

## Chapter 16

# Evolving from Earthlings into Martians?



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**Abstract** The question of whether or not earthlings should colonize Mars is exacerbated by the hostile conditions space travelers will confront: radiation exposure that threatens life; diminished gravity causing loss of bone strength; an alien surface atmosphere requiring cocoon living; and isolation from ongoing Earth history. If planners of a permanent Mars colony elect to create a posthuman species to populate the Red Planet, could CRISPR gene editing speed up adaptive evolution? To prevent interplanetary sin transfer, could genetic engineering pre-program virtue and altruism into the future Martian community? This essay concludes: if a biosphere already exists on Mars, we should treat it as having intrinsic value; but if Mars is currently lifeless, then, despite interplanetary sin transfer, we should take advantage of the opportunity to seed the Red Planet with life borrowed from Earth.

In Ray Bradbury’s fictional work, *Martian Chronicles*, colonizers from Earth wandering the Red Planet look for the resident Martians. When they peer into a canal and see their own reflection, they realize they alone are the Martians. “The Martians were there—in the canal—reflected in the water.... The Martians stared back up at them for a long, long silent time from the rippling water....” (Bradbury 2019).

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Does simply changing one's address from Earth to Mars immediately make one a Martian? Not quite. Who we are on Earth is largely determined by our historical past, our environmental present, and our anticipated future. We earthlings are contextualized, morphized, and localized by our home planet's *Sitz im Leben*. Charles Darwin's principle of natural selection predicts that if a generation of earthlings survive on the Red Planet they will do so only if they become contextually Martian. Only if they evolve. Only if they adapt. Only if they speciate. To become a Martian is to become a posthuman.<sup>1</sup>

Posthuman in every respect? Or, only some respects? The theologian will be skeptical about excessive promises of total transformation. It is a safe gamble that the pattern of human sin developed on Earth will be borne to every new world we earthlings settle. Perhaps, we need a new theological category: *interplanetary sin transfer*. Even if earthlings moving to Mars adapt physically, what about their spiritual development? Or lack thereof?

In what follows, we will imagine a speeded-up evolution leading to what might be considered a new species, a posthuman species of Martians. Might we even attempt to direct if not govern this future speciation through CRISPR gene editing?

Our analysis in this essay of the potential to control future evolution through genetic engineering will grant that we can alter the human body; yet we will wonder with skepticism whether we can alter the human soul. To press the matter, we will examine the prospect of enhancing our genetic predisposition to living a life of virtue and to creating on Mars a posthuman colony characterized by altruism and neighbor love. Is it possible, we will ask, to establish a utopian community on Mars? Or, will that future Mars colony only extend what we have on Earth: avarice, greed, competition, war, and environmental desecration? Will we export terrestrial sin to extraterrestrial worlds?

## 16.1 Can Earthlings Evolve into Martians?

When we imagine a colony of earthlings on Mars, we detonate an explosion of harrowing challenges to be overcome. The Martian environment is so hostile to terrestrial life that our astronauts will either have to create an earthlike cocoon on

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<sup>1</sup>The term, *posthuman*, here refers to a successor species to the current human, even if the present generation witnesses the transition from the human to the posthuman in a short span of time. This provocative term has garnered varying meanings in other discourses. In discussions surrounding transhumanism, for example, it refers to the evolution of superintelligence. In postmodern deconstructionist philosophy, this term destabilizes what we've assumed to be human. "Posthumanism is inextricably related to the studies of the differences, referring to the fields of research which developed out of the deconstruction of the 'neutral subject' of Western onto-epistemologies. The deconstruction enacted within the historical and philosophical frame of Postmodernism, by feminist, black, gay and lesbian, postcolonial, and chicana theorists, together with differently abled activists and other outsiders, pointed out the partiality of the construction of the Discourse...of the self-claimed objectivity of hegemonic accounts" Ferrando 2019, 24–25).



the Red Planet or adapt the human species to an alternative environment. Or, most likely, a combination of both.

Just getting to Mars, let alone walking the surface of the Red Planet, will subject us earthlings to increased radiation. Without either high tech protection or adaptation, we will glow momentarily like green embers before blinking out.

Once we have arrived on Mars, we will skip lightly on the surface with only 38% of Earth's gravity. Our eight irons will carry a golf ball further than a number 2 wood at Pebble Beach, which will make the golfers happy.

This lack of gravitational load will change the shape of our bodies. We will rely on different muscles than those we need here on Earth. We will suffer bone loss estimated to be ten times higher than osteoporosis.

Mars' atmosphere is extremely thin; it is less than one percent of Earth's atmosphere. It is composed of about 95% carbon dioxide (CO<sub>2</sub>), 3% nitrogen (N<sub>2</sub>), and 1.6% argon (Ar), plus some trace gases such as methane and water vapor.<sup>2</sup> From the surface, we will look at the Martian atmosphere through our helmet visors. Or, will we? It is not clear that we will be able to see clearly. Mars' thin atmosphere carries clouds of iron oxide dust. The sky on Mars, rather than blue and bright, is rust colored and dim, somewhere between beige and pink. Everything we look at will seem alien.

Martian dust is finer than anything on Earth. Martian dust will penetrate each and every seal devised by humans from Earth. Nothing will be completely impenetrable except perhaps for a protective suit. We will need to buy Pledge by the case load.

In short, Mars will not provide the grassy plains, snow-capped mountains, and trickling streams sustaining terrestrial life that our home planet has. Biologically speaking, Mars is antipathetic to the life as we have grown up with it.

How should we handle this belligerent threat? By striking first. We strike first either by the technological creation of a safe cocoon or, alternatively, adapting ourselves to live and thrive in that hostile environment. Konrad Szocik, like the Boy Scouts of America, alerts us to *Be Prepared!* "It is worth keeping in mind that living in different—let us call them unnatural places, which are not a part of the environment of evolutionary adaptedness—locations is not problematic per se, if humans are prepared in an appropriate way to live there" (Szocik 2019, 244).

A space suit would provide our colonizers on Mars with a mobile cocoon. But earthlings colonizing Mars would want to do more than take a Sunday afternoon walk. We would live there. And living on the fourth planet from the Sun would wreak havoc on our human biology. Can we change our inherited biology? Can we adapt? Can we deliberately invoke the intentional equivalent of natural selection to enhance certain people for adaptation to Mars?

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<sup>2</sup>There is some mystery attached to the Martian atmosphere. It changes seasonally. "The values logged by the SAM instrument for carbon dioxide (CO<sub>2</sub>) at Gale were 95% by volume; molecular nitrogen (N<sub>2</sub>), 2.6%; argon (Ar), 1.9%; molecular O<sub>2</sub>, 0.16%; and carbon monoxide, 0.06%. The constituents were found to mix and circulate in response to seasonal changes in the Martian air pressure. The changes in pressure occur as CO<sub>2</sub> freezes over the Martian poles in winter, leading the pressure to fall globally." (Carreau 2019).

Adam Hadhazy suggests that the present generation can take control of future evolutionary adaptation through genetic engineering. “Biologically enhancing people for space travel... would involve altering genes to render would-be astronauts more robust against the ravages of space. The genes could, for instance, make bones superhumanly strong, or ramp up the repairing of DNA strands sundered by radiation” (Hadhazy 2019). We are ready to ask: might the new CRISPR/Cas9 technology for gene editing provide just what we need to govern the creation of a posthuman Martian species? (Gouw 2018).

Evolutionary change over time is expected. Could the present generation of earthlings take control of the reins of evolution? Guide it? Speed it up? Engineer our successor species? Create Martians?

## 16.2 The Moral Question: Should Earthlings Colonize Mars?

Here is a prior moral question: should earthlings colonize Mars at all? Yes indeed, says Robert Zubrin, who founded the Mars Society in 1998. “Mars can and should be settled with Earth émigrés” (Zubrin 2019, 305). Zubrin is already packing his toothbrush for the Mars trip. Will everyone back home envy his trip and wish him *bon voyage*?

No, we earthlings should not colonize Mars or any other planet, trumpets NASA consultant Linda Billings. Billings alerts us to two dangers lurking beneath colonization ardor. The first danger hiding beneath colonization zeal is that “colonizing other planets and exploiting extraterrestrial resources... is a variant of nationalist ideology... some interpretation of Christian dominion, or dominationist, theology” (Billings 2017, 328–329). Just as European colonization born of manifest destiny reaped injustice on the indigenous peoples of the Americas, Australia, Africa, and Asia, we can only forecast a duplication when earthlings subjugate off-Earth geographies.

The second danger—actually a variant on the first one—is fear of interplanetary sin transfer. If we earthlings have been so destructive to our home planet, we are likely to contaminate other worlds too. “It would be unethical to contaminate a potentially habitable planet for further scientific exploration and immoral to transport a tiny, non-representative, subset of humanity—made up of people who could afford to spend hundreds of thousands to millions of dollars on the trip—to live on Mars” (Billings 2019, 341). We have messed up Earth. Should we mess up another planet too? Why spread the contamination of Earth by human injustice and careless pollution any further in this universe?

Monica Vidaurri would agree with Billings, because terrestrial economic and political injustice is built right into space exploration ideology. “American domination/exceptionalism in space displays an open disregard of all other nations that participate in space, and a disregard for the right that all nations and people reserve for science and exploration. And, of course, colonizing other worlds comes with an



astronomical burden to resolve: who will be able to do the colonizing, who is going to set this in motion, and why?" (Vidaurri 2019) In short, the economics of launching space colonization only reinforces structural injustice on our home planet.

Then, according to Vidaurri, there is the matter of the interplanetary transfer of human sin. We on Earth will take our sin with us when we leave Earth. "In this light, ethical exploration and a responsible approach to fair play in space is going to require a serious and uncomfortable assessment surrounding the goals that both public and private sectors have in space, a humbling assessment our technological readiness, and an even more uncomfortable assessment of who the proponents for colonization/settling historically have been and currently are, and why they view colonization as our right" (Vidaurri 2019) History tells us who we are. Traveling to Mars will not in itself cut the ties with our past habits. We will carry our evolved habits with us, replete with the human propensity for competition, avarice, greed, violence, war, and ecological sacrilege.

Whether it is recognized or not, non-theologians in this debate are practicing theology without a license. Perhaps no license is necessary when it comes to grasping the dark side of human nature. Our evolutionary history on Earth has defined who we are; and who we are is observable to anyone with eyes open to see. What Billings and Vidaurri observe is what theologians for centuries have called, *sin* (Peters 1994).

Without using theological terms such as *sin* or *soul*, Ray Bradbury describes the human condition vividly in *The Martian Chronicles*. "We earth men have a talent for ruining big, beautiful things" (Bradbury 2019).

Theologian Noreen Herzfeld draws the connection between non-theological and theological assessments of the human soul. She is even more pessimistic about our terrestrial future. She doubts that *Homo sapiens* on Earth will stave off self-destruction before the rocket to Mars even departs the launch pad. "The mechanisms of evolution that lead to intelligent life and technological development also lead to propensities traditionally labeled as sin. These propensities make it difficult for technological civilizations to survive long enough to escape their home planet" (Herzfeld 2019, 366).

Does the human condition have to be this way? No. Sin may be normal for us, but it is not required by nature. Theologian Reinhold Niebuhr is remembered for declaring that sin is universal; but it is not necessary. "Sin is natural in the sense that it is universal but not in the sense that it is necessary" (Niebuhr 1941, I:242). Here is the implication: earthlings who elect to colonize Mars and become Martians will continue the sinful history begun on Earth. This will happen not by necessity; but it will be predictable.

In sum, we are born into sin and we perpetuate sin throughout our lives, passing it on to future generations. As it stands, we leopards are not likely to give birth to Martian kittens without spots. Unless, of course, we alter our genetic code to erase those spots. Unless, of course, we redesign the human soul. Unless, of course, we turn Martian civilization into utopia.

### 16.3 Could Gene Editing Turn Sin into Virtue?

A utopian Mars colony would be made up of individuals who exhibit personal virtue along with care for both their neighbors and the common good. *Altruism* is a term frequently used in the scientific community to describe this.<sup>3</sup> Jacob Haqq-Misra uses the term, *deep altruism*, to refer to such a community over time, over a millennium. “Deep altruism can then be defined as the selfless pursuit of informational value for the well-being of others in the distant future” (Haqq-Misra 2019, 145). For the posthuman Martian colony to foster deep altruism, the individual colonizers will have to have undergone a moral transformation. Compared to humans back on Earth, the posthuman utopians will need a renewal of soul, a spiritual revolution, a process of deification. What will it take to accomplish all this? Could gene editing do the trick?

Whether genetic engineering can alter the soul as well as the body depends on just what genes determine and how potent they are. It is easy to attribute more governing power to genes than they deserve. It is easy to overestimate the influence of genetic expression and, thereby, overestimate our capacity for genetic determinism.

“Genes, genes, everywhere,” mewls neuroscientist Robert Sapolsky. “Large genetic contributions have even been uncovered for everything from the frequency with which teenagers text to the occurrences of dental phobias.... [But, at most,] genetic influences on behavior often work through very indirect routes” (Sapolsky 2017, 237). The prospect of engineering virtue or altruism into our evolutionary future is dependent on the existence of identifiable genes for virtue and altruism and on our technological capacity for controlling those genes. If Sapolsky is right, such genes may not exist and, if they do, they may be less deterministic than we assume.

Despite the tenuousness of genetic determinism, we still engage in a thought experiment by pressing the question: could we edit our genome by deleting sin genes and replace them with virtue genes? Could the present generation of *Homo sapiens* transform itself or, additionally, give birth to a successor species of posthumans with greater virtue than the current progenitor species?

Our focus here is the connection between genes, virtue, neighbor love, and altruism. Roman Catholic moral theologians, such as Charles Curran, are the most knowledgeable when it comes to virtue. “The classical tradition recognized the three theological virtues of faith, hope, and charity, as well as the cardinal moral virtues of prudence, justice, fortitude, and temperance. From the theological perspective, even these moral virtues involved both the gift of God’s grace and the human response” (Curran 2011, 32). These seven virtues are moral ends in themselves, requiring that the virtuous person transcends his or her self to embrace each virtuous trait.

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<sup>3</sup>“Selfishness beats altruism within groups. Altruistic groups beat selfish groups. Everything else is commentary” (Wilson and Wilson 2018, 297). “Christian ethicists do not often use the word ‘altruism’, because the term is not morally helpful” (Pope 2007, 227).



There is more to virtue. Surrendering self-interest on behalf of one or another virtue is to take a giant step toward neighbor love, toward loving the other for the sake of the other, toward altruism if not *agape* love. “The art of living,” declares philosopher Ottfried Höffe, “lies in the good life as the sense of well-being that, admittedly, includes a jolting dosage of interest in the well-being of others as well” (Höffe 2010, 330). In short, to live the life of virtue the individual person must sacrifice self-interest on behalf of the virtue itself and, in addition, on behalf of the well-being of the neighbor. Is this humanly possible? Could we enhance the possibility of virtuous living through genetic engineering?

To approach this question, we must first ask: is the human person changeable? Transformable? Improvable? Yes. We *Homo sapiens* are a work in progress. Our future can be different from the past. In fact, we are beckoned by God to become more than we have been. We are invited even to become the image of God, according to astroethicist and theologian, Jacques Arnould. “So a human individual is not created but formed gradually, through a journey; the individual does not immediately attain the perfect image of God, but represents a divine promise that remains to be achieved” (Arnould 2018, 29).<sup>4</sup> Could we achieve that divine promise by editing our genomes toward virtue enhancement?

At least one philosopher, Mark Walker, answers affirmatively: yes, we can enhance human virtue and even pursue sanctification if not deification through gene editing. “To soul building we must also enhance the biological basis of our humanity [through] genetically engineered virtue” (Walker 2018, 251). Walker sponsors what he calls *The Genetic Virtue Program*, to create caring humans with the so-called Big Five specific complex traits: openness, conscientiousness, extroversion, agreeableness, and neuroticism (Bouchard and McGue 2003, 4). These particular traits require more intelligence than we *Homo sapiens* currently exhibit. So, the first enhancement will be intelligence; and intelligence will in turn lead toward enhanced virtue. Walker fittingly calls his posthuman species, *Homo bigheadus*. Walker hopes these bigheads will continue our altruistic precedent and yield to a still more intelligent species, *Homo biggerheadus*. The present generation of *Homo sapiens* who will make way for a superior successor species would win the laurel for virtuous altruism. Walker’s goal is to employ genetic enhancement to “makes us more like God in terms of virtue” (Walker 2018, 267).

Self-transformation through gene editing will make us virtuous, loving, God-like. Right? Well, not if you ask the experts, the theologians.

The difficulty in pursuing virtue through genetic enhancement is that most virtue theorists deny that virtuous living is natural or spontaneous. Rather, virtue requires conscious attention, will power, discipline, and habit formation. Virtue takes time. Virtue takes more than biology. Virtue relies on a process of soul formation guided by the human will and energized by divine grace.

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<sup>4</sup>Deconstructionist Francesca Ferrando reminds us that the concept of the human is fluid, not fixed. “...radical deconstruction of the human as a fixed notion, emphasizing instead its dynamic and constantly evolving side and celebrating the differences that inhabit the human species itself” (Ferrando 2019, 187).



Roman Catholic bioethicist Lisa Fullam makes this clear. Yes, she would welcome a healthy genetic start, but the running of the race toward the life of virtue would still require a willing self-discipline over time. Moral transformation is a participatory process. “So, could we engineer virtue genetically, at the start of one’s life? No, not really. Virtue happens after we inherit our genomes. Virtue involves one’s practice toward perfection. Virtue is pursued through schooling the appetites by intellect (including beliefs and commitments) over time. Virtue is the fruit attained after a process of growth in character. Virtue is not a static trait or constellation of traits. We grow into virtue more than we possess it. Indeed, as we make progress in a given virtue, we tend to see more broadly the scope and ramifications that it has for our lives” (Fullam 2018, 321). If what Fullam holds is true, then the skillful editing of astronaut genomes could not in itself determine the level of virtue in a future Mars colony.

Ukrainian Orthodox scientist Gayle Woloschak pursues the ultimate virtue, becoming God-like. Even if gene editing could aid in her pursuit of deification, any genetic enhancement would not guarantee Godlikeness for two reasons. First, the opportunity for deification must be egalitarian, open for all persons regardless of their respective genomes. Second, deification requires an act of the human will, a cooperative act that receives God’s grace and builds on that grace.

The idea of becoming God-like is the calling of each Christian, and each person needs to be willing to heed the call to deification. Each person must freely consent to living a holy life...this salvation must be available to all people regardless of genetic make-up or environmental influences. Each person is called to the life of growth toward God achieved through discernment, prayer, contemplation, meditation, and virtue. Deification requires not just the grace of God extending to humanity, but it also requires the willingness of the human person to choose this path of righteousness and goodness. It is a full cooperation between God and the person with the human being freely choosing to accept God’s will and action in his/her life.

Salvation (and deification as a component of it) must be accessible to each human person. Genetics cannot be a precondition for salvation since it could limit salvation to only selected parts of humanity (Woloschak 2018, 304).

Protestant ethicist Braden Molhoek iterates what appears to be the consensus position. “Genetic engineering has the capacity to enhance the human disposition to moral behavior, but gene editing cannot create virtue because virtues are stable, habituated dispositions, acquired over time” (Molhoek 2018, 279).

Let us pause to summarize our findings on the question of genetic moral enhancement. First, genetic influence is at best limited. Genes predispose; they do not determine (Peters 2003). Even inserting a special virtue gene would not guarantee that a person’s resulting behavior would be moral let alone God-like. No number of genetic strings can turn a human person into a moral puppet.

Second, everyday morality along with the passionate pursuit of virtue requires two things not found in the DNA, namely, free will combined with commitment over time. One must choose virtue for it to be virtue. More, one must choose virtue daily, repeatedly, and habitually. Even when God’s grace strengthens the human will, the



decision to live virtuously and to love one's neighbor requires freely elected human agency.

What does this imply for our future colony on Mars? The level of virtue in that future Mars colony cannot be pre-programmed genetically in advance. If Martian colonialists are to live in an altruistic community characterized by moral excellence and mutual care, it will require willful participation on the part of astral travelers who choose the life of virtue. The road to utopia is not paved by genes.

## 16.4 How Do Sin and Grace Interact?

The power of the human self to transcend itself when embracing either virtue or altruistic neighbor love is not itself a human power. It is a divine power. When that divine power grasps us within our daily life it is called *grace*.

Grace comes to us when we are passive and when we are active. The divine expression of unconditional love, mercy, and forgiveness, can be received by us only passively.<sup>5</sup> We have no control over the sovereign God, so we can at most accept with gratitude God's grace as a gift. The scholastics alluded to this as *gratia operans* and the Protestant Reformers as *sola gratia*. God's grace is unmerited, unasked for, and uncontrollable.

There is more. There is also an active relationship offered to us by God's grace. "Grace reorders the self and his or her relation to all other objects of love," avers Stephen Pope in the context of a discussion of evolution (Pope 2007, 236). Grace has the power to change, to transform, and to renew.

When God's grace grasps us, it empowers us. Grace overcomes our inherited propensity to serve the self with self-survival, self-merit, and self-aggrandizement. God's grace liberates the self from the self's past, opening a future where it is possible to embrace virtue for virtue's sake or embrace the neighbor for the neighbor's sake.

Reinhold Niebuhr outlines the dialectic between sin and grace. "Grace represents on the one hand the mercy and forgiveness of God by which [God] completes what [we humans] cannot complete and overcomes the sinful elements in all of [our] achievements.... Grace is on the other hand the power of God in man; it represents the accession of resources which [humanity] does not have of [itself], enabling [us] to become what [we] truly ought to be. It is synonymous with the gift of the Holy Spirit" (Niebuhr 1941, II:98–99).

This dialectic constitutes our active sharing in the dynamics of grace, a sharing with divine and human dimensions. In scholastic theology it was known as *gratia cooperans* or synergy, that is, divine grace that cooperates with human free will.

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<sup>5</sup> Martin Luther champions the passive reception of divine grace. "No human being can be thoroughly humbled until knowing that one's salvation is utterly beyond one's own powers, devices, endeavors, will, and works, and depends entirely on the choice, will, and work of another, namely, of God" (Luther 2016, 178).

Methodists know it as sanctification and the orthodox as deification. Lutherans tend to discourage such synergy, relying almost solely on the passive reception of grace.

The grace empowered person experiences both continuity and discontinuity with his or her previous self. Transformation both negates past sin while fulfilling the beauties of our naturally bequeathed identity. “Grace is related to nature partly as a fulfillment and partly as negation” (Niebuhr 1941, II:245). One implication we may draw for the present discussion is this: a graced life fulfills our humanity. Grace does not make us posthuman; rather, it makes us truly human.

The true human, according to the New Testament, is Jesus Christ, the *eikon tou Theou*, the *imago Dei*, the image of God. Grace empowers us to grow in likeness to Christ, to grow into our true humanity. Sanctification amounts to growth into fulfillment, not replacement. This would apply to altruistic Martians as well as those of us who remain at home on Earth.

## 16.5 Again: Should Earthlings Terraform or Colonize Mars?

When on the eve of the modern world Europeans colonized the Americas, Australia, Africa, and Asia, the existing inhabitants had to make way for invaders. The colonizers brought a new form of injustice to those previously living on the land. This is not likely to be the case when earthlings travel to Mars. Nobody’s currently at home on Mars.

On Mars, presently, there is nobody to be victimized by our interplanetary sin transfer.<sup>6</sup> Only our companion astronauts. Only those making up the new Martian family could become victims of the injustices we have known on Earth.

If the explorers we send to the Red Planet discover a native biosphere, however, the moral situation would change dramatically. Then, the question of intrinsic value would arise. Should we earthlings treat an existing form of Martian life as a moral end rather than merely a means for our own instrumental value? I believe any sign of existing life on Mars would warrant this ethical inquiry (Peters 2018; Race and Randolph 2002).

If we decide that existing Martian life should be treated as having intrinsic value, we will be mandated to embrace the equivalent of virtue. That is, we will find ourselves mandated to protect if not enhance the well-being of that Martian life

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<sup>6</sup>Astrobiologist Chris Impey distinguishes European expansionism from Mars colonization. “The historical example of manifest destiny is misleading in the context of space colonization. Countries have grown and gained resources on Earth by seizing territory and displacing or subjugating the original inhabitants. Even in the twenty-first century, the stains of this brutal history persist. Space is a new resource. The people who leave Earth won’t be taking land from anyone” (Impey 2019, 107). Still, there is a debate regarding microbial life on Mars. “NASA allegedly found strong evidence of life on Mars way back in July 1976” (Axe 2019).



for its own sake. To care for the welfare of an off-Earth life form will require a sacrifice of our own self-interest on behalf of the interest and perhaps even the flourishing of that biosphere. Can we forecast that earthlings will rise to that level of altruistic behavior? Can we count on God providing sufficient grace to transform terrestrial sin into extraterrestrial virtue?

This leads us back to our earlier question: should we earthlings colonize Mars? If we confirm that Mars is without life, should we take life to an apparently lifeless planet?

NASA's Christopher McKay answers, yes, indeed. McKay's ethical calculus begins with a premise: life is better than non-life. This premise implies two corollaries. First, if life already exists on any off-Earth planet or moon, then we earthlings are morally obligated to treat it with intrinsic value. Second, if life does not already exist on Mars, then we should consider bringing life to that heavenly body. "Here is my astroethical premise," writes McKay, "*the long-term goal for astrobiology is the enhancement of the richness and diversity of life in the universe*" (McKay 2018, 381, McKay's italics). Regardless of the prospect of interplanetary sin transfer, McKay is ready to pack his toothbrush for the trip.

I concur with McKay. If it turns out that Mars is already inhabited by microbial life, we need to consider a possible obligation to treat that life as having intrinsic value. This may require protecting that life from our own exploitation and destruction. It may even require enhancing that life form's future.

The astroethicist enjoys some flexibility here. The principle of intrinsic value, like the principle of dignity borrowed loosely from philosopher Immanuel Kant, goes like this: *treat life as an end in itself and not merely as a means to some further end*. Note the term, *merely*. An off-Earth life form just like the waitress in a restaurant can, under certain circumstances, function as a means as long as he or she is not *merely* a means. The waitress provides a means for placing a hot meal on the table. Yet, in a prior and more fundamental sense, the waitress is a person deserving dignity, deserving treatment as a moral end for her own sake and well-being. By analogy, life discovered on an off-Earth site might become a means for some degree of exploitation while, at the same time, we would respect and protect that life as a moral end as well. In short, just what *intrinsic value* requires of us must be determined on a case by case basis.

If it turns out that Mars is not inhabited by existing life, then the question of terraforming Mars or even colonizing Mars opens up. Fear of rocketing terrestrial injustice to the Red Planet is insufficient grounds for staying home, in my judgment. The Martian colony need not achieve utopian status to warrant its establishment.

## 16.6 Conclusion

The hurdles to be jumped by Earth émigrés to Mars are skyscraper high: radiation exposure that threatens us with death; diminished gravity causing loss of bone strength; an alien surface atmosphere requiring cocoon living; and isolation from ongoing Earth history. We have asked: if planners of a permanent Mars colony elect

to create a posthuman species to populate the Red Planet, could CRISPR gene editing speed up adaptive evolution?

This was followed by a related question dripping with theological stickiness: to prevent interplanetary sin transfer, could genetic engineering pre-program virtue and altruism into the Martian community? We concluded that, even if gene editing could engineer physical adaptation, pre-programming genes could not guarantee in advance that posthuman Martians would be virtuous or altruistic. Only freely elected consent and commitment would make that possible.

We have grappled with these concerns because of the hotly debated issue: should earthlings colonize Mars or not? Those opposing colonization remind us of the injustices resulting from Europe's conquering of new worlds, the economic inequities built into existing space programs, and the havoc the human species has wreaked on the ecology of our home planet, Earth. Even though they avoid theological language, opponents of Mars colonization fear interplanetary sin transfer. They fear that colonizers will disturb the now tranquil Mars with avarice, greed, competition, violence, war, and environmental desecration.

I have offered this conclusion: if a biosphere exists on Mars, then we should treat it as having intrinsic value. But if Mars is currently lifeless, then, despite interplanetary sin transfer, we should take advantage of the opportunity to seed the Red Planet with life for the sake of its future.

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