CONTOURS OF DESIGN

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According to intelligent design theorists (hereafter, 'ID theorists'), the theory of intelligent design (IDT) is not a theory in biology (Dembski 2004); it is, rather, a research project whose conclusions have implications for a small subset of systems within biology (Behe 2004).[1] Nor, so it is claimed, does IDT fall within theology, although its predecessor, the teleological argument, and so-called creationism, whose predecessor is also the teleological argument, indeed do. For many, the distinction between biology and theology, on the one hand, and IDT, on the other, is hard to see. If IDT is regarded as a biological research program, its claims can easily be taken by competing theorists to entail more than ID theorists intend. If IDT is taken to be essentially theological, it is open to accusations of being a pseudo-science. Biology and theology are thus the conceptual Scylla and Charybdis between which the proponents of IDT must navigate while presenting the IDT project.

Such navigation is also crucial for critics of IDT. Ronald Dworkin, in *Law's Empire*, points out that argumentation requires what Timothy Endicott refers to as the "fulcrum of disagreement," the set of claims each interlocutor must agree on before a debate can take place (Dworkin 1986; Endicott 2001). If, for example, two legal theorists cannot agree upon the proper usage of the term 'law', then an argument about what the concept of law entails cannot begin.[2] Similarly, if ID theorists and their critics cannot agree upon what IDT essentially claims, then debates about the nature of IDT–let alone the truth of IDT's claims–will yield little, if anything.

The purpose of the present paper is not to argue that IDT's hypotheses are true, useful, or whatever it is that makes a scientific claim good; rather, I only want to present the project of IDT

in what I take to be the most charitable light by arguing that it is in fact a science. Moreover, the argument I put forward will reveal IDT's distinctiveness *vis-á-vis* biology and theology. Structurally, the argument is a series of two disjunctive syllogisms: Either intelligence is a genuine kind or it is not. On the one hand, if intelligence is not an artificial kind, then denying that intelligence is a genuine kind entails (for reasons offered below) eliminativism with regard to intelligence; on the other hand, if intelligence is a genuine kind, then (also for reasons discussed below) either IDT counts as a science, or the boundary for what counts as a kind is arbitrarily drawn. Since drawing arbitrary divisions in philosophy or science seems unacceptable and few want to go the eliminativist route, one therefore ought to accept IDT as a science. I begin with the concept of kinds.

Kinds, Laws, and Domains

Genuine kinds, typically taken to be properties that carve reality at its joints,[3] are denoted by predicates such as '*x* is an electron' or '*x* is a tiger'.[4] Genuine kinds are often contrasted with so-called "artificial" kinds, which are denoted by predicates such as '*x* is a chair' or '*x* is a book'. Now, it is often held that laws of nature are regularities that hold between properties and thus between genuine kinds.[5] Therefore, science is largely in the business of discovering what genuine kinds (hereafter, simply 'kinds') and properties there are and describing the relationships between those kinds.[6] For this paper, I assume all of this is true.

As Paul Oppenheim and Hilary Putnam (1958) have pointed out, the scientific enterprise itself seems to consist in a hierarchy of special sciences that, in a sense, sit atop physics:[7]

5.....Sociology
4.....Psychology
3.....Biology
2.....Chemistry
1.....Physics

That these sciences seem to form a hierarchy points to some interesting facts. First, properties (and thus kinds) appear to cluster. For example, '*x* is an electron' and '*x* is a positron' seem somehow more closely related than '*x* is an electron' and '*x* is a tiger'. Yet all three are often believed to denote kinds. As a consequence, laws also appear (to a large degree) to cluster. Let us call the cluster of properties and laws falling within a particular science, that science's "domain." Second, unlike the relation between properties within a domain, there seems to be a constitutive relation between properties in different domains. That is, higher-level properties (and thus higher-level kinds) seem to *consist in* arrangements of lower-level properties (and therefore lower-level kinds). Let us call higher-level properties, "special-science" properties or "special" properties, and lower-level properties, "physical" properties.

Here, though, is where things get tricky. For, if–as seems plausible–dualism is false,[8] then it appears some sort of identity relation between special properties and physical properties must exist. Consequently, many have attempted to unify the sciences by "reducing" the predicates in special sciences to predicates in physics via so-called "bridge laws," biconditional statements by which specia -science predicates (hereafter 'special predicates') can be defined in terms of physical predicates[9]:

(L_R) $\quad \forall x(Sx \leftrightarrow Px)$

where '*Sx*' denotes a special property and '*Px*' denotes a physical property.

Jerry Fodor (1974) points out, however, special predicates do not have a one-to-one correspondence relation with physical predicates.[10] Rather, since a special property can be "realized" (whether through emergence, supervenience, or whatever) by a multitude of physical properties, biconditionals that cross the boundary between a special science and physics connect a special predicate to a *disjunction* of physical predicates:

(L_A) $\forall x(Sx \leftrightarrow P_1x \vee P_2x \vee \ldots \vee P_nx)$

Now, according to Fodor, kinds just are properties whose names appear in law-statements. And since law-statements do not consist in disjunctive predicates, there can be no disjunctive properties and thus no disjunctive kinds. Since there can be no disjunctive kinds, the predicates within a special science are blocked from being reduced to physical predicates. Therefore, for Fodor, it is the failure of disjunctive kinds' names to appear in true law-statements that prevents the positing of disjunctive kinds. Many take the multiple realizability of special properties by physical properties to prevent special-science kinds from being reduced to physical kinds.[11] Therefore, a single physical entity can possess properties from multiple domains, and thus, moreover, two scientific domains can "overlap" within a single spacetime region.

That a single entity can simultaneously possess properties from multiple domains makes puzzling how we are able to distinguish between domains. In considering this issue, two questions come to the fore. First, how do we come to think that an aggregate of physical kinds like particles, waves, and fields of force is also a biological kind, say, a Peregrine falcon? The answer lies in our ability to detect homogeneity across instances. While two electrons might look exactly similar, they look nothing like Peregrine falcons; but (despite their failing to be *exactly* similar) two Peregrine falcons will usually look quite similar. So, we group electrons into one

kind and Peregrine falcons into another. The second question is, why are things like electrons and positrons placed in one domain (physics) and Peregrine falcons and Bengal tigers placed in another (biology)? The short answer is that Peregrine falcons and Bengal tigers are understood to be *realized by* electrons and positrons (among other things). Now, this asymmetric realizing relation between properties defines domain boundaries. So, perceived homogeneity across instances[12] and the asymmetric realizing relation between properties together allow us to recognize distinct domains despite their overlapping within spacetime regions.

To summarize what has been discussed thus far, first, domains consist in projectible properties and the laws that hold between them; second, if some property or kind S is realized (in whatever way) by a set $\{P_1, P_2, ..., P_n\}$ of properties or kinds, then S and P_x exist in distinct domains; and, finally, since a single object can possess two projectible properties one of which is realizable by the other, two domains can overlap within a single spacetime region. Now, let us turn to the question of intelligence and how it might be detected.

The Intelligence Domain

The first premise of the argument I am putting forward is this:

(1) Either intelligence is a genuine kind, or it is not.

Taking the first disjunct, is there reason to think that intelligence is a kind? Consider that we are naturally predisposed to recognize kinds. In fact, history seems to indicate that such recognition is the foundation of science. One notices homogeneity across events[13]; one posits a law to explain that homogeneity; the law-hypothesis is tested; and, through repeated experiments, the law-statement is revised and eventually the law is confirmed.[14] This whole process begins with the

ability to recognize homogeneity, which we take to indicate a kind. So, with the exception of particularly specialized kinds, we need not be told that such-and-such is a kind; we have simply learned to recognize kinds by developing our abilities to survive in the world.[15]

Now, as stated above, a genuine kind is distinguished from an artificial kind in virtue of the former's appearing in laws and thus being projectible. Notice, however, there need not be a rigorous definition of the kind in question in order to determine whether an entity is a member. Rather, we need only enough information to indicate that the kind-predicate maps onto a property (or set of properties) that appears within laws.[16]

Consider, then, intelligence. Notice, first, that we have a built in ability to recognize very often events which were structured by an intelligent agent, and we are able to recognize such events quite naturally, without having to bring any sort of "intelligence" detecting apparatus to bear. Let us call an event structured by an intelligent agent an "intelligence-event."[17] As it turns out, several sciences are in the business of detecting intelligence-events. Archeologists, for example, must be able to distinguish between artifacts found in the ground versus mere geological patterns; forensic scientists need to differentiate between evidence of intentional action versus mere patterns within a crime scene; success for the Search for Extra-terrestrial Intelligence Institute (SETI) requires the Institute's distinguishing between background "noise" in space versus intentional communication. All of these projects presuppose the ability to distinguish between intelligence-events and non-intelligence-events. And only rarely must one broach the question of whether or not an event is an intelligence-event *even if their practitioners did not observe the event's being brought about.* Together, our natural ability to detect intelligent causes, certain sciences' requiring the ability to detect intelligent causes, and the *success*[18] of both

indicate that homogeneity exists across intelligence-events. Thus, it seems most reasonable to understand intelligence as a kind, even if it is posited as a theoretical or functional kind.

Now, let us turn to my second premise:

(2) If intelligence is a kind, then intelligence figures into scientific laws.

Our brains seem naturally wired to detect homogeneity, which often leads to the positing of lawful relations between homogeneous events. And we seem naturally predisposed to take intelligence as a kind and thus intuitively to hold to something like lawful relations between intelligence-events and their causes.[19] One could imagine, however, that it might be unclear for certain events whether intelligence figures into the cause. In such cases, one might attempt to formalize our intuitive law-statements and success would reveal any actual laws in which intelligence occurs.

William Dembski (1998, 2002, 2004a) has attempted to do just this. At the center of Dembki's work is a posited feature of systems that exhibit an intelligent cause; he refers to this feature as "specified complexity" (1998, 2002, 2004a). Roughly put, complexity increases as the number of variables necessary for the system to exist increases. So, complexity is inversely proportional to the probability of the system's occurring by chance. Specification, a teleological notion, has to do with patterns that are independent of the conditions under which the system occurs but with which the system matches. A highly complex system that contingently matches a specified goal (which is inferred from the system) is said to exhibit specified complexity.

The first law Dembski puts forward is a variation of Peter Medawar's Law of Conservation of Information (Medawar 1984).[20] Dembski calls his variation the "nondeterministic version," which is limited to information within specified complex systems (Dembski 2004a):

(CI) For all *x*, if *x* exhibits specified complexity, then *x* could not have been generated by chance, necessity, or their conjunction.

Dembski's second law (what I shall call the "Law of Specified Complexity") is essentially this[21]:

(SC) For all *x*, if *x* exhibits specified complexity, then *x* was formed by an intelligent agent.

If these law-statements are true, (CI) and (SC) together provide a method of determining whether or not a system exhibits specified complexity. According to (CI), if the system in question could have been generated by chance or necessity or a combination of both, then the system fails to exhibit specified complexity. Therefore, the methodological first step is to rule out necessity; the second step is to rule out chance. Once these have been ruled out, then, according to Dembski, one can assert that the system exhibits specified complexity. Then, by (SC), one can claim that the system was formed by an intelligent agent. Again, I do not claim that IDT's claims are true; I only want to describe what ID theorists claim to be up to.[22]

So, having argued that intelligence is a kind and thus figures into laws, I now present the third premise of my argument:

(3) If there exists a set of kinds and laws those kinds figure into, then those kinds and laws form a domain of empirical inquiry.

Notice that for archeologists, their intelligence-detection activities occur within the same spacetime region as geologists; thus, their respective domains overlap. Conceptually, though, the activities of geologists and archeologists do not overlap. Rather, the intelligence-events themselves help demarcate the boundary between geology and archeology. Geology and archeology compliment each other: once an archeologist discovers intelligent causes for a particular system in the ground, the geologist's work there is done.[23]

There is a parallel to be drawn here, I believe, between how archeologists and geologists relate and how biologists and ID theorists should relate. If certain systems within biological organisms turn out to have been designed, then the biologist's quest to determine how the system *came to exist* will cease to be relevant.[24] So, a biologist and an ID theorist relate in a way similar to the way a geologist and an archeologist relate: IDT (if true) would be biology's compliment. Thus, IDT should not be regarded as a theory within biology, but as a research project *independent of biology* but whose conclusions might partially demarcate the domain of biology.

(4) If intelligence and its laws form a domain of empirical inquiry, then IDT is a science.

Regarding this premise, three crucial points need to be made. First, consider that intelligence is not directly observed. Even in psychology, intelligence is studied via its effects. For archeology, intelligence is theoretically even further removed. To use 'functional' and 'theoretical' in distinctive ways, both psychologists and archeologists theoretically define intelligence, but archeologists functionally define it. That is, the nature of the intelligence itself simply does not fall within the scope of archeology, as it does in psychology.[25] Like archeology, IDT can make no claim with regard to the nature of the intelligence cause. Instead it only uses a functional definition of intelligence to account for the event in question (Dembski 2004a). Second, by functionally defining intelligence IDT avoids falling into the Charybdis of theology. The only thing that putatively threatens IDT is positing a supernatural intelligence. But IDT's functionally defining intelligence limits the theory's scope to only the effects of the intelligence; again the nature of the intelligence falls outside IDT's scope. In this way, IDT avoids theology.[26] Finally, given a functional definition of intelligence, if one were to grant that an observed system

exhibits the effects of intelligence, then claiming the intelligence cannot have been of a certain type is to make an arbitrary division within intelligence as a kind. Put another way, saying that something which behaves *as if* it possesses intelligence does not possess intelligence because it does not show up in a certain location is to make an arbitrary division within a genuine kind.[27]

So, straightforwardly stated, if kinds carve reality at its joints and our predicates match up to kinds based upon homogeneity and causal relations, then kinds and the laws between them can be the subject of empirical enquiry, which is sufficient to create a domain worthy of scientific research. So, if, as I have argued, IDT's claims that intelligence is a kind and that intelligence shows up in laws are true, then intelligence and the laws in which it appears form the domain for an empirical research program regardless of what is said about the nature of that intelligence.

It might be, however, that the reader will concede my conditional premises but demur when it comes to my arguing for the truth of the first antecedent, *viz.,* the first disjunct in (1). In that case, I present my final premise:

(5) Denying that intelligence is a genuine kind requires reductionism with regard to intelligence.

Dembski's laws might be true if intelligence is eliminated altogether, but they would be vacuous.[28] But many do not want to be eliminativist with regard to intelligence.[29] So, to avoid being arbitrary with regard to the boundary of intelligence or eliminativist with regard to intelligence itself requires positing intelligence as a genuine kind. And together, intelligence and laws in which it appears, form a domain of empirical inquiry. Since ID theorists claim this domain just is their domain of inquiry (and after all, who would know better?), then we must accept IDT as a science, and let the debate begin in earnest over whether its hypotheses are true.

ENDNOTES

1. Elliott Sober points out in his article "The Design Argument" that there are essentially two types of teleological arguments: the argument from putative cosmological design and the argument from putative biological design (2004). For the purposes of this paper, I shall be concerned only with the latter.

2. Notice also that if each theorist assumes incorrectly that 'law' is being used in the same way by both, any putative agreement is meaningless.

3. D. M. Armstrong (1989) takes '*x* is an electron' to denote a type of substance rather than a property, and it remains an open question as to what the relationship is between substance types and properties. I find Armstrong's distinction between substances and properties compelling, but since nothing in my argument–so far as I can tell, at any rate–hinges on the distinction and since it is common to refer to natural kinds as types of properties, I shall continue in that vein throughout this paper.

4. Throughout this paper, I shall use the phrase 'genuine kind' rather than the usual 'natural kind'. If, as I shall argue, IDT *(a)* is by definition non-committed to taking a stand with regard to whether the intelligence in question is natural or supernatural and *(b)* entails positing an intelligent cause based solely upon empirical evidence, then the term 'natural' could just as well be used by ID theorists and their proponents. I use 'genuine kind', however, to avoid certain contingent connotations associated with 'natural kind'.

5. It is often said "...between universals," but in hopes of avoiding questions of realism with regard to universals, I shall speak in terms of properties.

6. D. M. Armstrong (1978a) argues that which properties there are in the world should be left up to the sciences. If Armstrong is right, then a subset of the discovered properties will be natural kinds. Moreover, if kinds are properties (cf. endnote 3), then they are likely compound properties. So, for example, if it were the case that a particle *x* is an electron iff *x* has a rest mass of 9.109×10^{-31} kg, a charge of -1.602×10^{-19} C, and spin 1/2, then '*x* is an electron' would be coextensive with the following conjunctive predicate,

(E) *x* has a rest mass of 9.109×10^{-31} kg, a charge of -1.602×10^{-19} C, and spin 1/2

which denotes the compound property that is identical to being an electron.

7. What I have presented in the text of the paper is actually a modification of what Oppenheim and Putnam (1958) present which is,

6.....Social Groups
5.....(Multi-cellular) living things
4.....Cells
3.....Molecules
2.....Atoms
1.....Elementary particles

Since the modified version has become the standard description and refers more explicitly to the various sciences by name, I have opted to utilize the modified version in this paper.

8. I assume substance physicalism with regard to humans. For the purposes of this paper, however, I shall assume an agnostic stance concerning dualism regarding other beings such as God and his angels.

9. See in particular Oppenheim and Putnam (1958) and especially Ernest Nagel (1961).

10. See also Donald Davidson (1970), Saul Kripke (1972), and Jaegwon Kim (1992) and (1998).

11. Contra Foder (1974) Jaegwon Kim (1992), following Nelson Goodman (1983), takes genuine kinds to be projectible properties. Kim argues that disjunctive properties cannot be kinds because they are not projectible. Thus, for Kim, it is disjunctive kinds' failing to be projectible that prevents their names from appearing in law-statements. Kim seems closer to the mark, but either way, the multiple realizability of special properties by physical properties is taken by many to prevent special-science kinds from being eliminated through reduction.

Since Donald Davidson's (1970), property dualism has been taken to be consistent with substance physicalism. John Bickle (1998) and Kim (1992) and (1998), however, have forcefully argued that physicalism and property dualism are inconsistent.

12. This is a common line, but I believe that there are some difficulties with this notion. Consider that if perception is a causal relation and causation is a physical relation, then we should be able to detect physical homogeneity and physical heterogeneity. But special predicates are based on *disjunctions* of *heterogenious* properties. I think this raises a huge question about how special predication occurs. For the purposes of this paper, however, I will assume that at times we can perceive homogeneity when we are being appeared to heterogeneitily, as it were.

13. I am using 'event' and its cognates to mean something like a property exemplification, by an object, at a time (Kim 1976).

14. Using 'confirmed' is a bit idealistic, I grant, but by withstanding tests in various controlled environments, the law-statement is at least shown to be pretty close to the truth.

15. Roger Shepard (1994) gives an interesting naturalistic account of how we come to recognize kinds. Thus, since science is also concerned with discovering kinds, I have argued elsewhere that science should be seen as a more rigorous and self-aware application of how the natural mind grasps the world.

16. If two predicates map onto properties *F* and *G*, and *F* and *G* appear in all the same laws of nature, then '*F*' and '*G*' denote the same property. Whether or not *F* and *G* in fact appear in all the same law statements is a matter that can be determined only through inductive inference. But if there is a single instance in which *F* and *G* appear in different laws of nature, we must conclude they are distinct.

17. Two things worth pointing out: First, because lower-level kinds are constitutive of higher-level kinds, a higher-level kind can often be thought of as a system of lower-level kinds. Second, I use 'event' to denote simply a property exemplification at a time (cf. Kim [1976]), whether the property is exemplified by a system, object, spacetime region, or whatever.

18. At least with regard to forensic science and archeology.

19. To apply this truism to archeology, consider for example that there seems little need to posit this law-statement, "For all patterns, if a patterns possesses such-and-such characteristics, then it was created by an intelligent agent," and try to figure out what those characteristics are. For, if one were to stumble upon a small, very sharp, flat stone shaped like a triangle but with a small T-shaped "tail," one would not say, "Gee, I wonder how the elements caused this rock to look exactly like an arrowhead." That the arrowhead had been formed by an intelligent agent would be immediately assumed.

20. According to Medawar's law, a closed system whose processes are deterministic cannot generate information (Dembski 2004a). Dembski points out, however, that the universe seems nondeterministic, and in a nondeterministic universe, new information can be generated. Dembski therefore argues that the sort of information that cannot be generated within a nondeterministic universe is in fact limited to complex specified information.

21. Notice that specified complexity is not taken to be a necessary condition, but rather a sufficient condition for determining that the system in question was formed by an intelligent agent. Consequently, as Dembski (2004b) points out, the law allows for possibility that some system which have been designed might go undetected as such.

22. Even if (CI) and (SC) turn out to be false, then if intelligence is a kind, then it figures into laws. If (CI) and (SC) turn out to be false, ID theorists will simply need to work to uncover the laws in which intelligence figures.

23. Two things are worth pointing out here. First, notice that the geologist does not try to figure out how natural forces might have created something that looks exactly like a clay pot complete with human images carved in the exterior. Second, there is a sense in which geology and archeology might overlap: the artifact could still be analyzed in terms of its mineral content, say. That is, again, the same entity can simultaneously possess properties across multiple domains. Presumably, however, the reason for determining the mineral content of an artifact would be to aid the archeologist in her work. Similarly, a biologist's discovering how an organic system works would not be in conflict with ID theorist's description of how the system came to exist.

24. The biologist might therefore turn to the task of figuring out how the system *works*.

25. Thus, in short, I am using 'functional' to denote a mode of definition such that whether observed or not, the kind would still lie outside the domain of the science in question. Thus, dark matter and quarks are theoretical kinds in physics; they are not functional kinds, for once they are empirically observed, they cease being theoretical kinds, but they continue exist within the domain of physics. Intelligence, however, whether observed or not, will never fall within the domain or archeology except as a kind defined in terms of its causal role.

26. I might point out that many theologians have discussed possible religious implications of the Big Bang. But clearly that does not show that Big Bang cosmology falls within theology. If the argument put forward in this paper is sound, then the same can be said for IDT: IDT's practitioners identifying the intelligence of IDT with a supernatural intelligence does not entail that IDT is theology any more than a Christian physicist's taking the Big Bang to be identical to the Creation event described in Gen 1:2-5 makes Big Bang cosmology theology.

27. Of course, the something which so behaves if functionally defined is something that possesses intelligence.

28. Being vacuously true, I assume, is not the sort of thing one wants his or her scientific theory to be.

29. See note 11.

CITED WORKS

Armstrong, D. M. *Universals: An Opinionated Introduction*. Boulder: Westview Press, 1989.

Behe, Michael. "Irreducible Complexity: Obstacle to Darwinian Evolution." In *Debating Design: From Darwin to DNA*, edited by William Dembski and Michael Ruse. Cambridge, UK: Press Syndicate of the University of Cambridge, 2004.

Bickle, John. *Psychoneural Reduction: The New Wave.* Cambridge: The MIT Press, 1998.

Davidson, Donald. "Mental Events." In *Experience and Theory*, edited by Lawrence Foster and J. W. Swanson. London: Duckworth, 1970; reprinted in Davidson, Donald. *Essays on Actions and Events,* 2nd edition. Oxford: Clarendon Press, 2001.

Dembski, William. *The Design Inference: Eliminating Chance through Small Probabilities*. Cambridge: Cambridge University Press, 1998.

----------. *No Free Lunch: Why Specified Complexity Cannot Be Purchased without Intelligence.* Lanham: Rowman and Littlefield, 2002.

----------. *The Design Revolution: Answering the Toughest Questions about Intelligent Design*. Downers Grove, InterVarsity Press, 2004a.

----------. "The Logical Underpinnings of Intelligent Design." In *Debating Design: From Darwin to DNA,* edited by William Dembski and Michael Ruse. Cambridge: Cambridge University Press, 2004b.

Dworkin, Ronald. *Law's Empire.* Cambridge: Harvard University Press, 1986.

Endicott, Timothy A. O. "Herbert Hart and the Semantic Sting." In *Hart's Postscript: Essays on the Postscript to the Concept of Law,* edited by Jules Coleman. Oxford: Oxford University Press, 2001.

Fodor, Jerry. "Special Sciences." In The Philosophy of Science, edited by Richard Boyd, Philip Gasper, and J. D. Trout. Cambridge: The MIT Press, 1991. Originally published, "Special Sciences, or The Disunity of Science as a Working Hypothesis." *Synthese* 28 (1974): 77-115.

Goodman, Nelson. *Fact, Fiction, and Forecast,* 4th edition. Cambridge: Harvard University Press, 1983.

Kim, Jaegwon. "Events as Property Exemplifications." In *Action Theory*, edited by M. Brand and D. Walton. Dordrecht, Holland: D. Reidel, 1976.

---------. "Multiple Realization and the Metaphysics of Reduction." *Philosophy and Phenomenological Research* 52 (March 1992): 1-26.

----------. *Mind in a Physical World: An Essay on the Mind-Body Problem and Mental Causation.* Cambridge: The MIT Press, 1998.

Kripke, Saul. *Naming and Necessity.* Cambridge: Harvard University Press, 1972.

Medawar, Peter. *The Limits of Science.* New York: Harper and Row, 1984.

Nagel, Ernest. *The Structure of Science.* New York: Harcourt Brace, 1961.

Oppenheim, Paul and Hilary Putnam. "Unity of Science as a Working Hypothesis." In *Minnesota Studies in the Philosophy of Science. Vol. 2, Concepts, Theories, and the Mind-Body Problem,* edited by Herbert Feigl, Michael Scriven, and Grover Maxwell. Minneapolis: University of Minnesota Press, 1958.

Putnam, Hilary. "Philosophy and our Mental Life." In *Mind, Language and Reality: Philosophical Papers.* Vol. 2. London: Cambridge University Press, 1975.

Shepard, Roger N. "Perceptual-cognitive Universals as Reflections of the World." *Psychonomic Bulletin and Review* 1 (1994): 2-28.

Sober, Elliot. *Philosophy of Biology*, 2nd edition. Boulder: Westview Press, 2000.

----------. "The Design Argument." In *The Blackwell Companion to the Philosophy of Religion*, edited by W. Mann. Oxford: Blackwell Publishing, forthcoming.