



Contents lists available at ScienceDirect

# Studies in History and Philosophy of Biological and Biomedical Sciences

journal homepage: [www.elsevier.com/locate/shpsc](http://www.elsevier.com/locate/shpsc)

## Normativity, agency, and life

James Barham

Department of Philosophy, University of Notre Dame, 100 Molloy Hall, Notre Dame, IN 46556, USA

### ARTICLE INFO

Article history:  
Available online 21 June 2011

Keywords:  
Normativity  
Agency  
Life  
Teleology  
Naturalism  
Organism

### ABSTRACT

There is an immense philosophical literature dealing with the notions of normativity and agency, as well as a sizeable and rapidly growing scientific literature on the topic of autonomous agents. However, there has been very little cross-fertilization between these two literatures. As a result, the philosophical literature tends to assume a somewhat outdated mechanistic image of living things, resulting in a quasi-dualistic picture in which only human beings, or the higher animals, can be normative agents properly speaking. From this perspective, the project of 'naturalizing normativity' becomes almost a contradiction in terms. At the same time, the scientific literature tends to misuse 'normativity,' 'agency,' and related terms, assuming that it is meaningful to ascribe these concepts to 'autonomous agents' conceived of as physical systems whose behavior is to be explained in terms of ordinary physical law. From this perspective, the true depth of the difficulty involved in understanding what makes living systems distinctive *qua* physical systems becomes occluded. In this essay, I begin the attempt to remedy this situation. After some preliminary discussion of terminology and situating of my project within the contemporary philosophical landscape, I make a distinction between two different aspects of the project of naturalizing normativity: (1) the 'Scope Problem,' which consists in saying how widely in nature our concept of normative agency may properly be applied; and (2) the 'Ground Problem,' which consists in rationalizing the phenomenon of normative agency in terms of the rest of our knowledge of nature. Then, in the remainder of this paper, I argue that the Scope Problem ought to be resolved in favor of attributing normative agency, in the proper sense of those words, to living things as such. The Ground Problem will be discussed in a companion paper at a later time.

© 2011 Elsevier Ltd. All rights reserved.

When citing this paper, please use the full journal title *Studies in History and Philosophy of Biological and Biomedical Sciences*

### 1. Introduction

In this paper, I will explore the possibility of giving a realistic account of normative agency, properly so called, as an essential property of life. Needless to say, this is a highly ambitious and contentious thesis. I will not be able even to touch upon all of the many questions raised by my thesis here, much less provide anything like a proof. What I will do, however, is discuss two specific issues, which—together with a third issue I hope to discuss on a future occasion—I trust will constitute a *prima facie* case for at least according my thesis serious consideration.

First, in Section 2, below, I will deal with some key definitional issues. What exactly do we mean by the concepts of 'normativity' and 'agency'? How are the two concepts related? And what might it mean to 'naturalize' normativity and/or agency? In reply to this

last question, I will distinguish eliminativist and epiphenomenalist versions of 'naturalized normativity' from the realistic project of giving an account of the place in nature of normativity, considered as an objectively existing phenomenon. Furthermore, I will argue that if we take the realistic project of naturalizing normativity seriously, then we must distinguish between what I will call the 'Scope Problem'—namely, the problem of determining the proper scope of application of our concept of normative agency—and the 'Ground Problem'—the problem of characterizing the physical ground of normativity in nature.

Then, in Section 3, I will investigate the Scope Problem, arguing that the proper scope of application of our concept of natural agency is to life—that is, to living systems, or organisms—as such. A similar investigation of the Ground Problem will be undertaken elsewhere.

E-mail address: [jbarham@nd.edu](mailto:jbarham@nd.edu)

## 2. What do we mean by 'normative agency' and what would it mean to 'naturalize' it?

The paradigm case of 'normativity' is undoubtedly moral prescription and proscription, expressed through the terms 'ought,' 'should,' 'must,' and related locutions. For example: 'Thou shalt not kill.' Nevertheless, it is not difficult to see that the moral 'ought' is only a species of a wider genus of normativity that applies to human actions generally. For example: 'You *ought* to use a hammer (to pound nails)'; 'You *should not* smoke (to avoid coming down with lung disease)'; 'You *must* practice, practice, practice (to get to Carnegie Hall)'; and so on. What all of these normative claims have in common is the prescription or proscription of an action, considered as the appropriate means to attaining an end. In this respect, we can see that norms are instrumental in character. They seem to be essentially involved with furthering the actualization of ends by specifying actions conducive to such actualization. That is, norms connect ends to the appropriate means, and wherever there is a means-end relationship, there is normativity in this sense. If norms are real, as opposed to merely notional, then the 'specifying' of appropriate actions that they do makes a real contribution to influencing or determining real events in the world. To this extent, then, norms are analogous to ordinary causes—physical forces—but, as I shall argue below, they cannot be construed as literally being ordinary causes or physical forces. In fact, the crux of the problem of normativity lies in understanding how something that is not an ordinary cause or physical force can nevertheless have a real influence or determinative power over events in the world.

The norms I have been discussing so far are clearly nonmoral, since actions attain a moral quality by virtue of their impact on the welfare of other human beings—an impact which actions like using a hammer, giving up smoking, and practicing one's musical instrument lack (at least directly). Moreover, moral and nonmoral norms are both 'instrumental oughts,' since they both connect ends to the appropriate means.<sup>1</sup> Following the customary terminology, we may distinguish 'moral actions' from merely 'prudential actions.' Let us call, then, nonmoral instances of prescription and proscription of actions instances of the 'prudential ought.' It follows that the genus 'instrumental ought' consists of two species, the 'moral ought' and the 'prudential ought.' And so the 'moral ought,' resident in our paradigm of normativity, is in fact only a fairly restricted special case of a much more general phenomenon. This is also evident from the fact that all 'moral oughts' prescribe or proscribe human actions, but not all prescriptions or proscriptions of human actions are moral in character. Many of them are prudential. In other words, outside of the sphere of moral action lies the vast sphere of prudential action where normativity is equally present under the guise of the 'instrumental ought.' This entitles me to ignore the 'moral ought' here, in spite of the fact that it is our paradigm of normativity. Everything I say hereafter about normativity should be understood as applying in the first instance to the 'prudential ought.'

Another issue that must be addressed is the nature of what I have been calling 'prescription' and 'proscription.' As we have seen, human beings often express normativity by means of such auxiliary verbs as 'must,' 'ought,' or 'should.' In addition, the imperative mood of the verb is often employed for this purpose. Moreover, norms may be codified in the form of written or unwritten laws, rules, maxims, and other types of commands, prohibitions, and recommendations. All of these types of normativity seem to involve language and human intentionality in a fundamental way. This is an issue that is orthogonal to the moral/prudential issue. That is, the seemingly linguistic character of normativity considered as

prescription would seem to restrict the 'prudential ought' to human actions as surely as the 'moral ought' is so restricted. After all, how can there literally be prescriptions in the absence of a prescriber, commands in the absence of a commander, and so on?

And yet the notion of normativity does appear to be more widely applicable than just to the human case. For instance, it is natural to say things like: 'Dogs *ought* to get plenty of exercise'; 'Hearts *should* beat in sinus rhythm'; and 'Plants *must* have water.' This makes it seem as though there is a kind of *requirement* in some natural systems that has nothing to do essentially with either language or human intentionality. This notion of requirement is more generic than prescriptivity, or, in other words, human language-mediated prescriptivity stands in relation to this broader notion of normative requirement as species to genus. If that is so, then it is natural to ask: What is the nature of this more generic form of normative requirement? This is another way of posing the question that lies at core of this project, and will comprise the main topic of Section 3, below.

Yet another distinction I wish to make involves two different senses in which the terms 'normative' and 'normativity' are sometimes used. I will call them the 'narrow' and 'broad' senses. In the narrow sense, normativity is simply the 'instrumental ought' that we have been discussing up until now, namely, the idea of requirement—that is, the fact that there is something that an agent is required to do in a certain situation in order to attain a particular end. Though the notion of normative 'requirement' is already broad with respect to the narrower notion of 'prescriptivity,' it is nevertheless comparatively narrow in relation to another way that the term 'normativity' is sometimes used—namely, as an umbrella term to designate a family of closely related concepts for which we seem to have no collective name in colloquial English. We use the term 'normativity' in this broad sense *faute de mieux*, and the resulting ambiguity can give rise to confusion if we are not careful. The family of related concepts that are sometimes referred to as 'normative' in this broad sense is specified by the network of mutual implication existing among a number of concepts that are analytically contained in the concept of 'action' in the normative sense of 'acting for a reason' (as well as the concept of 'agency,' understood as the power to 'act for a reason'). 'Normativity' in this broad sense encompasses such concepts as purpose, value, well-being, need, and being a reason for action, in addition to the narrow 'instrumental ought.' In Section 3, below, I will attempt to justify the claim that there is in fact a natural kind corresponding to this umbrella concept of 'normativity.' For now, I would like to make a more limited point regarding the claim that normativity—in both the narrow and broad senses of the term—is intimately connected to agency.

First, take the narrow sense of normative requirement as the 'instrumental ought.' If normative requirement is the fact that an agent ought to (or should or must) do something in a given situation in order to attain a particular end, then normativity in the narrow sense clearly implies agency. But what about the converse case: Does agency imply normativity? If actions are held to be somehow controlled or guided by reasons, and if reasons are held to be metaphysically distinct from causes, then reasons may be said to indicate what should, or ought to, be done in a given situation. This does make it seem as though agency implies normativity. Unfortunately, there are two difficulties with this claim.

The first difficulty lies in determining the kinds of things to which the concept of normative agency may be properly applied.

<sup>1</sup> This is true even if one interprets 'moral oughts' as categorical imperatives, because the categoricity of a moral imperative lies in its supremacy over other imperatives (i.e., its unconditionality), not in its pointlessness. Categorical imperatives, too, prescribe or proscribe actions, and *ipso facto* connect ends to means (for example, where the end may be construed as 'doing one's duty').

Call this the ‘Scope Problem.’ The problem arises from the fact that many commentators feel that reasons may properly be said to exist only where the capacity for their conscious weighing, or rational deliberation, exists. Accepting this claim would of course mean that only human beings could qualify as agents in the normative sense. According to this way of thinking, one ought to take care to say that human beings ‘act,’ while other animals merely ‘behave,’ where actions are held to be guided by reasons, in contradistinction to behaviors, which are merely caused.<sup>2</sup>

Nevertheless, we find it natural to speak of the ‘reasons’ that (at least some) non-human animals have for doing the things that they do. For example, if I observe my cat jumping down from the windowsill and going into the kitchen, and I know that the kitchen is where her milk bowl is located, then I may infer the reason why she went into the kitchen: namely, to get a drink of milk. All of this seems closely analogous to my own behavior when I go into the kitchen from time to time to get a drink of water. If I say that getting a drink of water is the reason why I go into the kitchen, why should I not say that getting a drink of milk is the reason why my cat goes into the kitchen? It is true that my behavior may sometimes be complicated by the existence of countervailing reasons (‘Shall I have a beer instead?’) and the need to weigh them in a way that my cat’s behavior is not. But I see little reason to doubt that our motivations in this case are basically similar—that when my cat is thirsty she experiences something similar to what I experience when I am thirsty; that the pleasure she takes in her milk is not so different from the pleasure I take in my glass of water; and so on. And, indeed, it may often happen that my behavior may be nearly as simple and unreflecting as hers (say, if I go into the kitchen on ‘automatic pilot,’ that is, with my mind on something else). If my unreflecting behavior nevertheless qualifies as acting for a reason—that is, qualifies as an action in the normative sense—then why should not her behavior so qualify? It may still be objected that I am trading on an ambiguity in the notion of a ‘reason.’ There is also a causal use of the concept, as in asking for the ‘reason’ for an airplane crash or a mining accident. Therefore, one might wonder why my cat’s reason for going into the kitchen should not be construed as a purely causal reason of that sort. Of course, one would then have to explain why that construal of the concept should apply to my cat’s behavior, but not to my own behavior. However, that would be a superficial reply. And, besides, there may be some readers who would be prepared to see my own reasons given this same sort of causal construal. Therefore, to address this worry adequately will mean digging deeper, and attempting to elucidate the fundamental difference between causes and normative reasons. Indeed, in a sense, that may be viewed as the central aim of this paper. But, in that case, I cannot accept the charge of equivocation, as that would amount to the claim that there is no important difference between causes and reasons, which would be the main question at issue here.

If my cat’s behavior really is so similar to mine as to justify counting it as a case of normative action, still it cannot be denied that it differs importantly from mine in that in my case the potential for rational deliberation is always there, while in her case it is not. This is certainly a significant difference, and it needs to be marked by a terminological distinction. Let us call the cat’s form of acting ‘subrational.’ But then, the question arises: Is subrational action truly normative? To the extent that we are comfortable explaining the cat’s behavior by reference to reasons, it

would seem that it is. But if we accept this, then obviously we cannot associate the concept of acting for a reason with rational deliberation alone, nor can we sustain a distinction between action and behavior in the traditional way. There are several ways to go here. One would be to deny that subrational behavior is truly normative action. Another would be to say that not all action is truly normative, but that a sort of ‘subnormative’ action also exists. Yet another would be to bite the bullet and admit that our original distinction was misguided, and that the higher animals (at least) are fully capable of action in the normative sense. But since this last way involves rejecting the association of acting for a reason with rational deliberation, the question would then arise: How are we to understand the capacity of acting for a reason—that is, normative agency?

This brings us to the second difficulty involving the claim that agency implies normativity. This difficulty lies in understanding how something like normative agency can exist in nature at all, given the rest of the world picture painted for us by contemporary natural science. Call this the ‘Ground Problem.’ I note in passing that the Ground Problem is just as much a problem for those who hold that the concept of normative agency is essentially connected with rational deliberation as it is for those who would widen the concept’s scope of applicability to include (at least) the higher animals. However we resolve the Scope Problem, the Ground Problem still remains—which is not to say, however, that some solutions to the Scope Problem may not lend themselves more readily than others to a solution to the Ground Problem.

In the next section, I will argue in favor of a radical solution to the Scope Problem that views normative agency as a property of living things as such. That is, I claim that all organisms are normative agents, and that only organisms are normative agents in a literal, original, and underived sense. This claim will be based on a conceptual argument that consists of several components, but which is ultimately based on the fact that what distinguishes organisms as a natural kind is that they must act in order to preserve themselves in existence.<sup>3</sup> Upon another occasion I hope to address the Ground Problem.

In this section, I have so far focused on explaining what I intend and do not intend by the terms ‘normativity’ and ‘agency,’ and I hope thereby to have clarified my aims in this paper. Before turning to the detailed investigation of the Scope Problem, however, there is one more preliminary matter that I would like to discuss in order to reduce still further the possibility of misunderstanding. Broadly speaking, this paper can be viewed as a contribution to the project of ‘naturalizing normativity’—a project that is proceeding along a broad front of contemporary philosophy. And yet, for many philosophers the concepts ‘normative’ and ‘natural’ remain antithetical, and the idea of ‘naturalized normativity’ is an oxymoron. For this reason, a few words about what the project of naturalizing normativity does and does not entail are necessary.

The project of naturalizing normativity is a highly various and complex enterprise, but perhaps it would not be oversimplifying matters too much to distinguish three main approaches. The first approach is the effort to eliminate normativity from our ontology altogether. On this view, normativity is ‘naturalized’ by showing that it does not really exist, and that in reality the ‘natural’ (understood here as a contrast class to the ‘normative’) is all there is. This may be achieved, it is supposed, either

<sup>2</sup> Here, I shall say that an event is ‘caused,’ in the sense of ‘efficient causation,’ if it is determined solely by physical laws as currently understood by mainstream, contemporary natural science. This somewhat convoluted formula is intended to leave open the possibility that, while present-day natural science may lack a theoretical perspective apt for the proper understanding of acting for a reason, it is nevertheless conceivable that such a perspective may be developed in the future.

<sup>3</sup> I acknowledge many difficulties in specifying what is to count as an ‘organism’ (what do we say about viruses, colonial organisms, cancers, beehives, and other doubtful cases?), but cannot consider the problem in detail here. For present purposes, I assume that the individual prokaryotic cell is the paradigm organism.

by showing that the putative normative phenomena (such as actions) to which our normative concepts seem to refer can be ontologically ‘reduced’ to nonnormative phenomena, and so are redundant, or else by showing that the putative normative phenomena do not really exist in an objective sense, and are merely a subjective ‘projection’ of human concepts and behavioral response patterns onto the world—i.e., a sort of ‘illusion.’ The justification for the eliminative approach may be expressed by means of something like the following argument (*viz.*, the ‘Eliminative Argument’):

- (1) The picture of the world painted for us by the present-day physical sciences (including chemistry and biology) is complete in all fundamentals. Call this the ‘present physical picture.’
- (2) Our ontology—that is, our list of the things that really exist in an objective sense—ought to correspond to the present physical picture.
- (3) The present physical picture makes no mention of normative phenomena.
- (4) Therefore, normative phenomena do not really exist in an objective sense, and ought to be eliminated from our ontology.

Now, this simple picture would have to be complicated in numerous ways if a faithful account of the state of play in the literature were our goal here. For one thing, it would have to be acknowledged that there are relatively few philosophers who explicitly embrace eliminativism (e.g., Churchland, 2007; P.S. Davies, 2009). This should not be surprising, since to deny flat-out that normativity exists is a very strong and highly counterintuitive claim. But it does mean that the many philosophers who subscribe to one form or another of ‘reductionism’ owe us a clear explanation of exactly what they take the ontological status of the ‘reduced’ higher-level entities to be. To see this, let us set aside the many complex epistemological and semantic issues, and look toward the metaphysical implications of the basic reductionist idea—that a higher-level ‘reduced’ entity is ‘nothing but’ or ‘nothing over and above’ the lower-level entities and relations of the reduction base.<sup>4</sup> It would seem that the reductionist is faced with a dilemma. After the ‘reduction’ has been carried out, the reductionist must say either that the higher-level ‘reduced’ entity still exists as a real entity with causal powers of its own, or that it does not. If the ‘reduced’ entity is held still to exist, then the position of the reductionist will be difficult to distinguish from that of the nonreductive physicalist (to be discussed below). If not, then the position of the reductionist will be difficult to distinguish from that of the eliminativist. Either way, the reductionist position will be revealed to be unstable.

In any case, my goal here is not to stake out a position on reductionism for its own sake, but rather to limn the conceptual alternatives available for ‘naturalizing normativity.’ For this purpose, it is enough to define ‘reductionism’ with respect to normativity as follows:

*Normative Reduction:* To reduce a putative normative phenomenon is to give an account of the phenomenon that is both empirically and theoretically adequate and that neither employs nor presupposes any normative concepts.

If an empirically and theoretically adequate account of a putative normative phenomenon (such as action) could really be given in entirely nonnormative terms, then surely we would be entitled to deny the reality of the normativity of the putative normative phenomenon. Whether one takes an ‘epiphenomenalist’ or a frankly ‘eliminativist’ attitude toward the ‘reduced’ putatively normative phenomenon, then, would seem to be of comparatively small interest. What is of signal interest is that under the scenario we are considering we would appear to have little reason to allow the putative normative phenomenon onto our list of the real features of the world. For all intents and purposes, then, reductionism with respect to normativity is virtually indistinguishable from eliminativism, and so there is little reason for us to consider it here as an independent position within the conceptual landscape of ‘naturalized normativity.’<sup>5</sup>

At the opposite extreme from eliminativism is so-called ‘liberal’ (McDowell, 1998) or ‘naïve’ (Hornsby, 1997) naturalism.<sup>6</sup> This second main approach to naturalizing normativity is a view that takes common sense rather than natural science as the arbiter of what is to count as ‘natural,’ i.e., as belonging to ‘nature.’ Liberal naturalism assumes that human beings are members in good standing of the natural world. This means that all the properties of human beings—indeed, all phenomena associated with, or pertaining to, human beings—are likewise natural. On this view, ‘natural’ contrasts with ‘supernatural’ (what ‘transcends’ nature), but not with ‘normative.’ The normative, as a feature of the human, is to be viewed as a subset of the natural. This of course raises the question of how the normative natural phenomena and the nonnormative natural phenomena (let us call them the ‘physical phenomena’) are related. However, liberal naturalism considers itself under no obligation to explain this relation. Rather, liberal naturalism is content to point out the limitations of natural science. Science is cognitively authoritative as far as it goes, but it only goes as far as the physical phenomena. Its writ simply does not extend to the entirety of nature. That is, liberal naturalism denies premise (2) of the Eliminative Argument outright. But while it is assuredly true that at present the normative phenomena lie beyond the ken of natural science, it is not clear why this limitation should be one of principle, true for all time. The problem with liberal naturalism is that by elevating the present limits of natural science to a matter of principle, it can seem to come perilously close to dualism. For if it is true that the normative is a part of nature, then there must be some connection between the normative and the physical, and what reason can there be in principle why natural science should be forever forbidden from coming to understand the nature of this connection?

In between the two extremes of eliminativism and liberal naturalism is nonreductive physicalism. This third main approach to naturalizing normativity exists in a great variety of different forms, but they all have in common the idea that premise (2) of the Eliminative Argument ought to be, not denied outright as in liberal naturalism, but relaxed in such a way as to make it possible for us to admit into our ontology the normative and other higher-level phenomena, which are conceived of as standing in a certain admissible relation to the present physical picture, even though they are not formally a part of that picture. The trick here is to specify the exact nature of the admissible relation between the normative phenomena and the present physical picture. The

<sup>4</sup> In a more adequate discussion, several different forms of reductionism would have to be distinguished: epistemological vs. ontological, and with respect to the latter, causal vs. compositional forms, to name only a few (see Gillett, 2007).

<sup>5</sup> For further discussion of these issues in terms of the realism/anti-realism debate, see Fine, 2002.

<sup>6</sup> One might suppose the opposite of eliminativism to be not liberal naturalism, but dualism—by which I mean the positing of a fundamental ontological discontinuity between normative and physical phenomena. For dualists, the natural is to be identified with the physical, understood as the ‘nonnormative,’ such that the ‘normative’ and the ‘natural’ become contraries. That being the case, it seems more appropriate to classify dualism, not as a pole within the naturalization project, but rather as the repudiation of that project altogether.

two main candidate relations are supervenience and emergence.<sup>7</sup> Unfortunately, there are good reasons to believe that the supervenience relation collapses back into epiphenomenalism—and hence, for all practical purposes, eliminativism—while the emergence relation has been criticized as being underspecified and mysterious (see Kim, 1998).

In this paper, I will pursue a strategy that has affinities with both liberal naturalism and nonreductive physicalism, but which accepts premise (2) of the Eliminative Argument according to the principle that it is desirable that our picture of the world be unified. Instead, I will deny premise (1). That is, I will claim that we have good reason to believe that the present physical picture is radically incomplete. Completing our physical picture will mean enlarging it to make room for the normative phenomena, considered as objectively real. Call this position ‘normative realism.’ No heavy-duty metaphysics is required to support normative realism; it merely requires being prepared to accord to normative phenomena the same ontological status that we ordinarily accord to non-normative phenomena. In other words, ontological parity between normative and nonnormative phenomena will be realism enough for our purposes here.<sup>8</sup> In this way, we will be able to vindicate the liberal naturalist’s insistence on according full ontological status and dignity to the normative phenomena, without walling them off from the physical phenomena on principle. At the same time, the nonreductive physicalist’s postulate of a relation between the normative phenomena and the physical phenomena will be vindicated, and the relation itself clarified and shown to be admissible, by means of the notion of the nonreductive ‘grounding’<sup>9</sup> of normative agency in physical phenomena of a certain sort that remains to be specified, but is capable in principle of being fully incorporated into our future scientific world-picture. With these various distinctions under our belt, let us now turn to the Scope Problem.

### 3. What is the proper scope of our concept of normative agency?

I begin with an informal argument for taking the proper scope of our concept of normative agency to be life itself, i.e., living systems, or organisms, as such. To simplify the presentation of the argument, however, I would like first to stipulate a definition of one of the concepts employed in it. The reason is that some of the concepts that might naturally be assumed to fall under the concept of normativity in the broad or umbrella sense (like the moral right; courage, justice, honesty, beneficence, and the other virtues; beauty; etc.) are of no relevance to our reflections here because their applicability is restricted to human beings. Therefore, it is convenient to define an intermediate class of normative concepts that lie in between normativity in the widest possible sense and normativity in the narrow sense of the ‘instrumental ought.’ I will

call this intermediate group of normative concepts the class of ‘elementary normative concepts,’ which I define as follows:

*Elementary normative concepts* are normative concepts connected to prudential instrumental action generally, exclusive of the normative concepts that imply human rational deliberation.

Examples of the elementary normative concepts are purpose, value, well-being, need, being a reason for action, and the ‘instrumental ought’ (normative requirement in the narrow sense). With this definition in hand, we are ready to proceed to the main argument of this section—let us call it the ‘Scope Argument.’

First, although it is difficult to provide necessary and sufficient conditions for something’s counting as ‘normative,’ nevertheless it is apparent that the elementary normative concepts are intimately related to one another conceptually. None of the concepts stands on its own two feet, as it were, but rather each leans heavily on its neighbors for support. Each of the elementary normative concepts is somehow incomplete on its own. For example, it is very hard to explain what we mean by ‘purpose’ without appealing to some notion of ‘value’ (Bedau, 1992). It seems, then, that the elementary normative concepts come as a package deal.

Second, though it is difficult to say precisely in what the ‘family resemblance’ among the elementary normative concepts consists, one feature that surely unites them as a group is that each of them is partly constitutive of agency, in the normative sense. That is to say, each elementary normative concept constitutes an aspect of our complex concept of normative agency. For example, ‘having a purpose’ is part of what we mean by ‘acting’ in the normative sense. A motion that had no purpose (in the sense of ‘goal’ or ‘end’) would not count as an ‘action.’ (Snowing is not an ‘action.’) Moreover, ‘having a purpose,’ or ‘end,’ implies a need to act—namely, to find and employ the ‘means’ appropriate to realizing the end. A state of affairs that no agent ever brought about by taking the appropriate instrumental actions would not count as an ‘end.’ (My snow-covered yard is merely the result, not the purpose or goal or end, of its having snowed.<sup>10</sup>) So, the logical entailment between purpose and action runs in both directions.<sup>11</sup>

Third, certain of the elementary normative concepts (e.g., purpose, need, well-being) are clearly properly ascribable to organisms as such.

From the foregoing considerations, we may conclude that all of the elementary normative concepts, as well as the concept of agency, are properly ascribable to organisms as such—i.e., organisms are properly regarded as agents in the full normative sense of the term. In other words, the proper scope of application of our concept of normative agency is living systems as such.

Let us now look more closely at each of these claims in turn.

<sup>7</sup> Supervenience is the relation between a higher-level (‘supervenient’) entity or property and a lower-level, acceptably physical (‘subvenient’) base such that there can be no change in the former without a corresponding change in the latter. It is important that the supervenience relation be conceived of as asymmetrical, in the sense that all causal influence flows from the base ‘upwards’ to the supervenient entity or property. (For discussion, see Savellos & Yalçın, 1995.) Emergence is conceived of in a variety of ways, but in its most important, synchronic sense, it is basically the denial of this last condition, such that at least some causal influence is conceived of as flowing ‘downwards’ from one or more higher-level entities or properties to the base. A further important component of the emergence relation is the idea that the higher-level entities and properties are not exhaustively determined by the causal properties of the base, which notion is often expressed by the slogan ‘the whole is more than the sum of the parts.’ (For discussion, see Bedau & Humphreys (2008), Clayton & Davies (2006), and Corradini & O’Connor (2010).)

<sup>8</sup> Thus, if someone were an anti-realist about scientific entities in general, but considered normative phenomena like normative action to be no less real (or more unreal) than nonnormative phenomena like matter, force, or energy, then that person would qualify as a ‘normative realist’ for present purposes.

<sup>9</sup> In the sense of Fine, 2002.

<sup>10</sup> To be sure, a snow-covered yard might be transformed into an end by human intentionality, as in a child’s desire for a ‘white Christmas,’ and perhaps someday our improved control over the weather might even permit means to be taken to bring about such an end, but these examples only reinforce the tight conceptual link between purpose and action.

<sup>11</sup> It might be objected that I have simply stipulated that this be the case by excluding those concepts not constitutive of prudential instrumental action from my notion of an ‘elementary normative concept’ in the definition above. However, even in the wider case, moral concepts would seem to be just as closely linked to action as prudential instrumental concepts. After all, to be morally good is to act rightly (justly, beneficently, etc.) towards one’s fellow human beings. While it is true that there may be a few normative concepts specific to the human domain for which the link to action seems looser (beauty comes to mind), nevertheless, the link seems very tight in the elementary cases, not just by definition, but rather due to inherent features of our concepts of normativity and agency. And, in any case, the elementary normative concepts are the ones that concern us here.

### 3.1. The elementary normative concepts are a package deal

This can be easily established by attending to the meaning of the concepts involved. I will begin with the concept of need. First, we must ask: Is it certain that need is in fact a normative concept at all?

It seems hard to deny that it is, at least in my own case. Satisfying my own vital needs appears to me as among the most peremptory of all the commands I am subject to. This fact becomes especially clear when one of them runs a risk of not being satisfied. For example, if I am lost in the desert, there is little that will appear to me under the aspect of a higher duty than that of securing some water to drink, in order to save my life.<sup>12</sup> It is true that one of the things that distinguish me from most if not all other life forms, is that there is indeed one thing that may appear to me as a higher duty than saving my own life, and that is saving another human being's life. So that if I happen to have a last swallow of water in my canteen, I may well give it to my wife or my child or my friend, or even a perfect stranger I happen to be thrown in with. But, notice that the point of my sacrifice is still to preserve life. I am unlikely simply to pour my last mouthful of water into the sand, at least so long as my reason and will do not fail me. Therefore, it seems that satisfying vital needs constitutes the highest of all normative imperatives, whether conceived of prudentially, in relation to the preservation of my own life, or morally, in relation to the preservation of the life of other human beings. Moreover, not only is need (at least in the vital sense we are investigating here) a normative concept itself, it can be shown to be very near to the *fons et origo* of all the other normative concepts. Let us see how.

From the concept of need immediately flows the concept of value: For a system to have needs is already for it to partition its environment into valenced categories. There are things to be pursued, and things to be avoided, that the needs may be satisfied. 'Good' and 'bad' are concepts of an immense semantic richness; nevertheless, there are really no more appropriate terms with which to describe these things that are to be pursued or avoided, based on our vital needs.<sup>13</sup> From the idea of pursuing the good proceeds directly that of end-directedness (or purposiveness), for what else does it mean to pursue the good than to have achieving a certain good (and thereby satisfying a certain need) as one's end or purpose? As Aquinas famously noted, the concept of value (good and bad) implies the concept of having a purpose or pursuing an end (*Summa Theologiae*, I-II.94.2): '*bonum est faciendum et prosequendum, et malum vitandum*' [the good is to be done and pursued, and the bad avoided]. From this, the 'instrumental ought' (normative requirement) follows immediately; indeed, the 'instrumental ought' is already tacitly relied upon in the grammatical form of Aquinas's formulation of this point: '*faciendum ... prosequendum ... vitandum*' [is to be done ... to be pursued ... to be avoided]. If one has the end or purpose of satisfying one's need for water (even short of saving one's life in the desert!), then one ought to seek water to drink. Which means, in turn, that the need for water provides an excellent reason for whatever steps must be taken to secure the water.

Conversely, as Burge has pointed out, good also implies should, or, as he puts it: 'goods generate shoulds' (Burge, 2003, p. 513), or, a little less apothegmatically, 'goods imply standards for achieving

them' (*ibid.*, p. 516). McLaughlin (2009) agrees, noting that (*ibid.*, p. 98):

When we view a causal chain as a series of means and ends, we presuppose something that stops the regress, something that has a good. And this applies whether it is an intentional agent, an organism, or simply anything that can be said to have interests—whether or not it consciously takes interest in them. We presuppose an entity somewhere down the line which has some kind of interests that (*ceteris paribus*) ought to be served. [original emphasis]

One way of summarizing much of the dense network of mutual implication formed by these concepts—a way that is pithy and highlights the central role of the notion of need—is the following (Lowe, 2008, p. 209):

Just as a true belief is one which *corresponds to fact*, so a good action is one which *corresponds to need*. In another idiom, just as facts are the *truth-makers* of true beliefs, so needs are the *goodness-makers* of good actions. [original emphasis]

However, though the concept of vital need lies close to the center of normativity in the broad sense, it does not quite lie at the very center. Need is not quite basic. That is because most of the functions that we associate with vital needs are instrumental, that is, relative or conditional in character. For example, most living things need to consume water in some form or other. One might suppose that water is an intrinsic need of, say, human beings, if one judged solely from the pleasure that we derive from drinking water when we are thirsty. But of course we all know very well that it is not the quenching of thirst *per se* in which our vital need for water really consists. Rather, thirst is merely the sign by which our need for water is brought to our conscious awareness. A man lost in the desert might well be able to put up with mere thirst, no matter how terrible, if he did not know that the need represented by the thirst must be fulfilled if he is to go on living. The point is an obvious one that does not require belaboring. To put it in the most general way, I propose the following definition of (vital) need:

(Vital) Need: A biological function is constituted as a (vital) need only in relation to a normative state of affairs such that the state of affairs can only be preserved by the proper exercise of the function.

This raises the fundamental question: What is the normative state of affairs that is logically prior to the concept of need? There are two obvious candidates. One is 'life' (or, perhaps, 'survival' or 'reproduction'). The other is 'well-being' (or 'welfare' or 'flourishing'). Detailed discussion of the definition of life must be postponed until a future occasion. For now, let us focus on the latter concept, of well-being or flourishing.

Kraut (2007) states the basic idea of well-being or flourishing very simply (*ibid.*, p. 5): 'For most living things, to flourish is simply to be healthy: to be an organism that is unimpeded in its growth and normal functioning.' He goes on to show how the concept has nothing whatever to do with sapience or sentience, but is clearly properly ascribable even to plants (*ibid.*, pp. 6–7):

<sup>12</sup> If anyone is tempted to say that the point of securing the water is primarily to satisfy my thirst, not to save my life, he is raising an interesting issue that opens out into a number of side-paths. For example, sometimes shipwrecked sailors may drink sea water, even in full knowledge that doing so spells death. There is no space to explore this complication adequately here, but let me make two quick points. First, the sailors will surely hold out against their thirst as long as possible, so long as their reason and will are intact. This proves that in their own minds the end of quenching their thirst is secondary and instrumental to the end of preserving their life. Second, at the end of the day we must explain the very existence of thirst in terms of the need of the organism for water, which again shows that the preservation of life is conceptually prior to the quenching of thirst.

<sup>13</sup> Stuart Kauffman offers the suggestion of 'yum' and 'yuck' (Kauffman, 2000; Kauffman & Clayton, 2006; Kauffman et al., 2008), which, in addition to wit, has the virtue of minimal ambiguity. His intended application of these terms to single cells may be controversial, but at least in human terms, who would deny that when I say 'yum,' I am saying of something that I find it 'good,' and likewise for 'yuck' and 'bad'?

Such terms as ‘welfare,’ ‘well-being,’ and ‘utility’ are seldom, if ever, applied to plants. But it is just as obvious a point about plants as it is about animals that some things are good for them and other are not. If something can flourish or fall short of flourishing, that by itself shows that we can speak of what is good for it.

In another passage, he is even more explicit on the main point at issue (*ibid.*, p. 9):

Plants do not have minds. And yet some things are good for them: to grow, to thrive, to flourish, to live out the full term of their lives in good health. Whatever impedes this—diseases, droughts, excessive heat and cold—is bad for them.

In other words, logically speaking well-being is not essentially connected with sapience or sentience, but is rather connected with the fundamental vital functions as such.

Foot (2001) makes a very similar point, though she uses the slightly different terminology of ‘natural goodness’; from the context, though, it is clear that she could just as well say ‘well-being’ or ‘flourishing’ (*ibid.*, pp. 26–27):

[...] ‘natural’ goodness, as I define it, which is attributable only to living things themselves and to their parts, characteristics, and operations, is intrinsic or ‘autonomous’ goodness in that it depends directly on the relation of an individual to the ‘life form’ of its species.

Here, we have finally reached rock bottom in our search for original or underived normativity. The notion of well-being or flourishing is as basic as it gets. The only way to go deeper is to pass from our everyday vocabulary altogether and venture onto the terrain of the natural sciences, in order to investigate in what the well-being and flourishing of living things consists, from a scientific point of view. That is, to go deeper we must pass from the Scope Problem to the Ground Problem, and inquire into the physical nature of life itself—a task that must be reserved for a future occasion.

### 3.2. *The elementary normative concepts are constitutive of agency*

The second consideration states that collectively the elementary normative concepts comprise or constitute our concept of (normative) agency. No detailed discussion is required here. This claim can be amply justified by simply observing that all of the elementary normative concepts discussed in the previous subsection are connected in one way or another with the concept of acting for a reason. Conversely, a direct analysis of the concept of acting for a reason reveals its fundamentally teleological (means-end) structure (behavior lacking a teleological structure does not count as action),<sup>14</sup> from which flow the concepts of value and the ‘instrumental ought,’ from which in turn flow the concepts of need and well-being. Agency—the capacity of acting for a reason—then, is implied by the elementary normative concepts, and the elementary normative concepts imply agency. Agency is not something over and above the elementary normative concepts. Rather, agency is a complex concept consisting of a number of different aspects, and some of these various aspects are captured by the individual elementary normative concepts.

### 3.3. *Certain of the elementary normative concepts are properly ascribable to organisms as such*

Everything that has been said so far tends to reinforce the intuition we began with—namely, that it is perfectly proper to ascribe

normative concepts in a literal way to living systems as such. If only one or two of the concepts were clearly so ascribable—say, need or purpose—then one might perhaps dismiss that fact as a quirk of the language. But if all of the elementary normative concepts are so ascribable, and especially if all of them seem to stand in the same, densely interconnected, network-style relationship to one another when considered in their application to living systems generally as when considered in their application to human beings, then it becomes much more difficult to argue that the identity of the conditions of application of the concepts in the two cases is merely accidental, and of no importance for our understanding of the real nature of things. On the contrary, there seems to be a genuine mystery here that cries out for an explanation. Why do the world and our way of thinking and talking about it seem to conspire to give every appearance that normativity and agency are objectively real features of organisms, if in fact they are not?

We have already shown that some of the elementary normative concepts, such as purpose, need, and well-being, are clearly ascribable to some of the lower life forms, such as plants. Indeed, this is abundantly clear from ordinary language and our everyday experience of the world. Plants *need* water (need). Water is *good* for plants (value). It is *unhealthy* for a plant to go too long without water (well-being). Some plants turn their leaves toward the sun *in order* to capture more light (purpose). To capture more light is the *reason* why some plants turn their leaves toward the sun (having a reason for action). So much is, or ought to be, tolerably obvious.

Nevertheless, for many readers, I suppose that the conclusion of the Scope Argument—the proper scope of application of our concept of normative agency is living systems as such—will seem so difficult to believe as to constitute as *reductio* of the Scope Argument as a whole. If one looks for a claim to dispute as a result of taking the argument as a *reductio*, that claim will most likely be the one relating to the proper ascribability of any of the elementary normative concepts to organisms as such. For this reason, I will spend a little extra time attempting to provide independent motivation for the acceptance of this consideration.

The crucial point is to see that the ascription of normativity to living systems (organisms) as such is not only a matter of how we ordinarily speak. If that were the case, then indeed we could not accept the truth of this claim with such certainty. After all, ordinary language might be mistaken on this point, since it developed before so much was known about the material constitution of organisms. But it is not just ordinary language that sanctions the ascription of normativity to organisms, it is biological science itself. Let us see how.

#### 3.3.1. *The ascription of normativity: the case of bacterial chemotaxis*

Take, for example, bacteria. Many bacteria, such as *E. coli*, swim about by means of a locomotory faculty called ‘chemotaxis.’<sup>15</sup> Such bacteria are capable of engaging in two forms of locomotion, or ‘motility.’ In the first form (called ‘running’), the bacteria swim in a straight line. In the second form (called ‘tumbling’), they move about at random. At the molecular level, the bacteria contain a locomotory assemblage, which is basically a protein motor that causes external appendages called ‘flagella’ to rotate, either counterclockwise (for running) or clockwise (for tumbling). This motor is connected to a sensory assemblage, consisting of a complex, transmembrane, protein-receptor array that is sometimes referred to as a ‘nanobrain’ (e.g., Webre et al., 2003). The inner workings of this nanobrain, as well as its chemical linkages to the motor, are immensely complicated, but, in a nutshell, the organ enables the bacterium to sample

<sup>14</sup> See, e.g., Delancey (2006), Foot (2001), Okrent (2007), Schueler (2003), Sehon (2005), and Wilson (1989).

<sup>15</sup> For brief descriptions and interpretative discussion, see Shimizu & Bray (2003), Wadham & Armitage (2004), and Webre, Wolanin, & Stock (2003); for full technical details, see Stock & Surette (1996).

its external environment for a large number of chemical compounds, to compare the concentrations of these compounds at different times, in this way to determine whether the concentration of a given compound is increasing or decreasing between samplings, and thus to determine whether it is traveling in a favorable or unfavorable direction (where 'favorable' means traveling toward an attractant or away from a repellent, and 'unfavorable' means the reverse). Finally, by means of its nanobrain the bacterium adjusts the setting of its motor so that if it finds itself swimming in a favorable direction it continues running (i.e., it continues traveling in the same direction) and if it finds itself swimming in an unfavorable direction it begins tumbling (i.e., it tries a different direction).

The elucidation of many of the molecular details of all of this, which are of staggering complexity, represents an outstanding achievement of contemporary science (even if many things remain to be worked out). How we should understand the relationship between those molecular details and the apparent normative agency of the bacterium in exercising its locomotory faculty is an important theme that I hope to address on another occasion. For now, I would like to point out just that the concepts of normativity and agency do indeed seem to apply in the case of bacterial motility, as just described.

Thus, we may begin with the observation that bacteria need various nutrients, such as lactose, sucrose, and other sugars. Without such nutrients, a bacterium will die. This of course presupposes that self-preservation in life is normative, and death something to be avoided. Indeed, 'health,' 'vigor,' 'vitality,' 'viability'—all of these are descriptors that scientists commonly use to refer to the well-being of living things, including individual cells. For example, Campbell (2008, p. 2386) claims that '[m]echanical forces, generated while cells migrate, are important for maintaining a healthy cell,' while Lloyd and Hayes (1995) expressly ascribe the notions of 'vigor,' 'vitality,' and 'viability' to microorganisms.<sup>16</sup> Given this norm of well-being and the needs generated by it, nutrients then may be said to be good for a bacterium—that is, they are 'to be pursued.' Thus, the bacterium's motility is end-directed, or purposive. Moreover, a bacterium 'should' swim toward its nutrients (if it does not, there is something wrong with it). If it senses that it is swimming in the right direction (toward its nutrients), then it has reason to continue swimming in the same direction, that is, to run (by rotating its flagella counterclockwise). All of this makes it seem natural to say that swimming toward its food is something that the bacterium does, not something that happens to it. In short, bacteria act.

All of this may be said quite naturally, without in any way forcing the language. There is no sense that in describing a bacterium's swimming toward its food as the bacterium's acting, we have slipped somewhere from speaking the literal truth to speaking in poetic fancies or metaphors. That is not to say, of course, that how such descriptions sound to the untutored ear settles the matter. There are certainly objections that can be raised at this point, and I will address some of them presently. Nevertheless, in the ensuing discussion, it is important for us to keep in mind that this way of describing the faculty of motility in even the lowly bacterium is perfectly natural, and that this fact is a significant one.

There is one objection that may be advanced against the preceding argument, which can, I believe, be dispensed with fairly quickly. One might say that the biologists themselves do not use this sort of normative language to describe bacterial motility. Or, to be more precise, they attempt to avoid using such language

wherever possible, though they are seldom successful in suppressing normative vocabulary entirely for any length of time.<sup>17</sup> Still why not take our cue from the biologists' own practice? Rather than speak of the bacterium's 'pursuing the good,' or even 'swimming toward its food,' why not just speak of its 'following a positive attractant gradient'? But notice that this locution is itself a metaphor. After all, bacteria are not 'attracted' up a chemical gradient in the same way that iron filings are 'attracted' to a magnet.<sup>18</sup> Bacterial motility is not a matter of a direct reaction to impressed forces or of a tight coupling to an external field. Chemical gradients do not 'pull' bacteria along; rather, bacteria carry their own principle of motion within them. They move, as we might say, 'of their own accord.' That is, they control what they do in such a way that they swim up only those gradients that are good for them. Therefore, motility is not something that merely happens to bacteria, but rather something that bacteria achieve or accomplish. And that is just another way of saying that bacteria 'act.' Therefore, in point of fact, it is the common-sense normative, agential descriptors of bacterial motility that are literal, and the descriptors that employ physico-chemical terminology known not to be strictly applicable that are metaphorical. Such metaphors amount to a kind of euphemism—an effort to avoid the natural way of describing phenomena such as bacterial motility in terms of normativity and agency.

However, there is a more penetrating form of the foregoing objection that cannot be dismissed so easily. Some might claim that, rather than focusing on whether bacterial motility at the whole-system level is more properly described as 'pursuing the good' versus 'following an attractant gradient,' we ought rather to consider the fact that both sorts of descriptions have (supposedly) been rendered redundant by our knowledge of the molecular details of the chemotaxis subsystem. The idea would be that both sorts of whole-system-level descriptions are little more than convenient verbal summaries that stand in for the myriad physical and chemical details of what is transpiring at the molecular level. In principle, then, if not in practice, one should be able to explain bacterial motility by referring to events exclusively at the molecular level. And indeed if it were true that all the causal work was being done at that level, then, by the parsimony principle, we really should avoid ascribing any ontological significance to whatever purely verbal formulations we may use to summarize those events for our own convenience at the whole-system level.

This sort of objection might seem to be open to the same reply as before—namely, that living systems are not passively swept along by external causes, but rather are active in the pursuit of their own interests. However, this time, when the objection is expressed in its more radical form, a ready rejoinder becomes apparent. That is the following claim. Science has now (for all practical purposes) fully explained in molecular detail how organismic subsystems like the bacterial chemotaxis locomotory system work. That is, we are now in possession of a (for all practical purposes) complete understanding of the internal 'mechanisms' that give rise to the behavior of bacterial motility. While it is true that that type of behavior is very different in detail from the movement of iron filings in a magnetic field, nevertheless—so the argument goes—we are now in a position to see that there is no deep difference in principle. Everything is still happening according to the laws of physics and chemistry; it is just that those laws work themselves out in a special way in certain kinds of systems, which we call 'organisms.' But that is no problem, because we can fully

<sup>16</sup> Of course, such usage of normative concepts by scientists does not in itself show that the concepts cannot be given a reductive analysis. While there is an extensive philosophical literature on the concept of 'health' (Ereshfsky, 2009), most of it focuses solely on human beings, and simply presupposes the natural/normative dichotomy at issue here. Wachbroit (1994) importantly shows that the notion of biological 'normality' is irreducible to a nonnormative, statistical concept.

<sup>17</sup> Cf. almost any page of any molecular or cell biology textbook, to say nothing of works on physiology or animal behavior.

<sup>18</sup> Historically, the metaphor must have run the other way—from personal or sexual attraction to magnetic 'attraction.' But if biologists today speak of a bacterium's food as an 'attractant,' it is surely in order to assimilate its behavior more closely to that of iron filings, and not that of young lovers.

explain that special way the laws of physics and chemistry have of working themselves out in the case of organisms, by supplementing those laws with a few metaphysically unproblematic auxiliary concepts, such as 'negative feedback control,' 'fitness,' 'natural selection,' and a few others. The capstone of this line of thinking is the observation that we ascribe normative, agential descriptors to manmade machines, as well as to organisms. For example, I might well say that my car 'needs' gasoline; that the 'purpose' of the gasoline is to make the car go; that if the fuel tank is nearly empty, then gasoline 'should' be added; that a nearly empty fuel tank is a 'reason' for gasoline to be added; etc. And an automobile, too, is not ordinarily moved about willy-nilly by external forces, but rather contains its own principle of motion within it. In this sense, it too moves 'of its own accord.'

Since the 'machinery' of bacteria is now known to be no different, in principle, from the machinery of automobiles—or so it is claimed—and since we ascribe the same sort of normative, agential descriptors to both kinds of systems, should we not then view organisms and machines as belonging to the same natural kind? Not to put too fine a point on it: Shouldn't we simply say that organisms are machines? And if that is so, then we need not worry about which vocabulary we use. Just as I feel free to say that my car 'needs' gasoline, all the while realizing that this is just an elliptical way of describing how the car operates internally, so too (on this view) I should feel free to say that *E. coli* 'need' sucrose, all the while realizing that this is just an elliptical way of describing how bacteria operate internally.

There are two kinds of responses that one might make to this suggestion. One would be to retreat to the position that there is no fundamental difference between organisms and machines, after all, and give up the aim of naturalizing normativity altogether, except by elimination. This is the way urged upon us by Lenman (2005). In a penetrating discussion of McDowell, Foot, Hursthouse, and other 'liberal' naturalist authors, he refuses to accept their finding of normativity in the natural inclinations of living things. For example, he writes (*ibid.*, p. 46):

A nurturing polar bear father . . . is certainly behaving in a way that may surprise ethologists and we may classify it accordingly as defective in a very deflated sense of that word. But surely that's just classification. How does something that deserves to be called *authority* get into this picture? That's the mystery. A greenhouse full of plants is a space full of healthy and less healthy specimens, specimens that promise to reproduce and live a long time, and specimens that do not. Sure it does. But, except when you are inside it, there are no *reasons* in your greenhouse. No *normativity*, certainly no *authority*, merely a space in which certain natural dispositional properties are distributed in certain ways. [original emphasis]

On the next page, Lenman goes on to invoke Williams's (1995, p. 110) dictum that the complete absence of teleology from nature is the 'first and hardest lesson of Darwinism,' one which we have yet to take sufficiently to heart.

Lenman's paper is of the first importance because it poses in stark and vivid terms the precise challenge to which any realistic effort to naturalize normativity must respond. But it is not as though there were an actual argument in the quoted passage; rather, Lenman simply assumes that organisms are mechanistic systems to which normative concepts may not properly be ascribed. But of course that is the very point at issue. The reason he is able to get away with such flagrant question-begging is that he is working against the background of near-universal agreement

with his presupposition that organisms are machines.<sup>19</sup> Therefore, in the final analysis there is no way to respond to Lenman's challenge effectively other than by providing an alternative account of what organisms could be, such that normative agency might be properly ascribable to them.

The other type of response would be to take the bull by the horns and explain why organisms are not machines—that is, why organisms constitute a natural kind, but manmade machines do not. It is easy enough to say (what is obviously true) that organisms have 'original' or 'intrinsic' normativity, while machines have 'derived' or 'extrinsic' normativity. But what does that mean? What is original or intrinsic normativity? After all, organisms are physical systems, are they not? How, then, exactly, do they differ from machines?

This is the master question. To pose this question is to ask about the ultimate ground of normativity in nature. Unfortunately, the detailed investigation of this question must await a future occasion. For now, let us turn to the conclusion of the Scope Argument before concluding.

### 3.4. *The proper scope of our concept of normative agency is living systems as such*

In addition to defending the above considerations, I shall support the Scope Argument by attempting to defend the conclusion directly. If the conclusion can be rendered more plausible on independent grounds, then this suspicion that the overall argument amounts to a *reductio* will pose less of a problem.

To this end, I would like to review some considerations that have been introduced recently into the literature on the philosophy of action by some of our most distinguished philosophers working in this field. For the most part, they take their arguments to apply to the higher animals alone, but after reviewing some of them, I will show that they are equally applicable to organisms as such.

Let us start with a distinction of Railton's (2009). He notes that much of our action is the result, not of rational deliberation, but rather of more or less automatic practical skills or competences—what he calls 'fluent agency.' Then, he notes that rational deliberation presupposes fluent agency (*ibid.*, p. 103):

I have no quarrel with treating deliberate choice as one paradigm in the theory of rational or autonomous action—it is certainly an important phenomenon for any such theory to explain. My argument instead is that it cannot be the fundamental phenomenon, for it is built up from, and at every step involves, the operation of countless non-deliberative processes that are—and must be—quite unlike choice. These processes are not self-aware or reflective, yet they are intelligent and responsive to reasons *qua* reasons. They make us the agents we are, and give our agency its capacity for rational, autonomous self-expression.

Railton does not discuss the other animals, but his notion of fluent agency would seem to apply to them as well. Certainly, such notions as automatic skills or competences and fluidity of motion would seem to apply to the pouncings of cats and the acrobatics of squirrels in a perfectly literal way. There remains the issue of whether such behaviors are responsive to reasons *qua* reasons. This is, of course, the crucial point. As it happens, a number of philosophers have recently begun to argue that the behaviors of at least the higher animals are responsive to reasons in the right way, and thus do qualify as 'actions' in the normative sense.

<sup>19</sup> Davidson's seminal contributions (e.g., 2001a, 2001b) played an important historical role in framing the action debate in this way. For argument that Davidson's position is indeed question-begging in essential respects, see Finkelstein (2007, especially, p. 267).

For instance, Steward (2009a) believes that it is not necessary to ascribe intentions to the higher animals in order to accept that they are in an important respect the authors of their own actions. Thus, she writes the following, appealing essentially to our common-sense way of speaking and thinking about animals (Steward, 2009b, pp. 303–304):

And I should like to insist that the idea that an *animal* might be able to produce a bodily movement, so far from being a strange piece of metaphysical lunacy seems to be part and parcel of an everyday picture of the world with which we are very comfortable. It is not at all obvious that there must be something deeply wrong with it. Animals have many powers—what is so strange about the idea that one of the types of powers of which they are possessed is the power to control in certain respects movements (and other changes) in their own bodies? [original emphasis]

Korsgaard's (2009) view of the matter is similar. Though she is more willing than Steward is to ascribe intentions to the higher animals, her reasoning here, like Steward's, remains anchored in our commonsense way of understanding animal behavior (Korsgaard, *ibid.*, p. 90):

Human beings are, after all, not the only creatures who act. The distinction between actions and events also applies to the other animals. A non-human action, no less than a human one, is in some way ascribed to the acting animal herself. The movements are her own. When a cat chases a mouse, that is not something that happens to the cat, but something that she does. To this extent, we regard the other animals as being the authors of their own actions, and as having something like volition.

Glock (2009) is still more explicit about the propriety of ascribing intentional states to the higher animals (*ibid.*, p. 242):

Both in everyday life and in science we explain the behaviour of higher animals by reference to their beliefs, desires, intentions, goals, purposes. These psychological explanations are not causal, at least not in the sense of efficient or mechanical causation. Instead they are intentional in the sense explained above, just as our explanations of human behaviour. In both cases we employ intentional verbs, and we explain the behaviour by reference to the fact that *A* believes that *p*, desires *X*, wants to  $\Phi$ , etc.

Boyle and Lavin (2010, p. 178) agree, observing that the general form of explanation of which intentional explanation is an instance 'can apply to nonrational animals and indeed to plants. Its application marks the feature of living things we are tracking when we say that what goes on with them is subject to teleological explanation.'

Finally, Hurley (2003) has addressed the issue of rational deliberation in this way (*ibid.*, p. 231):

[...] acting for reasons does not require conceptual abilities—not, at least, the full-fledged context-free conceptual abilities associated with theoretical rationality and inferential promiscuity. I appeal to practical reasons in particular to argue that the space of reasons is the space of actions, not the space of conceptualized inference or theorizing.

Hurley goes on to raise the issue of whether we can properly speak of a non-human animal's reasons for action as being the animal's own reasons, as opposed to its behavior's being merely conformable to reasons supplied by a human observer, as suggested by Dennett's (1987) notion of the 'intentional stance.' Here is how she puts this point (*ibid.*; 233):

It may still be objected that while there may *be* reasons to act that an agent has not conceptualized, these cannot be the agent's *own* reasons, reasons for the agent, at the personal or animal level (see and cf. Dennett, 1996, chap. 5, 6). [original emphasis]

And here is what she says immediately in reply:

I disagree. I understand reasons for action at the personal or animal level in terms of the requirements of holism and normativity. Perceptual information leads to no invariant response, but explains actions only in the context set by intentions and the constraints of at least primitive forms of practical rationality.

In these passages, Hurley corroborates my conclusion that subrational animals may properly be said to act intentionally, and to be agents.

So far, I have only discussed reasons for ascribing literal normative agency to the higher animals. Apart from Steward, the reason cited was basically that the higher animals appear to have intentional states like ours. This material was rehearsed in order to respond to the traditional concerns of many if not most philosophers of action who have usually assumed that literal normative agency ought to be ascribed only to rational beings like us. But even if the position of Steward and the others were to be accepted, that would still leave me only half-way to my stated goal. For, I wish to claim, not just that normativity and agency exist objectively in relation to the higher animals, but that they exist objectively in relation to organisms as such. That is a bridge too far for Steward and the others, and is denied with a greater or lesser degree of explicitness by all of them.

What are some of their reasons for resisting the more radical move I am urging? Interestingly, it does not seem to be the issue of intentionality that is of primary concern to them (that is to say, none of them argues that action is conceptually linked to conscious intentions). Rather, they make two basic points.

The first point is that they are reluctant to ascribe normative agency to living systems that do not meet some threshold of flexibility of behavior, or 'intelligence.' The idea seems to be that if the system's behavior is sufficiently stereotyped, then it is simply 'automatic' or 'mechanical,' and no longer meets the criterion of normative agency. Thus, Hurley (2003) contrasts animals with intentions to those supposedly operating according to 'invariant' stimulus-response relations (*ibid.*, pp. 235–236).

There are two different kinds of responses that one might give to this worry. First, as the details of the chemotaxis system outlined above suggest, the behavior of lower organisms is not really as stereotyped as one might think. In fact, it has been observed that no two bacteria can be counted on to respond in precisely the same way to identical environmental circumstances, not even if they are genetically identical (Zimmer, 2008, pp. 44–49).<sup>20</sup> In general, one may say that the idea of a rigid stimulus-response relation in the lower organisms is something of a myth. Most of the behavior even of the lower organisms is in fact endogenously generated (Brembs, 2010; Heisenberg, 2009; Maye, Hsieh, Sugihara, & Brembs, 2007; Prete, 2004; Simons, 1992; Trewavas, 2009). Moreover, it is now beginning to be acknowledged that the capacity for flexible, purposive behavior is the key to the 'robustness,' or stability, of the cell, and ultimately of all living things. For example, Kirschner and Gerhart (2005, pp. 107–108) have put this point as follows:

The organism is not robust because it has been built in such a rigid manner that it does not buckle under stress. Its robustness stems from a physiology that is adaptive. It stays the same, not

<sup>20</sup> See, also, Trewavas, 1999.

because it cannot change but because it compensates for change around it. The secret of the phenotype is dynamic restoration.

Indeed, Kirschner (2010, p. 3803) goes so far as to claim that 'all of biology is built on the dynamic and adaptive capacity of the cell.'<sup>21</sup> On this view, 'adaptive capacity' is tantamount to an elementary form of 'cognition' or 'intelligence' that is an inherent property of living things as such.<sup>22</sup>

Nevertheless, it would of course be foolish to deny that the behavior of bacteria is relatively speaking far more stereotyped than that of higher organisms like cats and dogs. It is important, therefore, to add—and this is the second response to the first worry—that intelligence is not really a relevant criterion for assessing whether agency is properly ascribed to a system. Rather, responsiveness to reasons is the relevant criterion. And as we have seen above, however limited a bacterium's behavioral repertoire may be compared to a higher animal's, it clearly passes that test with flying colors.

The second worry raised by several of our authors relates to the fact that we commonly ascribe agency only to whole animals, and not to their component parts. Thus, Hurley (2003) clearly states that '[...] I understand the subpersonal level as the level of causal/functional description at which talk of normative constraints and reasons no longer applies' (*ibid.*, p. 234), and the other authors make similar remarks.

This makes intuitive sense, and does reflect common sense, which has been one of our chief guides so far. However, we must be attentive here to a distinction that is too easily blurred. It is one thing to say that agency is properly ascribable to whole organisms, and not to their parts. It is something else to say that whole organisms are endowed with a power of agency only over the movements of their bodies as a whole, or over the movements of the external parts of their bodies, and not over the processes internal to their bodies. I am going to argue that there is no good reason in principle to withhold ascription of objectively normative agency to an organism's control of its own internal processes.

I agree, of course, that agency is conceptually linked to the capacities of a system as a whole (and I will examine in detail what this condition amounts to, in a future publication). But it does not follow that internal processes cannot be actions of a system, for there remains the possibility that the system as a whole may actively control its own component parts.<sup>23</sup>

Burge (2009) gives us a clear account of what this holistic requirement involves (*ibid.*, p. 260):

I think that the relevant notion of action is grounded in functioning, coordinated behavior by the whole organism, issuing from the individual's central behavioral capacities, not purely from sub-systems.

This criterion can clearly be met with respect to the active control of a whole system's component parts, just so long as the parts are controlled by the whole system, and not the other way around. For example, consider the difference between voluntary and involuntary actions within your own body.

We have voluntary control over several of the component parts of our body. Examples include the thoracic diaphragm (breathing),

the esophagus (swallowing, belching), the bladder, and the rectal sphincter, not to mention the skeletal muscles.<sup>24</sup> Let us consider breathing. No one, I take it, will deny that by holding my breath for a minute while I am under water, I am acting. And yet, the same internal part (namely, the thoracic diaphragm) is being controlled just as surely when that control is involuntary (i.e., unconscious) as when it is voluntary (conscious). In both cases, the control has exactly the same function—that is, it occurs for basically the same reasons. In both cases, the reason for the occurrence of the internal processes is the introduction of air (containing oxygen) into the respiratory and eventually the circulatory systems. The only difference is that voluntary breathing permits an additional layer of control, permitting greater responsiveness to environmental contingencies, like the need to exclude water or other foreign substances. In short, from the point of view of why the body does what it does, voluntary control of breathing is just more of the same of what is already provided by involuntary control of breathing. Therefore, it is hard to see what principled reason one could give for saying that the voluntary control of breathing qualifies as a normative action while the involuntary control of breathing does not.

I conclude from this example that there is no good reason to deny that, in principle, the whole organism can be in control of its component parts.

#### 4. Conclusion

On the basis of commonsense linguistic usage and conceptual analysis, as well as the Scope Argument, I conclude that there is no principled reason for maintaining that normativity and agency are properties of human beings alone, or even that they are properties of the higher animals only. If that is the case, then we are faced with a decision (assuming we do not wish to be outright dualists) between accepting eliminativism and seeing ourselves as mere machines devoid of any genuine normativity, on the one hand, and seeing all living systems (organisms) without exception as normative agents, on the other. Nothing I have said here excludes our taking the eliminativist path. However, assuming that we opt to follow common sense in viewing ourselves as genuine normative agents, then the arguments I have deployed in this essay lead to the conclusion that we must also accept the objective existence of normativity and agency in organisms as such.

#### Acknowledgements

I would like to express my deepest gratitude to Lenny Moss and Phillip R. Sloan for their unwavering loyalty and support over the years.

#### References

- Albrecht-Buehler, G. (2009). Cell intelligence website. <<http://www.basic.northwestern.edu/g-buehler/FRAME.HTM>> Accessed 11.04.10 (last updated 24.07.09).
- Bedau, M. A. (1992). Goal-directed systems and the good. *Monist*, 75, 34–51.
- Bedau, M. A., & Humphreys, P. (Eds.). (2008). *Emergence: Contemporary readings in philosophy and science*. Cambridge, MA: Bradford Books/MIT Press.

<sup>21</sup> See, also, Harold (2001), Piersma & van Gils (2011), and Turner (2007), take a similar view of the adaptive capacity of higher animals.

<sup>22</sup> There is no space here to analyze this controversial claim, but for the idea that 'intelligence' may be properly ascribed to living things as such, see Albrecht-Buehler (2009), Ben-Jacob (2009a, 2009b), Ben-Jacob & Levine (2006), Ford (2009), Shapiro (2007), and Trewavas (2003, 2005, 2010). For the closely related view that living processes are inherently 'cognitive,' see Calvo & Keijzer (2009), Heschl (1990), Lyon (2006), Stewart (1996), and van Duijn, Keijzer, & Franken (2006).

<sup>23</sup> Frankfurt (1997) raises an objection to this line of reasoning when he asserts that the concept of control or guidance is intuitively linked to the conscious actions of whole persons. As he remarks of pupil dilation (*ibid.*, p. 46): 'The guidance in this case is attributable only to the operation of some mechanism with which [the person] cannot be identified.' But this objection fails to take into account the fact that it is the whole organism, not the person *qua* rational agent, with which such subpersonal instances of control are to be identified, as well as the fact that such control (or 'regulation') is routinely attributed by scientists to biological systems.

<sup>24</sup> The case of the skeletal muscles contains the complication that the voluntary control of the internal part (the muscle) is simultaneously manifested externally (by the movement of the corresponding limb), and some might wish to ascribe the agent's control in such cases solely to the external manifestation. For simplicity's sake, I set this case aside.

- Ben-Jacob, E. (2009a). Learning from bacteria about natural information processing. In G. Witzany (Ed.), *Natural genetic engineering and natural genome editing (=Annals of the New York Academy of Sciences)* (Vol. 1178, pp. 78–90). Boston, MA: Blackwell Publishers on behalf of the New York Academy of Sciences.
- Ben-Jacob, E. (2009b). Bacterial complexity: More is different on all levels. In S. Nakanishi, R. Kageyama, & D. Watanabe (Eds.), *Systems biology: The challenge of complexity* (pp. 25–35). Tokyo: Springer.
- Ben-Jacob, E., & Levine, H. (2006). Self-engineering capabilities of bacteria. *Journal of the Royal Society Interface*, 3, 197–214.
- Boyle, M., & Lavin, D. (2010). Goodness and desire. In S. Tenenbaum (Ed.), *Desire, practical reason, and the good* (pp. 161–201). Oxford: Oxford University Press.
- Brembs, B. (2010). Towards a scientific concept of free will as a biological trait: Spontaneous actions and decision-making in invertebrates. *Proceedings of the Royal Society of London B*, 278, 930–939.
- Burge, T. (2003). Perceptual entitlement. *Philosophy and Phenomenological Research*, 67, 503–548.
- Burge, T. (2009). Primitive agency and natural norms. *Philosophy and Phenomenological Research*, 79, 251–278.
- Calvo, P., & Keijzer, F. (2009). Cognition in plants. In F. Baluška (Ed.), *Plant–environment interactions: From sensory plant biology to active plant behavior* (pp. 247–266). Berlin: Springer.
- Campbell, I. D. (2008). Croonian lecture 2006: Structure of the living cell. *Philosophical Transactions of the Royal Society of London B*, 363, 2379–2391.
- Clayton, P., & Davies, P. (Eds.). (2006). *The re-emergence of emergence: The emergentist hypothesis from science to religion*. Oxford: Oxford University Press.
- Churchland, P. M. (2007). *Neurophilosophy at work*. Cambridge: Cambridge University Press.
- Corradini, A., & O'Connor, T. (2010). *Emergence in science and philosophy*. New York: Routledge.
- Davidson, D. (2001a). Mental events. In *idem, Essays on actions and events* (2nd ed., pp. 207–224). Oxford: Clarendon Press (Originally published in Foster, L. & Swanson, J. W. (Eds.), *Experience and theory* (pp. 79–101). Amherst: University of Massachusetts Press, 1970).
- Davidson, D. (2001b). Rational animals. In *idem, Subjective, intersubjective, objective* (pp. 95–105). Oxford: Clarendon Press (Originally published in *Dialectica*, 1982, 36, 317–327).
- Davies, P. S. (2009). *Subjects of the world: Darwin's rhetoric and the study of agency in nature*. Chicago: University of Chicago Press.
- Delancey, C. (2006). Action, the scientific worldview, and being-in-the-world. In H. L. Dreyfus & M. A. Wrathall (Eds.), *A companion to phenomenology and existentialism* (pp. 356–376). Malden, MA: Blackwell.
- Dennett, D. C. (1987). *The intentional stance*. Cambridge, MA: Bradford Books/MIT Press.
- Dennett, D. C. (1996). *Kinds of minds: Toward an understanding of consciousness*. New York: Basic Books.
- Ereshefsky, M. (2009). Defining 'health' and 'disease'. *Studies in History and Philosophy of the Biological and Biomedical Sciences*, 40, 221–227.
- Fine, K. (2002). The question of realism. In A. Bottani, M. Carrara, & P. Giaretta (Eds.), *Individuals, essence and identity: Themes of analytic metaphysics* (pp. 3–48). Dordrecht, Netherlands: Kluwer Academic.
- Finkelstein, D. H. (2007). Holism and animal minds. In A. Cray (Ed.), *Wittgenstein and the moral life: Essays in honor of Cora Diamond* (pp. 251–278). Cambridge, MA: Bradford Books/MIT Press.
- Foot, P. (2001). *Natural goodness*. Oxford: Clarendon Press.
- Ford, B. J. (2009). On intelligence in cells: The case for whole cell biology. *Interdisciplinary Science Reviews*, 34, 350–365.
- Frankfurt, H. G. (1997). The problem of action. In A. R. Mele (Ed.), *The philosophy of action* (pp. 42–52). Oxford: Oxford University Press (Originally published in *American Philosophical Quarterly*, 1978, 15, 157–162).
- Gillett, C. (2007). Understanding the new reductionism: The metaphysics of science and compositional reduction. *Journal of Philosophy*, 104, 193–216.
- Glock, H.-J. (2009). Can animals act for reasons? *Inquiry*, 52, 232–254.
- Harold, F. M. (2001). *The way of the cell: Molecules, organisms, and the order of life*. Oxford: University of Oxford Press.
- Heisenberg, M. (2009). Is free will an illusion? *Nature*, 459, 164–165.
- Heschl, A. (1990). L=C: A simple equation with astonishing consequences. *Journal of Theoretical Biology*, 145, 13–40.
- Hornsby, J. (1997). *Simple mindedness: In defense of naïve naturalism in the philosophy of mind*. Cambridge, MA: Harvard University Press.
- Hurley, S. (2003). Animal action in the space of reasons. *Mind and Language*, 18, 231–256 (Reprinted with revisions as 'Making Sense of Animals,' in Hurley S. & Nudds, M. (Eds.), *Rational animals?* (pp. 139–171). Oxford: Oxford University Press, 200.).
- Kauffman, S. A. (2000). *Investigations*. Oxford: Oxford University Press.
- Kauffman, S., & Clayton, P. (2006). On emergence, agency, and organization. *Biology and Philosophy*, 21, 501–521.
- Kauffman, S., Logan, R. K., Este, R., Goebel, R., Hobill, D., & Shmulevich, I. (2008). Propagating organization: An inquiry. *Biology and Philosophy*, 23, 27–45.
- Kim, J. (1998). *Mind in a physical world: An essay on the mind-body problem and mental causation*. Cambridge, MA: Bradford Books/MIT Press.
- Kirschner, M. (2010). Cell biology as a world view. *Molecular Biology of the Cell*, 21, 3803.
- Kirschner, M. W., & Gerhart, J. C. (2005). *The plausibility of life: Resolving Darwin's dilemma*. New Haven, CT: Yale University Press.
- Korsgaard, C. M. (2009). *Self-constitution: Agency, identity, and integrity*. Oxford: Oxford University Press.
- Kraut, R. (2007). *What is good and why: The ethics of well-being*. Cambridge, MA: Harvard University Press.
- Lenman, J. (2005). The Saucer of Mud, the Kudzu Vine and the Uxorious Cheetah: Against Neo-Aristotelian Naturalism in Metaethics. *European Journal of Analytical Philosophy*, 1(2), 37–50.
- Lloyd, D., & Hayes, A. J. (1995). Vigour, vitality and viability of microorganisms. *FEMS Microbiology Letters*, 133, 1–7.
- Lowe, E. J. (2008). *Personal agency: The metaphysics of mind and action*. Oxford: Oxford University Press.
- Lyon, P. (2006). The Biogenic Approach to Cognition. *Cognitive Processing*, 7, 11–29.
- Maye, A., Hsieh, C., Sugihara, G., & Brembs, B. (2007). Order in spontaneous behavior. *PLoS ONE*, 2(5), e443.
- McDowell, J. (1998). Two Sorts of Naturalism. In *idem, Mind, value, and reality* (pp. 167–197). Cambridge, MA: Harvard University Press (Originally published in Hursthouse, R., Lawrence, G., & Quinn, W., (Eds.), *Virtues and reasons: Philippa Foot and moral theory* (pp. 149–179). Oxford: Clarendon Press, 1996).
- McLaughlin, P. (2009). Functions and norms. In U. Krohs & P. Kroes (Eds.), *Functions in biological and artificial worlds: Comparative philosophical perspectives* (pp. 93–102). Cambridge, MA: MIT Press.
- Okrent, M. (2007). *Rational animals: The teleological roots of intentionality*. Athens, OH: University of Ohio Press.
- Piersma, T., & van Gils, J. A. (2011). *The flexible phenotype: A body-centered integration of ecology, physiology, and behaviour*. Oxford: Oxford University Press.
- Prete, F. R. (Ed.). (2004). *Complex worlds from simpler nervous systems*. Cambridge, MA: Bradford Books/MIT Press.
- Railton, P. (2009). Practical competence and fluent agency. In D. Sobel & S. Wall (Eds.), *Reasons for action* (pp. 81–115). Cambridge: Cambridge University Press.
- Savellos, E. E., & Yalçın, U. D. (Eds.). (1995). *Supervenience: New essays*. Cambridge: Cambridge University Press.
- Schueler, G. F. (2003). *Reasons and purposes: Human rationality and the teleological explanation of action*. Oxford: Clarendon Press.
- Sehon, S. (2005). *Teleological realism: Mind, agency, and explanation*. Cambridge, MA: Bradford Books/MIT Press.
- Shapiro, J. A. (2007). Bacteria are small but not stupid: Cognition, natural genetic engineering, and socio-bacteriology. *Studies in History and Philosophy of the Biological and Biomedical Sciences*, 38, 807–819.
- Shimizu, T. S., & Bray, D. (2003). Modelling the bacterial chemotaxis receptor complex. In G. Bock & J. A. Goode (Eds.), *In Silico Simulation of Biological Processes* (pp. 162–177). Chichester, UK: John Wiley & Sons (Novartis Foundation Symposium 247).
- Simons, P. (1992). *The action plant: Movement and nervous behaviour in plants*. Oxford: Blackwell.
- Steward, H. (2009a). Animal agency. *Inquiry*, 52, 217–231.
- Steward, H. (2009b). Sub-intentional actions and the over-mentalization of agency. In C. Sandis (Ed.), *New essays on the explanation of action* (pp. 295–312). London: Palgrave/Macmillan.
- Stewart, J. (1996). Cognition = life: Implications for higher-level cognition. *Behavioural Processes*, 35, 311–326.
- Stock, J. B., & Surette, M. G. (1996). Chemotaxis. In F. C. Neidhardt (Ed.), *Escherichia coli and salmonella: Cellular and molecular biology* (2nd ed., Vol. 1, pp. 1103–1129). Washington, DC: ASM Press.
- Trewavas, A. (1999). The importance of individuality. In H. R. Lerner (Ed.), *Plant responses to environmental stresses: From phytohormones to genome reorganization* (pp. 27–42). New York: Marcel Dekker.
- Trewavas, A. (2003). Aspects of plant intelligence. *Annals of Botany*, 92, 1–20.
- Trewavas, A. (2005). Plant intelligence. *Naturwissenschaften*, 92, 401–413.
- Trewavas, A. (2009). What is plant behaviour? *Plant, Cell and Environment*, 32, 606–616.
- Trewavas, A. (2010). The green plant as an intelligent organism. In F. Baluška, S. Mancuso, & D. Volkmann (Eds.), *Communication in plants: Neuronal aspects of plant life* (pp. 1–18). Berlin: Springer.
- Turner, J. S. (2007). *The tinkerer's accomplice: How design emerges from life itself*. Cambridge, MA: Harvard University Press.
- van Duijn, M., Keijzer, F., & Franken, D. (2006). Principles of minimal cognition: Casting cognition as sensorimotor coordination. *Adaptive Behavior*, 14, 157–170.
- Wachbroit, R. (1994). Normality as a biological concept. *Philosophy of Science*, 61, 579–591.
- Wadhams, G. H., & Armitage, J. P. (2004). Making sense of it all: Bacterial chemotaxis. *Nature Reviews: Molecular & Cell Biology*, 5, 1024–1037.
- Webre, D. J., Wolanin, P. M., & Stock, J. B. (2003). Bacterial chemotaxis. *Current Biology*, 13(2), R47–R49.
- Williams, B. (1995). Evolution, ethics, and the representation problem. In *idem, Making sense of humanity, other philosophical papers, 1982–1993* (pp. 100–110). Cambridge: Cambridge University Press (Originally published in Bendall, D. S. (Ed.), *Evolution from molecules to men* (pp. 554–566). Cambridge: Cambridge University Press, 1983).
- Wilson, G. M. (1989). *The intentionality of human action, revised and enlarged ed.* Stanford, CA: Stanford University Press (Originally published in 1980).
- Zimmer, C. (2008). *Microcosm: E. coli and the new science of life*. New York: Pantheon.