SUPER-LONG SPACE FLIGHTS WILL PROBABLY INVOLVE A HUMAN VERSION OF HIBERNATION.

WAKE ME UP WHEN WE GET THERE

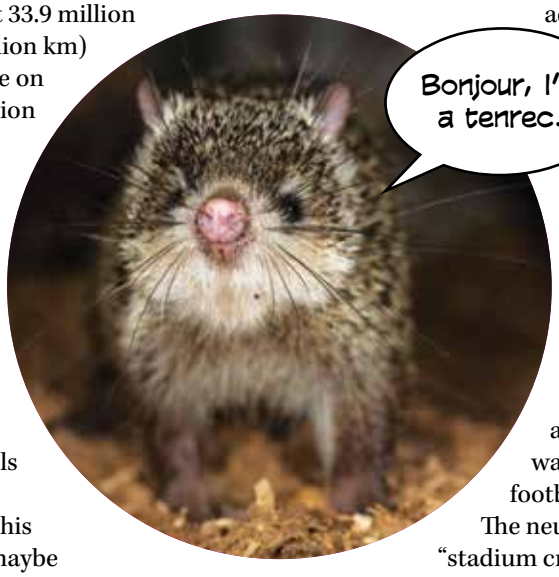
by Brittany Moya del Pino

Scientists estimate there may be as many as 300 million planets in our Milky Way galaxy that hold the possibility of extraterrestrial life. These planets orbit stars that have similar age, temperature, and size to our sun, meaning they get around the same amount of light, heat, and energy as Earth does. With these conditions, they might have liquid water and other important chemicals for life on their surfaces.

If a planet has all of these requirements in place, might we live there, too, someday? That's a tricky question to answer. Before we can test out our ability to live on another planet, we need to figure out how to live through what will be the longest trip ever, perhaps taking a cue from certain members of the Animal Kingdom.

Talking Torpor

Scientists are already considering this problem for planned human passenger voyages to Mars. The trip from Earth to Mars will take more than six months, as the spacecraft crosses at least 33.9 million miles (54.6 million km) of space. People on a Martian mission will travel in spacecraft that have limited room for exercise or storing foods, drinks, and medicine.



Arctic ground squirrels may provide an answer for this situation. Or, maybe black bears can give us a clue. It could also be lemurs, or mice, or cute little hedgehog-like critters from Madagascar known as tenrecs. Each of these mammals has the ability to hibernate during seasonal periods when food and water are harder to find, such as winter or a long dry season. Scientists also refer to this as torpor or "suspended animation." Hibernation allows them to survive without eating, drinking, exercising, pooping, or peeing. Special molecules in their blood protect their bodies from stress and other damage as they rest.

Hibernation looks a bit different in every animal. Arctic ground squirrels entering hibernation go into what's called a torpor state as their normally 200 to 400 beat-per-minute heart rate slows down to 3 to 10 beats per minute and their body temperature drops close to or even below freezing. They breathe only a few times each minute. If you discover a ground squirrel hibernating in its den, you'll probably think it's dead. Meanwhile, a black bear's heart rate falls from 60 beats per minute to 16. Unlike smaller animals, its body still stays relatively warm. Many female bears actually enter hibernation while pregnant and emerge in the spring, five to six months later, with new babies.

Torpor is not the same as sleep. Scientists know this because they can measure coordinated brain cell activity, which sweeps across and through areas of the brain. Imagine a crowd of people standing up and sitting down during a stadium wave at a football game. The neurons—or "stadium crowd"—in a hibernating brain "stand and sit" differently from the crowd in a sleeping brain.

Every branch of the mammal class has at least one member species that can hibernate. In fact, some scientists believe this is how mammals survived the environmental changes that triggered the extinction of dinosaurs—they may have simply hibernated through it! In our very distant evolutionary past, humans likely have an ancient ancestor that hibernated in a burrow.

The Outlook for Astronauts

But how can humans hibernate if it doesn't come naturally to us now? This is the part scientists are still trying to figure out. Despite what you might have seen in science fiction movies, it probably won't look like Han Solo getting frozen in carbonite. Cold temperatures can help people survive accidents like near-drowning in an icy lake, and hospitals will actually lower a person's body temperature to help them to survive heart attacks or strokes, but cooling someone down for more than a few days usually spells trouble.

We do know that whether you're big or small, hibernation requires chubbiness. "Tenrecs go into hibernation incredibly fat, like a bowling ball, and they come out of it thin," explained Kenneth Storey, a professor at Carleton University in Ottawa, Canada who studies animal tissues to figure out what different species have in common during torpor. He noted that torpor seems to slow the body's clock and extend the natural lifespan of mammals that enter the state.

Storey believes that microRNAs, tiny snippets of chemical code that turn off some genes and turn others on, offer the greatest potential to trigger human torpor for short periods, such as two weeks. Private researchers and national space agencies like NASA are still considering lots of options, such as harnessing the bacteria in our guts to help bodies adapt during longer periods of torpor.

Hibernation will be only part of the equation when we plan trips beyond our solar system. The closest exoplanet is about 4.2 light-years away, which means that even if hibernation helps astronauts to live longer than usual, we will still need to plan trips that involve people spending their entire adult life on a spacecraft. Those astronauts would, in turn, have babies who would learn to become astronauts and continue their voyage for generation after generation.

But maybe our understanding of the universe will radically evolve before then. Maybe we will figure out how to engineer a spaceship that travels at the speed of light. Or, maybe we will crack Madeline L'Engle's *Wrinkle in Time* approach and find a way to take shortcuts through the 3D fabric of our universe. No matter what, when it comes to exploring Earth-like planets outside our solar system, we may need to follow clues from Mother Nature if we want to cheat Father Time.

Brittany Moya del Pino writes stories that explain cool natural phenomena, such as what scientists hope to learn from marine microbes that live without sunlight or oxygen beneath the rocky ocean floor. She lives in Virginia.