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The Ethics of Biocontamination¹

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Abstract:

The search for biosignatures and for life itself draws upon a strong background intuition that life matters in a deep way. Not just human life or sentient life, but life as such. Accordingly, biocontamination is a matter which concerns ethics as well as the protection of opportunities for science. However, this idea that life has value is a difficult intuition to tease out and understand, and even harder justify. It is difficult to make sense of in the light of 'the parallel case,' i.e. our largely instrumental treatment of microbial life here on Earth. In what follows, some tentative moves will be made in order to help us to understand the widespread intuition about life's importance. These moves will then help us to understand what is problematic about crashing tardigrades onto the lunar surface, and our ethical responsibilities in relation to any microbial life found in situ, elsewhere in the Solar System. The approach does not call upon rights theory, or focus upon individual microbes as the bearers of such rights. Attention is shaped by a more aggregate focus, and the concept of inherent value is qualified in order to draw out the relational dimensions of human valuing, and the pragmatic dimensions of an inclusion of the standing of microbial life within a social ethic.

Keywords: ethics, microbial life, inherent value, planetary environmental protection.

Running head suggestion: Ch1 biocontamination ethics

Webpage links: <https://www.cosmovis.uk> <https://kcl.academia.edu/TonyMilligan>

1.1 The Beresheet Tardigrades

In 2019, the Israeli lander Beresheet brought life to the Moon. The lander crashed, and parts of a disk imprinted with tardigrades in a dessicated/croptobiotic state are assumed to have survived the incident. The tardigrades need rehydration to do anything, but they are in situ, and

¹ Forthcoming in Octavio A. Chon Torres, Ted Peters, Joseph Seckbach and Richard Gordon, *Astrobiology: Science, Ethics, and Public Policy* (Wiley Scrivener: 2020).

are presumed to be alive. Seeding the Moon with life was not the primary goal of the mission, or any sort of explicitly stated goal of the mission. Rather, the aim was to achieve a soft lunar landing, brought about by private and state sector collaboration, with much of the credit going to the private sector. More specifically, to the American venture capitalist Nova Spivack's Arch Mission Foundation which does have a goal of sending life elsewhere in order to 'backing up' planet Earth. However, there seems to have been no intention to scatter living organisms in an uncontrollable way. 'For the first 24 hours we were just in shock,' Spivack stated afterwards. "We sort of expected that it would be successful. We knew there were risks but we didn't think the risks were that significant" [1.1].

In terms of the ways in which we approach space, and the extension of life's presence, I will assume that the approach was not quite good enough. The fact that the tardigrades were included was a surprise to people involved in the mission from the state side, with the manifest intentionality or unintentionally ambiguous. It is unlikely that their inclusion would have been approved by the Israeli Space Agency (ISA), had the contents of the disk been made clearer. This applies even though the legal requirements for planetary protection, which apply to Mars and the other planets, are not generally considered to apply in quite the same way to the Moon given the definitive absence of indigenous lunar life [1.2]. I will remain officially neutral on the question of whether or not the action was actually illegal, under international law, although my suspicion is that international law may simply be indeterminate on the question. And while legal responsibility would ultimately fall upon the Israeli state, as it was the launch state, I have no interest in linking this issue of biological contamination in space into some broader and hostile political narrative. Instead, my interest is in the ethical claim that it was wrong to take

the tardigrades to the Moon *in this way* and that the wrongness is nothing to do with the launch state. It would have been just as wrong if **the** agency involved had been NASA, ESA, Roscosmos, JAXA, or China's CNSA.

But what exactly was wrong about the action is less clear. Not because there may have been nothing wrong with it, but because there are multiple candidates for its wrongness. We might, for example claim that 'Any transfer of life from Earth to the Moon should be avoided,' or that 'Such transfer should be avoided until we have better control mechanisms,' that 'Life should only be transferred as a result of some sort of international consensus, in less haphazard ways, and with clear and defensible goals in mind.' I am sympathetic to the latter two claims rather than the first. Which strikes me as unnecessarily restrictive. To say this plays upon a widely shared intuition that transferring life of any sort elsewhere is something that matters, even if the life in question is in the form of micro-animals, like tardigrades, or even in the more rudimentary form of unicellular microorganisms.

Our best evidence is that this intuition *is* widely shared, at least across the scientific community and the space community more generally. The **apparent** discovery of unusual concentrations of phosphene in the atmosphere of Venus in 2017, as a possible biosignature, became something of an event when the **news** found its way into the international press during the Covid-19 epidemic, as a moment of great hope. Yet, nobody imagined that we were on the brink of discovering giant trees or the warring kingdoms of an Edgar Rice Burrough's novel. This was Venus, not Burrough's 'Amtor.' Life, if present, would be rudimentary. Yet, somehow still extremely important. Discovery would be one of the great events of the 21st century...if it occurred. We might also appeal to the **similar** hopes surrounding the Allan Hills 84001

meteorite, and the claims made in 1996 that it contained microscopic fossil evidence for life. A claim later rejected by the broader scientific community, but one which accelerated a sense that we might be close to discovery, and accelerated the expansion of astrobiology as a multi-disciplinary scientific research field.

What we can draw from these incidents is the breadth and depth of the intuition that discovery would matter a great deal, and not just because of its scientific potential but also as a pivotal event for humanity as a whole. Partly, it could be explained as a massive advance in astrobiology, and our understanding of life. But such a boost is not actually entailed, as anything like a matter of logical necessity, or of some loser conception of necessity. The kind of rudimentary life that we might discover could well reflect our local conditions within the Solar System, and be much the same as microbial life as we already know it. Or, it could be different, but in a way that falls within a range of extremophiles whose boundaries are of a familiar sort. We might even imagine finding something similar here, on the ocean floor or in a cave somewhere. This would give us something interesting and important, but on its own not nothing radically new in terms of biology, and it might not clarify our understanding of what life everywhere *must* be like. Discovery may instantly open up new vistas of microbiology, but it may instead open up lines of enquiry which are strongly continuous with those we already engage in.

Whatever scientific pathways it opened up, discovery would be a momentous event in our shared human history. Yet, it is difficult to say more than this, and tempting to treat it as a 'just so' story, to say in answer to the question of why we have this intuition and this attitude towards life 'we just do.' What follows will try to push our understanding of the intuition a little

further. Not too far, because it involves matters of depth, and progress in our understanding of them is often slow or else does not happen at all. The innovative moves will be distributed through the text, with a heavy concentration toward the end of the paper, where something will be said about planetary environmental protection and the ethical side of the avoidance of contamination. The preliminaries and mid-section will also involve some familiar moves, in an attempt to tease out our conflicting intuitions about microbial life, and the idea advanced by people such as myself [1.3] and Charles Cockell [1.4, 1.5] that such life might sometimes have ethical standing in its own right. In a sense, it is easier to understand why something that matters *in its own right* should also matter to us. Yet the idea here, of something mattering *in its own right* should not be mistaken for a claim that organisms of this sort have 'rights.' Which is one way to think about having ethical standing, but not the only way of doing so. In the case of microbial organisms, it may not be our best option.

In a terminology familiar from other areas of ethics (e.g. environmental ethics and animal ethics), it may help to talk about life as something that matters, as something with 'intrinsic value.' Although, this concept of 'intrinsic value' is often associated with arbitrary bestowals of importance, and it can be a little misleading in terms of what it tracks. By this, I mean that there are many examples of ethicists picking out some or other property as the locus of intrinsic value, and then using this to drive their entire position, even at the expense of implausible claims about the equality of all value bearers, from insects to humans and other primates [1.6]. In what follows, I will try to avoid this arbitrariness, and will comment upon why 'intrinsic value' is such an awkward terminology. Nonetheless, my point is that what sits behind our sense of the importance of discovery is not just aspirations for a certain kind of important

scientific progress, but a deep sense of life's own importance. A sense that even in its most rudimentary instances, life *can* matter, given the right context and circumstances. And this is one of the reasons why we have a reasonable sense of caution about how we spread it elsewhere. The next section will try to tease out possible grounds for this attitude towards life, as something that can matter in its own right, in spite of a conflicting intuition that many of us also have about the relative unimportance, or strictly instrumental importance, of certain kinds of life.

1.2 Our conflicting intuitions

It is difficult to make sense of how humans can reasonably hold two apparently conflicting attitudes about microbial life at the same time: (1) our widely shared view that finding rudimentary life elsewhere would be extremely important, and that such life *ought* to be protected, for more than scientific reasons; coupled (2) our mundane treatment of microbial life here on Earth in a strictly instrumental way. Microbial life is indispensable for our lives. Indeed, as Donna Haraway [1.7] points out we are outnumbered in our own bodies, with more bacteria than cells carrying our DNA. Yet, we also depend upon oxygen to survive, and we are not about to claim that it has some sort of intrinsic value. Routinely, and often intentionally, we destroy microbial life, and we have no bad conscience about doing so. We destroy it as something which has not importance in its own right. Yet, the life that we would find wonderful in the first of these attitudes may be much the same, in structural terms, as the life we destroy in routine ways. Let us call this 'the parallel case.'

Of course, we might set aside all such deliberations by appealing to the basic unreliability of ethical intuitions and the attitudes they underpin. In which case there is no problem to be explained. Our intuitions about the importance of life elsewhere, its discovery and protection, would then say something about our psychology, rather than about the genuine importance of any of these things. However, this is a move that comes at a high price. The actual practice of ethics, and especially of attempting to think in some orderly way about ethics, requires us to draw upon our shared ethical intuitions. We may then discard them in the light of further deliberation, or we may come to regard some intuitions as more important than others, in the light of various theories about ethics, or in the light of various thought experiments, or in the light of described experience. We may pursue what John Rawls called a 'reflective equilibrium' between theories and intuitions, or between intuitions, principles and a multiplicity of theories. Or we may adopt some similar approach which acknowledges that intuitions themselves have an important functional role in ethics. They shape background requirements and ways of speaking across ethical differences between peoples, times and cultures. They may not be where we finish, when engaging in ethical enquiry, but they are often a useful starting point or part of the mix, in our best deliberations about ethics. I will take it, then, that a fell-swoop approach of simply dismissing our intuitions about the value of life will generate too many other problems. Our intuitions are something to be explained and examined, not dismissed.

What may make the combination of the two attitudes above harder to understand as a rational, justifiable combination, is a way of addressing ethical questions about the non-human by appeal to a concept of 'value' in the sense of 'intrinsic value.' A concept I will use here, but

with a cautionary warning. The concept can make us think about inherent properties as the locus of ethical importance, as something we might separate from everything else and still regard it as having the same significance. Exactly what sort of entities are taken to have has, of course, shifted over time. So, for example, there was a time when many philosophers believed that only humans had such value, because the inherent property which was the locus of value was rational autonomy [1.8] or, more traditionally, the possession of an immortal soul [1.9]. With changes in our attitudes towards non-human animals [1.10, 1.11], the relevant property shifted, to sentience. Something less demanding than rational autonomy. (Which some animals may actually have, but others probably do not.) Yet the structure of justification remained the same: something inherent was sufficient grounds, on its own, for attributions of value [1.12]. Environmental ethics then led to a further readjustment, allowing us to attribute value to places and things without requiring them to be sentient. While we may try to think like a mountain, in the manner proposed by Aldo Leopold [1.13], mountains do not actually think. They are not sentient. It is only in science fiction [1.14] that we might consider Olympus Mons as inherently valuable because of an imagined sentience.

Environmental ethics has traditionally been split in multiple ways. Some versions say that we should care for the non-sentient, including non-sentient life, for strictly instrumental reasons [1.15]. Other versions attribute value to such life and also to various sorts of non-life (mountains, and rivers thought of as distinct from the life they support). Within discussions of how to extend environmental ethics to space, Erik Persson [1.16] takes something closer to the former view, while I take the latter view. But this is not a division between warm-hearted theorists, and theorists of a different sort. Advocates of animal rights also tend to

withhold value attributions from microbes, yet they could hardly be regarded as lacking in a sense of warmth or care for the non-human. In many cases, those who hold different positions in the debate may urge exactly the same practical forms of protection protocols for microbes, albeit with marginally differing justifications. Is this, then, a difference that makes no difference? I suspect not, for two reasons. First, an intrinsic value approach does help to make our familiar attitude towards discovery more intelligible. Second, it is far from obvious that we can tell any plausible, non-arbitrary, tale about what makes any ethical claims true while placing rudimentary life forms outside of the cluster of things whose value is endorsed. This is more of a methodological and metaethical point, and it takes the discussion off in a slightly more abstract direction. However, the small number of abstract metaethical moves which are made below will be kept to a minimum.

Among the approaches which do allow that microbial life can be of inherent value, some take the 'inherent' part of the idea in a fairly literal sense. However, rather than rationality, or sentience being the special property which is of value, it is *structure*, or *structured complexity* which is taken to be important. And there is something to this idea. Structures which are unique contribute to diversity, and they may make individual things irreplaceable. Applications of the idea to the context of space have important strengths [1.17]. Although, they can also go off in unusual directions, e.g. when it is claimed that limiting entropy is itself somehow an ethical goal, and perhaps something that a cosmos-level or cosmocentric ethic could be based around [1.18]. However, moves of this sort can be a little like participating in a game in which we are asked 'Pick a property...any property,' and ethical considerability is then associated with whatever property we happen to select: self-consciousness, sentience, structure, and so on.

The most plausible versions of this approach are ones which suggest that structure is at least *part* of the story of why we value things. They may also appeal to a concept of ‘integrity’ which is arguably more intuitively plausible than talk about ‘rights’ in the case of non-sentient life or things [1.19]. If, for example, I ask an old question once put by Chris McKay [1.20], ‘Does Mars have rights?’ there is something a little odd about the question. But if I ask ‘Does Mars have integrity?’ we can more readily understand what is at stake. And what is at stake will be partly a matter of the unique Martian structures of places such as Olympus Mons and the Valles. Structure, then is part of the story of value if we appeal to the more plausible ethical concept of integrity, but it is not the whole story. After all. Everything has structure, yet we cannot value everything in the way that we may value living things and special places.

Also, if we appeal *only* to structure we will be back where we started, dealing with the parallel case. As indicated, the awkward truth is that any microbial life that we find elsewhere, and value, may well turn out to be structurally similar to microbial life here on Earth, i.e. the kind of life that we routinely kill in large numbers as part of our daily lives. Life which we also kill intentionally when using sanitizing gel, or when we clean kitchen worktops and bathrooms. Yet in such cases, it seems absurd to suggest that we are doing anything wrong. There have, admittedly, been voices making precisely this suggestion, but they have tended to draw upon a special sort of religiously-inflected ethic about life. Here, I am thinking of the Jain tradition, which has been in something of a longstanding care conflict with Buddhism, and geared to showing a broader range of care than that extended by Buddhists to all sentient beings. And, up to a point, I am thinking also of Albert Schweitzer, who drew upon Jain ideas in the 1920s, and combined them with a Christian-inflected reading of respect from Immanuel Kant, to

produce a sort of ur-theory of life's value, drawn upon later by environmentalists in the 1960s and 1970s [1.21]. Schweitzer's view was that all life had value. Indeed, all life had *equal* value, but the pragmatics of being human require us to set this aside in cases where it is simply impractical. We are flawed beings and cannot value all that we ought to, and in the way that we ought to.

Structure, if thought of as just another move in the property identifying game, may fare no better than the rest (rational agency, sentience, and so on). What we may need to break out of the game is a more relational understanding of what is at stake, rather than one which treats value talk as if it involved the search for some mysterious inner thing of wonder, a kind of invisible inner gold, undetectable by our best science. Appeals to integrity already tend to do this, either deliberately or by accident. They shift towards more of a 'systems' view of things, locating individual things in a broader supporting and enabling context. For example, Holmes Rolston III [1.22] is notorious for making this move of an appeal to 'integrity' of other planets in his early attempt to theorize environmental ethics in space: unique structures bear the marks of unique history. The value of whatever has value is not then to be thought of exclusively in terms of its immediately present structure, but in terms of the combination of structure, the unique past that it is a signature for, and its contribution to diversity [1.23]. Such an approach has traction when it comes to the parallel case. It allows us to make sense of our differing attitudes towards what may be structurally similar life forms as more than an issue of pragmatics, more of a sense that we need to kill microbes routinely *here*, but do not need to kill them *there*. Rather, microbes *here* and *there* have different histories, and it is (at least in part)

as a result of these differing histories, and our overall differing relation to them, that we are justified in treating them differently.

To back up this more relational shift in our thinking about value and about practices of valuing, we may think of our most striking experience of what it is to value something other than ourselves, i.e. love. Consider an old thought experiment from Derek Parfitt: if you love someone who steps into a replicator and is disassembled, should you love the person who steps out at the other location? They will be a physiologically exact duplicate. Parfitt believes that we should. Some of us think that cases of this sort are more problematic [1.25, 1.26]. What matters, from the standpoint of loving another, is not structure alone, but unique causal history. For example, I want to go home to the same Suzanne that I met at the end of my teens and sat out with under the stars, not a physiologically or structurally exact copy. Just as I want to see the original paintings by Titian, and not a brilliant duplicate. (And yes, I know that exact duplication may only be possible in theory, but that is enough for such thought experiments to run. Conceivability does not always entail possibility.)

But what this drives us towards is not simply a one-dimensional account of the role of relations in attributions of value, one which connects structure and history and does little else. Rather, it drives us towards acceptance that the whole practice of talking about value is really a way of capturing something about our human relations to each other, and to things that certain agents will tend to regard as important *in their own right*. Another way to make the point is to say that 'value talk' can usefully be seen as a sort of convenient shorthand which helps us to recognize what might more formally be referred to as 'reasons for action and response.' This approach to value talk is very different from treating it as a way of picking out hidden inner

gold. Instead, there are reasons for acting and responding (e.g. for feeling compassion and regret) in particular ways, that suitable agents will be able to appreciate. For convenience, I will speak of 'reasons for action' and leave the reader to fill in various other sorts of associated reasons for feeling in particular ways, and for response more generally. Additionally, the reasons that I have in mind are not instrumental, or at least they are only ever partly instrumental. They acknowledge things as having a significance in their own right, in ways which can be independent of our interest in them.

In line with this approach, if we can say that all human agents with a reasonably unimpaired rationality and appropriate socialization would affirm something, or recognize something, then from an ethical point of view, *who could ask for anything more?* If only a crazy person, or someone suffering from a certain kind of mental disorder would act in a particular way, this will give us everything that we need to know in order to use a language of value and of ethical truths in stable ways, secure in the expectation that future humans will share much the same attitudes, unless something goes badly wrong.

Of course, ethical disputes often involve disagreement among rational agents, rather than general agreement with only irrational or impaired agents dissenting. And in this respect they are like disputes about politics and economics. But both of these are cases in which disagreement on its own is not taken to imply the absence of truth. Such disagreement, instead, indicates the difficulty of finding the truth, and particularly so in context where beliefs are heavily skewed (on all sides) by interests. Similarly, we can navigate our way through ethical disagreements in much the same way by considering the best way to look at matters, among multiple rivals. Sometimes there may be no such best way of looking at matters, but we will

often accept that some ways are better than others. And this will narrow the range of our legitimate options. My point here is the simple and familiar one that value talk then presupposes valuers. Value talk makes little sense without them. Yet, it is less misleading for such talk to draw upon metaphors of vision, and of seeing, than it is for such talk to draw upon metaphors of projection. Such talk concerns recognition and response, recognition that various aspects of how the world stands are particularly salient to our deliberations, ways of feeling, and actions. And having the relevant kinds of responsiveness is part of what it is to be human.

Strictly, in terms of metaethical theory, this draws upon what is known as a ‘response-dependent’ approach [1.27] to what makes at least some ethical claims true. Certain kinds of suitable observers are disposed to respond in particular ways, with sensitivity to what others might miss, and certain kinds of things are disposed to produce the relevant response in agents of this suitably sensitive sort. The dispositions are not all on the one side, with the human agent. The dispositional properties are both *here* and *there*. In terms of metaethical theory, this may well be ‘the best game in town’ unless we want to say that ethics is constructed or projected. But it is also an approach which blocks off arbitrary restrictions of value to rational beings, or sentient beings. Instead, it keeps such attributions aligned closely with the boarder range of things that suitable and well-placed agents are actually disposed to value.

As an exemplar, and one which draws us back directly to the valuing of living things, we may think of two variants of a familiar story. One draws from Loren Eiseley’s short story, “The Star Thrower” (1969), in which a narrator encounters a young boy confronted with a mass of starfish washed up on the beach. He holds on away from the mud while the narrator asks “Do you collect?” The boy throws the starfish back to the water and replies, “Only like this...And

only for the living.” The narrator later compares our human predicament to that of stars cast onto an infinite beach by an unknown hurler of suns” [1.28] The story is about small acts of compassion, but the compassion in question presupposes that there is something worth saving and not just some manner of private distress. In the second variant, which owes something to Ronald Hepburn’s essay on “Wonder” (1980) [1.29], the boy on the beach finds out that he can get a couple of cents for every starfish that he gathers but does not return to the sea. And so, he gathers a massive number, exchanging their lives for pennies. The thought here is that there is something lacking in his encounter with the creatures. He sees them only as exchangeable goods. A sense of wonder is missing, or at least compromised.

Comparing the two cases, it will take a good deal of work to convince most of us that there is nothing to choose between them. Or that the first is a merely sentimental reaction, and the second a more realistic reaction. The clash here is certainly, in part, a clash between two ways of seeing. And perhaps one way of seeing is a lot ‘nicer’ than the other. But my point is not just that we side with the child who tries to rescue the starfish. Rather, my point is that the child who sees only the financial potential of the echinoderms really is *missing something* about them. That, in some sense, he sees less of what there is to be seen, while the child who throws back the starfish sees more. He has a fuller grasp of the reality. Moreover, this idea does not depend upon his possession of a theory of mind and consciousness. He may turn out to have no view at all about whether starfish or urchins think. If he were to come to believe that they are only reactive, and not conscious in any way which is analogous to our consciousness, we need not imagine that he would then behave any differently. They might still be seen by him as living creatures, and their lives of even one or two might still be seen as something worth saving.

1.3 The Intelligibility of microbial value

The above story about value and valuing begins to allow us to make sense of why we think that the presence or absence of even non-sentient life can be a significant matter. And here, we need not mistake the beginning of a fuller account for more than it is. Even so, it helps us to make sense of why the discovery of life or of genuine biosignatures in the atmosphere of Venus would be momentous. And why we might think that randomly populating the Moon with micro-animals is not the kind of thing we should take lightly, as an insignificant accident. In neither case do we need to think of the rudimentary forms of life in question as the possible precursors of more complex life, or beings such as ourselves. Yet, given the choice between a universe in which there is no life, or a universe in which there is only microbial life, and with no prospect of evolving into beings of some other sort, most of us would choose the latter. This, again, is a thought experiment, or 'only' a thought experiment, rather than a demonstration of a more rigorous sort. Yet it can show us something about our attitude towards life, or it can help us to articulate, more clearly, what that attitude is..

But if we do go down this road, and accept that we may well have reasons for action in relation to living things which are not just about our own interests, or about anything other than the living things themselves, where does it get us? I will take it that several significant problems still remain. And one of these concerns intelligibility. In the case of microbial life, which feels nothing at all, can we even make sense of the avoidance of biocontamination as a matter of 'protection' in any familiar sense? Can we, for example, think of ourselves as engaged in an attempt to ensure that no *harm* is done? While it may be difficult to make sense of talk

about microbes having rights, we may still have to defend the difficult idea that it makes sense to talk about microbes being *harmed*, when there is no way for them to experience the harm. The example of the starfish on the beech may perhaps suggest that experience is not really what matter here, but we may still have more to say about what is at stake.

To do so, I will make a softening up move, an argumentative move which begins to erode a familiar intuition in favour of something a little more qualified. It involves consideration of our own case. Ordinarily, when we are harmed, we imagine some physical impact that we are all too well aware of. Or perhaps we might think of psychological trauma. In any case, the paradigm instances of being harmed do seem to involve awareness. What we do not feel and do not know do not harm us. But are such cases of harm really the only ones in which harm occurs? There do seem to be other cases of the sort which have figured in accounts of posthumous harm [1.30], and cases where harm occurs but there is no associated experience.

For an example of the former, consider the possibility that the folios of Shakespeare's plays might have been destroyed in the Great Fire of London, i.e. in an event which occurred after his death. In the imagined world where this occurs, Shakespeare's impact upon the world is much less than it has been in our own world. He is forgotten, or reduced to a footnote. Someone who might figure only in dissertations on obscure playwrights of the Elizabethan era. Perhaps, we might find it difficult to say that Shakespeare himself has been harmed, because he would not be around to be harmed, but perhaps the excellence of his life has been harmed. Or, we might use any one of several alternative descriptions, leaving little doubt that *something* had been harmed, and the something in question is closely connected to the playwright. In this case, the harm would not be contingent upon his awareness of the harm. We need not imagine

that he hovers around in the air somewhere. Also, this is not just a peculiar example, but a thought experiment which draws out our familiar intuition that we have duties and responsibilities in relation to the dead, and that these do not reduce to our ways of caring for those who are alive.

Pulling matters even closer to the mundane. Are we really so confident that 'What we do not know cannot harm us'? Let us suppose that you are unfaithful to your partner. I am not talking here about open relationships, but straightforward infidelity under conditions where there is a reasonable and unforced expectation of exclusivity and loyalty. The norms of intimacy which are internal to the relationship are violated. Let us also suppose that you are extremely careful, and that there really is no way that your partner can find out. It seems odd to say that you have done something wrong, but that there is no victim of the wrongdoing. That nobody, or nobody's life has been in any way damaged. That its excellence has not been in any way compromised. Surely, it is better to have a life in which one's partner is faithful, rather than unfaithful, *irrespective of whether or not any infidelity is ever disclosed?* Similar imaginary cases can be run in order to drive home the point. Rapists who ensure that their victims are never aware of having been raped have nonetheless harmed them in terrible ways. These are cases which erode our rather hedonistic sense that what we do not know, and are not aware of cannot harm us, that harm is akin to pain and benefits akin to pleasure. Rather, in terms which matter here in a direct way, *harm does not always depend upon awareness.*

Of course, we can say that these are cases that involve beings who have been aware at some point in time, even if they are not aware of the harms in question. And that may seem to be a significant consideration to some of us. I think it may be irrelevant, but accept that others

might see things differently, and neither of us may be making a blunder of any easily demonstrated sort. So, let us treat this only as a softening up argument, and nothing more. What really gets us over the line to the idea that non-sentient life, such as microbes, can be harmed is a combination of two further arguments.

The first is an argument of a familiar sort, first formulated in modern terms by Richard Routley [1.31], drawn from environmental ethics and (a little inconveniently) named the “Last Man Argument.” This is a little inconvenient, because it is gendered in a way which is entirely unnecessary but also plays upon a problematically gendered strand of environmentalist thinking. So, let us think of it as a “Last Human Argument.” This last human has outlived all others and, with his dying movement, wantonly chooses to cause untold environmental devastation. Forests are blown up, canyons flooded, and so on. Surely, he or she does something wrong? Yet the wrongness is difficult to make sense of without allowing that something is actually harmed. We can also remove various candidates for such harm from the thought experiment, e.g. other creatures. This takes us as far as the original version went. The point was to drive the intuition that ecosystems and the environment matter in ways which go beyond their usefulness to us, or to any other particular creature.

The thought experiment can, however, be extended in ways which also remove all sentient life, and leave only the non-sentients. In such a case, the destruction still seems wrong and it is still difficult to say that wrong is done, but there is no harm. Harm again seems separable from an awareness of harm. A variant of this Last Human Argument has been run by Charles Cockell, in order to tease out the idea that microbes may have value in their own right [1.4]. We are invited to imagine someone who wantonly kicks through a microbial mat. Surely,

they are doing something wrong? Surely, harm is done, and what harm presupposes is something to which the harm attaches. We can also strengthen the case in various ways: make it the only one of its kind, allow that all relevant scientific inquiry has already been conducted, and so on. It still seems that wrong is done, and that the wrong specifically involves harm. In some respects, this kind of argumentative move also overlaps with the choice between universes case above. In both, there is a presupposition in favour of life over non-life. Life is also taken to be the kind of thing that can be harmed, hence also the kind of thing that might be protected.

The second argument concerns ideas of directedness, flourishing or 'telos.' Our language for human well-being often draws from non-sentients, and in particular from the world of plants. There is something for a plant, or a tree, to *flourish*. Its development has direction. Trees are usually the exemplar which is appealed to here [1.32]. They have a 'good of their own' [1.33]. This is a good which may be blocked, and the blocking is a form of harm to trees. This matches well with our ordinary ways of thinking about things. When someone sets fire to a tree, the tree is harmed (unless it is one of those forest trees which are part of a cycle in which fire helps propagation of offspring). The trees are harmed without being aware of the harm, and the harm takes the particular form of blocking their directedness or development. Something similar may be said about micro-animals and microorganisms. Indeed, while we may have no universal definition of life by contrast with non-life, we have multiple working definitions that we can use more locally, and they tend to include functional activity. Having something like directedness is, or is close to being, partly definitional for life. All life may be harmed in this sense.

These reflections may draw upon a kind of moral sensibility which is not shared by all readers, yet they do not require us to posit anything outlandish. They do not require us to claim consciousness or sentience where we have no evidence for it, in order to underpin value talk in the relevant contexts. But, more importantly, they do not imply that we should adopt any impossibly demanding attitudes towards microorganisms. By this, I mean that an account of microbial value should not fall into the trap that Albert Schweitzer [1.21] fell into: the idea that all life should be regarded as equal, or as equal *through and through*, i.e. equal in more than some elusive ultimate metaphysical sense. (The universe is equally lacking in any concern about any of us. In that respect, we are all equal.) A restricted variant of this same mistaken move, which extends only to sentient life, is a familiar feature of classic animal rights theory [1.11], but not of more pragmatic forms of animal rights advocacy [1.12]: the idea that all value bearers are equal. Value is then thought of in binary terms. You can have it or not, and it always involves exactly the same moral standing.

A commitment to equality of this sort is not a psychologically available standpoint for beings such as ourselves. Nor is it at all required. We cannot treat microorganisms as having the same importance as humans, and should not ordinarily treat them as having the same importance as other sentient beings, entire rainforests, rivers, and so on. Indeed, the idea that all value bearers are equal, or that all life is equal, fits better with an understanding of value talk which again treats it as a way of speaking about hidden inner gold, rather than as a way of talking about our reasons for action (and response). When we adopt the latter approach towards value it should be readily apparent that we have very different reasons for action in relation to different sorts of creatures and different life forms. In ordinary life, my reasons for

action in relation to a microbial mat and in relation to my wife Suzanne may in some small respects overlap, but they will also in some very large respects diverge. Even if I were to notionally claim to treat them equally, this would not accurately track the pattern of my actions. The latter would still show significant differences in my practices of valuing.

The crucially important political language of egalitarianism, which fits so well and does so much work in certain areas of our lives, and in some animal and environmental contexts, has little useful role to play in such deliberations about microbial value. We are not, then called upon to value microbial life in impossible, or excessive, ways. Yet, to say this is not to revert to a 'no value' view, or to say that terrestrial microbes and microbial life in situ elsewhere in space are much the same, from an ethical point of view. Again, we will have very different (legitimate) reasons for acting in relation to them. We will have reasons for protection in the case of Martian microbes that we do not have in relation to the microbes on the kitchen chopping board, or in the bathroom sink. We will legitimately worry about biocontamination in relation to the former, but not the latter, even if decontamination protocols themselves involve the destruction of terrestrial microbes.

1.4 Contamination and Discovery

To recap, we *can* make sense of the widely shared intuition that some kind of special protection ought to be extended to even the most primitive forms of life, if we should ever find them elsewhere in the Solar System. Talk about their having value or (more precisely) intrinsic value can be understood in terms of our having reasons to act in ways which show a regard to avoid harm, but which are not driven by our own interests. Of course, the idea of 'having reasons' of

this sort is itself something that might be analyzed in various different ways. It is something else that we might argue about. However, for convenience, I will take it that a reason for action is something that plays a role within a practice of justification. Such practices have to end somewhere, at a point where we are satisfied that enough has been said. (We do not mimic children who simply say 'But why?' no matter what they are told.) But the place where they end varies from context to context. A consideration may justify in one context, but not in another context.

So, what then are the kinds of things that we might say, by way of justification, when considering the protection of microbial life from the dangers of biocontamination? Here are some examples: 'It is the only life indigenous to this planet,' 'It comes from a second and entirely distinct genesis,' 'It has been around for billions of years, as part of a process that we do not want to end,' 'We should not be the kind of beings who think only of our own interests,' and so on. None of these are the kinds of bedrock consideration that our 19th century predecessors might have sought for as a solid foundation to which every ethical justification could ultimately be traced. But very little of our patterns of valuing draws upon foundations of that sort. Such foundations do little in terms of lived ethical agency. Rather, we are almost invariably caught up in the different task of weighing one inconclusive consideration against another, while accepting that these considerations really do matter even though they are not conclusive.

Weighing up microbial protection is like this too. I have already committed, above, to the view that value bearers should not, and cannot, be treated equally except in some limited contexts. Our reasons for protecting microbial life *for its own sake*, will not be the same as our

reasons for protecting one another from biohazards. And this applies here, or on any planet we happen to go to. And if we were ever to discover complex, sentient, life somewhere, in a place which also had microbial life, we would have reasons to prioritize protection of such complex and sentient life over the microbial life. Or, to regard the latter as part of a larger ecosystem which supports the more important kind of life. The fact that one kind of life is sentient, while the other is not, would itself be a reason that we could obviously offer in any justification of our actions. In some cases, it might be enough, in others a little more might need to be said. The general point here is, however, a simple one: all life *cannot* be treated equally, all of the time, but what we offer by way of a justification for treating different life forms differently should at least be intelligible to others, and it should stem from something other than any simple form of anthropocentrism, fantasies about human destiny, or some similar ideologically-driven consideration. Moreover, it is life that matters greatly, not microbial life that matters greatly. Microbial life matters because it is life, and not because of the rights of individual microbes, or because of any impossible extension of admirable political ideas about equality.

Where this leaves us is with some easy choices, and some much harder choices which will form the conclusion below. Among the easy choices there is the basic assigning of priority in comparisons between microorganisms and more complex beings. That will generally go to vital matters of life and death for sentient organisms and for beings in relevant ways like ourselves. We can, of course, imagine peculiar cases in which the life of a single human can only be saved at the expense of all known microbial life in some place. And that could be a genuine dilemma of a peculiar sort. I do not think we could ask the human to sacrifice their life to save the second genesis, but we could understand why they might do so, and might even admire

their doing so. Note also, I revert here to a language of historic depth (i.e. second genesis) to grasp a sense of the psychological state of a human caught up in such a predicament, and fully able to realize the enormity of the decision they face.

On the simpler side, and as an extension of this same life or death thought experiment, there is also the default commitment to preservation rather than destruction. If we find life elsewhere, even microbial life, we should not destroy it or expose it to risks of biocontamination, unless there is some absolutely compelling reason to do so. We should not be like the wanton agent in the Last Human Argument, and it is difficult to imagine someone who would consider it acceptable to act in such a way, unless they happened to be damaged by their own past. This default commitment to preservation rather than destruction extends to reasonable protocols concerning forward contamination. The assumption that the biochemistry of life elsewhere will be so different that it will always be safe from whatever we bring with us may be a convenient assumption, but it is not a safe assumption. We do not need to work with anything so optimistic, even though going would be considerably less expensive if it happened to be true. Protocols to avoid forward contamination, until we know what we are dealing with, should remain robust. And this is already covered in planetary protection protocols, although a further appeal to planetary environmental protection will add a further rationale for what we already try to do.

On the simpler side, there is also the question of the permissibility of experimentation. Generally speaking, experimentation only becomes an ethical problem in the case of experiencing subjects such as humans and other animals. Accepting microbial value is also not the same as attributing rights in the traditional way, i.e. to *individual* right bearers. There are

few contexts in which we ever encounter microbes on an individual basis. Rather, except under laboratory conditions, we encounter them in aggregates. Hence, Charles Cockell's choice of examples, i.e. the wanton destruction of a microbial mat [1.4]. Valuing microbial life is largely about how we behave in relation to microbial life in aggregates and *as a whole*, or *overall*. And this is not something that would ordinarily be impacted by experimentation. Nor does it entail any consequentialist maximisation, favouring a default of having more individual microbes rather than fewer on the grounds that every microbe is precious, so the more there are the more value will exist. (I do not think that value talk works this way with humans, much less with microbes.)

There is one possible qualification to this. The Viking lander experiment which delivered a false positive in 1976 involved testing for biosignatures in a regolith sample, then super-heating the sample to destroy any microbial life, and retesting the sample. There may well be something wrong about arriving on a planet and *immediately*, as first priority, trying to kill indigenous life. Admittedly, it is difficult to explain why it would nonetheless be permissible later, but not *in that moment*. However, the intuition that it is not a good way to begin looks like it might have a justification. The justification could, of course, appeal not to microbial value, but to 'who we want to be.' Yet, a point of the latter sort, a virtue or character-focused point, would probably presuppose something like microbial value in order to make sense of the idea that harm has been done, and done in a way which should have been avoided.

What all this points towards or suggests is an ethical default of *protecting what we find*, in the sense of *protecting whatever overall level of microbial presence we find elsewhere in the Solar System*, and the requirement that we must have a good reason for disrupting this

presence in significant ways. (And yes, this leaves questions over the distinction between 'significant' and 'non-significant' disruption.) In its favour, as a point about political realisability, this ethical approach will synchronize well with planetary protection for scientific inquiry. And neither involve anything akin to a microbial version of the prime directive in which ~~non-~~interference with life is outlawed. As a qualifier, I use the language of 'points towards' and 'suggests,' in order to emphasize the provisional nature of these conclusions, and the fact that they are not logically entailed by some set of first principles in combination with the available evidence. Arrival at this point has instead drawn from something less rigorous than that, but also from the kind of enquiry which may be well suited to the elusive nature of the difficulties of talking about ethics in relation to microbial life forms elsewhere, i.e. in a context which is relatively new.

A final simple-side consideration, and one which aligns well with this ethical default of *protecting what we find*, is that we should not add to the complexity of our ethical dilemmas, unnecessarily, and without a good reason. There may, for example, be good reasons to take microbial life to Mars, or even tardigrades to the Moon *at some point in time*, but when we do so, we alter the playing field and the range of considerations that we must then take account of. This should not be done for trivial reasons, or by accident. Once it is in situ, microbial life may be on the way to having a different standing from the standing it has on Earth. A dropped petri dish may be picked up, the disk with imprinted tardigrades may be picked up, at this point in time. Later, may be different. On this view, what was wrong about crashing tardigrades onto the Moon was not just the 'go it alone approach' which did not pay due regard to the need for

an international consensus, it was also the risk of ‘changing of the playing field’ for no good reason.

1.5 Conclusion

The final substantive section above considered some of the easier implications of accepting microbial value and doing so in the qualified and non-demanding way. As indicated, such an acceptance of microbial value will help to make sense of our shared interest in discovery. An interest which extends beyond scientific curiosity and is rooted in a sense that life matters to us. The best way to value life is, of course, to value living things when we can, and in the ways that we can. And this is about our relation to the rest of life, rather than simply a matter of recognizing inherently valuable structures or properties. Value talk works best when understood as a shorthand for our relation to others, to ourselves, and to what is non-human, i.e. as something relational. (Although it is not the relation itself that is valued, or at least not only this relation.)

On the harder side, we are left with the difficult question of specifying the extent of protection that any discovered microbial life would deserve, given that it would be an instance of life and that life is something we value. There may be no context free answer to this. It might depend upon just how rare we consider life to be in the universe. If peculiar local conditions within the Solar System have given rise to two independent cases of life’s evolution, but the peculiar conditions really are peculiar, I suspect that we would have to regard our reasons for microbial protection as stronger than they would otherwise be. Beyond that, any attitude towards microbial protection as part of a societal-level ethic would have to meet the

requirements that any societal-level ethic of any sort must meet: it would have to be psychologically available to ordinary agents; politically viable (given some reasonable, if ordinarily flawed, set of political structures); and stable enough for some approximation to it to be accepted across multiple generations. The exploration of space is, after all, a multi-generational project.

These requirements suggest that a viable form of microbial protection from the risks of biocontamination, or from other harms, could not interfere with otherwise justifiable human activities such as infrastructure construction, scientific enquiry, and resource extraction. We can imagine cases in which it may make sense to say ‘Don’t mine there’ because of the local presence and patterning of microbial life. Cases of this sort might be the ‘sharp end’ of the ethical dilemmas we eventually face in the light of an acceptance of microbial value. (Rather than the fictionally extreme scenario considered above, where the human must die if the microbial life is to survive.) But, given that our attitude towards microbial protection is an aggregate attitude, and draws from a concern with life as such, it would be much harder to say ‘Don’t mine anywhere’ on similar grounds. There might always be other reasons for us to restrict mining, but that is a different matter.

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