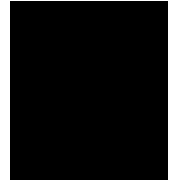


# Preface

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Being aware of our origins and the nature of our existence is of paramount importance and occupies the thoughts of every generation and every individual. Through science, religion, and philosophy—among many other means—we have relentlessly pursued those fundamentals. For many, the extent of our existence transcends the physical universe and bounds of detection, and it is also clear that virtually all of the great questions about the physical universe remain unanswered. What was the origin of the Universe? What is the underlying nature of matter, energy, space, and time? What was the origin of life on Earth, what is the universal context for all life, and is there a connection between the two? Questions like these, while probing the bounds of the physical universe, cut very close to our deepest spiritual ponderings.

Yet these questions need not remain unanswered. Through science, we have at our disposal some of the most powerful tools with which to move ever closer toward answers. And although modern science is at times taxing, it is of essential value in our pursuit of serious, fundamental answers. The *process of science*, although a very human endeavor, has stringent in-built fail-safes that impede stagnation and falsehood and allow the truths in nature, however elusive, to be revealed in exquisite detail.

The process of science begins with a theory or hypothesis about the working of some aspect of nature. With robust and persistent testing followed by scrutiny by anonymous peers in a given field, weak theories are discarded, possible theories are revised, and slowly but steadily sound theories emerge that provide valid descriptions of how nature actually functions. Even then science does not rest. It is only when theories stand the test of time that we gain confidence in their use—predicting the behavior and future outcomes of natural systems and working well alongside other loosely related theories or *auxiliary hypotheses*. And if, for any reason, or at any time, our most acclaimed theory is shown to be even slightly flawed, it must be satisfactorily amended or, however reluctantly, rejected. No “established fact” is sacred and no “expert” is impervious to the rigors of science. This is

science's greatest strength, and is the reason it has been so immensely effective.

The process of science is thus relentless in peeling back layer upon layer of universal mysteries, revealing their underlying structures and behaviors. But even here it encounters challenges. Many of the great bastions of religion, philosophy, and metaphysics—traditionally central to our purpose—have been challenged if they appear to lack a scientific foundation. It often seems that science is in conflict with that which, based in mystery, is so precious to us.

Despite such contention, we must however ask ourselves whether we wish to probe more deeply into the origin and fate of the Universe, and into our own origins and the cosmological context for all life, by using every means at our disposal. Do we want to know more about such things and are we prepared for the implications to our findings, no matter how contentious and challenging? Do we have a role in the unfolding human quest to know who we are and from whence we came—and do we want to acknowledge it; or are we content to say that the extent of our existence is already well enough known? Do we have a role in shaping our future, or do we just allow Nature to take charge of the future direction of humanity?

These are challenging issues—not just for scientists, philosophers, and priests, but for all of us. And the often exasperating nature of the questions themselves does not help. No matter how much we have wanted to know the origin of the Universe or the cosmic nature of life, finding answers has been incredibly difficult. With virtually all trace of our origin long since faded and with the Universe so prohibitively vast, answers to questions about the nature of life and the origin of the Universe have traditionally been elusive.

This, however, is no longer the case. Over the past century we have crossed a threshold. We have developed scientific hypotheses and some measure of insight into those most mysterious aspects of Nature—from the fundamentals of matter, energy, space, and time to the dawn of the Universe billions of years ago; and from the origin of life on Earth to the seemingly universal nature of the make-up of its building blocks. And while we are not much closer to ultimate answers, we are now more confident of eventually attaining some scientific conclusions. Our powerful process of science is underpinned by hundreds of years of significant groundwork that is now supported by spectacular technology capable of peering into ever smaller domains, to ever greater cosmological vistas and back through billions of years of natural history on Earth, and elsewhere.

Indeed, the question of life elsewhere in the Universe—traditionally relegated to the realm of speculation due to the lack of plausible answers—is now firmly rooted in analytical science and we are perhaps on the verge of a

revolution in both thinking and results, the outcome of which may be profound. As we probe the origins of life on Earth and the grand nature of the Universe, we are increasingly finding suggestions that life here is not some isolated incident, but instead seems to be intimately connected to the Cosmos within which we find ourselves. Increasingly, questions about our origin and nature are being answered, but many of those answers are resident in space. The Universe is where we now think we will find many far-reaching answers about our origins and existence.

In view of recent progress and developments, the pursuit of our great questions continues with ever-increasing pace, not only because real and tangible answers may be forthcoming, but also because they will be of supreme relevance to all of us. Thus, our role in life is surely clear: we may not yet have answers to many of the great questions of our fundamental nature, but in being capable of achieving at least some answers, our mandate is to build upon the work of those who came before us and progress toward a more enlightened future.

This book is therefore an attempt to convey a significant development that is currently unfolding in our understanding of, and connection with, the planet Mars, and what it may reveal regarding our origins and the cosmic context for all forms of life.

<http://www.springer.com/978-0-387-34164-4>

Mars, A Cosmic Stepping Stone  
Uncovering Humanity's Cosmic Context  
Nolan, K.

2008, XXII, 386 p. 165 illus., 53 illus. in color., Hardcover  
ISBN: 978-0-387-34164-4