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The Effects of Space Travel on Humans

Space; the final frontier, but what is its cost? Space travel may have educational purposes, but it comes with an effect to the human. With space travel, we have been able to learn more about the structure and complexity of the amazing universe that God created many years ago. However, human body's DNA, bone structure, muscular system, and mental health all are at extreme risk and are weakened, and in some cases damaged, while in space.

One part of the human body that become damaged is the DNA. Telomeres are the protective shields on the ends of our chromosomes (KE, Money). Just like the aglets on the ends of your shoelaces, telomeres prevent the chromosomes from fraying. In space, the telomeres become stretched as gravity no longer pulls down on them. The intense radiation of space, which is ten times the amount of radiation humans on earth receive, also seeps into the telomeres. So far, these effects have not caused long-term harm to any astronaut. However, any damage to DNA can lead to health issues, such as cancer, reproductive harm, and in extreme cases, death. If the chromosomes become frayed, or damaged, this could also cause organ damage, blood clotting issues, and other harm.

The greatest example of what can happen when a human's chromosomes are extremely damaged by radiation would be the 1999 Tokaimura Nuclear Accident (Preston). This accident was caused by scientist Hisashi Ouchi. Ouchi was pouring uranium into a precipitation tank inside the Tokaimura nuclear power plant, and he poured too much into the tank. The tank had a limit of two kilograms of uranium; he poured over sixteen kilograms of uranium into the tank. His actions caused the tank to turn into a nuclear reactor and detonate. Ouchi received the largest human dose of radiation ever; surprisingly, he did not get radiation poisoning. Hisashi Ouchi's chromosomes were destroyed in the blast, and his skin and internal organs were severely burned; he was basically microwaved. Doctors attempted skin grafts, blood transfusions, and IVs, but nothing helped. Due to his chromosomes being obliterated by the radiation, his body was unable to repair itself; the skin grafts did not stay attached to his body and his pores leaked all of the fluids the doctors provided Ouchi. Hisashi Ouchi was thankfully in a coma for most of this time. He died months later.

The human bone structure was designed by God to be constantly pulled on by gravity. Being in a near-zero gravity, high-radiation environment caused the bones of the astronaut to become weak, brittle, and mineral deficient (Parks). If the astronaut does not properly manage or protect themselves, their ability to lead a normal life upon return to earth will be impeded for years. For example, two United States astronauts broke their hips within days of returning to earth. Damage to the skeletal system may even cause problems for long-term space expeditions, including Mars, Mercury, and deep space missions.

When in space, the body begins to break down the calcium within the bones and deposit said calcium into the blood stream (Canright). The bones' calcium is broken down so much that astronauts typically lose eight to twelve percent of their weight-bearing bones per six-month mission on the International Space Station (Williams). This breaking down of calcium comes out to approximately one to two percent per month.

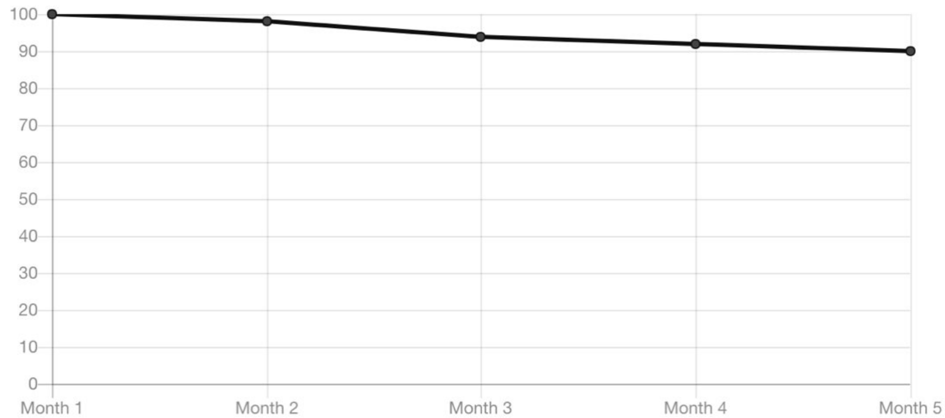

Figure 1: Astronaut bone mass loss chart produced with data collected from NASA and Canadian Medical Association studies.

The muscular system is also greatly affected by antigravity. Human muscles often become atrophied while astronauts are not on a celestial body (Whiting). This can produce long-term complications for astronauts when they return to earth. The astronauts could be unable to walk, lift items, or even hold their own heads up. According to one study, on a two-week mission an astronaut may lose twenty-percent of his/her calf muscle volume. This study also suggests that astronauts lose thirty percent of their calf muscle volume within six months.

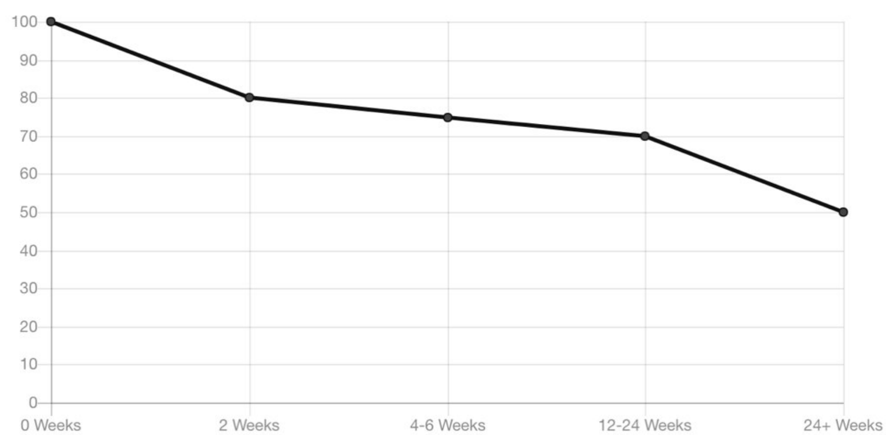

Figure 2: Calf muscle atrophy chart produced with data collected from NASA and Canadian Medical Association studies.

Deprived of gravity, the heart has an easier time pumping blood around the human body (Bragdon). While this may sound good, it actually causes the heart to shrink. The area around the heart, face, and neck also swells from collected blood. A majority of the blood within the human body is below the waist, but without gravity, it collects in the upper body. One problem with this is that blood collects in the head and puts pressure on the brain and eyes (Meggs). This side effect goes largely unnoticed in space. However, upon return to earth, it causes astronauts to be vertiginous and weak for days.

The psychological impact of space travel is one of the biggest problems modern astronauts face. While locked in small spaces, humans have a tendency to become paranoid, belligerent, and stressed. An example of an astronaut's mental health declining due to a space mission would be the case of Lisa Nowak (Morris). Nowak was an astronaut and United States Naval captain who went to the International Space Station aboard the Space Shuttle *Discovery*. While she was in space her mental state appeared unaffected, her first few months back on earth would prove otherwise. Nowak drove nine hundred miles to an airport armed with a knife, mallet, and BB gun. She then donned a black wig and began tailing Airforce Captain Colleen Shipman. In the airport's parking lot, Nowak attempted to attack Captain Shipman. Nowak was arrested and given a psychological evaluation. She was found to have multiple disorders, including depression.

Former NASA flight surgeon and psychiatrist Dr. Patricia Santy stated, "NASA tends to deny behavioral issues are a big problem for astronauts" (Morris). Following this, NASA's Johnson Space Center conducted an internal review of NASA's medical assessments and recommended that the agency implement additional mental evaluations. NASA's Human Research Program is actively evaluating mental risk factors and hazards in order to improve space vessels for the occupants. The Human Research Program has discovered that astronauts have seven primary environmental factors that affect mental health while away from earth; sleep changes, exposure to radiation, shifts in gravity, confined living space, limited social interactions, home sickness, high-pressure work environment, and public scrutiny are the primary environmental factors (Slack).

The most important method of protecting an astronaut's mental health is keeping them happy or content. When a human isin bad moods, the brain releases stress hormones into the body. The easiest way to control this is by keeping the person in a good mood. NASA scientists have found that people working in a positive environment or with positive people are more efficient and healthier (Slack). NASA now prohibits any person that has been diagnosed with a psychiatric disorder from completing the astronaut training program. The agency also requires an evaluation of an astronaut candidate's family's mental health history and any traumatic events that may have impacted their mental health.

As we humans explore the expanse of space, we must be careful with our own health and find ways to protect it. Many of the health concerns with space travel, such as bone, muscle, and heart damage, have not been resolved and still pose a risk to astronauts. We must find a way to reduce the human cost of space travel if we are to continue exploring the outer reaches of God's Creation.

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