What Moves a Man

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Suppose you were to ask me, what is the purpose of life? I could obviously reply to you in many different ways. I could reply, with the catechist, that our purpose here is to glorify God and enjoy his goodness forever. Or, with the Stoic, I could affirm that our purpose here as men is to understand the law and form our character in such a manner that we are capable of adhering to the law throughout our lives. Or I could respond in Kantian fashion and tell you that our purpose is to act in a rationally consistent and universally valid fashion. You will no doubt find some of these answers more sufficient than others. You may at last be dissatisfied with all of them. But you will certainly recognize them as answers to your question; that is to say, you will recognize in each one not necessarily a proposition that you regard as true, but a proposition that can be weighed for truth or falsity.

But now suppose, in answer to your question, I offered the following answer: "the meaning of life is 7/12." Or what if I replied that the purpose of life is "$\pi=c/d$." You would undoubtedly suspect me of impertinence. You would have good grounds for your suspicion too, because statistics and equations are not bad answers to your question; they are obviously not answers at all. Mathematical propositions do not merely fail to provide a true answer to your question; they cannot, according to the significance of the question, even be evaluated for truth or falsity. Mathematical propositions simply do not possess the form that an answer to your question must have, and anyone with a minimal degree of rational competence would be expected to understand this.

Again, consider the following: suppose that you asked me what it is like to look at something beautiful. I could answer, in a rather Platonic vein, that in the presence of the beautiful object, one feels a desire akin to that felt when contemplating the good. Or with Burke I might assert that when beholding a beautiful object, one feels a kind of invitation to intimacy with that object. Or I could simply reply with Dostoyevsky and tell you that the experience induces a terrible moral struggle at the center of our being. No doubt you will find all these answers insufficient in a greater or lesser degree, for what description of beauty has ever wholly sufficed? But again, you will recognize in such

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replies that a serious attempt to answer your question was being made.

But what if I replied that we can understand aesthetic experience in the following way: "f(s)ds=fx." Or that the unique sentiments associated with beauty are best captured by the number 1.3469. Again, you would not recognize in either of these responses anything resembling the form that an answer to your inquiry must take. Such mathematical statements can never approach the reality of aesthetic experience, and the attempt to offer them as an explanation for that phenomenon would be recognizable by all minimally rational persons as inane.

What these examples demonstrate is that the truths of human experience cannot be rendered in mathematical propositions. Equations, statistics, and other kinds of mathematical statements are fundamentally inapposite to human experience and cannot in any way assert the truths of human experience. But modern science is nothing other than the attempt to reduce all knowledge to mathematical propositions about the world. Therefore, science is entirely incapable of providing true propositions concerning human experience and the forms of action motivated by experience.

It is likely that few, if any, modern persons will concur with my definition of science as "the attempt to reduce all knowledge to mathematical propositions about the world." And yet, in the seventeenth century, when the natural sciences assumed the form with which we are familiar, it was quite clear to practitioners and observers alike that the new thing, the unique thing, about the natural sciences was the practice of expressing observed natural phenomena as mathematical laws.[1] Thus Kepler boasted of his laws of planetary motion: "I . . . show how these physical courses are to be given numerical and geometrical expression."[2] Galileo regarded the universe as a book to be deciphered by the scientist, written in the language of mathematics;[3] he defined his subject as "those sciences where mathematical demonstrations are applied to natural phenomena." Descartes maintained that mathematics was the queen and cornerstone of all the other disciplines and that certain knowledge in the sciences is always mathematical knowledge.[4]

Newton expressly declared the unique contribution of "the moderns" in the realm of physical science to be the endeavor "to subject the phenomena of nature to the law of mathematics,"[5] and by the time that his work had established the paragon of scientific reasoning for over two centuries of European man, few would have dissented from the opinion that "science is the exact mathematical formulation of the processes of the natural world."[6] It was owing to this fact—*and to this fact alone*—that the early advocates of scientific methodology were able to point to the unique conclusiveness of scientific investigations, in comparison with the sterile and interminable wrangling of other modes of inquiry (in particular, scholastic metaphysics). As Thomas Reid was to acknowledge somewhat later, "it is thought that mathematical demonstration carries a peculiar evidence along with it, which leaves no room for further dispute."[7]

The modern world, of course, has inherited that conviction in the unique certainty provided by scientific methodology, and this conviction stands behind not just the very recent fad for evolutionary explanations of morality, religion, and the arts, but also the emergence of such now venerable disciplines as sociology and cultural anthropology, which came into the world on the supposition that science could bring greater rigor, and therefore

greater conclusiveness, to social and cultural issues of long-standing debate. But as modern man has grown increasingly convinced of science's special trustworthiness, he has grown progressively more amnesiac about the only rational basis for that conviction, which, as those early theorists saw so lucidly, lies solely in the capacity of the scientist to "subject the phenomena of nature to the law of mathematics." The modern world has simply ceased to recognize the need to justify their belief in scientific certainty; the spread of "scientism," or the habit of applying scientific methodology to the whole range of human questions, depends on this very indifference. But if scientific explanations have any claim to distinctive certainty, if we are to prefer them on the grounds of conclusiveness to explanations of any other sort, then it can only be owing to the scientist's ability to state his findings in the form of mathematical propositions.

I hasten to add that this is properly the ideal, and not always the actuality, of scientific research. What the scientist pursues is the equation underlying observed natural phenomena, and he considers such an equation to be the complete expression of the law explaining all manifestations of the observed phenomena; all other attempts to express the law, in lieu of such an equation, are provisional. Even questions that have been pursued for centuries are assumed to have some answer, in the form of mathematically expressed law, awaiting discovery. I do not claim then that a given inquiry is not properly scientific if it has no equations to show for it, but only if that inquiry evinces no movement toward mathematical expression or is of such a nature as to render it necessarily incapable of mathematical expression. In the words of Etienne Gilson, "mathematics provides science with its most perfect mode of expression."[8] This is the genuine ideal of science, and should be its constant ambition. The perfected scientific proposition is the mathematical proposition. The last word of the scientist on reality is numerical.

The most startling confirmation of this fact is presented by contemporary evolutionary theory, in which mathematical models are applied to that sphere of natural phenomena that would appear to resist such an application most incorrigibly—animal behavior. Contemporary biology is mathematical biology. The application of all sorts of game-theoretical models to biological data is now the ubiquitous method of evolutionary theory, and since it is unquestionable Darwinian dogma that no fundamental distinction obtains between man and the other animals, it follows in the minds of these theorists that the same methods used to explain the behavior of bacteria and bats can be used to explain the behavior of men. Consequently, as we witness the invasion of the humane realm by evolutionary theory, we observe the increased application of game-theoretical models to the universal features of human experience. It is virtually impossible to find an evolutionary treatment of politics, ethics, or aesthetics that does not rely, for instance, on the apparatus of the Prisoner's Dilemma and its underlying computations. Modern biology may as well be called "Newtonian" rather than "Darwinian," for it owes as much to the methodology of abstract mathematical modeling as it does to the theory of natural selection.

But undoubtedly the most breathtaking, even flamboyant, evidence of just how committed modern materialists are to preserving the appearance of mathematical explanation is to be found in the theory of memes, which Richard Dawkins defines as "units of cultural transmission, or units of imitation," and which E.O. Wilson

similarly refers to as "units of culture." To refer to a "unit of x" is invariably to imply that "x" is something that is quantifiable or measurable—that is to say, stated in mathematical fashion—but, obviously, culture or imitation are things that cannot be quantified or measured in any meaningful way. It is quite frankly stunning that educated adults would have the audacity to erect a theory of human behavior in defiance of such a fact. Yet the "meme meme" has gained considerable popularity among the Darwinian ranks; a pseudo-discipline of "memetics" has emerged, complete with journals and webpages. All of this is nonsense, to be sure, but it serves to demonstrate the conviction among modern materialists that if they simply preserve the appearance of mathematical methodology, the reality of scientific exactitude will follow of a course. Behind such theorizing lies the assumption that human experience—and it should not need to be said that culture is the fruit of human experience—is just another of those natural phenomena that may be fruitfully subjected to mathematically expressed law.

But obviously, human experience includes, among other things, the framing of purposes, impressions of beauty, and the deliberation of intractable problems, phenomena that it would be absurd to try to explain by way of mathematical statements.[9] But this is all evolutionary theory—this is all any science—can offer by way of explanation. Dozens of books purporting to offer a Darwinian theory of ethics have dropped from the presses in recent years, received with various degrees of acclaim; but what no one seems to acknowledge is that a Darwinian theory of ethics is, of necessity, a theory that says something like "virtue is the ratio of 7 over 12." And this is not any sort of exaggeration but exactly what one of the leading authorities of Darwinian theory has explicitly stated in the opening of his most influential book. George Williams begins *Adaptation and Natural Selection* by claiming that opposition to Darwinism stems from the limits of the imagination, because "it is difficult to imagine that an acceptable moral order could arise from vital statistics."[10]

The statement is nonsense in the strictest definition of that word; it means nothing. A "moral order" cannot "arise" out of "statistics" any more than a taste for Beethoven arises out of Einstein's equations, and this is known to anyone who understands the meaning of the words *moral* and *statistics*. We cannot even say that Williams is wrong about the origins of morality, for his words do not even rise to a level of meaning that can be evaluated as right or wrong. Yet here is the most blatant sort of evidence imaginable of modern science's irrepressible drive toward mathematical explanation. Those authors who purport to offer a Darwinian theory of ethics must, like Williams, pretend to derive morality from statistics, and therefore their books do not present a theory of ethics that is false (however false may be the *arguments* mustered in its defense) but rather a theory of ethics that ultimately cannot be judged as true or false at all, a theory of perfect irrelevance to the phenomena it pretends to explain.

It is helpful here to turn to an early work of Thomas Reid, his "Essay on Quantity," in which he attempts to delineate what sorts of things are indeed subject to the laws of mathematics:

> whatever has quantity, or is measurable, must be made up of parts, which bear proportion to each other, and to the whole, so that it may be increased by addition of like parts, and diminished

> by subtraction, may be multiplied and divided, and in short, may bear any proportion to another quantity of the same kind, that one line or number can bear to another. . . . This then is the characteristic of quantity; whatever has this property may be adopted into mathematics, and its quantity and relations may be measured with mathematical accuracy and certainty.

He goes on to specify the three kinds of proper, or irreducible, quantities: "Whatever has quantity must have it in one or other of these three kinds, extension, duration, or number. These are the measure of themselves, and of all things else that are measurable." It is only to such quantities that mathematical demonstrations are authentically applicable: "mathematical evidence is an evidence *sui generis,* not competent to any proposition which does not express a relation of things measurable by lines or numbers." Among the things that do not "express a relation of things measurable by lines or numbers" are the contents of subjective human experience: "Till our affections and appetites shall themselves be reduced to quantity, and exact measures of their various degrees be assigned, in vain shall we essay to measure virtue and merit by them. This is only to ring changes on words, and to make a show of mathematical reasoning, without advancing one step in real knowledge."[11]

Consider John Maynard Smith's attempt to explain the biological phenomena of aggression in terms of what he called the "evolutionarily stable strategy." This "strategy" of organisms would determine the precise numbers of genes correlating to aggressive behavior and genes correlating to nonaggressive behavior that will continue to proliferate in a given population, quantities that are at last expressible in an ideal ratio.[12] In order to calculate that ratio, Smith has invented a game-theoretical model, called Hawk-Dove, so that the final scientific explanation of aggression is a set of calculations and the ratio they produce in the end—another example of "subjecting the phenomena of nature to the law of mathematics." And the model clearly implies that not merely the genes but also *aggression itself* is a thing that can be subjected to mathematical treatment. For what Smith wants to say is that aggression is present here and absent there, or aggression is found here to a greater degree than it is found there; but none of these things can be said without implying that aggression is something discrete, quantifiable, and measurable. But obviously, aggression is none of these things; it cannot be divided into discrete items or elements, and often cannot be said to be "certainly present here" or "certainly absent there." There is nothing in the phenomenon of aggression that is "measurable by line or number." So to imply that the phenomenon of aggression is something that can be adequately treated by a mathematical model is merely "to ring changes on words, and make a show of mathematical reasoning."

What is highly revelatory is Smith's stated justification for his methodology: "the purpose of the Hawk-Dove game . . . is not to represent any specific animal example, but to reveal the logical possibilities inherent in all contest situations."[13] But of course, all aggression is specific; there is no biological aggression absent a biological organism, so a model that begins by omitting reference to the "specific animal" is one that necessarily begins by omitting aggression, which is to say, a model that begins by omitting the very thing it is supposed to explain. In its place we merely have a marker—the category of "hawk," or aggressive animal—ostensibly referring

to aggressive behavior. The model derived from these markers is purportedly a model of causality; what the Darwinian wants to say is that animals behave the way they do because of the influence of the law of selection, represented in the mathematical model. But it is a perfect mystery how a model that bears no real reference to specific animal behavior can provide a causal explanation of specific animal behavior. And specific animals are the only sorts of animals that actually behave. So whatever else Smith's model may be taken to explain, it cannot possibly be taken as an explanation of aggressive behavior.

Regardless of the obvious and fundamental impediments in the way of their mathematical reductionism, the Darwinians continue to offer their models as explanations of nearly every form of human behavior imaginable—moral, political, artistic, and religious—relying on the predictive efficacy of these models to vindicate their truthfulness. Predictive efficacy has long been recognized as one of the hallmark traits of a sound scientific theory, so in touting this feature of their models, the Darwinians are surely working within a venerable tradition of scientific reasoning. And yet the predictions they offer are so ludicrously unconvincing, one wonders how they have the cheek to present them to the public. They come in two distinct varieties: the breathtakingly false and the even more breathtakingly trivial. An example of the first sort comes from R. D. Alexander: "we are programmed to use all our effort, and in fact to use our lives, in reproduction."[14] Examples of the second sort are on offer from Martin Daly and Margo Wilson: "Perhaps the most obvious prediction from a Darwinian view of parental motives is this: substitute parents will generally tend to care less profoundly for children than natural parents,"[15] and from Denis Dutton: "The number-one topic for poetic and sung language worldwide and through history is love. This is exactly what you would predict if poetry recited or sung had evolved in the context of courtship as a kind of cognitive foreplay."[16] Who can possibly be convinced by such "predictions"? Quite obviously, anyone could "predict" that stepparents are less affectionate toward their children than biological parents, or that love constitutes the predominant theme of poetry, without so much as having heard of Darwin in his entire life. So what can such a "prediction" be taken to verify?

Yet let us assign as much predictive power to these models as the Darwinians wish; this does nothing to establish their explanatory truth. The reliance on predictive accuracy to affirm the truth of theories, so long a basic feature of science, is no more than a variation on the fallacy of affirming the consequent, the invalid deductive argument that takes the form "if p then q; q, therefore p." What is evidently problematic about such an argument is that there may be any number of alternative antecedents responsible for the outcome q. Theorists of science generally work their way around this logical impasse by invoking the "inference to the best explanation," which assumes there exists some wholly scientific criteria according to which one can determine the best of these rival antecedents. That is fine, so long as the rival antecedents are all scientific assertions, because in that case we have an uncontroversial criterion—namely, the relevant scientific knowledge—to guide us in determining which of these rivals does indeed constitute the "best explanation." But in the case of human behavior, there will always be at least one alternative antecedent—one rival explanation—that is not scientific at all and that is of another

order altogether than the purely physical, and that is an explanation in terms of human experience. In this case, the question is no longer whether we should prefer this explanation to others on the basis of an uncontroversial scientific criterion but whether we should judge this explanation by scientific criteria in the first place. That there can be no scientific argument for selecting scientific criteria that is not perfectly question begging seems too obvious a point to belabor.

Mathematical models are always purportedly models of physical reality. They can refer to nothing lacking in the primary qualities of location, extension, or mass. But the contents of human experience—memories and desires and beliefs—have no location, no extension, no mass. So there is no room for human experience in mathematical models. As Alasdair MacIntyre has noted:

> Being aware of what I am is conceptually inseparable from confronting what I am not, but could become. Hence, for a self-concious agent to have a trait is for that agent to be confronted by an indefinitely large set of possibilities of developing, modifying, or abolishing that trait. . . . What we can observe in nature is, so to speak, all that there is to discover; but what we can observe in human beings is the expression of rational activity, which cannot be understood as merely the sum of the movements that we observe.[17]

Recall the basic defect in Smith's theory of aggression: he was trying to quantify an unquantifiable entity. Aggression is a form of behavior motivated by anger, resentment, or envy; its *causes,* therefore, will always have something of the subjective in them, and therefore something of the immeasurable and unquantifiable. A game-theoretical model, such as Smith has constructed, could never fit such causes into its explanatory picture; and so, as we saw, Smith had to content himself with a *symbol* of aggression, rather than anything like the real thing. Smith's theory of aggression is one thing; the reality of aggression is another thing altogether, and there is no way to marry the two in any rational fashion. Hegel remarks that "the murderer is not the abstraction of a murderer"; nor is the belligerent an abstraction of a belligerent.[18] There is no way to pretend that the theory of an "evolutionarily stable strategy" explains the anger or resentment that motivates aggression, because the theory is a mathematical model, and the emotions are subjective facts, and there is no room in a mathematical model for subjective facts.[19] So the explanation in terms of physical mechanisms (that is, genes and natural selection) and the explanation in terms of subjective experience are rival and incompatible theories of human aggression. And in the case of every significant human action, there will always be these two rival and incompatible accounts—the mechanistic Darwinian one and the phenomenological one.

Let us then examine one such evolutionary account of a specific form of human behavior in order to determine if it does indeed provide us with the "best explanation." An article titled "Parental Investment in Children with Chronic Disease: The Effect of Child's and Mother's Age" offers us a fairly typical specimen of evolutionary reasoning, directed, in this case, at a purported explanation of how a mother will behave toward a child afflicted with some chronic disease.[20] We learn from this article that the evolutionary theorist supposes, first and foremost, that the mother's entire interest in her child is directly correlated to that child's "reproductive value," which is

to say, the probability of that child passing her genes along to the next generation. All her attention to her child will constitute a form of "parental investment," which refers to any energy expended in order to ensure the passing on of those genes.

Our theorist therefore surmises that the older the child gets, and the more of an "investment" the mother has made, the more concern she will demonstrate for his illness: "it was hypothesized that mothers will report higher emotional investment in older children, since these children have a higher RV [reproductive value], and therefore they should be more cherished." He suspects, and has adequate research to confirm his suspicion, that a mother's need to show direct care (feeding, carrying, bathing, nursing) to her child will decrease as that child ages: "It was postulated that direct care will decrease as the child grows. . . . A cross-cultural study of seven pre-industrial communities (Whiting and Edwards, 1988) found that maternal nurturance declines dramatically from age 2–3 to age 4–5, and from age 4–5 to age 6–8." He is certain that an older mother will show more care to her sick child than younger mothers, "who have a greater number of reproductive years ahead"; his certainty will be based, again, on substantive research: "studies in other animals demonstrate that older Mongolian gerbil mothers are more maternal than younger ones." But if the child should die, the evolutionary theorist will be perfectly dumbfounded by the spectacle of grief likely to ensue, seeing that it confers no selective advantage on the bereaved: "there is a debate whether grief per se is adaptive at all since it can no longer assist the dead child."

There can be no question of this being the "best explanation"; rather, it is a question of this being any sort of serious explanation at all. What sort of right-thinking person, desiring a fuller understanding of the relationship between a mother and a child, consults the research on Mongolian gerbils, or expresses puzzlement that a mother should grieve for her dead child because no evolutionary advantage could accrue from such sorrow? Anyone whose mind had not been defaced by materialist dogma would simply say that a mother's behavior under such circumstances—from her solicitude for her child's welfare, to her sorrow for his suffering—originates in her affection for her child, and that in such affection we will find the explanation for her behavior. There is nothing mysterious about such explanations, and only the most arbitrarily skeptical would dare to assert *that we don't know these things*.

Indeed, as Chesterton observed, the resort to scientistic explanations of human behavior in the place of common sense is always a sort of charade, "the trick of making things seem distant and dehumanised, merely by pretending not to understand things that we do understand" (like why an eight-year-old requires less assistance bathing than a two-year-old). Nor is there any hope of marrying the two modes of explanation, for there can be no translation from the barbarous jargon of "reproductive value" and "parental investment" into the emotions that form human experience. So we are confronted with a choice between the physicalist, Darwinian explanation and the commonsensical explanation. But really, then, there is no choice at all.

The Darwinian account of maternal care, cited above, is itself based on one of the archetypal theories of contemporary Darwinism, the theory of kin selection, which dictates that actions that benefit the near kin of an organism can actually redound to the advantage of that organism's own genes. One consequence of

this theory was notoriously expressed by William Hamilton as the expectation that "no one is prepared to sacrifice his life for any single person but that everyone will sacrifice it for more than two brothers, or four half-brothers, or eight first-cousins."[21] When David Stove pointed out that this "prediction" is, in fact, entirely false as regards the behavior of most, if not all, men—that is to say, entirely false as regards the behavior that Hamilton is pretending to explain—Simon Blackburn attempted to rebut Stove's point by claiming that Hamilton was merely offering a model, with the assistance of which we can decipher the variegated phenomena of nature;[22] the implication being that we could somehow adjust for the variables of life.

But this is to miss the point of Stove's objection entirely. Obviously, what is wrong with Hamilton's theory is not that he offers us an inaccurate or incomplete model of human behavior; what is wrong is the assumption that you can adequately explain human behavior *according to models at all*. As James Franklin notes:

> In a case like Newton's theory of gravity, there is a clear sense of numerical approximation, and the predictions of the theory can be measured to be true within so many percent. Nothing could be further from the situation that obtains with Hamilton's "prediction." It is not as if the model predicts that animals will sacrifice themselves for 8 first cousins, whereas observation shows the true figure is 8.3. The truth is more, as Stove says, that a robin red breast cannot tell the difference between his first cousin and a bit of red wool on a wire.[23]

And if the model is inapplicable to robins, how much more inapplicable is it to human life!

Hamilton's theory dictates that "second cousins should be 1/16 as likely to receive altruism as offspring or siblings."[24] But in reality—in the world we really occupy—second cousins aren't 1/16 as likely to receive altruism as siblings; they are not 1/16 as likely to receive anything from anybody! Human beings aren't 1/16 more likely than other human beings to do anything, and anybody who believes otherwise has simply gone mad with statistical analysis. So Hamilton's model, which is a model of organisms acting in probabilistic fashion, is, insofar as it is applied to humans, a model with no corresponding reality. Again, it is not a question of this being the "best explanation"; it is a question of it being an explanation at all. Certainly, someone who states that "Jim threw himself on that grenade because of his deep affection for his comrades and his high sense of honor" is stating an intelligible proposition; someone who states that "Jim threw himself on that grenade because he had a one in sixteen chance of doing so" is not stating an intelligible proposition.

Faced with a choice between their deeply flawed physicalist models and the insights of standard human experience, the Darwinians opt for the former reflexively. But here is the crucial point to grasp: they have absolutely no scientific grounds for making that choice in the first place, and more important, that choice necessarily precedes all their allegedly scientific theories. The mathematical models of behavior, the game-theoretical calculations—all of it assumes that an explanation of human behavior can be rendered only in purely physical terms, which is to say, the entire evolutionary theory of man presupposes a materialist ontology and cannot possess any significance apart from that ontology. But there can be no scientific grounds for accepting any particular ontology, so

that the decision to adopt their physicalist models can be nothing other than ideological. The theory of kin selection, notions of parental investment, and all the other key doctrines of evolutionary psychology routinely presented to the public as "objective" science cannot even get off the ground until the ideology is in place, so we have good cause to doubt whether these things constitute authentic science at all. Well-meaning persons have struggled sincerely to disentangle evolutionary science from the ideological commitments of its most vociferous and belligerent proponents, but in the case of the Darwinian theory of human nature, it is ideology all the way down.

In one of the earlier works of apologetic for the nascent scientific revolution, the *History of the Royal Society*, Bishop Sprat remarked that the men of science had hitherto avoided inquiries into "the Reason, the Understanding, the Tempers, the Will, the Passions of Men," but that, "when they shall have made more progress in material things, they will be in a condition of pronouncing more boldly on them too."[25] We are now, more than three centuries later, far more advanced in our knowledge of "material things," and we can safely judge what has become of the good bishop's boast. We can fairly assess now what has become of the project of applying scientific methodology to human nature. What it has brought us are "memes," and statistically derived moral norms, and bewilderment that mothers should mourn for their dead children. This is what it has all come to at last. And so perhaps it is time to conclude, once and for all, that the project never depended on "more progress in material things" but that it was misconceived from the beginning, for a proper understanding of ourselves will never be in the power of science to provide.

1 See E. A. Burtt, *The Metaphysical Foundations of Modern Science* (Atlantic Highlands, NJ: Humanities Press, 1952).
2 Quoted in Robin Briggs, *The Scientific Revolution of the 17th Century* (London: Longman, 1969), 43. Of Kepler, see also Burtt: "Kepler's position led to an important doctrine of knowledge. Not only is it true that we can discover mathematical relations in all objects presented to the senses; all certain knowledge must be knowledge of their quantitative characteristics, perfect knowledge is always mathematical," 67.
3 I. Bernard Cohen, *Revolutions in Science* (Cambridge, MA: Harvard University Press, 1985), 140.
4 Herbert Butterfield, *Origins of Modern Science* (London: G. Bell and Sons, 1949), 78. See also Burtt, *Metaphysical Foundations*, 107: "Descartes is at pains carefully to illustrate his thesis that exact knowledge in any science is always mathematical knowledge."
5 Holmes Boynton, ed., *The Beginnings of Modern Science* (New York: Walter J. Black, 1948), 50, 63. Of Newton, see also Burtt, "for Newton, careful experimentation must occur at the beginning and end of every important scientific step, because it is always the sensible facts that we are seeking to comprehend; but the comprehension, so far as it is exact, must be expressed in the mathematical language," 222; and "For Newton, then, science was composed of laws stating the mathematical behavior of nature solely—laws clearly deducible from phenomena and exactly verifiable in phenomena—everything further is to be swept out of science, which thus becomes a body of absolutely certain truth about the doings of the physical world," 226.
6 Burtt, *Metaphysical Foundations*, 226.
7 Thomas Reid, "Essay on Quantity," in *Essays on the Powers of the Human Mind, to Which Are Prefixed, an Essay on Quantity and an Analysis of Aristotle's Logic* (Edinburgh: Bell and Bradfute, 1819), 3.
8 Etienne Gilson, *From Aristotle to Darwin and Back Again* (San Francisco: Ignatius Press, 2009), 158.
9 "Obviously, man was not a subject suited to mathematical study. His performances could not be treated by the quantitative method, except in the most meager fashion. His was a life of colors and sounds, of pleasures, of griefs, of passionate loves, of ambitions, and strivings. Hence the real world must be the world outside of man; the world of astronomy and the world of resting and moving terrestrial objects," Burtt, *Metaphysical Foundations*, 90.
10 George Williams, *Adaptation and Natural Selection* (Princeton, NJ: Princeton University Press, 1996), 4.
11 Reid, "Essay on Quantity," 4–10.
12 Richard Dawkins, *The Selfish Gene* (New York: Oxford University Press, 1976), 71.
13 John Maynard Smith, *Evolution and the Theory of Games* (New York: Cambridge University Press, 1982), 6.
14 Quoted in David Stove, *Darwinian Fairytales* (New York: Encounter Books, 1995), 321.
15 Quoted in Robert Wright, *The Moral Animal* (New York: Vintage Books, 1994), 103.

16 Denis Dutton, *The Art Instinct* (New York: Bloomsbury Press, 2009), 149.
17 Alasdair MacIntyre, "Hegel on Faces and Skulls," in *The Tasks of Philosophy* (New York: Cambridge University Press, 2006), 83.
18 Ibid., 83.
19 "Quine argued that if there is to be a science of human behavior whose key expressions characterize that behavior in terms precise enough to provide us with genuine laws, those expressions must be formulated in a vocabulary which omits all reference to intentions, purposes, and reasons for action." In Alasdair MacIntyre, *After Virtue* (Notre Dame, IN: University of Notre Dame Press, 1984), 83.
20 All quotes and references in the following paragraph are from the following: "Parental Investment in Children with Chronic Disease: The Effect of Child's and Mother's Age," in *The Journal of Evolutionary Psychology* 5, no. 4 (2007): 844–59.
21 Quoted in Stove, *Darwinian Fairytales*, 227.
22 Simon Blackburn, "I Rather Think I Am a Darwinian," *Philosophy* 71 (1996): 605–16.
23 James Franklin, "Stove's Anti-Darwinism" *Philosophy* 72, no. 279 (January 1997): 133–36.
24 Dawkins, *Selfish Gene*, 94.
25 Thomas Sprat, *The History of the Royal Society* (London: J. Martyn at the Bell, 1666), 83.