogeneity

April 14, 2021 | Madison, WI

15th
WISCONSIN
STEM CELL
SYMPOSIUM

Image courtesy of Dr. Li-Fang Chu,
Thomson Group, Mergridge Institute
for Research and University of
Wisconsin-Madison

Research highlights from SCRMC faculty

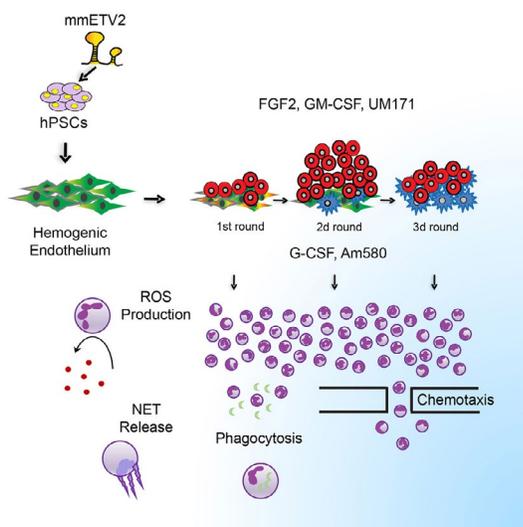
Following are selected 2020 research highlights from UW–Madison [SCRMC faculty members](#) helping to advance research, collaboration, training and education in the field.

Stem cells could help cancer patients fight dangerous infections

Scientists at the UW–Madison have developed a more efficient way to grow white blood cells, which serve as front-line defenders against bacterial infections, but are often depleted as a potentially deadly side effect of cancer treatment.

In 2009, [Igor Slukvin, MD, PhD, professor of pathology and laboratory medicine at the UW School of Medicine and Public Health](#), pioneered transforming stem cells into multiple types of white blood cells. Now, with collaborators including [Anna Huttenlocher, MD, professor of pediatrics and medical microbiology and immunology](#), and support from the National Institutes of Health and a UW2020 grant, the researchers have developed a method to prompt induced pluripotent stem cells to differentiate into a bed of granulocyte progenitors that can continuously produce the valuable neutrophils for weeks.

The technique, published in the journal [Stem Cell Reports](#), refines the process of goading the stem cells to mature into neutrophil producers by replacing the standard expensive, relatively inefficient and time-intensive process using a series of small molecules called cytokines that carry signals from cell to cell.



New tool for assessing heart muscle cells helps unlock their potential

Heart muscle cells made from stem cells could be used to screen drugs or develop cell-based therapies for heart disease. But these cells, called cardiomyocytes, are often immature, disorganized and unable to behave together like working muscle tissue. UW–Madison researchers have created a new way to study how fully capable heart cells organize themselves into muscle with rod-like units called myofibrils, which can contract together to pump blood. What they learn could help them steer cardiomyocytes into more useful stages of development.

The team described its advance in a paper published in May in the [Journal of Applied Physics](#). [Wendy Crone, PhD, Engineering Physics](#), says this new technique, called the scanning gradient Fourier transform (SGFT) method, gives researchers a valuable tool for evaluating cells and determining the most effective interventions for coaxing immature cardiomyocytes to become mature cells with highly organized internal structures.

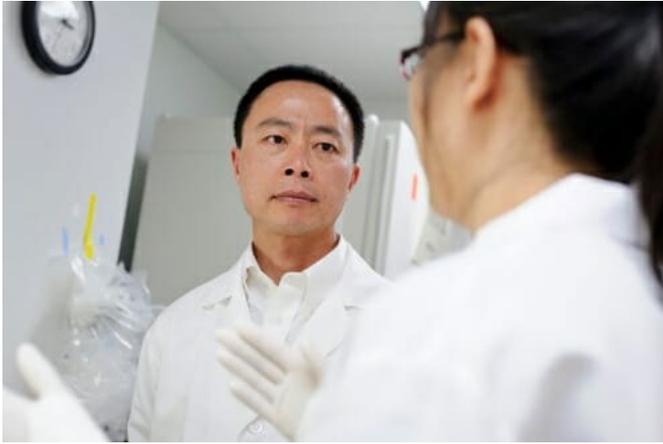
Stem cells can repair Parkinson’s-damaged circuits in mouse brains

UW–Madison researchers, led by [neuroscientist Su-Chun Zhang](#), demonstrated a proof-of-concept stem cell treatment in a mouse model of Parkinson’s disease. They found that neurons derived from stem cells can integrate well into the correct regions of the brain, connect with native neurons and restore motor functions.

The key is identity. By carefully tracking the fate of transplanted stem cells, the scientists found that the cells’ identity—dopamine-producing cells in the case of Parkinson’s—defined the connections they made and how they functioned.

Coupled with an increasing array of methods to produce dozens of unique neurons from stem cells, the scientists say this work suggests neural stem cell

therapy is a realistic goal. However, much more research is needed to translate findings from mice to people research in 2021. The findings were published in the journal Cell Stem Cell.



Su-Chun Zhang talks with a postdoctoral student in his research lab at the Waisman Center.

Photo: Jeff Miller

Newly identified cellular trash removal program helps create new neurons

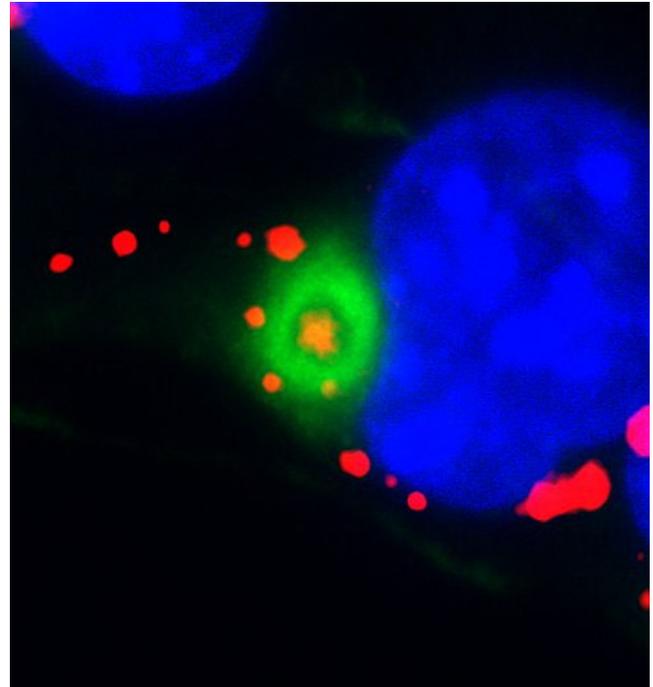
Assistant Professor of Neuroscience **Darcie Moore** led work with graduate student **Christopher Morrow** to discover how a cellular filament helps neural stem cells clear damaged and clumped proteins, an important step in eventually producing new neurons

The work provides a new cellular target for interventions that could boost neuron production when it's needed most, such as after brain injuries. And because clumping proteins are a hallmark of many neurodegenerative diseases, like Alzheimer's, the new study could provide insight into how these toxic proteins can be cleared away.

Celebrating 25 years of embryonic stem cell research at UW–Madison

It's been 25 years since UW–Madison scientist James Thomson became the first in the world to successfully isolate and culture primate embryonic stem cells.

Thanks to advances in pluripotent stem cell research and also gene-editing, scientists are also making progress in understanding the underlying causes of



An immunofluorescence image of a neural stem cell in a dish that was chemically stressed to induce the formation of aggresomes, where damaged proteins accumulate for destruction. Vimentin (green) cages aggregated proteins (red) next to the nucleus (blue). Image by Christopher Morrow

Parkinson's disease, diabetes, pregnancy disorders, sickle-cell anemia, auto-immune diseases, cartilage regeneration and much more. Universities and medical institutions today have well-established centers, such as the UW–Madison Stem Cell and Regenerative Medicine Center, to help bring researchers and resources together to advance the field and educate the next generation of stem cell scientists, doctors, educators, business people and policy makers.

For more information about what's happening at the UW-Madison Stem Cell and Regenerative Medicine Center, go to the [website](#) for more details.

SCRMC fast facts

- Over 700 faculty, staff and students overall are working, teaching and studying in the field of stem cell and regenerative medicine at UW–Madison.
- SCRMC faculty members work across six UW–Madison schools and colleges, 40 departments, and 10 centers and institutes.
- In 2019-2020, stem cell research at UW–Madison drew more than \$44 million in NIH funding. Additional funding comes from other federal government agencies, industry and philanthropic sources.
- In the past decade, our scientists have published close to 1,349 peer-reviewed research articles involving stem cells.
- UW–Madison School of Medicine and Public Health funding and philanthropic gifts support the SCRMC’s activities, such as funding pilot research grants, education and training for students, research support cores, events facilitating scientific collaboration, and public outreach.
- The National Institutes of Health show that nearly 30 clinical trials are underway worldwide involving human embryonic stem cells and their derivatives, intended to advance treatments for heart disease, diabetes, Parkinson’s disease and more. Another 57 trials involve the use of induced pluripotent stem cells.
- The global stem cells market is expected to reach a value of US\$467 billion by 2024. The emergence of induced pluripotent stem (iPS) cells as an alternative to ESCs (embryonic stem cells), growth of developing markets, and evolution of new stem cell therapies represent promising growth opportunities for leading players in this sector.

The graphic features the ISSCR 2021 Virtual logo on the left, with the text 'THE FUTURE STARTS HERE' in large, stylized letters on the right. Below the logo is a 'FEATURED SPEAKERS' section with four portraits and their names and affiliations. At the bottom, the dates '21-26 JUNE 2021' and deadlines 'ABSTRACT DEADLINE: 24 FEBRUARY' and 'EARLY REGISTRATION ENDS: 21 APRIL' are listed. The ISSCR logo is in the bottom right corner.

ISSCR 2021 VIRTUAL

THE FUTURE STARTS HERE

FEATURED SPEAKERS

 KEYNOTE ADDRESS SHINYA YAMANAKA, MD, PHD GIRA, KYOTO UNIVERSITY, JAPAN	 ERNEST MCCULLOCH LECTURE SEAN MORRISON, PHD UT SOUTHWESTERN, USA	 ANNE MCLAREN LECTURE SUSANA CHUVPICHIT, PHD LEIDEN UNIVERSITY MEDICAL CENTER, NETHERLANDS	 JOHN MCNEISH MEMORIAL LECTURE VIVIANE TABAR, MD MEMORIAL SLOAN-KETTERING CANCER CENTER, USA
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21-26 JUNE 2021
ABSTRACT DEADLINE: 24 FEBRUARY **EARLY REGISTRATION ENDS: 21 APRIL**

ISSCR

The ISSCR virtual meeting will be June 21-26, 2021. Mark your calendars today. Watch for more information soon.

Emery H. Bresnick, Gary Felsenfeld Professor of Cell and Regenerative Biology, is director of UW–Madison Blood Research Program and co-director of the Cancer Genetic/Epigenetic Mechanisms Program of the Carbone Cancer Center. In 2020 he received one of 11 WARF Named Professorships that honor faculty who have made major contributions to the advancement of knowledge, primarily through their research endeavors, but also as a result of their teaching and service activities. His research led to the discovery of new paradigms of blood stem- and progenitor-cell development and function, as well as human disease diagnostic strategies.

Randolph Ashton, Gavin Knight, Benjamin Knudsen, Carlos Marti-Figueroa and Nisha Iyer received one of two 2020 Innovation Awards from WARF. Their work, Superior Neural Tissue Models for Disease Modeling, Drug Development and More, involves stem cell-derived models of human tissue. This technology provides a critical step toward bioengineering brain and spinal cord organoids (simplified organs) with applications such as toxicology screening.

Jacques Galipeau, MD, Hematology, Medical Oncology and Palliative Care, and associate dean for therapeutics development, UW School of Medicine and Public Health, began his two-year term as president-elect of the International Society for Cell & Gene Therapy (ISCT) on June 1, 2020. The ISCT is a global society of clinicians, regulators, researchers, technologists and industry partners with a shared vision to translate cellular and gene therapy into safe and effective therapies to improve patients' lives worldwide.

Postdoctoral Training Awards

- **Meha Kabra**, Pediatrics, Ophthalmology and Visual Sciences (Bikash Pattnaik lab): CRISPR Base Editing and Stem Cell Therapy for Inherited Retinal Dystrophy.
- **Daniel Radecki**, Comparative Biosciences (Jayshree Samanta lab): GpnmB is a Novel Regulator of TGF β 1 Signaling in Adult Neural Stem Cells.

Graduate Training Awards

- **Lauryn Campagnoli**, Neuroscience Training Program (Randolph Ashton lab): Bioengineering Hippocampal Organoid Microarrays Derived from Human Pluripotent Stem Cells.
- **Steven Mayerl**, Ophthalmology and Visual Sciences (David Gamm lab): Human Pluripotent Stem Cell Modeling of IMPG2-mediated Retinitis Pigmentosa.

2020 ICTR Pilot Awards

The 2020 ICTR Pilot Awards program continues the tradition of encouraging early stage investigators in pursuit of preliminary data for larger studies, supporting innovative directions in clinical and translational research, and promoting research that addresses health disparities and advances health equity.

Targeting Metabolism to Stimulate Adult Heart Regeneration.

Ahmed Mahmoud, PhD, and Jiyoung Bae, School of Medicine & Public Health

Address the role of individual metabolites in regulating cardiomyocyte proliferation and cardiac regeneration, which will lead to key mechanistic insights and novel therapies for adult heart disease.

Novel Precision Therapeutic Strategies for Catecholaminergic Polymorphic Ventricular Tachycardia (CPVT) Using Human Induced Pluripotent Stem Cells.

Di Lang, PhD, Jianhua Zhang, PhD, School of Medicine & Public Health

The goal of their work is to advance in vitro modeling of the monogenic cardiac disease catecholaminergic polymorphic ventricular tachycardia (CPVT).

Plunkett donation advances orthopedic

Editor's note: This excerpt is from an article that appeared in the Spring 2020 SCRMC newsletter, written by Jordana Lenon.

Gwen Plunkett recalls thinking, “He is so brilliant!” after she received a return phone call from Jamie Thomson shortly after his Science paper on successfully growing human embryonic stem cells came out in November 1998.

Thus began her close following of stem cell research progress in Wisconsin over the next two decades. Gwen and her late husband Jim Plunkett, who was president of Plunkett Raysich Architects in Milwaukee. The Plunketts supported the performing arts, public TV and radio, nature conservancies, museums, service clubs, education and scientific research.

Their latest gift to research benefited the Musculoskeletal Research Program of the Stem Cell and Regenerative Medicine Center at the UW–Madison. The SCRMC operates as part of the School of Medicine and Public Health and the Office of the Vice Chancellor for Research and Graduate Education.



Gwen and Jim Plunkett in 2000.

Specifically, the family’s gift supports preclinical research on reprogramming mesenchymal stem cells into viable, safe cartilage for joint repair. Osteoarthritis has become a major health concern among people over 50, according to [Wan-Ju Li, Ph.D., associate professor of orthopedics and rehabilitation and chair of the SCRMC Musculoskeletal Research Program](#). While hip and knee replacements work well for many, Li explained, they also come with a long list of potential risks and complications, including fracture during surgery, blood clots, dislocation and loosening.

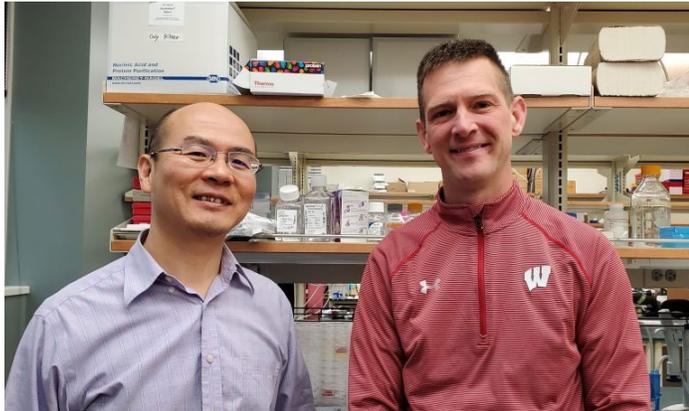
“Rapid advances in stem cell and gene editing research mean that using a patient’s own stem cells to grow and transplant new cartilage may soon become a reality, with the University of Wisconsin–Madison on the forefront of such work,” he said. “The Plunkett family’s gift is crucial to achieving our research goal to advance the knowledge of orthopedic regenerative medicine.”

In particular, the gift will be critical for initiating a new project focused on developing a large animal model to examine stem cell approaches for cartilage and bone repair, Li said.

“In addition to the potential of regenerative medicine for orthopedic applications,” he said, “we anticipate that the project will generate significant impact in other tissue regenerative medicine fields, such as blood, heart and nerve, by creating a translational animal model for research. Availability of such a model is crucial to the development of stem cell therapies for clinical applications. Because of the family’s generosity, it is now possible to fulfill these unmet needs.”

Gwen Plunkett said she was impressed that [Li’s trainee Brian Walczak was recognized by the International Orthopaedic Research Society for his progress in growing cartilage for safe transplant](#). Out of a field of more than 2,000 submitted studies, Walczak’s abstract, *Epigenetically reprogrammed synovial fluid-derived mesenchymal stem cells demonstrate enhanced therapeutic potential for treatment of chondral disease*, was one of only 15

regenerative medicine knowledge



Wan-Ju Li and Brian Walczak in the lab.

selected internationally to win a 2019 New Investigator Recognition Award and one of only two involving cartilage repair.

Walczak, assistant professor of orthopedics and rehabilitation, is a recipient of both a 2019 SCRMC training award and a UW Institute for Clinical and Translational Research training award. He also recently received a postdoctoral training award from the UW–Madison Institute on Aging.

“To be able to function as both a surgeon and a basic scientific researcher is a remarkable opportunity and I am extremely grateful to the Plunketts for this gift,



Wan-Ju Li shows the Plunketts a collagen fiber-mimicking nanomaterial used to grow reprogrammed mesenchymal stem cells to generate new cartilage.

which will go a long way in supporting our continuing work here at UW–Madison,” Walczak said.

Gwen, who suffered from osteoarthritis, wanted to make a difference by supporting solid scientific research that’s getting results in this area. “There are a lot of dubious stem cell clinics out there that say they can help, but I’m skeptical that what they’re selling has not actually been proven to work and you also don’t know how safe their procedures really are.”

With a background in science herself, Gwen’s main interest is scientific research, first working in a lab and as a donor to stem cell and regenerative medicine research. She is a benefactor and president of the Plunkett Family Foundation. She and her daughter Karen Plunkett visited Wan-Ju Li’s lab in April 2019. They had read research papers from the lab and asked a lot of questions, both during a presentation by Li and afterwards on a tour of the lab and its associated imaging and animal facilities at WIMR. Karen, a licensed architect like her father, served as principal and designed health care facilities at Plunkett Raysich Architects. She began her career in investment banking in New York and currently focuses her energy on developing incubator space, mentoring and funding small businesses. She is a principal of the Angel Investment Network, Silicon Pastures and managing director of the Plunkett Foundation.

“I enjoyed spending time with Gwen and Karen and was so impressed by how much Gwen already knew about stem cell research and how interesting and challenging her questions were,” Wan-Ju said after their visit. “It’s not always the case where you get someone who is so interested in every detail of the science, the lab, the people, the animals involved in the preclinical research, everything.”

Sadly, Gwen Plunkett passed away in July 2020. Wan-Ju continues to update Karen Plunkett on the results of the research that was so important to her mother. If you’d like to read the full article, go to the [SCRMC website](#).

Our mission

The UW–Madison Stem Cell and Regenerative Medicine Center (SCRMC) operates under the School of Medicine and Public Health (SMPH) and the Office of the Vice Chancellor for Research and Graduate Education. The center provides a central point of contact, information and facilitation for campus stem cell researchers.

SCRMC faculty members collaborate across several UW–Madison schools, colleges, departments and centers, including SMPH, UW Health, College of Engineering, Wisconsin Institute for Discovery, Morgridge Institute for Research, Waisman Center, Wisconsin National Primate Research Center, School of Veterinary Medicine and many others.

The center's mission is to advance the science of stem cell biology and foster breakthroughs in regenerative medicine through faculty interactions, research support and education.

To help the best minds solve the most difficult problems and move our field ahead, the SCRMC:

- Facilitates campus collaboration through scientific focus groups that meet frequently to share research progress and next steps.
- Co-funds pilot research project grants with the UW–Madison Institute for Clinical and Translational Research.
- Hosts scientific conferences and visiting professors to spur shared knowledge and collaboration.
- Provides core research services and shared equipment to researchers.
- Supports undergraduate, graduate and post-doctoral education, training and mentoring programs.
- Supports public outreach programs that inform thousands of teachers, students, families and civic groups.

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Make an impact on stem cell research

You play a vital role in the future of stem cell research. Your investment will yield rewards that will help change the future of medicine and health care. You can choose to support:

- Basic, preclinical or clinical research in a specific area.
- Education and training for students and post-doctoral fellows.
- A general fund that gives the center maximum flexibility to take advantage of new opportunities.

Please contact Pete Schmeling at 608-308-9388 or Pete.Schmeling@supportuw.org to make a gift in support of our important work. You may also complete the enclosed gift envelope, or donate on line at stemcells.wisc.edu/make-a-gift-2/.

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