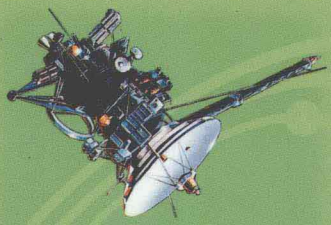
PLANETARY DREAMS



THE QUEST TO DISCOVER LIFE BEYOND EARTH

ROBERT SHAPIRO

Planetary Dreams

The Quest to Discover Life beyond Earth

Robert Shapiro

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Origins: A Skeptic's Guide to the Creation of Life on Earth

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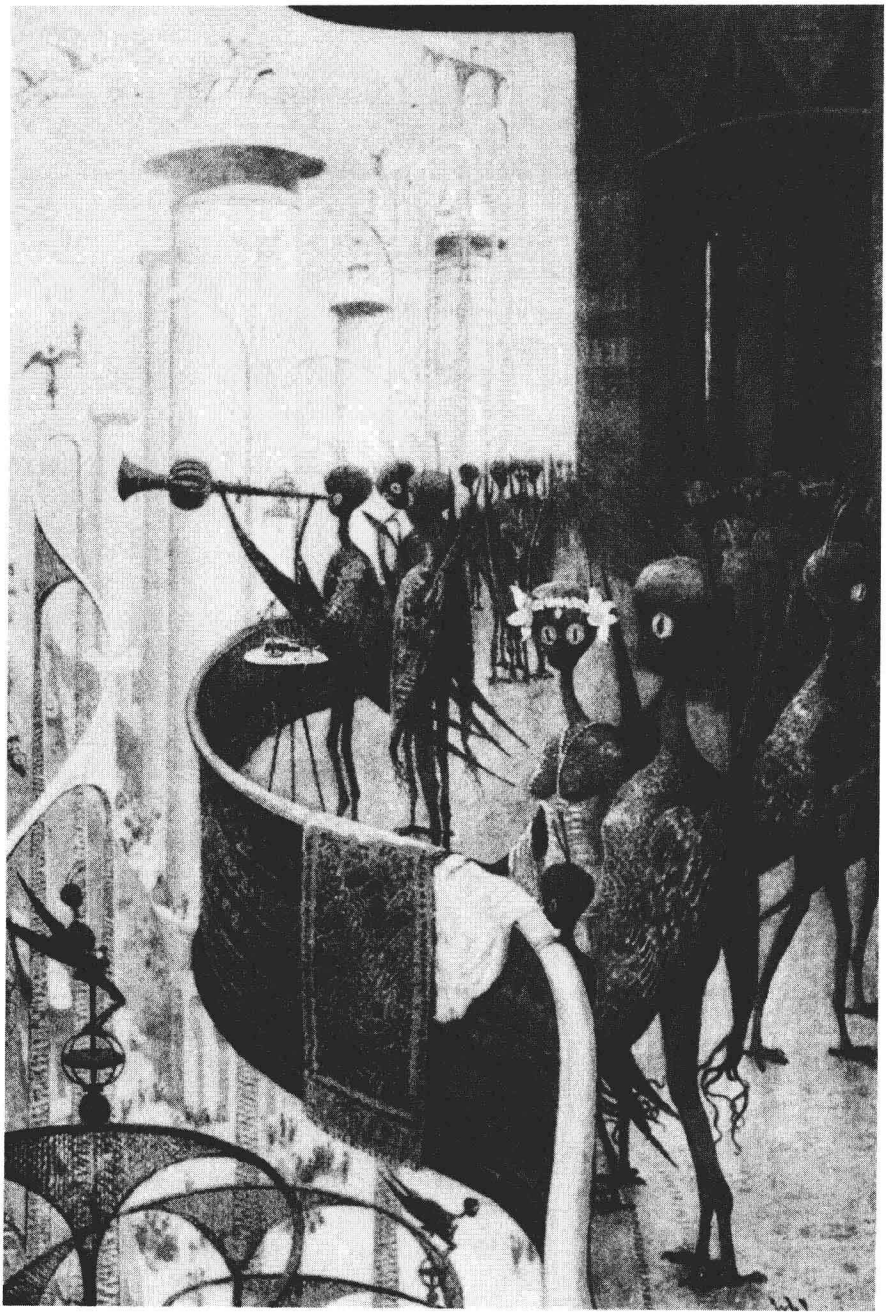

Drawing by William R. Leigh from H. G. Wells, "The Things That Live on Mars," a nonfiction article that appeared in *Cosmopolitan,* March 1908.

Preface

The ongoing, though intermittent, search for life in our solar system represents the central, unifying theme of this book. A number of researchers believe that a discovery of this type would be one of the most important ever made in science. I agree with them. But other scientists believe that such a search represents an enormous waste of public money. They feel that only Earth, in this system, provides a suitable home for life. Some of them argue that Earth may hold the only intelligent life in the entire universe.

Many of our fellow citizens may also see little point in a search for life in the solar system, but for very different reasons. They believe that intelligent aliens have been orbiting our planet for some time, occasionally descending to abduct suitable human specimens for genetic experiments. If advanced extraterrestrials are already here, then why search for much less evolved forms on Mars?

Such quarrels are not new. The debate over extraterrestrial life has been carried out with a great deal of passion, but with little progress, for centuries. Only in the last decades have we gained the ability to move it forward by collecting data at close range. We can send robots to inspect likely worlds such as Mars, Europa, and Titan, and return photographs, information, and samples, or, if we choose, we can go there ourselves and look around. We may find existing life, remnants of extinct life, or chemical systems evolving in the direction of life. Alternatively, we may encounter monotonous wastelands, lacking any sign that a process relevant to life has taken place there.

The results will help decide which of two very different views of the universe is more nearly correct. In one, the universe, despite its size, is barren. Life started on this planet either through special divine intervention or, for the nonreligious, by an enormous once-in-a-universe stroke of luck. The other point of view holds that the universe is fertile.The circumstances that

permit life are inherent within the laws of nature. Life will begin naturally and in a variety of circumstances, once certain basic conditions have been satisfied. If we only look, then we will discover a cosmos rich in life.

This debate cannot be settled by writing a book, but we may find the answer if we inspect the most likely sites in our solar system. I have tried to explain why certain sites seem very promising from a biochemist's point of view, and what we may find when we explore them. Our encounter with reality will culminate a long process in which human beings have projected their desires and fantasies onto our neighboring worlds. For millennia, scientists and others who are fascinated by the planets have conjured up exotic images of the beings that may dwell there. Many of them were banished as we gained a deeper understanding about what our neighboring worlds were really like. Yet the central idea, that life is not confined only to the planet Earth but has sprung up elsewhere in this vast universe, remains possible, though hotly disputed.

To appreciate the magnitude of the past debate and understand the feelings that have carried over into the present time, we will tour some of those earlier visions, the "dreams" that I refer to in my title. Our heritage of imagined fact and admitted science fiction concerning the planets remains rich and entertaining, and I have not resisted the temptation to embellish it a bit in this book.

The "dreams" that I write of are not the usual ones, the images that come up in our minds involuntarily during certain stages of sleep, but rather the hopes and expectations that we have lavished upon the other worlds around us. The other term in the title of this book also has an unconventional meaning. I will use the term *planets* to describe all of those worlds large enough to capture our imaginations. Strictly speaking, the term should only be applied to large bodies that circle the Sun directly, and not to the satellites or moons that orbit the planets. I felt, however, that a single evocative word should be used to include all of the larger worlds that we will want to explore, and perhaps inhabit, in the future.

In examining the planetary dreams of the past, I have tried to connect them to our picture of the larger universe that surrounded these worlds, and what role this larger cosmos played in the unfolding story of human history. Problems arise when we attempt to describe our present view of the dimensions and age of the universe in a way that does not overwhelm the reader. I have attempted to humanize the process by describing it in terms of a visit to a museum, an excursion which we can experience in our

present lives. Yet we must keep some measuring stick at hand so that the comparisons remain meaningful. I have chosen to work only with the metric system in terms of length, as I felt that the continual insertion of equivalents in terms of miles and inches would clutter the text. For readers unfamiliar with metric units, the following conversions will help: A kilometer is about six-tenths of a mile, but little harm will be done here if you simply divide the number of kilometers by two, to convert it to miles. In the same spirit, a meter may be taken as a yard, though it is about 10 percent longer. A centimeter is a bit more troublesome—two and a half of them make an inch. Questions of weight and temperature come up much less frequently in this book, so I have included both the metric units and the more familiar terms used in the United States side by side.

I hope that this book can be read simply for entertainment, or for the information that it contains, but I do have an additional agenda in mind. A generation ago, I and many of my friends were very excited by our exploration of the Moon and our robot reconnaissance of other nearby worlds. We have been dismayed to see this outburst of energy dissipate and dwindle to a trickle of missions of interest only to scientific specialists. The question of extraterrestrial life has had a very minor place in the recent robotic explorations. By emphasizing the importance of this question, I hope to move it to the front of the agenda and to infuse new energy into the space program as a whole. I could not get into this topic, however, without bringing up the other compelling motive for a larger human presence in space: The long-term survival and prosperity of the human race depends on it. I feel that these two purposes are linked psychologically and can move together side by side. If this work can play some role in accelerating that movement, then I shall be very gratified.

Robert Shapiro
New York City
June 1998

Acknowledgments

I dedicate this book to the memory of my lifelong friends, Gary and Menasha, I miss them very much.

My interest in this area began many years ago when I was approached by my close friend, Gerald (Gary) Feinberg, to collaborate in an earlier work, *Life Beyond Earth.* Many of the concepts that I consider here originated in our discussions for that earlier work. Our continuing conversations, until the time of his death, helped me to develop my ideas further. I deeply regret that he cannot share his thoughts about the final work with me.

Many scientists helped me during the preparation of this book by sharing their expertise with me in face-to-face discussions or interviews or by electronic mail. They include Mark Adler, Gustaf Arrhenius, John Baross, Daniel Britt, Graham Cairns-Smith, Sherwood Chang, Julian Chela-Flores, Brian Cooper, John Cronin, Christian De Duve, John Delaney, Albert Eschenmoser, Jack Farmer, Jim Ferris, E. Imre Friedman, J. Richard Gott III, Mayo Greenberg, Ralph Greenberg, Hyman Hartmann, Richard Hoover, Joan Horvath, Bob Jastrow, Torrence Johnson, Doron Lancet, Gilbert Levin, Alexandra MacDermott, Cliff Matthews, Chris McKay, Stanley Miller, Bruce Murray, Leslie Orgel, Bill Schopf, Linda Spilker, David Usher, and Gunter Wächtershäuser. Dr. Duane Gish was generous with his time and arranged a guided tour of the Museum of Creation and Earth History for me.

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Bill Burrows, my friend and New York University colleague, provided valuable advice and encouragement at several key stages of the book preparation process. I am grateful for his support.

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The concentration and diversion of time required for the preparation of a book put special stresses on those who have the misfortune of living with the aspiring author. My wife, Sandy, put up with my moods and provided love and comfort in exchange. She provided vital, if nontechnical, support for this undertaking.

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1

Planetary Dreams

Dream not of other worlds; what creatures there
live in what state, condition or degree.
—John Milton

The astronaut in his bulky suit moved through the open hatch of the lunar module and onto a large platform. He prepared himself to climb down the ladder that led to the surface. Before he reached the bottom, he pulled a ring on the side of the module to activate a small TV camera. When a message came back that the TV picture was being received, he started down the ladder toward the bottom rung.

A few hours earlier, I had huddled nervously by my radio until the exhilarating words came through: "Houston, Tranquility Base here. The Eagle has landed." Stunned by what had happened, I walked out of my apartment into a summer day in Washington Square Park, New York City. I was surprised to see the arch in its usual place and the crowds going about their normal business. At some deep level, I had expected the world to be rearranged.

That evening, I nailed my gaze to the small television screen and watched with amazement as the first pasty black-and-white images came in from the Moon. We all know what happened next. The astronauts explored the lunar surface for some hours, took photographs, collected rock samples, planted a flag, and safely started their return voyage on the next day.

The event is still recorded in bronze near the main desk of my town

library. A copy of the front page of the *New York Times* of July 21, 1969, proclaims in enormous letters: "Men Walk on Moon." Three other plaques complete the display. The librarians had selected replicas of the Genesis page of the Gutenberg Bible, the title page from a 1623 First Folio Edition of William Shakespeare's plays, and the Declaration of Independence. Obviously, great consequences were expected from the Moon excursion.

But events took a very different direction, despite the headlines and bronze plaques. After several more expeditions, the remainder of the Apollo Program was canceled. Human exploration of the Moon ended in 1972. Humans have not returned since then. In the words of Buzz Aldrin, the man who waited in the lunar module as Neil Armstrong climbed down that ladder, "The promise of a sustained, vibrant and growing human presence on the Moon has died a pathetic, almost incomprehensible death."

Yet the reasons for the program's downfall had existed from its very start. They were illustrated in a recent cable television production, *From the Earth to the Moon.* An early meeting of presidential advisers at the White House is restaged, and a science consultant comments, "The only thing we'll get for our money is some rocks."

The Moon, of course, has been obvious in the sky for the entire duration of human history. Men and women have looked up to it and created many different dreams about its meaning. Many of these visions have waned over the centuries, while others kept their substance up to the time of *Apollo 11.* When Armstrong and Aldrin stepped onto the Moon's surface, however, these myths met their doom. A stark reality had replaced them. The true significance of that occasion did not lie in what happened, but what did *not* happen. To make this clear, I will present three accounts of events that definitely did not take place during the *Apollo 11* landing.

A Slip of the Tongue: Non-Happening #1

Neil Armstrong stood on the ladder, glanced down at the ground below, and announced, "I'm going to step off the LM now." He lowered his left foot onto the lunar dust and spoke the prepared words: "That's one small step for man, one giant leap for mankind."

"*Cut,*" yelled the director. "Neil, you blew it. Turn the camera off." Armstrong moved the switch on the TV camera, shutting it down, and then walked over to the director. As he walked, he carefully limited his steps

to an apron that lay hidden from view of the camera. A worker used the same apron to move onto the set, and removed the single footprint in sand with a brush, as the director explained the blunder: "Neil, the words were: 'That's one small step for *a* man, one giant leap for mankind.' The way you said it," he continued, "makes no sense at all."

"But wait," his assistant said, "I like it better this way. It sounds more natural—the way it really might have happened. Let's check it out with Arthur."

When Arthur agreed with the assistant, Armstrong remounted the module and repeated the scene exactly as before. The remainder of the session went smoothly, and the film could be shown with full confidence when it premiered on July 20, 1969.

Author's Explanation: A Slip of the Tongue

This idea will sound absurd to most of us, but a few individuals have insisted that the Moon landing was a hoax. Perhaps the most prominent was Charles Johnson, President of the Flat Earth Society. In a 1980 interview, he maintained that the space program existed mainly to prop up the myth that the Earth is a globe. "The known, inhabited world is flat," he insisted. "Just as a guess, I'd say that the dome of heaven is about 4,000 miles away, and the stars are about as far as San Francisco is from Boston." He concluded, "The Sun and Moon are about 3,000 miles away and 32 miles across."

According to Johnson, the Moon landings were faked by Hollywood studios. The noted science fiction writer, Arthur C. Clarke, wrote the scripts. Johnson continued, "I recommend that the government get out of the space business and turn the whole thing over to ABC, CBS and NBC. The TV networks do a far superior job."

The source of his information was not simply the interior of his cranium. In 1968, one year prior to the first Moon landing, the stunning science fiction film, *2001, A Space Odyssey,* was released. Arthur C. Clarke had written a science fiction novel with the same name and had coauthored the screenplay with producer-director Stanley Kubrick. Their effort won an Oscar for Special Effects. Early in the film we saw realistic renditions of space travel to the Moon, an elaborate space station, and astronauts standing on a lunar hill, just above their well-developed main base. The landing of a shuttle at the base was depicted in exquisite detail, as was the excursion

of a lunar flier that visited a site where an important discovery had been made. Considerable pains were taken to include the minor aspects of life in space. (I still recall the instruction sheet that accompanied the space toilet.)

By comparison, the *Apollo 11* transmission looked like an amateur home movie, in washed-out and flickering black and white. The landscape appeared rounded and dull, with none of the dramatic sharp mountain peaks and jagged valleys shown in *2001. Apollo 11* had exactly the appearance that one would expect if the production were placed in the hands of government bureaucrats. They would skimp on film quality, even though the real savings would come from using facades instead of rockets and carrying out only a make-believe space program, instead of the real thing.

Charles Johnson's belief system had far deeper roots than distrust of the U.S. government, however. He was a Christian fundamentalist who relied on the Bible for his picture of the universe. He felt that the biblical view limited humankind to its natural domain—a flat Earth, while the heavens were reserved for God and his angels. For example, consider the following quote from Psalms 115:15–16 of the King James version: "Ye are blessed of the LORD which made heaven and earth. The heaven, *even* the heavens, *are* the LORD's; but the earth has he given to the children of men."

Physicist Harold Morowitz has summarized this biblically inspired universe:

> The Book of Genesis is explicit about the earth's being at the hub, leaving all other celestial objects in an accessory role.
>
> To believers in the exact word of Genesis, man is the raison d'être of creation, and all the rest of the universe consists of a group of heavenly objects set there by the Creator to decorate the human abode.

The Bible was not isolated in this interpretation: Other sources from antiquity held similar views and provided additional details. Aristotle, for example, had written, "there must be only one center and circumference; and given this latter fact, it follows from the same evidence and by the same compulsion, that the world must be unique. There cannot be several worlds."

In Aristotle's scheme, the Sun, Moon, planets, and stars were objects set in concentric spheres, fifty-six in number, which revolved around the Earth at the center. The system was perfected by Claudius Ptolemy, a Greek scientist of the second century A.D., and was later adopted by the medieval Roman Catholic Church as part of its unified worldview. If one accepts the

idea, dominant in our culture for many centuries, that the planets are decorations on a celestial ceiling overhanging our Earth, then any thought of pedestrian traffic on their surface appears nonsensical.

When Armstrong stepped down on the Moon's surface, he ended symbolically a centuries-long process in which the the Copernican sun-at-the-center system was substituted for the one of Ptolemy. The changeover did not take place easily. Galileo Galilei (1564–1642) was the first to observe a number of heavenly bodies through a telescope. He concluded that the Moon and planets were worlds in their own right. As a result, he came to no small measure of grief. He was compelled by the Catholic Church to reject his support for the Copernican system. Italian philosopher Giordano Bruno (1548–1600) had fared worse. He was burned at the stake in Rome, in part because of his advocacy of a multitude of worlds. Only within the past few years has Galileo been fully absolved from his heresy.

By the twentieth century, however, virtually everyone in technological societies accepted that the planets were separate worlds. Yet some final ceremony was appropriate. When Neil Armstrong and Buzz Aldrin actually walked on the surface of another world, with a sky above, ground beneath their feet, and Earth reduced visually to an ornament in the heavens above, only then was this ancient quarrel appropriately set to rest. To mark the occasion, Pope Paul VI at the Vatican observatory greeted the "conquerers of the moon, pale lamp of our nights and our dreams." The place of the Moon is no longer an issue, even in religion—except, of course, for Mr. Johnson and a handful of others who believe that the U.S. government is capable of simulating or concealing almost anything, the heavens included.

A View of the Crater: Non-Happening #2

Neil Armstrong moved awkwardly across the gray lava field around the module, which was rougher than had been expected. He had planted the flag and collected his rock sample—now he needed to find a suitable place to relocate the television camera, so that the Earth-bound audience would have a prettier view. He noticed that the ground rose up behind the lunar module, and he considered the possibilities of that location. When he had first tried to land the module, Armstrong had come upon a hazardous crater at the last minute. To avoid it and find a more suitable flat location, he had extended the flight, almost exhausting the available fuel. As he flew