

# **Do we need to be essentialists about biological species to show that they are explanatorily useful?**

Extrinsic (relational) properties of biological species include properties such as having a common ancestor, and sharing the same habitat. Intrinsic properties of biological species include properties such as having a tail, and having a certain genetic composition. Devitt (2008) argues that biological species have essential intrinsic properties. Although Devitt's opponents give a good critique of his claim about intrinsic properties, they overlook his reliance on explanatory essentialism – the claim that biological species need to have essential properties, whether extrinsic or intrinsic, in order to be explanatorily useful. This oversight is too generous a concession for anti-essentialists to make, because it leaves room for an argument for extrinsic biological essentialism. In order to defend anti-essentialism, I argue against explanatory essentialism by making a case for explanatory pluralism about biological species.

I use the first three sections of this essay to explain my focus on explanatory essentialism. In the first two sections, I summarise the main arguments for and against Intrinsic Biological Essentialism, showing that the central point of contention is whether or not there are theoretically important properties shared by all and only members of a species. In the third section, I show how Devitt argues that biological species must have such properties because they feature indispensably in certain types of explanation.

The fourth and fifth sections directly discuss the claim that biological species need to have essential properties in order to be explanatorily useful. In the fourth section, I argue that some otherwise powerful responses to Devitt neglect to question this claim. I then show why this is a problem for anti-essentialists, giving an argument for extrinsic essentialism from explanatory essentialism. In the fifth section, I present a challenge for explanatory essentialism: if explanatory essentialism is true, then explanations need to converge on one sort of property, whether intrinsic or extrinsic. I show that there is no such convergence when it comes to biological species. In effect, I argue for explanatory pluralism about biological species, which I recognise is closely linked to pluralism about biological species concepts. I conclude that we must

and can reject explanatory essentialism by accepting explanatory pluralism. Only then can we show that biological essentialism, especially in its extrinsic form, has really ‘died’.

## **Sections 1-3: the debate about biological essentialism**

In these three sections, I give a definition of Intrinsic Biological Essentialism and a general form of argument for it. I summarise the arguments against it, and then reconstruct Devitt’s argument from explanation.

### **1. Intrinsic Biological Essentialism: definition and general form of argument**

Devitt (2008, p.346) argues that “Linnaean taxa have essences that are, at least partly, intrinsic underlying properties”. He calls this doctrine “Intrinsic Biological Essentialism”. I look at each of these notions in turn to clarify the issue under discussion.

#### **1.1 Intrinsic**

According to Devitt (2008, pp.345-6), essences can be fully intrinsic, partly intrinsic and partly extrinsic, or fully extrinsic. Chemical elements have fully intrinsic essences – all and only samples of Plutonium share the microstructural property of having the atomic number 94. The essence of being a pencil is partly intrinsic and partly extrinsic. Being a pencil is “partly being an instrument for writing, which an object has in virtue of its relation to human intentions, and partly having the sort of physical constitution that distinguishes it from a pen, which an object has intrinsically” (2008, p.346). The essence of being Australian is fully extrinsic. All that is required for something to be Australian is for it to stand “in the right relation to Australia” (2008, p.346).

#### **1.2 Biological**

Devitt (2008, p.346) applies his argument to all the Linnaean taxa (kingdoms, phyla, classes, orders, families, genera, species, and even narrower levels like sub-species). Nevertheless, like Devitt, I focus on the taxonomic level of species. Essentialism about biological species has been discussed more than essentialism about taxa at any other levels, and for good reason – species are taken to be the basic unit of

biodiversity and evolution (Richards 2010, p.1). The case for biological essentialism is supposed to be strongest when it comes to species. If I show that species do not have essences, then I will have challenged Devitt's attempt to establish essentialism for all the Linnaean taxa.

### 1.3 Essentialism

Devitt starts off by defining 'essential property' and 'an essence':

“A property *P* is an *essential property* of being an *F* iff anything is an *F* partly in virtue of having *P*. A property *P* is *the essence* of being an *F* iff anything is an *F* in virtue of having *P*. The essence of being *F* is the sum of its essential properties.” (Devitt 2008, p.345)

The main idea we might get from the examples in 1.1 is that essences are uniquely shared properties. This gives us one condition for essentialism, which is also found in Okasha (2002, p.202), Ereshefsky (2008, p.101) and Sober (1980, p.353):

*Uniting Condition*: for a collection to have an essence, it is necessary that all and only the members of that collection share some property (or properties).

However, there is also agreement on the need for a further condition for essentialism. The reason for this is a general problem for essentialism, which can be called the 'triviality objection': essentialism characterised merely in terms of uniquely shared properties can be trivially satisfied. Sober's (1980, p.354) example of a trivial species essence is a list of the spatio-temporal locations of any collection of organisms. Lewens (2012a, p.752) picks up on this general objection when he points out that it will always be the case that “some pattern of genes – in the sense of some pattern of genotypic variation across the species as a whole – is common and peculiar to tigers”. Essentialism is rendered trivial if there are too many different shared properties across species members. The characteristic pattern of properties picked out as 'essential' by the Uniting Condition – and there will always be one – is generated by simply “enumerating whichever genes actually cause the instances of species-typical phenotypic properties” (Lewens 2012a, p.753).

Devitt does not tackle the triviality objection explicitly, but his definition of essentialism does suggest that there is more involved than the Uniting Condition. The

required relationship between  $F$  and  $P$  is put in terms of being an  $F$  “in virtue of” having  $P$ . I suggest that the constraint on what counts as an essential property forms a second condition for essentialism:

*Explanatory Condition:* for a collection to have an essence, it is necessary that all and only the members of that kind share some theoretically important property (or properties).

The need for shared properties to be ‘theoretically important’ (Dupré’s phrase; 1981, p.68) is agreed upon across the literature on biological essentialism, but ‘theoretical importance’ is cashed out in widely various ways. There are appeals to important shared properties (Okasha 2002, p.194, Dupré 1981, pp.67-9), contribution to laws, induction, and explanation (Griffiths 1999, p.209, p.215; Sober 1980, p.354), and properties shared as “a matter of fact not logic” (Boyd 1990, p.127). As my label suggests, Devitt takes the ‘theoretical importance’ of a property to be its explanatory importance.

Before examining Devitt’s suggestion, I want to show where his argument fits into the debate about essentialism. I give my own reconstruction of a general form of argument for Intrinsic Biological Essentialism, and then summarise the common arguments against it.

#### **1.4 A general form of argument for Intrinsic Biological Essentialism**

In 1.2, we narrowed down the scope of biological essentialism to being about a collection of organisms at the taxonomic level of species. From 1.3, we see that for any collection to have an essence, it must satisfy the Uniting Condition and the Explanatory Condition. Thus, species must satisfy these two conditions in order to have an essence. This requirement can be summarised as:

- A. The theoretically important properties shared by all and only members of a species are the essence of that species.

To get Intrinsic Biological Essentialism, essentialists must show:

- B. The theoretically important properties shared by all and only members of a species are intrinsic.

From A and B, we get the conclusion that Intrinsic Biological Essentialism is true:

C. The essence of a species consists of intrinsic properties.

This is a general form of argument for Intrinsic Biological Essentialism, but it is useful to see how an analogous argument works in application to a different essentialist claim. Traditionally, the hope (or assumption) has been that the argument for Intrinsic Biological Essentialism is as successful as the argument for essentialism about chemical elements. To argue for essentialism about chemical elements, we start with:

A'. The theoretically important properties shared by all and only samples of a chemical element are the essence of that chemical element.

Microstructural properties satisfy the two conditions for essentialism about chemical elements. For example, all and only samples of Plutonium share the atomic number 94, and this property is theoretically important because it is indicative of Plutonium's other chemical properties, too. Thus,

B'. The theoretically important properties shared by all and only samples of a chemical element are intrinsic.

C'. The essence of a chemical element consists of intrinsic properties.

The microstructural correlative in the case of biological species is usually claimed to be some sort of genetic property.

Now that we have the general argument for Intrinsic Biological Essentialism, we are in a good position to outline the arguments against it. We can then see how Devitt's response fits into the debate.

## **2. The argument against Intrinsic Biological Essentialism**

Devitt (2008, pp.349-50) lists several articles as "evidence of the consensus" against Intrinsic Biological Essentialism, including Sober (1980, 1993), Griffiths (2002), Matthen (1998), Ghiselin ([1974] 1992), Dupré (1981), and Okasha (2002). I add the more recent Lewens (2012a) to this list. Although these articles proceed in different ways, they all argue against the claim that the two conditions for biological

essentialism are satisfied by intrinsic properties. In other words, they all argue against B.

First, they point to empirical evidence against the Uniting Condition for essentialism. The universality and uniqueness of any intrinsic property of a species is threatened by the processes of mutation and recombination, which lead to intra-species variation in both genetics and morphology (Ereshefsky 2008, p.101). Dupré (1981, p.85) writes that variation within a species gives it a higher chance of survival in the face of changing environmental conditions. Also, the same phenotype can be produced by different gene combinations due to homeostatic developmental mechanisms (Dupré 1981, p.85). Where species are in similar environmental conditions, or are of shared ancestry, they may well share traits. Research suggests that there is no strict relationship between intrinsic properties and morphology. For example, Mallarino et. al (2012a, p.16222) conclude their investigation of mechanisms underlying the variation of shape and size of bird beaks with the observation that “different developmental programs can generate identical shapes, and similar developmental programs can pattern different shapes”. If this is so, then Devitt’s broader appeal to other intrinsic properties still does not give us essentialism. We cannot answer ‘why do members of the species *Chrysolophus pictus* have short beaks?’ with ‘because they have such-and-such a developmental program’. Finally, as Okasha (2002, p.196) writes, a brief consideration of the variety within the species *Canis familiaris* (the domestic dog) illustrates the difficulty of identifying universal and unique traits.

Second, opponents of intrinsic essentialism argue against the Explanatory Condition by appeal to the processes identified by evolutionary biology. These processes undermine claims to the theoretical importance of microstructural properties for several reasons. Sober (1980, p.353) writes that essentialism depends on a natural state model – that is, the essentialist assumes that we can identify some set of traits as natural, discounting others as results of interfering forces. However, Sober continues, such a model ignores the way that the relativity of phenotypes to the environment disallows a distinction between traits that are ‘natural’ or not. We can illustrate what Sober means with this example: the concentration of leaf chlorophyll of a single beech tree is ‘natural’ for its species only relative to its environment, and no environment is privileged. Sober (1980, p.380) contends that even if there were

some character shared by all and only organisms in a species, the explanation for internal homogeneity “would be given in terms of the selection pressures acting on the population”, not in terms of genetic similarity.

Therefore, it is by arguing against B that most anti-essentialists get to Sober’s (1980, p.353) oft-quoted verdict that “essentialism about species is today a dead issue”. In the next section, we see that Devitt’s appeal to explanation is a reply to this criticism.

### **3. Devitt’s argument from explanation**

It may seem strange that Devitt (2008, p.347) attempts to argue that species must have some essential intrinsic properties (even if their essences are not fully intrinsic) in the face of an anti-essentialist consensus. The best way to understand this is to see his appeal to explanatory power as an argument against the triviality objection to essentialism. Devitt accepts that essences need not be fully intrinsic, and suggests we may not be able to identify just one genetic property as essential (2008, p.371). Still, he maintains that B is true because some shared intrinsic properties are “theoretically important” due to their explanatory power.

I now reconstruct Devitt’s argument from explanation for Intrinsic Biological Essentialism. Devitt’s claim is that we make generalisations “about the morphology, physiology, and behavior of the members of these groups” (Devitt 2008, p.351) and that being a member of a species is “not just informative but explanatory” (Devitt 2008, p.352). He groups together requests for explanation, some of which fall under what he calls ‘the taxon problem’ (2008, p.357):

*The taxon problem:* Why is organism *O* a member of species *S*?

Take the organism Ratty, of the biological species *Arvicola amphibius* (the European water vole). We might ask ‘why is Ratty a member of *Arvicola amphibius*?’ Other related questions not of this form include: ‘what makes ‘Ratty is a member of *Arvicola amphibius*’ true?’

In his discussion of Devitt’s argument, Ereshefsky (2010, p.679) groups together other requests for explanation under the ‘trait problem’:

*The trait problem:* Why do members of species *S* typically have trait *T*?

For example, ‘why do members of *Arvicola amphibius* typically have long tails?’ Other related questions not of this form include: ‘why is ‘Ratty has a tail because he is a member of *Arvicola amphibius*’ explanatory?’

Devitt (2008, pp.361-2) then argues that only intrinsic essentialism can answer these two groups of questions. This is because the alternative is to appeal to shared extrinsic properties, which “cannot bear the explanatory burden” (2008, p.363). Let’s briefly outline some relational species concepts which do rely on extrinsic properties (adapted from characterisations given in Lewens 2012a, p.752, Ereshefsky 2010, p.104, and Okasha 2002, pp.199-200):

- Biological Species Concept: species are groups of organisms which can interbreed and are reproductively isolated from other such groups.
- Ecological Species Concept: species are groups of organisms which occupy the same ecological niche (use the same environmental resources and habitats).
- Phylogenetic Species Concept: species are groups of organisms which form a branch on a family tree of life constructed according to speciation and extinction events.
- Phenetic Species Concept: species are the largest groupings whose members bear a certain minimum degree of overall similarity to each other, based on how many traits they share.

For the taxon problem, we might employ the Biological Species Concept and say that an organism *O* is a member of species *S* because it can interbreed with other members of *S* to produce fertile offspring. Devitt (2008, p.361) argues that this cannot explain why any organism is an *S* in the first place. Saying Ratty is a member of *Arvicola amphibius* does not explain why the other organisms are members of *Arvicola amphibius*. Nor does it explain why Ratty can interbreed with members of *Arvicola amphibius* and not others. Similarly, the explanatory power provided by the Phenetic Species Concept is minimal, if any. It licenses purely inductive inferences. For good explanations, we seem to need intrinsic, essential properties – genetic codes or “developmental programs” (Devitt 2008, p.351).

There are similar challenges when it comes to the trait problem. Ereshefsky (2010, p.680) sees Devitt as arguing that the generalisations encapsulated by the trait



problem must be true in virtue of intrinsic properties, not extrinsic properties like the organism's history or environment. To this end, Devitt employs distinctions between historical and structural explanation, and ultimate and proximate causes (the distinctions are made by Mayr, 1961). A historical explanation may well provide the 'ultimate' causes of a trait, but the 'proximate' causes come as part of a structural explanation, "in terms of underlying structures and mechanisms instead" (2008, p.352). We can use an example to elucidate these distinctions. Ratty has a long tail because of his intrinsic features – developmental mechanisms that usually cause wolverines' tails to grow. These developmental mechanisms may well have been present in Ratty because of his genealogical relations (their ultimate causes). Nevertheless, intrinsic properties (proximate causes) must be there in order to give a structural explanation of the generalisation, given Ratty's environment (2008, p.352). And "so on through indefinitely many structural questions about the morphology, physiology, and behaviour of species" (Devitt 2008, p.363). We cannot, after all, explain the hardness of the Eureka Diamond in terms of its relation to the Florentine Diamond, but rather by appeal to the intrinsic essential properties of diamonds. The claim is that the same applies to biological species and their intrinsic properties.

Devitt admits that extrinsic notions of species might be useful in answering a different question: "in virtue of what are F's a subspecies, a species, a genus, etc.?" (2008, p.357). Even here, Devitt says that intrinsic essentialism must be involved, because we need to explain why organisms have the characteristics that the Biological Species Concept or Ecological Species Concept use to classify them into species. Members of species can interbreed or occupy the same niche because of their shared intrinsic properties (2008, p.361).

In summary, Devitt's argument is:

- (1) We make explanatory intra-species generalisations.
- (2) Extrinsic properties cannot support the explanatory power of intra-species generalisations.
- (3) Intrinsic properties can and do support the explanatory power of intra-species generalisations.

To get Intrinsic Biological Essentialism, Devitt must make the link between the theoretical importance and explanatory power:

- (4) A property that supports the explanatory power of intra-species generalizations has the sort of theoretical importance that makes it an essential property.

From (4), we get B, and from that C: Intrinsic Biological Essentialism.

Devitt uses explanatory power as a measure of theoretical importance. He claims that there is no need to worry about there being an “*ad hoc* identification” of intrinsic properties as essential (2008, p.371). This applies even if the essence ends up being partly extrinsic, or if there are indeterminate boundaries between species (2008, pp.373-5). Thus, Devitt’s argument is an attempt to establish B. He tries to show that some pattern of shared intrinsic properties across each species does have theoretical importance on the grounds of its explanatory power.

## **Sections 4-5: explanation and essentialism**

We have seen that Devitt’s claim about explanatory power is central in his contribution to the debate about essentialism. Now, I show that Devitt’s opponents have overlooked his underlying explanatory essentialism, and that this threatens their otherwise effective arguments for anti-essentialism. I then argue against explanatory essentialism by arguing for explanatory pluralism, thus defending anti-essentialism.

### **4. The problem: an argument for extrinsic biological essentialism**

Devitt’s opponents have left room for an argument for extrinsic essentialism. This is not to say that they conclude that extrinsic properties supplant intrinsic properties as species essences. In fact, quite the opposite – Lewens (2012a, p.751) sees himself as ‘shoring up’ the “anti-essentialist consensus”. Although Ereshefsky (2010) argues that relations can be explanatory in biology, he rejects all new forms of essentialism about biological taxa. Rather, the challenge is that Devitt’s critics have not put the final nail in the essentialist coffin. To do so, this argument for extrinsic essentialism must be dealt with.

In general, critics allow the argument for extrinsic essentialism because they focus on arguing against Devitt’s claim about explanatory intrinsic essences (“microessences”):

*Explanatory Intrinsic Biological Essentialism*: “if species membership can be explanatory, species must have explanatory microessences” (Lewens 2012a, p.753)

Critics tend to employ some of the arguments against intrinsic essentialism given in section 2 to weaken the intrinsic essentialist claim to (3) (see above), and then they show that (2) is false. To give an example, Lewens (2012a) draws on arguments given in section 2 to show that there is no pattern of intrinsic properties that unite members of a species. He uses this to make the triviality objection – Devitt is in danger of “trivialising the notion of essence” (2012a, p.752) if we end up simply “enumerating whichever genes actually cause the instances of species-typical phenotypic properties” (2012a, p.753). Then, Lewens (2012a, p.753) argues that relational species concepts can be explanatory, thus showing (2) to be false.

Despite the strengths of these criticisms, the problem with this way of arguing against Devitt is that it does not explicitly tackle (4). With the focus on intrinsic essentialism, (4) may not seem like a major point. However, in order to argue that (2) is false, Devitt’s critics show that:

(5) Extrinsic properties can and do support the reliability and explanatory power of intra-species generalisations.

From A, (4) and (5) we get the extrinsic essentialist analogues to B and C:

B". The theoretically important properties shared by all and only members of a species are extrinsic.

C". The essence of a species consists of extrinsic properties.

Accepting (4) is actually a generous concession to essentialists. Underlying (4) is Devitt’s explanatory biological essentialism:

*Explanatory biological essentialism*: if species membership can be explanatory, species must have essences, whether fully intrinsic, fully extrinsic, or partly both.

If we accept explanatory biological essentialism, and if a uniting pattern of explanation is discovered that involves extrinsic properties, then extrinsic biological essentialism is true.

It is not just Lewens and Ereshefsky who leave room for this argument for extrinsic essentialism. Other critics of intrinsic essentialism are open to this sort of argument, too. Griffiths (1999) even uses an argument along these lines to support extrinsic essentialism. Also, Griffiths reads Sober as saying that given the right choice of extrinsic properties, we could be Darwinian essentialists (Griffiths 1999, p.210; citing Sober 1980, p.209). Indeed, Devitt (2008, p.350) claims that there is a consensus that “if the essence of a species is not in the least intrinsic then it must be entirely relational”. As evidence, he cites Sterelny and Griffiths (1999, p.8), Okasha (2002, p.202), Ereshefsky (2001, p.209), Milikan (2000, p.19) and Hull ([1978] 1992, p.313).

Therefore, we can see that the appeal to shared intrinsic properties is not the foundational error in Devitt’s argument for essentialism, problematic as it is in application to biological species. Instead, the crucial point is Devitt’s claim that essential properties are those with explanatory power. In examining (4), we must deal with the question of whether or not we need to be essentialists about biological species to show that they are explanatorily useful. To show that biological essentialism, particularly in its extrinsic form, has really ‘died’, we need to show that it is not true that a property supporting the explanatory power of intra-species generalizations has the sort of theoretical importance that makes it an essential property.

## **5. The solution: explanatory pluralism about biological species**

As noted above, the appeal to theoretical importance is an attempt to answer the triviality objection. Explanatory power is supposed to distinguish between essential and non-essential properties in a way that preserves the traditional notion of essentialism. In Lewens (2012a, p.753) we see that this does not work with intrinsic properties, because there is great intra-species variation. A similar objection applies to extrinsic essentialism. Ereshefsky touches on this objection when he argues against including extrinsic properties as part of the essence of a species. He maintains that this gives us too general a notion of essence, leaving us with an “open-ended disjunction of all the intrinsic and extrinsic properties that cause the properties typically found in the members of a taxon, plus those phylogenetic and population relations that bound those properties” (2010, p.683). Like Lewens, Ereshefsky does

not recognise how this objection applies to explanatory essentialism. I now give my own argument against explanatory essentialism about biological species, by showing how the triviality objection applies to extrinsic properties, too.

For there to be non-trivial explanatory essentialism in general, there needs to be convergence in explanation on one sort of property, whether intrinsic or extrinsic. If one type of property explained everything, we would be essentialist about that property, even if it were extrinsic. Imagine that the distance of the sun from the Earth explains all the physical processes that occur on Earth. We would then be essentialist about the physical processes on Earth according to its distance from the sun (an extrinsic property). This also works for intrinsic essentialism about chemical elements – the atomic number of an element explains its other properties. If being malleable had one explanation in terms of the atomic number of an element, and being dense had an explanation which made no reference to the atomic number, we would have reason to doubt any claim to essentialism about chemical elements. As it turns out, explanations do converge on the one property of the atomic number of chemical elements.

To get extrinsic explanatory biological essentialism, there must be a determination of each species by ancestry or some other relational formula which is central in explaining everything about that species. If there are too many different explanatory extrinsic properties across species, then we end up with a trivial sense of essence again.

Therefore, to show that we do not need to be essentialists about biological species, we have to show that explanations involving biological species do not converge on one sort of property. To do this, two claims must be argued for. The first claim is that actual explanatory practice does not converge on one sort of property when it comes to biological species. The second claim is that there is no reason to believe that each type of explanation appeals to only one type of property. This second claim is needed because the first claim is insufficient to show that explanatory biological essentialism is false. If there is independent reason to believe that each type of explanation appeals to only one type of property when it comes to biological species, then explanatory essentialism is vindicated.

Before I argue for these two claims, I should admit that there are complex and controversial problems behind the current discussion which I am not able to solve here. This is especially the case with the problem of explanation. I cannot even go into the argument of whether or not one type of explanation is privileged in biology. Nor can I argue that there are clear distinctions between the properties and types of explanations I write about.<sup>1</sup> All I set out to show here is that there are many properties and types of explanations, even if not clearly distinguished, involved in explanation when it comes to biological species. If I argue for both my claims, I show that there is a strong case for pluralism about explanation when it comes to biological species. This is all I need in order to show that explanatory power does not distinguish those properties which are essential in the traditional sense.

### **5.1 Actual explanatory practice does not show convergence**

In this section, I make my case by looking at the explanations found in Lewens (2012a), Sober (1980), Griffiths (1999), Ereshefsky (2010) and Okasha (2002). First, I show that they appeal to many different types of properties, extrinsic and intrinsic. Second, I show that these explanations fall under many different types of explanation.

#### **5.1.1 No convergence on one type of property**

Lewens (2012a) lists many explanations which appeal to a variety of extrinsic properties. We can explain why tigers are stripy “by reference to the properties of their ancestors” as long as “inheritance is reasonably faithful” (2012a, p.753). However, he also lists explanations involving diverse relational structures, which “may include mutational biases, canalisation, likely mate-pairings, typical environmental conditions, typical environmental preferences, ongoing selective influences and so forth” (2012a, p.753). The relations themselves also vary “between individual organisms, and between organisms and their developmental and selective environments” (2012a, p.753). Elsewhere, he notes an appeal “to largely stabilised selection regimes, developmental influences and so forth to explain the three strikingly different adult male morphs of the marine crustacean species *Paracerceis sculpta*” (2012a, p.753).

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<sup>1</sup> In fact, Devitt (2008, p.352) himself assumes such clear distinctions when he adopts Mayr’s distinction between proximate and ultimate causes, and historical and structural explanations. If there are these clear distinctions, then there is an even stronger case against Devitt.

Lewens uses these examples to show that extrinsic properties can be explanatory. Nevertheless, some of them, especially large relational structures like a ‘developmental environment’, also involve many different intrinsic properties. Lewens admits that genetic as well as intrinsic developmental mechanisms can “partly” explain the stripes on an individual organism. This explanation sometimes generalises to a whole species because such mechanisms make for a “reliable tendency” to produce tiger-like organisms (Lewens 2012a, p.753).

Sober (1980) uses several different extrinsic properties in his explanations. He argues that under population thinking, variability within one generation is explained by appeal to variability in previous generations along with facts about the transmission of variability (1980, p.365). Because he argues against the Natural State Model, he also stresses explanation by appeal to environmental conditions. For example, “the height of a single corn plant genotype might vary according to environmental differences in temperature...” or the variation may be due to “the absence of trace elements in the soil” (1980, pp.374-5). Where there is internal homogeneity of species, such as in controlled environments, then explanation should not be in terms of intrinsic properties at all, but “given in terms of the selection pressures acting on the population” instead (1980, p.380).

It is also no surprise that Griffiths (1999), who supports extrinsic essentialism, appeals to many different properties in his explanations. To him, essence is “whatever causally explains maintenance of same property correlations throughout set of instances of the kind” (1999, p.218). Relevant properties include anything from shared microstructures to social conventions. Griffiths mentions extrinsic properties such as shared ancestry, situation in an ecological niche, and the relational structure of natural selection (1999, p.209, p.219, p.222). He also gives explanations in terms of intrinsic properties, such as genes and intrinsic developmental systems (1999, p.219, p.221). Indeed, Griffiths writes that phylogenetic inertia (the endurance of certain traits) itself has two possible explanations, one intrinsic and the other extrinsic (1999, p.220). Traits may be “entrenched” because they are developmentally linked to other traits, or are easy for a specific kind of developmental system to generate, like the fused segments of crustaceans (1999, p.221). Or, traits may be “entrenched” because of extrinsic properties – some traits are “selectively maintained”, like blindness in cave-dwelling organisms (1999, pp.220-1). Similarly, Okasha (2002, p.204) suggests

that explanations should focus on the “genotype and its developmental environment”. Ereshefsky (2010, p.683) appeals to intrinsic “developmental mechanisms” as the main source of explanation when it comes to biological species.

Devitt (2008, p.363) simply assumes that the “many structural questions about the morphology, physiology, and behaviour of species” will have explanations that appeal to one type of intrinsic property. However, the evidence suggests that when it comes to explaining traits of a species, or why an organism is a member of a species, there can be appeals to historical events, mechanisms, genes, natural selection, environmental conditions and more. There are many different properties used in explanations about biological species.

The variety of explanatory properties is unsurprising given the context-dependence of explanatory practice. One answer to ‘Why is that crayfish blind?’ could be the simple, ‘Because it lacks pigmented eye spots’ (Myers et. al 2014). However, the property of lacking pigmented eye spots may not be explanatory if the speaker is wondering why this crayfish is blind, unlike a member of the sighted crayfish species *Procambarus clarkia*. Lipton (1991) and David Lewis (1986) both argue that an adequate explanation must consider the contrast situation (the ‘foil’) of the explanans. We ask, ‘Why P?’ (‘Why is that crayfish blind?’), but we are really asking, ‘Why P rather than Q?’, where Q is the foil (‘...rather than sighted like this other crayfish?’). Lewis and Lipton suggest that explanation must pick out something that marks the difference between the fact and the foil (not just, ‘It has no pigmented eye spots’). Lewis (1986, pp.226-7) includes other guidelines for explanation that involve attention to context, such as the need to avoid repeating information the questioner already has. In the case of the crayfish, the members of the blind species *Procambarus lucifugus lucifugus* typically live in caves (Myers 2014), whilst the members of the sighted species *Procambarus clarkia* do not (Rogers 2000). The difference in habitat points to the need for an explanation of blindness given in terms of environmental factors, rather than intrinsic developmental mechanisms. This exemplifies and explains Griffiths’ (1999) point that there are at least two different explanations for entrenched traits. The selection of which explanatory properties are relevant depends partly on the request for information. As there are many different contexts in which an explanation might be required, it is to be expected that there are many different types of properties involved in explanation.



### 5.1.2 No convergence on one type of explanation

The examples given above also suggest that the types of explanations used when talking about biological species are many and varied. Apart from the division between explanations appealing to extrinsic properties, and explanations appealing to intrinsic properties, there are other divisions that can be made. Explanations involving ancestry and larger relational structures like natural selection seem to fall under a type of historical explanation. We can also distinguish between mechanistic explanations, environmental explanations and genetic explanations.

One objection may be that explanations which appeal to natural selection, environmental factors and genetic or developmental mechanisms are all just causal explanations. After all, essentialism is usually defined in causal terms: “The intrinsic essence is identified by its causal work” (Devitt 2008, p.371); “a kind’s essential property is causally responsible for other properties typically found among the members” (Ereshefsky 2008, p.101); essential properties must be the “causal mechanism working on each member of the species” (Sober 1980, p.355).

Nevertheless, even if we grouped all the explanations about biological species under a broad type of causal explanation, this does not discount the first point that explanations involve many different properties, both intrinsic and extrinsic. Also, like Devitt we might accept Mayr’s (1961, pp.1502-3) distinction between different types of causes. This would allow us to distinguish between different types of causal explanations, giving us a similar range of distinctions between explanations. We would still have extrinsic causal explanations, such as ecological explanations, and intrinsic causal explanations, such as genetic explanations. An answer to the question ‘why did this member of *Arvicola amphibius* build storage chambers in its nest?’ might be an ecological explanation: as watervoles feed on grasses and other vegetation, they would otherwise starve if they did not store up food for the winter. Or, it might be an extrinsic physiological explanation: a drop in temperature combined with the stimulation of surrounding vegetation affected the watervole, so that it started to build storage chambers in its nest that day (Oliphant 2003).

Furthermore, there may be non-causal explanations in biology. Sober writes that in the case of chemical elements, explanations are not given in terms of a “contingent causal force” acting on an element (1980, p.380). Giving the atomic number of an

element is not so much a causal explanation as a constitutive explanation, an account of what it is to be that element. When it comes to biological species, there may be similar constitutive explanations, or even teleological explanations. Okasha (2002, p.204) leaves this possibility open when he writes that most extrinsic properties are not “causally responsible”, or at least are “at least not the proximal explanation” for “superficial characteristics” such as morphological traits. For example, one answer to the question ‘Why does this plant look so much like this other plant?’ is: ‘Because it is of the same species’. This is a non-causal explanation under a phenetic classification of organisms, because species just are collections of organisms united by overall similarity to each other (Lewens 2012b, p.159). The answer seems to be explanatory only in a minimal sense, but it is not devoid of information. At least, it tells the questioner that there is a genuine similarity between these two plants, backed up by phenetic analysis.<sup>2</sup>

The types of explanation used when talking about biological species cannot be reduced to just one sort of constant pattern, whether extrinsic or intrinsic, that applies all the time.

## **5.2 No reason to believe that each type of explanation appeals to only one type of property**

Despite the evidence presented in the previous two sections, it may seem that there is a chance to rescue explanatory essentialism. If there is independent reason to believe that one type of explanation is better than the others, and it appeals to only one type of property, then explanatory essentialism is vindicated. Indeed, even if no single type of explanation is privileged, explanatory essentialism is justified as long as each type of explanation appeals to only one type of property.

However, we have already seen enough evidence against the claim that each type of explanation appeals to only one type of property. Our actual practice allows for pluralism in biological explanation – there are many types of explanation, and many different explanatory properties. For example, there are different properties involved

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<sup>2</sup> Mayr’s distinctions between causes, and the place of non-causal explanations in science, are by no means uncontroversial. I will not argue further for them, because the less controversial examples in the previous section provide sufficient evidence of the variety of properties used in explanations. Still, if arguments for other types of explanation are found to be convincing, they do add to the pluralist case.

in causal explanations about biological species, from the entire evolutionary history of an organism to the surrounding environmental conditions.

Nevertheless, I will examine two possible reasons to believe that each type of explanation appeals to only one type of property. The first is from consideration of different models of explanation. The second is from consideration of different species concepts. I argue that neither strongly challenges explanatory pluralism about biological species. Indeed, the second reason even reinforces explanatory pluralism.

The first suggestion is that a model of explanation could provide an independent reason to accept only one type of explanatory property. We might reject this objection outright, if we take Lipton's (2004, p.28) view that a model of explanation should align with actual explanatory practice. But suppose that Lipton is wrong, and that theory of explanation can significantly challenge current explanatory practice in biology. Even then, there is reason to believe that the common models of explanation do not provide us with an anti-pluralist argument. I demonstrate this point by examining two models of explanation: the deductive-nomological model and the causal model.<sup>3</sup>

According to the deductive-nomological model of explanation, a phenomenon is explained if it can be deduced from some law plus certain auxiliary statements concerning the explanandum (Hempel 1970). Suppose we take 'Ratty has a long tail because he is a member of the species *Arvicola amphibius*' as an elliptical deductive-nomological argument – it must presumably involve some laws governing the morphology of members of the species *Arvicola amphibius*. From the examples we have examined, it seems that if evolutionary biology has laws, they do not just involve genetics or developmental programs. Thus, the deductive-nomological model of explanation does not prevent appeal to laws about the relations between organisms instead. Nor does it imply that there is only one type of property that takes precedence in an explanation (indeed, for a full deductive-nomological explanation, presumably many types of properties must be involved).

Alternatively, Lewis and other proponents of the causal model of explanation claim that to explain a phenomenon is to give information about its causal history,

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<sup>3</sup> I do not go into the problems that face both as models of explanation – I discuss them only to make my limited point.

either by specifying some cause(s) or a causal chain (Lewis 1993). This model is useful for those who are sceptical about the status of laws in biology, but want to allow that we have many good explanations in biology all the same. If, as we have suggested, the evolutionary history of an organism is part of the causal information for why an organism has some morphological property, then it can be a good explanation. Again, this does not show that causal explanations converge on one sort of property in the case of biological species. As noted above, causal information can vary from the entire history of an organism to its habitat, and not all causal information is relevant all the time.

Therefore, consideration of the deductive-nomological and causal models of explanation alone does not show that there must be convergence to one sort of 'essential' property. This is not to say that there are no grounds to distinguish non-explanatory (merely descriptive) and explanatory information. Nor is this to say that we cannot show that causal (or other) properties are not particularly well suited to certain types of explanation. Rather, it gives us reason to reject the objection that theories of explanation give us independent reason to accept only one type of explanation, or explanations in terms of a single type of property. We are explanatory pluralists when it comes to biological species.

The second suggestion is that consideration of species concepts can help us to choose one type of explanation. Again, I do not want to go too far into the argument about whether or not there is a best type of explanation. However, it is worth discussing this suggestion because it shows that there is a close link between explanatory pluralism (when it comes to biological species) and pluralism about species concepts.

The suggestion is that each type of explanation is best suited to some particular species concept. For example, Griffiths proposes that historical explanation best suits cladistic taxa (1999, p.219), but causal explanation, appealing to gene exchange, may be more appropriate for the Biological Species Concept (1999, p.222). Alternatively, explanations in terms of natural selection are better suited to the Ecological Species Concept (1999, p.222). If we decide on a species concept, then we get one privileged type of explanation. For example, if it turns out that the Biological Species Concept is

the best way to classify organisms into species, then we will favour causal explanations which deal with intrinsic genetic properties.

However, the problem with this suggestion is that choice of species concept cannot precede the question of biological essentialism. So, it cannot precede this question of whether or not explanatory essentialism is true. Explanatory essentialism is supposed to be a way to argue for biological essentialism, which would then provide the best and clearest way to classify species (according to their essence). We cannot have an argument going from the fact that we have one species concept to the claim that there is one best type of explanation. Indeed, the many species concepts currently in use suggest the opposite – there are many types of explanation when it comes to biological species.

What we have seen so far does fit with pluralism about the very notion of species. As I have reconstructed it, much of the debate in the literature about whether or not certain properties are essential to species assumes that the species are as well-defined as chemical elements. Contrary to this assumption, part of the species problem is that we start off with “multiple, inconsistent ways to divide biodiversity into species on the basis of multiple, conflicting species concepts, without any obvious way of resolving the conflict” (Richards 2010, p.5).

A final attempt at shoring up essentialism may come from the suggestion that we could still be essentialist about each of the many different species concepts. However, we have already seen that there is no reason to believe there is any convergence on explanatory properties, even within each explanatory type. Different sorts of species concepts may be useful for different explanatory purposes – but this does not imply that any one of these different explanatory purposes converge on one sort of property.

Therefore, there is no reason to believe that each type of explanation appeals to only one type of property.

## **Conclusion**

Looking at the arguments for and against Intrinsic Biological Essentialism in the first two sections of this essay, I showed that the central notion of biological essentialism

is the claim that species have theoretically important shared properties. In the third section of this essay, we saw that Devitt's argument tries to support this claim by establishing that certain intrinsic properties are explanatorily useful. This gave us our focus on the crucial question of whether or not we need to be essentialists about biological species to show that they are explanatorily useful. In the fourth section, we saw that this question has been overlooked at the cost of accepting an argument for extrinsic essentialism. In the fifth section, I argued that biological species do not need to have essential properties, whether extrinsic or intrinsic, in order to be explanatorily useful. The explanations I examined showed no convergence on one type of property or one type of explanation. The two models of explanation we discussed were neutral regarding this topic. Furthermore, considerations of the variety of species concepts available reinforced the pluralist case. Thus, I rejected (4):

- (4) A property that supports the explanatory power of intra-species generalizations has the sort of theoretical importance that makes it an essential property.

Without (4), the arguments for intrinsic and extrinsic essentialism do not go through.

Current reluctance to support pluralism about explanation when it comes to biological species might be explained by reluctance to accept pluralism about species concepts. However, if pluralism about explanation is not accepted, replies to Devitt are constrained by having to deal with the issue of essentialism on Devitt's terms. According to Devitt's presentation of the issue, the choice is between intrinsic or extrinsic essentialism to preserve explanatory power. If we argue against explanatory essentialism by adopting explanatory pluralism, we reject this choice. We do not need to (indeed, cannot) make this choice because we cannot accept explanatory essentialism at all.

Thus, the question of whether or not we need to be essentialists about biological species to show that they are explanatorily useful is central to the debate about essentialism. If we do not accept explanatory essentialism, we do not need to accept extrinsic essentialism either. Lewens, Ereshefsky and other anti-essentialists are only vindicated if they accept explanatory pluralism – and perhaps pluralism about biological species concepts along with it.

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