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Biological classification, causal powers, dispositions and functional kinds

Abstract:

My main purpose in this paper is to argue for that biological kinds are not natural kinds but functional kinds. In short, this argument gives us at least two levels of classification and organisation in our austere schemes of description. One for biology and one for physics and chemistry. As Ellis scientific essentialism only accepts one type of organisation i.e. natural kinds with essences my position is to challenge that claim. However, introducing functional kinds is not to argue for a non dispositional property base for biological categories and kinds. It is rather to show that biological categories and kinds are best classified as “causal powers to produce a particular effect”. In this regard we can widen our perspective on the use of a dispositional ontology to entail higher level biological categories and kinds and at the same time preserve biology as an “autonomous” science.

Key words; scientific essentialism, natural kinds, causal powers, dispositions, biological classification, functional kinds

Ellis Scientific Essentialism

Ellis *scientific essentialism* is based upon the notion of natural kinds. Ellis argues that fundamental kinds in nature are characterized by their intrinsic causal powers. Belonging to a kind then is to have the “same causal power”. This constitute the Lockean real essence. These powers are, at base, the irreducible dispositional properties of the individual members of natural kinds, and it is the behavioural manifestation of these dispositions which are described by the laws of nature which govern causal processes and interaction in nature.

Because it is the intrinsic causal powers or dispositional properties which constitute the real essence of natural kinds, possession of such powers or properties is crucial to the identity of natural kinds. In particular if a thing is to be a member of a given kind, then necessarily it must possess those intrinsic powers and dispositions which are essential to that kind of thing. If it does not, it cannot be a member of that kind. Thus, the identities of things are wholly dependent on how they are disposed to act: “If protons for example are such ...things, then for anything to be a proton it must always be disposed to behave as protons do, and conversely, if anything is ever disposed to behave as protons does, then it is a proton”. If the above stated is accepted, Ellis says: “ then there is good reason to suppose that protons, or electrons or any other fundamental particles could not behave according to different laws without ceasing to be things of that kind”.¹ Hence we are in a position to “cut nature at the joints”.

Ellis presents his view as the *new philosophy of nature*. The new essentialism is in conflict both to traditional realism or a classical mechanistic realism and to various social constructivist or post modern reactions to classical metaphysics.

According to traditional mechanistic view of the world, matter is supposed to be essentially passiv and inert. In this view the laws of nature are nothing but empirical regularities which govern physical objects. This laws of nature is contingent regularities which is entirely distinct from the nature of intrinsic properties of the physical objects themselves. Hence the very same sets of object which might exist in our world might exist completely unchanged in any other possible world that is governed by entirely different natural laws. In contrast to this classical view, Ellis argue that the fundamental properties of physical objects are not passive but active. They have “causal powers or dispositions”. Such powers or dispositions cannot be reduced to more basic inactive categorical properties. Rather, they constitute the irreducible powers of things to behave in certain ways under certain circumstances. This view then leads Ellis to reject the classical view were laws are seen as mere *empirical regularities*. The laws of nature are descriptions of the behavioural patterns of things, which are made true by the possessions by those things of real, causal powers. And given this fact it follows that the laws of nature is also necessarily true. For if physical objects may not lose their powers without ceasing to be that very thing, the possession of those powers is also essential to understanding their identity. And as a consequence as the laws of nature depend on the basic causal powers in any world were the thing exist the laws describing these powers must also be true.

¹ Ellis (1999) p. 13

Equally and for the same reason given that these causal powers are real intrinsic powers which the things could not possess without being that kind of thing. That is, we are in a position to make real distinction in the world or “cut nature at the joints”, it could not be our intervening concepts or language which divides the world into kinds. In fact; “essentialists have a radically new category: the *necessary a posteriori*. Essentialists believe, for example; that the laws of nature are both necessary *and* a posteriori. They are a posteriori, because they have to be discovered by scientific investigation. But they are not analytically, or formally logically necessary, and they are not true by definition or convention. The laws of nature,..., are metaphysically necessary, and therefore grounded in reality, and not in language. That water is H₂O,...is something that had to be discovered, and it is certainly not anything that could be known a priori”.² Real dispositional properties thus ground natural kinds of causal processes. But like all natural kinds, these natural kinds of causal processes exist independently of our system of classification. It is a process that occurs independently of human concern, and it has its own essential nature. Consequently we have a new philosophy of nature based upon an active nature where causal powers within the things themselves are dispositions that these things processes essentially so as to act in particular ways in certain circumstances and in accordance with real natural laws. Ellis view is an essentialist realist alternative to both traditional metaphysical realism and social-constructivist or post modern relativism.

As Ellis states scientific essentialism excerpts itself on the basic level of physics or the fundamental particle level and it stretches into chemistry and may be parts of molecular biology. What is clear from this, is that: “A natural kind of process that is a display of a given dispositional property has a real essence,...and the scientific problem will be to specify precisely what this property is....The causal processes that are involved in the detailed explanation of a given disposition will have the same kind of structure” (physical)). Hence natural kinds must have strict boundaries due to physical structure. However, scientific essentialism is not so easily argued for when we investigate higher level biological entities and kinds. In this regard biological categorisation and classification just don’t seem to fit in well with Ellis scientific essentialism. Quite to the contrary biological categories and kinds seems to require particular property ascriptions as well as a level of complexity and vagueness which cannot be dealt with or classified into natural kinds which requires particular strict boundaries: “if there are any biological natural kinds, they would at least have to be variable kinds, for all plants and animals have variable causal powers and capacities. They learn and adapt, and their causal powers wax and wane. Hence, they cannot be assimilated to the natural kinds of chemistry or particle physics whose powers are determined by their intrinsic natures. And the’ conclusion is: “..., there are many good reasons to believe that biological species is not natural kinds... Specifically they fail the categorical distinction test i.e. they lack my distinctive real essence”.³

² Ellis (2002) p. 109

³ Ibid p. 25

It is exactly at this point that my own position might become interesting. I want to argue for that biological kinds are not natural kinds but *functional kinds*. Thus, my argument requires that we are able to see the relevance of two ways of classifying things in nature, one for physics and chemistry another for higher-level biological entities. And if this is the case then Ellis scientific essentialism cannot be the only truth or nothing but the truth. This is not to say however that a dispositional ontology for higher level biological kinds are wrong. Quite to the contrary, it only requires that we are open to at least two different way of classifying things. From my point of view Ellis essentialism is too restricted. Whatever consequences this view might have on Ellis metaphysics of the world is something I will return to.

My point of departure is to state that I think it is quite right to say that biological kinds are not natural kinds. In this regard biological kinds must be understood to be both more complex and expose vague boundaries physically structurally so that they cannot be sorted into kinds in similar ways as protons or electrons or the “stuff” in the periodic table. Nevertheless I want to argue that biological kinds are *kinds* of things with the same or “enough similar causal powers”, even if this cannot be understood in terms of Ellis essentialism. In this regard, biological kinds are not natural kinds but *functional kinds*. And functional kinds are less determinate kinds when it comes to the physical structural level, even if they are nothing but physical structures exposing certain inbuilt dispositions to act in certain ways under certain circumstances. At first sight these statements might seem to be somewhat contradictory and cannot be hold. As a consequence philosophers of different persuasion have also argued that biological kinds are not respectable because they cannot figure in scientific laws or causal laws (see Jaegwon Kim). Hence they are just second class and ultimately biology can at best be seen as doing without them. However, my argument here is to show that this is not necessary the case. Postulating biological kinds as functional kinds does not make the biological sciences less respectable or only second class sciences. Quite to the contrary functional kinds seems to be exactly what we need so as to be in a position to preserve biology as a respectable science. However if this is right then it seems that postulating functional kinds requires that we are both able to show that there is a dimension of “autonomi” with respect to the biological sciences and nevertheless argue for that this “autonomi” is not in conflict with the fundamental particle level. In this regard functional kinds are both necessary so as to see in what sense biology differs from physics, even if their manifestations are nothing but due to physical causes, that is; each manifestation of a biological cause is identified with a physical cause. So, to be able to argue for such a position I need to start out by saying something about biological categorize and kinds and what must be the case as a result of such a categorisation and classification. I will then return to the question why such catergorize and kinds are necessary so as to understand what biologists do.

My argument will rely upon a particular interpretation of Darwins theory of evolution by natural selection. Natural selection is *the* mechanism driving evolution. Hence my point of departure is to ask what must be the case if Darwins theory is true. That is, if the theory of evolution by natural selection is a true theory about how things develops in nature; what is then to be the case when it comes to understand biological entities

and kinds? There is at least one thing I think that all parties might agree upon. That is, if the theory of evolution by natural selection is a true theory then it must also be true that there are *physical systems which are selected for their effects*. This is what the fitness concept tells us in general terms. That is, every and each organism or assembly of organisms which have a better fitness relation than that of other organisms or assembly of organism, (given that natural selection is at work), will also have a better chance to survive and reproduce. Now if we do credit the theory of evolution that much, we also seem to be justified in stating that, given the circumstances; if physical systems are selected for their effects, then if physical systems have the “same effect” or somewhat looser “enough similar effect”, then under the right circumstances (*ceteris paribus*), such physical systems will be selected *for*. Hence it also seems that we can group physical systems together under the label “effect” and/or “enough similar effect” due to how they historically, potentially or actually behave in nature. This gives us a possible way to classify things under “effect” or “enough similar effect” i.e. what we are stating is that given that nature selects for effect or enough similar effect we are also justified in saying that there might be evolutionary *types*.⁴ Hence, to ascribe a selected effect to an item under this view then is to claim that earlier items of the same type had the effect and that their having had that effect helps explain the presence of later items of the type. This is what we might call a possible candidate of a *kind* in biology due to its evolutionary proper function. Hence we group things under a kind due to its evolutionary family of effects which have been the “why” it was selected *for*. It is a *functional kind*, because physical structures have been selected for by the same or enough similar effect i. e. hearts, kidneys, mimicry, camouflage, running from an predator, altruism or social control might be such effects.⁵

Selected effect now can be translated into function, such that physical structures having an effect is meaning in functional language, that the physical structure here plays or can play a role in certain environments i.e. under given circumstances. The structure in question has a “causal power” or a disposition to *do* certain things under certain circumstances. This is what functional effect amounts to in the biological world. Thus if physical systems are selected for by their effects we can state that physical structures are selected for by what they are *doing* in certain environment i.e. their “causal role” in that environment. Hence “function” does not amount to anything else but a things effect or “causal role” within those environment. Or as Rosenberg have stated; “Causal descriptions are often called “functional” role descriptions in philosophy of science, and I will use this terminology hereafter, understanding “functional” to mean simply “role in a network of causes and effects”.⁶

Thus, if physical structures with the same function or role is selected *for*, then we are also in a position to state that there must be evolutionary families with the same or

⁴ This notion of function relies upon the notion of proper function i.e. the etiological theory of function (i.e. we need proper (historical) function so as to be able to distinguish different (relevant) types of function) and Cummins function might imply proper function within its analysis (see Mitchell p. 409 and Griffith p 438 in NP (1998)).

⁵ I am relying upon multi-level selection theory here (see Wilson/Sober *Unto Others* (1998)

⁶ Rosenberg (1994) p. 24.

“enough similar effect or causal role”. That is, it seems reasonable to argue, that if Darwins theory of evolution by natural selection is a true about evolution, then we also seem justified in saying there are specific biological kinds or *functional kinds*. *All those physical systems selected for their effects or functional role are all functional kinds that exists in nature. All those physical systems selected for by a particular effect or particular functional role is a functional kind* (hearts, kidneys, mimicry, camouflage running from a predator, altruism and social control), *an instance of a functional kind or a functional kind token is a particular thing with that function* (a particular heart, kidney, flower or butterfly, or camelont, or geopard or a particular assembly of organisms with that particular effect).

Now it seems obvious that biologists need such a category. The reason is that they cannot do without them. A heart for instance cannot be defined except by reference to the function of hearts because no description purely in terms of morphological criteria or physical composition could demarcate hearts from non hearts. In this regard biologists need a category that ranges over different species, and hearts are morphologically or physically diverse: fish have a single pump with only one auricle, but amphibians and most other reptiles have a single heart with two auricles, and while many reptiles have a ventricle partly partitioned, only crocodiles, birds and mammals have the two separate ventricles. For the purpose of classifying hearts, what matters to biologists is that hearts manages to pump blood, this is the why they were selected *for*. It is the *what* they are causally disposed to do.⁷

Having clarified why there are functional kind categories our next question is; if we take functional kinds to exist and have the proper function as is required of a kind what does functional kinds contribute to our understanding of the biological sciences. It is exactly here that introducing functional kinds seems to do some interesting work. To be able to spell this out I am turning to the following assumptions:⁸

1. Functional kinds can do a similar job for biologist as natural kinds can for the physical/chemical sciences. In this regard functional kinds have a sameness relation through the same effect or enough similar effect for this to count as a type requirement necessarily for it to be considered *a kind* in question. What is more, such functional kinds can work in similar ways in biological explanations as natural kinds can in physics and chemistry
2. Functional kinds have biological causes. Biological causes are identical to physical causes. Hence, functional kinds or their instances are identical to their physical causes. Physical cause here being the same as a particular physical make up (structure) which “ have the causal power to produce a particular effect”. Even if functional kinds are less determinate then natural kinds when it comes to their physical make up (structure) level they are nevertheless nothing but physically composed.

⁷ See Neander (1998) p. 320

⁸ My argument here is inspired by Michael Esfeld, “The causal homogeneity of biological kinds” (*Hist and Phil. of the Life Sciences, Dec 2005*), even if I drive a different conclusion from it then Esfeld does

How are these two claims to be understood? Normally one would say, as Ellis might say that, if functional kinds are kinds of things which range over different physical structures they cannot work in physical laws or be nomotetical in any ordinary sense of nomotetical. The reason being that what is required for some basic laws of nature is the essential “causal powers” to produce that effects. As this requires natural kinds with the same or similar physical make up (structure) to produce the same or similar “causal power” then functional kinds does not qualify as kinds because they cannot be reduced to a particular physical “make up” (structure) so as to produce the required effect. Ellis requirement for belonging to a kind is; “the causal processes that are involved in the detailed explanation of a given disposition will all have the same kind of structure” Hence, functional kinds cannot figure in causal laws, because they vary in physical structure. The reason is that *we cannot conclude from instance identity to type identity*. Hence, as a consequence functional kinds must also vary in “causal power” because various physical structures cannot produce the same “causal power”. As a consequence, functional kinds does not function adequately in laws, *ipso facto* they are not scientifically respectable. On the other hand, if they can be reduced to physics or the necessary “causal power” according to physical cause, then there is no reason to keep them alive, because they can be eliminated by physics i.e. they could be possible candidates for natural kinds. Hence, due to traditional views the two statements above, either asks for an independent level with respect to biological categories and kinds or otherwise they can be eliminated by physics. In short; the two statements above seems to contradict each other. Hence it seems that we must show that functional kinds both can have the required “sameness relation” necessary for a kind and at the same time show that they are nothing but physical structures with “causal powers to produce a particular effect”, if we are to satisfy 1 and 2 above. How is this possible? Lets now turn to Esfelds argument for functional kinds satisfying the two claims above and see what follows from it.

As I have said biological kinds are functional kinds. I have also said that nothing hinders that functional kinds are manifested by an assembly of physical instances in such a way that biological instances of a particular type is identical to a physical structure producing certain “effects”. But, being a functional kind, biological categories seems to be multiply manifested in physical different structures. That is; the same functional kind is manifested by an assembly of physical instances which does not come under a physical type (i.e. a natural kind category). Rather, functional kinds to be manifested must so be through several physical types. The fact of *multiple manifestations* or realizations are the main reason why one endorse the claim that biological kinds does not have the causal relations required of a natural kind. Or as Enc and Adams have stated:

.. the Thesis of Multiple Realizability creates a broad class of types of characters all of which have the disposition to execute the function in question, and whatever their diverse properties or activities may be, each type within a class has its own properties or activities because those properties or activities have that disposition. As a result, when we explain the prevalence of a character

by attributing a function to it, we appeal to a generalization over a much broader class than is constituted by the properties that define the character. The broader class is generated by the fact that there is no one physical description of the type of structures each of which will perform the function... This property, as we argued above, is defineable only nonindividually. However, this is fully consistent with there being, for any sufficiently narrowly specified class of structures that possesses the function property, a physical description that form the supervenient basis for that property. This is why attributing function to a structure places the structure in a broader class over which counterfactual predictive generalizations are available that cannot be formulated at the level of the narrower class.⁹

Hence, biological kinds cannot be natural kinds because they cannot be reduced to a physical description due to Multiple Realizability. Thus, if the first claim stated above is true i.e. it is based on the assumption that there are biological patterns (biological kinds) that cannot be seized with physics and if these patterns are characterized by a homogeneous type or effects that this token (instances) produce, then how can the second claim be true i.e. that each biological cause is identical with a physical cause. Indeed, and according to Esfeld, starting from the second claim that each biological cause have a physical cause how can we without eliminating biological types get access to the fact that the second claim is true? Or in Jaegwon Kims words:

If the “multiplicity” or “diversity” of realizers mean anything, it must mean that these realizers are causally or homologically divers. Unless two realizers of E (emergent property in the sense of higher level property) show significant causal/nomological diversity, there is no clear reason why we should count them as two, not one. It follows then that multiply realizable properties are ipso facto causally and nomological heterogenous... All this points to the inescapable conclusion that E, because of its causal/nomic heterogeneity is unfit to figure in laws, and thereby disqualified as a usefull scientific property... The conclusion is therefore: as a significant scientific property, E has been reduced... eliminatively...¹⁰

As Kim acknowledge, this conclusion amounts to eliminative reduction, biological kinds – indeed all higher level functional kinds – are eliminated as natural kinds, not figuring in natural laws. Thus as we mentioned above and in accordance with Esfeld, it seems that we cannot have it both ways. Either biological kinds are not homeogenous enough and if they are they are not scientific respectable (they cannot figure in laws), or biological kinds are not kinds at all and thus can be eliminated. Hence as we said 1 and 2 above seems to contradict each other. Thus Esfeld ask; what is required so as to rescue biological categorization and causation? It is the fact that biological cause are

⁹ NP (1998) p. 389

¹⁰ Jaegwon Kim (1999) p. 17-18

identical to physical cause. Now, what we want to state is that this particular argument would lose its point if it is a consequence were there are no biological kinds or functional kinds.¹¹

Thus we are going to show how we might be able to avoid eliminativist reduction and thus hold on to the claim that there are biological kinds or functional kinds and the claim that biological cause is identical to physical cause. So how can both these claims be hold true at the same time and what follows from it. To see the solution to the problem we need to introduce a “type base” which allows for biological kinds in question and at the same time show how this type base can correspond to physical cause or physical structure of different types.

As our starting point we must say that we cannot “take away” talk of function in biology for then we do not describe biological systems or properties. Consider selection; biological properties of organisms are selected for the effects their instances have. And selection is blind to composition. That is why what is relevant to biology is function instead of composition as we have already stated. On the other hand, this does not require any additional explanation to that of physical cause so as to understand why function is nothing but biological cause being identical to physical cause. The way to make the connection between function and composition is the following; If we say that biological function corresponds to “causal power to produce certain effects”, then we are also in a position to state that the same function corresponds to the same “causal power to produce that effect”. Hence, “causal power to produce the same effect” might range over different physical types or structures. Hence, it is the “causal power to produce the same effect” which makes for the type base of the biological level because it is this causal power which serves the same or “enough similar” function in question. That is, each functional kind has the same or similar enough causal power to produce a specific effect i.e. that of hearts, kidneys, mimicry, camouflage, running from a predator, altruism or social control, etc even if we are dealing with quite different physical structures or physical causes so as to manifest that effect. In this regard, “causal power to produce a particular effect” is supervenient on the physical structural level in that quite different physical systems, might give rise to the same “effect”. In this regard, the sameness relation which resides through the same functional kind is the “causal power to produce a particular effect” i.e. the effect of hearts, kidneys, mimicry, camouflage, altruism, social control etc, and this is true even if this causal power realizes itself or manifest it self in all kinds of different physical structures or types (i. e. iguanas, amphibians, reptiles, birds, mammals etc). Thus we are in a position to hold on to the fact that a biological cause is identical to physical cause. That is, each instance of a functional kind if manifested is so because of some physical cause. Here manifestation of biological instances of a particular type is identical to a particular physical structures ability to produce that effect. However when we are talking about biological kinds as functional *kinds* the “causal power to produce a particular effect” is what resides as the “sameness relation” which corresponds to the capacity of every and each instance in the kind, that is, the effect which all and only those instances of a particular kind have in common, even if this

¹¹ We are following close to Esfeld (2002) here

range over all kinds of different physical structures. Hence, we can have it both ways, identifying each manifestation of a kind with a physical cause as a particular realizer of that effect and we can keep the biological functional level by showing how it is possible for different physical structures to realize or manifest the “same effect”. This makes a functional kind less determinate when it comes to physical structure seen in relation to a natural kind, which require “causal power to produce an effect” based upon “the sameness relation” do to a particular physical structure or make up. But this should not surprise anyone because biological properties and kinds are manifold more various and complex when it comes to their physical “make up” or structure i.e. the same “heart”, “kidney”, “mimicry” – effect, might range over quite different physical types. In this regard, selection does not operate on composition but on function. This is also why we need to keep the functional language alive so as to be able to hold on to a unity when it comes to understanding biological phenomena even if each an every manifestation of a biological instance corresponds to a physical causal manifestation.

In sum, based on the principle of different classification, there is a way to match the two claims 1 and 2 above. Biological causes are identical to physical causes such that a manifestation of a biological token is identical with a physical token. Nothing now hinders that configurations that are composed in different manners of physical tokens can produce the same or “enough similar” effect – that is effects that are salient for selection in a given environment. Therefore, and according to Esfeld, biological types are causally homogeneous i.e. if we define homogeneous by the same or enough similar “inbuilt causal power or disposition to produce a particular effect”; they are heterogeneous only with respect to their physical composition.

Now by this view it seems that we are also in a position to see that the functional ascription is sound, because it fits in with physical cause and physical structure. This is because “causal power to produce a particular effect” is what ascription of a function is knitted down to in these cases. *This is what every and each instance of a physical structure have in common under a biological type*, according to Esfeld. Hence, if biological cause is identical to physical cause then it is also the case that it is this causal disposition or “power” which resides in every and each instance of a biological type. Hence the connection between physics and biology is made, even if that “causal power” cannot be reduced to a particular physical “make up” or structure i.e. to a physical type or a natural kind. Nevertheless, it seems justified to state that it is the same or enough similar “causal power” which is manifested in a manifold of physical structures.

As quoted earlier, Enc and Adams claims that the vocabulary of supervening properties makes an irreducible contribution to the description of general patterns. However, if Esfeld is right and there is a pattern of similarity among biological tokens that justifies regarding these tokens as belonging to an homogeneous biological type, then there is a supervenience base for that pattern. Consequently, whatever several biological tokens of a type may have in common *this is not fixed by a particular physical make up*. But in this case, it seems that what constitutes these patterns and thus what makes several biological tokens similar is causally homogenous even if not

fixed by a particular physical composition. In short, the idea of two different manners of classification is sufficient to vindicate the two claims 1 and 2 above, and this idea – and these two claims – do not imply, that functional kinds are natural kinds. Hence, what we are arguing for here and in line with Esfelds reasoning is a possible causal homogeneity without elimination “respecting both the identity of biological causes and tokens with configurations of physical causes and tokens as well as the homogeneity of biological kinds, characterized each by a homogeneous pattern of a salient effect that their instances produce.”¹²

Functional Kinds and Biological Science

However the question still remain; does this view prevent us from making biological explanations rely upon respectable scientific statements? No such things follows. To the contrary introducing functional kinds might in fact shed light upon why biology is just as respectable as physics and chemistry. The following “lawlike” statement in biology can shed light on the problem:

(T) Whenever a system S's type in an environment of E's type has a goal (effect) of a G's type, behavior B occurs, because it brings about (or tends to bring about" goal (effect) B.

Were “brings about” or “tends to bring about” must be understood as the “causal power” or the disposition to bring about B. And if “causal power” to bring about B here is understood in relation to all kinds of different physical structures (i.e. the many realizable thesis) i.e. identified with an “assembly of physical structures producing that effect”. Then “causal power” to bring about B, is supervenient on any particular physical structure. A particular clear example of such a law is the *rule of intercalation*:

...which systematize a wide range of limbregenerative phenomena in coackroaches amphibians, fruit flies, and crustaceans. Each cell in the limb of such a creature is said to internalise a “positional value”, roughly a set of its coordinates on a grid covering the whole limb surface. Contiguous cells normally have positional values that differ by only one unit on each axis of the grid. When the limb is severed and the wound heals, cells with widely differing positional values are brought together. The rule of intercalation holds: “Discontinuities of positional values between adjacent cells result in the growth of new cells with intermediate values *so as to* restore continuity of positional values”.¹³

And, “restoring continuity” in these values and regenerating the lost limb are the same thing. Here the system S, is the limb stump; the environment E, is not explicitly mentioned but includes the absence of forces developmental biologists have identified as interfering with regeneration; the goal (effect), G, is regeneration;and it is brought about by the behavior B, intercalation of positional values of the component cell.

¹² See Esfeld (2005) p. 6 and 9

¹³ Rosenberg (1978) p. 49

Now the important thing is that this “law” which describes the “essence” of a functional kind are just as testable and just as strongly confirmed as those laws inbuilt in the essences of natural kinds, and moreover such laws can be brought within an assembly of physical structures which have one thing in common that is; “the same causal power to produce this particular effect”, even if this “causal power” ranges over quite different physical structures, or as we have stated there is no natural kind for that effect

By this view I think that we can see how and why biological kinds can figure in “causal explanations”. However, this requires two levels of classification and investigation of nature and it gives us access to understand in what sense biology is somewhat “autonomous” from that of physics. This is not to say that there is a conflict between physics and biology. Quite to the contrary they both seems to fit in quite well with equalizing “what is real” with the inbuilt “causal powers to produce an effect”. However, it makes the biological level less determinate when it comes to physical composition, but at the same time it gives us access to understand why the biological level is relevant. Hence, lets conclude by showing with Hilary Kornblith what might follow from this:

Camshafts are from the point of view of physics, a heterogeneous lot; they do not form a natural kind in physics. Camshafts come in different sizes, different shapes, different weights; they are made of a variety of different materials. Nevertheless, we are all camshaft materialists; we all recognize that camshafts are entirely composed of physical stuff... We speak of camshafts, and regard them as a kind in explaining the behavior of automobiles, because there are properties that all camshafts share and which serve to explain a range of automobile behavior... Someone who did not recognize the existence of a camshaft as a kind would fail to see important commonalities among different cars and thereby regard as entirely heterogeneous various phenomena which may be brought under the umbrella of a single explanation. When several different cars each fail to run because their camshafts all are broken, there is a common problem that they share even if their camshafts are, from the physicist point of view quite different. Although the behavior of each individual camshaft is the product of physical forces generated by the physical properties of the material of which it is composed, there is not some single physical explanation for the failure of all camshafts; from a physical perspective, their shortcomings may be quite heterogeneous. Adverting to the higher level property and thereby abstracting from the physical details of the camshafts’ composition allows us to capture these commonalities. If there are important generalizations to be captured at this level, then the study of auto mechanics will gain some legitimacy¹⁴

¹⁴Kornblith (2002) p. 39

Now what is true of auto mechanics might also be true of biology. While functional kinds are entirely physically composed this does not entail that the physical states on which functional state types supervene form a kind in physics. Just as camshafts may be heterogenous from the point of view of physical composition, the class of functional effect may be heterogenous from the point of view of physical composition. And if it is, one should not thereby conclude that it doesn't form a legitimate kind in biology. The legitimacy of talk about functional kind in biology is secured by showing that this allows for a biological theory that succeeds in prediction and explanation. No doubt each instance of a functional kind is entirely physically composed; but this does not require that they form a homogeneous physical kind.

Conclusion

Ellis scientific essentialism requires that there is only one legitimate classificatory scheme relevant in our austere schemes of description. That is the fundamental level of physics and chemistry with its notion of natural kinds. As I have argued, all natural kinds in biology are functional kinds. What is clear from this is that biology cannot be eliminated in terms of Ellis scientific essentialism. However, nothing of what I have said should be taken to be inconsistent with a dispositional ontology. Quite to the contrary, we can have a property base for biological types which give us access to see how this resides in the same or enough similar "inbuilt causal power to produce a particular effect" salient for selection, and this is true even if this "effect" might reside in a physically heterogeneous lot. And as I have argued whatever a biological type have in common is causally fixed by what is on the physical compositional level. And as I have shown the legitimacy of talk about functional kinds in biology is secured by showing that this allows for a biological theory that succeeds in explanation and prediction. However to be able to appreciate such a perspective we need to argue for two classificatory schemes one for physics and chemistry and one for biology. And this is true even if there is no biological cause without a physical cause.

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