Darwin's Causal Pluralism

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ABSTRACT: Historians of Biology have divided nineteenth century naturalists into two basic camps, Functionalists and Structuralists. This division is supposed to demarcate the alternative causal presuppositions working beneath research programs. If one is functionally oriented, then organic form will be contingent upon the causal powers of the environment. If structurally oriented, one argues for nonfunctional mechanisms (e.g., internal laws of growth) to account for organic form.

Traditionally, Darwin has been grouped with the functionalists because natural selection (an adaptational mechanism) plays the prominent role in shaping organic form. In this paper, I sketch the dichotomy of functionalism versus structuralism and then argue that Darwin cannot be characterized adequately with this dichotomy. I argue that Darwin can incorporate both causal stories because he makes two important modifications to the traditional metaphysical presuppositions. I then offer some brief reflections on the import of Darwin's causal pluralism for the Philosophy of Science.

KEY WORDS: Darwin, functionalism, structuralism, causal pluralism.

The dichotomy of "homology versus teleology", or as it is more recently characterized "structuralism versus functionalism", has been a perennial issue in the study of animal morphology, history and physiology. Traditionally, if a naturalist is "functionally" oriented, then emphasis is placed on the role of the environment in shaping organic form. The causal arrow points from adaptation or environmental "fit" towards animal structure. Contrawise, if one is "structurally" oriented, the emphasis is laid upon non-adaptive laws of growth. The causal arrow, in this orientation, points from nonfunctional structural process towards functional potential. Crudely stated, either structure causes function or function causes structure.

Interpreters of Darwin have taken great pains to group the patriarch of modern biology on the side of functionalism rather than structuralism. I will argue that this classification of Darwin is deficient, and that the classificational schema itself is overcome by Darwin's causal pluralism. My strategy will be to marshal Darwin's little explored "structural" explanations as evidence against a purely functionalist interpretation, and then argue that a pluralistic approach towards organic causality enables Darwin to overcome the dichotomy itself. Before moving on to Darwin's structuralism and ultimate synthesis of causal strategies, we must better understand the entrenched functionalist interpretation.

Biology and Philosophy **11:** 1–20, 1996.

1. DARWIN: THE STRICT FUNCTIONALIST

According to the mechanism of natural selection, organic structures are either selected for or disposed of contingent upon their utility in a given environment. Ernst Mayr (1963) refers to natural selection as the "creative" force behind organic form. Blind variation "proposes" structures but functional utility is the crucible for structural persistence. The heavy emphasis that Darwin laid upon his mechanism of natural selection provides strong reason to believe that functional adaptation was his only concern. I offer the following examples, from the nineteenth century to the present, as illustrations of the functionalist interpretive tendency.

In 1874 the *Gardeners' Chronicle. A Weekly Illustrated Journal of Horticulture and Allied Subjects* was quite adamant about Darwin's role in championing the functionalist over the structuralist perspective. They reverentially praised Mr. Darwin for having "advanced physiological science to a high degree" by "showing the relation of structural forms to definite purposes". Darwin is contrasted with the "obscurantist" structuralists like Goethe and Geoffroy, and the functionalist orientation of natural selection is taken to link all structures directly to environment (conditions of existence).

> Most of us remember the use that Paley made of the watch as an evidence of design, and of necessity of a designer. Twenty or thirty years ago this doctrine suffered by injudicious illustration, and a new school arose deriving its chief inspiration from Goethe. Modifications in form were set down as variations from an ideal pattern or type, and adaptations to special ends, though admitted in some cases, were discredited in others. Not the least service which Mr. Darwin has rendered to science has been the demonstration that many adaptations formerly supposed either to be of trifling moment or purposeless illustrations of a particular preordained pattern, are really adaptations to special purposes ....

The *Chronicle* piece then argues ironically that Darwin's functionalism serves traditional natural theology. "Mr. Darwin has not only advanced physiological science to a high degree ... but he has placed a most effective weapon in the hands of those who, like Paley, attach very high importance to the study of Natural Theology. Our pages of late years have teemed with illustrations of adaptations of structure to function ...." (*Gardeners' Chronicle. A Weekly Illustrated Journal of Horticulture and Allied Subjects* Vol. 2, 4 July 1874, p. 15. Taken from Barrett (1977) Vol. 2, p. 187–188).

Some critics, led by C. Naegeli,[1] revealed their functionalist interpretation of Darwin in their very criticism. German scholars were so sure that Darwinian transformation was strictly functional that they assumed the theory to stand or fall dependent upon whether every structure could be justified by adaptational considerations. If one could isolate anatomical features that had no functional utility (no clear adaptational justification) then these structures were evidence that natural selection played no role in such transformations and Darwinism was thus refuted. German critics often held out the identifying traits of plants, which had no functional utility, as a counter-example to the Darwinian explanatory

strategy. These critics were convinced that Darwin's theory led him foolishly to pursue some utility and survival value to every existing trait – no matter how trivial. This entire line of criticism, which has a long history, presupposes that the causal orientation of Darwin's system is exclusively bound to functional considerations. I will argue that this very common interpretation is actually precluded as early as the first edition of the *Origin* where Darwin explicitly struggles with those structures devoid of adaptational significance.

In the 1940s Ernst Cassirer argued from the functionalist interpretation of Darwin when he suggested that the key concepts of natural selection – "fitness", "selection", and the "struggle for existence" – were fundamentally purposive teleological notions. The teleology of a designing intelligence is of course gone, but the theoretical organization of natural selection focuses all biological phenomena around adaptation.

> Indeed, one can even go further and assert that no earlier biological theory ascribed quite so much significance to the idea of purpose, or advocated it so emphatically, since not only individual but absolutely *all* the phenomena of life are regarded from the standpoint of their survival value. All other questions retreat into the background before this one. (1950, p. 166)

Most recently, Michael Ruse has argued, in *The Darwinian Paradigm* (1989), that Darwin's focus on adaptation requires that we group him with the functionalists rather than the structuralists. Ruse argues that Darwin's chief goal in formulating the mechanism of natural selection was to come to terms with the phenomenon of ecological fit. This focus on the functional integration between both the "parts" of animals and the organism and its environment illustrates, according to Ruse, Darwin's essentially functionalist orientation (to be contrasted with structuralists like Richard Owen and Geoffroy St. Hilaire). Ruse claims that the presumption of a Darwinian analysis is "that when we are looking at features, especially complex ones, adaptation is there unless proven otherwise ..." (p. 134).

One contemporary exception to the purely functionalist interpretation of Darwin is Robert Richards' (1992) *The Meaning of Evolution*. Richards correctly recognizes some nonfunctional aspects of Darwin's theory – important causes of organic form beyond natural selection (e.g., the archetype) – but unfortunately axe-grinds these into the rather questionable thesis that Darwin was a closet "progressivist". I shall address Richards' work explicitly when we get to causal pluralism in Section 4.

To return to the functionalist tradition, some of these interpretive characterizations of Darwin are by no means false. The mechanism of natural selection is undoubtedly an explanatory matrix intended as a response to the "challenge of adaptations". What is unfortunate about these characterizations is that they do not appreciate Darwin's struggle with the additional challenge to any transmutation theory, namely the "challenge of homologies". Faced with the challenge of the morphological similarities pervasive throughout taxa, Darwin adopted a nonadaptational explanatory strategy. The traditional functionalist approach to homology was to argue, as Cuvier did in his famous

debate with Geoffroy,[2] that trait similarities between species must reflect similarities in environments – if function causes structure then cross-specific structural resemblance must reflect functional (environmental) resemblance. Darwin did not go this route. After annexing structuralist thinking, Darwin orchestrated his functional and structural modes into a duet of comprehensive explanatory strategies.

II. DARWIN'S STRUCTURALISM

The challenge of homologies

Richard Owen was almost single-handedly responsible for articulating the importance of the 1830 Cuvier-Geoffroy debate to his British countrymen. It was in this caustic battle before the Academie de France that the explicit dichotomy of functionalism versus structuralism first emerged. When Cuvier visited England in 1830 it was Owen who, relatively unknown, served as fortunate escort. This in turn resulted in an invitation, extended by the Baron himself, for Owen to study the collections in Paris. Owen spent much of his subsequent and illustrious career working through the issues first raised in his encounter with the Cuvier-Geoffroy debate.

More than 30 years after Owen's first exposure to the debate he was still formulating and attempting to synthesize the tensions raised by Cuvier and Geoffroy. He created a short list of the crucial issues raised by the debates. Topping the list was the following key question: "Unity of plan or Final Purpose, as governing condition of organic development?" Owen isolated the heart of morphology with the motto "Homology or Teleology."[3]

Owen's conservative tendencies and his wish to avoid any theoretical scandal that might subvert traditional theology aligned him, at first, on the side of teleology. Following in the path of the functionalist program, Owen sought to link animal structures to specific environmental conditions (just as a providential deity might have proceeded). The further he explored comparative anatomy, however, the less convinced he became of the functionalist dogma.

Geoffroy St. Hilaire's central vision of a unity extending through *embranchements*[4] began to appear increasingly plausible. In the 1840s Owen began to further develop Geoffroy's ideas and nomenclature, and toward the close of the decade (1849) he began to enthusiastically preach about the Word made flesh – the Archetype.

In Chapter XIII of the *Origin*, Darwin undertakes a discussion of Morphology which he describes as the "very soul" of natural history. Following Owen's lead, Darwin sets forth a devastating puzzle for traditional functionalists. The purely functionalist project seeks the solution for all structural similarity in the causality of similar conditions of existence. Darwin undercuts this strict functionalist interpretation[5] when he actually mocks the teleological approach with regard to skull structure. He invites his reader to entertain the puzzle:

> Why should the brain be enclosed in a box composed of such numerous and such extraordinarily shaped pieces of bone? As Owen has remarked, the benefit derived from the yielding of the separate pieces in the act of parturition of mammals, will by no means explain the same construction in the skulls of birds. Why should similar bones have been created in the formation of the wing and leg of a bat, used as they are for such totally different purposes? (1859, p. 437)

It is a great embarrassment to attribute the cause of partitioned skull structure to the peculiar functions of viviparous birthing processes, only to find essentially the same structure in oviparous animals. This is a serious enigma from the teleological perspective. Darwin, explicitly harkening back to Geoffroy,[6] asks us to consider the challenge of homologies.

> What can be more curious than that the hand of a man, formed for grasping, that of a mole for digging, the leg of the horse, the paddle of the porpoise, and the wing of the bat, should all be constructed on the same pattern, and should include the same bones, in the same relative positions? Geoffroy St. Hilaire has insisted strongly on the high importance of relative connection in homologous organs: the parts may change to almost any extent in form and size, and yet they always remain connected together in the same order. (1859, p. 434)

The "challenge of adaptation" was met by Darwin's claim that slight variations favorable to functioning in a given environment would be gradually increased and refined by environmental selection. We found that, with his notion of natural selection, Darwin was able to preserve the causal role of the "conditions of existence" upon organic structure while simultaneously jettisoning the "intentional" metaphysics that previously accompanied such teleological thinking. Now we find that just as the legacy of Cuvier came to pose the challenge of adaptation, so too the legacy of Geoffroy came to pose the "challenge of homology" (the problem of unity in diversity).

The unique functionalism of Darwin's natural selection holds that animal structures develop in a path determined by their utility in an environmental milieu. If we take this in its strictest sense, we must conclude that the morphology of the organism is a mere "passive possibility" awaiting determination via the external environment.[7] But, as Stephen Jay Gould (1980) points out, "Darwinism is not a mechanistic theory of environmental determinism. It does not view organisms as billiard balls, buffeted about by a shaping environment" (p. 81).

One of the places where Darwin clearly breaks with the environmental determinism of functionalism is in his recognition of the archetype. Before he fully reveals his new interpretation of the archetype, he alludes to the traditional attempts to reconcile adaptation and unity of plan. "Nothing can be more hopeless than to attempt to explain ... similarity of pattern ... by utility or by the doctrine of final causes". He continues by pointing out that "On the ordinary view of the independent creation of each being, we can only say that so it is; that it has so pleased the Creator to construct each animal and plant" (1859, p. 435). Before we fully develop Darwin's "structuralism" let us explore the "ordinary view" that he only alludes to here, regarding the challenge of homologies.

Owen's transcendental structuralism

Richard Owen's accomplishments as a naturalist were substantial and their value was not missed on Darwin, who referred to Owen over a dozen times throughout the first edition of the *Origin*. Darwin's uncanny ability both to abstract important elements of a thinker's system and to abandon what was unworkable is attested to in his treatment of Owen's archetype.

It was Owen who, ten years before Darwin, pronounced that in light of the "cranium problem" and other such homologies, the strictly functionalist approach (which as a protege of Cuvier he had earlier supported) became untenable. "These and a hundred such facts, force upon the contemplative anatomist the inadequacy of the teleological hypothesis ..." (1849, p. 73). Owen was not, however, a modern Geoffroy, for he still maintained Cuvier's four *embranchements* and did not assert an underlying unity for these branches. In addition, Owen abhorred Geoffroy's materialism.

Owen focused upon vertebrate construction and, as he found more and more parallels in ossification patterns, he began to envision an ideal vertebrate. If one mentally stripped away the specialized structures (the very structures which the teleologists considered to be the exclusive subject of anatomy), a primordial plan emerged which, in its simplicity, bore relation to the multitude of "actual" vertebrates.

Owen was raised on a diet of *Naturphilosophie* and Coleridgean romanticism, and when he found an underlying plan in animal structure he conceived it in terms of a transcendent Platonic Idea.[8] Joseph Henry Green, a German educated disciple of S. T. Coleridge, instructed Owen throughout the 1830s and 40s in the ways of transcendental zoology. It was Green who introduced Owen to the language of "archetypes" and "exemplars", and he instilled in him the quest to "discover the laws which give permanence and regularity, to discern the eternal ideas, which are the regulating types and standards" (see Desmond 1989, p. 263).

Owen's archetype was a long straight series of vertebrae with rib-like appendages – the whole thing shaped like a thin narrow fish of some sort. His idea was that the cranial bones of vertebrates had some essential relation to the four larger vertebrae at the front of his archetype. And various limbs (arms, legs, wings, etc.) were modifications of other vertebrae. On first reflection, this does not sound terribly interesting, for we can imagine a transformation through geological time in which vertebrae develop. We must remind ourselves, however, that Owen did not subscribe to any epigenetic doctrine of evolution (where secondary laws alone "created" new forms). That is to say, though Owen fully recognized "succession" in fossil species he attributed the creation of each new kind as the activity of Divine Idea – Word made flesh. Owen stated that "The recognition of an ideal Exemplar for the Vertebrated animals proves that the knowledge of such a being as Man must have existed before Man appeared. For the Divine mind which planned the Archetype also foreknew all its modifications" (1849, p. 85–89).

As to the "reason" why God, who could undoubtedly create any animal form that He wanted, would choose to "install" new forms with nonfunctional relations to old forms; we must throw up our hands and agree with Darwin's sarcastic characterization – "so it is". God apparently has an aesthetic sense of elegance and simplicity and does not wish to cloud the clarity of nature with a confusion of forms. It is amusing that the unity of type doctrine (or structuralism) in the hands of Owen attempts to reassert traditional theology, but in the hands of Geoffroy it was considered boldly atheistic.[9]

The ideal plan (the zoological blueprint) was, for Owen, ontologically prior to the varieties of vertebral organisms. The "creationism" involved in Owen's system was not, however, the vulgar doctrine of the religious fundamentalist. New forms *were* dispensed by God "on the installment plan" but Owen was sophisticated enough to give some secondary causal account – the progenitors of new forms were *ultimately* caused by God but *proximately* caused by physical process.

"Laws" of nature for Owen were conceived of as Divine edicts,[10] and he developed a material law of structural recursivity – in which simple forms naturally repeated themselves – to account for unity of plan. Likewise, he posited a law of adaptivity for specialized divergent structures. But the mechanisms of nature owe their being and their direction to the First Cause.[11]

Owen's "structuralism" is otherworldly. Function is dependent on structure in the same general way that the material world of activity is dependent on the eternal world of static Ideas. Owen's archetype is ultimately a product of Platonic and Christian conceptions of Nature as a poor "mirror" of Mind. Owen himself described the archetype as the "primal pattern – What Plato would have called the "Divine Idea" – on which the osseous frame of all vertebrate animals ... has been constructed" (Owen's letter to sister Maria Owen, 7 Nov. 1852, see Rupke 1993). It was from this aspect of Owen's thinking – the divine underpinnings – that Darwin washed his hands.

Darwin's generative laws

Darwin's structuralism is metaphysically closer to Geoffroy's than Owen's, in the sense that his general materialist orientation prompted him to see ideas (or the mental life generally) as "effects" of material development rather than Platonic "causes" of material development. It is clear from Darwin's M and N notebooks that Mind was thought to be a "product" of Nature rather than the other way around. This orientation led Darwin to both radically reinterpret Owen's structuralism, and harken back to Geoffroy's "creative generative laws".

Geoffroy's position argued that morphological "blueprints" were real in the sense that fairly stable generative laws constrained matter into the structures we observed (the occasional "glitch" in this fairly stable constraint provides the mechanism for the creation of novel kinds).[12] The laws are descriptions of the boundary conditions established when matter epigenetically builds upon itself. Channels or pathways of development naturally arise, for example, in the construction of the animal limb. When the radius and ulna emerge by a branching bifurcation from the humerus, they constrain each other from further branchings.[13] Thus organic form is created in part by constant morphogenetic rules.

This constancy of developmental laws, Geoffroy argued, provided the relative "stasis" of types through time – a provision met by the teleologists with essentialism or environmental determinism. Darwin follows Geoffroy's lead here and uses it as part of his answer to the challenge of homologies.

While discussing the varieties of insect mouths, Darwin explains that the reason for a unity underlying the varieties is that they are constructed by the concomitance of morphological laws at work on an ancestral hereditary pattern (p. 434–35). For Darwin however, unlike Geoffroy, these morphological laws are not the final solution to the challenge of homologies. The developmental rules only prescribe a range "within the limits of possibility" (p. 436). The range of these rules or laws of construction, then, seems too wide and inclusive to provide the strong constraints that the challenge of homologies would require. Nevertheless, nonadaptational laws of organic construction go some distance in accounting for the underlying *Bauplane* that we observe in the animal kingdom.

Darwin's form of structuralism is similar to Geoffroy's in the sense that material secondary laws (having nothing whatever to do with function) are recognized as constitutive of animal organization.[14] Darwin, early in the *Origin*, clearly contrasts this doctrine with the functionalist emphasis on conditions of life – giving evidence that bears out the role of non-functional causes:

> Seedlings from the same fruit, and the young of the same litter, sometimes differ considerably from each other, though both the young and the parents, as Muller has remarked, have apparently been exposed to exactly the same conditions of life; and this shows how unimportant the direct effects of the conditions of life are in comparison with the laws of reproduction, and of growth, and of inheritance; for had the action of the conditions been direct, if any of the young had varied, all would probably have varied in the same manner (p. 10).

The teleological approach that linked variations directly to the environment – thereby seeking to secure a way in which new structures could be automatically adapted to changing conditions – was shown to be erroneous. It is noteworthy that the studies which Geoffroy and his son did in Teratology and developmental law serve here as the foundation for questioning "perfect adaptation". If generative laws are unfolding regardless of environmental context, then the "fit" between organism and ecological niche will be approximate rather than perfect.

As we have pointed out, however, the generative laws themselves are not enough to cover the challenge of homologies. So Darwin reconstructs the concept of the archetype, but reconstructs it out of "matter", rather than out of "divine idea" as Owen had.

The material archetype

Though Darwin clearly recognizes the causal role of non-teleological laws, he does not believe that these laws "alone" are enough to explain the curious fact that the "hand of a man, formed for grasping, that of a mole for digging, the leg of the horse, the paddle of the porpoise and the wing of the bat, should all be constructed on the same pattern ...." (p. 434). The full solution to the challenge

of homologies, then, is that a "real common ancestor" provides the structural "inertia" or constraint on all subsequent forms. Hereditary continuity of an original form combined with the lawful constraints on the branching varieties of offspring produces homologous relations between animals.

In the back of Darwin's personal copy of Owen's *Nature of Limbs* he wrote: "I look at Owen's Archetype as more than ideal, as a real representation as far as the most consummate skill & loftiest generalizations can represent the parent form of the Vertebrata" (originally transcribed by Dov Ospovat, see Desmond 1982, p. 50) For Darwin, the archetype really crawled the earth.[15] The "figurative" archetype of the Critical German tradition (spear-headed by Goethe) and the Platonic "ideal" archetype of Richard Owen become, in Darwin's hands, a real blood relationship.[16]

The homologies between the limb construction of the human, the mole, the horse, the porpoise and the bat stem from the fact that an early ancestor (from which all these animals derived) had some crude tetrapod construction upon which further selection could work. Prior to this tetrapod form, we may assume, some tubular rudimentary vertebrate existed – no doubt looking very much like Owen's ideal animal. Darwin writes:

> If we suppose that the ancient progenitor, the archetype as it may be called, of all mammals, had its limbs constructed on the existing general pattern, for whatever purpose they served, we can at once perceive the plain signification of the homologous construction of the limbs throughout the whole class. So with the mouths of insects, we have only to suppose that their common progenitor had an upper lip, mandibles, and two pair of maxillae, these parts being perhaps very simple in form; and then natural selection will account for the infinite diversity in structure and function of the mouths of insects. (1859, p. 435–436)

Note that there is nothing absolutely necessary in the construction of this original progenitor. A purely Geoffroyean analysis would claim some necessity to the construction of the archetype – not in the same way that the transcendentalist might (positing an eternal Idea). On Geoffroy's "pure structuralist" account, unfolding non-teleological laws are alone responsible for unity of type, so given the same laws of nature the same essential body plan would have to arise again if evolution started over from scratch. But Darwin's understanding of the original progenitor is bound up with the contingency of his whole evolutionary system. There are developmental pathways but there are no "absolute" developmental pathways.

In the above passage Darwin considers the ancient ancestor, having its limbs constructed on the existing general pattern *"for whatever purpose they served"*. The contingency of this archetype is that it is tied (through the process of natural selection) to the specific (and equally contingent) environment. By some accident in the replication process (Darwin admits to knowing nothing about the laws of inheritance) a minor extension or transposition of the rudimentary vertebrae resulted in a crude limb. By some equally accidental state of the local environment, this random variation was favored. There was nothing foreordained

in the shape of that progenitor nor in the many varieties which followed except the "limits of possibility" as prescribed by basic generative laws.

In addition to Darwin's reinterpretation of Owen's ideal archetype into a material ancestor, he saw another virtue in the archetype concept. In the early 1850s T. H. Huxley coopted Owen's archetype into his work on natural classification. Instead of following Owen's metaphysical conception of the archetype (he attacked Owen frequently for such transgressions), he conceived of it as a *schematic* device to be used pedagogically.[17] Abstracted animal forms could be treated in their fundamentals with the use of an archetypical diagram. The abstracted animal was treated from a positivist perspective as a collection of properties that aided in the clear classification of forms – nothing more. Thus the archetype had the virtue of a useful heuristic diagram as well.

Before Darwin fully appropriated the archetype as a real ancestor, he showed sympathy towards Huxley's positivist or critical usage and distaste for Owen's metaphysical usage. In an 1853 letter to Huxley, Darwin says: "The discovery of the type or "idea" (in *your* sense, for I detest the word as used by Owen, Agassiz, & Co) of each great class, I cannot doubt is one of the very highest ends of natural history ..." (F. Darwin & A. C. Seward, 1903, Vol. I, p. 73).

We find, then, an interesting repeat (though not in exact sequence) of those German movements in biophilosophy from the earlier nineteenth century. Goethe passed through a series of phases in which he alternatively considered the plant archetype (*Urpflanze*) as real, ideal, and ultimately heuristic.[18] So too Darwin, Owen and Huxley seem to have worked through these conceptions of organic form. There are, of course, some very obvious differences between the distinctly German and British metaphysical perspectives on the archetype.

The "regulative" or heuristic conception of the archetype for the Germans stemmed out of Kant's analysis in the *Critique of Judgement* (1790). The Kantian position held that the regulative judgement had a certain "necessity" to it (reason leaned towards a systemic closure – a closure which, ironically, it could not obtain). But Huxley's use of a heuristic concept was considerably less compulsory. In addition, Darwin and one of Goethe's phases seem to share the idea that the archetype was "real". But while Darwin considered it to have lived in the remote past, Goethe (in 1786–1788) hiked around Italy looking for his. Finally, it is notable that Owen's idealism with regard to the archetype was shared by Romantic nature philosophers, but the latter usually held a more "immanent" view of the Deity rather than the "transcendent" tradition linked to British natural theology.

An interesting additional parallel between the Darwinian orientation and German biophilosophy seems worth noting. Darwin appeals to the archetype as "one" of the causes of current organic forms, and in so doing he champions the genetic mode of explanation. The powerful shaping force of history renders any *apriori* functionalist account (deducing structures from functional design requirements) remarkably incomplete. Recall that central to the dissatisfaction of the *Naturphilosophen* with Newtonian science was its inability to capture the essence of life itself. The tree of knowledge, it was claimed, had killed the tree

of life. An ideal of knowledge (prevalent in the seventeenth and eighteenth centuries) erected on mathematics and correlated with billiard-ball mechanics could not account (even for Kant, who accepted Newtonian principles) for the basic activity, history and integration of life. With Darwin came a limited affirmation of an ideal of knowledge that German philosophers had been extolling for years. This "new" ideal of knowledge is the "primacy of history" (see Cassirer 1950, p. 170).

That "time" has a role in the very "being" of an entity is a remarkably recent idea. The threat of such an idea (to a tradition that has made time a mere "accident" of being) can be measured by the willingness of its opponents to instinctively shout "genetic fallacy" whenever it is suggested. But genetic or historical inquiry does not set out to evaporate current entities or events into a rigidly determining past. Nor does it attempt to deny progress and development by reducing history to a cumulation of unrelated happenings. Instead, it is the assertion that problems in natural classification, physiology and so forth, can be solved with the aid of an historical analysis. "The laws of *real* nature are historical laws, and only through their discovery is it possible to escape a bare logical schematism and get back to the actual causes of phenomena" (Cassirer 1950, p. 178). Darwin characterizes the historicity of this new biology.

> When we no longer look at an organic being as a savage looks at a ship as something wholly beyond his comprehension; when we regard every production of Nature as one which has had a long history; when we contemplate every complex structure and instinct as the summing-up of many contrivances, each useful to its possessor, in the same way as any great mechanical invention is the summing-up of the labour, the experience, the reason and even the blunders of numerous workmen; when we thus view each organic being, how far more interesting – I speak from experience – does the study of natural history become! (6th ed., pp. 665–666)

The rejection of perfect adaptation

The inclusion of contingent "history" as an aspect of Darwin's overall causal framework is yet another important move away from pure functionalism. On the purely functionalist model, the evolutionary naturalist becomes a sort of *apriori* engineer – analyzing forms as necessary economic responses to ecological design requirements.[19] Adaptationism runs the risk, in seeking the explanation of all structures on utility grounds, of presupposing "perfect adaptation" as the theoretical bedrock of their explanations. Stephen Jay Gould (1983) has criticized this functionalist tendency in current biology.

> Evolutionary biologists have too often slipped into a seductively appealing mode of argument about the phenomenon of adaptation. We tend to view every structure as designed for a definite purpose, thus building (in our imagination) a world of perfect design not much different from that concocted by eighteenth century natural theologians who "proved" God's existence by the perfect architecture of organisms. (p. 155)

Darwin eschews such apriorism when he argues *for* the relevancy of contingent history and *against* the presupposition of "perfect" adaptation.

In Chapter VI of the *Origin* Darwin discusses possible difficulties with his theory of descent. It is in this section that Darwin faces the highest hurdle for natural selection – "organs of extreme perfection". The eye, with its remarkable precision and interconnected complexity, is raised as one of the most difficult structures to be accounted for by undesigned gradual modification. He persuasively meets the challenge of this complex organ by showing how even crude and rudimentary light sensitive variations could be progressively selected for over millions and millions of years. Yet later in the same section Darwin criticizes the "perfection" of the eye, saying: "The correction for the aberration of light is said, on high authority, not to be perfect even in that most perfect organ, the eye" (p. 202). He goes on to discuss several cases of "imperfect adaptation".

The point of this criticism of perfect adaptation seems two-fold. On the one hand it is another attempt, not unlike Part XI of Hume's *Dialogues Concerning Natural Religion*,[20] to throw doubt upon the empirical foundations for the "Argument from Design". More significantly, it is a concession to the limitations of pure functionalism or adaptationism in accounting for development. Remember that the functionalist program seeks to link every organic alteration to the influence of the environment – the conditions of existence. "Organic" evolution immediately tracks "environmental" evolution, thus perfect adaptation remains the principle by which structures are made intelligible. The functionalism of Darwin's natural selection also strives to draw a very strong connection between environmental and organic change, but that connection is a complex relation of "proposed" blind variations and "disposing" environmental pressures. Because the variations are not automatically adapted to the setting, selective pressure works on only what is available and this haphazard coalition results in an imperfect but serviceable "design".

Imperfect adaptations exist because natural selection is not the only constitutive of organic development – selection is constrained by actual variations. In addition, and more importantly for understanding Darwin's structuralism, there are laws of growth that not only contribute to the constraints on "perfect" adaptation but also fly in the face of all utility. There are "a-functional" growth patterns that may direct evolution in a limited path where selective pressures are temporarily lax.[21] Darwin says:

> [I] fully admit that many structures are of no direct use to their possessors. Physical conditions probably have had some little effect on structure, quite independently of any good thus gained. Correlation of growth has no doubt played a most important part, and a useful modification of one part will often have entailed on other parts diversified changes of no direct use. (*Origin* p. 199)

He goes on to list a series of a-functional causes of organic form including correlation of growth, the law of developmental reversion, and sexual selection. It is clear then that Darwin recognizes autonomous developmental mechanics (among other things) as contributing to organization. "But", he adds "by far the most important consideration is that the chief part of the organization of every being is simply due to *inheritance*; and consequently, though each being assuredly is well fitted for its place in nature, many structures now have no direct relation to the habits of life of each species" (p. 199, my emphasis).[22]

III. CONFUSING RHETORIC

Arguing that Darwinian causality is strictly functional is not entirely the fault of one-sided exegesis. In his zeal to express the novel mechanism of natural selection, Darwin himself occasionally blurs autonomous causal strategies together under the rubric of environmental selection. At the very end of Darwin's chapter concerning possible difficulties with the theory, he makes a lamentably short assessment of his place in the overall functional/structural debate. "It is generally acknowledged that all organic beings have been formed on two great laws – Unity of Type, and the Conditions of Existence" (p. 206). He explains that upon his theory the unity of type is explained by unity of descent. In other words, Darwin's real historical archetype is the reason why homologies exist in the man, the bat, the horse, the seal, even the bird. There is a structural "inertia" that gets transferred through descent.

Darwin then explicitly states, without elaboration, his theoretical connection with "the illustrious Cuvier" and his emphasis on the conditions of existence. The formative relation of the functional setting upon the organism is entirely absorbed (without Cuvier's metaphysics of course) by the principle of natural selection.

Darwin then makes this important, but potentially confusing, statement about the relation of the two principles. He says "the law of the Conditions of Existence is the higher law; as it includes, through inheritance of former adaptations, that of Unity of Type" (p. 206). Here is an excellent case for that interpretation, followed out by Michael Ruse (1987, p. 137), that Darwin belongs on the side of the teleologists. Darwin has formally stated that his utility-based principle subsumes the structuralist principle. We must be very careful, however, about how we read this passage.

My argument is that Darwin employs a battery of causal stories to complement each other in explaining organic form. Functional and structural causes may be irreducible to each other, but that does not mean that they rank as equals in every determination of organic form. To say that there are many causes of a phenomenon, but that there is an order of priority among them, is not monistic. In ranking the two principles here, Darwin is not usurping, in reductive fashion, competing laws. He is indicating that, amongst a concert of causes, a hierarchy exists. It would be a mistake to read this passage as an abdication of structural causation.

Directly before the above passage Darwin characterizes the coalition of organic causes. "Natural selection acts by either now adapting the varying parts of each being to its organic and inorganic conditions of life; or by having

adapted them during long-past periods of time: the adaptations ... being slightly affected by the direct action of the external conditions of life, *and being in all cases subjected to the several laws of growth*" (p. 206, my emphasis). This passage once again affirms the role of nonadaptive "laws of growth" in the comprehensive explanation of organization.

It is somewhat understandable then (given his somewhat confusing rhetoric about the all-embracing power of natural selection) that Darwin, who "fully admitted that many structures are of no direct use to their possessors" and accounted for this with a combination of the conservation of ancestral form and "the complex laws of growth", would be repeatedly criticized for his failure to recognize and account for nonadaptive structures.[23]

Darwin himself made apologies in later editions of the *Origin* and in the *Descent of Man* for not properly stressing nonadaptive causes, but he might have reminded his critics of this passage from the first edition: "And this shows how unimportant the direct effects of the conditions of life are in comparison with the laws of reproduction, and of growth, and of inheritance ..." (p. 10). It is true that in the overall system Darwin seems to have recognized the phenomenon of "adaptation" first and then worked towards homology by adding the corollaries "common ancestor" and "generative laws" (unlike Geoffroy who recognized "homology" first and worked towards adaptation by adding the corollary of "evolution"). But Darwin's causal pluralism does make room for (and his materialism demands) purely structural influences upon organization. Of course where those structural laws result in a development that is blatantly incongruous with environment, then natural selection has the last word.

IV. DARWIN'S CAUSAL PLURALISM

Most interpreters of Darwin have focused so exclusively upon his struggle with the challenge of adaptation, that they have failed to appreciate his equally important struggle with the challenge of homologies. Fortunately, Robert Richards (1992) has realized how formative this challenge became for Darwin's overall theory. Rethinking the archetype as ancestor and employing embryological models allowed Darwin, according to Richards, "to resolve the single most pressing problem presented to him by his professional colleagues: how to account for the unity of type, the Cuverian *embranchements* of design, that almost every leading naturalist of the time recognized in the animal kingdom. This problem hovered over Darwin's early efforts at constructing his theory of evolution ..." (pp. 92–93).

In showing that Darwin employed other causal models in nontrivial ways, Richards has made strides, I believe, in liberating Darwin's actual thinking from one-dimensional neo-Darwinian caricatures. Unfortunately, Richards uses the emphasis on these non-functional strategies as "evidence" of Darwin's (currently suppressed) tie to older, more progress-based, evolution theories like those of the preformationists and the *naturphilosophen*. This argument seems to accept the popular but unsound premise that any causal framework besides blind natural selection must have subterranean teleological tendencies.

Richards seems to think (p. 114) that Darwin's appeal to structural causes, like embryogenesis, is a concession to the idea that creatures advance progressively through time. Richards only fuels the fears of neo-Darwinian interpreters who think that nonfunctional causes (i.e., anything that is not natural selection) are backdoor ways to reintroduce Mind into nature. But structural causality implies a transcendental hierarchy of forms only if archetypes are understood on Owen's model – not Darwin's. Richards seems to know this at one moment (p. 132), but at other times he plows ahead to assert that " ... Darwin's progressivism was not merely a personal fancy ... it was deeply rooted in the structure of his theory" (p. 115 n. 50).

My argument is not that Darwin's collaborative use of structural and functional causes indicates an uneasy embrace of antagonistic old and new evolutionary models. Unlike Richards, I am arguing that Darwin, in his mature theory, recognized a plurality of causal mechanisms in response to specific empirical challenges and that this makes him still more ahead of his time rather than behind it. Indeed, in naturalizing both teleology and the archetype, Darwin left no obvious manner in which structural and functional causation could be metaphysically opposed.

The problem, encountered by the transformist,[24] of morphological "stasis" in the paleontological record was approached by Darwin in part with structural thinking and in part with functional thinking. The transformist who does not accept the reality of "species" (viewing them instead as statistical entities) must attend to the "unity" of varying individuals. The transformist teleologist (functionalist) argued that stasis in animal form over long temporal spans reflected stasis in "environment" over time. The pure structuralist account of stasis was to argue that the "generative laws" were stable constraints which would repeatedly reproduce similar form unless some teratological occurrence redirected it. Darwin admits to both accounts of relative stasis while adding his own contribution of hereditary inertia – or stated another way, the contribution of history.

Darwin not only freely employs alternative causal mechanisms when needed, he also gives some indication about how these causalities might "piggy-back" on one another. Natural selection is a functional mechanism but, even as it works to constitute particular organic forms, it is constrained by and is conjoined with nonadaptive structural causality. In the very first chapter of the *Origin*, for example, Darwin suggests a marriage between the structural causality of "correlation of growth" and the functional causality of selection (in this early passage Darwin is discussing "artificial" selection). The "correlation of growth", Darwin admits, is not clearly understood and falls into the structuralist camp of "many laws regulating variation, some few of which can be dimly seen, and will be hereafter briefly mentioned" (p. 11). But this structuralist mechanism collaborates with selection to constitute organic form.

> [P]igeons with feathered feet have skin between their outer toes; pigeons with short beaks have short feet, and those with long beaks large feet. Hence, if man goes on selecting, and thus augmenting, any peculiarity, he will almost certainly unconsciously modify other parts of the structure, owing to the mysterious laws of the correlation of growth. (p. 12)

Additionally, when Darwin discusses the interrelation of the principles of unity of type and conditions of existence (p. 206), he indicates how nonfunctional inherited traits may have functional histories.

The original intractable tension between structuralism and functionalism (Cuvier-Geoffroy debate) is overcome by Darwin largely because he understands the causal modalities as co-principles rather than competitors. The original tension between the adaptationist and structuralist approach was bound up with a metaphysics that placed all adaptation (design) on the foundation of conscious intentionality (usually the deity's), and all structuralism on the foundation of mindless materialism. Once Darwin had naturalized teleology (by removing "conscious design" from natural selection) and naturalized the archetype (by interpreting it as historically real, rather than Ideal), he could synthesize causal frameworks that had previously opposed each other on metaphysical grounds.

Darwin recognized that the precise place where one causal story breaks down is the exact point of strength for the complementary theoretical strategy. The precise point of collapse for the functionalist strategy (e.g., the puzzling common skull structure between viviparous and oviparous animals) becomes a phenomenon of perfect clarity under the aegis of structuralism. Yet, with few exceptions, biologists (particularly in the French and Anglo traditions) continue to constrain their science with a rigidly "dichotomous" interpretation of structure versus function.[25]

If there is a "lesson" for the philosopher of science contained within this history of science, then it might be about the value of a pluralistic orientation towards causality. As Timothy H. Goldsmith (1991) puts it: "Nothing of importance in biology can be said to have but a single cause" (p. 8).

Functionalists or structuralists that dogmatically attempt to use a monistic or singular causal story to usurp other (often complementary) causal stories, are unnecessarily constraining the Biological enterprise. Olivier Rieppel (1990) seems to appreciate this point when he argues that functionalism and structuralism are different "ways of seeing" the organism. And he says that "each of these contrasting research programs must stand on its own, for they address different causalities in the generation of biological form" (p. 293).

Today's biologists are engaged in a constant, and sometimes vociferous, debate about which causal story represents the *causa realissimus* of organic form. Microbiologists and evolutionists are repeatedly charging each other with "reductionism", but they might learn an important lesson from Darwin's causal pluralism. Organisms and populations have complex and multilayered causal histories. Failure to appreciate this basic character of biological phenomena results in an impoverished and incomplete science.

ACKNOWLEDGMENT

My thanks to Eugenie Gatens-Robinson, John S. Haller Jr., and an anonymous referee for their comments on earlier drafts of this paper.

NOTES

[1] C. Naegeli's 1865 *Entstehung und Begriff der naturhistorischen Art.*

[2] See Geoffroy's transcripts of the debate in his *Principes de philosophie zoologique* Paris: Didier, 1830.

[3] The full list is found in the "General Conclusions" of Owen's *On the Anatomy of Vertebrates*, 3 Vols. London, 1866–1868.

[4] Cuvier's influential classificational scheme consisted of four unbridgeable branches (*embranchements*); vertebrate, mollusk, radiate and articulate.

[5] This is a point that many Darwin expositors seem to have missed. Those at the *Gardeners' Chronicle* certainly seem to have missed this distinctly non-teleological turn.

[6] Strangely enough Louis Agassiz (that great enemy of evolution) *did* catch the anti-teleological strain in Darwin. Unlike the *Gardeners' Chronicle*, Agassiz recognized the synthetic feature (where structures are homologous independent of utility) of Darwin's system. Indeed, Agassiz framed the whole purpose of the *Origin* as an anti-functionalist work. This was all the more reason of course for Agassiz to despise Darwin, for (following the tactics that Cuvier used on Geoffroy) he argued that all such "unity" theories were inherently obscure and atheistic. Agassiz explains that "The aim of his first work on The Origin of Species was to show that neither vegetable nor animal forms are so distinct from one another or so independent in their origin *and structural relations* as most naturalists believed. This idea was not new. Under different aspects it had been urged repeatedly for more than a century by DeMaillet, by Lamarck, and by E. Geoffroy St. Hilaire ..." (1874, p. 94 my emphasis). In the same article Agassiz continues in Cuvier's footsteps by associating Darwin with that "exploded theory of the past" *Naturphilosophie*.

[7] Many critics, particularly the Germans (see Ch.IX of Cassirer's *The Problem of Knowledge* (1950), *did* characterize Darwin's system as entirely focused on the external causality of the environment upon the organism. Darwin took these criticisms very seriously. Despite his claims in the *Origin* that a logic of morphology answered questions where the utility functionalism of natural selection failed, he had by no means emphasized this point. When he wrote the *Descent of Man* (Part I, Ch. ii) he claimed that he may have overemphasized the role of natural selection.

[8] For a dissenting characterization of Owen's Platonism or lack thereof, see Nicholas a. Rupke's "Richard Owen's Vertebrate Archetype" in *Isis*, Vol. 84, 1993 pp. 231–51.

[9] Dov Ospovat gives a nice summary of Owen's theological message. "Owen himself ... thought that he was performing a valuable service not only to science but to theology. He thought that his scientific work refuted atheism. The Greek atomists, he said, argued that if the world was made by a deity, then the idea of the world must have existed before the world itself, a notion which they dismissed. Owen believed that his discovery of the ideal type or pattern of the vertebrates, the archetype, proved that ideas indeed existed before things ..." (1978, p. 48).

[10] T. H. Huxley chided Owen for his "unscientific" conception of "law", calling it "metaphorical mystification" and "fundamentally opposed to the spirit of modern science" (see Desmond 1982, ch. 1) Desmond, in his more recent work *The Politics of Evolution* (1989), persuasively argues that Owen's transcendental zoology stemmed from a conservative backlash against materialist doctrines that lent themselves well to socialist and democratic social reform. In much the same way that Cuvier stood as a powerful status quo icon – dispensing the scientific justification for traditional theology – so too, Owen stood as a foil to the budding materialism with its metaphors of "self-determining energies" and "atoms" "In an age when radicals were threatening the corporation's very existence, this rival idealist biology was designed to meet the leveling threat. It shifted the emphasis from base nature back to the Godhead, reinforcing the temporal control of the traditional leaders" (p. 13).

[11] Louis Agassiz seems to have held some rather similar notions about the role of God in zoology. But, unlike Owen, for Agassiz the progenitors do seem to be Divine acts of fiat. Here Agassiz provides a "defense" for his use of such an idea in science. "The most advanced Darwinians seem reluctant to acknowledge the intervention of an intellectual power in the diversity which obtains in nature, under the plea that such an admission implies distinct creative acts for every species. What if it were true? Have those who object to repeated acts of creation ever considered that no progress can be made in knowledge without repeated acts of thinking? And what are thoughts but specific acts of the mind?. Why should it then be unscientific to infer that the facts of nature are the result of a similar process, since there is no evidence of any other cause?" (1874, p. 101)

[12] For an example of this "teratological" version of evolutionary change see Geoffroy's (1833) "Le degre d'influence du monde ambiant pour modifier les formes animals", *Memoires de l'Academie royale des sciences de l'Institut de France*, 12, pp. 63–92.

[13] See Olivier Rieppel 1990, pp. 298–99.

[14] Darwin suggests a correlation of growth law, whereby modification in one part of the organism generally brings some modification in others. But for the most part he leaves these "laws of growth" undefined. In this passage he links the correlation of growth law with Geoffroy's son and philosophical disciple Isidore. "There are many laws regulating variation, some few of which can be dimly seen, and will be hereafter briefly mentioned. I will here only allude to what may be called correlation of growth. Any change in the embryo or larva will almost certainly entail changes in the mature animal. In monstrosities, the correlations between quite distinct parts are very curious; and many instances are given in Isidore Geoffroy St. Hilaire's great work on the subject" (1859, p. 11).

[15] In the concluding chapter of the *Origin* Darwin writes: "I believe that animals have descended from at most only four or five progenitors, and plants from an equal or lesser number. Analogy would lead me one step further, namely, to the belief that all animals and plants have descended from some one prototype" (p. 484).

[16] Ernst Mayr, in his introduction to the *Origin*, explains Darwin's strong break with tradition. "Any attachment to metaphysical idealism, any commitment to an unchanging *eidos*, precludes belief in descent with modification. The concept of evolution rejects the *eidos*, replacing it with the variable population. Gradual evolution and natural selection, emphasized so strongly and consistently by Darwin, are inconceivable except through population thinking. And, having abandoned the *eidos* in the context of evolutionary theory, one finds it untenable also in every other way. The philosophical consequences of this aspect of Darwinism have not yet been fully exploited". (Mayr's facsimile of the 1859 edition, 1964, p. xx). Indeed, I have always been irritated by the fact that all modern histories of the "fall of essentialism" take their start either from Wittgenstein's later work or the oddities of non-substantive physics! Of course Dewey, alone so it seems, recognized Darwin's undeniable contribution relatively shortly after it was made.

[17] See Huxley's (1853) "On the Morphology of the Cephalous Mollusca", in M. Foster and E. Lankester's (1892–1902) *The Scientific Memoirs of Thomas Henry Huxley* (London Macmillan) Vol. I.

[18] See pp. 74–77 of Ernst Cassirer's (1945) *Rousseau, Kant and Goethe*. Reprinted in 1963, trans. by Gutman, Kristeller and Randall. Harper Torchbooks.

[19] Contemporary "Panglossian" fallacies, as Gould calls them, actually echo Cuvier's audacious boast that given only one bone of an animal, he could successfully reconstruct the whole organism. This claim beautifully illustrates the potentially arrogant "apriorism" lurking within pure functionalism. Cuvier would treat the bone before him like an environmental niche that necessitated a perfectly designed joining bone, and so on. Given the design "problem" set by the first bone, the "solution" of the connecting bones must deductively follow based on functional requirement.

[20] Philo offers the following cryptic passage. "Look round this universe. What an immense profusion of beings, animated and organized, sensible and active! You admire this prodigious variety and fecundity. But inspect a little more narrowly these living existences, the only beings worth regarding. How hostile and destructive to each other! How insufficient all of them for their own happiness! How contemptible or odious to the spectator! The whole presents nothing but the idea of a blind nature, impregnated by a great vivifying principle, and pouring forth from her lap, without discernment or parental care, her maimed and abortive children!" (Penguin edition p. 121)

[21] In his *Autobiography*, while discussing religious issues, Darwin makes this revealing parenthetical. He is discussing the efficacy of natural selection and claims in passing that animal organization ("corporeal and mental organs") are not always strictly bound or determined by adaptive pressure. " ... all the corporeal and mental organs (excepting those which are neither advantageous or disadvantageous to the possessor) of all beings have been developed through natural selection ...." (Norton reprint 1969, pp. 88–89). The parenthetical comment is a subtle but important caveat.

[22] Gould and Vrba (1982) argue that an additional concept of "exaptation" be added to the arsenal of evolutionary causes. Exaptation is a term that roughly matches the sorts of nonfunctional organizational principles which Darwin invokes. A structure may originate and develop through the nonadaptive working-out of epigenetic laws. This structure may or may not eventually be offered up to selective pressures and ultimately prove adaptive in some way. We would not be led astray if we thought of Darwin's structuralism in terms of Gould and Vrba's exaptation. Gould (1983) defines the term in this way: " ... those useful structures that arose for other reasons or for no conventional reason at all, and were then fortuitously available for other usages, we call exaptations" (p. 171).

[23] Later in the century critics rallied around Carl Naegeli's *Entstehung des Begriffs der naturhistorischen Art* and *Mechanisch-Physiologische Theorie der Abstammunglehre* and the development of an "orthogenetic" evolution. Peter Bowler (1983) describes the original orthogenetic orientation in a fashion that clearly isolates it's "structuralism". "William Haacke's introduction of the term "orthogenesis" came in an 1893 discussion of heredity and variation in which he proposed that the germ plasm consists of geometrically structured elements whose rearrangements are limited by their actual shape. This created a structural predisposition to vary in a particular direction, which would account for linear, nonadaptive evolution" (p. 150).

[24] Recall that the Fixist thinkers like Cuvier and Agassiz had no real problem with stasis because "species" were real. The species was a foundational reality – unchanged and unchanging – variations were only the errors of wayward matter. Thus the stasis of kinds was no puzzle at all.

[25] Michael Ruse and Stephen Jay Gould are still lining up on either side of this supposed "dichotomy" Ruse (1989, p. 136) is even echoing Cuvier's criticisms of Geoffroy when he links Gould with "obscure" German *Naturphilosophen*.

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Can Biology Make Ethics Objective?

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ABSTRACT: A familiar position regarding the evolution of ethics is that biology can explain the origin of morals but that in doing so it removes the possibility of their having objective justification. This position is set fourth in detail in the writings of Michael Ruse (1986, 1987, 1989, 1990a, 1990b) but it is also taken by many others, notably, Jeffrie Murphy (1982), Andrew Oldenquist (1990), and Allan Gibbard (1990). I argue the contrary view that biology provides a justification of the existence of morals which is objective in the sense of being independent of people's moral views and their particular desires and preferences. Ironically, my argument builds on the very premises which are supposed to undermine the objectivity of morals. But my argument stops short of claiming that biology can give us a basis for justifying some particular system of morals. Drawing on an analogy with social contract theory, I offer a general reason why this more ambitious project cannot be expected to succeed if the argument is pursued along the same lines. Finally, I give reasons why the possibility of objective justification for a particular morality cannot be ruled out in general on evolutionary grounds.

KEY WORDS: Morality, evolution, justification, objectivity.

1. HOW DID MORALS EVOLVE?

This is a good question to which there is no sure answer. What has emerged over the past several decades is a collection of "just so stories" which are consistent with current biological theory. These accounts characteristically are coupled with a non-cognitivist reading of moral judgment. Not to beg any questions, let me assume with Ruse, Murphy, Oldenquist, and Gibbard that moral beliefs can be identified as such without presuming that they refer to or correspond to a realm of moral facts. What makes them moral beliefs, let us assume, is how they function with respect to guiding deliberation and motivating action. In particular, let us say (following Brandt 1979) that beliefs are moral when they share the following features: they intrinsically motivate certain actions or omissions, occasion feelings of guilt when this motivation is deficient, occasion admiration and esteem for others when they have an abundance of this motivation, and elicit the thought that having this motivation is important enough to warrant imposing sanctions against those who are deficient in it. Moral beliefs are from this perspective essentially dispositions to think, feel, and act in accordance with certain norms.

The next step in giving an evolutionary account of morals is to link this dispositional account of moral belief with natural selection. Suppose that these

Biology and Philosophy **11:** 21–31, 1996.