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Species as Individuals: Just another Class View of Species[1]

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ABSTRACT: In this paper I will present an argument that the view of species having the ontological status of individuals implies that species actually have the ontological status of classes, despite the fact that the representatives of the view that species are individuals (or SAI) claim the contrary. Representatives of the SAI view try to argue that species cannot be classes because classes cannot change. I will show that, according to the representatives of the SAI view, groups of organisms must fulfill four necessary conditions in order to be treated as species. They must be: 1. integrated and continuous spatiotemporal genealogical lineages of organisms that are their constituent elements; 2. separated from the continuous genealogical lineage, from the last known common ancestor to modern organisms, by evolutionary unity; 3. made up of organisms going through the same or similar evolutionary processes; 4. groups of organisms whose members reproduce sexually. I will also show that when these conditions are compared to the list of extrinsic essential properties made by Caplan and Devitt it will be apparent that they are the same. In conclusion I will argue that if, under the SAI view, one of the necessary conditions that groups of organisms must fulfill in order to be treated as species is that members of the species must reproduce sexually, then each member of the species must possess the same *specific mate recognition system* or SMRS, which in turn makes SMRS an intrinsic essential property of each member of the species. What follows from this is that, according to the species and individuals view, species are in fact classes.

KEYWORDS: Essential properties – ontological status of species – species as individuals – species as classes – specific mate recognition system.

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1. Species as individuals view

According to Wilkins (2009), the view that species have the ontological status of an individual is the only new philosophical position of the species since the modern synthesis. The author who first presented "the species-as-individuals view" (henceforth "SAI view") is a biologist, Michael Ghiselin in the paper called "On Psychologism in the Logic of Taxonomic Controversies" (see Ghiselin 1966). Later in the defense and further argumentation of the SAI view, philosopher David Hull joined in. Ghiselin and Hull are the two main representatives of the SAI view. The theory that species are individuals is allegedly the most widely accepted view on the ontological status of species among biologists (cf. Ghiselin 1992; Ereshefsky 2010).

Species cannot be classes because classes do not change. This illustrates Ghiselin's observation that the species concept is a theoretical concept in the context of evolutionary theory, which indicates the need for an alternative position to the view that species have the ontological status of classes. This is the main motivation for the SAI view and the consequent argument for that position is called the "evolutionary units argument". According to this argument, species are the result of various evolutionary processes that occur at lower levels of the biological hierarchy – genes, individuals, groups. The necessary condition for an entity to participate in any evolutionary process is spatiotemporal continuity and extension, which classes do not have. The very definition of a class entails that members of the class are spatiotemporally unrestricted, which *a priori* excludes them from participation in evolutionary processes. Spatiotemporal continuity and extension is a paradigmatic characteristic of an individual. Hull builds the SAI view on the analogy with the characteristics that are commonly attributed to individual organisms. Hull points out that the concept "individual" can be understood in a narrow and in a broader sense. In the narrow sense the concept "individual" refers to a single organism, while in a broader sense it refers to "any spatiotemporally localized and well-integrated entity" (Hull 1980, 313). For an argument in favor of the SAI view, the concept "individual" must be understood in a broader sense:

> Individuals are spatiotemporally localized entities that have reasonably sharp beginnings and endings in time. Some individuals do not change

> much during the course of their existence, others undergo considerable though limited change, and still others can change indefinitely until they eventually cease to exist. But regardless of the change that may occur, the entity must exist continuously through time and maintain its internal organization. How continuous the development, how sharp the beginnings and endings, and how well-integrated the entity must be is determined by the processes in which these individuals function, not by the contingencies of human perception. (Hull 1980, 313)

Here Hull is trying to show that the concept of individual does not necessarily refer only to individual organisms. A key property of an individual is spatiotemporal extension and location, which makes every species a historical entity. This property can be possessed by other entities as well, such as groups and, in this case, species. The difference between an individual organism and a species is that an individual organism lasts for a short period of time and its ability to change is limited by its genotype, while a species can exist over a long period of time and go through a potentially unlimited number of evolutionary changes. These changes are limited by genetic resources of a species which can potentially go through an infinite number of changes. That can also imply a change in a species without a qualitative change to a new species.

Potentially infinite variability of species does not necessarily make a species the unit of evolutionary change, it is rather the result of selection that takes place at the lower levels of biological hierarchy. It is this property that puts a major constraint on the status of what species can have. The selection at lower levels of the biological hierarchy is not possible if there is no spatiotemporal continuity and contact between members of the species, because selection is the consequence of differential survival and reproduction of members of a certain species. This means that the species must necessarily be an integrated and continuous spatiotemporal genealogical lineage of organisms, which are its constituent elements. That is a necessary property of an individual, not of a class.

Hull points out that this is a necessary but not sufficient condition of conceiving a species as an individual. Without additional requirements, all genes, organisms and species would form one individual because all organisms from the last known common ancestor until today form an integrated and continuous spatiotemporal genealogical lineage. Additional

requirement – which Hull uses to narrow down the ontological status of an individual to the level of the species – is an evolutionary unity.[2] Hull does not explain precisely enough the notion of evolutionary unity, but it could be said that evolutionary unity is "something" that differentiates a species as a particular individual from a continuous genealogical lineage since the last known common ancestor until today and from other species. Hull says that the evolutionary unity of a species is being maintained by internal and external mechanisms. The internal mechanisms are the gene flow and homeostasis, while the environment and the specific ecological niche make up the external mechanisms. In order to ascribe the ontological status of an individual to a species, it must have all these mechanisms,[3] plus it needs to fulfill the conditions mentioned earlier.

According to the first internal mechanism, two populations make one individual if there is gene flow between them at least occasionally – in the evolutionary conception of time. If two populations are long isolated, an additional criterion is required in order for the status of the individual to be ascribed to them, such as a potential breeding, which is in itself problematic since there are good species in nature that form stable hybrid zones but do not form one species. Because of that, ontological status of an individual would not be ascribed to them.

Second internal mechanism – homeostasis – Hull takes over from Eldredge and Gould:

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[2] In papers titled "Are Species Really Individuals?", "Individuality and Selection" and "Matter of Individuality", Hull uses three concepts that are related to the same condition of individuality: cohesion, coherence and evolutionary unity (see Hull 1976; 1980; 1992). I opted for the concept of evolutionary unity because – despite the fact that it is as imprecise as the other two concepts – it is the least imprecise of all three and that is why it seems the best in pointing out to the condition of individuality for species that Hull is trying to add in order to narrow it down to the species level.

[3] Hull nowhere explicitly stated the aforementioned claim, but it seems that this conclusion can be drawn for two reasons. The first reason I have already explained, and it refers to the fact that without these mechanisms the notion of the individual has too much scope. Another reason we can see from the claims of the representatives of the SAI view when they exclude organisms that reproduce asexually from the species status, which will be discussed later in the paper.

> The answer probably lies in a view of species and individuals as homeostatic systems – as amazingly well-buffered to resist change and maintain stability in the face of disturbing influences […] Lerner (1954, 6) recognizes two types of homeostasis, mediated in both cases, he believes, by the generally higher fitness of heterozygous vs. homozygous genotypes: (1) ontogenetic self-regulation of populations (developmental homeostasis) […] and (2) self-regulation of populations (genetic homeostasis) "based on natural selection favoring intermediate rather than extreme phenotypes". In this view, the importance of peripheral isolates lies in their small size and the alien environment beyond the species border that they inhabit – for only here are selective pressures strong enough and the inertia of large numbers sufficiently reduced to produce the "genetic revolution" (Mayr 1963, 533) that overcomes homeostasis. The coherence of a species, therefore, is not maintained by interaction among its members (gene flow). It emerges, rather, as an historical consequence of the species' origin as a peripherally isolated population that acquired its own powerful homeostatic system. (Eldredge & Gould 1972, 114)

According to Eldredge and Gould, species keep their evolutionary unity in the following way. After peripatric speciation, in the new environment, they create a new balance due to which they undergo small evolutionary changes and survive for as long as they can maintain this balance.

Hull explains that the environment influences an evolutionary unity of a species in a way that all the members of a certain species are affected by the same selection pressures. This implies that all members of a certain species will go through the same or similar evolutionary changes. For example, imagine that all members of the species X are under the selection pressure because of which taller members of the species have more offspring. If selection pressure worked in this way and if it would last long enough, the average height of members of species X at the time t_1 would be lower than the average height of the members of species X at the time t_3.

The second external mechanism that affects the evolutionary unity of a species is an ecological niche. Hull explains ecological niche as a "relation between a particular species and key environmental variables" (Hull 1992, 300). This means that different species in a combination with the same

environmental factors will occupy different ecological niches, and that is an important integration factor for Hull.

It is necessary to clarify one more condition of individuality and that is spatiotemporal continuity. Ghiselin (1992) points out that the notion of an individual in logic refers to a single object at any level of integration. This means that for an object to be an individual, it is not necessary for it to be physically continuous. Ghiselin (1992) explains it by using the following example: The United States are an individual, regardless of the fact that they are physically discontinuous. Between Alaska and the rest of the territory of the United States there is Canada's territory as well as the international waters. Therefore, we can say that for a certain organism or a population it is not important that they are spatiotemporally and physical continuous in order for them to be individuals.

Before going any further to the implications arising from the SAI view, it would be useful to make a summary of all the criteria for the species' individuality. The species is a theoretical concept in the context of evolutionary theory, which implies that species are historical entities and continuous genealogical lineages, which means that they have spatiotemporal location and continuity. The criterion by which one species is separated from other species is an evolutionary unity which, according to Hull, consists of internal mechanisms – gene flow and homeostasis – and external mechanisms, the environment (selection pressures) and ecological niche.

From the SAI point of view, a number of important consequences is entailed. The first consequence is that species can evolve: "If species were not individuals, they could not evolve. Indeed, they could not do anything whatsoever" (Ghiselin 1992, 364). Species, except that they evolve, "they speciate […] they provide their component organisms with genetical resources, and they become extinct" (Ghiselin 1992, 377). Hull and Ghiselin add that species even compete with other species, but point out that it is not as important as competition between members of the same species.

Another consequence of the SAI position is that whether or not an organism is a member of a species is not determined on the basis of the characteristics that an organism possesses, but rather based on the necessary and sufficient conditions. Organism is a member of a certain species if it

belongs to a certain genealogical lineage that meets the criteria of individuality. This entails two consequences: there are no laws about species and the names of species are personal names. "They are meaningless identification tags and nothing else" (Hull 1976, 174). When we use the term *Tatooine* we think of the fictional desert planet in a binary star system. This is not its definition but a description and the name is only a reference to that description. It is the same with species, when we say *Homo sapiens*, we do not refer to two-legged rational animals with a little hair on their bodies. *Homo sapiens* is only a label for a specific group of organisms. People may be two-legged rational animals with a little hair on their bodies as a rule, but we will not say for people without hair on their bodies that they are not people. Hull concludes that – if a species membership is not determined by necessary and sufficient conditions – then there is no human nature. Even if there are characteristics that are common to all and only humans, it would only be a temporary condition that can easily change with evolutionary changes in the future. Thus, individuals can only be described and that description will be temporary and subject to change as described individuals go through evolutionary changes.

Given that individual organisms belong to a certain species if they belong to a certain genealogical lineage and "since they are derived from and contribute to a single gene pool" (cf. Hull 1980, 328), they form parts of the species, and not members of the species. For clarity, it is useful to make an analogy with individual organisms. Different organs of an individual organism are not its members but parts, because they form a single, integrated and spatiotemporally continuous whole that changes as its parts are changing. Classes have members and the change of their members does not affect the determination of the class.

The next consequence of the SAI view is that organisms that reproduce asexually do not form species. Ghiselin makes a comparison to the economy and says that the attribution of the status of the species to the organisms that reproduce asexually would be like starting to create imaginary companies for the self-employed. There are three main reasons why Hull and Ghiselin believe that organisms that reproduce asexually do not form species. Hull says that organisms that reproduce asexually as well as taxa of a higher rank in the biological hierarchy, do not meet all the criteria for evolutionary unity. Organisms that reproduce asexually evolve, they have spatiotemporal continuity and location which makes them historical

entities and forms them into continuous genealogical lineages, they are exposed to selection pressures, they do fill certain ecological niches, but they completely "lack any intrinsic mechanisms for promoting evolutionary unity" such as gene flow and homeostasis (cf. Hull 1976, 183-184). Even if organisms that reproduce asexually had enough evolutionary unity, it should be based on the external mechanisms, and Hull doubts that external mechanisms would be effective for this task. Ghiselin states another reason. He believes that species are individuals which have to evolve separately from each other, and this is possible because they form separate reproductive units and because they are the result of a speciation process. It is clear that species that reproduce asexually do not meet the above criteria mentioned by Ghiselin. Species that reproduce asexually do not constitute separate reproductive units because they do not reproduce sexually. Therefore, they cannot evolve separately from one another, which implies that they cannot form species and therefore cannot be individuals. Hull adds that organisms that reproduce asexually cannot constitute entities of higher levels than those of genealogical lineages because they lack internal mechanisms of evolutionary unity and because they evolve only by processes of replication and interaction. So, the genealogical lineages are the peak of integration that organisms that reproduce asexually can achieve. Genealogical lineages are species of organisms that reproduce asexually, concludes Hull.

Hull and Ghiselin point out that the SAI view entails a stance in the debate on the problem of universals in the species problem. The entailed view is realism. The reason is simple; individuals are concrete objects that really exist. Ghiselin again draws an analogy with economy and says that species are as real as are the companies such as Diamondback or Textile House. We have also seen earlier in the paper that classes cannot evolve because they are abstract objects. The fact that species evolve implies that species have spatiotemporal continuity that is a necessary precondition of evolution and the basic characteristic of an individual. "Now that species are conceived of as individuals, they have to be absolutely concrete, and must be viewed as no more than intellectual constructs organisms are" (Ghiselin 1992, 366).

Another consequence of SAI view is that when a species dies out, it is forever. Hull presents two arguments in support of his claim. The first argument is derived from two basic properties of individuality, and those are

location and spatiotemporal continuity. Each species has its beginning in a certain period of time, at a certain location and its end. This makes it spatiotemporally unique. Once a species becomes extinct, the same species cannot reoccur. Even if we assume that in the future a species will appear that will have all the characteristics identical to the species that is now extinct, it would still be a new species. The difference would be in the spatiotemporal location of the new species. It is the same with organisms. Once an organism dies, the same organism can no longer be recovered. Even if an organism would appear that would be identical in every conceivable characteristic to the organisms that died, it would still be the new and different, spatiotemporally unique organism.

2. Species as classes view

The basic claim made by representatives of this position is very simple. They believe that species are classes because all members of the species possess some properties that are essential (Kitts & Kitts 1979; Kitcher 1992; Devitt 2008; Putnam 1975). For starters, it is necessary to define the notion of a class. For clarity and consistency, in the rest of the paper I will use the term class in the same way as Stamos: "[…] I shall use the term "class" for intensionally defined (therefore abstract) objects […] the members of the class must have common (nontrivial) properties" (Stamos 2003, 21). Common non-trivial properties of members of a certain class are also called "essential properties".

The simplest formulation of the position that species are classes was formulated by Putnam: "Lemon: natural kind word […] associated characteristics: yellow peel, tart taste, etc." (Putnam 1975, 144). All members of the species F have at least one essential property P.

When can properties be regarded as essential properties, and what makes an essence of a certain species, according to essentialism? Devitt explains:

> 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, 345)

According to Stamos, this way of defining classes and conditions of membership in the classes entails that the class is defined only as the membership conditions. He cites an example: "If x is an atom with seventy-nine protons in its nucleus, then x is an atom of gold" (Stamos 2003, 173). All organisms with the property P belong to the species F which is in perfect analogy with the example with the atom of gold. If this is true, this way of defining the species entails certain implications.

First implication is that species are abstract entities because membership conditions are abstract entities as well. The existence of the membership conditions is completely independent from the fact whether members of a certain class exist or not. It is clear that if we determine that "All organisms with the property P are members of the species F" that there may be a circumstance in which organisms with the property P do not exist. In this case, because species is an abstract entity, we can't conclude that species F does not exist, but only that it does not have any members.

Second implication is that classes defined in this way remain unchanged with changes in the number of its members, because the changes in the membership do not change the membership conditions, which in this case is the class (Stamos 2003, 172-173).

One version of essentialism of interest for the species problem is biological essentialism. This position is specific in that it claims that the necessary properties of species are genetic, as argued by Caplan (1980; 1981), Kitts & Kitts (1979) and Devitt (2008).

However, even this claim is disputed by some representatives of biological essentialism. Devitt and Caplan allow the existence of extrinsic necessary properties in addition to intrinsic necessary properties. According to Caplan, extrinsic necessary properties of a species are the ability to obtain a fertile offspring between group members and the origin from a common ancestor. In addition, Caplan thinks that the claim that species are classes does not imply that essential properties of species are eternal and unchanging. Species are after all entities that arise from evolutionary processes. When organisms do not manifest essential properties of a particular species, it is reasonable to assume that this class has gone extinct or has evolved to a different class. According to Caplan, species are classes that are subject to evolutionary processes and their consequences (see Caplan 1980, 74-75). Devitt, similar to Caplan, points out that it is specific for species, next to their intrinsic genetic properties, that they are also historical

entities and that their members are a part of the genealogical nexus (see Devitt 2008, 368). How can species be classes and have essential properties while undergoing evolutionary changes at the same time? This is explained by Devitt:

> Suppose that S1 and S2 are distinct species, on everyone's view of species, and that S2 evolved from S1 by natural selection. Essentialism requires that there be an intrinsic essence G1 for S1 and G2 for S2. G1 and G2 will be different but will have a lot in common. (Devitt 2008, 372)

The process of gradual evolutionary change, which would be compatible with essentialism, would proceed as follows: from S1 a group of organisms separates and under the circumstances between that group and the rest of the species S1 gene flow is interrupted. At this point in a group that separated, G1 is still its intrinsic essence. Suppose that the separate group is exposed to different selection pressures than species S1. Their essential intrinsic properties will slowly begin to change and move away more and more from G1 and approach more and more to G2, while this process is not completed. The end result of this process will be species S1 with G1 essential properties and species S2 with G2 essential properties. The process of gradual evolutionary change described in this way is compatible with the theory of evolution and is in accordance with basic tenets of essentialism. Let us remember that essentialism does not require that species must have eternal and unchanging essential properties. According to Devitt, species are a special type of classes that participate in the evolutionary processes and have no eternal and unchangeable essential properties. The way that species evolve and that they are classes at the same time, implies that species change classes as they evolve. In the illustrated example, species S2 with essential properties G2 evolved from species S1 with the essential properties G1. As species S1 went through evolutionary process, it gradually changed its essence from G1 to G2. In that way, organisms that at the beginning of the evolutionary process belonged to species S1 with essential properties G1, eventually become species S2 with essential properties G2 and thereby changed the class to which they belong.

3. Species as individuals: just another class view of species

Representatives of the SAI view try to argue that species cannot be classes because classes cannot change. Species participate in the evolutionary processes and that *a priori* makes them entities that are going through changes all the time. In this part of the paper, I will argue that the SAI view nevertheless implies that species have the ontological status of classes, although the representatives of the SAI view claim otherwise.

To begin with, let me remind the reader of the main tenets of the view that species are classes. First, all members of the species must possess some properties that are essential. As explained by Devitt:

> 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, 345)

What is important for the view that species are classes is that properties that are common to all members of the class must be nontrivial.

Second, representatives of the position that species are classes allow for the possibility that necessary properties can be extrinsic properties and not necessarily intrinsic. Caplan (1980) gives two examples of extrinsic necessary properties: the ability to obtain fertile offspring between group members and the origin from a common ancestor. Devitt (2008) expands the list of extrinsic necessary properties further: species are also historical entities and their members are a part of the genealogical nexus.

In addition, both Caplan (1980) and Devitt (2008) argue that the view that species are classes does not imply that essential properties of species are eternal and unchanging. Caplan (1980) states that species are classes that are subject to evolutionary processes and their consequences while Devitt (2008) explains how species can have the ontological status of a class and yet undergo evolutionary changes at the same time:

> Suppose that S1 and S2 are distinct species, on everyone's view of species, and that S2 evolved from S1 by natural selection. Essentialism requires that there be an intrinsic essence G1 for S1 and G2 for S2. G1 and G2 will be different but will have a lot in common. (Devitt 2008, 372)

With this line of argumentation, Caplan and Devitt intercept the arguments of the representatives of the SAI view according to which: a) species cannot be classes because classes cannot change, and b) their participation in the evolutionary processes *a priori* makes them the entities that are going through changes all the time, which excludes them from the ontological status of a class. Caplan and Devitt intercept the mentioned arguments of the representatives of the SAI view because they offer us a plausible interpretation of how it is possible for species to be classes that change by undergoing evolutionary processes as described in the second part of this paper.

To resume my discussion, the basic position of the representatives of the SAI view implies that species *necessarily* have to be integrated and that continuous spatiotemporal genealogical lineages of organisms and organisms are their constituent elements. The additional requirement of individuality of species is evolutionary unity maintained by internal and external mechanisms. It is evolutionary unity that separates individual species out of the continuous genealogical lineage as separate entities. Without evolutionary unity, it would not be possible to identify individual species, which makes it the second *necessary* condition of specieshood. The third condition for the individuality of species is that all members of a species are going through the same or similar evolutionary changes. This implies that if we have a group of organisms whose members do not go through the same or similar evolutionary changes, they do not belong to the same species, and if so, we have just reached the third *necessary* condition of specieshood. The last *necessary* condition of individuality of species is that species must consist of organisms that reproduce sexually, because organisms that reproduce asexually cannot form a species.

According to SAI view, species are individuals and that entails the following necessary conditions that groups of organisms must fulfill in order to be treated as species:

1. integrated and continuous spatiotemporal genealogical lineages of organisms that are their constituent elements;
2. separated from the continuous genealogical lineage from the last known common ancestor to modern organisms by evolutionary unity;

3. made up of organisms that go through the same or similar evolutionary processes;
4. groups of organisms whose members reproduce sexually.

These are the essential properties of species according to the SAI view. In accordance with the basic tenets of the view that species are classes, the SAI view also implies that for each entity to which "X is a species" applies, it is true that X must necessarily possess all four just mentioned properties.

It should be noted that these properties are not intrinsic properties of individual organisms but they are extrinsic properties of the species. However, as I have shown in the second part of the paper, Caplan and Devitt, both representatives of the view that species are classes, allow for the existence of extrinsic necessary properties for species and they explicitly state them as follows:

1. The ability to obtain a fertile offspring between group members.
2. The origin of a species from a common ancestor.
3. Species are historical entities.
4. Species members are a part of the same genealogical nexus.

If we compare the conditions that groups of organisms must fulfill in order to be treated as species according to the SAI view and extrinsic essential properties of species listed by Caplan and Devitt, it should be clear that they are fundamentally the same, although the formulation made by the representatives of the SAI view is slightly more detailed. If this is true, it is only possible to conclude that, according to the SAI view, species are in fact classes.

Do organisms in the SAI view have some intrinsic essential properties? I think that they must have at least one intrinsic essential property. If one of the necessary conditions that groups of organisms must fulfill in order to be treated as a species is that members of the species must reproduce sexually, the consequence on the level of individual organisms in that species would be that they must have some species *specific mate recognition system* (or SMRS) which is possessed by all and only members of the species. According to Paterson, SMRS is a group of adaptations – specific to each species and in turn to all and only members of a specific species –

which is being used during courtship and reproduction among potential partners. SMRS evolved as the adaptation under the influence of specific selection pressures when the incipient species detached from the ancestral species (Paterson 1992). It is important to note that the way SMRS evolved is a consequence of the fact that the group of organisms in question is: a) integrated and continuous spatiotemporal genealogical lineage, which b) is separated from the continuous genealogical lineage from the last known common ancestor to modern organisms by evolutionary unity. In this case, evolutionary unity consists of a species-specific selection pressures that shaped species SMRS. That makes SMRS an intrinsic essential property that each individual organism in a species must possess since one of the extrinsic essential properties of species is that a species is a group of organisms whose members reproduce sexually. Although the SAI view is relatively new, it does not seem to be a revolutionary position that will fundamentally change our understanding of species. It is only an interesting new version of the view that species have an ontological status of a class, the very thing that representatives of the SAI position wanted to avoid.

4. Conclusion

Representatives of the SAI view try to argue that species cannot be classes because classes cannot change, and since species are subject to evolutionary changes, they undergo changes all the time. According to the view that species are individuals, species are treated as:

1. integrated and continuous spatiotemporal genealogical lineages of organisms that are their constituent elements;
2. separated from the continuous genealogical lineage from the last known common ancestor to modern organisms by evolutionary unity;
3. made up of organisms that go through the same or similar evolutionary processes;
4. groups of organisms whose members reproduce sexually.

I argued that these are necessary conditions for groups of organisms to be treated as species, according to the representatives of the SAI view.

When these conditions are compared to the list of extrinsic essential properties made by Caplan and Devitt, it is clear that they are the same. If these are indeed necessary conditions for specieshood, then the conclusion that species are classes in the SAI view is unavoidable. I have also argued that, if under the SAI view one of the necessary conditions that groups of organisms must fulfill in order to be treated as species is that members of the species must reproduce sexually, then each member of the species must possess the same SMRS, which in turn makes SMRS an intrinsic essential property of each member of the species. This makes SAI view a new version of the old position that species have an ontological status of a class, not a revolutionary new position that will fundamentally change our understanding of species.

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