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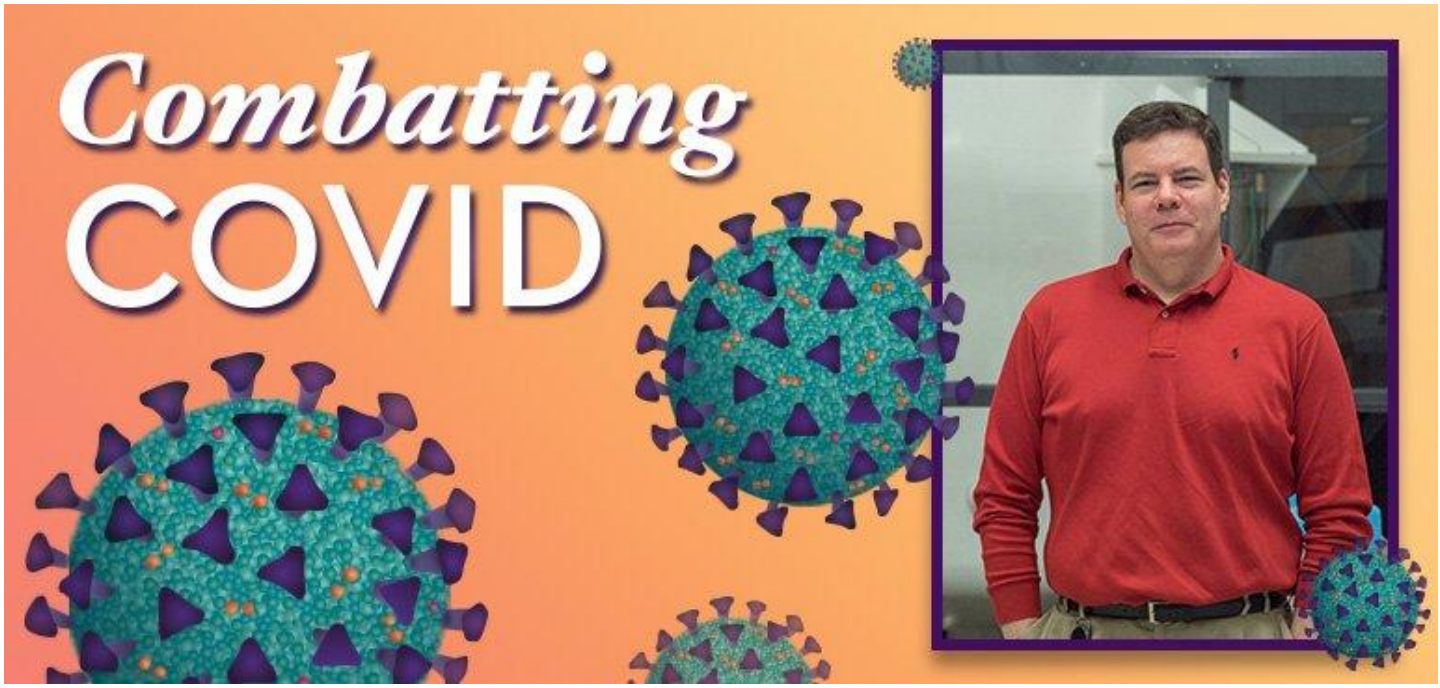
Stemming the spread of COVID



MagLab biomedical engineer Sam Grant is studying how stem cell therapies could be aimed against COVID-19. Caroline McNiel

A team of experts believes stem cells could be a route to a fast, effective therapy.

Story by KRISTEN COYNE

In recent years, MagLab biomedical engineer Sam Grant has studied how stem cell therapies can help the body recover from stroke and other health problems. But in April, with colleagues from the Florida State University College of Medicine and the FAMU-FSU College of Engineering, he began aiming the technique at a new enemy: COVID-19.

COMBATTING COVID

This series focuses on MagLab scientists who are leveraging their expertise and high-field magnets in the fight against COVID-19.

Led by College of Medicine Associate Professor David Meckes, the team was able to hit the ground running because they had already been working for years to create a special way to grow adult mesenchymal stem cells that secrete lots of vesicles — sac-like structures that play a role in cellular communication and healing. You can think of these vesicles as little FedEx trucks or ambulances that travel through the body, delivering news and lifesaving assistance where needed. Once they arrive at their destination, these vesicles release proteins that execute a specific healing task, like fighting inflammation and repairing tissue.

While earlier research focused on stroke and chronic wounds, the team was able to pivot their work on stem cells to a different target: the common cold, which belongs to the same family of viruses as SARS-CoV-2, the virus that causes COVID-19.

"We're re-tasking our stroke therapy ... and seeing if we can use similar types of culturing activities, preparation and modifications in order to treat this new disease," said Grant of their three-month project.

"It wouldn't be unreasonable to think that this could be translated into something that is actually in humans by the end of the year."

— Sam Grant

The researchers have moved swiftly. They have already grown stem cells and generated vesicles at the College of Engineering, where Grant is an associate professor, and are now exposing them *in vitro* to human cells infected with the common cold and similar viruses.

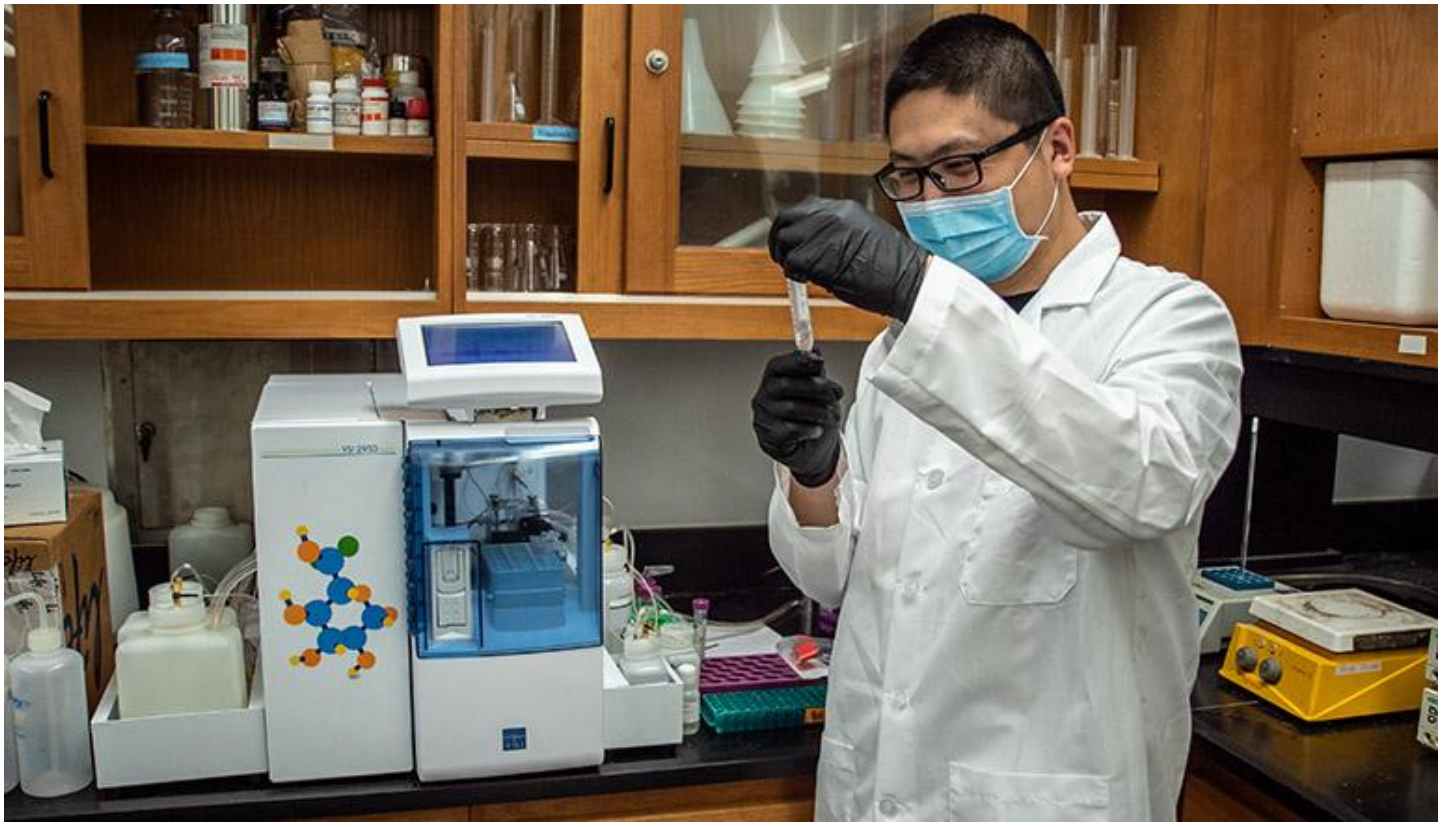
If successful, this preliminary work could progress to testing the approach in rodents using the world's strongest magnetic resonance imaging (MRI) machine for animal research at the MagLab. With a magnetic field of 21 teslas, about seven times stronger than a typical hospital MRI machine, this instrument provides high-resolution images of structures and processes in the body.

"We hope to examine animal models of infection that can be monitored with high-field MRI to see if such vesicles might have widespread systemic effects against viral vectors that approximate the SARS-CoV-2 virus," said Grant.

The long-term goal is to eventually bioengineer vesicles packed with anti-inflammatory and anti-viral agents that could treat COVID-19 patients.

Although he's been plenty busy doing science via Zoom, Grant said the new project is a welcome challenge. "I'm tired of sitting home not doing anything with regards to this particular pandemic," he said.

In part because of their ability to fight inflammation, stem cells are a promising route to a COVID-19 treatment, Grant said.



MagLab postdoctoral fellow and engineer Xuegang Yuan assesses metabolism in cultured human mesenchymal stem cells at the FAMU-FSU College of Engineering.

Photo credit: Stephen Bilenky

"COVID affects not only the lungs, but also the vascular system, parts of the brain, other organs as well," Grant said. "It has potentially a very wide, systemic effect."

It's also fortuitous for the project, said Grant, that stem cell therapies helped critically ill COVID patients in China, according to studies, and that the U.S. Food and Drug Administration has approved using stem cells and their products against COVID-19. Drug companies already have the infrastructure and capacity to produce any therapies the team might develop, he added.

"We think that the research we're doing now, because we're doing it in human cells … could translate very quickly into human studies," said Grant. "It wouldn't be unreasonable to think that this could be translated into something that is actually in humans by the end of the year.

"That's exciting and terrifying at the same time," he added.

Although the team's sights are now set on COVID-19, in the longer term their science could pay off against a slew of other viral diseases associated with inflammation, Grant said.

The National High Magnetic Field Laboratory is the world's largest and highest-powered magnet facility. Located at Florida State University, the University of Florida and Los Alamos National Laboratory, the interdisciplinary National MagLab hosts scientists from around the world to perform basic research in high magnetic fields, advancing our understanding of materials, energy and life. The lab is funded by the National Science Foundation (DMR-1644779) and the state of Florida. For more information, visit us online at nationalmaglab.org or follow us on Facebook, Twitter, Instagram and Pinterest at NationalMagLab.