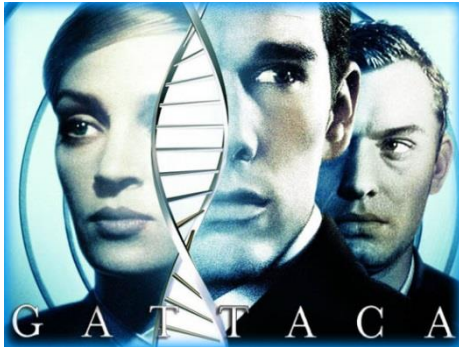


## Astronauts – Beyond Human?

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*“In the future, eugenics is common. A genetic registry database uses biometrics to classify those so created as "valids" while those conceived by traditional means and more susceptible to genetic disorders are known as "in-valids". Genetic discrimination is illegal, but in practice genotype profiling is used to identify valids to qualify for professional employment while in-valids are relegated to menial jobs.” GATTACA Movie [4]*

The recent Netflix series “Away” was inspired by experiences of Scott Kelly and his crew-mate Mikhail Kornienko during their one year long duration flight on the ISS (March 2015- March 2016). During the “Netflix-flight” of NASA astronaut Emma Green and her international crew of 7 the physical and psychical perils of a long spaceflight mission to Mars takes a dramatic development and the movie delivers a non-science-fiction psychological study on ambition, passion and solidarity in space and on Earth.

According to a December 2014 Esquire article also titled “Away” , written by Chris Jones, Scott Kelly was chosen for the long duration test flight on the ISS “because of the stomach sense that he is, more than just about anybody else on earth, purpose-built to fly. NASA’s psychologists and psychiatrists look for two contradictory-seeming traits in its candidates for long-duration missions: adaptability and resiliency. The first represents an astronaut’s tolerance for the chronic, low-level stress of being away—the confinement, the nearly constant white noise, the shitting into plastic bags. You yield in the fights you cannot win. The second indicates an astronaut’s ability to withstand acute stress, usually associated with an unfortunate turn of events. You fight the fights you must win”. “Scott is highly adaptable and highly resilient,” says Al Holland, a NASA psychologist who has tested Scott extensively. “He is some rare combination of grit and give”. [1]

With the pioneering work of Francisco Mojica at the turn of the century and Jennifer Anne Doudna’s breakthrough developments in CRISPR Cas9 gene editing - for which she won the 2020 Nobel Prize in chemistry - speculations have started whether this technique could be applied to correct deficits in astronauts to safeguard them against the bodily harms waiting for them in the basically hazardous environment of space either during long duration flights or “in situ” on Moon or Mars.

The most obvious choices for attention with respect to the health of astronauts are variations in gravity, atmospheric pressure and gas ratios, and solar radiation levels. Examples are: Gene LRP5 has been identified which could help humans to adapt to higher or lower gravity and high altitude dwellers in Ethiopia, or Nepal’s Sherpas appear to have separate adaptations for thriving in low oxygen environments. Recent research indicates that there are genetic mutations in each of these groups involving a gene PDE10A. [For more examples see Ref. 2]

One person looking at this idea is Christopher Mason, a member of the Department of Physiology and Biophysics at Weill Cornell Medicine. In 2011, Mason came up with what he called a “500-year-plan” to get humans off Earth. In it genetic modification plays a big role. “I think we have to consider it for people that we sent to other planets”, he says. “We don’t know if it’s a slight notch to existing gene expression, or a whole new chromosome or finally a complete rewriting of the genetic code”. [3]

Mason says there’s a decade or two of work left just to find out what effect space travel has on your genes, and which ones might be okay to change and which should be on a “do not disturb” list. His lab participated in NASA’s Twins Study, which is tracking physiological changes to an astronaut who was sent to the International Space Station for a year while his twin brother stayed on Earth. So far, that’s

about as close as NASA has gotten to the subject of gene manipulated astronauts—one that still hasn't been broached in any official agency document. [3]

Yet Mason says his lab is ready to take an initial step. Space is full of rays and fast-moving particles that damage DNA. So he's working on radiation-proofing human cells. His students are taking cells and adding extra copies of gene P53, a gene involved in preventing cancer that's known as the "protector of the genome." [3]

Of course such ideas are branching out quickly into the realm of moral and ethics.

"The ability to alter the DNA of a human embryo has created a global debate over whether it would be right or wrong to genetically modify people here on Earth, to enhance their fitness for this planet. People have strong views. Some say the human species is not a laboratory rat. No to eugenics!! No to gene manipulated people!! Others say it might actually work—let's check it out" is one opinion offered in an article by Antonio Regalado archive, the "Engineering the Perfect Astronaut" [3].

However, if you think about it, the engineered astronauts would not be representative of humankind – thus the survival of mankind on planet B would have to be based on mutations or genetically modified "humans". In addition human history has shown, that even the best intentions get corrupted whenever power, influence, greed competition and "big money" becomes involved –this is basic human behavior, which might not be cured to the better by simply replacing some gene sequences.

So, I guess I take sides with Elon Musk observing it wasn't really a technical battle standing in the way of gene manipulation, but a moral battle.

"You know, I call it the Hitler Problem. Hitler was all about creating the Übermensch and genetic purity, and it's like— how do you avoid the Hitler Problem? I don't know," he told Tim Urban of "Wait But Why" during an interview. [5]

In my opinion we have to rely on our endowed "on-board-faculties" we were created with and use the new scientific techniques to cure ailments, diseases and other plagues of human health. We should make every scientific and economic effort to make our Earth as habitable as possible under the given circumstances, rather than dream about "terraforming" or gene-manipulating astronauts to settle in a hostile, alien environment.

There is enough mankind can gain and capitalize on by carrying on with the conventional way of space exploration and exploitation relying on the "Scott Kellys" as they come along in the future.

## References

[1] "Away" article in Esquire <https://classic.esquire.com/article/2014/12/1/away-chris-jones>

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[3] Engineering the perfect Astronaut <https://www.technologyreview.com/2017/04/15/152545/engineering-the-perfect-astronaut/>

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[5] Tim Urban <https://www.businessinsider.com/elon-musk-doesnt-want-to-get-into-genetic-engineering-because-he-doesnt-know-how-to-avoid-the-hitler-problem-2015-6?r=DE&IR=T>