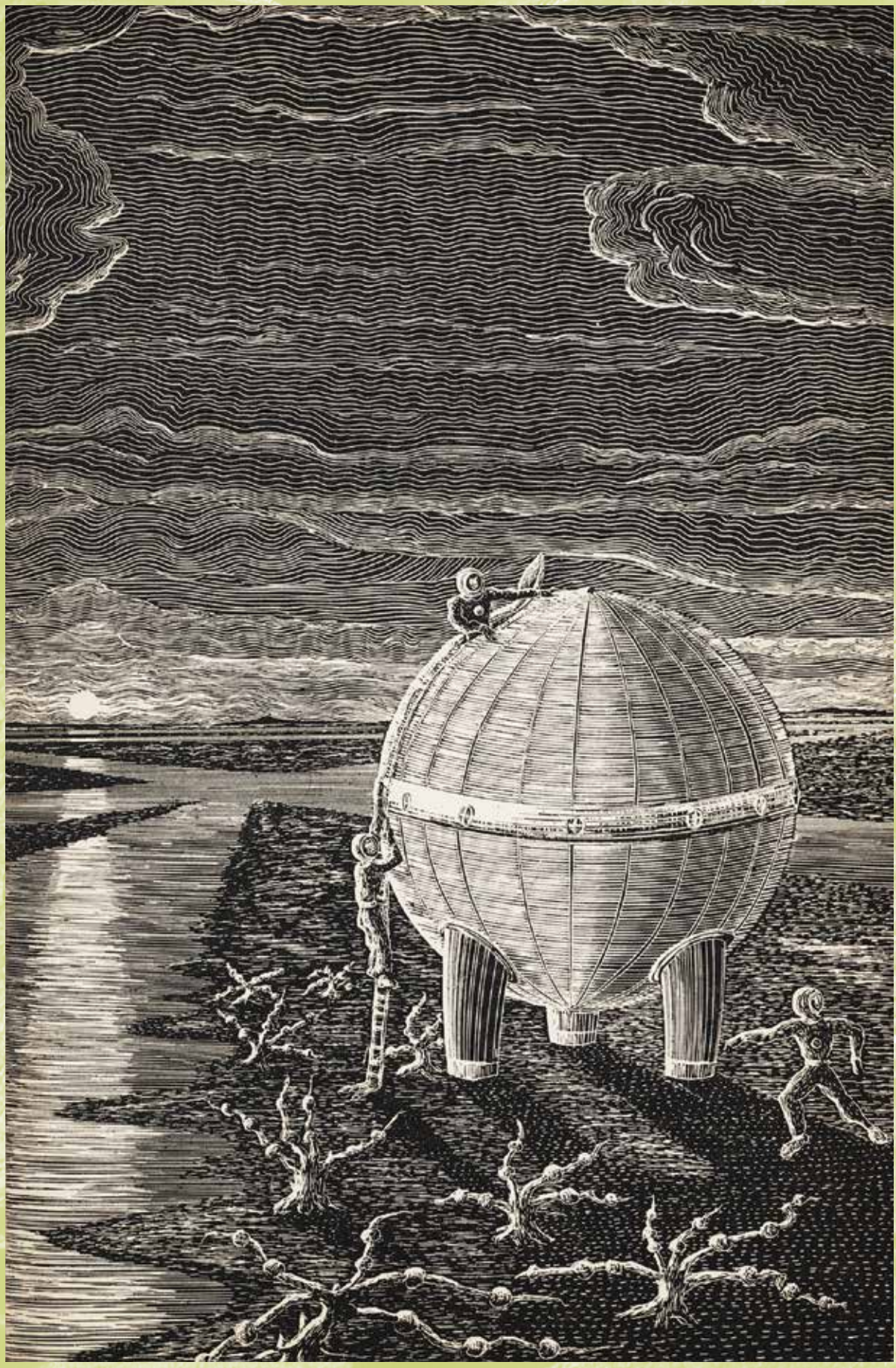

An illustration from Kenneth Heuer's *Men of Other Planets*.

GREEN MARS

BY JORDAN BIMM, PhD
Postdoctoral Research Fellow, University of Chicago

In 1953, Hubertus Strughold, a German physiologist and medical doctor working for the U.S. Air Force (USAF), published *The Green and Red Planet: A Physiological Study of the Possibility of Life on Mars*. For millennia, philosophers and astronomers have speculated about life elsewhere in the cosmos, but Strughold was the first modern life scientist to take up this question. As the title of his book suggests, he predicted that there was life on Mars, but that due to the planet's apparent lack of water, atmospheric pressure, and heat, it was limited to simple, hardy vegetation, similar to lichens. To test this hypothesis, Strughold invented a device that has since become a central tool for scientists studying potential extraterrestrial life – the Mars Jar.

Beginning in 1956, Strughold used a set of airtight glass containers to simulate the extreme environment thought to exist on his lichen-lined "Green Mars." Inside each Mars Jar was a thin atmosphere, arid soil, and freezing temperatures. Then, a team of Air Force scientists sealed different microbes, lichens, and mosses inside to see if any could survive. After 100 days, they found that some microbes not only survived but actually multiplied. Strughold called this new field of research "astrobiology" (the name the field goes by today), but he and his pioneering Air Force research program were soon forgotten.

After the National Aeronautics and Space Administration (NASA) was created in 1958, a new community of academic scientists led by the Nobel Prize winning molecular biologist Joshua Lederberg effectively took over the search for life on Mars under the banner of exobiology (for "extraterrestrial biology"). If you ask a present-day astrobiologist about the origin of their field, they will tell you about Lederberg and NASA exobiology, not Strughold and USAF astrobiology. It is this missing military chapter that my project *Putting Mars in a Jar*, seeks to recover, reintegrate, and learn from.

We all know Mars as the Red Planet, but what was Strughold's Green and Red Planet? Where did this idea that Mars is a planet of plants come from? How did the expectation of vegetation on Mars shape early astrobiology and plans for human exploration? These were the questions I had when I arrived at the Linda Hall Library in January 2019 as a Residential Fellow. My plan was to use the Library's extensive holding of rare astronomy texts to provide the deep historical context for Strughold's mid-century modeling of a Green and Red Planet.

The idea of Mars exclusively home to lichens is unfamiliar today, but back in the 1950s most of the world's top astronomers expected the first robotic missions from Earth to discover vast swaths of this vegetation. For example, in a 1955 edition of *National Geographic*, American astronomer E.C. Slipher wrote "many astronomers now feel sure the large dark areas [on Mars] represent vegetation." In the history of ideas about life on Mars, "Green Mars" attained its zenith in the 1950s, between Percival Lowell's fantastical *fin du siècle* vision of an intelligent canal-building civilization, and our current much more modest hopes for microbial life, or fossils of it from the distant past.

If, on December 4, 1957, you had tuned in to Walt Disney's animated anthology show *Disneyland*, you would have seen an episode called "Mars and Beyond," depicting a lush, verdant Mars with a narrator speculating that "there may be plant life that migrates in search of richer soil, there may be plants that feed on other plants, or even plants that feed on themselves." Two years later, a science fiction film called *The Angry Red Planet* featured giant carnivorous flora attacking unsuspecting astronauts. In 1958, Strughold appeared on the short-lived science television show *Doctors in Space* where he noted that only microbes and plant cells had survived in his Mars Jar experiments,

ABOVE and BACKGROUND: Mars images courtesy of NASA Image and Video Library.

suggesting that “no advanced animal or intelligent creatures are likely on Mars.”

But the image of a Green and Red Planet was plucked from the scientific imagination on July 15, 1965 when NASA’s Mariner 4 probe beamed back the first-ever close-up photographs of Mars’s surface showing a barren landscape more akin to the Moon than the Earth. This was the end, but harder to pin down was the beginning. Who was the first to suggest that Mars was home to vegetation? Answering this question took me deep into the Library’s collection and required tracing a timeline of astronomical observations going back to the 17th century.

For thousands of years, humans have recognized Mars in the night sky for its red appearance. This evoked cultural associations with blood, fire, death, and warfare. The possibility of life elsewhere in the cosmos has an equally long intellectual history going back at least to ancient Greece. The topic became known as “the plurality of worlds debate.” But these early speculations didn’t revolve around UFOs or little green humanoid creatures, they were mostly philosophical and theological thought experiments geared toward big questions about the nature of the universe, the veracity of the bible, and the power of the creator. Proponents of a plurality of inhabited worlds imagined other beings on any number of celestial bodies and didn’t single out Mars in particular.

In the 1600s, shortly after Galileo began using telescope technology to view the night sky, Mars became more than just a red point of light. Between 1659 and 1683, Dutch astronomer Christian Huygens viewed Mars through an early telescope and made the first-known sketches attempting to show surface features. We can see that Huygens saw dark areas contrasted with lighter areas, as well as a polar ice cap. Right from the start, these dark areas were assumed to be oceans – bodies of water – and the lighter areas continents of land. Huygens also noted that the dark areas seemed to grow and shrink over time, a phenomenon that became known as “seasonal changes” or “seasonal darkening.”

In the early 19th century, British astronomer John Herschel observed that sometimes the dark areas on Mars appeared blueish-green. In 1832, German astronomers Wilhelm Beer and Johann Mädler made the first attempt at mapping Mars, and used a greenish tint for the darker regions, which they also thought were oceans. Until this point, descriptions of the surface of Mars included only land and oceans, no mentions of vegetation.

This changed in 1860 when Emmanuel Liais, a nearly forgotten French astronomer working in Brazil, hypothesized that the dark features on Mars were not oceans, but vast tracts of vegetation. Liais, who was also a trained botanist, noticed that the mysterious “seasonal changes” to the dark areas corresponded with the melting of the polar caps, and concluded that what he and others were witnessing was the regular growth cycle of vegetation, regulated by the arrival and departure of liquid water from the poles.

Russian astronomer Gavriil Tikhov argued that simple, hardy vegetation like lichens that grow in cold, thin, and dry mountain environments still fit the bill, and were likely similar to what was growing on Mars.

1877 was the year that astronomers began to put Mars on the special pedestal it still occupies today. That year Italian astronomer Giovanni Schiaparelli published the now-famous claim that he could see a complex network of straight lines on the surface. He produced a detailed map but stopped short of saying anything about what might have caused them. Word of these *canali* ignited a Victorian-era sensation regarding the possibility of life on Mars, which as many readers of the *Hedgehog* will know compelled Percival Lowell to proclaim them evidence of an ancient intelligent civilization desperately trying to stave off drought.

Interestingly, Lowell’s vision of a technologically advanced Martian society incorporated Liais’s earlier vegetation hypothesis. To him, the darker regions where the lines seemed to meet were lush oases with vegetation growing along the banks of the canals as well. But early in the 20th century, new astronomical measurements revealed Mars to be far too cold and rarified to support the kinds of creatures Lowell had conjured – but the vegetation idea survived.

By building a model of a biological Mars, Strughold sought to enable future astronauts to travel there, discover life, capture it, study it, and then use it to colonize, militarize, and even terraform the planet.

Photo of USAF Mars Jars, 1957. Air Force Historical Research Agency.

When new observations turned up bad news for plants – a lack of chlorophyll and a lack of oxygen plants produce on Earth – the vegetation hypothesis adapted. Russian astronomer Gavriil Tikhov argued that simple, hardy vegetation like lichens that grow in cold, thin, and dry mountain environments still fit the bill, and were likely similar to what was growing on Mars. This was the state of thinking about life on Mars when Strughold arrived in Texas after the Second World War. European and American astronomers, straining to see through increasing large telescopes, and studying spectral data, seemed to favor Liais's vegetation hypothesis from 1860. My survey of the Library's collection of books about Mars written between 1940 and 1950 revealed that virtually all astronomers believed there was life on Mars, and that this life was vegetation similar to lichens.

Even though modern Mars Jars now model our more up-to-date understanding of the Red Planet, it is important to remember that Strughold's first simulations of life-on-Mars were meant to mimic this older idea of a Green and Red Planet. The prospect that Mars could harbor natural biological resources was appealing to Strughold and his German colleague rocket designer Wernher von Braun, as they both imagined large American military expeditions to the planet. When Strughold proposed and built the first Mars Jar for the Air Force, he wasn't interested in settling century old debates about the plurality of worlds, or answering the Big Question of "Are We Alone?" As USAF reports plainly state, the Mars Jar experiments were about assessing whether lichens and microbes on Mars could be harnessed to construct a self-sustaining U.S. military base as part of Cold War competition with the Soviet Union.

This obscure history reminds us that simulations or models of other planetary environments always also contain plans for these places. By building a model of a biological Mars, Strughold sought to enable future astronauts to travel there, discover life, capture it, study it, and then use it to colonize, militarize, and even terraform the planet. Built in to the original Mars Jar was this insidious idea that any life discovered there should be harnessed for human purposes. This forgoes any consideration of ethical concerns about how we ought to treat extraterrestrial biology and skips right to the assumption that alien life would be ours to collect, study, and use.

Recovering this early military moment in astrobiology highlights the normally taken-for-granted relationship between models, plans, and action in a new critical light. It opens up a space to rethink our assumed relationship with any extraterrestrial microbes we might one day find on the surface of Mars, in the clouds of Venus, or in the ocean on Europa. The Green and Red Planet in Strughold's Mars Jar reveals that these tiny models, wherever they appear, contain grand and specific visions of human involvement in space.

Jordan Bimm was a research fellow in residence at the Linda Hall Library during 2018-2019.