Descartes’ Mechanism and Biological Functions

Abstract. The “new mechanical philosophy” takes its inspiration from biology and simultaneously traces its origin to René Descartes. It pays little attention to Descartes’ mechanistic biology, however, which, admittedly, even most historians of philosophy and science mistakenly treat as a straightforward extension of Descartes’ attempt to explain natural phenomena in terms of shapes and movement of parts. In this article, I discuss the status of biological functions in Descartes’ mechanistic philosophy. While avoiding the pitfall of misidentifying the parts of living things or the causal systems they constitute, I argue that Descartes’ mechanistic biology evinces a strong anthropocentrism both with respect to its goals and, more surprisingly, its metaphysical foundations. Today’s mechanistic biology is no longer anthropocentric, and it cannot embrace the metaphysical foundations Descartes proposes, but examining Descartes’ account of biological functions identifies problems any mechanistic philosophy must face that only his anthropocentrism allowed him to solve.

Keywords: Descartes, Mechanism, Functions, Teleology, Anthropocentrism

1. Introduction.

According to William Bechtel, the “new mechanistic philosophers of science,”—Machamer, et al. (2000), Glennan (2002), and many others, including Bechtel himself—have been inspired by biologists who, in their explanations, have long appealed to mechanisms as opposed to “theories or laws” (2011, pp. 536). The mechanist’s “core idea”, however, traces
back to René Descartes, who claimed to have described “the whole universe as if it were a machine” (AT 8A: 315, CSM 1: 279).¹ Bechtel cites this much of Descartes to support his belief that Descartes explains “natural phenomena by identifying the responsible mechanism and explaining its functioning in terms of its parts and the operations they perform” (2011, pp. 535-36). It is beyond dispute that the history of mechanism owes a great deal to biology and to Descartes, to say nothing of the Hellenistic physicians who, ultimately, were Descartes’ mechanistic inspiration. Rarely, however, have philosophers of science looked carefully at Descartes’ mechanistic biology. In particular, they have not considered whether Descartes’ biological explanations, which include many references to the complex causal structure of living things, are consistent with the new mechanical philosophy.

In this paper, I examine the biological functions Descartes identifies in an effort to bring together the two inspirations for the “new mechanical philosophy” (Bogen 2008). I begin by explaining Descartes’ vocabulary for “function” and the pluralism it implies. Next, I identify tensions between Cartesian metaphysics and Descartes’ concepts of biological function, noting in particular that Descartes’ well known rejection of teleology threatens to undermine both the evaluative standard he uses to assign functions and the unity he attributes to living things. I then evaluate positions available in the current secondary literature, notably those of Des Chene (2001), Brown (2012) and Hatfield (2008). Finally, I offer my own interpretation, which defends Descartes’ attribution of biological functions and explains how it follows from his broader metaphysical views concerning human beings. The guiding idea of my interpretation is that Descartes’ prohibition against teleology leaves room for biological functions and that Descartes is committed to a version of anthropocentrism that treats the human body as the model for all living things, plants included. Ultimately, Cartesian Anthropocentrism solves some of the
problems associated with other interpretations, but it complicates the metaphysical foundations of Descartes’ mechanism and highlights difficulties that even today’s mechanical philosophy must confront.

2. Cartesian Pluralism.

There are two concepts of function operating in Descartes’ work. Appreciating this fact, we will immediately advance beyond many recent interpreters who, by failing to attend to Descartes’ pluralism, handicap efforts to understand his biology. In this section I discuss each concept separately and then indicate how the two relate to one another.

2.1. Normative Functions.

Descartes attributes what I call normative functions (NFs) to the parts and activities of living things. He writes, for example, about “the true function [usage] of respiration” and “the main function [usage] of the lung” (AT 6: 53, CSM 1: 138; AT 11: 236). Descartes even commits himself to the then-standard view that the “function [usage] of each muscle” can be learned through anatomical study (AT 11: 138). In each case, when he speaks of a “true” or “main” function, he is telling us what a thing is supposed to do.

To gain greater insight into this first concept of function, it is worth noting that usage, and the Latin usus from which it derives, have a well defined evaluative connotation in the life sciences of Descartes’ time. They answer the question, ‘what is this part or activity good for?’ by specifying a good or benefit that a part or activity provides to or for a living thing. Descartes explicitly links usage with utilité—that is, “benefit” or “usefulness”—when he writes, the “function [usage] of all the passions consists solely in this, that they dispose... [us] to want the
things which nature deems useful [*utiles*] for us, and to persist in this volition” (AT 11: 372, CSM 1: 349). And, as he immediately clarifies, it is not “the objects which stimulate the senses [and] excite different passions in us” that primarily concern us, but rather “the various ways in which [the objects] may harm or benefit us, or in general have importance for us.”

When Descartes attributes functions in this first sense, he is specifying what benefits an animal ultimately derives from a given part or activity. I address how this determination is made in Section 2.3 but, preliminarily, it is important to see that Descartes is assuming an evaluative standard that a part or activity is *supposed* to meet: it is *supposed* to benefit a living thing. Whether he is justified in this is one of the central topics for interpreters of Descartes’ biology, yet it is only by looking for normative properties—the value a thing has to or for a living thing—that he can specify the “true” or “main” function of a part or activity.

2.2. Causal Functions.

Another concept of “function,” what I will call “causal functions” (CFs), appears whenever Descartes uses the French *fonction* and the Latin *functio* and *actio*. Like usage, these are technical terms in the early modern life sciences. They answer the question: how does this part or activity work? Effectively, these are the functions identified by Cummins (1975), for a CF tells us how or what, as a matter of current fact, a certain part or activity contributes to the production of a given phenomenon or capacity. No evaluative standard—and nothing normative—is implied by Descartes’ *fonction, functio* or *actio*. They merely describe what some part or activity currently does or is disposed to do.

There are many instances in Descartes’ biology where he attributes CFs—so many, in fact, that identifying CFs would appear his primary concern.
I hypothesize the body to be nothing but a statue or machine.... [with] all the parts required to make it walk, eat, breathe, and indeed to imitate all those of our functions [fonctions] which can be imagined to proceed from matter and to depend solely on the disposition of the organs. (AT 11: 120, CSM 1: 99; modified)

If only we had spent enough effort getting to know the nature of our body, instead of attributing to the soul functions [fonctions] which depend solely on the body and on the disposition of its organs.... [F]unctions [fonctions] which some people attribute to the soul, such as moving the heart and the arteries, digesting food in the stomach and so on, do not involve any thought, and are simply bodily movements. (AT 11: 224-5, CSM 1: 314-315)

These are programmatic statements. Walking, eating, breathing, cardiac motion and the pulse all causally depend on some disposition of the parts of the body. There is no claim of benefit in the texts above. In fact, fonctions could just as easily have been translated “actions,” “movements” or even, simply, “effects,” without losing Descartes’ meaning. The latter passage makes this very claim.7

2.3. Functions, Medicine and Malfunctions.

NFs and CFs offer answers to distinct questions and draw on different facts about living things. Nevertheless, it would be a mistake to think the two are unrelated, or that they represent independent research programs for Descartes. It is true that, in principle, one might know the NF
of a part while remaining ignorant of how it works—this describes most people’s relationship with their own bodies, including, e.g. their hands, which are good grabbing—or the CF of a part while remaining ignorant of what it is good for—this describes the state of most mechanistic biology, which either avoids speculating about what a thing is good for or, as in the case of the appendix, for the longest time has no idea of its NF—but Descartes’ biology is not content with either alone.

Consider the example of the heart. For a fairly wide range of biological phenomena that we now seek to explain, everyone agrees that the heart’s CF is to pump the blood; pumping leads to circulation, which, in turn, makes possible a host of other CFs. Descartes could not be more committed to this claim which, at the time, had only recently been proposed by William Harvey. Descartes goes so far as to say that failing to correctly identify the heart’s CF “we cannot know anything regarding the theory of medicine, because all the other functions [fonctions] in the animal depend on the heart” (AT XI: 245). So, for example, if we are interested in explaining the capacity of an animal to deliver nutrients to its cells, we will discover that the heart’s CF is to pump blood. If we are interested in explaining the capacity of an animal to flee from predators, we will discover that the heart’s CF is to pump blood. In each case, a higher level or subsequent effect or capacity can be traced back to the activity of the heart as its cause. Ergo, as seen from the perspective of the biologist interested in explaining nutrition and animal motion, the heart’s CF is to pump the blood.

It is certainly conceivable that Descartes could have stopped here, in which case his biology would limit itself to explaining how the body and its parts work on the assumption that certain effects and capacities are uniquely biological. But Descartes’ willingness to identify the “true” and “main” function (usage) of things indicates he goes beyond attributing CFs. As we
saw above, NFs imply not only that a thing produces a specific effect accounting for a given phenomenon, like nutrition or movement, but that it *should* produce that effect; that producing this effect is its "true" or "main" function regardless of what it is actually doing now. In spite of the examples of NFs in Descartes' biology, several recent interpreters deny that Descartes actually meant, or that he is entitled, to attribute NFs to the parts of living things.

This issue interpretative dispute will be explored further in Section 3.1, but I want to suggest, preliminarily, that such conclusions come at a much higher cost than any of their proponents acknowledge. Indeed, without NFs, Descartes cannot attribute malfunctions to the parts or activities of living things, in which case his effort to unify the sciences unravels. For Descartes organizes the disciplines on the model of a tree (AT 8A:14-15, CSM 1: 186-87). He calls the roots "metaphysics," the trunk "physics," and "medicine," along with other applied sciences, are the limbs where the "fruit" is borne. Medicine's foundation in biology is explicit in this organization of the disciplines, where biology exists somewhere between physics and medicine.8 If medicine's aims are to be realized, physicians committed to deriving their principles from biology must be able to use biological functions to make assessments of the human body's healthy and diseased states; Descartes' biology must differentiate between functions and malfunctions. For physicians to know when to intervene, they must know not only how things work—their CFs—but what a thing's function is *supposed* to be—its NFs—so that they can set it right. We should not discount NFs precisely because Descartes recognizes that CFs alone are insufficient to link biology to medicine.9

Indeed, Descartes does attribute NFs in his biological works, acknowledging them whenever he can tie a CF to a living thing's preservation. Preservation in this case is not simply some higher level phenomenon to be explained at the discretion of the biologist. Preservation is
the precondition and effect in relation to which an animal’s parts and activities have value. If a CF is a means of securing preservation, than we know what the part or activity having that CF is good for, and Descartes will say it has an *usage*.

It is important to note that only those CFs strictly necessary for the animal’s preservation are termed “true” or “main” NFs, which indicates that a part of activity can have a number of CFs and NFs. Descartes writes, for example, that the “main function [usage]” of the lung is to take in air and alter the blood in transit from the right to the left ventricle. It is the lung’s immediate effect of altering the blood that enables the heart to pump blood. Yet, jarringly to the modern reader, the lungs have the “other [normative] function [usage]” of taking in air to “produce the voice” (AT 11: 236). Of these NFs, only the “main” NF of the lung is a CF strictly necessary for the animal’s survival. The voice may be beneficial in a great many circumstances, but for Descartes it is not strictly necessary. Elsewhere, focusing on respiration, Descartes tells us that its “true function [usage]” is to “bring enough fresh air into the lungs to” cool the blood (AT 6: 53, CSM 1: 138). Failing this, the “blood would not be fit to serve as fuel for the fire without light in the heart.” Descartes’ point is that respiration’s “true” NF is to support the heart’s CF of pumping blood. Like the heart’s CF of pumping blood, the respiration’s CF of cooling the blood is strictly necessary to assure the animal’s preservation. It is only in relation to this final effect, to preservation, which for Descartes’ biological and medical purposes is an unquestioned good, that a CF’s normative properties reveal themselves.

Key to my reconstruction is the claim that preservation is the final effect in terms of which Descartes evaluates CFs. This will be no less controversial than Descartes’ attribution of NFs themselves, and I will return to it in Section 5.2, but the claim itself is supported by a number of texts. First, there is Descartes’ belief that science is useful “most importantly, for the
preservation of health, which is undoubtedly the chief good and the foundation of all the other goods in this life” (AT 6: 62, CSM 1: 143). This sentiment is also found in the account of sensation in Meditation Six, where he tells us that sensations are part of “the best system that could be devised... conductive to the preservation of the healthy man” (AT 7, 87; CSM 2, 60). Descartes treats preservation of the healthy human being as the final effect used to assess which natural arrangement and coordination of parts is the best. Although he famously believes animals lack sensation in the full sense enjoyed by human beings—lacking souls they are less complex causal systems—animals nevertheless have “organic sensation” and the same dynamic material constitution of bones, nerves, muscles, and brain necessary to preserve themselves (AT 7: 427, CSM 2: 288; and, e.g., AT 3: 47-49, CSMK: 145-46). Descartes even claims that it is “qua animals... [that we have] a kind of natural impulse towards the preservation of our bodies” (AT 2: 599; CSMK: 140). Preservation is the final effect of our animal nature—that part of us that acts automatically and without thought—and the evaluative measure of the “best” biological systems.  


It is well known that Descartes claims to ground and, by some accounts, derive his science from his metaphysics (Hatfield 1985; Garber 1992). Having seen that his biology includes NFs and CFs, in this section I consider whether these functions are compatible with Descartes’ metaphysics. I provide reasons to believe they are not, first with respect to NFs and then CFs. Although I do not follow the details of Des Chene (2001) exactly, this section is heavily indebted to Des Chene’s analysis of the tension between Descartes biology and his metaphysics.
3.1. Cartesian Metaphysics and NFs.

Descartes’ prohibition against teleology is often described as one of his most important innovations in support of mechanistic science (Gaukroger, 2000, p. 383; Garber, 2002, p. 412; cf. Machamer, 1976). In Meditation Four he tells us “there is no doubt [God] always wills what is best,” but, nevertheless, “the whole class of causes that people typically derive from the purposes [fine] of things [is] utterly useless in natural science.” The reason: “there is considerable rashness in thinking myself capable of investigating the purposes [fines] of God” (AT VII 55; CSM 2, 38-39, modified). Descartes’ short argument against using teleology in science is an epistemic prohibition that can be represented with two premises: (1) one can know what natural things are supposed to do iff one can know God’s purposes and (2) one cannot know God’s purposes.

Descartes’ argument against how teleology is “typically” used appears to be inconsistent with his attribution of NFs. The question motivating the search for NFs is “what is this part of activity good for,” and answering this question seems to involve stipulating to a purpose served by a natural thing’s parts or activities. That is to say, “the NF of the heart is to pump blood” is equivalent to “the heart is supposed to pump blood.” Only knowing the purpose of a thing would entitle the biologist to explain what a part or activity is supposed to do, and in this way the final effect of preservation becomes a final cause, those very things “utterly useless in natural science.” To save NFs, we must show that they do not run afoul of (1) and (2).

But perhaps the greatest obstacle to NFs is Descartes’ conception of nature, which goes beyond his epistemic prohibition by denying evaluative judgments a foothold in the natural world (AT 7, 84-86; CSM 2, 58-59). In Meditation Six, Descartes conceding that a clockmaker has expectations for her clock, yet accounting for what happens in the natural world is
nevertheless independent of the teleology her expectations introduce. In other words, once the clock is made, changes in the world are strictly the result of the mechanical operation of parts where initial conditions and Descartes’ laws of nature determine effects with complete necessity. There is no question of anything in the natural world, clock or otherwise, failing to do what it is supposed to do because there are no ends in nature. When “I consider the function [usus] of a clock,” Descartes allows, “I may say that it is departing from its nature when it does not tell the right time”—i.e. that it malfunctions—“and similarly when I consider the mechanism of the human body, I may think that, in relation to the movements which normally occur in it, it too is deviating from its nature.” But, even provided some description of what normally occurs, Descartes adds that, “‘nature’ as I have just used it [to attribute a NF to an activity of the human body] is just a label which depends on my thought.” A strictly mechanistic science relegates malfunctions and NFs to a speculative teleology imposed on, but not genuinely present in, the natural world.

In light of Meditation Four and Meditation Six, only CFs appear to have any hope of surviving a strict application of Descartes’ metaphysics. But if we constrain our analysis of Descartes’ function statements to the descriptive enterprise of identifying CFs, then we will never account for either malfunctions or the biological foundation for medicine. I will return to this point in Sections 4 and 5. Before doing so, however, we need to consider the prospects for CFs more carefully.

3.2. Cartesian Metaphysics and CFs.

One of the marks against NFs is Descartes’ claim that the “nature” defining how a living thing ought to be “depends on my thought” alone, which implies there is something highly
conventional about the NFs we attribute to things. I am about to show that the same charge can be leveled against CFs. Specifically, it is not clear how Descartes avoids the conclusion that the unity of living things “depends on my thought.” In this section I will follow Des Chene (2001) and differentiate between substantial, intentional, physical and dispositional unities in order to show that none of them can be used by Descartes to attribute CFs to the parts and activities of living things.¹³

The conclusion that substantial and intentional unity cannot apply to living things is easy to reach. First, Descartes’ characterization of all bodies in terms of extension (AT 8A: 25, CSM 1: 210), and his related denial of substantial forms to all but the human body (AT 7: 443, CSM 2: 298), implies that living things are not substantial unities. Nor do living things exhibit intentional unity. Or, at least, their intentional unity is in principle unknowable, given (1) and (2), since recognizing the intentional unity of a living thing entails some knowledge of God’s intentions.¹⁴

By contrast, while living things must be physical unities, physical unity by itself cannot support the attribution of CFs. Descartes refers to “one body” or “one piece of matter” as “whatever is transferred at a given time even though [what is transferred] may in fact consist of many parts which have different motions relative to each other” (AT 8A: 54, CSM 1: 233). From the standpoint of Descartes’ biology, this gives rise to the *problem of parts*. When I exhale and take a breath, what was once one body sharing a common motion is destroyed because the air that was in my lungs is no longer present; a new body takes its place. Respiration is among the biological functions Descartes explicitly discusses. But Descartes shows no sign of accepting that the air’s CF—whatever it may be—is also a CF of a part of me. Physical unity fails to
provide a distinction between the proper parts of a living thing and those parts sharing a common motion.

This leaves only dispositional unity. As the unity something has in virtue of the arrangement and interaction of its parts, a dispositional unity would seem to offer relief from the problem of parts. Specifically, the proper parts of a living thing are just those parts whose causal relations are necessary to produce the effect that defines the limit of a dispositional unity. But this helps only insofar as some endpoint or final effect can be identified for a causal system, the internal effects of which result from the causal relations among the system’s parts.

Two problems emerge here, though Des Chene (2001) groups them together as the “boundary problem” (p. 132). The first is another iteration of the problem of parts. No less than in the case of physical unity, where Descartes is unable to identify the proper parts of living things, an advocate of dispositional unity must be able to determine the proper parts of living things as distinct from the external causes that set the parts in motion. For example, Descartes needs some means of excluding the air in my lungs from being a part of me, even though it is unarguably a cause of the heart’s pumping blood that leads to the final effect—as yet unspecified—that defines my limits as a dispositional unity. The second problem, which I call the problem of final effects, relates to the final effect or endpoint of the causal interactions that distinguish my body from its environment and the external effects it will invariably produce. Descartes needs some way of identifying a specific and predictable effect in order to define a dispositional unity. What makes one effect in the chain of causes and effects stand out from the rest?  

The viability of assigning dispositional unity to living things is a point of contention among the interpretations considered in Section 4, so it is worth being as clear as possible about
the “boundary problem” and, in particular, the problem of final effects. Suppose we want to claim that the heart is a cause of circulation and that its CF is to pump blood. The heart is also a cause of nutrition, animal motion, and other CFs, all of which are internal to a living thing. So far so good, and in each case the CF of the heart will be to pump blood. But why is the animal-sized living thing the dispositional unity to which the heart belongs? The heart, after all, belongs in a larger ecosystem—i.e., a larger causal system—of which it and even the effects of the animal as a whole are just parts. And even this larger ecosystem is internal to an ever larger whole. If the effects of the heart are not internal to an animal-sized living thing, why think that its CF is to pump blood? The worry is that Descartes simply has no non-arbitrary way to designate unified wholes relative to which parts can be assigned; he has no non-arbitrary way to differentiate internal from external effects. This is the problem of final effects.

One obvious route to saving dispositional unity would involve reintroducing teleology into Descartes’ biology. This is the strategy of Hatfield (2008) that will be considered below in Section 4.3. But note that appeal to God’s purposes as the creator of living things is not a viable option and, as Des Chene points out, a final effect seemingly “stands out only... in relation to the intentions of its builders (or someone else’s guesses about them)” (2001, pp. 131-132). Put another way, “the choice of terminus for the concerted motions of the parts is arbitrary” because the world, insofar as we know it, is indifferent to which effects are produced (Des Chene, 2001, p. 131). We saw Descartes’ own indifference on display in the Meditation Six passage cited in Section 3.1, and the fact that nature does not prefer one effect over another means that we still lack the resources to identify dispositional unities.

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Descartes’ biological practice appears to be both at odds with his prohibition against teleology and to unjustifiably assume the reality of living things as subjects whose parts can bear CFs. The next section considers three possible responses to these difficulties. To anticipate my own response in Section 5, I will defend a living thing’s dispositional unity by arguing that Descartes provides a non-arbitrary starting point for biology by treating the human body as a whole or complete thing, the final effect of which is its preservation, as known through our own experience of pain, hunger, and the other “internal senses.” By a series of analogies, this serves as the basis for attributing CFs and ultimately NFs to other living things.

4. Recent Interpretations.

Three interpretative strategies have emerged in discussions of Descartes’ biological functions. The first, exemplified by Des Chene (2001), accepts the loss of both NFs and CFs. Brown (2012) represents a second strategy that defends CFs and offers a hint that NFs might also be saved. Hatfield (2008) offers a third strategy that defends NFs outright. Below I examine each of these strategies and offer reasons to resist them all. It should be kept in mind, however, that, while this section is largely negative, each of the three strategies about to be considered has made an important contribution to the analysis of Descartes’ biology. I will be salvaging parts of each in Section 5.


The first strategy, adopted by Des Chene (2001), accepts that Descartes’ metaphysics is inconsistent with attributing biological functions. Des Chene affirms the prohibition against teleology—(1) and (2)—and describes living things and biological functions as, at best, a
“projection of human intentions” (2001: 11). Effectively, Des Chene believes that Descartes treats living things as artifacts the purposes of which we do not know but which we can guess. Because Des Chene believes the only viable alternative to “projection” for the defenders of functions is to revert to claiming to know God’s purposes, he considers all biological functions metaphysically suspect. Des Chene thus concludes that the boundary problem cannot be solved and Descartes’ biological practice cannot be justified.

Strategy 1 has many virtues, not least its insistence on widely-agreed upon features of Cartesian metaphysics and a willingness to allow Descartes to be hoist by his own metaphysical petard. Since all the remaining interpretations, including my own, are effectively responses to Strategy 1, I will not preempt those responses here. Instead, I will only point out that Des Chene’s conclusions sacrifice Descartes’ unified vision of the sciences. We saw in Section 2.3 that Descartes expected his biology would prepare the way for a better medicine. Not only does he call “the preservation of health... the principal end of my studies,” at one point he vows to “devote the rest of [his] life to nothing other than trying to acquire some knowledge of nature from which we may derive rules in medicine which are more reliable than those we have had up till now” (AT 6:62, CSM 1: 143; AT 6:78, CSM 1: 151; respectively). In light of such pronouncements, I suggest we ought to resist, where we can, any interpretation like Strategy 1 that prevents medicine’s biological foundation from being defended as, at least, an internally coherent position for Descartes.

4.2. **Strategy 2: Saving CFs.**

Strategy 2 argues that biological functions can be defended as instances of CFs. The most sophisticated version of Strategy 2 is advanced by Brown (2012), who argues that living
things exhibit a unique form of dispositional unity; what I will call “reciprocal unity.” In Brown’s own words, “interrelationships hold between material structures that stand in relations of reciprocal dependence (both for their operation and persistence) in a complex hierarchical structure” where living things are concerned (Brown, 2012, 85). This means there are effectively two kinds of dispositional unity. In the first, the parts of the unity depend on one another to the extent that only collectively can they produce the final effect of the whole. In the second, which are cases of reciprocal unity, the “relations among arrangements of matter are relations of mutual dependence” so that the parts depend on one another not just to produce the final effect of the whole, but even to exist at all (Idem.).

Brown finds evidence for reciprocal unity in Descartes’ unpublished embryology, where “the formation of the brain is necessary for the persistence of the heart and the formation of the heart [in turn, is] a necessary precondition for the formation of the brain” (2012, 86). Living things come into existence through a series of bootstrapping “relations of reciprocal dependence.” The process of formation continues until the “whole matrix of interdependent processes... [results in] a relatively closed [causal] system, one in which... no further structures are required to sustain the whole” (Idem.). Once this point is reached, the structures or parts that constitute the system will continue to operate together through a series of positive and negative feedback mechanisms, thereby ensuring the stability of the parts and the system as a whole. Notice that nowhere in this process, whether in the formation, operation or persistence of the causal system, is there a violation of the prohibition against teleology; matter and the laws of motion do not form such closed systems for “purposes or ends.”

Before considering what Brown describes as the most “important” feature of her interpretation—that it offers some relief to the boundary problem—there is an initial point worth
making. As we saw in Section 2, Descartes deploys two concepts of function marked by two different terms—*usage* and *fonction*. By “function,” Brown has in mind only the latter term. She cites one of the passages I included above in Section 2.2, which was an instance of “fonction,” and so, at most, a CF. But Brown nevertheless concludes: “Contrary to teleological readings [of Cartesian functions], such passages suggest that Descartes attributes functions to things *solely* on the basis of their causal role in the machine to which they belong” (81; emphasis added). It is true that passages with “fonction” “suggest” just what Brown says they do. But “fonction” is neither the only notion of function in Descartes’ biology and nor, as we saw above in Section 2.1, is it anywhere a teleological one. To find teleology in Descartes, we need to look for *usage* and *usus*.

But Brown claims for reciprocal unity, “most importantly,” that it offers a route to solving the “boundary problem”—“individuals [are] unified through the reciprocal dependence of their parts”—while avoiding any appeal to a prohibited teleology (88). One way in which Brown’s account advances beyond the dispositional unity noted in Section 3.2 is in how it demarcates the proper parts of living things. We “may exclude food, sunlight, rain, etc. from having functions for organisms... [because] they do not reciprocally depend for their being upon the existence of those organisms or their parts” (*Idem.*). Or to use the example of respiration, Brown can point out that she may depend on the air in her lungs, but the air does not depend on her. Since there are not “relations of reciprocal dependence” in this case, the air in the lungs can be excluded as a genuine component or part of a living thing. Thus, whatever necessary role air may have in formation, operation and preservation, Brown provides resources for concluding that air does not have a CF that would, at the same time, be a CF of a part of a living thing. Brown thus has a very plausible response to the *problem of parts*. 
It is less clear that Brown responds to the *problem of final effects*. She acknowledges that, concentrating on reciprocal unities, what we ordinarily take to be self-contained biological systems might turn out to be parts of larger unified wholes than we previously thought—her initial example includes a spider and its web (*Idem.*). This means that reciprocal dependence relations among bits of matter do not necessarily guide us from parts and their immediate effects to an endpoint or final effect of a well-defined whole. There exists a hierarchy of nested causal processes in the world, so reciprocal unity may not be enough to identify a subject for biological functions independent of a prior judgment that animal-sized bodies are, in fact, closed causal systems. In the end, Brown believes it is a virtue that her account leaves open the possibility that we may discover that biological systems are actually quite large, as cases of niche construction imply, but from the standpoint of Descartes’ biology this is little more than an acknowledgment that the *problem of final effects* has not been solved.

In fairness, Brown’s intuition seems entirely reasonable. She seems to believe that, looking at the world, we recognize that some things resist their environment and persist through time. Given the chance for further investigation, we will discover that, in the case of a subclass of these persistent things, the explanation for their lack of change is due to the reciprocal dependence relations among their parts. These are the world’s biological unities. They are the plants and animals to whose parts we can attribute CFs by analyzing how those parts contribute to the thing’s preservation.

To avoid any hint that this is really an arbitrary division of the world that “depends on my thought” (AT 7: 85, CSM 3: 59), we need to understand why preservation stands out from among the other possible effects we might notice in the world. Brown (2012) spends most of her time emphasizing dependent arrangements of parts and not the effects they produce, but guiding her
account is surely an assumption about the persistence of closed systems, of wholes and the internal effects of their parts that lead to their preservation. It is by tracking down the contribution of parts and activities to the living thing’s preservation that Descartes discovers relations of mutual dependence. But why is preservation the appropriate endpoint or final effect of a reciprocal unity? Brown appears simply committed to a definition of living things that emphasizes preservation. Yet, it is hard to understand how noticing any effect, even that of preservation, escapes the need to choose or privilege some facts about the world over others. What guides us here Brown does not say. To this extent, it is not clear that Strategy 2 escapes the charge of grounding biological functions on “a projection of human intentions” (Des Chene 2001: 11). In Section 5 I will offer a defense of preservation as a non-arbitrary effect of living things that is absent from Strategy 2.

But even if Brown is justified in accepting that preservation is the effect that defines her reciprocal unities, thereby solving the problem of final effects and the entirety of the boundary problem, NFs and a justification for linking biology and medicine would continue to elude Strategy 2. Anticipating such a complaint, Brown (2012) ends by citing Shapiro (2003) to speculate that we might nevertheless distinguish a part’s current CF from the CFs of others of its kind, and in this way attribute NFs to the parts of living things (Brown 2012: 89-91). For example, by comparing a particular heart with other hearts, we might conclude that a particular heart is not doing what it is supposed to because other hearts are doing something else. This, as Brown concedes, will work only if we can solve the problem of kinds.

I do not wish here to assess Brown’s or Shapiro’s prospects for solving the problem of kinds. Instead, I believe that there is a more immediate problem with their solution, one that relates to the discussion of medicine and malfunctions in Section 2.3. Sticking with the example
of the heart, assume that we discover the heart’s CF is to pump blood whenever we seek to explain how an animal preserves itself. But, if we are considering something that does not or can no longer pump blood, why think of it as a heart at all? That is, even if hearts form a functional kind, it is because of what they do or can do. In the malfunction case, this is precisely what the object before us is lacking: it does not and cannot pump blood. Why think it is legitimate to compare such a thing with members of a functional kind and conclude it is malfunctioning? It is no more malfunctioning than my ear is malfunctioning because it does not and cannot pump blood. Brown’s emphasis on structures may seem to provide a response, since CFs are obviously not our only means of identifying parts and kinds—the heart, whatever its function, is, anatomically speaking, in a certain location relative to other parts, has a certain range of size within a species, etc. However, this alternative will not suffice. Once the CF of a reciprocally dependent part is lost, the other parts would also lose their CFs like dominoes, resulting in death. Brown is not left comparing something that does not and cannot pump blood with hearts that can and do. Rather, she is forced into comparing a mere collection of parts—that is, a corpse, none of whose parts function or exhibit reciprocal dependence—with a reciprocal unity whose parts display reciprocal dependence. Without a host of prior assumptions, such a comparison between the parts of a corpse and those of a living thing cannot support attributions of functions, let alone NFs.

4.3. Strategy 3: Saving NFs.

Strategy 3 comes from Hatfield (2008) who, on Descartes’ behalf, defends a God-free teleology of natural selection in order to justify NFs. Hatfield also responds to the boundary problem, and justifies Descartes’ attributing CFs by stipulating to the unity of living things and
the kinds to which they belong—assuming “types of organisms, with heritable structures, form recognizable natural kinds that possess organic integrity” (Hatfield, 2008, p. 415). Strategy 3 is surely right on both counts: some version of a God-free teleology must be defended if we are to save NFs and Descartes’ biology proceeds as though living things are genuine unities.20 In this section, I argue that the selected functions of Strategy 3 are not identical with Descartes’ NFs, and that Hatfield’s appeals to Descartes’ biological practice neither solves the boundary problem nor preserves the unity of the sciences.

Hatfield tells us that Descartes believes “[h]earts exist because they pump blood” (2008, p. 413) However, Hatfield also tells us that Descartes’ cosmology is one in which our world “arises without God directly fashioning its parts.” Even if God is said to foresee the outcome, it is “natural processes [that] create the organized entities in the world,” which entirely eliminates a role for God’s purposes (Idem.). The teleology that remains Hatfield calls “end-state selected finality.” It is entirely consistent with this kind of teleology that God chooses the effect to be produced. In Hatfield’s example, “I make a mousetrap, but it exists because of what it can do.” The mousetrap itself, and not Hatfield, has “the [causal and normative] function of catching mice” (Idem.). But thinking of artifacts, designers and their intentions, we will continue to maintain that whatever teleology exists will depend, ultimately, on the purposes for which the objects in question were designed. In other words, if we are willing to talk about the mousetrap malfunctioning, we must, even if implicitly, refer to the purpose for which it was made and not simply to what it can do.

It is at this point in his discussion that Hatfield introduces a distinction that allows Strategy 3 to distance Descartes from (1)—the premise that ‘one can know what natural things are supposed to do iff one can know God’s purposes.’ Hatfield argues that “end-state selected
finality” can occur through selection without God’s purposes “since the selection process” where, say, faster animals survive and reproduce where slower ones do not, “occurs blindly, with no [consciously realized] end” (Idem.). This blind process “produces things that serve an end” because hearts that pumped blood in the past led to the animal’s survival in the present, and it is this fact, about how past hearts came to be selected, that now explains why present day hearts, and animals, exist.

Hatfield’s is an inviting speculation as it is the only strategy discussed so far that even considers defending NFs directly. But Descartes’ NFs are not selected functions. We saw in Section 2.1 that Descartes’ applies an evaluative standard that asks about the value or benefit that a part or activity provides to a living thing. At first glance, Strategy 3’s appeal to selective functions looks as though it answers this question. For example, hearts exist because they pump blood, so that is what they ought to do and, presumably, that is what they are good for too. But given Strategy 3’s emphasis on past selection, Hatfield must face his own version of the problem of final effects. After all, reproduction occurs over and over again and selection, like reproduction, is an ongoing process. The beneficiary of selected functions would seem to be the last member in the series, but the last living member in the series has, so far as we know, not yet come (McLaughlin, 2001). Whereas a straightforward appeal to God’s purposes ends this search for a beneficiary by looking to the intended beneficiary, which would, presumably be each individual living thing—each member of the series—Strategy 3 strives for a God-free teleology. As a result, Strategy 3 leaves us without a way to acknowledge that all living things with hearts are the beneficiaries of the heart’s CF of pumping blood, and thus it cannot support the attribution of Descartes’ NFs.21
Strategy 3’s response to the boundary problem is not altogether satisfactory either. As Hatfield (2008) points out, individual living things must exist if Descartes’ biology is to have any subject matter. And some kind of ontological status for living things is surely implied by Descartes’ comments about the reality of death. “To say that being broken has no genuine reality in this case would be to assign a tenuous status to death itself, even though, for Descartes, death has the metaphysical consequence that the mind quits the body” (Hatfield 2008: 415). Death is a fact about the body that the mind must detect. Dying is neither a projection nor an arbitrary choice that “depends on my thought” but a painful and unwanted realization that the body can no longer support union with the mind.22 But rightly insisting on these points, Hatfield (2008) merely cordons off for metaphysicians problems he believes to be of little interest to scientists. In Hatfield’s words, “for the purposes of Descartes’s... natural philosophy,” we may both understand animal bodies as “properly unified” and as forming “real physical kinds” (416-417). We may, but this is not a justification to the effect that we should. Strategy 3 assimilates practical scientific necessity and philosophical justification.

Finally, Strategy 3’s defense of the ontological status of living things abandons Descartes’ unified view of the sciences no less than Strategy 1. Hatfield certainly assures us that Descartes’ biology has a subject matter. And to resolve the “boundary problem” in this way fits the reality that Descartes was a practicing scientist long before he was a metaphysician. But whereas Strategy 1 severed the link between biology and medicine, Strategy 3 severs the link between metaphysics and natural science. Like Strategy 1, it leaves us in need of an approach that resists prioritizing one of Descartes’ sciences—metaphysics, physics, biology, medicine—over another.
5. A New Strategy

In the previous section I attempted to show that we must reject Strategies 1, 2 and 3. Nevertheless, that there are aspects of each strategy that deserve acceptance. For example, I accept the challenge posed by Strategy 1. I also accept Strategy 2’s defense of reciprocal dependence as a response to the *problem of parts*, and Strategy 3’s guidance that we must defend a God-free teleology to save NFs. I differ from the previous strategies in arguing that Descartes makes room for teleology once the correct solution to the *problem of final effects* is found. In Section 5.1, I argue that Meditation Four is not concerned with a living thing’s NFs but only with global questions about created things relative to the universe as a whole. This conclusion is supported by Descartes’ explicit effort, in response to Pierre Gassendi, to keep questions about NFs and questions about God’s purposes entirely distinct. In Section 5.2, I explain how Descartes takes advantage of the room left for teleology by addressing the *problem of final effects*. I show that Descartes believes we discover truths about living things, including especially the final effect of preservation, by first discovering biological truths about ourselves. This feature of Descartes’ biology I call *Cartesian Anthropocentrism*.

5.1. Teleology Without Purposes.

Immediately after rejecting teleology in Meditation Four, it “also occurs to me” writes Descartes, “that whenever we are inquiring whether the works of God are perfect, we ought to look at the whole universe, not just at one created thing on its own” (AT 7: 55, CSM 2: 39). The “created thing” in this case is the human mind, but the remark highlights that in attempting to evaluate the products of design, we cannot abstract away from the purposes of their designer. In the context of Meditation Four, this means that we cannot conclude that our mind’s capacity for
error is an imperfection of the universe as a whole unless we can evaluate the human mind from God’s perspective on the universe as a whole—that is, the point of view from which the choices were made when our minds were created. Any hope of reliably assuming God’s perspective, however, is prohibited by (2), the premise that ‘one cannot know God’s purposes.’

Although we are prohibited from denying that “the works of God are perfect,” Descartes nevertheless acknowledges that we often inquire about the perfection of “one created thing taken on its own.” He indicates the different conclusions we might draw from these two perspectives when he explains that, “what would rightly appear very imperfect if it existed on its own is quite perfect if considered as a part of the universe” (AT 7: 55-56, CSM 2: 39, modified). This last claim is the key to salvaging teleology and NFs for biology. In spite of (1) and (2), it shows that asking whether something is perfect, or as good as it can be relative to some standard short of the universe as a whole, is not necessarily prohibited or destined to issue in a false judgment. For example, we know we make mistakes and that this is an imperfection in us, even if our making mistakes is not an imperfection from the standpoint of the universe as a whole. All Descartes is prohibiting in Meditation Four are those “causes that people typically derive” from God’s purposes when they assume God’s perspective on the universe as a whole. This prohibition against teleology does not require that we give up on “what would rightly appear” to be a perfection or imperfection from a more limited perspective on what constitutes wholes and parts, namely, created things and their parts.

We can follow these claims into Descartes’ *Objections and Replies* to the *Meditations*, where the discussion turns from the “customary search for final causes” and the human mind to animals in general, and where we find Descartes explicitly distancing NFs from God’s purposes. In the Fifth Objections Gassendi takes issue with what he mistakenly believes is Descartes’
wholesale rejection of teleology. Gassendi wonders where Descartes would find better “evidence for the existence of... God than from the function [usu] of the various parts in plants, animals, man and yourself (or your body)” (AT 7: 309, CSM 2: 215). Focusing on the parts of living things, Gassendi goes on to note that many “great thinkers have been led by anatomical observation of the human body not just to achieve a knowledge of God but also to sing thankful hymns to him for having organized all the parts and having harmonized their functions [usu]” (Idem, modified). From observing the NFs we attribute to the parts of the human body, Gassendi believes we can and should infer design and God’s purposes.

Descartes remains unwilling to infer from the NFs of parts to God’s purposes (finis), but he does not reject NFs. He explains to Gassendi that “the function [usus] of the various parts of plants and animals etc. makes it appropriate to admire God as their efficient cause—to recognize and glorify the craftsman through examining his works; but we cannot guess from this what purpose [fīne] God had in making any given thing” (AT VII 374-375; CSM II 258). Descartes and Gassendi share the conviction that God is the creator of living things. They also share the premise that the parts of living things have NFs. Whether these premises imply or assume anything about God’s purposes in creating living things is the point on which they diverge. Contrary to Gassendi, Descartes believes that we can identify the NF of the parts of living things but we are neither entitled nor required to speculate about God’s purposes in so doing.

The question that I claimed in Section 2.1 leads Descartes to NFs—‘what is this part or activity good for?’—is different from the question that leads Gassendi from NFs to God—‘what purpose does this part or activity serve.’ We can distinguish these questions by noting that NFs are conveyed by the Latin usus and God’s purposes by fīne. But, remarkably, Gassendi believes these two terms refer to the same thing. In his counter-objections to Descartes’ replies, which
Gassendi published as a separate work three years after the *Meditations*, he writes: “I might wonder how you believe men may admire God for the function [*usu*] of those parts and still not guess for what purpose [*fine*] he made them.” Especially, “since function [*usu*] and purpose [*finis*] are the same [*Idem sunt*], and it is impossible to admire the creator of some function [*usus*] without admiring the creator of some purpose [*finis*]” (Gassendi 1972: 233, modified). Gassendi wants to know how Descartes attributes NFs, yet avoids attributing specific purposes to God. How can he work with teleology and refrain from assuming some knowledge about why living things were made the way they are?

Descartes never responds to Gassendi’s second objections but, had he done so, he would surely have maintained, just as Hatfield (2008) argues, that not all teleology is tied to the intentions of a creator. After all, what is good for a living thing is not necessarily the same as the purpose God had in creation. Even the fact that something is not good for a created thing—such as our being prone to error and suffering as a result—indicates nothing about God’s purposes. Indeed, Descartes nowhere accepts Gassendi’s claim that the purpose (*finis*) of a thing is the same as its NF (*usus*). Instead, Descartes appears to endorse a distinction between, on the one hand, Gassendi’s assumption that the NFs of the parts of a living thing depend, ultimately, on the purpose served by the living thing as a whole, and, on the other hand, Descartes’ own assumption that the NFs of the parts of living things refer to the final effect of preservation but do not depend on the preservation of the living thing as a whole serving some further purpose. For Descartes, asking what a given part is supposed to do assumes nothing more than that the final effect of a living thing is its own preservation and that this effect is valuable or good from the biologist’s limited perspective. In other words, what a part or activity is good for can just be
the preservation of the created thing as a whole, without the preservation of the whole serving
some further good or purpose envisioned by God.

Given Descartes’ response to Gassendi in the *Objections and Replies*, the characterization
of Descartes’ prohibition against teleology from Section 3.1 must be modified. The prohibition
should only apply to the teleology of created things as a whole, to the purpose that the created
thing serves, and not the *usage* and NFs associated with a created thing’s parts. That is, (1)
should be reformulated as (1₁): ‘one can know what natural things as a whole are supposed to do
iff one can know God’s purposes.’ With the sole exception of the human body, Descartes never
attributes a purpose or NF to a living thing as a whole, instead resting content with the final
effect of preservation. And he specifically rejects the idea that God made the world for us (AT
3:432). I will say more about the exceptional human body in Section 5.2, as it is the model for
all living things, but what bears emphasizing now is simply that Descartes’ NFs do not run afoul
of his prohibition against teleology as properly represented by (1₁).

Insofar as Descartes makes an assumption when he assigns NFs to the parts of living
things, it is that we can legitimately perceive them, in the words of Meditation Four, as “created
things” and that this perspective does not necessarily falsify the way the world is independently
of us. This claim, or one very much like it, is a centerpiece of Strategy 3. To the biologist,
living things are unified wholes. But unlike Strategy 3, I have tried to offer textual support for
the claim that Descartes recognizes and explicitly allows for a limited perspective on created
things that can pass metaphysical muster. I have also added that, from our limited perspective,
the parts and activities of these wholes can be assessed relative to their preservation. We can
ask: how well does this part, activity or arrangement contribute to the preservation of the created
thing? Is this part doing what it should be doing, namely, promoting the preservation of the whole? If it is not, it is malfunctioning.

To be clear, Descartes is not interested in rejecting all forms of teleology and this accounts for his view that NFs and purposes are not the same. Judged from the standpoint of Descartes’ contemporaries, this does not mean that there is teleology somewhere unexpected but that there is less teleology than would have been expected—that is, God’s purposes do not enter into biology. Gassendi’s inability to understand Descartes’ position testifies to this point. But for Descartes’ biology to take advantage of the room his rejection of teleology makes for it, he needs some way to solve the problem of final effects. He needs to be able to explain why living things are “created things” and more than a projection of our interests or intentions onto the world, as was the worry identified in Section 3.2. Descartes will also need to provide some justification for viewing preservation as valuable that does not force us into speculating about God’s purposes. Cartesian Anthropocentrism provides a route to dealing with these remaining issues.

5.2. Cartesian Anthropocentrism

There are at least two respects in which Descartes begins with what we know about ourselves only to proceed to the rest of the living world. The first relates to the metaphysical principles that constrain biological explanation. The second manifests in Descartes’ biology itself, where the final effect of preservation and its value are established as facts about the human body. In both cases, it is first-person experience and reflection on our own bodies that is Descartes’ starting point.
Many passages testify to Descartes advocacy of Cartesian Anthropocentricism, including especially the order of presentation in his Meditations, the opening to the Treatise on Man, and the accepted titles of his major biological works—Treatise on Man and Description of the Human Body—but it is when diagnosing our errors in biology that Descartes is at his most forthcoming. I will limit myself to just two such passages, incorporating numbered brackets for ease of exegesis:

[1] When people take a fall, and stick out their hands so as to protect their head, it is not reason that instructs them to do this; it is simply that the sight of the impending fall reaches the brain and sends the animal spirits into the nerves in the manner necessary to produce this movement....

[2] Our own experience reliably informs us that this is so....

[3] All the actions of the brutes resemble only those which occur in us without any assistance from the mind. [4] And we shall be forced to conclude from this that we know of absolutely no principle of movement in animals apart from the disposition of their organs and the continual flow of the spirits....

[5] We [thought otherwise] because we failed to distinguish the two principles of motion just described [in us]; and on seeing that the principle depending solely on the animal spirits and organs exists in the brutes just as it does in us, we jumped to the conclusion that the other principle, which consists in mind or thought, also exists in them. (AT 7: 229-231, CSM 2: 161-162).

[6] But there is no preconceived opinion to which we are all more accustomed from our earliest years than the belief that dumb animals think. [7] Our only
reason for this belief is the fact that we see that many of the organs of animals are not very different from ours in shape and movement. [8] Since we believe there is a single principle within us which causes these movements—namely, the soul, which both moves the body and thinks—we do not doubt that some such soul is to be found in animals too. [9] I came to realize, however, that there are two different principles causing our movements. The first is purely mechanical and corporeal, and depends solely on the force of the spirits and the structure of the organs.... The other, an incorporeal principle, is the mind or that soul which I have defined as a thinking substance. [10] Thereupon I investigated very carefully whether the movements of animals originated from both these principles or from one only. I soon perceived clearly that they could all originate from the corporeal and mechanical principle, and I regarded it as certain and demonstrated.... [11] But when I investigate what is most probable in this matter, I see no argument for animals having thoughts except this one: since they have eyes, ears, tongues and other sense-organs like ours, it seems likely that they have sensations like us; and since thought is included in our mode of sensation, similar thought seems to be attributable to them. (AT 5: 275-277, CSMK: 365).

Descartes believes we invariably begin by overestimating animals [6]. In these passages he explains why we do. Specifically, we notice that their bodies and their movements are like our own [7, 11], and we misapply principles of movement to them, attributing more causes than are strictly necessary [5, 8]. This is understandable, however, because initially we believe, from our own experience with our own bodies, that there is only one principle of movement: the soul
But in fact there are two principles of movement: the soul and body [5, 9]. We discover them in the course of metaphysical reflection, and then, in application, through experience with our own bodies [1, 2, 9], which sometimes move automatically [1] but other times only after an act of the soul [5, 9]. Once we recognize these two principles and their application in our own case, we return to animals, whose bodies and movements resemble our own [7, 11], and reconsider which principles of movement are present [3, 10]. We discover only one is needed, and not the one we initially thought [4, 10].

These claims are typical of Descartes’ anthropocentrism. Assumptions about the human being or our body are implicated in the initial (mistaken) judgment we make that animals have souls, in the discovery that there are two principles of movement and in our more considered judgment that animals operate without a soul. Throughout, Descartes cites the knowledge he thinks we can all gain about ourselves through metaphysical reflection and allows our familiarity with our own bodies to direct our biological studies. Beginning with the mind-body union, we proceed to the human body by itself and then, with the human body as our model, we proceed, by analogy, to the rest of the living world. Fundamentally, Descartes’ biology involves using what we know about our own body—that it has certain sense organs, behaves and moves in certain ways, etc.—to identify analogs in the world—those things with a similar shape, sense organs, behavior and movements—and then to attribute causes to those analogs given what we know about our own body—that it can be caused to move because of the mind or the body, etc.24

If the problem of final effects is solvable, it will be because preservation is a non-arbitrary final effect of either the union or the human body. As it turns out, it is the final effect of both when each is viewed as a whole or “created thing.” In the case of the human body, Descartes
explains “when we speak of the body of man... we simply mean the whole of the matter which is united with the soul of that man.... And we mean that this body is whole and entire so long as it has in itself all the dispositions required to preserve that union” (AT 4: 166; CSMK: 243). If we think of the mind and human body together as forming a complex causal system, the preservation of this causal system can only be accomplished through the preservation of its parts. The mind’s preservation is not an issue, as it does not have parts (AT 7: 85-86, CSM 2: 59), which implies that the mind by its nature will endure; this is why we can hope for an afterlife. But the human body is a different matter. It is, like the mind, whole on its own yet it is divisible into material parts that inevitably break apart (AT 7: 13-14, CSM 2: 9-10).

From the standpoint of the union, the effect or phenomenon guiding our search for the human body’s CF will be the union’s preservation, which Descartes takes to be a good for us. Proceeding down the causal chain from this final effect, we discover that the human body’s CF is to preserve itself. This is also its NF, because the human body’s CF benefits us by virtue of being an instrument of our preservation. Working down the causal chain still further, to the parts of the human body, we will discover that they too have CFs relative to the preservation of the human body’s CF of preservation. Immediately, they contribute to the preservation of the body as a whole, but later in the causal process they contribute to the preservation of the union. Our downward progress from the final effect of preservation of the union to the human body’s preservation to the preservation of the body’s parts provides the framework for working out any living thing’s biological functions. I refer readers back to Section 2.3 for more detail once the final effect of preservation has been introduced.

For the human body to be part of the union, and to have its own dispositions, even if they have a NF only with respect to the union, the human body must be something real, a unity in its
own right. In other words, there must be facts about the human body that do not depend on our thoughts, that are neither arbitrary nor a projection onto the world. This is the commitment Hatfield (2008) insists upon when citing the significance of death for Descartes; death could not matter if the body were not a unity on its own. We can say more, however, by noting, as Descartes does, that the human body is a part of a self-preserving causal system. It is this awareness of the union’s final effect that allows us to discover that the human body’s CF is to preserve itself and that this is its NF as well. And both are facts of nature, for when the body or its parts malfunction—that is, fail to promote the preservation of the human body and through it the union—Descartes will claim there is a “true error of nature” (AT 7: 85, CSM 2: 59). Thus, we discover the functions of the human body and its parts just as we must discover that the parts of the body that contribute to the preservation of the body as a whole are those parts in reciprocal relations of dependence, as emphasized in Strategy 2. But we only solve the problem of parts following Strategy 2 knowing the final effect of those parts and working down the causal chain back to them. We work backwards from the effect they produce, and though differentiating the proper parts of the human body is a genuine scientific achievement, so too is discovering that the final effect of the human body, taken as a whole or “created thing,” is its own preservation.

It is the “internal senses” that lead to the discovery that the human body is a dispositional unity the final effect of which is preservation. According to Descartes, these experiences—“sensations of hunger, thirst, pain and so on”—all have a qualitative character that picks out the one body to which we are “intimately joined” (AT 7: 81; CSM 2: 56). While all sensory experience requires some alteration of our body, it is only the “internal senses” that reveal which body belongs to us, which body is ours. And, at minimum, this body is a dispositional unity, one whose parts cooperate to produce sensory “perceptions [that] are agreeable... while others are
disagreeable mak[ing] it quite certain that my body... can be affected by the various beneficial or harmful bodies which surround it” (Idem.). “Experience” shows that we are not like a sailor in his ship, and that the senses role in preserving the body is part of “the best system that could be devised... conductive to the preservation of the healthy man” (AT 7, 87; CSM 2, 60).

The human body’s status as the model for all living things solves the problem of final effects. The biologist simply studies those bodies that are like the human body. Specifically using what we know about the human body, if we look for analogs in the natural world we will find that things exist that also have parts and engage in self-perpetuating behaviors like our own. The analogy between human and animal anatomy and physiology is what justifies the biologist’s study of more than just the human body. Once again, we no more choose to take an interest in preservation in our own case than we choose to have the internal senses. Nor do we impose preservation on other living things once we have been clued into it as an effect worth noticing. We discover it in both cases, it is just that we make the discovery about the human body first and then subsequently do we discover that other bodies with parts like ours preserve themselves, and that both do so through the reciprocal dependence of those parts. The subject matter of biology is ultimately grounded in the similarity between the human body and other bodies in the world.

It is one thing to solve the boundary problem, to show that Descartes is entitled to attribute CFs to the parts of living things, but is this enough to show that preservation is an effect capable of transforming an animal’s CFs into NFs? If we stick too closely to the case of artifacts, they can produce or have value, but not to themselves. Why are living things different? Here I refer us back to Section 5.1 and Descartes’ disagreement with Gassendi. For even in our own case, the preservation of the union is not something that needs to serve some further purpose.
in order to be of value to us. We need not even recognize it as valuable for it to be a natural
good. As I understand Descartes, once we settle on treating something as a “created thing”—
union, human body, living thing, etc.—its preservation is de facto of value. In other words, its
existence is the measure of all of its parts, and in so far as its parts contribute to its continued
existence, its parts have value; preservation is the only final effect attributable to a created thing
as a whole, and its parts have NFs because they promote that effect. Even the NF of the human
body is discovered only once it is related to the preservation of the union, and likewise the NFs
of the parts of living things are discovered once they are related to the preservation of the living
thing as a whole. In each case, Descartes assigns NFs to the parts even though, at the same time,
he claims that the preservation of the created thing as a whole does not serve some further
purpose.

Finally, we saw that none of the previous strategies is able to maintain a commitment to
the unity of the sciences. By virtue of solving the boundary problem and accounting for the
value of preservation, Strategy 4 succeeds where the others fail. Biology and medicine are still
linked together because the NFs assigned in biology can guide the physician’s interventions to
correct malfunctions. And biology is still linked to metaphysics because using what we know
about ourselves to guide our inquiry into other living things exploits Descartes’ metaphysical
principles concerning the union and the nature of extension. This is a great advantage for
Strategy 4, but in my concluding remarks I note some of the difficulties that remain.

6. Conclusion.

I have sought to show that Descartes’ attributions of biological functions are not
compatible with a straightforward account of either his prohibition against teleology or the
ontological foundation for his mechanistic science. Providing a rationale for Descartes’ function statements is the goal of Strategies 2 and 3, whereas Strategy 1 accepts that Descartes’ various commitments in metaphysics and biology cannot be made to fit together. Strategy 4 attempts to solve the problems that motivate Strategy 1. It draws on the reciprocal unity of Strategy 2 to solve the problem of parts but offers its own solution to the problem of final effects by drawing on Descartes’ anthropocentrism. Like Strategy 3, Strategy 4 carves out a space for teleology in Descartes’ science that distances questions about what a part of activity is good for from questions about which of God’s purposes it might serve. And, also like Strategy 3, which gives great weight to Descartes’ biological method, Strategy 4 emphasizes Descartes method but traces it back to its starting point: Cartesian Anthropocentrism.

There remain many issues and potential objections that I cannot respond to here. For example, one must consider to what extent similarities between living things can be found to support analogical inferences about the existence of other living things. After all, the biologist does not just study human bodies and other primates. What about morphologically different living things? What about living things that persist for only a very short time or in radically different environments? Cartesian Anthropocentrism does not provide much guidance on how similar living bodies must be to the human body. And analogy also threatens promiscuity. Not only might too many things prove similar to the human body, like the self-perpetuating vortices that form Descartes’ solar system, Descartes warns against the danger of making animals too much like ourselves and coming to believe that they have souls. He even sees this danger in efforts to explain the behavior of falling bodies which, when falling, seem to know where they are going. This conclusion was precisely what he thought led the Aristotelians to infer that falling bodies must have souls directing them (AT 7: 441-442, CSM 2: 297-298). All told, this is
further evidence of Descartes’ anthropocentrism, but it is also evidence that even Descartes recognizes the need to tame anthropocentrism’s use.

Still, it is worth being mindful of the challenges Cartesian Anthropocentrism must ultimately confront. For surely some of these challenges, whether about analogy or the metaphysics of the union that loomed so large in Section 5.2, explain why the history of mechanism tends to focus more on Descartes’ physics and not his biology, where his anthropocentrism is especially apparent. And if the new mechanical philosophy has left Cartesian Anthropocentrism behind, as it most surely has, it is appropriate to ask how it responds to the problems that Descartes uses Cartesian Anthropocentrism to solve. Are the problem of parts and the problem of final effects less urgent or any more tractable today? After such a long paper it would be unfair to now give an extended answer to this question, but I would suggest that both problems are still with us, however “new” our “new mechanical philosophy” seems to be.

Acknowledgments

Redacted for blind review

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3 Usus is the Latin translation of the Greek chreia. Latin-French Dictionaries, like Estinne (1570), translate “usus” as “usage” and make the connection between utor and servir, the latter of which Descartes also uses (e.g., AT 6, 46). Nicot (1606) notes of usage: “this is what in Latin is called Usus.”

4 There still exist modern advocates of NFs in this sense, including Canfield (1964) and McLaughlin (2001).

5 See also AT 11, 519. Descartes’ interest in “harm or benefit” also appears in his account of “sensory perceptions” (AT 7: 83, CSM 2: 57; Simmons 2001; Schmaltz (unpublished)) and his account of the passion of “irresolution” or indecision as having a “beneficial function [usage]” because it “gives [us] time to make a [deliberate] choice before committing” ourselves to any course of action (AT 11: 459, CSM 1: 390).

6 See references in note 2. “Fonction” was uncommon when Descartes wrote, having yet to appear in any of the general dictionaries I have examined (e.g., Cosgrove (1632); in Goclenius (1613) it does not have its own entry). Estinne (1570) does include “functio,” but “fonction” is not listed as its French equivalent; instead, one finds “charge ou office” (583).

7 The 1662 Latin translation of the first passage in this section uses “actiones,” meaning “actions,” where the original has “fonctions.” It thus seems even Descartes’ earliest translators wanted to avoid implying a NF when only a CF was involved.

8 Descartes’ medical advice bears out this connection. He advises, “the best method of keeping to a healthy diet, is to live and eat like animals, i.e., eat as much as we enjoy and relish, but no more” (AT 4: 178, CSMK: 353). Descartes even calls the study of animals a “prolegomena” to medicine (AT 4: 329, CSMK: 275). These, and other similar passages (e.g., AT 5: 62-63), imply that biology will serve as the basis for medical intervention aimed at preserving our health or reclaiming it when it is lost.
Today it is generally agreed that CFs by themselves cannot accommodate malfunctions (Davies 2001; cf. Godfrey-Smith 1993). Instead, because CFs are solely determined by what something currently does or can do, when the heart no longer pumps blood its CF simply changes, it does not malfunction. I discuss this issue further in Section 4.2.

Descartes’ source for the distinction between “true” as opposed to accidental NFs was likely the Hellenistic physician Galen of Pergamum—still the most important medical authority for Descartes—who distinguished between a “primary and necessary function” as opposed to ancillary functions, or functions “for good measure” (Schiefsky 2007).

Descartes, so far as I am aware, makes no allowance for the distinction between preserving health and assuring bare survival. He proceeds on the reasonable assumption that preserving health is the surest way to a long life.

In normal circumstances we are not as good as other animals at preservation. Whereas they automatically act to preserve themselves, we suffer the handicap of occasionally thinking about what to do (AT 4: 573, CSMK: 303; AT XI 640). In fact, “animals do many things better than we do” which “can be used to prove that they act naturally and mechanically” (AT 4: 575, CSMK: 304).

Des Chene (2001) refers to “functional or intentional unity” but I have dropped “functional” to limit confusion. The reason Des Chene combines the two is owing to (1), which for him indicates that all functionality results from intentionality or God’s purposes. This was the dominant view at the time Descartes wrote (Des Chene, 1996).

It might be argued that the ontological status of living things resembles the case of artifacts where, knowing they are artifacts, we presume they have intentional unity even though we are ignorant of the more elaborate teleology that created them. Even in Meditation Four, just prior to his short argument against teleology, Descartes acknowledges, “there is no doubt [God] always wills what is best.” Knowing this, we would know that the parts of living things are for the best, even if we do not know what the best is in this case.

There are difficulties with this appeal to intentional unity. First, any specification of what is best—i.e., adding any content to the claim that the animal serves some purpose—would amount to substituting our own intentions for the unknown intentions of God. Even if God made animals’ parts with a purpose, to guess at the purpose, without some more substantive principle
guiding our conjecture, holds the prospect of wildly missing the mark. Second, in order to guess at the purpose of things, there must already exist either physical or dispositional unities that can be co-opted to serve the purposes we envision for them. The reason the clock is a candidate for intentional unity is because it has both physical and dispositional unity.

15 Versions of the problem of parts and problem of final effects—as well as other challenges to the new mechanical philosophy—are surveyed in Franklin-Hall (unpublished). I thank XX for pointing out the similarity between my rendering of Des Chene (2001) and the problems identified by Franklin-Hall.

16 Similar arguments against CFs appeared earlier with slightly different emphasis in Gueroult (1984) [1953] and Canguilhem (2008) [1965].

17 Godfrey-Smith (1993) advocates this position; Brown cites this work.

18 This issue was first brought to my attention by Davies (2001), who asks: “On what grounds other than possession of the defining capacity might they [i.e., the supposedly malfunctioning part] retain their membership in the functional type?” (212).

19 Readers will be reminded of the selected functions defended by Wright (1973). Not being a Darwinian, Descartes, according to Hatfield, has the option of endorsing a version of Lucretius’ atomistic cosmology. Such an account holds the promise of explaining “the occurrence of organisms that exhibit immanent teleology” (Hatfield, 2008, 414). There are similarities to several of Lucretius’ claims in Descartes, and Hatfield cites them (AT 8A: 103; CSM 1: 258), but Hatfield’s point is simply that there were ends-selection mechanisms available to Descartes consistent with Descartes’ mechanism and the spirit of his rejection of teleology.

20 Other recent efforts to acknowledge a God-free teleology in Descartes’ physics include Machamer (1976); Simmons (2001); Schmaltz (unpublished).

21 We could also ask about the first function bearer in a species. Do its characteristic activities have a function given that they have yet to be selected? As with contemporary accounts of selected functions, like Wright (1973), it is not obvious that Hatfield’s version has the resources to answer this question. Moreover, Descartes believes in spontaneous generation for every member of a species (AT 3: 460). This again suggests that Hatfield’s God-free teleology is not applicable to all living things.
The flip side of Hatfield’s claim about death is that life must also have metaphysical significance. Whether this is consistent with Descartes’ belief that living things are essentially the same as other bodies in being merely extended is a complicated question for which Hatfield may have an answer when he speculates about what I would call a “Cartesian ontology of natures” (2008, p. 417). His answer is tentative, however, and I do not have the space to take it up here.

Descartes’ God certainly does what is best (AT 7: 55, CSM 2: 38). It must be remembered, however, that unlike Leibniz’s God, what is best is not something fixed independently of God’s will; Descartes’ God is subject to fewer constraints in creation and, in principle, could have made even the “eternal truths” differently (AT I145-146, CMSK: 22-23). Thus, to know what is best we must know God’s will, and that is precisely what we cannot claim to know with any specificity.

This is how Descartes’ biology begins but, of course, it is does not characterize its middle or end. At some point, Descartes turns in the opposite direction, inferring from facts discovered about animals to facts about us. In other words, animals become the model on the basis of which we make discoveries about the human body. For example, see Descartes’ account of the eyes’ CF, where he uses the eye of an ox to establish his conclusions (AT 6:115, CSM 1, 166).

The use of analogy to study the living world is a prominent feature of the early modern life sciences and extends even to the case of plants. For the analogy between the human body and the circulatory system Descartes finds in plants, see AT 2: 329.