**Species have Historical not Intrinsic Essences**

**Godman and Papineau**

**Abstract**

In a series of important recent papers, Michael Devitt has argued, against contemporary orthodoxy, that species and other biological taxa have essences. We fully support this revival of essentialism. We further agree with Devitt that biological essences are properties that explain the multiple shared features of taxon members. We are not persuaded, however, that these essences need be common intrinsic properties of those members. An alternative candidate is shared historical origins. We argue, contra Devitt, that historical essences explain the shared features of biological taxa just as well as intrinsic properties. Indeed we think that there are reasons for viewing historical essences as more basic than intrinsic properties. One reason is that many taxonomically shared features depend on non-zygotic inheritance rather than intrinsic genetic nature. Another is that that historical origins play a more significant role than intrinsic properties in explaining the shared features of non-sexually-reproducing organisms.

**I Millian Kinds**

Many categories are distinguished by the fact that all their instances share many, many properties. John Stuart Mill referred to such categories as “Kinds”.

By a Kind, it will be remembered, we mean one of those classes which are distinguished from all others not by one or a few definite properties, but by *an unknown multitude of them*. The class horse is a Kind, because the things which agree in possessing the characters by which we recognise a horse, agree in a great number of properties, as we know, and, it cannot be doubted, in a great many more than we know. ([1856], BK IV, CH 6, § 4).

Of course, horses are not alike in all respects. They vary in size, colour, and plenty of other features. Still, it remains the case that they are all alike in sharing manes, tails, a liking for hay, and many other anatomical and behavioural features—including, as Mill emphasizes, many that we are as yet ignorant of. In short, there are many true instances of the schema *All horses are F*.

What goes for horses goes for all other biological species. For any species, S, there are many true instances of the schema *All Cs are F*.

Biological species are by no means the only Millian Kinds. Chemical substances display the same structure. All samples of copper share the same density, melting point, electrical and heat conductivity, disposition to combine with other substances, and so on. It works the same with chemical compounds like water, as well as with elements like copper. Samples of water again share density, melting point, and so on. Whether a chemical substance C is an element or a compound, there will be a multitude of truths of the form *All Cs are F.* Again, astronomical objects fall into Kinds. All main-sequence stars share a wide range of properties with each other, as do red giants, white dwarfs, supernovae, comets, and planets.

Returning to the biological realm, species are by no means the only biological Kinds. Higher taxa (*genus, family, order, class, phylum*, . . .) also have members that share many features. Thus, all the members of the class *mammalia* have hair, a neocortex, mammary glands, are warm-blooded, and so on. (Note how the features shared by all the individual members of some such higher taxon will always be a subset of the features shared by all the individual members of any subordinate lower taxon. For example, the features shared by all mammals are a subset of the features shared by all horses.)[[1]](#footnote-1)

Most Kinds fall into types. All the different species are alike species, all the different chemical substances are alike chemical substances, and so on. This is important because it can tell us in advance which properties will be shared by the members of any given Kind. For organisms in a species, say, we know that morphology, anatomy, diet, breeding behaviour, . . . will be shared, but not injuries, size, number of siblings, . . . For samples of chemical substances, we know that density, melting point, combinatorial dispositions . . . will be shared, but not shape, monetary value . . .

Ruth Millikan speaks of “templates” for families of Kinds—a list of determinables such that all the members of any Kind in the relevant family will share the same determinate value. (For example, for chemical substances the list will include *melting point*: while different substances have different melting points, all samples of a given substance have the same one.) Someone who grasps the template for a family will thus be able to make many one-shot inductions. Once you’re seen the temperature at which one sample of copper melts, you’ll know the melting point for all. Once you’ve seen how one hedgehog reproduces, you’ll know how they all do (Millikan 1998).

Let us make one last point about the structure of Kinds. Not every category C that supports a range of generalizations of the form *All Cs are F* is a genuine Kind. Consider the category of:

*Mantelpieces that have a portrait of Robert De Niro and six glasses on top.*

Nowsuppose that the term, “De Niro piece”, has been coined to classify the instances that conform to this definition and that we go out and track down De Niro pieces. We will of course find that *All De Niro pieces are mantelpieces*, that *All De Niro pieces have a portrait of Robert De Niro*, and that *All De Niro pieces have six glasses.* Still, these are not genuine empirical generalizations. Rather, they are guaranteed by the definition of “De Niro piece”. Nor is there any reason to suppose that there are any other general truths about De Niro pieces, beyond those so definitionally guaranteed.

Because of this, categories like *De Niro piece* do not add to our power to anticipate nature. We can’t ever use generalizations involving such categories to tell us something we don't already know. Since we first need to check that something has all the properties entailed by the definition to know whether it is a De Niro piece, the generalizations about De Niro pieces cannot function as a means to predicting, as yet unchecked, properties.

With genuine Kinds, it is not like this. We can typically ascertain Kind membership and use it to predict properties *without* first checking whether all the properties associated with the Kind are present. I can easily determine that something is a horse, or a piece of copper, on the basis of just one or two of the many features that such things have in common.

We have explained Kinds, in part, by noting how they underpin the ability of human thinkers to make one-shot inductions and anticipate new features. But it is worth emphasizing that the structure of Kinds is not itself an anthropocentric matter. Kinds involve real patterns in nature, patterns that would still be there even if there were no thinkers to make use of them. These patterns may be very useful to human beings—indeed many of our cognitive powers have no doubt evolved to make use of them—but the patterns themselves are prior to this use.

**II Essences**

Kinds have a peculiar and striking structure. They enter into a multitude of generalizations (*All Cs are F*, for many *F*s), and these generalizations are not just matters of definition (as they are with cooked-up categories like *De Niro pieces*). Kinds thus raise an explanatory question. Why do all the Cs share so many properties? What is it about the Cs that accounts for their multifarious resemblance?

This is where essences come in. Essential properties are properties that explain all the other shared properties. For any Kind C, there will be some central common feature E possessed by each C, a feature that gives rise to all the other properties F shared by the Kind. The essential property thereby explains why the Kind supports multiple generalizations.

People sometime say that essences are the “*real definitions*” of categories, or again that they specify “*what it is to be a C*”, “*what it is to be*”, or “*in virtue of which something is a C*”. We are not against these ways of talking, but on their own they can seem to lack substance. What distinguishes, among the many properties shared by C, those that constitute its “real definition”, or that specify “what it is to be/what makes something/in virtue of which something is a C”? We take the special explanatory role of essences to answer these questions. Essential properties are those that are responsible for all the many other properties shared by the members of C.

Ruth Millikan has observed that there are two general sorts of Kinds, distinguished by two different sorts of essential properties. She calls them “eternal” Kinds and “historical’ Kinds. With an eternal Kind, the shared properties of the Kind are explained by an intrinsic, or “eternal”, property of the members. With a historical Kind, the shared properties are explained by a historical relation to a common origin. (1999; 2000)[[2]](#footnote-2)

Eternal Kinds are perhaps the more familiar. Chemical substances are the paradigm. Their essences are the structures of their constituent molecules.[[3]](#footnote-3) All samples of copper have the same density, melting point, electrical and heat conductivity . . . because they have the same molecular make-up. The same goes for astronomical Kinds, such as different kinds of stars, supernovae, comets (Ruphy 2010). For example, the common physical make-up of main-sequence stars (they fuse hydrogen to form helium) explains their other shared properties. Further cases suggest themselves. Geological Kinds arguably owe their many shared properties to common physical essences. Richard Boyd has suggested that weather categories like storms are further examples of eternal Kinds (1999, 84).[[4]](#footnote-4)

Now for historical Kinds. Consider all the different copies of *Alice in Wonderland*, including the paperback with a front page torn off on Marion’s bookshelf, the hardback in David’s study, and the many others in numerous libraries and book stores across the world. These instances all share their first word, their second word, . . . and so on to the end. They also share the same list of characters, the same plot, and the same locations. We thus have a wealth of generalizations of the form *All copies of Alice in Wonderland are F*. Copies of *Alice in Wonderland* form a Kind. But the common properties of this kind certainly are not explainable by any common physical essence. The copies of *Alice in Wonderland* are not physically alike. They can be made of different kinds of paper, or of board, or written in braille, and then there are audio versions on magnetic tape or digital disc.

Rather, all these instances are members of the same Kind because they are all copies of an original version. Their shared features are all due to their common descent from the original version written by Lewis Carroll. It is purely this chain of reproduction, not any common intrinsic property, that explains the shared features.

Many artefacts are like literary works in this respect. Earlier we alluded to all the features common to Vauxhall Zafiras. They all share the same shape, same engine, same ingenious system for stowing seats in the rear, and so on for all their many design features. So they too form a Kind. But here too the commonalities are not explained by some common intrinsic property. While the Zafiras do have many physical properties in common, none of these is distinguished as the source of all the other common features. Rather their many similarities stem from their all being made according to the same original blueprint. They are constituted as a Kind by their common historical source.

More generally, Kinds with historical explanatory essences can be found throughout the cultural, social and technological domains. They typically cover innovations which lack a shared intrinsic core, but where a chain of reproduction can account for the similarity amongst instances over time, including technological inventions and regional identity (Millikan 1999), religion, ideology, cultural syndromes (Godman 2015, 2016), and gender (Bach 2012). For historical kinds, the basic principle is that “each [instance] exhibits the properties of the kind because other members of that same historical kind exhibit them” (Millikan 1999, p 54).[[5]](#footnote-5)

Different examples of historical Kinds will involve different means and mechanisms of reproduction (for example, type setting, copying machines, and various modes of social learning). But all examples will involve three central ingredients: 1) the existence of a model, 2) new instances produced in interaction with the model or other past instances, 3) this interaction *causes* the new instances to resemble past instances. A chain of reproduction thus generates the relevant historical relations that ground and explain the Kind.

**III Biological Taxa**

In a series of important recent papers (2008, 2010, forthcoming), Michael Devitt has argued that biological species[[6]](#footnote-6) have intrinsic essences. Devitt’s position is nuanced. His fuller formulation is that biological essences “are, at least partly, intrinsic, underlying, and mostly genetic”. One reason for this more cautious formulation is that Devitt allows that biological essences are also partly historical as well as intrinsic. We shall return to this historical concession below. But first let us comment on Devitt’s thinking about the intrinsic component in biological essences.

Here Devitt is very much in accord with the points made in this paper so far. Although he often introduces essences as properties “in virtue of which an organism is C”, or “which makes it a C”, or so on, he makes it clear that such phrases must be cashed out in explanatory terms. As he sees it, the argument for supposing that species have intrinsic genetic essences is precisely that these essences explain the many shared features of species members: “generalizations about what they look like, about what they eat, about where they live, about what they prey on and are prey to, about their signals, about their mating habits, and so on” (Devitt 2008, 351).

So, for Devitt, biological species are a version of the “eternal” Kinds discussed above. Their shared features are explained by some common underlying intrinsic property. Still, this is not the only option suggested by our discussion so far. There is also the possibility of viewing species as historical Kinds, with the shared properties of their members being explained by their common descent from the same ancestors, rather than by their common genetic intrinsic make-up.

The discussion so far might have suggested that eternal and historical Kinds are disjoint. Eternal Kinds have instances that arise independently, with no causal interaction—such as chemical elements like copper and astronomical categories like main-sequence stars. Historical Kinds, by contrast, have instances that are causally related by lines of descent—such as copies of a literary work and members of a religion.

But in truth there is no principled reason why some Kinds should not qualify as both historical and eternal. Perhaps the instances of some Kind are *both* copied from some original *and* share some intrinsic physical make-up. Consider infectious diseases like measles or tuberculosis. One explanation for sufferers’ shared symptoms could be that their ailments are all copied from earlier sufferers. But another explanation would be that the sufferers all harbor the same physical microbe, and that this gives rise to their shared symptoms.

In cases like this, we can see things either way. We can view the Kind as historical, and see the shared properties as due to the instances having a common source. From this historical perspective, the intrinsic physical property is simply part of the mechanism by which instances of the Kind reproduce themselves. Just as books are reproduced with the help of typesetters and printing blocks, so is measles reproduced with the help of viruses. But we can also view the Kind as eternal, and explain the shared properties as due to the common underlying physical core. From this eternal perspective, the common reproductive source is simply the reason why the instances all have the same physical essence. Just as the shared constitution of copper samples arise from their similar conditions of formation, so does the shared physical essence of measles cases derive from their common ancestry.

There is no incompatibility here. The workings of infectious diseases are perfectly well understood. As it happens, our two models for explaining the structure of Kinds can both be applied to such cases. There is nothing wrong with that. The truth is that diseases happen *both* to reproduce themselves *and* to do so by giving all new instances a common intrinsic physical property.

What then about biological species? At first pass it might seem that they will come out like infectious diseases, as both historical and eternal Kinds. Members of a species owe their shared properties to their common ancestry, but at the same time species reproduce themselves by imbuing their members with intrinsic genetic cores. In the section after next, however, we shall argue against this picture. In our view, there are good reasons for viewing species as historical and not eternal Kinds. First, though, it will be useful to discuss Devitt’s views about historical species essences.

**IV Devitt on (Partly) Historical Essences**

Devitt holds that biological species have an essence that is partly intrinsic, but also partly historical. However, he is thinking of the historical element quite differently from us.

Devitt (2008, 2010, forthcoming) follows Ernst Mayr (1961) and Philip Kitcher (1984) in distinguishing two explanatory questions:

(1) Why do the members of a species each develop their range of shared phenotypic properties?

(2) What led to there being a species whose members develop this range of phenotypic properties?

The first question is about the ontogeny of the shared properties in species members, the second about the phylogeny of the species itself. Mayr called these two questions “proximate” and “ultimate” respectively. Devitt prefers Kitcher’s terminology of “structural” and “historical” (2008, 351-5). For the moment we shall follow him in this.

In Devitt’s view, the first structural question demands an answer in terms of intrinsic essences. There must be something inside tigers, say, that make them all develop their shared characteristics. There has to be something about the very nature of the group—a group that appears to be a species or taxon of some other sort—that, given its environment, determines the truth of the generalization” (2008, 352).

As Devitt sees it, then, historical essences only come in when we turn to the other, historical, question about what made the generalizations about the species true in the first place. Once we are looking for historical explanations of species, we should expect to bring in a historical element. The historical component in a species’ essence will be that part of its nature that explains how the species came to exist. And this, Devitt allows, will include an account of how the members of the species descended from earlier organisms. (Devitt forthcoming.)

A relatively minor point first. We are not persuaded that the notion of essence has much work to do with the Mayr-Kitcher question about evolutionary, plausibly adaptive, history. As we see it, talk of essences earns its keep when we need to explain a body of generalizations characteristic of a Millian Kind (for some C, many truths of the form *All Cs are F*). We don’t see why questions about the historical origin of species traits’ raise an explanatory challenge of this Millian form, and so to this extent think Devitt’s commitment to (partly) historical essences seems misplaced.

But let that point pass. (Perhaps some way can be found way of pressing the ultimate or historical question into Millian form.) The more basic issue is that we, unlike Devitt, are thinking of historical essences as answers to the first proximate question (1); not the historical question (2). When we say that literary works and religions are Kinds with *historical essences*, we are aiming to explain the proximate fact that their instances all display a great number of commonalities, and saying that this is due to their all being copied from a common source. We aren’t addressing questions about the *origins* of literary works or religions, so far at least, but only the striking fact that their instances display multiple similarities. (At this stage we need to note how Devitt’s use of the term “structural” for questions of type (1) prejudges the case against historical answers to such questions. To the extent that “structural” implies an answer in terms of intrinsic rather than historical properties, the terminology simply rules out the alternative historical option by fiat. Given this, we shall revert henceforth to Mayr’s original term “proximate”.)

We are thus thinking of historical essences quite differently from Devitt. For us they explain proximate multiple similarities, not historical origins. By way of further evidence for this difference, note that we have no need to answer a question that much perturbs Devitt, and occupies most of his paper “Historical Biological Essentialism”. From Devitt’s perspective, a historical species essence explains how the species emerged historically, and so needs to be informative about *which* ancestors constitute this essence. (Devitt argues that this challenge can only be met by identifying them as ancestors with a certain *intrinsic* essence; for him, it seems, this provides a further reason why species essences must be partly intrinsic.) By contrast, our appeal to historical essences imposes no demand that we give a criterion for species emergence. Since we are not concerned with the historical origins of species, we can by-pass such issues.

By way of analogy, consider a request for an explanation of the properties common to all Christians. We would say that the members of this Kind display so many common features because they are all influenced by a common historical source. This seems the right answer. But it doesn’t require us to be specific about when Christianity started. Maybe we should date it from Jesus, or from the first Pope, or from the Council of Nicea. But our historical account of the Kind would seem to stand up perfectly well whichever we do. (Perhaps there are issues for which a definite demarcation of Christianity, and of species membership, matters. But answering proximate questions about Kinds aren’t among them.)

**V Historical Over Intrinsic Essences**

We are thus left with the proximate question about biological species. Why do their members all share so many properties? As we have seen, one answer would be to assimilate species to eternal Kinds, as Devitt does, and appeal to the common genetic make-up intrinsic to each member. But an alternative would be to view species as historical Kinds, and attribute their shared properties to their common ancestry, with their genetic make-up simply being part of the species’ copying mechanism.

It might seem then that there is no good reason to favor one perspective over the other. If historical essences are just as legitimate as intrinsic ones, why should it matter that we can view biological species in two ways, each of which explains the common features of their instances? After all, the two stories can be viewed as complementary, showing how species are *both* like eternal kinds *and* like historical kinds, in line with our earlier analysis of infectious diseases.

In this section we would nevertheless like to suggest that there are at least two reasons to reject the assimilation of species to eternal Kinds and to view them as instead fundamentally historical. The first is to do with non-zygotic inheritance. The second is to do with species that reproduce by fission.

Non-zygotic inheritance first. It is often said that “acquired characteristics are not inherited”. But this dictum needs to be handled with care. It is of course true that acquired characteristics are not inherited *through the sexual bottleneck*. The children of a skilled forager will not of course inherit her skills simply from the genetic material she bequeaths them. But they might well inherit her skills in other ways—for instance, by her explicitly training them, or by their implicitly copying her tricks. In this sense, there is nothing at problematic about the inheritance of acquired characteristics. Of course offspring tend to resemble their parents in many ways that owe nothing to genetic inheritance, courtesy of various modes of social learning.

One common theme in much recent biological thinking is that this kind of inheritance can be just as important to the evolution and nature of biological species as genetic inheritance. Developmental systems theorists (Oyamaet al2003) and epigenetic evolutionists (Jablonka & Raz 2009) have emphasized how many inherited traits that are regarded as characteristic of species don’t go through the zygotic sexual bottleneck. Discussed cases include, habitat-imprinting mechanisms for insects, mating songs in killer whales, sexual preferences in birds, and tool use in chimpanzees and in humans.

It may be difficult to quantify the importance of such non-zygotic inheritance for the evolution of species. But there is no reason to think that it is a marginal phenomenon. Natural selection can operate on the variation of *any* phenotypic traits as long as these traits confer heritable variation of fitness–and so regardless of whether these heritable variations are caused by genetic or by non-genetic factors (Mameli 2004, 39). Given this, we can expect the traits that are systematically shared among species members to contain elements that depend on non-zygotic channels of inheritance as well as genetic ones.[[7]](#footnote-7)

It is worth emphasizing that the point we are making here is not just a denial of genetic determinism. Devitt is of course aware that few if any species-characteristic phenotypic traits are purely genetic, in the sense of being caused entirely by genetic factors, without any assistance from the environment.[[8]](#footnote-8) That is not the current issue. Rather we are observing that nothing requires characteristic traits shared by species members to depend on genetic inheritance *at all*. Genes are just one of the means by which parental characteristics are passed on to children.

This kind of non-zygotic inheritance is in obvious tension with supposing that intrinsic essences are always the proximate explanation of the common features of biological species. It might seem natural to suppose that such proximate explanations must appeal to material present in the zygote. Why do all tigers grow up the same, and different from zebras, even though tigers and zebras are subject to just the same environmental influences? What could explain that, except their shared genetic make-up? Well, the answer is that tigers and zebras aren’t subject to just the same environmental influences. Tigers are raised by tigers, while zebras are raised by zebras, and many of their species-characteristic properties can be due to this in itself – without any assistance from their genes.

That is the first reason why we think biological species should be counted as historical Kinds rather than eternal ones. Not all species-characteristic properties can be proximately explained by intrinsic genetic properties that are present in the zygote. Some shared characteristics derive from other ways in which parents are copied by their offspring. We can account for all the cases if we view species as historical Kinds, whose shared properties are due to copying mechanisms, in a way we can’t if we view them as eternal Kinds.

The second reason for denying that species have intrinsic essences relates to species that don’t reproduce zygotically period. Bacteria and some single-celled protists multiply solely by cellular fission. There seems no good reason to think of the similarities in such species as deriving from some essential inner core, rather than historically from the copying process of cellular mitosis.

As we have just seen, to the extent that there is an the argument for intrinsic essences, it hinges on the thought that it can only be the genetic material present in the zygote that explain why all members of a species grow up to display the same traits. We have already seen that this thought isn’t watertight even for organisms that do develop from zygotes. But, apart from that, it gets no grip at all on organisms that don't so develop, but are born full-grown, so to speak.

We don’t think all the pound coins pressed from some mould must have some common inner essence to explain why they share their many other joint properties. No more should we think this of the members of non-zygotic species. In both cases, the explanation of the shared properties is much simpler. The instances are all copied from the same original, and share properties for that reason. They haven’t developed into complex organisms from single cells that must therefore contain the source of their similarities. Since they don’t grow and develop, no inner essence is needed to explain why they do so the same way.[[9]](#footnote-9)

Bacteria and single-celled protists do contain DNA. But since this does not play a developmental role, but simply contributes to the metabolic workings of the cell, it has no better claim to being the intrinsic essence of these species than their cell walls, say. These traits are all simply different features of the organism that are reproduced by the copying process of mitosis.

Those, like Devitt, who defend intrinsic biological essentialism might object that asexually reproducing single-celled organisms do not fall naturally into *species*. Without sexually interacting organisms contributing to shared gene pools, these organisms constitute simple lineages rather than any more complex biological categories. True enough. But this does not undermine the argument. Even if they aren’t species, single-celled lineages are certainly biological Kinds, with their members displaying multiple similarities. So they must still have some shared essence, some common property that explains their many shared features. In the absence of any inner developmental core, this can only be their common historical source.

Devitt himself emphasizes that his underlying concern is with Linnaean taxa in general (2008, 346). Species are just a special case. In principle, we suppose, intrinsic essentialists could restrict their claims to taxa that involve full-fledged species, and so avoid the argument from single-celled organisms. But it strikes us as preferable to have one account that works for all biological taxa, including single-celled lineages, rather than one story for species and another for lineages.

**VI Conclusion**

Michael Devitt has made an important contribution by reopening the question of biological essentialism. He is quite right to reject the contemporary dogma that biology has no need of essences. As he insists, the members of biological taxa share a multitude of properties, and this demands essential explanation. We feel, however, that he has located biological essences in the wrong place. To ask for explanations of shared properties is not yet to embrace intrinsic essences. In many cases shared properties can instead be explained by a shared history. In our view, this is the right model for biological taxa. While intrinsic essences can explain many of the shared properties of sexually reproducing taxa, a fully general account that account for all shared properties across all taxa needs to be historical.

**References**

Bach, T (2012) Gender is a Natural Kind with a Historical Essence. *Ethics*, 122(2): 231-272.

Block, N (1997) Anti-Reductionism Slaps Back. *Noûs* 31(11): 107–132.

Boyd, R (1999) Kinds, Complexity and Multiple Realization: Comments on Millikan's ‘Historical Kinds and the Special Sciences’. *Philosophical Studies* 95(1): 67–98.

Devitt, M. (2008). Resurrecting biological essentialism. *Philosophy of Science*, *75*(3), 344-382.

Devitt, M. (2010) Species have (partly) intrinsic essences. *Philosophy of Science* 77(5): 648-661.

Devitt, M (forthcoming) Historical biological essentialism.

Godman, M (2015) The special science dilemma and how culture solves it. *Australasian Journal of Philosophy,* 93(3): 491-508.

Godman, M (2016) Cultural syndromes: socially learned but real. *Filosofia Unisinos*, 17(2): 185-191.

Jablonka, E & Raz, G (2009) Transgenerational epigenetic inheritance: prevalence, mechanisms, and implications for the study of heredity and evolution. *The Quarterly Review of Biology*, 84(2), 131-176.

Kim, J 1992 Multiple realizability and the metaphysics of reduction. *Philosophy and Phenomenological Research* 52(1): 1–26.

Kitcher, P. (1984). Species. *Philosophy of Science*, 51(2): 308-333.

Mameli, M (2004). Nongenetic selection and nongenetic inheritance. *The British Journal for the Philosophy of Science*, 55(1): 35-71.

Mayr E (1961) Cause and Effect in Biology. *Science* 131: 1501–1506.

Millikan, R G (1998) A common structure for concepts of individuals, stuffs, and real kinds: More Mama, more milk, and more mouse. *Behavioral and Brain Sciences*, 21(1): 55-65.

Millikan, R G (1999) Historical kinds and the special sciences, *Philosophical Studies,* 95: 45-65.

Millikan, R G (2000) *On clear and confused ideas: An essay about substance concepts*. Cambridge: Cambridge University Press.

Oyama, S Griffiths, PE & Gray, R D (Eds) (2003). *Cycles of contingency: Developmental systems and evolution*. Harvard: MIT Press.

Papineau, D (2009) Physicalism and the Human Sciences, in *Philosophy of the Social Sciences: Philosophical Theory and Scientific Practice*, ed. C. Mantzavinos, Cambridge: Cambridge University Press: 103–23.

Papineau, D (2010) Can any Sciences Be Special? in *Emergence in Mind*, ed. C. Macdonald and G. Macdonald, Oxford: Oxford University Press: 179–97.

Ruphy, S (2010) Are stellar kinds natural kinds? A challenging newcomer in the monism/pluralism and realism/antirealism debates. *Philosophy of Science*, *77*(5), 1109-1120.

1. It is even possible to regard *individual* animals, like Dobbin, and other persisting objects, like my car, as examples of Millian kinds. Think of the “members” of such kinds as their temporal stages. Then the “members” of Dobbin will not only share the features common to all horses, but also a certain size, colour and funny scar on his right ear. Again, the stages of my car won't only share the features common to all Vauxhall Zafiras, but also the tow ball I added and the dent in the bonnet. Unfortunately we will be unable to pursue this important topic further here (see Millikan 1999; 2000, 23 ff.). [↑](#footnote-ref-1)
2. Perhaps there are other sort of Kinds. One possibility is functional Kinds, whose instances share properties because they have been selected for the same purpose. Biological analogues, such as aerial insectivores, could arguably qualify here. But Kinds of this sort tend to be thin, with a relatively limited range of generalizations covering their members (Papineau 2009, 2010, Godman 2015). This is why biologists generally view homological classification as more important than analogical. [↑](#footnote-ref-2)
3. Note that it is the structure of the molecules that matters, not their chemical formulae. Isomers are chemical compounds whose molecules contain the same constituent atoms, but which have very different properties because of the way the atoms are arranged. [↑](#footnote-ref-3)
4. Perhaps, as Devitt has pointed out, the word “eternal’ is less than ideal (*personal correspondence*). The members of an eternal Kinds can be short-lived and in constant flux. Think of supernovae. But we shall stick to Millikan’s terminology. “Eternal” Kinds simply means those with intrinsic essences. [↑](#footnote-ref-4)
5. Non-reductive physicalists hold that there are “special sciences” whose laws range over types whose instances share no physical properties. Some critics have argued that this supposed physical heterogeneity is in tension with substantial laws [Kim 1992; Block 1997; Papineau 2009; 2010]. But this argument carries little weight against historically grounded special sciences. Historical categories conform to multiple generalizations because of shared origins, not shared physical natures [Millikan 1999; Godman 2015]. [↑](#footnote-ref-5)
6. In fact Devitt argues the point in general for all biological taxa, and focuses on species only for simplicity. We shall follow him in this. Note that all the points which follow apply to other taxa too. [↑](#footnote-ref-6)
7. From a traditional point of view, a change in gene-pool frequencies is necessary for evolution by natural selection. The position we are defending denies this. A change in the frequency of non-zygotically inherited traits can be driven by natural selection without any changes in gene frequencies. (See Mameli 2004). [↑](#footnote-ref-7)
8. See e.g. Devitt 2008, 352. [↑](#footnote-ref-8)
9. These points apply to some other biological species that reproduce non-sexually. Aspen trees and many *crassulaceae* reproduce largely vegetatively; to that extent their offspring are developed multi-cellular organisms, and so the similarities they share are in in no need of explanation by inner essences. [↑](#footnote-ref-9)