

Preface



Discussions of the idea of human space colonization often quickly diverge in one of two ways. Either people agree that it is an interesting and worthwhile endeavor, or they disagree, with the most common argument against it being that humanity has other pressing problems on its hands at the moment, and that space colonization would be callous and immoral because it would consume effort and resources that could be used to address those problems. This is one reason why Gerard K. O'Neill's 1976 book on space colonization, *The High Frontier*, contains large sections dedicated to showing that space colonization would materially benefit people on Earth. We do not feel that such a justification for human space colonization is necessary; the benefit, as we aim to show in this book, will be the preservation of our species itself, by the ancient methods of adaptation and evolution. While we of course believe that human problems on Earth must be addressed, our justification of human space colonization is not that it will immediately or materially help the people of Earth, but that it will provide a greater return: that it will be an insurance policy for our civilization and our species. Considering the dangers to humanity – non-human, such as asteroid impact, or human, such as warfare and the collapse that archaeologists have documented in every civilization of the ancient world – colonizing space would be the act of a mature civilization, and perhaps the only intelligent way to ensure that what humanity has built over the past few millennia will not be lost. Of course, civilization has built horrors as well as libraries, and it can also always be argued that colonizing space would only move human problems off of the Earth. We prefer to be optimistic, however, and we have good reason to believe that this will not be the case.

For many reasons, the first substantial off-Earth colonies will probably be on Mars, and the first colonists to arrive there will look on a world where not a single bullet has been fired, where not a single bomb has ever fallen from the sky. We think early colonists will be very aware of this. They might well prohibit such weapons entirely. Of course, we will still be human, and prone to the same fears and emotions that have governed many of our less-moral choices and actions in the past. But in a pristine world, we think, people will be determined not to repeat old madnesses, and they may be extremely intolerant of even the seeds of division, violence, and waste. In ancient Iceland, murderers and other criminals were banished to the wilderness, where life was nearly impossible. Similar rules may be enforced by early off-Earthers. And if things go badly in off-Earth colonies, for example on Mars, there would remain the solution that has been used by various human groups on Earth for millennia: social fission. In many cultures, it has been customary to relieve tensions by splitting up, an option almost impossible on Earth today. To paraphrase the science fiction writer Robert

Heinlein, *When things get so crowded that you need an ID, it is time to move*. The great thing about space travel is that it has given us somewhere to move. For a long time after the first colonists begin to settle the Red Planet, Mars will offer large landscapes for expansion; places to go if things turn badly.

And, of course, Mars is no end; one of our points in this book will be that human space colonization cannot be thought of as an end, like landing on the Moon nearly 50 years ago. Rather, what we write about in this book is a beginning. What we as anthropologists have learned from the study of human evolution is that as humanity has evolved, it has continually expanded outward, finding new places to live. Evolutionary adaptation to such a wide range of environments as inhabited by our species is the force that has shaped both our biological and cultural evolution. Just as humans on Earth have explored and settled in new environments throughout prehistory, eventually, people of Mars will want to move farther on; in fact, considering what we will describe in this book, that seems both natural and inevitable, while challenging it seems unnatural. We feel that other places in the Solar System, and perhaps some day even the galaxy, and even other galaxies, will all be explored, and some settled. Humanity, by this method of continual expansion, will have aligned itself with the nature of the Universe, which is change. There is no final utopia, because conditions change, and humanity itself changes. If there is a constant it is change and the evolution itself that adapts to that change. But for humanity to engage with this reality, we have to begin somewhere, and we argue that we should begin now. There will never be a best time to begin; it will always be argued that we have more pressing immediate concerns. But remaining focused on those immediate concerns could, in the end, cost us everything. In our daily lives, we invest heavily to protect our future, by buying insurance and minding our doings. Colonizing space will be nothing less than an insurance policy for our species and civilization. It is worth the both the cost and effort.

In addition to arguing that human space colonization is necessary, we argue that it will not be a technocratic endeavor, focused on rockets and robots, but on human beings. Space colonies, after all, will be for people, communities, and cultures. In this way, they will be a continuation of humanity's many adaptations over the last few million years. That the environments we choose to colonize in space will not be much like Earth environments is somewhat immaterial. This is because establishing colonies – and, over time, new branches of humanity – off of Earth will be *adaptation*, the fitting of a life form to a new environment. While human evolution has significant differences from the evolution of many other species in the past few billion years of Earth life, it is still evolution. For this reason, we also argue in this book that the study of evolutionary adaptation will be central to making a success of human space colonization, and near the end of the book we apply the lessons of adaptation in sketching out an adaptive framework for human space colonization.

This book is our attempt to shed new light – derived from understanding evolution and adaptation – on the ages-old dream of human space colonization. We feel that the best way to make it a success will be to use the adaptive lessons

of billions of years of Earth life to humanity's next adaptation: the *extraterrestrial* adaptation, extra- referring to outside of or beyond, and terrestrial referring to the planet Earth.

The most recent book to treat our subject from an anthropological perspective was *Interstellar Migration and the Human Experience*, a volume of papers, some written by anthropologists and others with interests in evolution, published in 1985 by anthropologist Ben Finney and Eric M. Jones. That book tackled serious evolutionary issues associated with human space colonization, and remains a good introduction to them, but some of its elements can now be revised with more recent understanding. For example, it was published before the concrete evidence for planets beyond our own Solar System (which are being discovered monthly, now), and several decades of genomic research have vastly improved our understanding of even basic evolutionary principles, and on the macro scale we have new bodies of theory to help understand evolution as well. We also know that the 'dark matter' theory proposed in the volume has been verified, and there is a significant shift today – perhaps unimaginable in the mid-1980s – away from a vision of government-driven human space colonization, and towards private space colonization. Our worries and concerns today also differ from those of the 1980s, at least in part; today climate change is a major concern, having edged out nuclear annihilation, though we have new worries about nuclear terrorism. And while biology and computing were both largely the tools of science in the past, today they are rapidly becoming the tools of a burgeoning biotechnology industry and the 'gaming' entertainment industry, respectively, with numerous and specific attendant effects. In all of these ways, and others, we live in a different world than that of 1985.

Still, many of our suggestions have been offered in the past; in the 1920s, the Russian scientist Konstantin Tsiolkovski was publishing freely about humans living off of the Earth, in space. But in this book we present new arguments for a collective course of action that could ensure the survival of humanity, and, most importantly, we sketch out an evolutionary and adaptive philosophy for space colonization that is informed by the lessons of anthropology and evolution. In part, our book is an attempt to update what was paved out by the authors and editors of *Interstellar Migration and the Human Experience*. But we also write for a new audience, asking them to believe in a course that many will call impossible, and to support the real efforts of small companies and independent researchers who are preparing for the next major adaptive episode of human evolution, which we call the Extraterrestrial Adaptation.

Most space colonization literature has been written by astronomers, engineers and others in the 'hard sciences', and much that they have written has been somewhat technical. But it is equally important to add a human dimension to the discussion of space colonization because space colonization will ultimately be about humanity. Technology must be a tool, not an end.

In this book we are introducing a philosophy of humans-in-space that emphasizes long-term adaptation and evolution, in great contrast to the necessarily short-term, exploratory character of human-in-space activities of the past half

century. We comment on occasion on technologies, but our focus is on what we can learn from our own evolutionary background that can be applied in making a success of human space colonization. Overall, our goal is to help shape a philosophy of space colonization rather than to—at this point—define any specific courses of action, such as population sizes for off-Earth colonies, or their cultural and biological composition. Rather, we are suggesting a new character to the concept of humans in space as subtle, but important, as the difference between, say, crossing an ocean by sailboat rather than with a motorized boat, or between climbing a mountain with a small and nimble team as opposed to climbing it with sherpas, supplemental oxygen and so on. The differences are important.

To structure the introduction of humanity to the space colonization literature, we employ the field of anthropology, the evolutionarily-based scientific study of the human species, both biologically and culturally.

We begin by introducing anthropology, showing how it is structured as a discipline, how it generates knowledge, and why it will be significant to the successful human colonization of space. We then discuss arguments for and against space colonization, arguing that it is important, and that we should begin now, and we conclude by sketching out an adaptive framework for human space colonization. Overall, we wish to establish the foundations of a human-centered, evolutionary paradigm for space colonization. Our book is organized in three main sections.

In Part I, *The Context and Uniqueness of Human Evolution and Adaptation*, we place humanity in the larger context of evolution and show why humanity is well-suited for adaptation to space.

We begin with Chapter 1, *The Extraterrestrial Adaptation: Humanity, Evolution and Migration Into Space*, in which we introduce the field of anthropology, describe why and how it will be significant to successful space colonization, and begin to build a framework for thinking about space colonization in terms of evolutionary adaptation.

In Chapter 2, *Stardust: the Origins of Life, Evolution and Adaptation* we summarize the evolutionary history of the genus *Homo*, noting that it is characterized by adaptability.

In Chapter 3, *The Adaptive Suite of the Genus Homo: Symbolism, Language and Niche Construction*, we outline how humanity has adapted to Earth environments throughout prehistory, not because of our biological constitution, but in fact despite it, using the tremendous power of our symbolic, language-using minds to actively alter and construct ecological niches for our own habitation. We also describe the evolution of modern civilization, showing exactly what it is and dispelling the illusion that it is a pinnacle or end to human evolution, and that – as has happened in the past – it could collapse.

In Part II, *Arguments For and Against Human Space Colonization*, we review the arguments for and against human space colonization, concluding that it is not simply an option, but necessary for the survival of our species, or, at least, the survival of civilization, which we feel is worthwhile.

In Chapter 4, *A Choice of Catastrophes: Arguments for Human Space Colonization*,

we argue that a number of threats to humanity make it important to begin colonizing space now as an insurance policy for the human species.

In Chapter 5, *Common Objections to Human Space Colonization* we consider the most common objections to space colonization – including that it is too costly, a technocratic stunt, an elitist or escapist endeavor – and recast space colonization as a responsible investment for the future of our species.

In Part III, *Human Adaptation to Space: Lessons from the Past and Shaping the Future*, we reveal an adaptive framework for planning and carrying out human space colonization – informed by evolution at large and the human colonization of difficult environments to date – and discuss some possible future homes for humanity.

We begin with Chapter 6, *Starpaths: Adaptation to Oceania* in which we use an astounding example of human adaptation in the ancient world to remind readers that human colonization of essentially alien regions is not a new and outlandish endeavor – or one focused on technology – but a natural continuation of millions of years of human adaptation and evolution.

In Chapter 7, *Building an Adaptive Framework for Human Space Colonization*, we outline an evolutionarily-informed, adaptive framework for human space colonization, based on all we have learned about evolutionary adaptation in the last 3+ billion years of Earth life, including human biological and cultural evolution discussed throughout this book.

We conclude with Chapter 8, *Distant Lands Unknown: Informed Speculation on the Human Future in Space*, in which we allow ourselves some informed speculation and offer a vision of how humanity might successfully begin to colonize our Solar System, and how this process would begin to change our species. We examine some of the latest concepts in extra-solar-system travel and interstellar propulsion, ponder the latest evidence of the multitude of worlds that lie beyond our own Solar System, and imagine what, and maybe even who, we might find there.

At the end of each chapter we include notes that often provide interesting details regarding points in the text, and/or references to technical reports, academic journal articles and other material we used to research this book.

Emigrating Beyond Earth

Human Adaptation and Space Colonization

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