THE ONTOLOGY OF SPECIES:

A RADICALLY PLURALISTIC PERSPECTIVE

By

BRANDON D. HOLTER

A thesis submitted in partial fulfillment of
the requirements for the degree of

MASTER OF ARTS IN PHILOSOPHY

WASHINGTON STATE UNIVERSITY
Department of Philosophy

AUGUST 2009

To the Faculty of Washington State University:

The members of the committee appointed to examine the thesis of BRANDON DAVID HOLTER find it satisfactory and recommend that it be accepted.

Joseph Campbell
(Chair)

Matthew Slater

Michael O'Rourke

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Abstract

By Brandon D. Holter, M.A.
Washington State University
August 2009

Chair: Joseph Keim Campbell

Species pluralism is an increasingly popular position in philosophy of biology, and with good reason. The diversity of the biological world and the evolutionary forces that shape them has convinced many biologists and philosophers that there are many overlapping groups of organisms we might call species. It is typical to approach the species problem with the question “what are species?” but I suggest the question “What *aren’t* species?” is equally daunting. Specifically, what sets of organisms do not constitute species? I content that no metaphysical distinction can be drawn between species groups and random assortments of organisms.

Species have posed conceptual problems [for philosophers] for centuries. There are many competing theories and little consensus. In chapter two I review the standard problems for species monism and the arguments for pluralism. I argue that not only are many species theories equally legitimate, but that the plurality, interactivity, and dynamic nature of evolutionary causes necessitates a pluralistic species theory.

Moderate species pluralism must justify the exclusion of species theories on the basis of some principle of moderation. These principles specify why some species taxa are real and others are not. Without such a principle, pluralists will have to admit that "anything goes" with regards to the ontology of species. In the penultimate chapter, I examine the parallels between mereological universalism and species pluralism.

The important congruency between the species debate and mereology is the problem of moderation, its motivations, intractability, and possible resolution. While the problem of moderation is present in both domains, I argue that philosophers of biology have failed to take it as seriously as mereologists. As a result, the solution offered in mereology is instructive for species pluralists.

TABLE OF CONTENTS

Page

CHAPTER ONE

INTRODUCTION

Well-formed answers to the question “what are species?” tell us by virtue of what relationship numerous organisms come to comprise a further ontological entity called species. The species question is best construed as the question “What relation(s) must some x’s (organisms) instantiate to form a species?” Van Inwagen’s special composition question, which informs this formulation of the species question, asks what relations must hold between parts for them to compose a further whole object, but other ontological inquires are well served by the general form of the question as well (van Inwagen 1990, 21-2; Slater ms. 6). I call individual relations proposed as answers to the species question species relations.

Each species relation corresponds to a species concept, a theory about what species are that is defined by the relation that underwrites it. The “biological species concept” (BSC) identifies reproductive compatibility as the relation that identifies all species taxa (Mayr 1992, 17). Reproductive compatibility may be interpreted variously, but it roughly means the ability to procreate. Any species theory (taxonomic approach) identifies which relations are properly considered species relations. The difference between a species theory and a species concept is that theories may identify multiple species relations, hence many corresponding concepts. Species concepts are necessarily monistic. Species *taxa* are real species, whatever they turn out to be, while species theories (taxonomic approaches) are merely proposed answers to the species question.

This work attempts to establish the intractable difficulties dormant in various attempted answers to the species question without denying the reality of species. Species do, after all, appear discreet to the casual observer. One notices with little effort that some organisms appear extremely similar; often members of species are indistinguishable to the untrained human eye, while those members appear distinctly different from other groups of similar organisms. "No naturalist would question the reality of the species he may find in his garden, whether it is a catbird, chickadee, robin, or starling… Species at a given locality are almost invariably separated from each other by a distinct gap" (Mayr 1987, 146).

I examine issues of realism, anti-realism, monism, and pluralism in the species debate. These alternative positions lead to a natural division of species theories into four categories, monistic realism, pluralistic realism, monistic anti-realism, and pluralistic anti-realism. The distinction between monistic and pluralistic anti-realism is not metaphysical as both positions contend that there are no metaphysically real species taxa. The monism/pluralism debate for anti-realists depends practical relevance alone (Stanford 1995, 89). They argue that the term 'species' ought to be used certain ways, not that certain species theories denote real taxa. Arguments from anti-realists regarding how best to conceptualized species take place on the semantic or pragmatic level, not at the level of metaphysics.

Some answers to the species question are monistic. They insist that only one relationship between individuals is pertinent to species membership and that each and every species will instantiate this relation. The aforementioned biological species concept offers one such theory of species monism. If a monistic species theory is tenable, no set of organisms lacking the favored relation may rightly be considered a species and any organisms displaying that relation must be members of a common species. Thus opponents of monism often point to problematic cases of species membership in order to undermine particular monistic species theories.

Problematic cases come in two varieties: unrecognized taxa and illegitimate taxa. Groups of organisms that do not display the relation endorsed by a specific theory but nonetheless ought to be considered species are instances of unrecognized taxa. Infertile organisms that are highly physiologically and genetically similar pose an unrecognized taxa problem for the BSC. Illegitimate taxa display the favored relation without forming a group that we are likely to consider a species. When members of two distinct species, Sx and Sy, produce fertile offspring, the reproductive ability of Sx and Sy should not suffice to group them under a single conjoined species. Every instance of hybridization between distinct species presents the BSC theorist with an illegitimate taxa problem because the relation of reproductive compatibility is present between Sx and Sy despite there being no common species taxa (Sterelny and Griffiths 1999, 188; Stanford 1995, 73).

Both kinds of problematic cases compare the taxa identified by a target species concept, in these cases the BSC, and assert that they fail to live up to intuitions about species taxa. One might object that these modes of criticism wrongly assume that alternative species relations are legitimate, such as the genetic and physiological relations identified in the unrecognized infertile taxa example. But mere intuitions are not the only basis for these objections, they are informed by the biological facts, and these are the only facts we can appeal to in critically analyzing species theories.

Species pluralism asserts that there is more than one relation organisms of a common species may bear. Some sets of organisms form species because they instantiate one species relation, others are individuated by another relation. Perhaps asexual species, being incapable of the reproductive compatibility needed for BSC, are distinguished by their genetic make-up. Such a theory recognizes the taxa formed by the relation of reproductive compatibility as well as the relation of similar genetic constitution. For pluralists, all sets of organisms bearing any of the relations they endorse as species relations count as real species taxa. Which relations the pluralist adopts will determine which taxa count, so the substance of any pluralistic theory lies in why some relations and their corresponding species concepts are considered real taxa.

Pluralism faces a problem not shared by monistic theories of species. Monists claim that one relation between organisms defines species while pluralists conjoin multiple relations. One question that plagues pluralism is why *only* those relations should count as definitive of species (Stanford 1995, 77). Monists, by assuming that taxonomists must strive for a univocal account of species, are able to exclude alternative theories by default (Sober 1984, 341). Only one relation defines species, so once a monistic theory is taken to be an adequate account, all other species concepts must be illegitimate. By denying the uniqueness of species relations, pluralists are made susceptible to the pointed question "What makes these relations adequate grounds for species membership and other relations illegitimate?"

Pluralists need a principled stance on what makes their favored relations distinguishable from those they reject, a principle of moderation. Moderation principles answer the question "What makes the taxa instantiating relations R_1 R_2 through R_n, different from other relations such that R_1 through R_n constitute species relations while the others do not?" There must be something common to the relations that distinguish species taxa lacking in other non-species relations. Perhaps only scientific species concepts, and their corresponding relations, should count. Rather than answering the species question by identifying a unique relation held by all species, pluralists identify a principle for identifying all of and only those relations. Thus principles of moderation define pluralistic species theories by picking out species relations, whereas identification of a single relation defines monistic accounts.

Every species theory identifies what commonality all species taxa share. Monism holds that all species members display a particular relation. A principle of moderation indicates what unifies a plurality of species relations under the heading species taxa. A similar question may be posed with regard to the species rank or category. The species rank question asks what makes species taxa different from higher Linnaean categories, like family and genera, as well as lower order taxa (subspecies). Questions about species taxa should remain distinct from issues about the species category (Devitt 2009, 2; Ereshefsky 1992). I am particularly concerned with what makes some groups species taxa, not with what makes those taxa belong to a particular rank.

The species taxon question involves why particular organisms belong to a species taxa, while the species rank question asks whether particular taxa are rightly considered species. Moderation principles do answer the question "what do all species taxa have in common?" but they do not necessarily entail any position with regards to the what distinguishes the Linnaean category of species from other such categories. A pluralist may hold that there is nothing distinguishing species taxa from other Linnaean categories, even that there are no Linnaean categories at all, while at the same time contending that something distinguishes species from random collections of organisms (Ereshefsky 2001). Some pluralists contend that term ‘species’ has no univocal meaning, so there can be no category to which each species taxa belongs (Ereshefsky, 1992). Confusing questions about taxa with rank or categorical questions unnecessarily muddies the waters of species theorizing.

The “Disorder” of Evolutionary Biology

Some are attracted to the study of natural science because they see a beautiful harmony in the orderly structure of natural phenomena. This examination of the metaphysics of species takes as fundamental to evolutionary biology the diversity and disorder of evolutionary phenomena. The contrast between chemical elements and species illustrates the difference between an orderly or unified picture of the natural world and the diversity found in the biological sciences. In the elements found on the periodic table, the microstructure of the substance strictly determines both what element it is and what visible properties it exemplifies (Sober 1980, 332).

Gold is always constituted by the same microstructure and has the same number of protons, and instantiates observable properties by virtue of this microstructure. Thus the weight and electrical conductivity of gold, for example, are caused by its microstructural properties and each of these is found in every example of gold as well. If we found a sample of gold differing in observable properties, say pink in color, scientists would be shocked. Not so in biology. “The patterns of variation actually found in nature do not fit easily with the idea of an essentialist definition of species” (Okasha 2002, 196).

Discovering organisms with some novel feature is not surprising in the slightest. In fact, it is what biologists have come to expect because the nature of the evolutionary process is such that variation is the rule rather than the exception in biology.

The theme that drives my arguments is the variability of the products and processes of evolution. The process of speciation is a slow and gradual one measured in generations of organisms with intermediate individuals along the way (Dupré 1981, 90). There are, on the other hand, no intermediate steps between two elements on the periodic table. The nature of evolution is not to produce clean-cut divisions the way the universe seems to have produced clear distinctions in elements[1]. David Hull observes that "our inability to distinguish most species by sets of necessary and sufficient conditions follows from evolutionary theory just as surely as quantum indeterminacy follows from quantum theory" (Hull 1976, 180).

Evolution, the force that produces variation and similarity in organisms, is itself a diverse set of processes. These processes produce individual organisms distinguishable in some ways from most other organisms, but relatively similar in others. Thus we notice groups of individual organisms similar to each other and dissimilar to other such collections—species. Much of the disagreement over species has been the result of different perspectives on how best to reflect the role of evolutionary processes in a theory of species membership. The claim that species taxa should reflect the processes that gave rise to them is not exclusive to evolutionary theory, however. Creationists contend that species are determined by god's creative will. Legitimacy of "creation science" aside,

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[1] Sober (1980, 334-5) thinks chemistry has no such clean-cut boundaries and that this is no problem for essentialism. He argues that transmutation, conversion of one chemical element into another, provides a case of vague boundaries. But transmutation is hardly the natural state of elemental matter.

even before the theory of evolution came along it was recognized that species taxa might be determined by the causes that generate them.

Evolutionary biologists recognize that there are many causes that contribute to the formation of species. Darwin understood that both environmental pressures and sexual reproduction were key processes in his theory, but in addition “many processes Darwin never dreamed of are important in molding populations, including mutation, segregation, recombination, genetic drift, gene conversion, and meiotic drive” (Richerson and Boyd 2005, 5). That there are multiple causes of variation and similarity between individuals is not itself problematic for species theories. However, because evolutionary causes interact with one another and occur with different prominence in particular speciation events, it is difficult to derive species taxa from the operation of evolutionary causes (Chandler and Gromko 1989).

The causal mechanisms that produce species taxa are not only many, but they do not act independent of each other. Evolutionary causes are interactive. When some new trait arises among a population it will have both a genetic and non-genetic factors that figure into its evolution (Sterelny and Giffiths 1999, 98). The genetic causes of a trait are not independent of environment in which it occurs; genes may be affected by other genetic factors, its genetic environment, as well as the ecological environment in which the organism finds itself. “Taken together, the relations of genes, organisms, and environments are reciprocal relations in which all three elements are both causes and effects” (Lewontin 2000, 100).

Evolutionary causes produce disorderly species taxa because they are many, interactive, and dynamic—they occur with variable importance from case to case.

Sometimes environmental pressures will be highly influential, sometimes not so much. This accounts for some of the taxonomic differences between chemical and biological kinds—their causes are dissimilar. I have spoken of evolutionary mechanisms as if they strait-forwardly caused species. This is, of course, not the case, but there is a sense in which such talk is justified. While tigers are not, in a strict sense, caused at all, their distinguishing features are. Species are differentiated by the properties unique to them and it is evolutionary mechanisms that produce these unique properties. Insomuch as new species are produced in evolution, they are produced by the changes in properties that occur via evolutionary forces. In this sense, when a new species becomes noticeably distinct from its parents species, we can say that the species was "caused by" the evolutionary forces that produced its unique features.

Overview

Motivated by the plurality of dynamic and interactive evolutionary causes, I present a theory of species that is radically pluralistic. More sets of organisms are really species taxa than most laypersons or scientists believe. The arguments that produce the particular theory of species pluralism I offer rely on a process of elimination of sorts. Chapter II reviews the problems for species monism and the standard arguments for pluralism. First, I review negative arguments against some prominent theories of typological monism based on the inadequacy of the species relation that defines them. Every species theory has a criterion for what should count as a real species and each theory is criticized on the grounds that their respective criteria are not tenable forms of species realism. I content that historical and individualistic accounts of species suffer many of the same difficulties as well. After examining the problems faced by monism, two motivations for pluralism are presented.

The first positive argument for species pluralism holds that multiple species theories are legitimate, so the assumption of monism is wrongheaded. To the extent that any one species theory identifies real taxa, other theories seem to capture real taxa just as well. A second motivation for pluralism stems from the observation that discontinuity, change, and variation are the rule rather than the exception in biology, a situation I have been painting in broad strokes so far. Many disputes about species revolve around which property ought to be considered primary in our taxonomic practice. Which properties of organisms—physical appearances, genetic constitution, historical relations, ecological niche, etc.—ought to determine species membership?

Some theories of species, most notably natural kind theories, have contended that what is important about species is that they have many properties in common. Species kinds on this view are, minimally, property clusters because sharing a number of features in common with other members is simply definitive of species (Boyd 1999, 406-7). Many pluralists, on the other hand, stress that the properties biologists find most salient for species are distributed in ways that do not correspond or co-occur in all of the members (Mishler and Donoghue 1982, 494). Finding any one property P in a population of individuals neither guarantees that P will be found in all of the individual members of the species, nor that any other properties will be clustered together in individuals displaying P. For pluralists of this bent, no property or trait is guaranteed to occur in individuals based on the presence of some other property. All to often, correspondences between salient properties have simply been assumed by biologists and philosophers alike (*Ibid.* 494; Kitcher 1984, 330).

We might analyze the distribution of any property across the entire population of the living world and choose to organize taxa based on its presence or absence. However, if we map the distribution of many biologically important properties among organisms, we will find that each property is unique in its distribution. As a result, each approach to classification that corresponds to the recognition of certain properties will model a distinct set of species taxa and distinct patterns of biological diversity. The essence of this motivation to pluralism is that diversity among individuals and species is so prevalent that no univocal account of species is possible, for it will fail to capture all of the relevant aspects of species taxa. Disorder and variety trickle down from evolutionary mechanisms—to species as well as individual organisms.

Chapter III focuses on pluralistic species theories. Monism faces the challenge of identifying one criteria of species membership that satisfies every occurrence of every species taxa. Pluralism faces a higher order issue. Monism has the advantage of ruling out every other species theory available based on the contention that only one theory can be legitimate. Pluralism must justify the exclusion of species theories on the basis of some principle of moderation that specifies why some species taxa are real and others are not. Otherwise the pluralist will have to admit that “anything goes” when it comes to identifying and defining species taxa. Few species pluralists have devoted much energy to defending against this problem of moderation, but it is a pressing concern (Stanford 1995, 77; Ghiselin 1987, 135-6)

In the penultimate chapter, I examine the parallels between mereological pluralism and species pluralism. Mereology, the theory of parts and wholes, is an especially applicable subject given the recent enthusiasm for treating species as individuals rather than kinds (Hull 1976; Ghiselin 1975; 1987). I concur with Phillip Kitcher that this distinction in ontological models is biologically neutral; all species theories can in principle be construed as either individualist or kind-based (Kitcher 1984, 314; 1987, 187). The debate between the two metaphysical perspectives is trivial for the taxonomic purposes of biology.[2]

The popularity of arguing that species are individuals or essentially historical entities is a relatively recent development in the philosophy of biology. These theories emphasize that species should be historically connected lineages, not just groups of organisms sharing common properties (Griffiths 1999; Ghiselin 1987). The latter view relies on classes, types, or kinds as the organizing principle of species. Individualists about species contend that the organisms should be grouped according to the part-whole relationship rather than kind and membership. Though not all proponents of the historical conception endorse the species as individuals thesis, Griffiths most especially does not, there is little that distinguishes individualism from mere historical accounts.

Both historical and individualist accounts of species are inspired on the principle most prominently promoted by Ernst Mayr that species are cohesive units distinguished by the individuals' reproductive relations (Mayr 1992, 17). The picture of species taxa

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[2] Matthew Slater has argued that mereological species differ from kinds because kinds may be amenable to vagueness, whereas there can be no such thing as a vague object. I reject *any* account of species as vague for two reasons: 1) It is an ad hoc way of avoiding problematic cases. Any unrecognized or illegitimate taxa can be waived away with the claim that "it's just vague." 2) Lewis' invective "What is this thing such that it sort of is so, and sort of isn't, that there is any such thing?" seems applicable whether the thing be kind or individual (Lewis 1986, 213).

that emerges is one of organisms sharing certain relations, sexual relations that require spatio-temporal contact, rather than sharing similarities or identities as on typological accounts. Thus individualists and historical species theories view species as spatio-temporally connected entities. The idea that these relations are anything like typical part-whole relations is controversial, I believe unfounded, and most importantly, trivial for our purposes. An imaginative philosopher can understand the idea that species might be groups of historically connected and reproduction-relationally defined individuals without reference to mereology.

The important congruency between species and mereology is the problem of moderation, its motivations, and its possible resolution. The relation that parts must have to be properly considered a whole object—the parthood relation—is subject to rigorous debate (Markosian 1998, Van Inwagen 1990). As in the species debate, there is a variety monistic, pluralistic, realistic, and anti-realistic perspectives, with the pluralistic realists in need of a principle of moderation. While the problem of moderating pluralism is present in both mereological and species theories, I argue that mereologists have taken it more seriously and offered a more satisfactory response than philosophers of biology. As a result, the solution of the problem of moderation in mereology is instructive for species pluralists.

CHAPTER TWO

Against Monism and For Pluralism About Species

Many of the arguments presented by species pluralists are variations on three general themes. One strategy targets a prominent monistic account of species and shows that there are problematic cases. Either the theory does not account for every case of species, there are unrecognized taxa, or some species endorsed by the theory are illegitimate. A substantial number of counter examples to one favored theory of species monism, a species concept, might succeed in refuting that theory but it quite obviously does not directly support pluralism. One problem that pluralists continually encounter when trying to advance these kind of negative arguments is the obstinate insistence that some other revised theory of species will eventually be discovered that will apply to every species taxa (Dupré 1996, 443).

> The possibility always remains that the fault is not in the nature of our concepts, but in our lack of insight into their determinant structure... a few more centuries of frustration (at least) would be needed before we can declare the project hopeless. For the foreseeable future, pluralism is the 'null hypothesis' that we should attempt to refute (Sober 1984, 340-41).

While arguments against particular species theories do not themselves make good arguments for pluralism, it should be noted that for those who assume species monism is tenable, showing the inadequacy of a commonly held or highly regarded monistic theory is persuasive in ways that other modes of argumentation are not. They force the committed monist to form a counter argument in defense of the theory, revise the theory, or find some new theory to adopt. The argument that eventually some monistic account will prove satisfactory merely asserts the validity monistic intuitions in the face of substantial challenges. In the second section of this chapter, I review the flaws found in monistic accounts of species.

To contrast, positive arguments that motivate species pluralism are susceptible to responses to the effect of “that’s an interesting theory, but I prefer my own monistic account.” The most common way of promoting pluralism is to argue that there are many legitimate ways of dividing up species taxa. Different philosophers rely on different interpretations of legitimacy, however, and this marks the distinction between variations on the equal legitimacy strategy. I consider three such variations. The utility of a species concept may ground its legitimacy by identifying features of organisms that are useful for some purpose. On this view, taxa regarded by the scientific community as mere folk taxonomy concocted for specialized purposes are legitimized, considered real, just because they are practical.

John Dupré argues that such common sense or “ordinary language” taxa are legitimate because they are useful and our ontology would be remiss if it did not include them (Dupré 1993, 28-36). A more conservative equal legitimacy argument is that different scientific practices require different species concepts. For instance, even if species are best defined in terms of their lineage of decent (as per historical species theories) paleontologists will never be able to identify a *Tyrannosaurus Rex* fossil as part of that species by investigating its reproductive relations. Whatever criterion they do use, likely gross physical properties of the fossil, can only be said to be legitimate if those properties reliably indicate species taxa. Thus the legitimacy of a scientific practice might buttress the legitimacy of a species theory that utilizes it (Kitcher 1984, 326). The third equal legitimacy argument appeals to the relevance of linking species concepts with species generating processes[3]. Many species theories are considered legitimate in part because they highlight causal processes key to evolutionary theory, the aforementioned criteria of reproductive relations included. Based on this, Marc Ereshefsky argues that a plurality of species concepts reflect relevant causal process and so should be counted equally legitimate candidates for species taxa (Ereshefsky 1992, 350-356).

Lastly, I consider a third strategy for motivating pluralism that turns on that idea that once we reach a proper understanding of the biological and evolutionary facts, the expectation that species monism should obtain is rendered obsolete. Such arguments try to broadly characterize the evolutionary process and its products in order to show that there is little reason to expect that there is a single taxonomic approach that identifies all and only the species taxa. Once we recognized the diverse, interact, and dynamic nature of evolutionary causes, and that the organisms produced are highly variable in ways that chemical elements like gold are not, species pluralism becomes an expected outcome of the evolutionary process. On one hand, the variability of individual organisms undercuts monistic theories because, as the following section shows, no common properties or relations among organisms can identify every species. On the other, the multiplicity and interactivity of evolutionary causes prevents biological taxonomy from developing a monistic theory that captures a single causal process responsible for every species produced. There is, therefore, no reason to expect that species monism should hold.

Taken individually, negative arguments against monistic theories, positive arguments for equal legitimacy, and the argument from evolutionary disorder are not

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[3] Ray Chandler and Mark Gromko (1989) oppose such a linking.

fully compelling in the sense of obligating any rational person to accept the conclusion of pluralism. Indeed it is not clear what a proof of species pluralism would look like. However, as pluralists have developed these separate lines of argumentation, their conjunction has become a powerful case against monism. If no single candidate theory is without substantial problematic cases and multiple theories seem equally adequate for delineating some species taxa, then this should be enough to at least question the utility of holding onto monist intuitions. Of course, nothing dictates that there could not be a monistic theory waiting to be discovered even if this is the case. It may be impossible to prove beyond any possibility of doubt that there is a plurality of overlapping species taxa, but the deficiency of monism, the legitimacy of pluralism, and a proper understanding of evolutionary facts do make a formidable case for the thesis.

Typological Monism

The traditional model for kinds or types[4] of objects — the model which species were assumed to conform to since the time of Aristotle — distinguishes kinds by their intrinsic properties (Hacking 1991, 120-21). Essential properties, the intrinsic properties that serve to identify and define classes, are thought to be causally responsible for at least some of the observable features of individuals of that kind (Kornblith 1993, 35). On this view, all members of any particular species, like chemical kinds such as gold and water, should turn out to have some intrinsic property in common. Unfortunately for species

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[4] I use these terms interchangeably.

monists committed to the traditional account of kinds, no such intrinsic properties have been discovered[5].

The most readily apparent intrinsic properties of organisms are gross physical features. Morphological species concepts classify organisms according to physical trait similarity and functions as the everyday notion of identifying species (e.g. looking at them). Coloration, body shape, and number of limbs are all morphological properties of organisms. Classifying species according to morphology is, however, extremely problematic (Ridley 2004, 348-50).

Some species contain morphologically distinct organisms. Besides the obvious physical differences between males and females, members of one butterfly species may mimic several distinct appearances so that they look radically different from each other, but much like other species (Sterelny and Griffiths 1999, 184). Sibling species are species that are nearly morphologically identical but do not interbreed, and so are considered separate species (Okasha 2002, 196; Dupré 1981, 83). Sibling species are problematic because they appear much more similar to each other than members of morphologically diverse species do. Lastly, morphology does not take into account the evolutionary history of morphologically similar species. Two populations with radically different evolutionary paths may, by coincidence, happen to appear similar, but they ought to be taxonomically distinguished (Lakoff 1987, 185-95). Morphological similarity proves a weak candidate for the monistic species relation.

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[5] Some, such as Paul E. Griffiths (1999) and T.E. Wilkerson (1995) and Michael Devitt (2008), do remain optimistic about an essentialist program.

Genetic criteria for species membership were once appealing to philosophers because genes are in part responsible for physical traits and get passed on to offspring. Thus genes were seen to partially account for morphology while being sensitive to descent. Unfortunately for this proposal, the maturation of genetic sciences revealed the many genetic differences within species that undermines classification into kinds (Okasha 2002, 197). As one devoted believer in the genetic theory of species admits, there may be as many genetic species as there are individual organisms (Wilkerson 1995, 133). The high frequency of genetic variation within species has prompted most philosophers to abandon the hope that intrinsic or microstructural properties can be appropriately utilized for typological species concepts, however. Especially given that a proposal such as Wilkerson's neither identifies robust kinds, species with many members, nor grounds predictions about classes of entities based on the observation of relatively few samples.

The problem for intrinsic properties as classificatory properties is that they simply do not seem to identify species taxa. Philosophers have increasingly been motivated to consider relational or extrinsic properties as basis for classification (Griffiths 1999, Okasha 2002). Roughly speaking, intrinsic properties are properties an object possesses on its own, independent of any other circumstance. Possession of relational properties, on the other hand, might depend on how some other entity is (Lewis 1983, 111-12). I, for example, have two legs simply because I posses them, whereas I am an uncle because my siblings have children. Being bipedal is intrinsic to me because only an alteration to my body could change that property, whereas my being an uncle depends on my relation to others. It is hypothetically possible that I not be an uncle without any change in my intrinsic properties, should my siblings never had children. Familial relations are paradigm examples of relational properties that ground some species concepts. Another is the ability to produced fertile offspring with other organisms.

The biological species concept defines species by way of breeding relations. Any organism is said to be of a species if it can breed with other members of that species so that differing species, which by definition cannot breed, are said to be reproductively isolated (Ridley 2004, 351; Mayr 1992, 17). The biological species concept is riddled with problems. As is often noted, asexual organisms simply do not breed, so it cannot apply to those species. Either asexual do not form species, since they have no breeding relations at all, or the BSC is woefully inadequate by leaving many taxa unrecognized (Dupré 1993, 46). Secondly, hybridization, the process of two distinct species being crossbred to produce some other species, is conceptually impossible according to this account because different species are not supposed to breed (Dupré 1981, 86). Finally, some species are reproductively compatible with some but not all of the members of their species. In some cases animal A may reproduce with animal B, and B with some further animal C, and yet A and C will be unable to breed. These are called ring species (Sterelny and Griffiths 1999, 189; Ridley 2004, 372).

While the biological species concept is deficient as an account of what property each member of a species should posses it is part of a revolution in biological thinking about species. Rather than treating species as groups of organisms sharing some property, they might be construed as relationally defined entities (Okasha 2002, 191). The popularity of construing species as individuals is a result of just this insight. Mereology takes parts of objects to compose an individual when they stand in the proper relation to each other rather than having some feature in common. My heart is a part of my body because it is embedded in a system with important functional relations to other body parts, not because every part of my body has anything in common (though this may also be the case).

Historical and Individualistic Monism

The shift in focus from intrinsic to relational properties has propagated many new species theories that focus on the historical aspects of species. Species are thought to be lineages of related organisms (de Queiroz 1999; Griffiths 1999). Historical and individualistic accounts of species are not by definition monistic, but some believe that some from of monism is made available by these theories (Ghiselin 1987; Hull 1976).

Individualism is not itself a full-blown theory of species since it only says that species members (or parts) are defined by their mereological relations. Without some further explication of what specific relation is definitional for species, individualism is a hopelessly vague theory (Slater ms. 6). Evolutionary theory says that all of the organisms alive today are the products of some early ancestor in remote biological antiquity, so all organisms are genealogically related and historically connected to some degree (Dupré 1993, 48; Brogaard 2004, 231). What degree of relation or historical connectedness is sufficient for species membership? One step toward solving this problem is by specifying that more inclusive taxa belong to the rank of family and genera rather than species. A ranking criterion that distinguishes species from higher categories does alleviate some ambiguity, but it does not necessarily result in monism.

> In order to reflect the diversity of causal agents directing evolutionary differentiation in different lineages, no universal ranking criterion can be found…The currently favoured monistic ranking concept of absolute reproductive

> isolation is not the most appropriate for all groups of organisms (Mishler and Brandon 1987, 308-9).

It should also be noted that the rank problem extends to less inclusive populations—it is not clear how small and exclusive species should be. "It is not entirely clear how we should motivate any stopping point in constructing genealogies until we reach the individual organism" (Dupré 1993, 49).

Another strategy for narrowing historical species concepts is to identify those evolutionary forces that give a species cohesion and similarity. One group of organisms may qualify as a species because in addition to sharing a common ancestor, as many overlapping groups of organisms do, are reproductively compatible. In fact, many species concepts can be conjoined with historical or individualist principles (Mishler and Donoghue 1982; Mishler and Brandon 1987). Marc Ereshefsky argues for a form of pluralism that recognizes ancestor-sharing taxa formed by different evolutionary mechanisms (Ereshefsky, 1992). On his theory, the ecological species concept—which classifies based on how organisms relate to their environment—or the biological species concept can be combined with a historical model of species to identify taxa produced by different causes. Similarly, a species individualist might hold that different individuals are made whole by different mechanisms (Hull 1976, 178-180; Mishler and Brandon 1987; Brogaard 2004, 236-240). Because historical and individualist accounts of species often employ any number of other species theories to supplement them, they suffer many of the same pluralistic problems as typological accounts. There are many accounts of species on the table that classify the same organisms in different ways whether one accepts that species must form historical lineages, compose unified individuals, or kinds. Each theory still seems to capture only part of what it means to be a species.

Finally, historical theories do not always allow for an objective demarcation of species that matches commonly held beliefs about what the taxa should be. A surprising example of higher taxa is illustrative: Crocodiles, as it turns out, are more closely related to birds than any other reptile (Sterelny and Griffiths 1999, 198; Lakoff 1987, 186). There is a common ancestor that birds and crocodiles share which no modern reptile does. If the historical and genealogical properties of taxa are to determine membership, no taxa can unite crocodiles with other reptiles to the exclusion of birds. Any attempt to recognize such a paraphyletic taxa—one that does not include every member of a group's common ancestor—will be ad hoc. The principles supporting a monistic species theory, however, need to apply to each and every species taxa. Given that birds are not properly considered reptiles, which would unite crocodiles with their kin, and crocodiles are not birds, as the history would seem to suggest, historical taxa require substantial supplement in order to pick out those groups usually considered legitimate biological taxa. Similar difficulties will occur for species when, at the population level, there are closely related groups of organisms differentiated by morphological, genetic, and behavioral properties such that they ought not to qualify as members of the same species.

Kitcher takes another strategy for rejecting historical accounts of species as plausibly monistic by arguing that in some cases historically disconnected organisms form species. By giving a convincing counterexample, Kitcher thinks that he can demonstrate that even though genealogical relations are important and perhaps even necessary for some species taxa, others will need recourse to a typological theory. Thus species taxa are necessarily pluralistic because some are determined by historical relations while others are not. Consider a hypothetical involving *C. Tesselatus,* a lizard hybrid produced by two other lizard species:

> Imagine that the entire initial population of *C. Tessalatus* was wiped out and that the species was rederived after a second incident of hybridization… Supposing that the clones founded in the first hybridization fall within the same range of genetic (morphological, behavioral, ecological) variation present in the population that has persisted to the present (Kitcher 1984, 315).

There is no reason, he goes on, to consider these two hybrid populations different species just because they do not form a continuous lineage. We might take the hypothetical further to drive this point home. Suppose that *C. Tessalatus* is generated regularly by hybridization but that each population dies out before the next comes into existence. Suppose also, to strengthen the argument, that each population is nearly identical to the others so that far less genetic, ecological, or morphological variability is found in successive generations of *C. Tessalatus* than any other species ever observed. Here it seems just shy of ridiculous to believe that each generation of lizards ought to be considered a different species.

I have not, of course, entertained or rejected every theory of species monism. However, substantial and intractable difficulties remain for the general taxonomic approaches of typological, historical, and mereological theories of species monism. Furthermore, specific accounts of these general approaches are unable to identify all of and only the legitimate species taxa.

For Pluralism

Negative arguments against monistic accounts of species are important in terms of the historical dispute between monists and pluralists because each blow to monism strengthens the relative plausibility of pluralism. Some philosophers will inevitably contend that there is still a hope of discovering some satisfactory account of species monism, but hopes and mere possibilities brook no argument. A tenable account of species monism should meet some minimal burden of proof. Pluralism should have its own basis of legitimacy as well, so positive arguments for pluralism must be considered. The most common line of reasoning offered is that no one species concept is legitimate in any important way that other theories are not.

Many species concepts seem equally legitimate or, conversely, equally flawed. The biological and ecological species concepts both identify factors that contribute to the formation of species, which seems to be why both identify at least some species taxa, but neither identify all of them. In addition, scientists employ many different species theories depending on their needs and contexts. The validity of these modes of scientific investigation and the predictions they underwrite seem to indicate the validity of those many species concepts (Kitcher 1984, 326). Studying the fossilized remains of long extinct species does not lend itself to determining the reproductive relations of those organisms, yet such research is the predominant basis of theorizing about those species taxa. If paleontologists can be said to discover species taxa, it would seem to bolster the legitimacy of the morphological species concept. The monist might counter that morphology is an indicator of species taxa but not determinant of them. However, each case of sibling species that are completely reproductively isolated yet physiologically similar is a strike against this line of reasoning. Interbreeding plants of drastically dissimilar physiologies are similarly troublesome since their morphology does not indicate their reproductive compatibilities or historical relations. “In some groups there is complete reproductive isolation between populations that would be recognized as one species on morphological grounds” (Mishler and Donoghue 1982, 494).

The utility of successful scientific practice and prediction may indicate the metaphysical legitimacy of the species theories they presuppose, and biologists have no small reserve of handy species theories. Thus the scientific practicability of some theories, for Kitcher, supports the conclusion that the taxa they posit are real. His formulation of the argument rejects monism on the basis that no species concept can serve the purposes of all biologists, and this is based on the assumption that the plurality of successful scientific practices implies a plurality of legitimate species concepts. But why stop at the practical virtues of *scientific* taxa? Surely the ability to predict and generalize about organisms based on scientific taxonomy lends some credence to those taxa, but mightn’t other human activities presuppose species taxa and ground generalizations?

Dupré argues for the validity of some taxonomic groups that biologists reject. These taxa are taken to be legitimate because they underwrite human activities and highlight objective similarities and differences in organisms. Lilies are an especially complicated occurrence of a biologically disjoint class:

> the Lonely Lily belongs to the genus *Eremocrinum*, the Avalanche Lily to the genus *Erythronium*, the Adobe Lily to the genus *Fritillaria*, and the Desert Lilly to the genus *Hesperocallis*. The White and Yellow Globe Lilies and the Sego Lily belong to the genus *Calochortus*; but this genus is shared with various species of Mariposa Tulip (Dupré 1981, 74).

There is a higher taxon, the family, to which all lilies belong, but it happens to include onions and garlic. To count them as lilies would stretch the meaning of the term lily beyond all significance. Like reptiles, lilies are a disjoint type of organism that defies commonly accepted norms of classification. Biologists are content to say that there just is no taxa that all and only the lilies belong to, but Dupré thinks that the concept is too useful to do away with. Also like reptiles, the taxa we call lilies seems a legitimate and useful one despite theoretical difficulties. Where they differ is that lily plays no crucial *scientific* role.

The practical significance of the distinction between onions and garlic is lost on the biological sciences, but the practice of food preparation would be severely hampered without those taxonomic categories. Dupré thus argues that the practicability of common sense taxa supports what he calls promiscuous realism, a radical variety of pluralism that endorses a wide plurality biological taxa (Dupré 1981; 1993; 1996). Kitcher's theory of species, by virtue of focusing only on scientifically useful species concepts, posits fewer overlapping taxa at the cost of ignoring common taxonomic distinctions, while Dupré's theory embraces a host of unscientific taxa.

A stronger appeal to the equal legitimacy of multiple species theories is grounded in the plurality of evolutionary causes. One thing that distinguishes some scientific species concepts from other theories is that they highlight evolutionary mechanisms. The flavors and digestibility of certain species, while important for cooking, are not important features of the evolutionary process. They do not tend to affect the evolution of groups of organisms. Gene flow, breeding relations, and ecological pressures are some of the primary actors in the process that produces species, however.

Connecting taxa with their causes is in principle a legitimate strategy. Species are differentiated by their possession of different properties, and these differences are cause by evolutionary mechanisms. When some mechanism, say environmental pressure E, causes a substantial change in part of a population so that there are now two noticeably distinct groups, then E can be said to have caused the formation of a new species. Imagine a simplified universe where only one causal process actively produced variation in the biological world. If environmental pressures somehow accounted for the entire evolutionary process, we could identify every species ever produced by identifying only the instances of environmentally caused variation.

If, as it seems, linking evolutionary causes to species concepts is one way of identifying real taxa, then pluralism is sure to follow. Because no biologist would dispute the claim that there are many evolutionary causes, we can conclude that there is a plurality of species taxa. Furthermore, since particular evolutionary mechanisms do not operate in isolation from other causes of variation, there must be multiple overlapping schemes of species delineation. Some species will have genetic variations influenced by environmental pressures, for instance, and these species can in principle be classified based on either genetic or ecological properties, but there is no guarantee that the groups they identify will be identical. Some individuals may share genes without sharing the ecological niche or vice versa. Finally, there may be more evolutionary causes than just those commonly presented in the biological sciences. Even the property of flavor may come into play given that particularly tasty organisms are likely to have an unfortunate disposition to be eaten often. While there is always the possibility that the various interactive causes of speciation events happen to produce a monistic taxonomy, it is not likely.

Pluralists contend that there is an overlapping plurality of species by arguing for the legitimacy of multiple concepts. For a realist about species, to say that these theories are equally legitimate is just another way of saying that the taxa they posit are equally real. The equal legitimacy strategy identifies the reasons philosophers feel justified in asserting the reality of any species taxa and goes on to claim that many species concepts meet those standards of reality. The three appeals to equal legitimacy I examine correspond to the three principles of moderation discussed in the following chapter. I argue for the weakness of these positions as moderating principles, but that weakness offers no comfort to the monist opposing the equal legitimacy arguments, as my criticism entails that the three principles are not pluralistic enough.

Gaining Perspective on Evolution

Another less utilized argumentative strategy for pluralists appeals to the “facts on the ground” in evolutionary biology. Some monists have insisted that species pluralism only appeals to philosophers who have failed to familiarize themselves with the biological facts.

> “If one is lazy, one may not feel inclined to do the work. If one is incompetent, one may not succeed. If one is dishonest, one may not wish to admit that one does not know all the answers. Therefore a species is, by definition, whatever some expert finds it expedient to label with a specific epithet… The experts will disagree, not because they differ upon a scientific issue, but because they are not engaged in science at all (Ghiselin 1987, 135-6).

Pluralists are, however, able to make the same point against dogmatic monists. Many biological facts support pluralism, and some of them have been indicated already.

Lazyness and dishonest ignorance is just as useful for hopeful monists unable or unwilling to come to terms with pluralism. For some philosophers, when we stand back and take a broad view of evolution, the biological facts clearly indicate the plurality of species.

Dupré characterizes biological ontology as a disorderly process that results in disorderly organization. “Thus my motivation for pluralism is not methodological… but ontological. It is that the complexity and variety of the biological world is such that only a pluralistic approach is likely to prove adequate for its investigation” (Dupré 1993, 53). Consider the tree of life, a graphic representation of species as branches in a family tree spanning the entire history of life on Earth. The lines that represent each species branch further away when the species diverge in their respective appearances and properties. Because individual organisms within a species vary, we can picture a scattering of dots around species each branch to represent the individuals. Taking away the lines that represent general similarities and difference in species we are presented with a disorderly array of dots (organisms). Some dots will form a recognizable branch of species taxa. There are few cases of mammals that look much like humans, so the human branch will be a tight cluster of dots. Other taxa will be more problematic. In some cases, we are likely to see a chaotic jumble of individuals that do not outline distinct branches at all. Diversity within species and similarity between them is profligate, and as a result there will be borderline or indeterminate cases of species membership (Dupré 1981, 89-90). Thus, different theories will legitimately identify different taxa.

Mishler and Donoghue consider the distribution of properties salient to species classification, arguing that none are plausibly considered primary to the others (Mishler and Donoghue 1982, 495). What motivates their pluralism is the noncorrespondence of these properties in species taxa. As has been pointed out, organisms similar in one respect thought important for classification (ecology, reproductive compatibility, morphology, etc.) are often dissimilar in others.

Finally, recalling the plurality of evolutionary causes and their interactive nature, anyone concerned with the species controversy ought to recognize that no single cause is ever responsible for an evolutionary divergence. When some new trait arises among a population it will have both a genetic and non-genetic factors that figure into its evolution (Sterelny and Giffiths 1999, 98). The genetic causes of a trait are not independent of environment in which it occurs; genes may be affected by both other genetic factors, its genetic environment, and the ecological environment in which the organism finds itself.

> If we want to understand the causes of the differences in shape, size, color, behavior, and physiology among individuals we must be prepared to work with genetic differences at many gene loci, each of small effect, and with interactions between gene and environment (Lewontin 2000, 120).

Given the nature of the evolutionary process, identifying the causes of diversity in the biological world will not necessarily identify their products, and only a pluralistic approach is suited to capture the complexity and diversity of kinds of organisms. Mishler and Donoghue are so committed to the principle of diversity of species taxa that they recommend scientists “working on relatively little known organisms should not assume that [species] concepts derived from other groups of organisms are necessarily applicable” (1982, 501). They recommend a kind of open-ended pluralism that always leaves room for an additional theory of taxa delineation.

The ongoing dispute between monists and pluralists is characterized by an incongruity of argumentative strategies. Where monists are concerned to put forth some theory that can account for all species taxa and argue against the general coherency of pluralism, pluralists must show the inadequacy of particular varieties of monism and contend that pluralism is not only consistent with but also necessitated by the biological and evolutionary facts.

CHAPTER THREE

The Problem of Moderation

An important feature of an account of species pluralism is how many species taxa it is willing to endorse. Once pluralism about species is espoused, the challenge is to find a principled way to restrict which species concepts are to count as genuine species taxa. Moderate theories will posit only a few real species taxa while radical pluralists believe there are many. Unless every possible species concept identifies real taxa, pluralism must be restricted such that only a limited number of species concepts qualify as legitimate. Thus an important challenge facing species pluralists is to find a principle of moderation— some criteria that species concepts must meet in order to pick out real taxa.

Some monists insist that any form of species pluralism is incompatible with realism (Ereshefsky 2007, 13; Hull 1990, 84). The concern is that once philosophers reject monism they reject the only viable means of arguing for the exclusion of other species theories. Instead of insisting that just one species concept is real, the pluralist will need a principle of moderation that identifies which taxa are real and which are not. Devoted monists contend that whatever principle of moderation pluralists adopt, it will ultimately constitute an arbitrary or merely subjective choice and thus will be inconsistent with realism.

> In effect this means that one can pick and choose among a variety of criteria, such as reproductive isolation, and similarities and differences in this, that, and the other. But we are not told how to make the criterion of membership be an objective one. Such pluralism does not characterize such terms as "atom" and "molecule" (Ghiselin 1987, 136).

I concur. But not, as Ghiselin would prefer, because species have to be monistic or because all forms of pluralism are irreconcilable with realism. To the contrary, moderate theories of species pluralism are not pluralistic enough.

Construing species theories, monistic or pluralistic, as claims about sets of organisms enables every possible species theory to be evaluated (Kitcher 1987, 187). Sets make no claim about the relationships between members. Kind theories assume that members must share some common feature and individualist concepts rely on the parthood relation, but sets can be any collection of organisms whatsoever. Thus set theory provides an ontologically neutral vantage point from which to evaluate any species theory. If species are individuals they can be represented as sets of organisms that share the parthood relation, and if they are kinds species are construed as sets of organisms that share a common property. Furthermore, the bare claim that species are sets recognizes that any collection organisms might form species taxa and therefore represents the most radically pluralistic theory possible. It is, therefore, a natural starting place for inquiring about moderation.

Monists and pluralists alike are mortified by the claim that any set of organisms constitutes a species taxon (Kitcher 1987, 187; Ereshefsky 1992, 358). This thesis, which I call species universalism, conflicts with our common sense intuition that only non-trivially similar organisms ought to be classified together. As I have noted previously, any set of organisms are similar in *some* way. All organisms are descended from common ancestry, for example, so this similarity is trivial for classificatory purposes. Nonetheless, species universalism holds that taxa united by trivial species relations are real, if cumbersome. Furthermore, mere sets do not conform to the intuitions that species are the main unit of evolution studied by scientists. Mere sets do not evolve and they are not the phenomena scientists are interested to investigate when they inquire about species[6]. The intuitions that undermine species universalism correspond to the motivations behind the most prominent principles of moderation found within the pluralist literature.

Three forms of moderate pluralism, defined by their respective principles of moderation, dominate the landscape. Pragmatic pluralism holds that only sets of organisms that are similar in interesting or useful ways form species taxa. Dupré's promiscuous realism is one form of pragmatic pluralism and, as the name implies, it is a relatively radical variety of species pluralism, for it endorses more sets of organisms as real species taxa than most philosophers are willing to ascent to. While I do not endorse monism, I argue that monists correctly assert that no principle of moderation can both restrict species pluralism and be consistent with realism. Pragmatic pluralism, which claims that human interests determine which sets of organisms are species, is strait-forwardly in conflict with realism. Interests are located in the mind of persons, not the objective world, and for this reason monists have not been unfair in criticizing some forms of pluralism as subjectivist. Likewise, the usefulness of a species concept is based on how people are disposed to regard it, a feature inapplicable to metaphysical reality.

Another way to restrict species theories is to rely on the sciences for taxa delineation. One reason is epistemological— we might think that the sciences are in the best position to decide which species taxa are real. Even if current species concepts do not mirror the exact structure of real species taxa, they may still provide the best

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[6] I say "mere sets" because both Kitcher and I contend that sets of organisms are species, hence the scientifically interesting things that evolve are sets. But only a subset of all the possible sets constitute those groups (Kitcher 1984, 309).

understanding of real species. Thus current species theories may be instrumental in indicating real species taxa (Kitcher 1984, 318). It is not altogether clear which sets of organisms should qualify as real on Kitcher's theory. Perhaps "the most accurate definition of 'species' is the cynic's. Species are those groups of organisms which are recognized as species by competent taxonomists" (*Ibid.* 308). Widespread disagreement among scientists has, however, been a persistent problem in the species debate, so it's not clear that the cynic's definition is constructive. It may be that scientists someday arrive at a complete understanding of species so that only those sets they identify at that time should be counted real. Without strong evidentiary support, this claim constitutes a mere hope, much like the faith some dogmatic monists put in the future triumph of some single species concept.

The other argument that aims to establish the claim that scientific species concepts are real while non-scientific taxa are not involves an appeal to causality. Scientific study of species often focuses on the causal processes that result in similarity and diversity in the biological world. One reason for thinking that scientific species concepts are metaphysically privileged, or more likely to be real, is that they highlight these causal processes (Ereshefsky 1992, 359). I reject the casual approach because no comprehensive account of every causal mechanism responsible for species formation is offered. If some causal mechanisms are worthy of species concepts that denote real taxa, then all of them are. However, no causal approach to species pluralism can identify every evolutionary cause of species taxa and, therefore, constitute a properly restricted pluralistic theory.

For each approach to moderation—pragmatic, epistemological, and causal—I offer general arguments in opposition as well as a review of popular examples of each. Dupré is a strait-forward pragmatist and I critique his theory of promiscuous realism as such. Ereshefsky presents a causal appeal to scientific taxa, which I save for last. Kitcher's position is harder to pin down. I present two alternative readings of his brand of pluralism. First I consider the pragmatic aspect of Kitcher's moderate pluralism, then the epistemological reading that appeals to scientific practice for moderation.

Pragmatic Pluralism

As Kyle Stanford has argued, pragmatic pluralism of the sort offered by philosophers such as Dupré and Kitcher conflict with realism about species taxa (Stanford 1995, 77-86). These theories rely on the idea that some sets of organisms are not interesting or useful enough to be considered real taxa. While pragmatism describes the way people ought choose between species concepts, choosing those that are useful for their purposes, it is not an acceptable form of metaphysical realism about the ontology of species.

Phillip Kitcher proposes a moderate form of pragmatic pluralistic realism by defending four claims: (1) Species are sets. (2) There are many real biologically interesting relations among organisms that can be used to classify species. (3) A pluralism free from inevitable confusion and arbitrary choice is made possible by (2). (4) This form pluralism is compatible with realism (Kitcher 1984, 309). The first point is not of concern to this discussion, but claims (2) through (4) are problematic. (3) and (4) claim that (2) allows for a principled restriction on which theories are to count as real species.

But, as Stanford points out, it is the phrase “biologically interesting” that does the work of moderating this form of pluralism, and there are many real biologically uninteresting relations among organisms that can be used to classify species as well (Stanford 1995, 77). (2) is in conflict with (4) because being interesting is not a feature of mind-independent reality.

Though Kitcher rightly claims that “different views of species may be produced by different biological priorities,” different views are also produced by decidedly non-biological priorities as well (Kitcher 1984, p. 324).

> There is no reason for privileging some set of biological categories over well-grounded common-sense categories… When these categories are taken seriously they nicely illustrate the reasons for doubting the existence of a privileged set of scientific categories, and contribute significantly to the elaboration and illustration of promiscuous realism (Dupré 1996, 444).

Dupré has advocated a form of pluralism that acknowledges all human interests as legitimate so that even the culinary properties of organisms, properties relevant to cooking, can be used as classificatory properties (Dupré 1981, p. 80). While the relations that give rise to culinary properties are real, Kitcher wants to restrict his theory to include only those properties that are interesting to biological sciences. While Dupré’s pluralism is decidedly more radical than Kitcher’s, they both rely on the idea that some properties are interesting or useful to some domain of human inquiry, and that these properties are the only ones that ought to be used for classificatory practices. I call this kind of theory pragmatic pluralism because it is moderated by reference to which properties are useful to human activities, and I contend that it is at odds with realism.

Species concepts may be interesting to some and not others[7]. Culinary properties are interesting to chefs, not biologists, but we may just as well think of cases where a species concept is interesting to some biologists and not others. Historically, biologists have changed their minds about which concepts are useful, but it cannot be the case that these discarded theories once delineated real taxa but have since ceased to do so. Species simply do not bounce in and out of existence based on human classificatory practices. Such a "realism" depends on how people regard organisms, not how they are in mind-independent reality (Stanford 1995, 83). Pragmatism does not underwrite realism because it turns on properties that are not mind-independent. The property of being interesting is one that only exists if some person is interested, so the fact that some features of organisms are uninteresting says something about human mental dispositions, not the organisms themselves. This kind of taxonomic approach is a strait forward violation of realism because reality is independent of minds, thus real ontological entities cannot be defined in terms of mind-dependent properties if they are to be considered mind-independently real.

Kitcher's pragmatic pluralism faces the problem of how to decide which persons' interests are to be regarded as relevant. If the theory is a moderate one—if it does not endorse a great number of species concepts—he will have to claim that not every feature found interesting by someone indicates real species taxa. Whereas Dupré is willing to admit that a radical plurality of species taxa correspond to the radical plurality of interests, Kitcher needs a principled reason for rejecting schemes like culinary taxa as

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[7] Or, alternatively, to the same person at different times. A molecular biologist may find herself quite unconcerned with genetic constitution while in the kitchen, just as a chef may worry about the well adapted teeth of grizzlies while in the woods.

genuine species. The best possible reasons are discussed below and rejected, but as Kitcher himself has recognized, moderate pluralism should ignore the interests of "the inexpert, inane, and insane" (Kitcher 1987, 190). While there are objective facts about what people find interesting, if we want to base a tenable form of species realism on interests, what is needed are some *objective* facts about organisms that justify their being considered interesting. Otherwise the interests of the inexpert, inane, and insane cannot be ignored.

Those who employ species concepts, of course, ought to restrict which concepts they accept and use based on their needs and interests. Biologists make use of species taxa that highlight the similarities and differences in organisms which are relevant to their domain of inquiry, as do chefs. Pragmatism functions well as an account of how scientists and others choose which concepts to employ, but does not serve as a foundation for realism. How scientists or chefs ought to choose species theories is a separate issue from the metaphysical reality of species. Such discourse takes place on the pragmatic or semantic level, not the metaphysical.

Marc Ereshefsky has raised two objections to Stanford's arguments against species realism, and though I do not intend to argue for an anti-realist thesis, the objections apply to the critique of pragmatic realism offered above. One claim is that the argument against pragmatic realism is too global in that it applies to classification generally rather than species specifically. According to this line of thinking, "Stanford's interpretation of how classifications are chosen is doing all the work here," not anything about species taxa specifically (Ereshefsky 1998, 108).

Because the argument against pragmatic realism turns on the idea that interests are the deciding factor in choosing classificatory schemes, Ereshefsky claims we may as well apply this argument to all classificatory schemes, monist, pluralist, biological, or otherwise. What the argument demands, however, is a claim about why *species* realism is particularly problematic. There are two reasons why species realism is more difficult to justify than realism about other taxonomies. One is the fact of pluralism. The fact that there are multiple conflicting yet reasonable accounts of species underlies the problem of moderation and classification selection. Electrons, on the other hand, cannot be questioned on these grounds because there is no disagreement about how they ought to be classified. Because of the dominance of a single theory in the taxonomy of physics, monism goes unquestioned. No argument about how many real electron concepts there are necessitates a principle of moderation that would restrict which electron concepts ought to be considered legitimate.[8] Pragmatism is invoked in response to the need for the moderation of a pluralistic theory, a concern not shared by monists.

The second reason that the argument against pragmatic realism is species-specific is that philosophers like Dupré and Kitcher have put forward these pragmatic positions as species theories. Though they may reflect broader views about classification generally, specific theories about species have been offered. If the arguments from interest dependence that expose the problems in those species theories apply to some broader theory of pragmatic classification, then it is a fault of the proposed pragmatic species theories that they embrace the problematic claim that pragmatic classification is

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[8] There may be some dispute about whether or not electrons are real, but any example of taxanomic monism will do.

compatible with realism. The fact that Stanford's argument exposes a flaw common to any pragmatic approach to classification is nothing to count against it as an argument against pragmatic accounts of species. Any taxonomic approach that relies on human interests as its criterion for which taxa are legitimated is not a form of realism.

The Epistemological Appeal to Science

Kitcher's appeal that only biologically interesting relations be used for classification may hinge on the use of 'biologically' rather than 'interesting.' This constitutes an appeal to the powers of science to discover real kinds rather than the importance of human interests. The rigorous process of scientific investigation, one might argue, ensures that scientists are in the best position to discover real species taxa. Though this is surely the case, it is not itself an argument for the reality of taxa produced by current biological theories.

To some extent, biologists are surely in the best epistemological position to decide which species concepts identify real taxa because they have made a profession of studying the kind of empirical facts relevant to the debate. However, it's the wide disagreement within the biological sciences that has precipitated philosophical intervention in questions about species taxa. Biology, and related scientific fields, are currently enveloped in disagreement about which species concepts adequately capture the salient features of species taxa. As a result, appealing to the ability of biology to correctly identify real species is inadequate as a moderating principle, though its worth noting that biologists are not likely as promiscuous in their realism as Dupré. However, as long as biologists are in a state of rampant disagreement, biology itself provides no solutions to the species problem. This is precisely why philosophers have engaged in the species debate; biology alone, as it is practiced today, seems to be inadequate for answering the question “which species concepts identify real species taxa?”

The fact that empirical evidence alone is not enough to decide between species concepts today does not mean that biologists are engaged in a hopeless endeavor. “If empirical evidence does in some slight way affect our choice of species concepts, then there is a glimmer of hope, no matter how slight, that biologists may eventually choose the right concepts” (Ereshefsky 1998, 109). There is room for hope that biology will eventually arrive at a consensus about which species are real. However, even if the future emergence of such a consensus were guaranteed, it would not underwrite realism about current biological taxonomies. Perhaps biologists will agree on exactly which species concepts are valid, but that does not mean that any of those theories will be the ones biologists consider important today. There may be a set of correct theories that does not resemble any of our current taxonomic approaches. The claim that biologists are in the best epistemological position to provide species concepts that correspond to real taxa underwrites realism about current species taxa if and only if the biological community can reach some consensus about which species concepts are valid and the theories endorsed by that agreement are the ones available today. Both of these conditions are far from certain.

Lastly, there is little reason to believe that only biological theories are legitimate species theories because the phenomena biologists choose to study are historically contingent and somewhat arbitrary. Genetics, for example, is a relatively young science. There may be real genetic species, but their reality has never been dependent on the existence of genetic science. If they are real now, they were real even before the advent of genetics. Perhaps other domains of biological inquiry have yet to be discovered or are not utilized. Consider again a taxonomic approach that utilizes properties important to cooking practices. Such taxonomy is based on properties that can be empirically investigated. Flavors and poisons, two features salient to culinary taxonomy, are products of the interactions between the chemical composition of the organisms eaten and human digestive systems. In principle, a whole branch of biology called culinary-biology could be devoted to studying these kinds of facts. Nonetheless, the establishment of such a science would not make it any more likely that culinary species were real.

Many features of organisms could be made the subject of systematic scientific inquiries, but not all of them are. Without further argument as to why only the features biologists currently find pertinent should qualify as a basis for metaphysically real taxa to the exclusion of others, there is no reason to believe that only the taxa biologists find interesting are real. Whether or not some features of organisms are accessible, interesting, or important enough to be the subject of a science is not itself a reason for accepting or rejecting those features as salient for species identification.

The Causal Appeal to Science

What makes the biological study of species more relevant to classificatory practices than other methods of investigation may be its focus on causal mechanisms (Ereshefsky 1992, 359). In ideal circumstances, the cause of similarity and diversity among organisms would reveal all of and only the real species taxa. If there were only one cause of the differentiation of biological kinds, a taxonomic system based on that causal mechanism would adequately capture every relevant sense in which organisms belonged to different species. Every similarity and difference in individuals could be accounted for by reference to that one cause. Those ideal circumstances are not the ones biologists are confronted with.

Ecological pressures, reproductive isolation, genetic transmission, and mutation are just some of the forces that cause organisms to diversify and remain similar. Each of these causes has at least one corresponding species theory as well: the ecological species concept (Van Valen 1976), the biological species concept (Mayr, 1970), and the genetic account of species (Wilkerson 1995, 131-36). The problem is that no one of these causal mechanisms is responsible for every similarity and difference among organisms. Often they are not exclusive causes of any one evolutionary change either. Ecological pressures and genetic factors may both act, and interact, to produce a new species (Sterelny and Griffiths 1999, 97-8).

One motivation for rejecting species monism is that no one classificatory scheme can capture the relevance of all the causal mechanisms at work in evolution. The plurality of evolutionary causes is problematic for species pluralism as well. Because evolutionary mechanisms produce changes through interactions with each other, there are not distinct taxa corresponding to each distinct mechanism. Were it the case that genes caused one set of taxa to evolve while ecology caused another, developing separate classification schemes for each cause would entirely account for every evolutionary event that produced a new species. A pluralistic theory of species might then identify x number of species concepts, where x is equal to the total number of evolutionary causes, and have fully accounted for every relevant feature of species taxa. The fact is, however, that single speciation events are produced by multiple interacting causes. As a result, there are not several distinct taxa corresponding to the different causal mechanisms at work in evolution. The problems for pluralism is that there is no reason to believe, given the interaction of evolutionary causes, that providing one species concept for each cause will account for every species taxa. Most species taxa just are not the product of a single cause.

Taxonomic approaches that utilize evolutionary causes might be combined in order to account for the plurality of processes that lead to species formation. Mishler and Brandon, recognizing that evolutionary causes do not operate in isolation, propose that their historical approach to species be supplemented with various species concepts (Mishler and Brandon 1987, 306)[9]. In order to emphasize the causal processes most prominent in the formation of species taxa, biologists should use the ecological species concept to identify those lineages in which ecological pressures are prevalent causes of the speciation event. Such an approach is able to highlight multiple causal mechanisms, ecology and decent in this case, and hence may overcome the objection offered above.

While this is certainly a useful recommendation to scientists because the species concept employed will in fact emphasize multiple relevant causes, it is difficult to contend that these muti-cause species concepts will pick out the real taxa as well. Even if a species concept is able to account for multiple causes, it is unlikely that one can or will identify every factor that played some causal role in the evolutionary development of that species. Such a theory would be cumbersome at best, impossible at worst. Secondly,

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[9] As discussed in chapter II “For Pluralism.”

ecological pressures may play a primary or secondary role in species formation. In some cases, the role one causal mechanism plays will be prominent while in others it will be minor. Species concepts are not dynamic in this way. Even if species concepts could accurately represent the relative importance of various evolutionary factors, and this is claim itself is dubious, it would be likely to necessitate a unique species concept for each species taxa. It is likely that every species that has ever existed has come about from a slightly different balance of evolutionary forces. Lastly, it is unclear how multi-cause species concepts could represent either the interactive or dynamic nature of evolutionary processes.

The prospects for moderate pluralism would be much brighter were single causal mechanisms responsible for species taxa because an enumeration of those causes would list all of the relevant factors for classification. Ereshefsky moderates his species pluralism by limiting legitimate taxa to those that highlight causal mechanisms and providing four principles of acceptability that reflect the practical demands applicable to most scientific theories (Ereshefsky 1992, 358-361). He distinguishes between two kinds of principles, motivating and sorting principles, which ought to restrict species pluralism. Sorting principles are just the principles by which species are sorted or delineated, which are given by the species concepts themselves. Motivating principles identify the causal factor highlighted by the particular species concept invoked in the sorting principle. The ecological species approach, for instance, sorts based the ecological niche occupied by individuals, and is motivated by the fact that ecological pressures cause evolutionary change as well as stability.

For Ereshefsky, cases of legitimate species are not limited to those concepts that highlight causes of evolutionary change, however. Genuine taxa are merely nodes of causal process. “Motivating principles either cite the causal processes that give rise to lineages or the similar causally efficacious nature of those lineages” (*Ibid.* 359). Though the theories explicitly endorsed all highlight causal process that form species, Ereshefsky makes room for taxa based on the causal processes that similar organisms give rise to. The principle that species taxa be motivated by identifying ‘causal nodes’ does little to restrict species pluralism because it allows that any causally efficacious feature of organisms can be utilized for classification. Culinary taxa highlight the similar causes of organisms on the human digestive system, so even far-flung theories such as this are motivated by the recognition of causal nodes. Culinary taxa such as onions fit the description perfectly—they are lineages with similar causally efficacious properties.

Ereshefsky offers four restrictions on sorting and motivating principles in order to moderate his pluralism. Motivating principles should be empirically testable, consistent with other scientific theories generally, and “derivable from the tenets of the theory for which the taxonomy is produced.” (*Ibid*. 361). Sorting principles should sort organisms into a single taxonomy that is internally consistent so that no individual is part of multiple species. This principle is not automatically violated by pluralism because consistency constrains each individual species concept, not their conjunction. This is undisputed. Likewise, few would dispute the claim that any species theory should be based on empirically testable features and consistent with modern science. These are demands any taxonomic theory must be held to. Not even culinary taxa should dare violate such principles—but nothing about them undermines the legitimacy of culinary taxa. If any restriction is to do the work of disqualifying species theories that are based on causally efficacious properties but not of interest to the biological sciences, it is the derivability principle.

What does it mean for a species theory to be derived from the scientific theory it was produced for? Ereshefsky's example is that species taxa based on interbreeding relations are motivated by the causal role of interbreeding in producing stable groups of organisms (*Ibid*. 359). Evolutionary theory tells us that interbreeding causes stability, so the tenets of evolutionary theory indicate which nodes of causality are relevant to species classification. We can derive the interbreeding species concept from evolutionary biology because evolutionary theory says that species are produced, in part, by interbreeding relations. This view would seem restrict species concepts to those that identify features that cause species similarity and differentiation. Two problems arise for the derivability principle: on the one hand, it does little to moderate pluralism, and on the other, it does not guarantee the identification of real taxa.

The first issue is that the derivability principle requires that each legitimate species concept be produced for some broader scientific theory. Like Kitcher's emphasis on biologically interesting theories, this approach dictates that only species concepts accepted by certain branches of science are real. If a species concept is to be both derived from and produced for a scientific theory in order for it to count as legitimate, no unscientific species theory will do. The fact that many features of organisms, like means of locomotion and culinary properties, *could* be the subject of a scientific discipline but are not indicates the arbitrary nature of such a restriction. Some species taxa cannot be derived from scientific theories, but only because of the contingent fact that scientists do not find those properties interesting enough to be the subject of some broader scientific theory, not because they are in principle unable to be the subject of scientific inquiry.

The second problem for the derivability principle is the observation that individual causal processes do not form distinct species taxonomies. Identifying one causal process that produces stability in populations of organisms does not identify one set of species taxa produced by that process. There is good reason for suggesting that the causal processes responsible for evolution should be used to identify species, but isolating these mechanisms conceptually does not indicate species taxa that are individuated metaphysically. The fact that many causal processes interact in species formation undermines the claim that there are distinct species taxa for each cause identified by evolutionary theory, or that classification based on these causes should indentify taxa that are any more real than taxa that do not. Nothing about Ereshefsky's strategy for moderating pluralism vis-à-vis the derivability principle identifies taxa that are privileged or more real than others. Furthermore, the only obvious reason for classifying by evolutionary causes of species, rather than causally efficacious properties of species, is that evolutionary causes are responsible for species formation.

The sense in which evolutionary causes are responsible for species formation is deceptive, however, since no single cause is responsible for many individual cases of species formation. Individual causal mechanisms like interbreeding are usually partial causes, not fully responsible for speciation events. A causal approach to classification would be compelling as a moderate pluralism if individual causes accounted entirely for how some species were created, and if some limited set of cause-based species concepts could account for most or all of the species recognized by biologists, but no such theory or set of theories is available.

The species taxa identified by evolutionary causes are sorted based on features that partially account for some species formation events, but because each individual species theory accounts for only one distinct causal mechanism, they identify few, if any, distinct kinds of species. The ecological approach, for example, will identify species that were formed by genetic or interbreeding causes as well as ecological, or some interaction between them all. What we are looking for is a complete account of what species taxa have been produced by evolution, not what mechanisms produced them. Just because ecological factors play some part of the causal role in producing some species does not mean that ecological factors correctly identify a whole class of real species taxa. Again, this would be the case only if ecological causes functioned independent of other evolutionary factors. Evolutionary causes are not so isolated, and as a result there is no reason to believe that species pluralism can be moderated by treating species as if they were caused by isolated mechanisms.

While the sciences identify causal mechanisms that produce species, it is not clear that the only species produced are those sorted according to causal evolutionary factors. It may be the case that a wide variety of species are produced by the constant interaction of evolutionary forces. As Dupré puts it "Nothing in evolutionary theory guarantees that genealogy will always provide us with the distinctions we need in order to understand the current *products* of evolution as opposed to the process by which they came to be" (Dupré 1993, 51). Upon reflection, this should not come as a shock to metaphysicians and scientific taxonomists intent on discovering objectively real taxa. After all, the paradigm of objective taxonomy, elements of the periodic table, are neither identified nor classified by the processes that produced them.

CHAPTER FOUR

Species Universalism and Mereology

Moderate pluralistic realism about species must face the difficult, perhaps impossible, task of identifying a mind-independent feature of reality that distinguishes the real species taxa from the unreal— a principle of moderation. If there is no proper way to moderate species pluralism, no principle that picks out which species theories identify real species kinds, then only a radical solution will do. One option is to deny that species are real at all. I regard anti-realism as a position of last resort, though. There are other theories of species pluralism that may save realism while conceding that moderation is untenable. Mereological universalism has confronted the problem of moderation, for individual objects, and produced a radically pluralistic theory consistent with realism.

Mereology is concerned with the relations between parts that compose whole objects. A precise formulation of the inquiry is given by the special composition question which asks what relations must hold between parts in order for them to compose a further object (van Inwagen 1990, 21-2). As in the species debate, metaphysicians have offered both monistic and pluralist answers to this question, and some have offered radically pluralistic perspectives (Sider 2001, 120-132; Lewis 1986). Also like the species question, the problem of moderation forces philosophers to ask whether pluralism about composition can be restricted to a moderate number of theories (Markosian 2007).

Philosophers of biology have paid little attention to these pertinent developments in metaphysics. The philosophical problems addressed by mereological universalism are quite applicable to species theories. Ironically, though species have increasingly been treated as individuals rather than kinds or classes, metaphysical discussions of parts and wholes have been noticeably absent. Philosophers concerned with the species debate and theories of composition are hard pressed to reconcile realism with the problematic cases of particular entities, be they kinds or individuals. Pluralists also face the problem of moderation, or "restriction" as it is often called in mereology. I propose a theory of species universalism that parallels mereological universalism in order to overcome some of the persistent difficulties concerning species. A plausible solution of the problem of moderation has already been advanced by mereological universalists, so all that remains is to develop a species pluralism of similar nature and see if it is a viable alternative.

Mereological and species pluralism have a few notable parallels. The problem of moderation is sometimes stated as a problem about vagueness in mereology, and I note that this vagueness is inherited from taking on the thesis of individualism, not due to any specific mistake made by species individualists.[10]Vagueness is an issue about meaning so, following the universalists' lead, I turn to the semantic level fix the vagueness problem. The semantic features of universalism alleviate problems concerning trivial taxa, communicative confusion, and practicality. By relocating much of the species debate at the semantic level, the pluralistic realist avoids arbitrary forms of moderation inconsistent with realism.

Kitcher suggests a form of realism that entails the most radically plural theory of species kinds. Though he does not defend it as a satisfying account of species because it

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[10] The vagueness problem for species individualists is discussed in Chapter Two "Against Monism."

renders scientific species concepts metaphysically indistinguishable from mere sets of organisms, the following "cheap" account of species realism is offered:

> anyone who accepts a modest realism about sets can endorse realism about species. Organisms exist and so do sets of those organisms. The particular sets of organisms that are species exist independently of human cognition. So realism about species is trivially true." (Kitcher 1984, 330).

The suggestion that any set of organisms is real may underwrite radically pluralistic realism, but Kitcher's line of thinking is that if all the sets of organisms are real, then whichever species kinds the sciences decide are practical are real as well. Thus Kitcher has a starting point from which the compatibility of realism and pluralism is made clear, even if it is not his own theory. The consequence of this approach is that all the trivial sets of organisms are real as well— all of the organisms in Texas, for example, form a real taxa. Given that he promotes a moderate theory of species, this remark appears to be merely tangential to Kitcher's account. However, if no moderate theory of species pluralism proves viable, then this cheap realism about biological sets may be of some consolation. If the sets of organisms that are ordinarily called species turn out to have no exclusive claim to actual existence, then we should consider adding sets to our ontology that are not paradigm examples of species in order to make room for those that are.

Species universalism is the view that every possible set of organisms, including paradigm cases of species, are on an equal footing with regard to reality (existence). Species universalism has an ontological counterpart in mereological universalism, the view that every possible collection of individuals, organic or otherwise, compose a further whole object[11].

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[11] The name "species universalism" is, of course, inspired by its mereological counterpart.

Species universalism is analogous to mereological universalism because they both take real entities—composite objects and species respectively—to be constituted by every possible set of lower level entities. Universalism in mereology takes every set of all possible parts to be a real object, where possible parts are just any other object, composite or simple. Species universalism takes every set of all the organisms in the world to be a real species taxa. Because radically pluralistic ontologies are so rarely considered in the biological context, it is instructive to look to mereological universalism as an analog for species universalism. In fact, it seems to me that species universalism has been lurking in the dark theoretical corners of mereological treatments of species for some time.

The motivation for rejecting moderate pluralism for species given in chapter three is similar to the problems found with moderate, or restricted, theories of composition. David Lewis argues that:

> The trouble with restricted composition is as follows. It is a vague matter whether a given class satisfies our intuitive desiderata for composition. Each desideratum taken by itself is vague, and we get still more vagueness by trading them off against each other" (Lewis 1986, 212).

For all the proposed moderate criteria of composition—like cohesion, contact, and fastening— none of them come close to identifying all and only the objects typically considered ordinary individual objects, nor is there any moderately pluralistic conglomerate of those theories that is fruitful (van Inwagen 1990, 56-60).[12] Universalists think that no compositional criterion or plurality of criteria can determine when composition occurs, so there is only one conclusion: either composition always occurs or

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[12] Van Inwagen is not an anti-realist about composite individuals, he has his own pet theory of composition, but he critiques and rejects a substantial number of standard mereological relations.

it never does; either every set of individuals is a real object or none of them are (Van Cleve 2007, 328).

Universalists reject the possibility that composition never occurs because the implication is that no composite objects exist, and this seems wildly implausible given that we ourselves appear to be such objects. In stead, they adopt the position that any random scattering of material is a whole object. It's a hard pill to swallow, but the medicine seems to work. Universalism, while counter intuitive, is not obviously at odds with realism, whereas all of the other proposed criteria for composition are. Mereology resembles set theory on this view because a set is real just in case its members are real, and universalism says that object is present just in case its parts are real[13]. Both universalist theories of species and whole objects can be modeled after sets.

The motivation behind mereological universalism is often formulated as problem about vagueness. Consider the problem of identifying the exact parts of a single cloud, a collection of water droplets in the atmosphere (Lewis 1993, 164). Water vapor is present throughout the entire atmosphere, including the areas proximate to the boundaries of the cloud, so picking out the exact point at which the parts of the cloud cease and mere diffuse water vapor begins is an exercise in futility. There is no principled way to decide which water molecules are rightly considered parts of the cloud and which are not. Lewis then extends this example to all individuals by pointing out that all individuals are composed of particles and that for every object, some of those particles will be questionable parts. Sometimes (and more often than we would like), it is vague whether

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[13] Of course this reverses Lewis' universalist position in an important way as he intends to understand set theory through composition (1991).

or not some object is part of a further composite object. Vagueness troubles the metaphysics of composition because the object itself cannot be vague. Thus problematic cases of composition lead philosophers to conclude that composition always occurs in order to avoid endorsing either vague entities or arbitrary principles of restricted composition.

> If not every class has a fusion, then we can consider two possible cases, one in which composition occurs and another in which it does not, which are connected by a 'continuous series of cases' …each extremely similar to the last. Since composition can never be vague, there must be a sharp cut-off in this series where composition abruptly stops occurring. But that is implausible. So composition always occurs" (Sider 2001, 122).

To compare, David Hull, a rather devoted species monist, takes mereology to be the proper ontological theory of species and recognizes this problem of vague boundaries for them. He responds by insisting that "comparable difficulties can be found for organisms, and organisms are supposed to be paradigm individuals" (Hull 1976, 187). He concludes that because such problems of vagueness are ignored in organisms, they can be ignored for species as well. The proper reply to such an argument is that ignoring the problem does not make it go away. Mereologists have examined the problem of moderation and proposed a solution that reconciles realism with pluralism while attending to the problem of vagueness. For organisms, this means that each problematic case is in fact a composite organism, and a great many others besides. Counter-intuitions aside, it is just as well to conclude that whatever mereologists have said about composition goes for species. Without even knowing what the mereological theory is, an intelligent person should be willing to blindly put their faith in the truth of their solution, so long as it's viable, rather than rely on ignorance. Elliot Sober comes closer to realizing the universalist possibility when he admits that considering species mere sets of organisms is difficult for him to accept because he does not think of individual objects as mere sets, but explicitly acknowledges that perhaps he ought to (Sober 1984, 338).

I suspect that one reason philosophers have found mereology an appealing ontological framework for species questions is that the phenomenon of composition is an unsettled matter. Disagreement about how parts form integrated wholes reigns in the field of mereology, and this gives the species individualists little restrictions on what kind of mereological relations they can take to be species relations.[14] Individualists recognize the need for specific criteria of composition, but it is unclear that any solution is forthcoming.

As previously noted, Mishler and Donoghue have contended that there is an open ended number of mechanisms by which the cohesion of an individual species might be preserved, but that position seems to sidestep the very real problem of vagueness that species individualism faces (Mishler and Donoghue 1982, 501). In short, claiming that species are individuals is well nigh meaningless without a presupposed theory of composition. A lack of consensus about how individuals are composed has allowed species individualists to make vague claims about what species are without owning up to the problems of that vagueness. Each problematic case of species membership is a case of vagueness—it is vague whether or not the set including a problematic organism composes a species. Thus vagueness in compositional theories allows problematic species cases to go untreated by individualists. Either species are metaphysically vague, a proposition I reject out of hand, or a better theory of species is needed.

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[14] Peter van Inwagen (1990), for example, considers, and rejects, a whole host of plausible principles of composition.

Realism

One deficiency the analogy between species and composite wholes suffers is relative non-urgency of species compared to ordinary objects. Consider the dichotomy the universalist presents just before declaring that composition occurs between all existing objects: either universalism is true or there are no composite objects. Denying universalism commits us to denying the reality of chairs, planets, and any object that doesn't have some other ontological theory to rely on. Humans might be individuals due to some other feature than the composition of their parts, perhaps because we are persons or because we are living. Nonetheless, anti-realism about such a broad group of familiar objects is a foreboding conceptual possibility. Species taxa, on the other hand, are a relatively narrow band of phenomena that might be thrown out more readily. Nonetheless, we should run with a realistic account of species as far as possible before carelessly succumbing to anti-realism.

Stanford holds that anti-realism is preferable to realism because species kinds are subject to the interests of scientists and their aims. Since real species kinds cannot be individuated on interest-relative grounds they must not be real (Stanford 1995, 86). But there is an available alternative. I propose that accepting boring or uninteresting species kinds as real would be preferable to denying realism about species. If a radically pluralistic theory can support realism about scientifically interesting species theories by endorsing realism about trivial species kinds as well, better to include trivial or counter-intuitive entities in our ontology than exclude important ones.

The best argument for universal species realism is that it does not posit any additional entity over and above the level of individual organisms. Species are real only to the degree that their respective individuals are real. Evolution does not produce kinds of organisms, not species kinds anyway, only the individuals that constitute them. However, this differs from anti-realism because it endorses a theory of species taxa for just what they are: collections of variously similar and dissimilar organisms. The individual living beings are real and so are their features and properties, so recognition of the fact that some groups of them are objectively similar and dissimilar is just to recognize that taxa exist.

Given the choice between ontological nihilism with regard to individual objects and mereological universalism, many sensible metaphysicians have sided with realism of the cheap and radically pluralistic variety rather than admit that there are no real composite wholes. If the problem of moderation is threatening to the species theory, as Stanford argues, anti-realism is not the only alternative. Species theorists may well retreat to universalism rather than admit that there are no real species kinds, and for the same reasons. Some species taxa are almost undeniably real—*Homo Sapiens* for example. As in mereology, once the door is opened to common sense entities the problematic ones are sure to follow, and with them the universalist solution.

Quantifier Restriction and Vagueness

One objection that species universalism is sure to encounter is that even if species, at the level of pure metaphysics, are merely sets of organisms, the subject has been changed entirely. When philosophers, biologists, and laypeople talk about species they are not talking about just any old set. They are referring to specific groups of similar organisms, reproductively compatible groups, or whatever their favorite theory of species, if they have a well-developed theory at all, specifies as species. This is commonly called the "tower of Babel" complaint, and at it's core is the belief that radical pluralism results in inevitable confusion about what is being discussed when engaging in discourse about species (Dupré 1993, 52). Talk about pigs, for instance, is clearly about some distinct set of animals. If any set of animals qualifies as a species, then any number of sets might correspond to the name "pigs," and two people can hardly succeed in understanding each other without time consuming explications of what specific set of organisms are being called pigs.

Hull accuses the radical pluralist of obfuscating her terms without need, for if there is one set of pigs corresponding to the ones caused by ecological pressures and another distinct set that are capable of breeding, the pluralist ignores this distinction and continues talking about pigs as if it were perfectly clear what she is talking about (Hull 1990, 84-5). This is no difficult problem for pluralism since linguistic distinctions can easily be made between eco-pigs and bio-pigs.[15]Eliminative pluralists contend that the term species should be done away with entirely in favor of more specific terms such as eco-species and bio-species (Ereshefsky 1992, 357-8). Hull admits that the Babel problem is just that "nothing is gained and much is lost by not reflecting this distinction consistently in our terminology," but simple revisions to the way we talk about species can clear up any such confusion (Hull 1990, 84). Furthermore, it is monists who lose out when pluralistic species distinctions *are* specified because they ignore useful distinctions

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[15] "bio-pig" is meant to highlight the fact that breeding relations are central to the biological species concept.

between non-identical taxa. Surely something is lost in ignoring the distinction between entities like ‘eco-pigs’ and ‘bio-pigs’, even if that something is sometimes trivial. Nothing is lost and something is gained by reflecting a plurality of species in our terminology.

It is not commonly the case that speakers will have good reasons for explicitly referring to specific theories of species when talking about them. Generally, we all know what we’re talking about, whether implicitly or explicitly. Universalism relies on quantification restriction to disambiguate a concept when needed. First, let’s get clear on how mereological universalists formulate the linguistic aspect of universalism.

Vagueness, the problem that motivates universalism, is a semantic feature. It is vague as to which organisms are rightly considered pigs, or at least what criterion should pick them out. When two plausible candidate populations are linked to the word pig, it is a problem that species theorists must confront: what pig means has become vague. Furthermore, talk of ‘species’ is vague if there is no monist or moderately pluralistic formulation of the meaning. It is not the case, however, that there is some things called ‘species’ or ‘pigs’ that are vague. What is vague is the language. “The only intelligible account of vagueness locates it in our thought and language” (Lewis 1986, 212).

However, explicitly defining terms or labeling them with specifying operators like ‘eco’ and ‘bio’ is not the only way to disambiguate language. Consider students in a philosophy class that are wary of offering an answer to the question “What do you know?” They don’t hesitate because they don’t know anything or because they are unsure of what they know. The resistance stems from the fact that in the philosophical context justifying knowledge is a demanding task. Oftentimes, we take in cues from our linguistic context to reach a nuanced understanding of terms (Grice 1975). One way of describing the occurrences of context sensitive language is to say that the quantifiers of the language have been restricted (Lewis 1986, 213). On this theory, quantifiers do a lot of linguistic heavy lifting.

Lewis stresses that instead of restricting, or moderating, mereological pluralism, we ought to restrict quantifiers so that the implicit meaning of “the pigs,” where “the” is the context sensitive quantifier, specifies the domain of organisms the term pigs is supposed to apply to. Its not clear that it matters which words do the work of restriction, the point is that some objects a word might refer to on one occasion are ruled out by the context of another. The tower of Babel objection assumes that people are incapable of taking contextual meaning into account in order to be specific about which aspects of a vague word are being invoked. People outside of the biological discourse have little occasion to distinguish between competing species concepts or populations formed by different evolutionary mechanisms.

Most of the time, words like ‘lily’ are just vague. Consider how many people use the word species and how many people can give a satisfactory definition of the term. Common ways of speaking about species may not bother with hodge-podge sets of organisms, but they are not seriously committed to their unreality either. “At best, [common sense] is committed to the view that the scattered objects of mereology, if they exist, are for the most part not worth mentioning” (Rosen and Dorr 2002, 213). Universalists overcome the apparent vagueness of pluralistic terminology by appealing to language users’ ability to pick out meanings by intentionally, rather than explicitly, ignoring or emphasizing aspects of meaning. Like Humpty Dumpty in Lewis Carroll’s

Alice's Adventures in Wonderland, "When I use a word it means just what I choose it to mean — neither more nor less." Whether the other participants in the conversation know what's meant is another matter entirely. In an ironic turn of language, I stress that "…accepting pluralism, even encouraging it, is not the same as promoting ambiguous terminology." (Hull 1990, 84). Indeed accepting any radically pluralistic ontology demands specificity, whether implicit or explicit, in order to curb unnecessary confusion.

Again, one is struck by the coincidental promotion of ideas useful to species universalism throughout mereological treatments of species, and monistic ones at that! Hull seems to have no problem with saying that the naming of individuals, and hence the naming of species, "is in general a rather arbitrary exercise. Any term can be applied to anything one wishes" (Hull 1976, 178). In different contexts species terms will pick out different sets depending on the interests of the speaker, and yet the taxa identified refer to a set of beings that exist independently of our interests (Brogaard 2004, 238).

The tower of Babel objection has many responses. It is an issue that any theory endorsing radical pluralism will have to confront, but linguistic philosophy is up to the task. Leaning on intentionality or context to specify vague meanings is the philosophical hard route. The objection is countered easily by insisting that words with a plurality of commonly used meanings be explicitly labeled, as with 'eco-pigs' and 'bio-pigs.' It is surprising that it has been raised and responded to so many times (Dupré 1993; Ereshefsky 1992; Kitcher 1984; Hull 1990).

CHAPTER FIVE

Conclusion

When people talk about species they can discuss whatever organisms they care to address. Sometimes there is no thing or taxa that corresponds to their discussion topic because the conversation takes place at an unsophisticated level that does not necessitate a complicated understanding of species. Other times they are referring to whatever taxa the situation demands they consider. This is just the kind of theory some philosophers are likely to mistake for subjectivism or nominalism. It is an easy mistake. Species universalism supports the idea that I refer to whatever collection of organisms I want to when talking about species, and that those taxa are real, despite their possible ridiculousness. An immature understanding of the theory might conclude that people can think species into existence (subjectivism), or stipulate that they are real (nominalism). The short response is that it is just a fact that sets of organisms exist. Some sets are reproductively compatible, some share ecological niches, one set consists of me and the cockroach in the corner, but all of them are real (Brogaard 2004, 238).

This approach to classification attempts to transcend the debate between realism and nominalism to take elements from each. Linguistic conventions play a role in how we talk about and conceive of the biological world, even in the most rigorous of scientific contexts. Hilary Putnam has made this point by saying "elements of what we call 'language' or 'mind' penetrate… deeply into what we call 'reality'" (Putnam 1990, 28). For the mereological universalists who thinks that there are an uncountable number of real objects, the objects of what we might call "practical ontology" (the things we *usually* consider real) differ from everything else only because we recognize and think about them. The rest is completely trivial despite being real. Thus Putnam suggests that instead of inquiring about what is, the search for metaphysical reality, philosophy ought to be more concerned with finding better ways of thinking about reality (*Ibid.* 21). Reality is a mundane feature of ontology on this view, and not worthy of devoting much philosophical resources to. Most of the real intellectual work needs to be done at the semantic or pragmatic level. One reason for rejecting Stanford's appeal to anti-realism is that he is too concerned about interest-relative ontology. All practical ontology is interest-relative, but being interest relative is compatible with being real when so many real taxa exist.

What distinguished scientific species concepts from the many real taxa endorsed by radical pluralism? Scientific taxa may simply be more useful and interesting. Scientists and laymen alike may simply ignore the mass of uninteresting taxa, much the way uninteresting composite objects are ignored in everyday discourse according to Lewis' universalist theory of composition (Lewis 1986, 213). Classifying organisms based on physical similarity may indicate the presence of other interesting properties better than classifying based on body weight, but that does not mean morphological taxa are any more real than size-based taxa, just more useful. All too often, the utility or naturalness of a species theory is taken as an indicator of reality and a lack of usefulness as metaphysically salient. Ontology is the subject of what exists, not what is useful. Philosophers and scientists have a hard time believing that scientific taxa are not more real than non-scientific classifications because the scientific theories are the most useful for attaining understanding of the natural world. As well they should, it is the role of natural scientists to strive for such understanding. Ontology, however, is best left to the metaphysicians. Dupré, I suspect, has a similar view. Part of his motivation for claiming that any useful taxonomy is real is to wrest species ontology out of the hands of science and its dogmatic adherents (those whose believe science is in the business of providing metaphysically privileged descriptions of reality).

In the case of the periodic table, there is no reason or use in thinking that scientists did not discover a fundamental ontology of the universe. The classification of substances by way of microstructural necessary and sufficient conditions fits our best models of typological ontology. Not so for species. Biologists seem to make headway trying to understand the mechanisms of evolutionary theory while progressing little in their understanding of the species produced. Thankfully science has not yet co-opted every last corner of philosophy, and for good reason. Sometimes it takes a philosopher to point out the limitations of scientific reasoning. While biologists are perfectly capable of comprehending what species are, their understanding of biological causes has not produced a legitimate ontology of the evolutionary products. Due attention to the interactive nature of evolutionary causes and their variability of importance in specific taxa indicates that that there is no reason to expect that it would.

Philosophical recognition of the radical plurality of species taxa does not have much, if any, practical impact. Laypersons are free to talk about species in a vague manner so long as it suits their purposes. Scientists ought to be guarded about which species concepts they use because it affects their ability to go about doing science. Just because species theories that highlight evolutionary causes are not metaphysically privileged does not mean they aren't scientifically privileged. To the contrary, classifying organisms based on their evolutionary causes is productive for doing exactly what evolutionary biologists are supposed to do, reaching for a better understanding of the process of evolution. While it is tempting to think that only interesting, useful, or scientific species are real, these positions are not tenable upon philosophical reflection.

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