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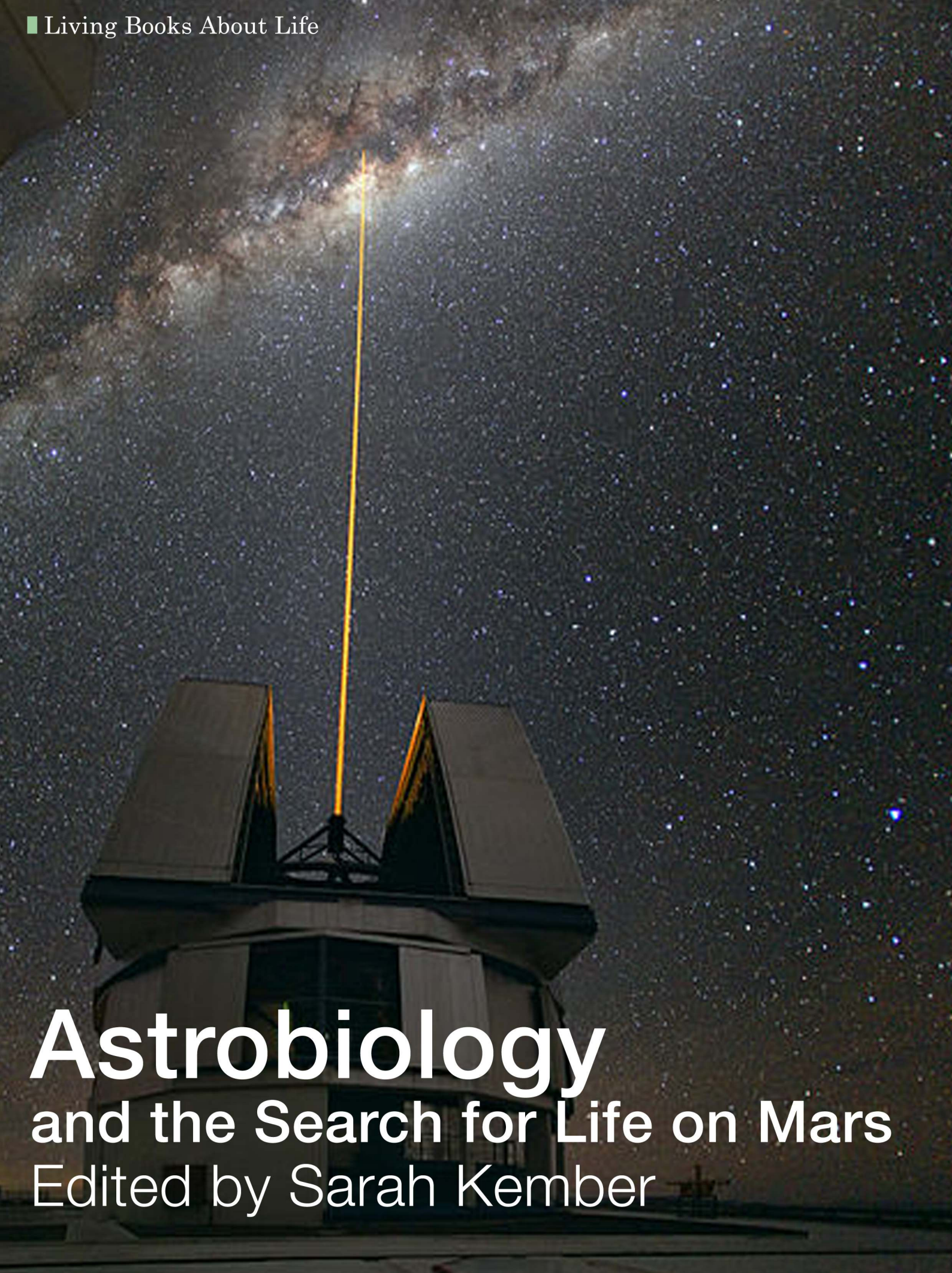

Astrobiology
and the Search for Life on Mars

Edited by Sarah Kember

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Introduction: What Is Life?

I'm not going to answer this question. In fact, I doubt if it will ever be possible to give a full answer. (Haldane, 1949: 58)

What Is Life?

J. B. S. Haldane (1949) and Erwin Schrödinger (1944), two of the twentieth century's most influential scientists, posed the direct question, 'what is life?' and declared that it was a question unlikely to find an answer. Life, they suggested, might exceed the ability of science to represent it and even though the sciences of biology, physics and chemistry might usefully describe life's structures, systems and processes, those sciences should not seek to reduce it to the sum of its parts. While Schrödinger drew attention to the physical structure of living matter, including especially the cell, Haldane asserted that 'what is common to life is the chemical events' (1949: 59) and so therefore life might be defined, though not reduced, to 'a pattern of chemical processes' (62) involving the use of oxygen, enzymes and so on.

Following Schrödinger and Haldane, Chris McKay's article, published in 2004 and included in this collection, asks again 'What is Life – and How Do We Search For It in Other Worlds?'. For him, the still open and unresolved question of life is intrinsically linked to the problem of how to find it (here, or elsewhere) since, he queries, how can we search for something that we cannot adequately define? It should be noted that this dilemma did not deter the founders of Artificial Life, a project that succeeded Artificial Intelligence and that sought to both simulate 'life-as-we-know-it' and synthesise 'life-as-it-could-be' by reducing life to the informational and therefore computational criteria of self-organisation, self-replication, evolution, autonomy and emergence (Langton, 1996: 40; Kember, 2003). McKay concedes that certain characteristics of life, such as metabolism and motion, can occur without biology, but rather than pursuing contestable (re)definitions of life that could not, for him, constitute the basis for a search, he prefers to ask a more pragmatic question: 'what does life need?'. The elements that support life – energy, carbon, liquid water, nitrogen, sulphur and phosphorus – are not contested and, barring only liquid water, they are abundant in the Solar System. It seems logical then, McKay argues, to search for life indirectly, by looking at where the water is. The case for liquid water on Mars has, as we will see, a long and argumentative history. In as far as the current case is, as McKay maintains, 'tight', then there is justification for his upbeat assessment that, with the correct instruments, it should be possible to find life-as-we-know-it – and even life-as-it-could-be. He writes: 'while it could be similar at the top (ecological) and bottom (chemical) levels, life on Mars could be quite alien in the middle, in the realm of biochemistry' (2004: 1261).

The tone of Zhuralev and Avetisovs' (2006) article on 'The definition of life in the context of its origin' is somewhat downbeat in comparison with McKay's. Life is too complex and diverse to define, they argue, and our understanding of it is poor. They offer a very useful overview of historical variations in the definition of life, ranging from Darwin's sense of life as a system that evolves by means of natural selection to more recent informational and ecological definitions. What is interesting about their argument – aside from a critical philosophical inclination that is often lacking elsewhere – is the extent to which they reject the view of life as information; a view that has characterised the technosciences since the discovery of DNA in the 1950s and that is derived, they suggest, from Shannon and Weavers' post-war Information Theory. As a defining characteristic of life, information is 'often reduced to storage and the expression of genetic information (2006: 281). Yet, for Zhuralev and Avetisov, information is likely to be far more complex than this. However, a more complex account of information as a factor of biological processes, structures and states is not currently available. I have argued elsewhere (2003) that the informational approach to life has long been contested within biology and computer science. In *The Darwin Wars* (1999), for example, Andrew Brown contrasts information-based genetic determinism (Richard Dawkin's view of life as the expression of our selfish genes) with the argument that the fundamental unit of life is in fact not the gene, but rather the individual organism – albeit one that receives and feeds back information to its own internal environment, and to the external one too. If the always contestable view of life as a (cybernetic) information processing system is, to an extent, unavoidable for Zhuralev and Avetisov, their own attempt at a contingent description puts

information into play with the materiality that Shannon and Weaver sought to elide (Hayles, 1999). Combining states with processes, it undermines the autonomy of both the individual agent/organism and the abstract informational or ecological system within which such an agent/organism supposedly resides.

From Exo- to Astrobiology

If ideas about complexity, heterogeneity and even relationality arise in Zhuralev and Avetisovs' 'doomed' quest for an adequate definition of life, they are notably absent in the fields of exobiology and astrobiology, which connect the question of life with the problem of finding it 'out there'. Exobiology and astrobiology are effectively synonyms, but Stefan Helmreich explains how and when (in 1998) astrobiology 'became a favoured designation for the study of cosmic biology when NASA founded its Astrobiology Institute' (2006: 68). On its webpage, NASA defines astrobiology as 'the study of the origin, evolution, distribution and future of life in the universe'. It is further described as a multidisciplinary field that encompasses 'the search for habitable environments in our Solar System and habitable planets outside our Solar System' as well as 'the search for evidence of prebiotic chemistry and life on Mars and other bodies in our Solar System, laboratory and field research into the origins and early evolution of life on Earth, and studies of the potential for life to adapt to challenges on Earth and in space' (http://astrobiology.nasa.gov). This definition encompasses the recent study of extremophiles, or organisms that live in environments previously considered uninhabitable due to extreme temperature, lack of oxygen and so on. It hints at the possibilities of terraforming – of recreating human societies on other

planets, including Mars – and has, at its core, the long-held assumption of an analogy between Earth and Mars.

The analogy between Earth and Mars is explored at length in Percival Lowell's books on Mars, spanning the late nineteenth- and early twentieth century, and included in this living book because of their widely acknowledged influence on the development of exo- and astrobiology, and, indeed, due to their direct relation to nineteenth- and twentieth century science-fiction (Markley, 2005). In *The War of the Worlds*, published just a few years after Lowell's *Mars*, H.G. Wells refers to the nebular hypothesis, a theory of planetary formation initially suggested by Immanuel Kant and Pierre Simon Laplace that is the basis of Lowell's argument for the existence of intelligent life on Mars. The nebular hypothesis maintains that planets were formed by condensed gas rings emitted from the Sun. The rate of cooling and subsequent habitability of the planets was determined by their respective size and distance from the Sun. Since Mars is both smaller than Earth and further from the Sun, it is, according to this hypothesis, 'older than our world; and long before this earth ceased to be molten, life upon its surface must have begun its course' (Wells, 1898: 1-2). For Lowell and Wells, the basis of the analogy between Earth and Mars is not simply that the two planets are neighbours, but that one is an older and therefore more evolved version of the other. It is, at this stage, a temporal analogy, which, through subsequent debates, observations and explorations of Mars – particularly in the 1960s – becomes also a spatial analogy. The latter is premised on the opposition of Earth and Mars as, respectively, the blue planet and the red planet (that is, when viewed from space); the live planet and the dead

one. It is my contention that this doppelgänger phase of the relation between Earth and Mars is nearing its end – an end signalled by Gilbert Levin's findings in the Viking Labelled Release experiment of 1976 and accelerated by the confirmation of Lowell's concerns about the sustainability of life on Earth. The two articles included here from the journal *Sustainability* demonstrate, I suggest, a continued allegiance to Lowell's thinking and a return to the earlier temporal analogy in which Mars stands, once again, for the future of life on Earth.

Astrobiology's analogies are of course premised on a belief in the autonomy of Earth and Mars, humans and aliens, and in their subsequent ability to interact with each other. The notion of panspermia – i.e., meteor-bound microbes travelling between planets and linking their respective origins and evolution – underlies astrobiology, as does the representationalism that allows a life form to be substituted or evidenced by its biochemical signature. Representationalism, as Karen Barad (2007) suggests, is premised on the autonomy of the thing and its trace; an autonomy which allows for the latter to be (as it were, by itself) more or less reliable, more or less accurate in its description of an object or being whose absence is therefore made present. In his article, 'The Signature of Life: Designing the Astrobiological Imagination', Helmreich reminds us that for Derrida (in 'Signature Event Context') the representational link is broken and that the signature has, in effect, no signer. Helmreich writes: 'the signature of life can exist only insofar as life itself is a replicable absence, a metaphysical quality we know when we don't see it' (2006: 73). Life itself, for Foucault, is precisely a metaphysical quality – it is not only a construct but a kind of construct that did not even exist

before the end of the eighteenth century. In the transition from natural history to biology and from the study of living beings to the study of life itself there is, Foucault suggests, a process of splitting and separation in which life and being become exterior to each other. Life, he argues, 'on the confines of being, is what is exterior to it and also, at the same time, what manifests itself within it' (1997: 264). The idea of life as an inexhaustible force which passes through but surpasses being informs the vitalist philosophy of Henri Bergson (1998). It is significant in this context that life for Bergson, associated as it is more with processes than states, more with becoming than being, remains resolutely unrepresentable.

Biosignatures are generated by biochemical processes such as the acquisition and conversion of energy, and are sought in the chemical ingredients, and even in the elements needed for life, notably water – but also, more recently, sulphur and methane. Drawing on the work of Hillel Schwartz, Helmreich considers the 'de-signs' or, to use Derrida's terms, 'dissentions' – the internal revolutions – at play within astrobiology (Helmreich, 2006: 75; Derrida, 1978: 38). He asks: 'Within the biosignatures astrobiologists employ – or, better, *design* – as evidence for life, do there lurk logics of de-sign? That is, having installed a representational system for detecting direct and remote signs of life, might astrobiologists also be curving away from this system, from these signs?' (76). The signs of de-sign exist, for example, in the recognition of the limitations of terrestrial analogies for extraterrestrial life, in the acknowledged but necessary reduction of life to its states, structures and processes and in contestations over visual evidence and the interpretation of data. Astrobiology's internal revolutions are what make and

unmake the field. They extend from Lowell to Levin and beyond, and they incorporate key events such as the claim, in 1996, that a team led by David McKay 'had discovered traces of biogenic materials and possibly of fossil microorganisms within ALH84001, a 1.9kg meteorite of Martian origin' (Taylor, 2001: 3). The Mariner 4 flyby of 1964 had dealt 'the final blow to the concept of Mars as an Earth-like and potentially life-bearing world'. Although the Martian meteorite demonstrated the continued desire for extant life of Mars, it revealed, at best, extinct life (13). The fossilised organisms onboard the meteorite were more virus-sized than bacterial and therefore a little short of qualifying as life forms. It was also suggested that the microbe-like structures were 'more likely to be artefacts arising from the preparation of fractured crystalline materials for examination by stereoscan electron-microscopy' (4).

The history of astrobiology is entangled with the history of technologies, from telescopes to microscopes via photography and spectrography. Although the trajectory from Lowell's observatory in Flagstaff Arizona to the onboard cameras of Spirit and Opportunity (NASA's robots, roving Mars since 2004) has involved moving ever closer to the object in question (life on Mars, past or present), the history of Mars technology has not been one of unquestioned progress, since the object has never been successfully disentangled from its mode of observation. The de-signs of astrobiology are more marked than those of other sciences because its object is ultimately elusive and its methods so variable. In his paper addressing historical perspectives on the question of life on Mars, Taylor shows how, between the late nineteenth century and the early twenty-first century, the 'pendulum of

scientific opinion' swung from the claim that there must be intelligent life on Mars, to the claim that there was no life at all, back to the possibility of microbial life, albeit in the past (2001: 14). This pendulum dynamic followed the use of different diagnostic instruments. The technological and contextual contingency of scientific claims extends, of course, to the design and execution of experiments – including, especially, the Viking experiments of the 1970s as one of the most contested of all. Viking 1 landed on Mars in 1976. It contained three different experiments designed to search for biochemical signatures 'consistent with the presence of life' (15). Robert Markley, in his comprehensive study of the science and culture of the *Dying Planet*, maintains that each experiment was limited by an unavoidable terracentrism, based on an analogy between life on Earth and life on Mars which defines and constrains both the popular and scientific imagination. He argues that the principal investigators 'acknowledged that they were operating from terrestrial expectations about how alien microbes might respond to water, nutrients, heat and light' and that their experiments 'encoded different views about how such hypothesized life might metabolize nutrients and respond to environmental stimuli' (2005: 244). Taylor adds to this the perhaps contentious note that 'prior to the actual spacecraft landings, the opinions of the three individuals responsible for each of the active-biology experiments ranged from optimism regarding the discovery of life (Gilbert Levin), a cautious 50/50 chance expectation (Vince Oyama), to complete pessimism (Norman Horowitz)'. Not only were their views largely unchanged once the data was analysed, he maintains, 'they have remained unchanged right down to the present day' (15).

Within the broad field of astrobiology, both analogical and representational reasoning are continually designed, de-signed and – as we will see by following the trajectory of both Lowell and Levins' work – re-designed. The question that remains, and may always remain, pertains to the possibility of extant or even extinct life on Mars that is sufficiently disentangled from extant (or even extinct) knowledge and preconception; techniques, technologies and values characteristic of life here on Earth. If alien life is truly alien, how do we recognise it? These questions, I suggest, become clearer if we switch registers from science to philosophy, or at least relinquish, rather than attempt to recover, the designs of representation and the presumed autonomies that underline analogical thought. However, two recent articles from the journal *Sustainability* show that these designs are far from relinquished and, indeed, as I indicated earlier, take us back to nineteenth century analogical thought in which the futures of Earth and Mars are intertwined. Pabulo Henrique Rampelotto's article considers what the continued 'discovery' (presuming as this term does the disentanglement of object from its mode of observation) of terran extremophiles offers to the field of astrobiology – which, in short, is the hope of extant life on Mars. Microbes, he maintains, 'can return to life even after hundreds of millions of years' and so there is the possibility, given that Mars once had an environment like ours, that 'life could have survived and adapted to the subsurface conditions' (2010: 1609). If life can be found under a rock in the Atacama desert, then why, Rampelotto asks, can't it be found on Mars? The list of known extremophiles is exhausting (thermophiles, psychrophiles, halophiles, acidophiles, alkaliphiles….) but not exhaustive. Life is just not as sensitive as we once thought. It can do without light

and even oxygen – though not, as Lowell always said, without water.

If Rampelotto's article looks from Earth toward Mars – an ageing planet that Lowell said was populated by a superior race of nevertheless doomed and dying Martians – Seth Baum's contribution to *Sustainability*, and to this collection, returns the gaze and asks: 'Is Humanity Doomed?'. Happily, he believes that our fate is not so certain. Baum does not share the environmental determinism that drove Lowell's theory of planetology, and he is equivocal about Lowell's sense of Mars as a prophet, 'foretelling our future' (Lowell, 1908: 111). Planetology is Lowell's attempt to reconcile the nebular hypothesis with Darwin's theory of evolution. He argues, in *Mars as the Abode of Life*, that there are six stages to a planet's evolution, taking it from birth to death. Earth is at stage 4 (terraqueous), while Mars is at stage 5 (terrestrial – the 'oceans have departed') and the Moon is dead at stage 6 (1908: 11). By virtue of being older than Earth in evolutionary terms, Mars indicates a future already foretold in the 'expansion of Earth's deserts' (135) – and, I might add, in the melting of its polar ice-caps. Environmental determinism may drive the 'Goldilocks principle' of astrobiology (the idea of habitable zones that are 'just right' for life), but Baum suggests that it is undermined by insights gleaned from extremophiles on Earth. He ponders the Fermi paradox – which suggests that logically, mathematically, there should be alien life in abundance even though we have, arguably, failed to detect it – and eschews Eschatology, or end of the world scenarios such as the impact event(s) that did for the dinosaurs. True, he says, our Sun will one day collapse, but since other disasters (for example, climate and ecological ones) are far more imminent, the question of

sustainability remains valid – and, indeed, vital. Since sustainability, for Baum, is a fundamentally ethical (as much as environmental) issue (see also Braidotti, 2006) that might enable humans to avoid the fate of Lowell's Martians – who are doomed, despite their canal-building efforts, to drying out – his conclusions are surprising. As if Lowell had morphed into Wells in his imagination, Baum suggests that our efforts to render our planet sustainable are only a means of buying time, 'so that future generations can colonize space' (2010: 600). Like Well's Martian invaders – driven from their own planet to colonize and consume the inhabitants of Earth – it looks likely that we may have to move out after all.

Mars and Martians

The pairings that structure the chapters in this book are analogues or doubles. They contain texts that appear to be autonomous but are, I suggest, co-constitutive of each other, even as the boundary cuts are made between science and fiction, Earth and Mars, humans and aliens. Cuts, according to Barad: 'cut 'things' together and apart' (2007: 179). She adds that 'what lies on the other side of the agential cut is not separate from us' (393) and therefore the challenge, ethically, is not how we do or don't, should or shouldn't respond to radical alterity, but rather, what is the degree to which we are prepared to recognise our entanglement with others – with the alien as the ultimate other, with Mars as a planet that co-evolves with Earth in the Solar System. If the human condition is one of becoming-with aliens (as well as technologies, animals and so on) and the condition of Earth is one of becoming-with Mars (among other objects in the Solar System), we retain, according to the psychoanalyst

Melanie Klein, a psychological tendency (which for me is also strongly cultural) to deny, or at least to defer, the recognition of our connectivity with seemingly exterior entities. Klein (1988) writes about the early development of infants, and about the anxiety that can be generated by separation – from the Mother as the original object of love and hate – and the frustration of bodily needs. That anxiety produces what she calls the paranoid/schizoid tendency, whereby good and bad feelings about the object are externalised, split and projected onto it. The object thereby becomes persecutory, and the subject becomes paranoid. Although the development process is by no means linear, it is not until those mixed feelings are synthesised internally that the infant moves into the phase of depressive anxiety, or greater psychic realism. There are, I suggest, many cultural manifestations, perhaps particular to the West (and its tendency, as Levi Strauss [1978] maintains, to think in binary oppositions), of our arrested, or at least non-linear development. Not least of these is our relation to Mars and Martians – a relation from which, it seems to me, we have endured a difficult separation, and through which we act out, in science as in the imagination, the frustration of our bodily-environmental needs. Indeed, our relation to Mars and Martians is, to say the least, a highly anxious one. Where – in fantasies of terraforming, or of intelligent and heroic canal-building aliens – it is clear that we idealise the planet and its inhabitants (from whom we may or may not have originated, and into whom we may or may not evolve), it is also apparent that we fear the sort of persecution that so far only our species has been proven to conduct. This, of course, is the subtext of *War of the Worlds*, which exemplifies and exposes the paranoid projections of Western cultural imperialism, embodying them in

monstrous, destructive, vampiric Martian-machines. On a note of pure speculation, I cannot help but wonder if a relatively stable era or phase of psychic realism will not be achieved until or unless we find – dead or alive – the first Martian microbe whose existence is not disputed and which is, if not strictly analogous, then at least related to our own. Our relationality with aliens, in other words, may need to be spelled out.

In the meantime splitting remains the sign of anxious agential connection. It is the bio/psycho/cultural signature of human-alien, co-dependent and co-constitutive life forms that may remain forever unrepresentable (or absent, in Derrida's sense), but that are nevertheless becoming (in Bergson's sense). Which is to say that human-aliens exist (as I argue in the epilogue) more *as* time than *in* space. Time, for Bergson (1998), is a synonym for movement, duration, creative evolution – and life itself. Human-aliens are a facet of what Barad (2007) refers to as the dynamic intra-actions of entities that appear separate and merely interactive. Bergson, before her, insisted that our eyes deceive us, and that we see only states, not processes. For me, these dynamic intra-actions also connect science and fiction; Percival Lowell and his detractors, such as Alfred Russell Wallace, without whom Lowell would not have written his later work; and also Gilbert Levin and his NASA-backed detractors, who have contributed to keeping alive a claim (of some 35 years and counting) that Mars is both habitable and inhabited. The pairing of texts in this living book as either analogues or doubles is therefore ironic, although it does demonstrate the pendulum dynamic of debates on Mars, and the extent to which these are structured by a dispute over the nature of scientific knowledge and, specifically, the relation

between observation and deduction, and between data and interpretation. Debates on Mars and Martians in the late nineteenth and early twentieth century do not simply contribute to the production of science-fiction, I maintain, but rather generate within themselves fictional and narrative tropes. They are stories involving compelling, un/reliable narrators; strong and sometimes obsessive characters; antagonism; a sense of crisis and a quest for resolution (see McKee [1999] for an outline of the characteristics of story-telling). What is more, although other commentators, such as Markley (2005), have shown the extent to which scientific debates remain porous, and are literally in-formed by the knowledge, technologies and values of their time, I would want to go further. In this book, I incorporate texts that span the interval from 1895 to 2011: I include, among others, the pairing of Lowell's *Mars* with Wells' *War of the Worlds*; Lowell's *Mars and Its Canals* with Wallace's *Is Mars Habitable?*, and Lowell's *Mars as the Abode of Life* with Levin's most recent update of his landmark piece, co-authored with Patricia Ann Straat and entitled 'Life on Mars? The Viking Labeled Release Experiment' (included here as 'The Labeled Release Experiment – Past and Future'). In doing this, I seek to reflect and enact not so much the porosity of science with relation to the social, but first of all the production of a technoscientific culture of inextricable fact and fiction, in which aliens always already exist.

I will not offer a summary of Lowell's books beyond the points that have already been highlighted; those that will be mentioned in the next section of the introduction concern method and the disputed nature of scientific knowledge. It is precisely in the protracted self-defence of his science of Mars and Martians that Lowell

establishes himself as an un/reliable narrator and an increasingly obsessive character, engaged in an antagonistic debate whose narrative crisis appears at the end of *Mars* and is resolved thirteen years later, at the end of *Mars as the Abode of Life*. The crisis, outlined by Lowell, and extended by Wells, concerns not so much the existence of beings on Mars, or even the biological, chemical and physical characteristics of Martian life itself. As Lowell puts it: 'That Mars seems to be inhabited is not the last, but the first word on the subject. More important than the mere fact of the existence of living beings there, is the question of what they may be like' (1895: 211). The crisis, then, concerns the character of the Martians; one that Lowell tends to idealise as superior in intelligence to us and more egalitarian (the canals spread across the entire planet to the benefit of all, and not just of those living in the relatively terraqueous poles), while Wells demonises it as excessively imperialist. Between them, they cover the spectrum of what Klein calls the paranoid/schizoid phase, in which anxiety (about the primary object) is felt as a fear of annihilation. Lowell foretells the annihilation of life on Earth as the planet moves inexorably through the evolutionary phases of its development. His books are, among other things, a series of projections in which the fate of Earth and Earthlings is played on Mars and Martians. This intelligent and socially-minded race of superior beings is doomed and dying. The crisis – and the tension – is resolved by his conclusion, at the end of his writing, that very soon this race will be dead. For Wells, the crisis of annihilating invaders is resolved by means of an annihilating invasion: the Martians are killed off by alien-human bacteria.

In recent decades, the scientific imagination has been organised around the prospect of Martians as- rather than Martians-with microbes. In this respect, the work of Gilbert Levin stands out as both a successor to that of Percival Lowell (maintaining, against a concerted and powerful opposition, the case for extant life) and as the clearest and most consistent articulation of a position towards which the pendulum of scientific opinion is swinging – albeit despite itself – as Mars begins, once again, to look habitable. In 'The Labeled Release Experiment – Past and Future' (written in 2011 and published here for the first time), he offers a retrospective analysis of the data and contested interpretations of his original findings in the 1970s. Then, in his paper with Straat, Levin concluded that although his findings were consistent with life, it was possible that 'non-terrestrial soil chemistry may be mimicking a biological response' (1977). His interpretation was cautious, he suggests in retrospect, 'because of the great significance of finding extraterrestrial life' (2011: 10). However, subsequent to the other two Viking experiments conducted by Oyama and Horowitz, it became the basis of the dominant view, sanctioned within the scientific community as a whole. Taylor offers a summary of the labeled release, gas exchange and carbon assimilation experiments, all designed to detect metabolic activity using different methods. While 'Levin and Oyama's experiments sought to detect life by the decomposition of organic nutrients into gas during metabolism', Horowitz's experiment 'was based on an initial synthesis of organic matter that would incorporate the labelled atmospheric gases supplied' (2001: 15). Even though, according to Taylor, two out of the three experiments 'appeared to indicate a positive result' for biological activity, doubts arose concerning the existence of organic molecules on

Mars and, prior to NASA ending its biological experimentation programme in 1977, the general opinion was that the results were either non-biological, or simply too ambiguous (15). For Levin, this ambiguity called for further controls and experiments, which he continues to conduct and design to this day. His aim, still, is to eliminate the possibility of a non-biological interpretation of the Viking data – that, he maintains, was never in itself contested. 'The disagreement', he writes, 'is about the interpretation – for life or not – of the data' (2011: 2).

Looking back over decades of disagreement, Levin now argues that, since his experiment 'satisfied the pre-mission criteria for the discovery of microbial life', there should have been an official follow-up, instead of which NASA and ESA merely presumed that the reaction generated by the labelled release experiment 'was caused by a strong oxidant in the surface material of Mars' (2). Since, for him, an interpretation based on the presence of oxidants is inconsistent with the data, and, having reviewed this in the light of subsequent research on extremophiles and the Martian environment, Levin is able to conclude that not only is it 'more difficult to imagine a sterile Mars than a live one', but that he did indeed find life (24). In a context in which the Goldilocks principle of habitats that are just right for life has been reassessed as a – perhaps – more Kleinian, depressive principle of not ideal but *good enough*, Levin is able to argue that it is now 'extremely difficult to deny that liquid water in amounts sufficient for microbial activity exists at the Viking landing sites and over broad areas of Mars' (18). The 'concept of Mars as a habitat' has indeed 'changed radically'; in effect, it has changed back from Wallace's claim that it is dry, uninhabitable and uninhabited to Lowell's claim that,

although it is caught in an inevitable dialectic with death, there is, after all, life on Mars (18).

Aliens Between Fact and Fiction – As If!

From H. G. Wells (1898) to Orson Welles (1938), and from *The Greening of Mars* (1984) to *District 9* (2009), there has been a tradition of writing about Mars and Martians that hovers between fact and fiction, presenting stories as if they were documents of events. Looking back at my own work, the concept of 'as if' has been associated with metaphor and the creation of associations between unlike entities, such as humans and machines, monsters or, indeed, aliens (Kember, 1998). Recently, however, I have revised my interpretation and associated the 'as if' concept more with metamorphosis than metaphor, and with the becomings attendant upon connections that always already exist (Kember, 2011). This interpretation is more consistent with Foucault (1997) – and, following him, with Braidotti's (2002) sense of the potentiality of between-space, as well as with Haraway (2008) and then Barad's (2007) reading of the intra-actions between companion species. I want to insist then on the companionate relationality not only of humans and aliens but of fact and fiction, of story and document. Being dynamic and processual, such relationality precludes the possibility of representationalism, and therefore of maintaining a division between truth and illusion. Without relinquishing its claim to representational realism, one of the many interesting things about Lowell's work is the extent to which – by virtue of its extraordinary conclusions, and its proximity in time and tone with a major work of fiction – it explores the boundary of truth and illusion and, what's more, pushes science toward an edge with art

and (emerging) media that is policed, increasingly, in the name of ethics. Boundary work, as more contemporary science story-tellers such as Haraway and Barad maintain, highlights ethics *not* as right response, but as recognition and responsibility toward the constitutive other. For Lowell, the constitutive other of science is philosophy and the constitutive other of the scientist is the sketch-artist and the photographer. In the Preface to*Mars and its Canals*, Lowell writes, in response to his as-yet unnamed detractors within the scientific community, that: 'Formulae are the anaesthetics of thought, not its stimulants; and to make anyone think is far better worthwhile than cramming him with ill-considered, and therefore indigestible learning' (1906: ix). Along with this propensity to make people think, he defends his method, namely a 'systematic study' of Mars, conducted while using 'a small instrument, in good air' and producing many hundreds of sketches and drawings, a number of which are reproduced in his books as evidence for canals – and therefore intelligent life – on Mars (1895: v). The chain of evidence that leads from a pencil sketch to an alien species is, he claims, a logical deduction, strengthened by the intervention of photography in 1905. This, involving the use of a colour screen amongst various other refinements, was able to reproduce what Lowell already saw, including some canals, some seas and even 'a snowfall' (1906: 275). Photography, for Lowell, was personified as a reliable, trustworthy observer, albeit one limited in ability. It could offer a recording 'after the fact', meaning after the conjunction of draftsman/sketch-artist, instrument and logical deduction – all of which added up to the ethics of 'seeing well' (274, 195). It is Lowell himself as the first observer (after Schiaparelli) of the canals, as the discoverer of life on Mars, who embodies the ethics of

seeing well. This, in turn, enables him to explore the boundary between truth and illusion with such confidence that he presents his work as proof that 'what reads like fiction is all the more wonderful for being fact' (196). Lowell's long reach over subsequent debates extends, I would suggest, to his assertion – and denial – of a connection between humans and aliens, fact and fiction, that de-centres 'us', that discomforted the conservatives of his day and that continues to enable later science story-tellers to do much the same.

My last pair of analogue-opposites consists of the equally fantastic *Sounds of Earth* and *Scrambles of Earth*. *Sounds of Earth* is the golden, interstellar record placed aboard the Voyager spacecraft in 1977 and designed by NASA to represent human life aurally to who ever or whatever might be out there to receive it. *Scrambles of Earth* is this same record remixed by extraterrestrials and recorded (the CD is available on Amazon) on behalf of SETI-X (the Search for Extraterrestrial Life in Exile), a dissident off-shoot of the better known organisation. SETI-X suggest that this recording is 'rather at odds' with the anthropological and technological aspects of the original project, which offers, in retrospect, 'incomplete recording information for much of the disc's non-Western music – with credit and copyright often given to those European and American ethnomusicologists who recorded "Pygmy Girls" and "Navajo Indians", while the names of Bach, Mozart and Stravinsky stand as tokens of unitary authorship and putatively universal genius' (http://earthscramble.com/). The alien remix is, according to SETI-X, implicitly critical of the original's Eurocentrism, and evinces almost total non-compliance with standard record speed (one rotation every 3.6 seconds), the distinction between sound and

noise, copyright laws and so on. It seems to me – although this could very easily be a facet of my own preconceptions – that *Scrambles of Earth* does not display the same desire to represent alien life aurally. Rather, what we have here is evidence of de-sign or dissent; an overturning from within which suggests that our extraterrestrial companions do not consider themselves to be altogether other.

Postscript

In lieu of an end-point or conclusion to this long introduction, I would like to offer a brief postscript, which serves to reiterate my argument that debates on astrobiology and the quest for life on Mars are analogical, antagonistic and ultimately circular. In a recent article entitled 'Media, Mars and Metamorphosis', I discussed a remarkable open access electronic book edited by Jeremy Hoyle and concerning, amongst others, a microbiologist named Lou (surname withheld for legal purposes). Lou had designed an experiment, conducted thus far in secret, to test for microbial life on Mars. It is reasonable, I think, to deduce that the experiment was carried and performed by one of the Mars rovers – either Spirit or Opportunity. We know for a fact that the ill-fated Beagle 2 did include biological experiments and, with Levin, I find that NASA's apparent reluctance to pursue life experiments literally beggars belief. Since Spirit has been stuck in a sand-trap for some time, there would certainly have been ample opportunity for this robot to conduct, for example, probe experiments into the sub-soil where liquid water is likely to be found, at least at certain times of the year. Lou, interviewed by Hoyle, and, having been fired by NASA and effectively released from his confidentiality

agreement, claims to have discovered microbial life in a form fundamentally similar to that of green sulphur bacteria which form in aggregates around unicellular organisms – in this case, resembling E. Coli. After Levin and Lowell before him, Lou submitted his findings to peer review, but was received with scepticism and ultimately humiliated. He was driven to take extreme measures to vindicate himself, and he reveals to Hoyle that he ingested the microbe so that he himself would come to embody alien life. Hoyle is dismissive, and readers of this volume may discover for themselves just how dearly his conservatism cost him (Kember, 2010). That is not what I am reporting here, however. Rather, I have been asked to give notice of Lou's intention (he is no longer speaking to Hoyle) to conduct a follow-up experiment – on himself. This will be an experiment designed to test for the presence of hybrid human-alien cells. I do not know, at this stage, whether or not they are green, but I am assured that evidence will be provided in the form of sketches and photographs as well as, of course, biochemical signatures. As it is the duty of the scientist to offer a taxonomy of life-forms, so it is the privilege of those who discover new life-forms to name them. Although Lou is still in the process of choosing a name, I can reveal that among those currently receiving his consideration is the *Clathratiforme Lowevinyte*, in homage, it would seem, to those who have influenced him and his field most profoundly.

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Articles

'Here are phenomena that are passing strange'

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Mars

H. G. Wells

The War of the Worlds

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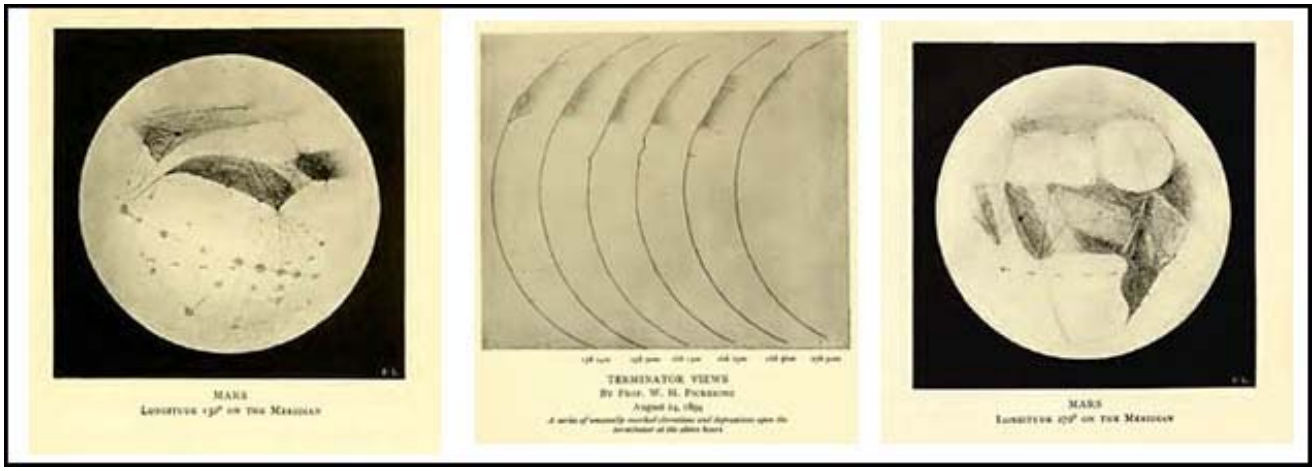

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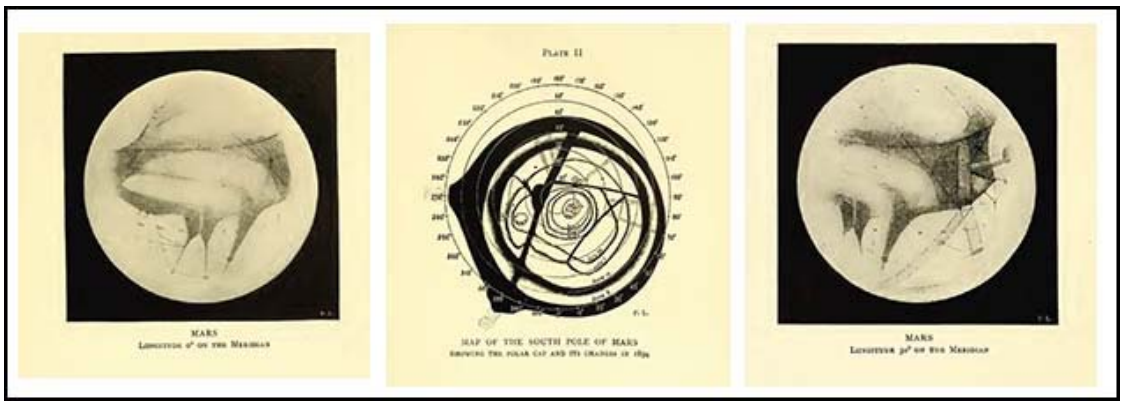

Afterword

Sarah Kember

Creative Evolution?: The Quest for Life (On Mars)

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