USC, JPL to launch fungi in journey to develop space meds

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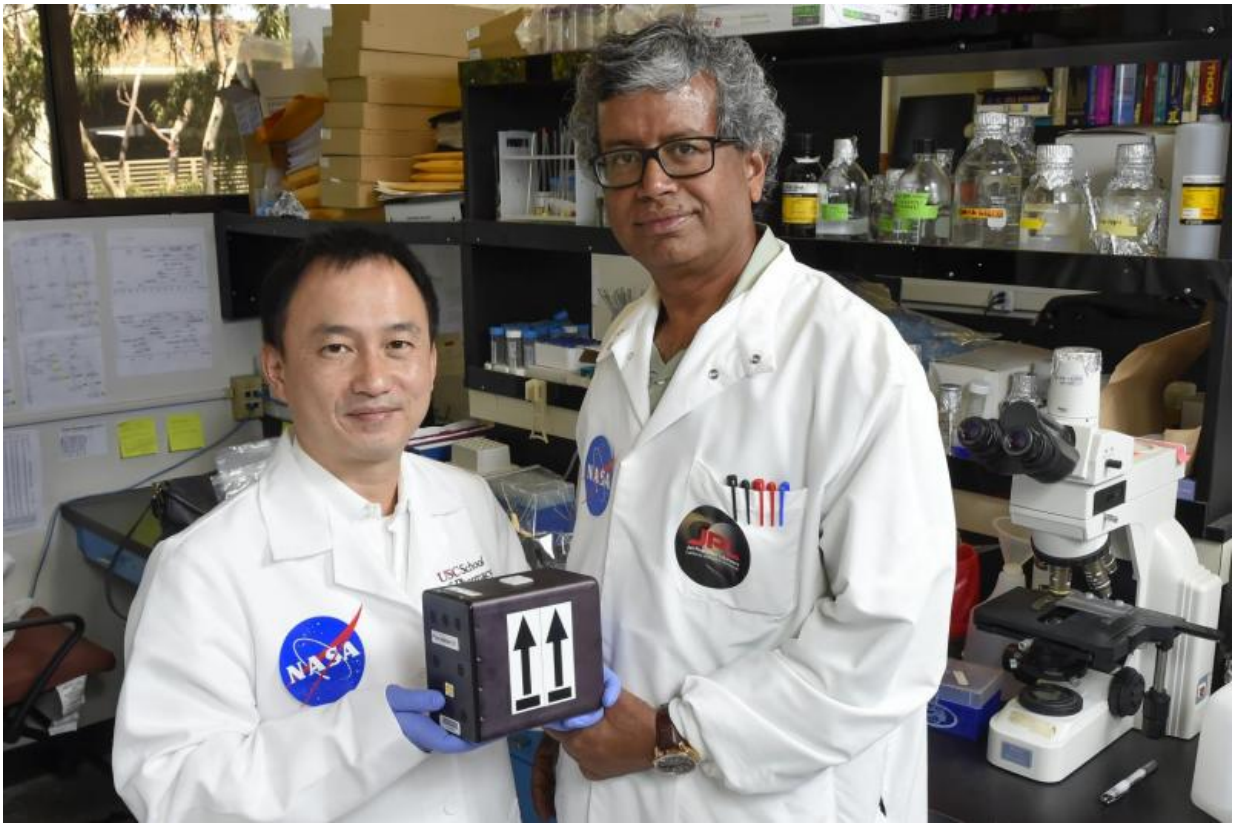

Clay Wang, a professor at USC School of Pharmacy, and Kasthuri "Venkat" Venkateswaran, senior research scientist at NASA's Jet Propulsion Laboratory, will be the first team in the world to launch fungi into space for drug discovery purposes. Credit: Gus Ruelas

Researchers at USC and NASA's Jet Propulsion Laboratory say they will

be the first team in the world to launch fungi into space for the purpose of potentially developing new medicine for use both in space and on Earth.

Certain types of fungi produce very important molecules called secondary metabolites that are not essential for their growth or reproduction but can be used to make beneficial pharmaceuticals. Examples of secondary metabolites include the antibiotic penicillin and the cholesterol-lowering drug lovastatin.

The stressful environment of the International Space Station (ISS) could trigger changes in physiological responses (such as gene expression) and metabolism of a well-studied fungus called *Aspergillus nidulans*, said Clay Wang, a professor of pharmacology and pharmaceutical sciences and chemistry at the USC School of Pharmacy and the USC Dornsife College of Letters, Arts and Sciences.

"The high-radiation, microgravity environment in space could prompt *Aspergillus nidulans* to produce molecules it doesn't create in Earth's less stressful conditions," said Wang, who heads the USC-JPL collaborative study. "We've done extensive genetic analysis of this fungus and found that it could potentially produce 40 different types of drugs. The organism is known to produce osteoporosis drugs, which is very important from an astronaut's perspective because we know that in space travel, astronauts experience bone loss."

USC and JPL researchers will send specimens of *Aspergillus nidulans* to the International Space Station aboard the SpaceX CRS-8 mission. A Falcon 9 rocket is scheduled to launch from Cape Canaveral Air Force Station in Florida at 1:43 p.m. PDT on April 8. This will be SpaceX's first Cargo Resupply Services flight since CRS-7 exploded 139 seconds into flight on June 28, 2015.

Based on current, Earth-based research, USC scientists said molecules from *Aspergillus nidulans* have the potential to be used in anti-cancer, anti-fungal and Alzheimer's disease studies. As a leading research university, USC is uniquely equipped to address these intractable problems both on Earth and perhaps beyond.

Kasthuri "Venkat" Venkateswaran, senior research scientist at JPL and co-principal investigator in this study, said the new compounds that might be produced in space could be valuable for humankind.

"This is an ambitious project for NASA to see if we could have some breakthrough in space biology," Venkat said. "Until now, we have sent bacteria and yeast to the ISS. We have also exposed fungi to facilities outside ISS, but this is the first time we are growing fungi inside ISS to seek new drug discovery. NASA needs to develop self-sustaining measures to keep humans healthy in space because calling 911 is not an option."

Wang's lab and others have found that when fungi are put in stressful conditions, silent secondary metabolite pathways are turned on. *Aspergillus nidulans* has been used as a genetic model in fungal research and its genome was the first to be sequenced.

Wang began focusing his research on this "fungal Rosetta Stone" in 2005 and has been able to link about 30 percent of its secondary metabolites genes with the potential bioactive products they produce. His lab has yet to unlock and mine cryptic pathways that could prove to be useful therapeutics.

"These drug-producing organisms do not make all the drugs they can make," Wang said. "In most cases, the drug-producing pathways are silent. They only make the drugs when they need to."

Four different *Aspergillus nidulans* strains will be stored at 4 degrees Celsius (39.2 degrees Fahrenheit) and placed in the payload of SpaceX CRS-8. Once the spacecraft reaches the ISS, the fungi will be placed in ideal growth conditions at 37 degrees Celsius (98.6 degrees Fahrenheit), where they will remain for either four or seven days. Then the fungal payload will be cooled to 4 degrees Celsius. After splashdown in May, the samples will be returned to USC, enabling Wang and his team to analyze the data with a control sample grown on Earth.

"This is the first project where we see an intersection between pharmaceutical science and space exploration," Wang said. "Drugs have an expiration date. NASA's human mission to Mars is expected to last anywhere from one to three years. Not all drugs are going to be stable in that time period, so the ability to make drugs in space will enable us to go further away from Earth and will also benefit future space explorations."

Wang will participate in a NASA teleconference at 10 a.m. PDT on March 28.

NASA's Space Biology Program, which aims to uncover new basic knowledge that could equip the agency for human space exploration, provided USC and JPL $600,000 for this study. USC School of Pharmacy doctoral students Jillian Romsdahl and Adriana Blachowicz participated in this project.

Provided by University of Southern California