

Allen, Colin, Bekoff, Mark and Lauder, George (eds.), *Nature's Purposes: Analyses of Function and Design in Biology*, Cambridge, MIT Press, 1998, pp. vi + 597, US\$31.50 (paper)

Buller, David J. (ed.), *Function, Selection, and Design*, Albany, State University of New York Press, 1999, pp. viii + 325, US\$21.95 (paper).

Conceptual problems concerning function, goal, and design in biology continue to sustain lively debate, and two excellent new anthologies, *Nature's Purposes* and *Function, Selection, and Design* collect essays central to that debate (*NP* and *FSD* respectively; references are to chapters unless otherwise noted). There is a great deal of overlap between the two volumes, particularly concerning the aetiological theory of functions—a widely-held view—and its main competitor, the 'causal role' theory. However, *Nature's Purposes*, longer by seven essays, is broader in scope, including contributions by both scientists and philosophers and expanded consideration of the causal role theory.

Recent proponents of the aetiological theory point to the influence of Larry Wright. Wright ('Functions', *NP* 2; *FSD* 1) suggests that the functions of an object are those of its consequences that explain its presence. For instance, the function of windshield wipers is to clear rain away; this is something they do, and it explains in part why they are on cars. Wright extends his analysis to biological traits by reference to natural selection. This line of thought is pursued in 'second generation' aetiological theories, such as those of Neander ('Teleological Notion of "Function"', *FSD* 6) and Millikan (*Language, Thought, and Other Biological Categories* (MIT Press, 1984), excerpted, *FSD* 3). The ideas underlying Neander's and Millikan's analyses are fundamentally similar. For trait token *T* to have function *F*, (1) *T* must be of a type defined by a relationship of ancestry, where similarity of structure is preserved from generation to generation; and (2) performance of *F* by members of *T*'s lineage must have contributed to success in natural selection of their bearers.

Millikan and Neander allow that traits coded for by a given allele at a given gene locus form an appropriate historically defined type, meeting (1). Performances of *F* by ancestors of *T* contribute to success in natural selection of their bearers just in case those performances cause the proportion of ancestors of *T* to increase from one generation to the next, i.e., just in case there is 'selection for' ancestors of *T* leading to 'selection of' bearers of *T*, in Sober's sense (*The Nature of Selection*, MIT Press 1984, p. 100). Like Wright, Neander and Millikan understand the function of a trait to be a consequence of it explaining its presence: past performances of a selectively favoured consequence by traits of the appropriate historically defined type explain the trait's present existence, as opposed to the existence of other historically defined types of traits. Reference to consequences of a trait—i.e., the consequences of a trait's ancestors—generates teleology.

Ayala (an evolutionary biologist) and Brandon contribute papers about teleology in biology generally, not just in the context of function ascriptions (*NP* 1 & 3, respectively). Nonetheless, their accounts are essentially identical to the aetiological theory with respect to functions. They propose that *adaptation* generates teleology in biology, claiming that a trait is an adaptation for a certain activity if the trait has a history of selection for that activity. Ayala and Brandon each offer brief but especially informative accounts of adaptation and natural selection.

Robert Cummins's 'Functional Analysis' (*NP* 6; *FSD* 2) introduced into the philosophical literature a theory of biological functions now the primary rival of the aetiological theory. On Cummins's view, termed the 'causal role' theory, the function of a trait is the contribution it makes to some complexly-achieved capacity of a system of which it is a part. Cummins argues that function ascriptions arise in the context of a strategy for explaining why systems exhibiting behaviour associated with a disposition do so. In the 'function-analytical strategy', a disposition *D* of a system is analysed into component dispositions such that the coordinated action of the latter explains the manifestation of the system disposition *D*. A 'causal role' function of a trait is any one of the 'analysing' dispositions instantiated by the trait, i.e., any disposition referred to in functional analysis instantiated by the trait. For instance, 'the function of the heart is to pump blood' amounts to the claim that, relative to an analysis of the body's capacity for circulation, pumping blood is a disposition of the heart that in part accounts for circulation. On this view functions are neither historical nor teleological.

Nature's Purposes collects an important set of essays elaborating theories that have an essential affinity with Cummins's view because they are ahistorical. Martin Rudwick, a paleontologist, proposes an 'ahistorical' view that is nonetheless teleological (*FSD* 4). Rudwick claims that organisms are to be viewed as machines built for the purpose of survival, and that functions of traits are those activities contributing to that end, and for which they are maximally efficient given structural constraints of their materials. Bock and von Wahlert, biologists, propose an ahistorical view in 'Adaptation and the Form-Function Complex' (*FSD* 5). The function of a trait, they propose, is any

disposition of it due to its structure and composition, considered broadly without reference to the environment; what they term a trait's 'biological role', also an ahistorical concept, are those functions (in their sense) manifested by the organism in its normal environment. Ernest Nagel's position in 'Teleology Revisited' is teleological (*FSD* 7). A function of a trait is a consequence of it that contributes to a goal of a system containing it. Roughly, Nagel understands a system to be goal directed just in case it has a kind of organisation resembling homeostasis. In 'Functions', (*NP* 8; *FSD* 4) Bigelow and Pargetter elaborate the 'propensity view', on which the function of a trait is its contribution to fitness of organisms of which it is *currently* a part. They motivate this view by suggesting that function ascriptions explain future and current success in selection. Buller's inclusion of 'Functions' reflects his view that theories of function making reference to selection form a distinct group (*FSD* p. 20); for Buller, this is even more fundamental than the distinction between historically and ahistorically-based theories. Indeed, the focus on ahistorical theories in *Nature's Purposes*—which on the whole are formulated without reference to selection—marks a significant departure from Buller, whose collection centres around theories emphasising the role of selection.

Both volumes devote considerable space to views formulated as a result of critical evaluation of the aetiological and causal role theories, especially their relationship. Scientist Hinde (*NP* 15), a 'pluralist', takes the position that there are distinct concepts of 'function', some referring to selection, some not. Millikan ('An Ambiguity in the Notion of Function', *FSD* 5) sharpens the distinction: reference to history is the salient feature of selection-based theories. Following this line of thought further, in addition to discussing philosophical method and responding to counter-examples, Neander ('Functions as Selected Effects', *NP* 11) and Millikan ('In Defense of Proper Functions', *NP* 10) claim that conceptual roles available to each function concept differ substantially: causal role functions cannot generate biological norms, i.e., account for malfunction. A heart that cannot pump blood cannot contribute to the body's capacity for circulation, and so cannot have blood-pumping as a causal role function. But clearly it does still have that function, and furthermore, it is subject to a norm in the sense that it is *supposed* to pump blood; indeed, this norm defines a functional category, 'heart'. Millikan and Neander point out that on the aetiological theory, even a diseased heart has a function, because it is only required that it possess the appropriate causal history. In contrast, though 'pluralistic', Amundson and Lauder (*NP* 12) stress the importance of causal role functions, especially in functional anatomy. They argue that, biological norms notwithstanding, causal role functions are not based on prior proper function ascriptions. Traits ascribed causal role functions are anatomical traits, defined and identified by their constitution and morphology.

Arguing against the propensity theory, Mitchell (*NP* 14) proposes a response to putative 'fictional doubles' counter-examples to the aetiological view (e.g., Bigelow and Pargetter, *NP* pp. 248–9). Should one of a pair of physically identical organisms lack the appropriate causal history, say, appearing *ex nihilo* moments ago, its traits apparently have no aetiological functions. But shouldn't identical traits have identical functions? Mitchell cites studies showing that the Monarch butterfly's wing colouration is selected for 'teaching' predators that it tastes bad, while the mimic's colouration is selected for copying the Monarch's. She further notes that biologists make a corresponding distinction between the functions of the patterns. Godfrey-Smith suggests ('Consensus Without Unity', *FSD* 9) that 'unification' should be resisted because causal role functions play a role distinct from aetiological functions, the former explaining how a trait works, the latter describing what it does that explains its success in selection. He amends the aetiological theory to refer to a recent history of selection, and to a system containing the trait in question, to whose fitness the trait contributes ('A Modern History Theory of Functions', *FSD* 9, *NP* 17). Reference to recent selection solves problems associated with traits that change function.

Griffiths ('Functional Analysis and Proper Functions', *NP* 16; *FSD* 7), a 'unifier', understands proper functions to be a subclass of causal role functions. The proper function of a trait is the causal role function of the trait in its ancestral bearers, relative to a functional analysis of fitness, insofar as selection is responsible for the current proportion of the trait in the population. Reference to current proportion—rather than increase, for Neander and Millikan—accounts for cases (especially those having to do with change of function) in which selection for a trait results in a decrease in its representation. On Buller's 'unification' ('Etiological Theories of Function', *FSD* 15), the function of a trait also depends on a functional analysis of its ancestral bearers' fitness. However, on Buller's so-called 'weak' theory, proper functions are relative to a functional analysis of ancestors' fitness, not referring to a selection process. This accounts in particular for functions of traits in which there was no hereditary variation. Indeed, Buller claims that 'strong' aetiological theories such as Millikan's, Neander's, and Griffiths's presuppose such a functional analysis, even though they explicitly relativise proper functions to the trait's contribution to ancestral selection processes, that is, contributions to fitness *differences*.

Kitcher's ('Function and Design', *NP* 18; *FSD* 8) unifying strategy is based on the idea that the function of a trait is what it was designed to do, recognising selection as a source of design. However, Kitcher claims that it is not necessary that a trait's presence be fully explained by selection; its function may just be one of its consequences that contributes in some way to some capacity of the organism that arose in response to an environmental stress. This accounts for causal role functions assigned without direct reference to selection; in this way, Kitcher's theory resembles Buller's. But Kitcher distances his account from aetiological accounts: it is ahistorical, allowing causal role functions of current traits. Walsh and Ariew (*FSD* 14) advocate the 'relational theory', on which the function of trait type *X* is its 'positive and significant' contribution to the average fitness of bearers of *X*, relative to a 'selective regime'. A 'selective regime' is a set of environmental conditions relevant to an organism's fitness. This theory is broadly unifying: a trait's average contribution to fitness is its causal role function, relative to a functional analysis of fitness; 'relational-functions' in past regimes coincide with aetiological functions, and in future or present regimes with functions assigned on the propensity view.

Finally, both collections contain selections concerning design. How are form and function related? What role does a trait's function play in explaining its construction, and vice versa? Of particular concern are questions about whether inheritance, 'engineering' constraints set by the composition of a trait, or selection are the primary determinants of form. Essays by scientists Lauder, Gould and Vrba, and Gans (*NP* 19, 20, and 21 respectively) should encourage philosophical questions about the topic, which has received little philosophical consideration beyond that of Allen and Bekoff (*NP & FSD* 13). They claim that traits are not always designed for their functions: design requires progressive modification of structure.

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Heyde, Ludwig, *The Weight of Finitude: On the Philosophical Question of God*, Albany, State University of New York Press, 1999, pp. 177 + xviii, US\$17.95 (paper).

Heyde begins by 'wondering about God's relative absence in contemporary philosophy' (p. xvii) and 'Euro-American' culture (p. 1). This leads him to reflect upon a logic of absence leaving humankind, the world, and even God emptied of the essential. In choosing 'essential', Heyde draws less upon an ontology of substance than a metaphysic of intrinsic value. Under Enlightenment critique, the *absolute* intrinsic value, God, withdraws into 'an indeterminate, empty transcendence' (p. 19; cf. p. 24). Consequently, 'finite actuality loses all weight' in the calibrated scales of instrumental reason, whose dominant conception of actuality reduces everything, including the calibrator, to mere utility (pp. 24–5).

To recover finitude's weight, Heyde recapitulates Anselm, Aquinas, Descartes, Kant, and Hegel's reflections upon 'proofs' of God. He pursues this by a Hegelian "'phenomenology" of "philosophical experiences" of the absolute' (p. 27). Heyde characterises these as '*fundamental experiences of thought* ... lead[ing] to ... affirmation of God' (p. 33). Such experiences, characterised by a 'processive ... *dialectical* element' (p. 118), occur when thought, 'having reached its limits, ... touches upon something ... surpass[ing] thought' (p. 80), where '*thought* (not knowledge) finds itself necessarily thinking *something* ... *absolute*' (p. 88). Heyde maintains that such experiences have an '*objective reference*' and are 'not just ... subjective construction[s]' (p. 118).

By 'objective reference', Heyde indicates a constant to these experiences. Essentially, he means that affirming God results from 'being confronted with a ... necessity outside ... [one's] power' and 'being submitted to a logic ... befall[ing] one's subjective understanding'. One thus affirms 'something *actual* that ... is actuality as such' (p. 118). Consequently, although permeated by individual thinkers' particularity, such thought experiences are 'fundamentally directed toward universality', having '*reference to truth*' and being 'intended ... [as] valid for everyone who wants to think' (p. 118; cf. 142–3).

Heyde makes a bold claim in maintaining that traditional proofs justify an affirmation of God. How does he manage this? First, he reduces expectations—they cannot conclusively demonstrate God's existence (cf. pp. 73–4, 142–3). Second, he attempts to heighten appreciation of their non-arbitrary character—they recur as experiences of thought when thinking approaches its limits (cf. pp. 48, 50, 80, 88, 118, 140). This phenomenological approach to reevaluating traditional proofs will likely find little resonance in analytical philosophy, but Heyde is dealing with 'justifiable' affirmations, not analytical proofs.