

## IS TELEOLOGY INEVITABLE IN BIOLOGY? A THEORETICAL TRIAL OF BIOLOGICAL FUNCTIONS

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### Resumen

En muchas ramas de la Biología se comparte un hablar funcional, en donde se dice que las partes o acciones de los seres vivos sirven para algo. Mucha de la investigación trabajada en esta disciplina trata de establecer cuál es la función de la parte o acción de un ser vivo. Detrás de las atribuciones funcionales podría haber una dimensión teleológica; es decir, las funciones ayudan a explicar la presencia de una cosa. Este estudio examina el compromiso teleológico en la caracterización de funciones en la Biología. Para poner ello a prueba, y con miras a sustentar ese compromiso, se revisan tres teorías naturalistas contemporáneas sobre la función; estas son: el acercamiento sistémico, la teoría de los efectos seleccionados y la explicación organizacional. Cada una de estas teorías busca redefinir el concepto de función y a la vez atender el asunto de la teleología. La reexaminación hecha en este estudio muestra hasta qué punto es la teleología inseparable de la función y, hasta cierto grado, cuán imprescindible es para la Biología.

Palabras claves: función, Teleología, Filosofía de la Biología, causas finales, Biología

### Abstract

Most subfields in Biology share a language known as function-talk, whereby the parts and actions of living things are said to be *for* something. Much of the research in this discipline aims at elucidating what the function of an organism's part or action is. Beneath functional attributions there may well be a teleological dimension, where functions help accounting for the presence of an item. This study examines the teleological commitment in functional characterization in Biology. In order to test and substantiate this commitment, three contemporary, naturalistic theories of

function in the philosophy of Biology are reviewed, specifically the Systemic Approach, the Selected Effects theory, and the Organizational Account. Each of these theories seeks to redefine the concept of function and to somehow address the issue of teleology. Reexamining these theories unravels the extent to which teleology is inseparable from function and inevitable, to some degree, for biology.

Keywords: function, Teleology, Philosophy of Biology, final causes, Biology

## Introduction

In everyday language, it is not uncommon to seek and to allude to the purpose of things. The *purpose* of a bookshelf is to hold books; the *goal* of the U.S. Department of Education is to promote student achievement; the *aim* of the U.S. Bill of Rights is to guarantee personal freedoms and rights to its citizens. In spite of the plurality, each of the aforementioned purposive statements shares an explanatory role—one concerning the reason which accounts for the presence of such purposive items. The view that the presence of something can be explained by appealing to its purpose, goal, or end is known as *teleology*<sup>1</sup> (Cummins, 2010, 164; Walsh 113; Wouters 128). This particular sense of teleology *qua* explanation which alludes to purpose is employed exclusively in this study. Here teleology has nothing to do with a collective purpose of goodness in nature (Plato, *Timaeus*), nor with an appeal to an intelligent designer (Paley, *Natural Theology*), and little to do with mankind's utility (Spinoza, *Ethics*, Appendix to the First Part). Thus, teleology is understood here as the quest of answering the why-it-is-there question in regard to the study of biological parts and actions.

*Function* is common in ordinary language, and commonplace expressions, such as “the function of a typewriter is to type,” make evident the ordinary meaning of function. Functions express what an item is *for*. So, its explanatory role essentially accounts for what-it-is-for and/or what something is meant to do (Garvey 112; Godfrey-Smith 59; Mossio *et al.* 814). This explanatory role from functional attribution is focused on here.

The two realms that most exhaust function-talk are the realms of artifacts and of living things. This study centers on the latter realm. Functions are important in Biology because an essential part of biology research involves uncovering what a living thing's parts and processes are for (Campbell *et al.* 7). Further, to decipher functions is an important asset for inferring adaptation (Futuyma & Kirkpatrick 68). A biologist manifests his or her functional attribution in linguistic expressions, such

as “the function of  $x$  is  $y$ ,” or other similar equivalents, such as “ $x$  has a role in  $y$ ,” or “ $x$  in order to  $y$ ” (Canfield 285).

Since function purports to account what something is for, it relates to the *purpose* or reason for being there. It follows that functions may well be teleological, because functions to account for the presence of something becomes teleological (Wright 155; Mossio *et al.* 814). This teleological aspect in function gave rise to the main inquiry in this research. If functions are teleological, then *biological* functions must be teleological as well. Given the importance of functional attribution for biology, to what extent could this mean that teleological thought is inevitable in its study?

Reasons for supporting this teleological commitment in biological functions were sought through the revision and analysis of three contemporary, naturalistic theories of function, which are namely the Systemic Approach, the Selected Effects theory, and the Organizational Account. Each of these theories propose a conceptual definition of function that has decisive role in their proponents’ commitment to teleology in biological function. Proponents of these theories have discarded, accepted, or even modified their positions towards Teleology. Analyzing their reasons for doing so will provide the fertile ground for a plausible answer to the question concerning the inevitableness of teleological thought in biological sciences.

### **Historical issue of Teleology**

The first appearance of teleology *qua* explanation was in the form of Aristotle’s final causes, “the end that for the sake of which a thing is or is done” (*Physics* II 3; *Metaphysics* V 2). Along with three other causes (i.e. formal, efficient, and material causes), a student of nature or the physicists would thus be equipped for a better or causal understanding of nature (*physis*) (Falcon). According to Aristotle, final causes had an important role in explaining “the inherent goal-directed tendencies imbued in the matter of living organisms” (Ariew 162) and in non-living matter. Also, Aristotle gives an ontological status to the studied teleology in nature (Aristotle, *Physics* II, 1). For more than two millennia, goal-directed tendencies would be the epicenter of scientific conception of motion and growth (Cummins, 2010, 166).

The word *teleology* first appeared in Christian Wolff’s *Preliminary Discourse* in 1728; it was mentioned as a mode of explanation in reference to an end (*telos*), and it was contrasted against efficient causes (Glaserfeld 17; Ferrater 767). During this period, philosophical discussion of a contrast between final and efficient causes

was not uncommon due to the predominance of the mechanistic view of the world in post-Newtonian physics (Glaserfeld 18; Perlman 3; Wouters 128). Overshadowed by efficient causes in the apex of mechanics, teleology had little room for the study of nature, except in the field of life sciences. In his *Critique of Judgment* (1790), Kant defends the view that understanding organisms would be impossible, unless by means of a teleological mode of thinking (Fox Keller 25). Kant supports this, whilst warning us against giving an ontological interpretation of any purpose of nature (§67, 285). Two central events in the history of philosophy and biology seem to have expurgated any talk of teleology. In the early twentieth century, logical positivism would condemn teleology as meaningless for lacking an empirical corroboration of final causes (Perlman 4). On the other hand, the integration of the ideas of mendelian genetics and natural selection, also known as Evolutionary Synthesis, was conducive to the current unsympathetic sentiment towards teleology in science (Wouters 128).

Nonetheless, the elimination of teleological explanation in science resulted in the restriction of the advancement that was hoped to follow from a non-teleological biology. Displeased by the inadequate replacement of teleology, philosophers of biology from the second half of the Twentieth century, and with a predominantly naturalistic outlook, reexamined the issue of teleology, hoping to naturalize biological functions, along with its teleological feature (Wouters 129; Perlman 5).

### **Naturalism and theories of function**

The theories of function that were chosen in this study are the Systemic Approach (SA), the Selected Effects theory (SE), and the Organizational Account (OA). How each of these theories deal with the issue of teleology in the context of *biological* functions was an important decisive factor for this study, because some proposed definitions of function determined the fate of teleology in general. These three approaches to function share the philosophical stance known as *naturalism*, which makes them “naturalistic” theories of function. So before analyzing reasons for discarding or advocating for teleology, the principal tenets of naturalism must to be sketched for a better understanding of the agenda behind such naturalistic theories.

Naturalism is the “two-fold view that (1) everything is composed of natural entities [...] whose properties determine all the properties of things [...]; and (2) acceptable methods of justification and explanation are continuous, in some sense, with those in science” (*Cambridge Dictionary of Philosophy* 596). Its strict scientific methodology leaves no room for judgements of value posed by an external observer.

Rather, it limits its concerns to purely natural phenomena that can be explained by natural causes (Bedau 647; Edwards V 448).

Naturalism regulates both function and teleology. Ontological and epistemological naturalistic tenets make biological functions inherent properties of the constituent parts of living systems, because they correspond to *natural* effects of an organism's parts, which are sought by (scientific) biologists (Perlman 10). Concerning teleology, if the *why* question alludes to a *natural* cause or a scientifically acceptable causal explanation, then teleology is accepted or said to be *naturalized* (Mossio 814). Moreover, to naturalize teleology is way of legitimizing its mode of explanation. In addition to these naturalistic criteria, philosophical analyses of function pragmatically seek to make their definitions compatible with scientific application of function talk in Biology and commonplace usage (Garvey 112).

## Contemporary approaches

### *Systemic Approach*

The first theory to be discussed is known as Systemic Approach (SA). Robert Cummins, the leading proponent of the SA theory, proposes that “the function of an item is the role of that item in bringing about an activity or capacity of a complex system of which that item is a part” (paraphrased by Wouters 135). At the core of this theory, the functional analyses express the explanatory essence of function when the *capacity* or *disposition* of an organism's part is identified, instead of showing why it is present (Cummins, 1975, 751). In other words, rather than explaining what it is for, functions aim to understand *how it works* (Cummins, 2010, 165; Garvey 122). Cummins (2010) argues that the teleological explanation is not directly addressed in the characterization of functions, making it an irrelevant explanandum (165). Also, he defends the view that teleology fails to provide adequate causal grounding. The effects of a function-bearing item cannot causally determine its current presence (746). Hence, to analyze function is to seek how the constituent parts of a system (e.g. the parts of a heart) contribute to a higher complexity level (e.g. the heart) of a system's disposition or capacity (to circulate blood). The focus of this theory on the *actual* functions of existing traits makes it *present-looking* and also suits with its usage of in biological sciences (Perlman 12; Garvey 122).

Certainly, much of the functional ascriptions in Biology involve explaining how parts and processes work to contribute to higher level phenomena. RNA

interference, method whereby the expression of specific genes is silenced, helps assess what a key protein does and how it contributes to normal or aberrant cellular level capacities (Agrawal 657-658). However, irrespective of the insistence of discarding teleological thought as irrelevant to functional analysis, it can be argued that SA's talk of *contribution* does not wholly eschew the purposive element of functions. There is still a forwards-looking *end* or goal-directed tendency in the description of functional parts. A dispositional approach that recognized this purposive element was the Goal Contribution Approach, which interpreted capacities in cybernetic "goal states" (Adams 505; Mossio *et al.* 818).

Moreover, SA has been subject to criticism mainly due to the non-restrictive ambiguity of the term *contribution*. Opponents against this approach argue that it lacks a "criterion to identify the relevant set of contributions for which functional analysis makes sense" and is "unable to draw an appropriate distinction between 'proper' functions and accidental, useful contributions" (Mossio *et al.* 817). Interestingly, Mossio declares that the unsatisfactory redefinition of function according to SA is due to "the price paid for excluding the teleological dimension as a proper explanandum" (819).

### ***Selected Effects theory***

The second theory discussed here is the Selected Effects (SE) theory, a branch of the etiological approach. This study focuses on Karen Neander's conception of proper functions, because of her explicit reference to natural selection as the basis of her analysis. "It is the/a proper function of an item (*X*) of an organism (*O*) to do that which items of *X*'s type did to contribute to the inclusive fitness of *O*'s ancestors, and which caused the genotype, of which *X* is the phenotypic expression, to be selected by natural selection" (174).

Consequently, the proper function of the heart is to circulate blood, because doing so is what "caused [it] to be favored by natural selection" (168). It should be noted how the teleological dimension of functions is naturalized here. Why a heart is there is still appealed to its function. Yet to avoid the causal loop of confusing the effect for its cause, the appealed effects in SE are historically in the past. How functional items became present can be accounted for by the scientifically accepted mechanism of natural selection (Cummins, 2010, 167).

The strongest criticism towards SE in the function debate is that its criterion for functional attributions focuses almost exclusively to their evolutionary histories, instead of what functional items *actually* do (Mossio *et al.* 821). SE has been challenged claiming the elucidation of the evolutionary history of functions is both

impossible in biology and insignificant in the ascriptions of biological functions (Wouters 144; Cummins, 2010, 171; Mossio et al 821). Harveian physiology, which precedes Darwin, rebuts, stating that evolutionary history is an unnecessary condition for function characterization. Neander addressed this “[concern] for the criteria of application that [biologists] have in mind” (176). A contemporary biologist would have no qualms in justifying function in the light of evolution, since her notions behind functional ascriptions are influenced by her theoretical background. This, however, does no justice to Harvey’s functional ascription, which is why Neander contends that Harvey “will have supposed that biological parts and processes were the result of *some* sort of selection process (such as design by God)” (176). If this were true, then it illustrates how a biologist is somehow intuitively committed to the purposive element inherent in biological functions, even if selection were done mechanistically (i.e. not intentionally) by nature.

### ***Organizational Account***

Matteo Mossio, Cristian Saborido, and Alvaro Moreno are the proponents of the final contemporary approach assessed here, which is called Organizational Account (OA). Their proposition for biological functions merges the virtues in the etiological and dispositional approaches, which are, respectively, adequate in accounting for functional normativity, and proper for the recognition of the means-end causal relationship in function talk. The central theoretical conception of biological organization makes this pluralistic blend original. Although innovative in their solution, Mossio *et al.* state that OA is driven by the same naturalistic agenda—that is, to naturalize its teleological dimension, along with its normative dimension (815). It is relevant for this study to make mention that OA shares a positive attitude towards this teleological dimension, that functions have a role in “explaining the existence, structure, and morphology of [function-bearing items]” (814).

The natural phenomena whereby the teleological quality of functions will be grounded is the emergence of self-maintaining systems. A self-maintaining system arises when many microscopic elements adopt a macroscopic ordered pattern or structure “in the presence of a specific flow of energy and matter in far-from-thermodynamic equilibrium (FFE) conditions” (823). The system will be self-maintained by virtue of the mutual interdependence of the micro and macroscopic contributions; this mutual causal relation is referred as *organizational closure*, which becomes the basis of the of teleology, because it “justifies explaining the existence of a process by referring to its effects” (825). In a complex system, such as biological systems, functional attributions will specify the contribution to the mutually causal-maintenance of localizable patterns and structures in the system (826).

Essentially, OA embraces function's teleological dimension and claims to adequately advocate for its naturalized grounding in the light of closed and differentiated self-maintaining organizational systems. Whether the appeal to the natural phenomenon of self-maintaining systems is a convenient naturalistic strategy for advocating its legitimate use in Biology or not, the evident uneasiness of abandoning a function's teleological dimension and the effort of preserving it is enough to illustrate the importance of this notion in Biology, and in other functional attributing scientific fields.

## Conclusion

Having assessed three naturalistic contemporary accounts of the concept of function, there is reason for trusting in the once suspicious teleological notion in functional attributions. Although condemned as an irrelevant *explanandum* in SA, it was shown here that the vagueness in its notion of *contribution* in functional analyses revealed a covert purposive element a system's lower constituent. In the SE approach biologists, regardless of theoretical background, implicitly supposed functional items as adaptive traits, which make manifest his or her instinctive teleological mode of reasoning. Finally, it was shown in OA how a theoretical conception of biological organization provides the means for which to embrace a teleological notion in biological. Thus, from these three theories teleology has a constitutive role in biological functions. In none of these approaches is teleology not thought to supersede biological processes, such as evolutionary processes; however, teleology in biology is (1) an unavoidable descriptive apparatus and (2) a methodologically useful in biology, such as the inference to adaptive traits.

Moreover, naturalism as the basis for legitimizing the teleological feature of functions presents an internal issue. In these three theories, teleology can not only be justified, unless a reduction to natural phenomena or causes is found. Whenever teleology is sought to be understood under causal grounds, the why-it-is-there question suddenly becomes a how-it-came-to-be. If teleology is reduced to efficient causes, then it ceases to be teleological. Natural selection and organizational-closure are examples of how a *naturalized* teleology is an ill translation of efficient causes. Naturalism, hoping to make justice for the teleological notion, ironically misperceives its true explicative nature and must be deemed unfit for its so-called justification.



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## Notes:

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<sup>1</sup> Although an agent may somehow be implied from this concept of teleology, I only wish to stress it explains the presence of something by alluding to its purpose. Goal-directedness or forward-looking are interchangeable with this concept.