Earth-based or star-bound, heed these heart-healthy lessons from space

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Photo: NASA

On Feb. 20, 1962, John Glenn made history when he became the first

American to orbit the Earth.

About half an hour after launch, somewhere over Zanzibar, he made a bit of lesser-known history by becoming the first person to use workout equipment in space.

"It was called the MA-6 In-flight Exercise Device," said fellow space veteran James A. Pawelczyk, associate professor of physiology and kinesiology at Pennsylvania State University in University Park. "And it was basically a strap connected to a bungee cord and a handle."

Glenn put his feet through the strap and worked out, while his pulse and blood pressure were measured.

That might seem like a minor footnote to a grand adventure. But it shows that from the days of Glenn's first, short flight, we've been asking, "How does the cardiovascular system adapt? And can we keep it healthy?" said Pawelczyk.

The answer to that second question offers lessons to those of us who may never get closer to space than an episode of "Star Trek." In short, no matter where you are, if you want to live long and prosper, you should stay active.

"That's something we take for granted now," but not when Glenn flew, Pawelczyk said. "In a lot of ways our development in space has paralleled the way that we think about cardiovascular health here on the ground."

Weightlessness might look fun, but it's a challenge for the heart. Free from the pull of gravity, blood pools in the astronaut's upper body.

"Take a look at anybody in flight, and you can really see that very

distinctive puffy face," said Pawelczyk, who spent 16 days in orbit aboard the space shuttle Columbia in 1998. He remembers having a meal with his crewmates, "and everybody having this amusing time of lifting the skin off their legs because their legs had gotten so thin."

Astronauts also can suffer muscle atrophy, loss of bone density and other problems. The effects are a lot like rapid aging.

Dr. Benjamin Levine, director of the Institute for Exercise and Environmental Medicine at Texas Health Presbyterian Hospital in Dallas, has been involved in many pioneering space cardiology experiments.

To understand what happens to astronauts' bodies in space, Levine studies earthbound people confined to beds. The beds are tilted back slightly to mimic the way weightlessness affects fluid distribution. In such conditions, the heart muscle atrophies by about 1% a week, said Levine, also a professor of cardiology and distinguished professor of exercise sciences at UT Southwestern Medical Center.

He and his team wanted to see if exercise could change that. So, they had people confined to bed do rowing exercises, and compared them with a group that didn't.

After five weeks, the hearts of bedridden patients shrank and stiffened, "just as we expected," he said. But those who rowed? "Nothing happened. It was as if they were never in bed."

The results were replicated with astronauts on the International Space Station. "We didn't see any cardiac atrophy at all" when astronauts exercised, Levine said.

The findings were published last July in *Circulation* and also showed

exercise in space and IV fluids on landing could keep astronauts from fainting when they returned to Earth.

Other work by Levine shows three weeks of bedrest is worse for the body's ability to do physical work than 30 years of aging. The implication, Levine said, is many heart problems, on Earth or in space, might be kept at bay by training.

But not all of them. Which is why another aspect of heart health in space should sound familiar to the earthbound: It's important to get regular exams.

Not all astronauts are "perfectly healthy, Special Forces-type people, you know," Levine said. "They're middle-aged men and women. If you look for what is the most catastrophic event that can happen in a middle-aged man or a woman on a three-year mission to Mars, it would be an acute coronary syndrome." Which makes health screenings vital.

Limiting the odds of an unexpected cardiovascular problem will be key for long-term missions. In space, nobody can call an ambulance. That point was driven home recently.

The *New England Journal of Medicine* in January reported on an unnamed astronaut who, two months into a six-month mission, developed an unexpected jugular vein blood clot. Agencies on Earth scrambled to come up with a treatment response, and the astronaut completed the mission. The clot vanished soon after their return to Earth.

Astronauts headed to the moon or Mars also will move beyond the protection of Earth's magnetic field, where they'll be exposed to ionizing radiation. Research suggests such exposure can accelerate hardening of the arteries.

Overall, Levine said, the heart does well in space. Other dangers loom larger and serve as reminders of the daring that it took for Glenn to climb inside his capsule.

"One-hundred percent of the deaths so far in the space program have been because of catastrophic loss of the vehicle," Levine said.

Pawelczyk was a toddler when Glenn first flew. But their careers would overlap. When Pawelczyk was weeks away from his 1998 flight, Glenn was preparing for his second trip into space later that year.

Their first meeting was accidental. Pawelczyk had been kept waiting outside a classroom where he'd been scheduled to do some training. When he walked in to see what was causing the very un-NASA-like delay, there was Glenn.

He called Glenn, who died in 2016 at age 95, a humble and gracious person. "What an extraordinary American."