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Elizabeth C. Shaw
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Terrence Ehrman, C.S.C.
University of Notre Dame

SHOUD THE PRACTICE OF SCIENCE lead to atheism, or God, or neither? This question is an urgent one today as promulgators of atheism, such as the New Atheists (or NATS), promote an intrinsic atheistic end for those who practice science. Popular media present the relationship between science and religion/faith as inherently antagonistic. A good number of my undergraduate students reveal their own rejection of their former Catholic faith and acceptance of agnosticism or atheism primarily after they encountered Darwinian evolution in high school. They saw as incompatible an evolutionary origin of humankind and a theological/biblical origin. Their own confusion about the compatibility of reason and faith takes place within the pervasive mindset of claims of conflict between science and faith as portrayed in the media and the aggressive marketing of incompatibility by the NATS. The issue is an urgent one, but it is not a new one. To gain historical perspective and insight into the principles at work, let us look back seventeen centuries.

In the fourth century, the bishop Basil preached a series of homilies on the six days of creation – the *Hexaemeron*. Basil wanted to wean his audience from their infatuation with the theater of their own activities, and to take his listeners by the hand and lead them into the natural world of creation so that they can lift their minds to God.[1] Basil was acutely aware, however, that mere sight of the visible world does not suffice to lead one to God. He drew attention to the Greek natural philosophers, who he said "made much ado to explain nature,"[2] but

were blind to a Creator, "deceived," he wrote, "by their inherent atheism."[3] Fascinated and drawn to study the natural world, these natural philosophers possessed "worldly wisdom."[4] Wise is the one who knows well the causes operative in some field of study – the wise architect, for example, knows the causes and principles in that field. But this is not philosophical or theological wisdom. For all their "worldly wisdom," the natural philosophers, continued Basil, "have discovered all except one thing . . . the fact that God is the Creator of the universe."[5] Their failure to perceive God from their study of the world, Basil sharply condemns, is because "they have willfully shut their eyes to the knowledge of the truth."[6]

They did not find the Creator because they did not bring a philosophical or theological perspective to what they studied. Uninitiated Christians and natural philosophers fail to encounter the Creator through creation because, as Basil states, "it is absolutely necessary that all lovers of great and grand shows should bring a mind well prepared to study them."[7] Only the person who brings to the wonders of the natural world a philosophical inquiry is "well prepared" to study the world and able to transcend the physical and material. So it was in the time of Saint Basil, and so it is today.

Instead of an avenue to know God, the natural world has become for many scientists, particularly among some Neo-Darwinian advocates, an argument against God's existence. Daniel Dennett considers Darwin's idea a dangerous one because it dissolves, like a universal acid, belief in God and with it any sense of divine purpose, design, or intentionality to the world and especially to human life.[8] Richard Dawkins describes the world in which we live as exhibiting those "properties we should expect if there is, at bottom, no design, no purpose, no evil and no good, nothing but blind, pitiless indifference. . . . DNA neither cares nor knows. DNA just is."[9] These atheistic views are presented as coming from the method and findings of science itself, but the NATS thrive on shock, insult, and sloppy

thinking and study. Theirs is a public discourse but not an educated, civil discourse.

So, we are back to our question, "Do the scientific method itself and its discoveries of natural causes lead to atheism?" From science comes worldly wisdom, but philosophical and theological presuppositions lead to atheism or God. For the scientist possessed of philosophical and theological wisdom, science is a tool to study nature that allows one to encounter nature as creation and to praise the Creator for it in all its splendor as revealed by scientific discoveries.

In this presentation, I will first discuss the NATS' understanding of faith, God, science itself, and causation, and then I will show how this is a misunderstanding and misrepresentation of each that establishes the conditions for an intrinsic conflict between science and faith. My rebuke of NATS draws upon the nineteenth-century writings of Fr. John Zahm, C.S.C., whose engagement with the atheists of his day, the Old Atheists (OATS), directly parallels today's situation. Third, I compare and contrast the atheism of the NATS and of Hazel Motes, the character from Flannery O'Connor's *Wise Blood*, who both make an idol of reason. I conclude with some suggestions for evangelization concerning science and creation.

Richard Dawkins and the New Atheists

The NATS wield science as a corrosive sprinkler system to dissolve faith and its imagined object – God. They claim that reason alone, through scientific methodology, discovers what is true about the empirical world. Faith is simply "belief without evidence and in untestable propositions"; faith is incompatible with reason.[10] Science advances through testing and experimentation, constantly rejecting what is false, and thereby gaining practical and applicable knowledge about how the world actually works. Faith claims are repeatedly shown to be scientifically unreliable and false. The NATS make faith an equivalent and univocal mode of knowing with reason and deduction.

They reject faith and its correlate, revelation. Dawkins quotes approvingly James Watson's befuddlement, "I can't believe anyone accepts truth by revelation."[11] Coupled with this, Dawkins rejects theology as a field without an object of study.[12]

Integral to his rejection of the existence of God is Dawkins's univocal understanding of God. Dawkins explicitly states that God is a scientific hypothesis that can be rejected or corroborated on evidence. His God hypothesis states, "[T]here exists a superhuman, supernatural intelligence who deliberately designed and created the universe and everything in it including us."[13] God's existence "is a scientific hypothesis like any other" and "a scientific fact about the universe, discoverable in principle if not in practice."[14] As science discredits the existence of Zeus, Apollo, Amon Ra, Mithras, Baal, Thor, Wotan, the Golden Calf, the Flying Spaghetti monster, and the tooth fairy, Dawkins just goes one god or imaginary being further – the Christian God.[15] Placing God within the domain and range of scientific inquiry and amid the pantheon of these other gods and imaginary items, Dawkins reveals a univocal view of God as one more thing in the world.

Dawkins is aware that believers may reject the god he himself rejects, so he makes the universal blanket statement, "I am attacking God, all gods, anything and everything supernatural, wherever and whenever they have been or will be invented."[16] This universal rejection, however, applies only to the category of things in the universe. But being another thing in the world is not what all call God, especially Thomas Aquinas.

Restoration and Clarification

Faith. The NATS fall, or hurl themselves, into one of the two dangerous extremes identified by Blaise Pascal: to shut reason out or to let nothing else in.[17] Reason and faith are two ways of knowing, but their mode is quite different. In forming personal relationships, reason

gives way to faith in how we know the other. Dawkins's insistence on evidence and proof would dissolve existing or developing friendships. If a man would not consent to marry his fiancée unless he could prove that she loved him, then she should not wait for him, because she would be left standing at the altar for the rest of time. Reason can indicate she loves him: she talks to him every day and shows signs of affection. She tells him that she loves him. It is reasonable for him to think that she loves him. There is evidence, but these are not proofs of love, only indications. She could be deceiving him in order to marry him and run off with his money. Only if he takes a stand and believes that she loves him will he be able fully to receive what she has to give. A Dawkinsian demand for proof dissolves the relationship. His demand, "Prove that you love me," should be met only with her saying goodbye. We "know" God not as a thing – more on this shortly – but only in a relationship more personal than any human one. Faith in God demands that we take a stand. Do we believe or not? But faith is not unreasonable. Reason can lead us all the way to that moment. Now, on to God himself.

God. God is not one more being in the world, just more powerful and magnificent, alongside all others. God's distinction from the world is of a different order than the distinction of one natural object from another because God is being itself – *ipsum esse subsistens*. God is not a "thing" at all. God is not "a being," nor does God "have being" as natural things do. God *is* being. If the nature of a human being is to be a rational animal, then the nature of God is to be *to-be*.[18] God is more like a verb than a noun. This grammatical anomaly prohibits direct speech about what God is. We are limited to analogy. The Christian God does not fit on a list of things. God transcends human categories and compartmentalization. God transcends the domain and range of science, for science studies only natural objects, things, and their changes in this world, but God is not one of those things.

God's transcendence as Creator brings about a fundamental distinction between God and what God creates. Creation is not just the universe and everything in it – nature and natural objects. Creation is fundamentally the relationship of dependence of all that is upon God for existence. God is the cause of existence; all things have being by participating in God's being. Thus, any scientist studies not creation but nature. Creation is not a scientific category but a metaphysical one. A better understanding of God's transcendence and relation to the world as Creator overcomes the conflict model of science and theology, which makes natural and divine causes competitors.

Causation. Dawkins's error in his conceptual idolization of God as a thing in the world leads to a second fundamental error that flows immediately from it: that natural and divine causes are mutually exclusive and part of a zero-sum game. Besides Dawkins's thinking God an imaginary thing, he thinks God causally redundant. Science accounts fully for the cause of some phenomenon. He says that evolution allows him to be an intellectually satisfied atheist. Evolution provides a natural explanation of human origins that eliminates the need for a divine cause. Dawkins, like Darwin before him (and David Hume before him, in principle), rightly rejects William Paley's watchmaker argument. Paley and the British physico-theologians argued that the empirical design in living organisms pointed to and required a divine designer, God. Darwin provided natural evidence – natural selection – to explain this design. Natural causes were competent to form this biological complexity and design. Paley was rightly defeated. However, Paley et al. had made a mistake in accepting the Cartesian mechanization of nature and organisms. Deprived of Aristotelian unity and finality, living organisms became inert machines. But machines require a mechanic or designer as an external cause of the design. For Paley, God the mechanic or designer was a univocal cause. He shares this in common with Dawkins. Hume anticipated Darwin by three-quarters of a century but lacked what the latter

discovered. Hume critiqued the argument from design, wondering whether matter could form in such a manner on its own.[19] Hume, Darwin, and Dawkins rightly critique and overthrow the falsely founded Paleyan argument from design, but Dawkins makes a logical error in thinking that a natural explanation necessarily eliminates a divine explanation. This would be true only if divine and natural causes were univocal, that is, if divine causes operated as natural causes. But God does not act univocally. As transcendent cause, God is the primary cause of all that is and the cause of all causes. God creates things with natures to act and have causal properties themselves. But this natural – or secondary – causation is at a different ontological level. Divine and natural causes are not in competition with each other.

Conflation of Science and Metaphysical Naturalism. Besides not understanding who God is and how God acts, the NATS also wrongly conflate science with their metaphysical naturalism. They transgress the proper epistemological boundaries among science, philosophy, and theology. Science studies a subset of reality – that of natural causes using a particular method (hypothetico-deductive) confined by measurements and observations. Philosophy studies the whole of reality from the perspective of natural reason. Theology is the science of revealed truth received by faith. Does science lead one to God, or to atheism? Strictly as a method, abstracting from all else, science makes no claim or statement about God. Science per se does not lead to atheism or theism. Because science does not invoke or study divine causes, the method can be called methodological naturalism, but then to make the claim that all that exists *is only nature*, because only naturalism is presumed methodologically, is a logical error. This is scientism, namely, that presupposition of a framework of metaphysical naturalism and the claim that science is the only means to truth.

John Zahm, C.S.C. and the Old Atheists

The error of the NATS continues a century-old error of the OATS. They exchange methodological naturalism for metaphysical naturalism. The prior commitment to atheism of some modern biologists is a metaphysical position and not something required by science itself. The NATS like the OATS before them both use the science of evolution to promote their metaphysical position of atheism. Ted Peters and Marty Hewlett identity this as evolution shrink-wrapped in atheism.[20] Evolution as a science is, then, always presented in connection with atheism. One must be aware of this epistemological and philosophical conflation.

Fr. John Zahm, C.S.C., in his 1896 book *Evolution and Dogma,* recognized that the science of evolution was being used instrumentally by the OATS to promote their atheism.

> For it was announced with the loudest flourish of trumpets, not only that Evolution is a firmly established doctrine, about whose truth there can no longer be any doubt, but it was also boldly declared, by some of its most noted exponents, to be subversive of all religion and of all belief in a Deity. Materialists, atheists, and anarchists the world over, loudly proclaimed that there is no God, because, they would have it, science had demonstrated that there is no longer any *raison d'etre* for such a Being. Evolution, they claimed, takes the place of creation, and eternal, self-existent matter and force exclude an omnipotent personal Creator.[21]

Zahm reconciles the compatibility of natural and divine causation by drawing upon creation *ex nihilo* and primary and secondary causation. In doing so, he also refutes Paley's argument that reduces God to a univocal cause. "To Paley, as to the older school of natural theologians, God was the direct cause of all that exists; to the evolutionist he is the Cause of causes – *Causa causarum*, of the world and all it contains."[22] Zahm rejects the argument used by the OATS (and over a century later

by the NATS) who are beholden to univocal causation that natural causes eliminate the need for divine causation. "They conclude that because, forsooth, they understand how a thing is done, that God did not do it. 'No matter how wonderful . . . has been the machinery which has worked, perhaps for centuries, perhaps for millions of ages, to bring about some beneficent results, if they can but catch a glimpse of the wheels, its Divine character disappears.'"[23] Zahm also notes the antagonism and resistance among scientists to consideration of the divine. "It would, indeed, seem that the sole aim and purpose of a certain school of modern scientists, is to discover some means of evading the mystery of creation. For they do not only deny creation, but also deny its possibility, and all this because they, with 'the fool', persist in saying in their hearts, 'There is no God.'"[24]

Zahm encourages his contemporaries in the Church to meet the science of evolution on its own terms and without the atheistic shrink-wrap. Ernst Haeckel from the nineteenth-century and Dawkins from the twenty-first make the same philosophical and epistemological error, which misleads their audience, when they make a philosophical claim under the guise of science. The NATS like the OATS make an idol of both God and science. Idolatry is either the reduction of God to another univocal thing in the world, or the elevation of a thing in the world to an object of worship. John Paul II saw the proper relationship between science and religion: "science can purify religion from error and superstition; religion can purify science from idolatry and false absolutes."[25]

Hazel Motes and the Idolatry of Reason

Idolatry brings us to Hazel Motes. Hazel Motes in Flannery O'Connor's novel *Wise Blood* is the twenty-two-year-old army veteran who abandoned his pre-war vocation to be a preacher like his grandfather and instead rejected Jesus Christ, God, and even his own soul. Told by his army bunkmates that he had no soul that could be

sullied by visiting a brothel, Motes, after desiring to believe what they said, accepts this nonexistence of his soul, which in turn frees him from sin. He "converted to nothing instead of to evil."[26] He no longer believes in sin or in God.[27] He did not think it right "to believe anything you couldn't see or hold in your hands or test with your teeth."[28] He becomes a street preacher of a new church, the Church of Christ Without Christ.[29] This church has no Fall and no Redemption and no moral distinctions based on behavior.[30] Motes declared in Johannine capital letters, "I AM clean. . . . If Jesus existed, I wouldn't be clean."[31] In his nihilistic ecclesiology, Motes professes that "there's only one truth and that is that there's no truth. No truth behind all truths is what I and this church preach!"[32] With no demands made upon the believers, Motes preaches "the Church Without Christ, the church peaceful and satisfied!"[33]

Motes has no need of Jesus because he has his dilapidated Essex automobile in which he sleeps and upon which he stands and preaches. He exclaims, "Nobody with a good car needs to be justified."[34] A malicious policeman pulled Hazel Motes over while driving and then proceeded to push his car over an embankment, the car crashing thirty feet below. Asked by the officer if he were going anywhere, Motes replied, "No."[35] Hazel Motes's radical dependence upon the Essex, upon the material, the technological, and the rational, could not take him where he wanted to go.[36]

Hazel Motes's atheism has much in common with the NATS. Dawkins et al. reject Jesus Christ, God, the soul, and sin. Science, or perhaps more properly scientism, holds the place of Motes's Essex automobile for Dawkins. On his website, Dawkins proclaims that "critical thinking is the real saviour of humankind."[37] Like Motes and his landlady, Mrs. Flood, Dawkins accepts only the material, sensible world capable of observation and scientific study. New Atheism is a religion of belief but without God. It is faith in reason alone, for outside of reason, there is no truth.

For Hazel Motes, however, there was no truth at all. In the tradition of the humanist atheists – Feuerbach, Freud, Marx, Nietzsche – Motes knew the absence of God meant nihilism and no truth. The nonexistence of God is world-changing for the humanist atheists. For Nietzsche, there was no longer good and evil but only the will to power. For the NATS, the dissolution of God is more like waking from a dream where there was some vague sense of something that used to be. Instead of nihilism and the lack of truth, the NATS argue that humans will flourish, freed from superstition and falsehood. God is not required for morality. God does not provide the basis for morality, but reason and science do.

But the NATS' dependence on, or idolatry of, reason and science is Hazel's dependence on his car. Reason and science cannot get the NATS to where they want to go – a coherent world order of truth and progressive morality. Dawkins is more than inconsistent; he is incoherent in his *sola ratio/scientia*. Materialism and evolution and sociobiology do not – and cannot – account for truth and morality. On the one hand, Dawkins states there is no good or evil, and on the other hand he creates a new Ten Commandments to govern moral decisions. Love, honesty, faithfulness, respect, justice, and generosity are all human goods. How does materialism account for mind, truth, reason, and trustworthiness of reason? How does one distinguish behavior that is true rather than merely adaptive evolutionarily?

The NATS lack the consistency of Motes and Nietzsche to descend into nihilism when God is extinct. Instead, they trumpet the nonexistence of God as they live a mostly educated, middle-class social life focused on enjoyment similar to Motes's church, "peaceful and satisfied."[38] Today, atheist "church services" have developed, such as Sunday Assembly, founded by two comedians who "wanted to do something that was like church but totally secular and inclusive of all – no matter what they believed."[39] Their motto is "Live Better, Help Often, Wonder More," and they encourage new members to "[m]ost of all, have fun, be nice and join in."[40]

Completely foreign to them and the NATS is the Cross, which brings us back to Motes and his conversion after his car – his idol of reason – was destroyed. Deprived of his world of reason, his encounter with nothingness begins a conversion. He blinds himself with quicklime and subjects himself to various painful penances (glass in shoes, barbed wire around his chest).[41] Blinded, he sees with greater vision about reality. "If there is no bottom in your eyes, they hold more."[42] He has moved beyond the visible and observable to the invisible and divine. His secular landlady, Mrs. Flood, says what he is doing is not normal, like "boiling in oil or being a saint or walling up cats. . . . There's no reason for it. People have quit doing it." Motes responds, "They ain't quit doing it as long as I'm doing it." To her secular incredulity about why he does it, he replies, "I'm not clean." [43] He has rediscovered sin, not only individual sins but sinfulness. He has rediscovered the inherent relation and identity of humankind with God. This world is no longer for him. "There's no other house nor no other city"[44] for where he wants to go. Just before he dies, he tells the police, "I want to go on where I'm going."[45] Only freed of his idolatry of reason, technology, and materialism could he reach his destination and see the truth about reality.

Conclusion

Dawkins and the NATS are like Hazel Motes attached to his Essex, though without the nihilism. They are also like the natural philosophers, critiqued by Saint Basil, who "have willfully shut their eyes to the knowledge of the truth." In their self-imposed darkness, they transmute, by their atheist alchemy, science into scientism and hold onto this as their single truth and begetter of truth. Instead of mocking a caricature of religion, they should follow the response of Mrs. Flood, who was captivated by Hazel Motes's blindness, looking into his eye sockets, as if trying to "peer . . . into the mystery of religious belief."[46] She saw in his blind eyes "the look of seeing something" and

of "going after something . . . in the distance."[47] That distance is not any spatial distance. The NATS and uninitiated Christians first need to understand the transcendence of God beyond univocal being. This is the beginning of understanding the noncompetitive nature of natural and divine causation. Christians should not fear science and its discoveries. Rather, they should be encouraged not only to encounter the Creator through creation but also to study the natural world and have intimate knowledge of how it works through secondary causes. Science is the modern agora for the proclamation of the gospel. Mislead by the false prophets of New Atheism and their scientism, many people follow the NATS into agnosticism and atheism because of the purported incompatibility between science and faith. A century ago, John Zahm, C.S.C. anticipated the new evangelization in relation to seminary formation regarding science and agnosticism: "If we were to devote as much time to science as we do the Classics, we could exhibit better results."[48]

Fr. Terrence Ehrman, C.S.C. is assistant director for life sciences research and outreach of the Center for Theology, Science, and Human Flourishing at the University of Notre Dame.

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[1] Saint Basil the Great, *The Treatise De Spiritu Sancto and The Nine Homilies of the Hexaemeron*, ed. Paul Böer, Sr. (Veritatis Splendor Publications, 2012), 1.6, p. 133.

[2] Ibid., 1.2, p. 128.

[3] Ibid., 1.2, p. 129.

[4] Ibid., 1.4, p. 131.

[5] Ibid.

[6] Ibid.

[7] Ibid., 6.1, p. 191.

[8] Daniel Dennett, *Darwin's Dangerous Idea* (New York: Simon and Schuster, 1995), 63, 83.

[9] Richard Dawkins, *River out of Eden: A Darwinian View of Life* (New York: Basic Books, 1995), 133.

[10] Sam Harris, *The End of Faith* (New York: W. W. Norton, 2004), 16, 19, 29.

[11] Richard Dawkins, *The God Hypothesis* (Boston: Houghton Mifflin, 2006), 126.

[12] Ibid., 78–80.

[13] Ibid., 52.

[14] Ibid., 72–73.

[15] Ibid., 77.

[16] Ibid., 57.

[17] Blaise Pascal, *Pensées* (London: Penguin Books, 1966), 13.183.

[18] David Burrell, C.S.C., *Aquinas: God and Action* (Scranton, PA: University of Scranton Press, 2008), 25-26.

[19] David Hume, *Dialogues Concerning Natural Religion* (Indianapolis: Hackett Publishing, 1980), II, pp. 17–18.

[20] Ted Peters and Martinez Hewlett, *Can You Believe in God and Evolution?* (Nashville: Abingdon Press, 2008), 85.

[21] John Zahm, *Evolution and Dogma* (New York: Arno Press, 1978), 209–10.

[22] Ibid., 412.

[23] Ibid., 411.

[24] Ibid., 221.

[25] John Paul II, "Message of His Holiness to Rev. George V. Coyne, S.J.," in *Physics, Philosophy, and Theology: A Common Quest for Understanding*, ed. R. J. Russell, W. R. Stoeger, S.J., and George V. Coyne, S.J. (Vatican City: Vatican Observatory, 1997), M13.

[26] Flannery O'Connor, *Wise Blood*, in *O'Connor: Collected Works* (New York: Library of America, 1988), 12.

[27] Ibid., 29.

[28] Ibid., 116.

[29] Ibid., 59.

[30] Ibid., 69.

[31] Ibid., 52.

[32] Ibid., 93.

[33] Ibid., 80.

[34] Ibid., 64.

[35] Ibid., 118.

[36] William Rodney Allen, "The Cage of Matter: The World as Zoo in Flannery O'Connor's *Wise Blood*," *American Literature* 58 (1986): 268.

[37] Richard Dawkins Foundation, https://richarddawkins.net/aboutus/.

[38] Stephen LeDrew, *The Evolution of Atheism: The Politics of a Modern Movement* (Oxford: Oxford University Press, 2015), 213–19.

[39] Sunday Assembly, https://www.sundayassembly.com/story.

[40] Sunday Assembly, https://www.sundayassembly.com/.

[41] O'Connor, *Wise Blood*, 125–26.

[42] Ibid., 126.

[43] Ibid., 127.

[44] Ibid., 129.

[45] Ibid., 131.

[46] Yen-Chi Wu, "'The Church Without Christ': Radical Theology, Secularism, and Flannery O'Conner's *Wise Blood*," *The Wenshan Review of Literature and Culture* 9 (December 2015): 98.

[47] O'Connor, *Wise Blood*, 120–21.

[48] Ralph Weber, *Notre Dame's John Zahm: American Catholic Apologist and Educator* (Notre Dame, IN: University of Notre Dame Press, 1961), 74.

Free Will and the New Atheism

Katherin A. Rogers
University of Delaware

THE NEW ATHEISTS OFTEN DENY the existence of human free will. I am thinking especially of Sam Harris, who has recently published a book called *Free Will*, denying that we have any such thing.[1] I will also mention Daniel Dennett, whose books *Elbow Room* and *Freedom Evolves*, defend "compatibilism," the view that we possess a "freedom" that is compatible with everything, including all of our choices and actions, being determined.[2] According to Dennett we do not have, do not need, and should not want, the sort of robust freedom that I mean by the term "free will."[3] In the present paper I will sketch a version of free will, mention why we might want to believe we do have such a thing, and then briefly suggest ways to defend free will against the attacks of the New Atheists.

By "free will" I will mean *libertarian* free will, the sort of freedom that can ground moral responsibility, praise, and blame, and that renders its possessor a being with great dignity and what we might call metaphysical stature; this is the sort of freedom that could make a created agent a genuine *imago Dei*. I will be appealing to the careful analysis of libertarian freedom proposed by Saint Anselm of Canterbury.[4] Anselm holds that the sort of free will that is most important is the sort that can allow for morally significant choices.[5] Anselm takes it that God has created us so that we can confront open options and be in what might be called the "torn condition" (my terminology), debating between the morally better and the morally worse courses. God's purpose here, according to Anselm, is that the created agent should be able to choose *a se*, truly from himself. On Anselm's account, a libertarian free choice, then, is not causally necessitated by natural causes, nor is it caused by God as the primary cause. (This sets Anselm apart from many medieval thinkers, including Thomas Aquinas – at least as I read Thomas.) Anselmian libertarianism

clearly entails the denial of determinism and hence of compatibilism. It is a version of what is today referred to as "agent causation," a theory that has been much discussed among philosophers in the last several decades.

It is important to note that libertarians do not insist that every time you make a rational choice – you debate between alternatives, and then opt one way or another – you are making a *libertarian* free choice. It may be that many of your choices are causally necessitated. The libertarian holds that only some of your choices are made with libertarian freedom. And the libertarian assumes that you did not create yourself and you are not the author of most of your beliefs and desires. It is curious that Sam Harris's main argument against free will is that you are not in control of the beliefs and desires that occur to you.[6] His claim is probably overstated in that clearly we do have some control over what we believe and desire. If I know that walking by the bakery will trigger a desire for that better-to-be-avoided slice of cake, I can walk on the opposite side of the street and avoid the desire. But in any case, to my knowledge, no libertarian claims that we exercise a great deal of control over our beliefs and desires.

Anselm, indeed, says quite the opposite. Anselm's motive, in producing his analysis of free will, is to allow some scope for human moral responsibility in a universe in which everything that has ontological status (real *being*) is made and kept in being from moment to moment by God. God, then, is the immediate source of our beliefs and desires. Anselm proposes an exceedingly clever and parsimonious agent causation, in which absolutely all that is up to the created agent is the ability to pursue one God-given desire over another. God, then, is the sole source of all the things that *exist*, but created agents can have some effect on the events that *happen*. This is hardly any aseity (from-oneself-ness) at all, but it is just enough to allow for responsibility. Anselm's libertarianism, and, I take it, any philosophically sophisticated libertarianism, is quite immune to this argument of Harris's.

What is the evidence for libertarianism? Harris writes that the defense of free will is based on a feeling of freedom. I take it that we do have such a feeling, and perhaps some, both inside and outside of the philosophical community, have taken this feeling to provide some evidence for free will. But I know of no libertarian who bases his whole argument on this feeling. And all, I assume, grant that such a feeling could be consistent with the truth of determinism.

Most libertarians, I believe, approach the question of the plausibility or reasonableness of libertarianism differently. Many begin with an intuition or a recognition that we bear responsibility for our choices and actions, that we are the appropriate subjects of praise and blame. (Among philosophers an intuition or a recognition would be a more respectable starting point than a "feeling," depending, of course, on what one meant by a "feeling." Harris does not make it clear.) And then they argue that, if our choices and actions are ultimately the products of forces outside of ourselves, over which we have no control, we could not be responsible for them. Only libertarian free will could allow for the responsibility that we know we exercise.

Complementary to this approach, some libertarians, past and present, are explicit in working within the framework of Christianity. In the Christian universe, there is an objective moral order to which, it is assumed, human agents are capable of conforming or not. And God holds us responsible for our choices and actions. And so, argue many Christian philosophers, Anselm included, our choices and actions must be ultimately up to us. (Certainly many important Christian philosophers have disagreed and held that God is the source of all, including every human choice and action. I would include in this list the later Augustine, Thomas Aquinas, and Calvin.) Moreover, at least on Anselm's theory, in order for us to be true *imagines Dei*, we must reflect, in our own small way, the perfect independence – Aseity – of God. Being free makes us very special kinds of things. This would seem to be a widely accepted belief, even bracketing the Christian worldview that gave rise to it.

Why do the New Atheists reject free will? Prima facie one might suppose that, having denied the existence of God, the New Atheists would attempt to set us (humankind) up in God's place as arbiters of our own destinies. Instead, many have insisted that our choices and actions are determined by a blind nature. There seem to be several reasons for this. (Sometimes one perceives a rather vague association of free will with religion, but since that does not rise to the level of argument, let's set that aside.[7]) Among the reasons there seems to be, first, the thought that materialism or physicalism, the thesis that all that exists is physical, is the scientific view.[8] And many who reject free will assume that free will requires substance dualism, the view that the human person is composed of two distinct elements, a physical body and a nonphysical soul or mind.

A first point to make is that physicalism is an assumption that could not be demonstrated by any of the sciences. That is not automatically a problem, in that one has to make foundational assumptions to get on with the business of thinking about the world. But physicalism faces serious difficulties, not least of which is the fact of consciousness. It would take a brave soul indeed to deny that he was having conscious experiences. But it is notoriously difficult to analyze conscious experience as ultimately brain activity. Certainly most philosophers grant that there is a very close connection between physical phenomena and mental phenomena, but there is lively debate over whether the latter can be reduced to the former.[9] Further, if free will requires nonphysical souls or minds, and mind cannot be reduced to the physical, it might be more rational for one to qualify one's physicalism than to abandon free will. But suppose, for the sake of argument, that it is possible to offer a plausible analysis of mental experience as ultimately reducible to brain events. All that would tell you is that free will, like other mental phenomena, can be analyzed as a physical process. But that would not entail that free will, even the very robust brand that Anselm proposes, does not exist.

Many who reject free will suggest that determinism – the view that all events, including human choices and actions, are causally necessitated – is the scientific approach. And again, this is an assumption that could not possibly be demonstrated by any of the sciences. We simply do not have access to "all events." In the nineteenth century one could fit the thought of a beautifully mechanistic, determined universe with the science of the day. Not so now that the consensus among physicists is that subatomic particles behave indeterminately. Some defenders of free will have gone so far as to try to associate free choice with this quantum indeterminacy.[10] I do not find this a very helpful association. Nevertheless, the fact that science believes there is indeterminacy in the universe should undermine the claim that determinism is the scientific view.

Sometimes one reads psychologists discussing free will and opining that they must assume determinism regarding human choices and actions in order to study human behavior. But, first, even if one supposes that assuming determinism is a helpful working hypothesis, a working hypothesis is a different beast from a theory for which we have evidence. And second, the claim that psychologists must assume determinism to do their work is just false. When you actually study the experiments on human agency that have been conducted in recent decades, what you find is this: none of the experiments includes the assumption of determinism in the actual structure of the experiment – whatever beliefs the experimenter may embrace on the subject – and none of the experiments provides evidence for determinism. And yet the experiments are often extremely interesting, providing insight into various aspects of human agency.

It is interesting that, although the New Atheists often express themselves as if they were giving us the scientific perspective, they often offer, as the clincher against free will, a philosophical rather than a scientific point. There is a standard philosophical complaint against libertarianism. It is found in the work of Saint Augustine in the fifth century.[11] The modern *locus classicus* is David Hume.[12] And both Harris

and Dennett find it very telling.[13] The argument is that if your choice is not determined by your preceding character, but rather that, given everything that led up to it, you could have chosen other than you chose, then your choice was a matter of chance or luck, and you cannot be responsible for it.

This is a powerful criticism, and the recent attempt to link libertarian free will with quantum indeterminacy may well succumb to it. But there is a plausible response. Rather than insisting that some preceding condition of the agent is the cause of his choice, perhaps we can say that the agent himself is the cause. And so long as he has reasons for choosing as he chooses, it is a mistake to insist that the choice is merely luck or chance.[14] The debate is still going on in the philosophical community, and a New Atheist like Harris should not write as if the issue had been settled against libertarian freedom.

A further point that Harris makes is a kind of moral argument. He points to the consequences of believing in free will and holds that rejecting free will places one in a better position morally. This is not exactly evidence for determinism, but it seems to me it should be taken seriously. Given the tone of their writing, a case can be made that the motive behind the New Atheists' crusade against religion, and the sort of free will they associate with religion, is that they judge that religious belief, and belief in free will, encourage bad behavior. Harris holds that belief in free will leads to hatred of those who do wrong and encourages cruel punishment. He writes, "I think that losing the sense of free will has only improved my ethics – by increasing my feelings of compassion and forgiveness, and diminishing my sense of entitlement to the fruits of my own good luck."[15]

In that Christianity preaches compassion and forgiveness, here is a public relations job for Christians. If we have failed, as individuals or as a community, both to preach and to practice compassion and forgiveness, we can try to do better. Insofar as Christians have indeed been compassionate and forgiving, we might – without tipping too far into self-congratulation – attempt to advertise the connection between

Christianity and the presence of these virtues on the planet. Moreover, at least on Anselm's analysis, we cannot take much credit in our accomplishments. At the best, all we can do is cling to the appropriate God-given desires. We do not create ourselves and have just enough freedom to ground responsibility.

Furthermore, upon examination, it is hard to defend the determinist perspective as occupying the morally superior position that Harris claims for it. Harris's becoming more forgiving is personally laudable, but intellectually incoherent. We forgive others when they are sorry for their behavior. But on Harris's account, the wrongdoer is not responsible for what he did. It was just his bad luck. Assuming this wrongdoer grasps the "truth" of determinism, he should find it cognitively impossible to repent, since his choices and deeds did not arise from himself. The wrongdoer, and the rest of us, may believe that what happened was a bad thing, but that is not the same as being sorry for what one has done. And since the wrongdoer cannot repent, the rest of us involved cannot forgive. And abandoning forgiveness, it seems to me, would constitute a change for the very much worse in the human condition. (Some determinists grant that it would be better if everyone continued the fuzzy thinking that certain wholesome reactive attitudes like forgiveness require, but Harris is not among them.[16])

And Harris has the classic problem with punishment that always confronts people who take desert out of the picture. He grants that, as a society, we have to punish wrongdoers. But they do not *deserve* the punishment since they were just unlucky. We punish them for consequentialist reasons, to protect society.[17] Another way of phrasing this is that we must use convicted criminals as a means to benefit the rest of us. But the principle that other people are to be used for the purposes . . . of the majority? of those with the power to do the using? . . . is not appealing. Again, the denial of responsibility demeans the human agent.

If desert is excised from our theories of punishment then the old, standard difficulty arises: Under certain circumstances "punishing" the innocent might benefit society. (The scare quotes are there because it seems odd to label the infliction of harm on an innocent person "punishment.") In those circumstances it would be justifiable to "punish" the innocent, again using him as an object to achieve benefits for other members of society. And that is a problematic conclusion. By insisting that responsibility must play some role in society's meting out punishment, we avoid the conclusion that some may be used for the benefit of others. Harris is mistaken to claim the moral high ground for determinism.

Nowadays one sometimes hears that there is experimental evidence against free will. There is not, and the philosopher is often dismayed that those who make this claim fail even to explain what they understand by the term "free will." A brief look at a couple of sorts of evidence can suggest why the anti-free-will conclusion goes far beyond what the experiments actually show. One sort of evidence involves showing that people are sometimes mistaken about their actions, believing they have done something that they have not actually done, or believing they have not done something that they did. So, for example, Daniel Wegner in his *The Illusion of Conscious Will*, which both Dennett and Harris cite with approval, records some extremely interesting experiments along these lines, some of which he himself has conducted.[18] Sometimes the subjects are obviously psychologically abnormal, but sometimes they are just folks.

Wegner's conclusion, though, goes far beyond what his evidence indicates. At least at times (he is not perfectly clear or consistent) he seems to embrace the thought that mental events such as intentions and choices are epiphenomenal. That is, brain events of which we are unaware cause overt bodily behavior, and these brain events also cause the mental accompaniments. I might experience making a choice, but the choice wasn't actually part of the causal history of the action I "chose." (Harris sometimes suggests this position. He writes, "[T]he

actual explanation for my behavior is hidden from me. And it is perfectly obvious that I, as the conscious witness of my experience, am not the deep cause of it."[19] Like Wegner, Harris is not clear or consistent.) Wegner also appeals to David Hume's highly debatable theory of causation, though he misses the point that Hume's theory undermines his own thesis that we are justified in believing that brain events cause other body events. He brings up the "luck" problem mentioned above, and the Libet experiments to be discussed below. But none of these elements, including his litany of experiments, provides any evidence at all for the radical claim that free will is an illusion. It is very interesting, indeed important, to discover how often people can be mistaken about their motives, intentions, choices, and actions, but it does not follow that we never make free choices, and it certainly does not follow that mental events are epiphenomena.

Neuroscience offers a different sort of experiment, of which the most famous are the Libet experiments. These are frequently cited as evidence against free will, although Libet himself insists that they do not show that we are not free.[20] Very roughly, one version of the experiments goes like this: The subject is sitting in a chair with a machine reading his brain activity. He is supposed to decide, after a while, to flex his wrist. And he is also supposed to watch a clock so that, afterward, he can report what time he made the decision. What the experiments seem to show is that a special sort of brain activity *precedes* the time that the subjects says he decided to flex his wrist. This has led some to conclude that the brain activity, of which the subject was unaware, caused him to choose. And if brain events cause choices, those choices are determined, and human agents do not have free will. Q.E.D.

There are a host of problems that have been raised against the conclusions that have been drawn from the Libet experiments. The timing issue – could someone really accurately report when they made the decision? – has occasioned significant skepticism. But let me briefly mention two problems that strike me as more fundamental, even if we

accept that the experiments provided accurate information about the timing of the choice and the brain events. First, what I take it that most of us, like Anselm, are interested in when we worry about free will involves *morally significant* choices. Such a choice is radically different from the wrist-flexing in the experiment. In a morally significant choice you are not sitting in a laboratory; you are going about your business in the world. And (at least this is how Anselm would describe it) you debated between doing the better and the worse action, and then opted for one over the other. These two sorts of choices are so radically different that evidence concerning one may not provide insight concerning the other. Perhaps even more telling, on Anselm's account, since you are in the "torn condition" before choosing, and on the assumption that brain events and mental events are closely causally associated, we would expect a special sort of brain activity to precede a choice. So the fact that the Libet experiments show such brain activity does not provide any evidence against the sort of robust libertarian freedom proposed by Anselm.

Science has most definitely not shown belief in free will to be misguided. *Could* libertarianism be empirically disproven in the future? Many philosophers, even many libertarians, assume that, in the future, science will be able to prove whether or not libertarianism is the case. (Interestingly, both Dennett and Harris grant that it is impossible to demonstrate that one could not have chosen otherwise, which is tantamount to saying that belief in determinism *cannot* be based on empirical evidence.[21]) I want to suggest (just briefly, although there is a great deal to say here) that such a proof would be extremely difficult to come by. First, remember that the libertarian claim is just that people occasionally, maybe rarely, make free choices. Most of our beliefs, desires, choices, and behaviors may very well be determined. So establishing that many of these phenomena are often determined would not undermine libertarianism as Anselm and most philosophically sophisticated libertarians understand it.

And, again, what libertarians are interested in are moral choices. So let us imagine the neuroscientist of the future (Dr. NOF) being able to read your brain activity at a distance and monitor real moral choices. We have seen that it is not enough for Dr. NOF to establish that there is a special sort of brain activity before you choose. That is taken for granted. What Dr. NOF needs to find in order to show that your morally significant choice for this over that is determined must be something like a *specific* kind of brain activity preceding a *certain sort* of moral choice. What Dr. NOF needs to find is activity pattern X if you're going to choose what you consider to be the virtuous object, and pattern Y if you're going to choose what you consider to be the wrong/vicious object. And he needs to find these consistently with numerous subjects.

Question 1 is: Did you agree to be constantly monitored? Suppose you did. Might it not be the case that knowing you are being monitored will inhibit your ability to choose freely? Moreover, someone who would agree to be monitored is psychologically aberrant, and so, even if Dr. NOF can establish a causal connection between preceding brain patterns and the choice for the good or the bad option in the case of someone who agrees to be monitored, it does not follow that no one has free will. Suppose you are being monitored by Dr. NOF, and you did *not* agree to it. Dr. NOF is being wildly unethical, of course, although that need not undermine his findings. But if you are living in the sort of vicious society where scientists behave this way, then that might inhibit your ability to choose freely. So even if the unknowing subjects of Dr. NOF's are determined, that doesn't mean we are.

And here is an even more fundamental problem for discovering that morally significant choices are causally necessitated. In order to establish that event A causally necessitated event B, presumably you need to observe a large number of events relevantly similar to A constantly followed by events relevantly similar to B. But each individual human being is unique. Each person's circumstances of heredity and environment are different. Each person's situation at any

given time, each person's set of beliefs and desires at any given time, is unique. One could hardly imagine a more unique event than a human choice. The neuroscience of the future that I was imagining is probably just impossible. So there is not currently, and probably could never be, strong empirical evidence for or against the existence of libertarian freedom.

Some might say that if the truth or falsity of libertarianism cannot be proven empirically, so that the view cannot be part of the scientific picture of the universe, then we should reject it. But note that it follows from the point that libertarianism is not provable either way that the same is true of determinism. Perhaps the question of free will is, and must remain, an issue for philosophers to deal with. One might suggest that, in the absence of empirical evidence, and given that philosophers have been dithering about the issue at least since Aristotle, agnosticism is the most reasonable position. But, in that it has such a significant and practical impact on how we view ourselves and each other, free will is one of those questions on which it is probably neither possible nor beneficial to try to sit on the fence.

So, in conclusion, let me offer just a few (among many more) pragmatic arguments in favor of committing to belief in free will. First, as I suggested above, it is demeaning to people to hold that they are not free and responsible agents. It can even lead to believing that it is permissible to treat others as mere means to our own ends. Secondly – and this one goes back at least as far as the worries that some had over Saint Augustine's apparent rejection of robust, libertarian free will – there is the problem of moral laxness. If you believe that you are not free, you will still make choices, of course. But you may not exert as much effort to choose the better over the worse if you believe that, whatever you choose, it was not ultimately up to you. Your choice was causally necessitated by factors outside of you – perhaps by God, perhaps by a blind nature.

Here is a third pragmatic argument for committing to the belief that you are free, aimed specifically at those scientists, like Wegner and

(possibly) Harris, who apparently embrace the view that our motives, intentions, and choices are epiphenomenal. This claim, when made by the scientist who has performed experiments purportedly leading to this conclusion, is wildly self-refuting. Wegner says that your overt behavior is caused by preconscious brain events, not by conscious intentions. But if this were truly the case, then no one has ever engaged in a scientific experiment because an experiment is, by Webster's definition, "an operation carried out under controlled conditions in order to discover an unknown effect or law, to test or establish a hypothesis or to illustrate a known law." Experiments, then, are *intention-guided* behaviors. If the scientist's intentions are epiphenomenal, they are not part of the causal or explanatory history of the behavior in which he engages. And so the behavior cannot be considered an experiment. Wegner himself does not notice this and happily assumes that he and his colleagues engage in intentional behavior. But that is cause for concern in itself, in that it constitutes setting himself up as apart from the mass of humanity, judging the rest of us as in the grip of an illusion.[22]

This point about experimentation is just an especially egregious example of a very common phenomenon. Harris writes as if religious people who, on his telling, are unkind to others due to believing in free will are blameworthy on that account, as if they should not have behaved as they did. But on his view, everyone must behave just as they behave. No one is responsible for what they do since their behavior is causally necessitated by factors outside of themselves. But I take it that everyone actually assumes that they, and their neighbors, are free, responsible actors as they go about their business in the world. It is unseemly, then, of the New Atheists to deny free will.

Katherin Rogers is professor of philosophy at the University of Delaware.

[1] Sam Harris, *Free Will* (New York: The Free Press, 2012).

[2] Daniel Dennett, *Elbow Room* (Cambridge, MA: The MIT Press, 1984); Daniel Dennett, *Freedom Evolves* (New York: Viking, 2003).

[3] A quick glance at the internet reveals that many New Atheists, such as Jerry Coyne, Richard Dawkins, and Steven Pinker, deny the existence of free will, although at times they defend the thought that it is beneficial to believe in free will as a sort of necessary illusion.

[4] I have tried to spell out and defend Anselm's version of libertarianism in two recent books, *Anselm on Freedom* (Oxford: Oxford University Press, 2008) and *Freedom and Self-Creation: Anselmian Libertarianism* (Oxford: Oxford University Press, 2015).

[5] This leaves open the question of what other sort of free choice there might be.

[6] Harris, *Free Will*, 6-9.

[7] Ibid., 55, 61.

[8] I believe that philosophers now prefer the term "physicalism" because "matter" down the ages has been problematic; think of Aristotle's prime matter, which is "pure potentiality," or the past atomists' indivisible little "chunks" of stuff. With superstring theory the thought that the physical universe is composed of anything like what the term "matter" supposedly referred to has become difficult to maintain.

[9] Impressed by the irreducible nature of consciousness, Thomas Nagel in *Mind and Cosmos* (Oxford: Oxford University Press, 2012) argues that science should come to terms with the thought that our universe naturally exhibits consciousness-causing traits.

[10] The most important proponent of this view is Robert Kane, *The Significance of Free Will* (Oxford: Oxford University Press, 1996).

[11] *Opus Imperfectum contra Julianum* 5.56; Rogers, *Anselm on Freedom*, 35-36.

[12] David Hume, *A Treatise of Human Nature*, pt. 3, sec. 2.

[13] Daniel Dennett, *Brainstorm* (Ann Arbor, MI: Bradford Books, 1978), 290, 295. Harris, *Free Will*, 5.

[14] Timothy O'Connor, *Persons and Causes* (Oxford: Oxford University Press, 2000).

[15] Harris, *Free Will*, 45.

[16] Ibid.

[17] Ibid., 53-59.

[18] Daniel Wegner, *The Illusion of Conscious Will* (Cambridge, MA: The MIT Press, 2002). Dennett, *Freedom Evolves*, 224; Harris, *Free Will*, 24 n. 12.

[19] Harris, *Free Will*, 43-44.

[20] Benjamin Libet, "Do We Have Free Will?" in *The Oxford Handbook of Free Will*, ed. Robert Kane (Oxford: Oxford University Press, 2002), 551-64.

[21] Dennett, *Elbow Room*, 135-36; Harris, *Free Will*, 76 n. 17.

[22] See my "Freedom, Science, and Religion" in *Scientific Approaches to the Philosophy of Religion*, ed. Yujin Nagasawa (New York: Palgrave Macmillan, 2012), 237-54.

Responding to the New Atheism: Doing as Thomas Does

Timothy Pawl
University of St. Thomas, Minnesota

SOME PARENTS, SEEING THAT THEY FAIL to live up to certain of their own standards, say, "Do as I say, not as I do." One Church Father who would not need to say such a thing is Saint Thomas Aquinas. In this brief presentation, I discuss not only his work and conclusions, but also his method of responding. My hope is to present a methodology based on that great saint that will help Catholics respond to the New Atheism.

Many Catholics, for instance, Bishop Robert Barron, philosopher Ed Feser, and theologian Scott Hahn, have provided insightful responses to the New Atheists, responses that draw upon the philosophy and intellectual insights of Saint Thomas Aquinas.[1] This is important work, and I believe that the thought of Saint Thomas can help illuminate the Catholic response to the New Atheism.

Another insight from Aquinas is important, too, in my estimation, though less commented on. Not only do his conclusions bring light, his *methodology* does as well. By looking at how Aquinas responded to interlocutors in his own day, we can glean important truths about how best to respond to the New Atheism. In combatting the New Atheism, what he says is important, but also *how he says it*.

At the outset, one might ask: why Saint Thomas? Surely he is not the only one to employ a methodology useful for responding to the New Atheists. What of Saint Frances De Sales? Surely the method he employed to bring 72,000 Calvinists back to the Catholic faith (as the story goes) would be useful as well. Not only useful; empirically verified! No doubt there is overlap on the methodology of these two great Doctors of the Church. And no doubt contemplation of the methods and manner of Saint Frances De Sales would be most useful

for us as well. But one can't do all things in such a short paper, and my expertise makes me much more reliable in Thomistic matters than in Salesian.

Moreover, there is ecclesial precedent. The Catholic Church encourages and exhorts following Saint Thomas in no unclear terms. Pope Leo XIII, in his encyclical *Aeterni Patris*, exhorted Catholic philosophers to follow in the footsteps of Saint Thomas. Pope Pius X, in his encyclical *Pascendi Dominci Gregis*, writes, "let Professors remember that they cannot set Saint Thomas aside, especially in metaphysical questions, without grave detriment."[2] This professor has remembered, and is acting accordingly. No doubt, Pope Pius X intended for professors to consider what Thomas says in his *answers* to metaphysical questions. Surely that is a good thing to do, and Thomas is a good place to look for a strong metaphysics. But I very much doubt that the good pope would have intended for us to look at his answers, but not his *method of answering*, for there is grave detriment in ignoring both the example of this thought and the example of his thinking.

With respect to Saint Thomas's method, I see at least two ways in which following in his dialectical footsteps will be useful to answering the New Atheists. They concern: (1) how to *present* the views of one's interlocutor, and (2) how to *reply* to those views. Allow me to say a little about each of these two aspects of Saint Thomas's method. In doing so, I will provide examples from the New Atheists for comparison.

First, Aquinas was clear and charitable in his presentation of his interlocutors' views. Consider, just for one example, one of his most commented on articles in the *Summa theologica*, article 3 of question 2 of the first part, where he presents his famous Five Ways. Witness how he presents his opponent's views. He writes, in the first objection:

> It seems that God does not exist; because if one of two contraries be infinite, the other would be altogether destroyed. But the word "God" means that He is infinite goodness. If, therefore, God existed, there would be no evil

> discoverable; but there is evil in the world. Therefore God does not exist.[3]

Now, whatever one thinks of the conclusion here, you cannot accuse Aquinas of being uncareful with the logic of the objection to God's existence. For he presents it in a common argumentative form in the second sentence: If God existed, there would be no evil; but there is evil; thus, by *modus tollens*, God does not exist. And if one wonders why that first premise is true, Aquinas provides justification for that premise as well: If one contrary is infinite, the other is destroyed; he assumes good and evil are contraries (aren't they?). Thus, if God is infinite goodness, evil is destroyed (that is, does not exist). Now, God, if God exists, is infinite goodness. Thus, if God exists, evil does not, which is precisely what that first premise says. Aquinas doesn't try to justify the second premise, that there is evil, but can we blame him for this? Is it not obvious to us that evil things occur?

Open the *Summa* to any set of, say, three pages. You'll find another such argument from an opponent carefully laid out and justified. So the first aspect of a Thomistic method of response is to represent carefully the objector's views to the best of your abilities, taking care to provide it in a logically perspicuous form, and with whatever justification for the premises one might offer.

Now, compare this method with the treatment Aquinas himself receives from the New Atheists when they discuss his Five Ways.[4] As is well known, Aquinas argued in his First and Second Way that anything that is moved or caused is moved or caused by another. Allow me to focus on causation for the remainder of this example, but know that many of the same things can be said about the reception of his argument from motion as well. Now, either that other thing is caused, or it is uncaused. If uncaused, we have reached an uncaused cause. If caused, then, as per our first premise, it is caused by another. Such a regress cannot go on infinitely, claimed Aquinas, so there must be a first cause, which we call God. The *Summa*, being a textbook of sorts for those studying for the priesthood, and not an apologetic work,

contains some, but not much, by way of argumentation against this infinite regress. But his *Summa contra Gentiles* (book 1, chapter 13), which *is* meant as a demonstration for interreligious interlocutors, *does* include much by way of justification for that claim.

One important thing to note here is that Aquinas's premise is that anything *that is caused* is caused by another, not merely that everything is caused by another. This is important to appreciate the level of uncharity involved in many responses to this and other cosmological arguments on the part of New Atheists. Daniel Dennett writes:

> The Cosmological Argument, which in its simplest form states that since everything must have a cause the universe must have a cause – namely, God – doesn't stay simple for long. Some deny the premise, since quantum physics teaches us (doesn't it?) that not everything that happens needs to have a cause. Others prefer to accept the premise and then ask: What caused God? The reply that God is self-caused (somehow) then raises the rebuttal: If something can be self-caused, why can't the universe as a whole be the thing that is self-caused. . . . Unless you have a taste for mathematics and theoretical physics on the one hand, or the niceties of scholastic logic on the other, you are not apt to find any of this compelling, or even fathomable.[5]

The thing to note in this treatment is that it gets the argument wrong in an uncharitable way. It is much easier to criticize the premise "everything must have a cause" than to criticize the premise "everything that is caused is caused by another."[6] In modifying that important premise, the New Atheist makes the argument easier to show incorrect. Moreover, note the reply that Dennett puts in the mouth of a proponent of the cosmological argument: God is self-caused. This, too, is quickly objected to. But, again, this is not a view that the proponent of the cosmological argument will proffer. In fact, we see Aquinas *rejecting the view* in his discussion of the Second Way,

where he argues for the conclusion that it is impossible for a thing to be the cause of itself!

What do we see here, then? We see a hasty presentation of the argument that modifies a premise to make it easier to defeat. We see a potential response given on behalf of the proponent of the cosmological argument which is not, in fact, helpful, and, in fact, explicitly contrary to the argumentation of Aquinas in this very context.

Compare this to the presentation Aquinas gave of his own opponent's views – the careful argumentation, the support for the contestable premise – and one sees a drastic difference in philosophical charity, and also explicitness of argumentation. My first recommendation, then, is that we model our responses to the New Atheism on Aquinas by *being careful and charitable in our presentation of their views*.

Second, consider how Aquinas *replies* to the views that he offers from his opponents. It is extraordinarily rare (though not entirely unheard of) that one finds him saying an unkind word about his opponent. Saint Thomas argued against his contemporaries who were providing what he took to be false and pernicious philosophies, even if those philosophies seemed absurd. For instance, he argued, painstakingly and carefully, against the Latin Averroists, who claimed that all humans share the same intellect. Now, this is clearly a ludicrous thing to say, and Aquinas thought as much. And it is clearly contrary to the faith, as Aquinas points out, since it precludes individual merit or culpability. Nevertheless, Aquinas says that this view must be shown false by *philosophical argumentation* as well. This is, in part, because his opponents are not all Christian (Averroes himself was a Muslim) and so appeal to the faith is not always going to be dialectically advantageous. We find him, in just one of the multiple texts where he discusses the view, providing *thirty-four* arguments for the Averroist position, and responding to each of them![7] Let that sink in for a moment. He provides thirty-four arguments on behalf of his

opponents, then carefully assesses their soundness. In another he painstakingly argues that the view, purportedly found in the works of Aristotle, is in fact contrary to Aristotle's philosophy. In both these texts, one comes to appreciate the integrity that Aquinas had when responding to the views of his interlocutors.

A reader ignorant of this medieval debate will be puzzled over the time and careful argumentation Saint Thomas gives to arguing against such a peculiar view. Nevertheless, it was a popular view during his time, and he saw it as his duty to respond to its argumentation, even if arguing against it proved frustrating or onerous for him, as it appeared to in his introduction to "On the uniqueness of the intellect against the Averroists" (*De unitate intellectus contra Averroistas*). He still presented the view clearly and replied to their arguments in depth. In fact, just two of his treatments of this view together number more than 30,000 words in their standard English translation – that's more than ten times the length of this brief article.

Again, compare the Thomistic method of reply to that of the New Atheists. We've already seen Dennett strawman Aquinas's argumentation, then provide a reply which itself was contrary to Saint Thomas's thought. What of the other New Atheists? Consider Richard Dawkins, who briefly discusses the Five Ways in his *The God Delusion*. In the almost-three-pages he sets aside for responding to Aquinas's Five Ways, the biologist Dawkins does better than the philosopher Dennett in presenting the way from causation. As Dawkins sees it, it goes as follows:

> Nothing is caused by itself. Every effect has a prior cause, and again we are pushed back into regress. This has to be terminated by a first cause, which we call God.[8]

Note that Dawkins understands that Aquinas wouldn't call God "self-caused." Also, note that he says every *effect*, not every *thing*, has a prior cause. In both these ways, he is to be commended over Dennett with respect to this argument.

Nevertheless, witness his response to the argument. He writes of this Second Way, as well as the First and Third (he treats them together):

> They make the entirely unwarranted assumption that God himself is immune to the regress. Even if we allow the dubious luxury of arbitrarily conjuring up a terminator to an infinite regress and giving it a name, simply because we need one, there is absolutely no reason to endow that terminator with any of the properties normally ascribed to God: omnipotence, omniscience, goodness.[9]

This is the extent of Dawkins's reply to Aquinas, aside from his mentioning two things that come to mind when he thinks of the cosmological argument – a bit of poetry and a nonsense recipe. What to make of this reply?

First, how unwarranted is it to assume that God himself escapes the regress? The regress is formed by use of the premise "every effect has a prior cause." Is it so unwarranted to believe that the thing referred to by the title "God," whatever it is, is itself not an effect of some *other* thing? Isn't it part of the very concept of God, in the Judeo-Christian tradition, that that thing is not an effect of some more ultimate entity? It seems to me that Dawkins hasn't given enough thought to whether the assumption is warranted or not. Moreover, even if he has given ample thought to it, he hasn't provided an *argument* for the claim. Rather, he has merely asserted it.

Second, if we really stand faced with an infinite regress, and we really do, as Dawkins notes, need some terminator for it, how luxurious is it to posit one? This seems no different from any other situation in which we stand faced with a difficulty and require an entity to solve it. Rather than being a luxury, it seems needful. Rather than an arbitrary conjuration, it seems principled positing.

Third, he notes that even if we allow the Christian the assumption that God, whatever God is, is not the effect of another entity, we still

haven't derived the God of Christianity, with all his perfections, from the Second Way. And so, reasons Dawkins, this argument is a failure. As he says of the arguments, they "don't prove anything" and are "easily . . . exposed as vacuous."[10] What of this response to the argument? For one thing, Aquinas would agree that he has not demonstrated a God with these attributes from the Five Ways. After all, Aquinas follows the article containing the Five Ways with an article questioning whether God has a body – and then later with articles questioning whether God is perfect, good, infinite, immutable, eternal, and even whether there is just one God. This reply, then, misunderstands Aquinas's intent in a drastic way, and responds to his argument in light of this misunderstanding.

My second recommendation, then, is that we model our responses to the New Atheism on Aquinas by *being careful and charitable in our response to their views*.

The truth is, responding as Thomas responds is not only the better path philosophically, it is also instrumentally better. For a central goal of any Catholic, whether a scholar or not, is, or ought to be, the salvation of souls and the work of Christ's kingdom. Reflect back a moment on the treatment that Aquinas received from the New Atheists I cited. Such treatment is not winsome. It does not invite the interlocutor to union, but rather puts the interlocutor off. In such pugnacious debates, we might win the argument, but we will lose the spiritual war. Or, if "lose" is too strong, we will at least be detrimental to the work of bringing the interlocutor into God's holy Church, into union with him, and also union with us. The method of Saint Thomas – the method that excises snark, rudeness, and rhetorical punches, and instead focuses on careful presentation of the very best the opponent offers, with a careful, critical refutation of the argument – is much less likely to cause a personal schism or vendetta.

Philosophers are fond of the scripture passage which exhorts us to "sanctify Christ as Lord in your hearts, always *being* ready to make a defense to everyone who asks you to give an account for the hope that

is in you." Yet we often forget to finish the verse, which says we must do so "with gentleness and reverence" (1 Pet 3:15). Likewise, Paul tells Timothy that "[o]pponents must be gently instructed, in the hope that God will grant them repentance leading them to a knowledge of the truth" (2 Tim 2:25). To my mind, Saint Thomas Aquinas is an excellent exemplar of how to give a defense of the hope we carry as Catholics, and of gently instructing in his writings. He is, in my view, a wonderful example of how best to respond to the New Atheists.

Timothy Pawl is associate professor of philosophy at the University of St. Thomas in St. Paul, Minnesota.

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[1] See, for instance, Bishop Robert Barron, "Aquinas and Why the New Atheists are Right," available at: https://youtu.be/-NMex7qk5GU; Edward Feser, *The Last Superstition* (South Bend, IN: St. Augustine's Press, 2010); and Scott Hahn and Benjamin Wiker, *Answering the New Atheism: Dismantling Dawkins' Case against God* (Steubenville, OH: Emmaus Road, 2008).

[2] http://www.vatican.va/holy_father/pius_x/encyclicals/documents/hf_p-x_enc_19070908_pascendi-dominici-gregis_en.html.

[3] St. Thomas Aquinas, *The Summa Theologica of St. Thomas Aquinas*, trans. Fathers of the English Dominican Province (Allen, TX: Christian Classics, 1981), I, q. 2, a. 3, obj. 1.

[4] For more discussion of the Five Ways, see my "Aquinas' Five Ways," in *Just the Arguments: 100 of the Most Important Arguments in Western Philosophy* (Oxford: Wiley-Blackwell, 2011), 7-17; and also my "The Five Ways," in *The Oxford Handbook of Aquinas* (Oxford: Oxford University Press, 2012).

[5] Daniel Dennett, *Breaking the Spell: Religion as a Natural Phenomenon* (New York: Penguin, 2006), 242.

[6] Feser similarly criticizes New Atheists for misreading the cosmological argument. See Edward Feser, "The New Atheists and the Cosmological Argument," *Midwest Studies in Philosophy* 37 (1): 154–77.

[7] See Saint Thomas's *Disputed Questions on Spiritual Creatures*, aa. 9 and 10.

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[8] Richard Dawkins, *The God Delusion* (Boston: Houghton Mifflin, 2006), 77.

[9] Ibid.

[10] Ibid.

Some Unhelpful Tendencies in Some Catholic Writing on Modern Science

Stephen M. Barr
University of Delaware

I HAVE HAD THE OPPORTUNITY to speak with many hundreds of Catholics about science and religion over the last twenty years: in private conversations, by e-mail, and in Q&A sessions after public lectures I have given. And I have come to realize how much unsettlement, nervousness, and even fear there is among Catholics about the relation of science and faith.

Theoretically, there shouldn't be. A believing Catholic shouldn't think that scientific truth could contradict the truths of the faith. As *Gaudium et spes* put it, "Methodical research in all branches of knowledge, provided it is carried out in a truly scientific manner . . . , can never conflict with the faith, because the things of the world and the things of faith derive from the same God."

And yet anxiety there is.

There are many reasons for it. Atheist scientists have been very vocal, such as Richard Dawkins, Steven Weinberg, Stephen Hawking, Victor Stenger, and Lawrence Krauss. They get a lot of attention, and this reinforces the widespread impression that the scientific community is devoid of religious faith. The historical myth that modern science and religion have always been at war – what historians call the "conflict thesis," although completely discredited among historians, is the conventional wisdom among educated and uneducated people alike. When I ask Catholic audiences what name comes to mind when they think about the Church's relation to science, they reply immediately and in one voice: Galileo!

People have been told that faith is believing without evidence, whereas science is all about evidence. The false idea that faith is a blind

leap has become a cliché. Belief in miracles seems unscientific to many people almost by definition. The accounts in the book of Genesis don't seem to match up with what science has learned; and all that many lay people are told about this is that the book of Genesis isn't to be taken too literally. But how it *should* be taken, they are rarely told.

I think many Catholics live in fear – and almost the expectation – that any day there is likely to be a scientific discovery that will overturn the religious applecart. They read that the great Stephen Hawking has said that the universe can create itself by a quantum fluctuation. They hear that a magical thing called the God particle has been discovered, and they imagine it must do something that God was once thought to do. They are told that computers will someday achieve consciousness and be more intelligent than human beings. They read that neuroscience is disproving the reality of free will and the soul. And they worry what the discovery of extraterrestrial life would mean.

In short, modern science is seen as something dangerous to belief.

And certainly it has created intellectual difficulties for many people. According to recent studies, a perception that science and religion are incompatible is a significant factor in Catholics losing their faith.

Historians tell us that the roots of the problem extend a long way back. They point to a number of philosophical shocks produced by the Scientific Revolution of the sixteenth and seventeenth centuries.

One of these was the unravelling of the medieval intellectual synthesis. In the Middle Ages, Aristotelianism was the language of both theology and science. But science developed its own very different vocabulary, and the two worlds gradually drifted apart and stopped talking to each other. Theology and science were not enemies, but they did become strangers.

A second shock was the abandonment of teleology in favor of mechanistic explanations, especially in the physical sciences. This was, of course, one of the things that helped destroy the Aristotelian synthesis.

A third shock was the determinism of the laws discovered by Newton and indeed of all of classical physics. This determinism created an enormous problem for belief in human free will and (especially for Protestant theologians) a question of how even God could act freely in the world.

Finally, the success of the reductive methods of modern science, whereby the properties and behavior of things are understood in terms of the interactions of their constituent parts, tended to inspire a variety of reductive philosophical ideas, including the materialism and scientism that have become such formidable threats to faith today.

It is understandable that some people think modern science itself is to blame for all this. They don't see how its rise and development could have led to all these baneful consequences for faith if modern science weren't itself defective in some way. One finds this stated or implied in much Catholic discourse about modern science and the Scientific Revolution that gave birth to it.

Declinism in various forms is popular with some Catholic thinkers. By this I mean the tendency to trace all modern ills to some intellectual mistake, sometimes rather subtle, in the distant past that caused the train of history to go off the rails, leading to a succession of nearly inevitable and worsening disasters: the Reformation, the Enlightenment, and the rise of various pernicious modern ideologies. Sometimes the trail of error is traced back all the way to William of Ockham or sometimes even further. I am not denying that there is some truth in these stories, but clearly this tendency can be taken too far.

A similar story is often told by Catholic intellectuals about modern science. Here the culprits are usually identified as Francis Bacon and René Descartes, with sometimes Galileo and Hobbes mentioned as accomplices. According to these accounts, modern science was conceived in philosophical error, and thereby its nature was corrupted and its vision distorted from the very beginning. The materialism and

scientism that plague us today are seen as simply the logical outcome of modern science's flawed philosophical foundations.

There are at least four ways modern science and its methods are seen as flawed and as giving us a distorted picture of nature.

First, it is said, modern science was motivated chiefly by a desire to dominate nature and control it for our own purposes, rather than a desire to know the truth of things and their natural ends. Not *episteme*, but *techne* was the prized goal. One contemporary writer puts this view very clearly:

> For ancient philosophers, the dignity of contemplation resided in its desirability for its own sake as the fulfillment of our longing for truth, rather than as a means to utilitarian ends. The architects of modern thought [Bacon, Descartes, Galileo, and Hobbes] championed analysis for the sake of increased power and security.

Often quoted is Descartes's statement that science will allow us to become the "masters and possessors of nature." Also frequently cited is Galileo's statement that if nature hides its secrets from us, we should subject it to torture to extract the answers it would not otherwise give. These statements and others like them are also popular with feminist historians of science, for whom they are evidence that Western science is phallocratic, dominating, and destructive. Here it should be said in Galileo's defense that his statement about torturing nature had nothing to do with sadism, domination, or lack of respect for the created world. He was merely advocating, using a memorable metaphor, the need for "doing experiments." And the need for experimentation in science most definitely needed advocates at that time, because the view of Aristotelians was that manmade devices, including those used to perform experiments, did not teach one about nature, since they forced things to move in a violent or artificial way rather than according to their natural motion.

A second criticism of modern science is that it willfully blinded itself to formal and final causes, allowing only material and efficient causes into scientific explanation. This criticism is so common and well known that it is not necessary for me to document it here. But still, I think it useful to quote two statements by prominent Catholic thinkers. The first statement, by Cardinal Schönborn, is the following:

> Modern science first excludes *a priori* final and formal causes, then investigates nature under the reductive mode of mechanism (efficient and material causes), and then turns around to claim both final and formal causes are obviously unreal, and also that its mode of knowing the corporeal world takes priority over all other forms of human knowledge.

Note something very significant. This author is simply equating "modern science" with scientism. The assertions that things not discussed by science are unreal and that science always has priority over other ways of knowing are obviously statements *about* science – metascientific statements – not statements *of* science. Many scientists might endorse them, but I daresay far more would reject them. What I think is revealing about this quote is how easily and unconsciously its author attributes the errors of scientism to modern science as such.

The second quote is from an article by the late Cardinal Dulles, who is describing with evident approval the views of Etienne Gilson:

> The Thomist philosopher Etienne Gilson vigorously contended in his 1971 book *From Aristotle to Darwin and Back Again* that Francis Bacon and others perpetrated a *philosophical error* when they eliminated two of Aristotle's four causes from *the purview of science*. They sought to explain everything in mechanistic terms, referring only to material and efficient causes and discarding formal and final causality. (emphasis mine)

It is a philosophical error to deny the *reality* of final and formal causes. And Bacon and others may well have committed it. But what they are accused of by Gilson, according to Dulles, is merely saying that such causes shouldn't be within "the purview of science." That is not the same thing, and to equate the two things is, again, to confuse a certain view about how science should be conducted (which Dulles clearly considers to be part of how modern science has defined itself since Bacon) with certain radical philosophical claims. Again we see the implicit attribution of philosophical error to modern science as such.

A third accusation leveled against modern science is that it regards itself as being only about appearances and phenomena rather than the reality underlying those appearances or the unseen causes of those phenomena. In other words, modern science is accused of being inherently positivistic in its self-understanding. To quote again Cardinal Schönborn: "[P]hysical reality is conceived of according to the reductive claims of modern science (which is to say, positivism)." Note again, the simple identification of modern science with radical philosophical positions. Science does not just employ reductive methods; science as such makes reductive *claims*. And those claims are said to be positivistic.

There is a paradoxical aspect to the way some Catholic authors discuss modern science. They castigate positivism and claim to be champions of a realist view of science – realism being the view that science tells one about reality. And yet one sometimes finds the very same authors making positivistic statements about modern science themselves.

In particular, one finds them saying that modern science is only about fitting the data, making quantitative predictions, and controlling nature. They say that the theories of modern science are always provisional and approximate and therefore not the truth about nature, but just models that work. The highly mathematical entities posited by modern science are said to be merely *entia rationis*, mental constructs

that are useful in correlating measured quantities, but to correspond to no entities outside the mind.

This is connected to a fourth critique of modern science, which is that by confining itself to the measurable and the quantitative, it can deal only with relatively superficial aspects of reality. Much of this critique comes from an Aristotelian perspective, according to which quantity pertains primarily to adventitious accidental features of things, such as location, size, and so on, rather than to their natures, essences, and causes. Whether a cat is here or there, is moving or at rest, is large or small, is in this or that spatial configuration (such as sitting or standing), or whether it is one of a large or small number of cats, makes no difference to what a cat is or to its essential properties. What is gained in precision and rigor by the quantitative methods of modern science is lost in ontological depth, so to speak.

Of course, there is some truth in all of these claims. The control of nature for our benefit and practical applications are a very large part of modern science. An exclusive focus on mechanisms can make one lose sight of teleology. Positivism has indeed left a residue on the thinking of many scientists. And there is much about reality – including the most important things – that cannot be explained by the quantitative sciences, such as physics.

But on the whole, the critique I have sketched is misguided and harmful.

It is harmful, I believe, for three reasons. First, it is largely based on a caricature of modern science. Second, it leads much of Catholic commentary on modern science to have a defensive, fearful, and even hostile tone, which interferes with the task of evangelizing a world that rightly esteems the achievements of science and that is increasingly influenced by scientific modes of thought. And third, it leads to misdiagnoses that mistake friends for enemies and enemies for friends, and causes some to embrace ideas that are actually corrosive to

traditional faith and to resist ideas that are actually apologetically helpful.

I cannot adequately support all of these contentions in the limited time available, especially as I wish to spend the last part of my talk delivering a more positive message. I will only briefly discuss my reasons for making them.

Let me start with the idea that the chief inspiration of modern science is the desire to control and manipulate nature for our own purposes rather than to know truth for its own sake. I will answer this first by quoting some statements made by Saint John Paul II in an address to the Pontifical Academy of Science on November 10, 1979, at a commemoration of the centenary of the birth of Albert Einstein. He said,

> The search for truth is the task of basic science. The researcher who moves on this first level of science, feels all the fascination of Saint Augustine's words: "Intellectum valde ama," "greatly love understanding!" and the function that is characteristic of it, to know truth. Pure science is a good. . . .
>
> On its second level [versant], science turns to practical applications, which find their full development in the various technologies. In the phase of its concrete achievements, science is necessary to mankind to satisfy the rightful requirements of life, and to overcome the different ills that threaten it. There is no doubt that applied science has rendered and will continue to render immense services to man, provided it is inspired by love, regulated by wisdom, and accompanied by the courage that defends it against the undue interference of all tyrannical powers.

Note the very positive assessment of science, both in its pure and applied forms. But note also that Saint John Paul II placed the search for truth as the first level of science. And, indeed, that search is what does motivate most scientists. They do "love understanding."

What is it that fires the imagination of most young people when first attracted to science? It is the marvels of nature: dinosaurs, weird creatures from the ocean depths, the Big Bang, black holes, amazingly beautiful pictures from the Hubble Space Telescope of colorful planets and moons and awe inspiring galaxies and nebulas – things that are completely useless to know about from a practical point of view. What stirs the soul of most scientists and science lovers is the thrill of discovery. It is the excitement of Archimedes' exclamation "Eureka!" Yes, Archimedes had hit upon the solution of a practical problem, how to determine whether the king's crown was made of pure gold; but what undoubtedly excited Archimedes much more was that he had gained a sudden insight into nature.

As Saint Augustine understood, the thirst for understanding is a thirst for God. Let us remember the words of Johannes Kepler, when he made perhaps the first great discovery of modern science. He wrote, "I thank thee, Lord God our Creator, that thou hast allowed me to see the beauty in thy work of creation."

To tell people who love or respect science that it's primarily about domination and control is to do them an injustice and to invite their scorn.

I turn now to the question of final and formal causes and their supposed banishment from modern science. I say supposed banishment, because I believe final and formal causality are still very much a part of modern science. What were banished – or rather set aside – were certain Aristotelian ways of thinking about these things. And there was a reason why they were set aside: they had proven scientifically sterile, at least in physics, astronomy, and the areas where modern science was to score its first great triumphs.

Let me quote from a recent book:

> Modern science in the sixteenth and seventeenth centuries rightly shifted its interest to mechanistic explanations of

> natural phenomena, limiting explanation to efficient and material causes. It must be acknowledged that the endeavor to explain sensible things in the light of their substantial form or telos was a stumbling block for the Peripatetic tradition for centuries. Its sterile attempts were quickly outmoded by the quantitative procedures of modern physics and chemistry. Today we would say that there is no point in asking the purpose of limestone deposits in Indiana or that of penguins in the Antarctic.

This very clear-eyed appraisal was written by a distinguished philosopher who has been a foremost champion of Aristotelian-Thomistic thought in our time, and I might add a leading light of the Fellowship of Catholic Scholars, none other than Professor Jude Dougherty, in his interesting book *The Nature of Scientific Explanation*.

Or listen to Fr. Stanley Jaki, certainly no enemy of Aristotle or Saint Thomas, in his book *The Road of Science and the Ways to God*: "Bacon therefore could and did banish from physics the study of final causes as barren virgins, and he rightly insisted on the disastrous effect of their study in the physics of Aristotle."

Nevertheless, as Fr. Jaki also emphasized, the scientists of the seventeenth century were by no means opposed to the idea of purpose in nature. Quite the contrary. He says, "On one crucial point Bacon was not the guide of Hooke and his associates in the Royal Society. Their works were a continual celebration of purposeful arrangements in nature."

Jaki then spends several pages describing the enthusiastic embrace of teleology by Robert Hooke, Nehemiah Grew, Robert Boyle, William Harvey, Isaac Newton, and other leading British scientists of the time.

The point is that the scientists of the seventeenth century were not opposed to the idea of purpose in nature, they simply thought that it didn't help one understand the operations of nature, that is, how it works. Modern scientists do indeed search for physical "mechanisms" to explain phenomena. But as the late Professor Austin L. Hughes, a Catholic evolutionary biologist, noted in his brilliant (but still

unpublished) book *The Folly of Scientism*, the very idea of a physical "mechanism" is based on an analogy between natural processes and machines. And the only actual machines that we know about are ones built by human beings for a purpose. Thus, mechanism does not exclude purpose but can go hand in hand with it. However, as Hughes further noted, once a machine is built by a human being it generally "goes about its business without regard for our expectations." In other words, to understand the operation of a machine, how it does what it does, one need not focus on the purposes of the one who built it.

Hughes spoke of modern science as involving a form of "ascesis" or self-denial. He wrote, "The scientific method involves deliberately setting aside certain ways of thinking to which our minds naturally tend. . . . The great discovery of modern science is that we can learn a lot about nature by this kind of self-denial."

At this point many Aristotelian-Thomist philosophers would be likely to point out that the purposiveness of machines is very different from the finality one finds in natural kinds, such as animals and plants. The machine is built "for the sake of" something or someone other than itself – the automobile is for the sake of the driver, for example. By contrast, the activity of a plant or animal is for the sake of its own flourishing, the perfecting or realizing of its own nature. Modern science, however, is not blind to this kind of purposiveness.

Some people imagine that it is. For example, consider the following statement of Cardinal Dulles, from the same article I quoted earlier. After saying that modern science has "discarded" final causes, he explains why this is a mistake:

> Final causality is particularly important in the realm of living organisms. The organs of the animal or human body are not intelligible except in terms of their purpose or finality. The brain is not intelligible without reference to the faculty of thinking that is its purpose, nor is the eye intelligible without reference to the function of seeing.

The fact, however, is that modern science is not oblivious to the fact that the function of an eye is to see and of the brain to think, or that the function of the immune system is immunity, of the respiratory system respiration, of the reproductive system reproduction, of the visual cortex vision, and so on. That indeed is why scientists name them as they do. And scientists well understand that these functions are ordered to the flourishing of these creatures.

But doesn't Darwinian evolution deny teleology? Yes and no. It certainly does as regards the mutations that fuel evolutionary change. These are said not to be aiming at anything, to be undirected toward a goal. The mutations happen willy-nilly, quite apart from whether they are beneficial or harmful. However, there is a teleology, not always noticed or acknowledged, in Darwinian evolution. It is to be found in the process of natural selection.

Why does natural selection favor this mutation but not that one? Because this one makes the eye see better in some way, which serves the purpose of helping the creature find food or mates, or avoid predators, which in turn serves the purpose of helping the animal to live and thrive and reproduce. Why, on the other hand, do species that take up residence in dark caves often gradually become blind and even sometimes lose their eyes? Because seeing serves no purpose for them, and so mutations that harm the faculty of sight are not selected against. It is mutations that confer a benefit – an advantage – that get fixed in the population by selection. Teleology may come in the back door, as it were, but it is there. Darwinism can account for very little indeed without bringing intrinsic finality into its explanation. Indeed, the famous evolutionary biologist Ernst Mayr admitted that finalistic explanations play an important role in evolution, though he chose to call them teleonomic rather than teleological, which was really just a verbal dodge, as Stanley Jaki noted.

Admittedly, a modern biologist who is an atheist would not say there are goals or ends in biology in the sense of purposes in the mind of God, but neither, for that matter, would Aristotle have said that.

It is also wrong to think that modern science has no use for formal causes. It appeals to form all the time. For example, a liver and a muscle are made up of the same material constituents – hydrogen, carbon, oxygen, and so on – acting on each other by the same basic forces. It is precisely their *forms,* in the sense of the way the matter is organized, their organic structures, that differ and enable them to play different roles in the body.

The same is true in physics. The very same carbon atoms can form a diamond, which is transparent, hard, and electrically insulating, or they can form a piece of graphite, which is opaque, soft, and electrically conducting. What explains their different properties is the difference in form, in intelligible structure. Indeed, as one goes deeper into fundamental physics, one finds that matter itself seems almost to dissolve into the pure forms of advanced mathematics.

The question is not whether form is important in modern science; it is whether the forms of modern physics and biology – namely, structure of various types – corresponds to the Aristotelian notion of substantial form. There is at least some similarity. An Aristotelian philosopher who recognizes this is again Professor Jude Dougherty. He considers this question at length in *The Nature of Scientific Explanation*. After discussing the role of structure in modern science he says,

> Permit me to make a distinction, lest it be supposed that I have been identifying structure with the Aristotelian concept of essence. Structure is not a synonym for essence. Structure is in the order of accident; . . . This is not to say that structure does not explain a great deal. If we know the structure of a molecule or organism, we can make a great many predictions about it.

He goes on to explain that structure is "in the order of accident" partly because the structure of things can be modified without changing them essentially. But then he notes that structural changes can also change

things from one kind to another and concludes that not all structure is accidental: "[T]here seems to be a distinction between essential structure and accidental structure." This leads him to ask, rhetorically, "Have we reached the point where we are willing to say that the structures postulated by or described by the sciences are really nothing other than Aristotle's forms?"

In the end, he rejects that conclusion. But his discussion shows an appreciation of the fact that central to modern science and its explanations are notions of form – in fact, very rich and fruitful notions of form – and these forms bear some resemblance to those of Aristotelian philosophy, even if they may not be quite the same. The notion that formal causality has been banished from modern science is at best a gross oversimplification, but in my view actually the reverse of the truth.

I now turn to the accusation that modern science is positivistic.

The heyday of positivism was the first half of the twentieth century, when it was extremely influential, perhaps dominant, among philosophers of science and also affected the thinking of many scientists. Einstein in developing his theory of gravity, general relativity, was influenced by the ideas of Ernst Mach, who was one of the founders of positivism. And as physicists tried to make sense of quantum mechanics in the 1920s and 1930s, they often resorted to positivist ideas or ways of speaking. The reason they did is the following: In thinking about quantum mechanics, one can stay out of philosophical trouble as long as one confines oneself to what is measured. Things get very confusing philosophically if one starts to worry about what the world is like between measurements and about how physical reality is in itself and not just how it presents itself to us in the results of our measurements. An easy way out, therefore, is to say that physics is just about phenomena, appearances, and measurements, and many physicists took this way out, at least rhetorically.

But these symptoms of positivist thinking among physicists were deceptive. Though Einstein was originally influenced by Mach, the theory of gravity he ended up with is actually not Machian in character. And when Heisenberg urged upon Einstein a certain positivist idea as the right way to think about quantum mechanics, on the grounds that Einstein himself had said similar things when developing relativity, Einstein retorted, "Yes, I did say this, but it is nonsense all the same." Einstein, as it turned out, was very much a philosophical realist. And because he couldn't see how to understand quantum mechanics in a realist way, he notoriously rejected it as an incomplete theory.

The truth is that scientists are overwhelmingly philosophical realists. They believe that science tells one about reality and not merely about appearances or the readings on the dials of one's experimental devices. That is why they are as philosophically puzzled about quantum mechanics as everyone else. (Though, it should be noted, there are realist ways of understanding quantum mechanics.)

Allow me to quote again Professor Dougherty:

> The British empiricists, as well as Comte [the father of positivism], failed to pay much attention to the actual practice in the sciences of their day, practices that in no way and in none of its parts were in accord with their positivist schemes.

And yet, paradoxically enough, a very strong influence of positivism can be seen in much Catholic writing about modern science. How did this come about? It came about largely through the influence of Pierre Duhem and Jacques Maritain. Duhem, who lived from 1861 to 1916, was a distinguished scientist and an important historian and philosopher of science. As a philosopher of science he was a thoroughgoing and avowed positivist, but a positivist of an unusual kind.

A main principle of the positivists was the rejection of metaphysics, which for them included the notion that there is a reality

underlying appearances and phenomena. Duhem agreed with other positivists in saying that modern science was only about appearances and phenomena and had nothing to say about underlying reality. Unlike them, however, Duhem believed in such a reality, but maintained that only Aristotelian-Thomistic metaphysics could give one access to it. So there were two kinds of knowledge in his scheme: the knowledge of appearances given by modern science, and the knowledge of being given by Aristotelian-Thomistic metaphysics.

Jacques Maritain had very similar ideas, and through him, they profoundly shaped much neo-Thomist thinking about science. Here is how Michal Heller, the Polish priest, physicist, and philosopher, describes the situation:

> The neo-thomistic approach to the sciences . . . had two roots. The first root . . . went back to Aristotle and St. Thomas Aquinas. . . . Maritain and others applied [Aristotle's] theory of knowledge to the modern sciences and supplemented it with suitably modified elements of the [then] current philosophy of science. This was the second root. . . . However, the [then] current philosophy of science was mainly of . . . positivistic . . . origin. [It] assumed that [as] no essences exist, one can meaningfully speak only about appearances. Neo-thomists took over his doctrine, but modified it by claiming that whereas science investigates phenomena, philosophy penetrates into the essences of things.

William A. Wallace, one of the leaders of the River Forest school of Thomism, gives a similar account.

The positivism that infiltrated Catholic thinking and discourse about science in this way has interfered with genuine theological engagement with modern science. It has also sometimes led Catholic authors to make bizarre statements, of which I would rather not give instances.

It is easy to understand the appeal of these ideas. They allow one to put modern science in a box. If it doesn't tell you about reality, then it cannot do any harm philosophically. And in particular it cannot do harm to religion.

Finally, there is the criticism that the focus of modern science on the quantitative and measurable leads it astray philosophically. This is a complicated topic, and there is no time to discuss it in this talk. I gave a talk on precisely this question at a conference of Catholic philosophers of science in the summer of 2016, so I will refer you to that talk. Here I will only say that for a variety of reasons some Catholic thinkers have failed properly to understand the mathematization of modern physical science and how deeply it allows us to grasp the natures, essences, and causes of things – at least inanimate things.

Up to now, most of my talk has been somewhat negative in tone. But my main message is actually hopeful. What I have been negative about are the negative views of modern science one finds in some Catholic discourse about it. I have been so, because I think modern science is our friend if we look at it in the right light, and if we think long-term. If we really believe that the truths of science and the truths of faith cannot contradict each other, then we ought to have confidence that as science progresses apparent difficulties will be resolved and that seeming dangers will prove illusory. We should expect scientific breakthroughs to narrow the distance between scientific perspectives and religious ones, not to increase them.

The main point of my book *Modern Physics and Ancient Faith* is that in several areas this has already happened in the twentieth century. I would like now to recapitulate briefly the developments I mentioned in that book, which were almost entirely taken from physics, and also mention a few taken from other fields. So let me first mention five developments within physics.

First, there is the discovery of the Big Bang. For a while, it seemed that modern science was pointing to a universe that had no temporal beginning. The idea of a beginning came increasingly to be seen as a relic of outmoded religious mythology. The discovery in physics that "energy can neither be created nor destroyed," the discovery in chemistry that the number of atoms does not change in reactions, and the fact that it seemed unnatural for space and time coordinates to be bounded, all suggested a universe unbounded in time. Einstein's theory of general relativity and the Big Bang theory that was based on it showed that it was possible and even probable that the universe and time itself had a beginning. Evidence for the Big Bang is now overwhelming. It is possible that the Big Bang was not the beginning of the universe and that something preceded it. Nevertheless, there are strong theoretical arguments that the universe had a temporal beginning, if not at the Big Bang then earlier.

I am not that sympathetic to attempts to prove the existence of God from the finite age of the universe, and in particular the so-called Kalam argument. I think that temporal beginning and creation are distinct ideas, as Saint Thomas Aquinas understood. Nevertheless, the discovery of the Big Bang certainly brings the scientific picture of the world closer to the religious view and further from the view clearly preferred by many atheists.

A second development has been the discovery that the laws of physics form a beautiful, harmonious, intricate, and unified mathematical structure based on very profound ideas. The mathematization of physics, which has been looked at askance by some Catholic thinkers, as I have noted, has in fact revealed this wonderful truth to us.

I like to quote Hermann Weyl, one of the great mathematicians and mathematical physicists of the twentieth century. He wrote in 1931, "Many people think that modern science is far removed from God. I find, on the contrary, . . . that in our knowledge of physical

nature, we have penetrated so far that we can obtain a vision of the flawless harmony that is in conformity with sublime reason."

We have since then penetrated the mathematical secrets of nature much further. One of the most brilliant physicists in the world, Edward Witten, who describes himself as a skeptical agnostic, said the following in an interview in 1993:

> The laws of nature as they've been uncovered in the last few centuries, and especially . . . in the last century, are very surprising. They are very subtle. . . . They've got a great beauty, which is a little hard to describe, maybe, if one hasn't experienced it. . . . The laws as we know them are very beautiful mathematically. They involve very interesting and subtle concepts. . . . It is a rich story, and it all hangs together beautifully.

In another interview, Witten was equally rhapsodic about so-called superstring theory, which he and many other top theoretical physicists regard as the most probable candidate for the ultimate theory of physics. He said to the interviewer, "I don't think I've succeeded in conveying to you its wonder, incredible consistency, remarkable elegance, and beauty."

A third development, which has unfolded mostly over the last forty years, and especially the last twenty, has been the realization that the laws of physics have many features that are just right to make the existence of life possible. These are sometimes called "anthropic coincidences." Some of these concern parameters that appear in the laws of physics having numerical values that seem "fine-tuned" to make life possible. This has opened people's eyes once again, including the eyes of some scientists and philosophers, to the possibility of purpose in nature. I will quote Ed Witten again. He may not see in these coincidences evidence of purpose, but he is obviously deeply impressed by them. He said,

> The laws of nature are very delicate. . . . Just with physics we already know, [the fact] that galaxies, stars and planets roughly like ours could have formed, and that living things roughly like us could have formed, depends on many details of the laws of physics as we currently know them being just the way they are and not being slightly different. [I think] we'll never resolve the sense of wonder about that.

A fourth development is the overthrow of determinism by quantum mechanics in the 1920s and 1930s. As I mentioned, the determinism of Newtonian physics, and classical physics as a whole, created serious difficulties for belief in human free will – or at least for the possibility a freely acting person could affect the physical world by his decisions. It led to the concept, still taken as dogma by most materialists, that the physical world is "causally closed." So the overthrow of determinism was an enormous positive development from the viewpoint of traditional theism.

A fifth positive development is that powerful antimaterialist arguments have emerged based on discoveries in physics and mathematics. From physics, we have again, quantum mechanics. What has vexed so many philosophers and physicists about quantum mechanics concerns what is called "the measurement problem." Attempts to grapple with this have led many people into strange philosophical directions. However, a strong argument can be made that the measurement problem arises only if one accepts materialism or physicalism as a premise. In the words of the distinguished philosopher of physics Hans Halvorson of Princeton, "In the case of quantum mechanics, if one presupposes physicalism, then one quickly lands in the measurement problem." That is why several eminent physicists of the twentieth century, such as Eugene Wigner and Sir Rudolf Peierls, argued on the basis of quantum mechanics that materialism is false and that the mind or consciousness is not reducible to physics.

In short, I would maintain that the traditional interpretation of quantum mechanics has two profound implications favorable to the Catholic conception of the world, and highly unfavorable to a materialist or physicalist conception of it. By contrast, some notable Catholic thinkers have regarded the traditional interpretation of quantum mechanics as posing a philosophical and theological danger – for example, Stanley Jaki, Mortimer Adler, and the physicist Peter E. Hodgson. Their worry was that it could not be reconciled with a realist view of science. They were in good company, because Einstein had the same concern. But, as Hans Halverson noted, some of the philosophical conundrums of quantum mechanics arise only if one adopts materialist premises. And since many philosophers and physicists adopt those premises, quantum mechanics has seemed more dangerous to a sound and traditional metaphysics than it really is. Here is a case where modern physics is much more of a friend to traditional religious belief than many Catholic thinkers appreciate, thinkers who have in fact overlooked its apologetical value.

There is also an argument against reductive theories of the human mind that is based on Gödel's theorem in mathematics. I discussed this at length in my book, but will not go into here.

Because I am a physicist, the five scientific developments favorable to religion conception that I just mentioned were the focus of my book *Modern Physics and Ancient Faith*. But there are important developments of this kind in other fields as well.

For example, in the early days of evolutionary theory, it was not clear whether human beings had emerged in one location or by parallel development in many widely separated locations, as postulated by so-called multiregional theories of human origins. Each view had its defenders. The multiregional view would obviously be quite problematic for Catholic theology, as it would imperil the original unity of the human race, with implications for original sin and other doctrines. This was something that naturally concerned the Magisterium. But in recent decades, evidence has come strongly to

favor the idea that *Homo sapiens* not only emerged in one location, but that this happened in a geographically very small area with an original population that numbered in the few thousands. (The development of *Homo sapiens* after the species arose has involved a small amount of multiregional influence: there were interbreeding events with "archaic" species of homo that had emerged in Eurasia, including Neanderthals and Denisovans, leaving a small imprint on the human genome.)

Just as remarkable are recent ideas on the origins of human language. In a new book that may well prove to be epoch-making, Robert Berwick and Noam Chomsky make the case very powerfully for what might be called a Big Bang theory of the emergence of human language. Using a variety of very sophisticated arguments and discoveries in linguistics, computer science, neuroscience, evolutionary theory, the study of animal communication, and other fields, they argue (a) that no other animals have language – even in rudimentary form – in the sense that humans do (that is, recursively infinite syntactical language, as needed for abstract thought), (b) that human language was first an instrument of thought rather than communication, and (c) that this capacity emerged very suddenly, probably over a single generation, and likely in a single individual, as a result of a small number of fortuitous mutations. Just as interesting, they make the following statement:

> The atomic elements pose deep mysteries. The minimal meaning-bearing elements of human languages – word-like but not words – are radically different from anything known in animal communication systems. Their origin is entirely obscure, posing a very serious problem for the evolution of human cognitive capacities, language in particular. . . . The problem is severe, and is insufficiently recognized and understood.

What they are saying is that while one can explain in evolutionary terms how the capacity arose to manipulate wordlike, meaning-bearing units,

it is mysterious how the first such units themselves arose. To put it simply, the ability to manipulate concepts and concepts to manipulate have to appear together, and that is very hard to explain.

Finally, I would note that it is becoming more common for philosophers and scientists to admit that consciousness cannot be explained in physicalist terms. The philosopher David Chalmers created a sensation back in 1997 with his book *The Conscious Mind: In Search of a Fundamental Theory*, in which he made this case. Thomas Nagel scandalized his fellow atheists when he argued the same point (among others) very forcefully in his 2012 book, *Mind and Cosmos*. It has become respectable for philosophers to refer to the "hard problem of consciousness," a term coined by Chalmers. I would state the problem this way: Given a complete description of any physical system as would be understood by modern physics, there is no way in principle to deduce from it, mathematically or logically, any conclusion about whether that system is conscious and has subjective experiences. I think this follows obviously from the nature of modern physics. Here is what Ed Witten, in the same interview I quoted twice before, said about this:

> I tend to think consciousness will be a mystery. That's what I tend to believe. I tend to think that the workings of the conscious brain will be elucidated to a large extent [and] . . . that biologists, with perhaps physicists contributing, will understand much better how the brain works. But why something that we call consciousness goes with those workings I think will remain mysterious, perhaps I'm mistaken. I have a much easier time imagining how we'd understand the Big Bang, even though we can't do it yet, than I can imagine understanding consciousness. . . . I am not going to attempt to define consciousness. In a way that is connected to fact that I don't think it will become part of physics. . . . I am skeptical that it's going to become part of physics.

Saying it will not become a part of physics is tantamount to saying that physicalism cannot account for it.

To conclude, I think that time is on our side as far as the actual discoveries of science are concerned. Science in the long run converges on the truth concerning the things it can study, and – to the extent that it does so – it must in the long run be the friend of religious truth. To the extent that scientific discoveries or theories sometimes seem inimical or dangerous to theology or sound philosophy, it is not because modern science is defective in its methods; rather, it is because modern science is still incomplete. It is still *in via*, still on the road. Nevertheless, whatever the twists and turns in that road, whatever labyrinthine ways science follows in pursuing its goals – we should be confident about where it must lead in the end.

Stephen M. Barr is professor of physics at the University of Delaware.

Purposes Revisited: Teleological Realism and Biophysical Reductionism

Phillip R. Sloan
University of Notre Dame

IN APPROACHING THE LARGE TOPIC implied by my title, I am concerned to address some of the challenges presented by recent developments in life science to issues that I feel are at the heart of a crisis in the understanding of the human person. These emerge as a consequence of some trends in contemporary biological science. Francis Crick's claim fifty years ago, at an important juncture in the development of molecular biology, that "the ultimate aim of the modern movement in biology is in fact to explain all biology in terms of physics and chemistry,"[1] has now been extended to warrant a bottom-up naturalism that threatens to eliminate the human being. As Crick pronounces more recently as the triumph of this vision,

> Your joys and sorrows, your memories and your ambitions, your sense of personal identity and your free will, are in fact no more than the behavior of a vast assembly of nerve-cells and their attendant molecules. [2]

As Mary Midgley responds to these pronouncements of Crick and other recent bioprophets in her *Are You an Illusion?*, there is something deeply implausible about what is being claimed in the name of molecular biology, an epistemological naivété that does not grasp its own assumptions. But we continue to hear such claims in the name of reductive biology.

The consequences of such philosophical claims extend into debates over when life begins, conclusions on the ethical manipulation of the human genome and the legitimacy of human cloning, the moral

permissibility of human-animal hybrids, the scientific study of consciousness, and many other larger philosophical and theological issues of concern to Catholic intellectuals and humanists generally. These are extensions of the conceptual and biotechnological revolution in the life sciences that has taken place over the last century.

Central to the analysis of these problems is the claim that teleological purpose and the validity of teleological conceptions and causation in discussions of the nature of life, and particularly human life, have been decisively undermined by the developments of life science. Where such purposive activities might seem to be operating, such as in the embryological development of the organism, traditional teleology can be replaced by "teleonomic" analyses, undermining a realistic interpretation of properly teleological principles that I see to be central to Catholic ethical and scientific thought. It is my intent in this essay to explain the differences between "teleological" and "teleonomic" explanations, and the proper place of the former in contemporary biological inquiry.

In my brief discussion I will first give a quick summary of some important historical background that helps us position what I feel has been the misinterpretation of the question of teleological realism in contemporary discussions. This will define the differences between "teleological" and "teleonomical" explanations. I will then look at some of the more recent developments in biology that I think give us ways of recovering some of the critical insights of a reworked Aristotelian theory of biology that I consider to be demanded by the phenomena themselves. These also carry importance for Catholic philosophical thought.

Historical Reflections

I erect a historical firewall for this discussion with the so-called mechanism–vitalism dispute that opened the twentieth century, a controversy that began initially around issues in experimental

embryology, but then moved by the 1930s into philosophy and even physics. We can pose this initially as a conflict between those accepting the views of German reductive biophysics of the nineteenth century, popularized for English-speaking audiences by the German-trained emigré physiologist Jacques Loeb (1859-1924), and those in some way following arguments similar to those of German embryologist later turned philosopher Hans Driesch (1867-1941).

Jacques Loeb is an earlier example of a scientist turned popularizer of scientism, represented more recently by individuals like Francis Crick. Loeb served as a spokesperson for the new experimental biology grounded in a reduction of life to physics and chemistry. His status as a scientific popularizer was such that he became the archetype for the character of Dr. Max Gottlieb in the Sinclair Lewis novel *Arrowsmith*.[3]

Loeb set out his views most starkly in a lecture to the Monist Society in 1910, published in 1911 as the *Mechanistic Conception of Life*. In this treatise, Loeb drew upon studies in animal and plant tropisms, the newly discovered work of Mendel, developments in the embryological school known as "developmental mechanics," and on the success of contemporary physics and chemistry in the explanation of such phenomena as animal heat production, to support the conclusion that all of life, including human life, could be explained through a rigorous physical-chemical determinism. This even extended to ethics, which he treated in strong deterministic terms.

In opposition, Hans Driesch developed his philosophical insights initially in his 1907 Gifford Lectures, published in 1908 with a second edition in 1929 as *The Science and Philosophy of the Organism*. His views were then expanded and developed more generally in a series of philosophical works extending into the 1940s. Developing from his own early work in experimental embryology and his discovery of how mutilated sea urchin embryos could nonetheless develop to adult form through internal repair and compensation, a phenomenon he later termed "harmonious equipotentiality," Driesch claimed that living systems involved higher integrative powers – organismic properties –

that could not be reduced to their causal conditions. After examining various alternative explanations in terms of the kind of reductive causal physiology and chemistry championed by Loeb, he concluded that the phenomena could be saved only by the positing of an autonomous principle of life that was causally involved in morphogenesis. To give some conceptual grounding for this, Driesch employed a qualified restatement of Aristotle's notion of the "entelechy."[4] This he considered warranted in view of such phenomena as harmonious equipotentiality. Claiming Aristotle as the "first vitalist in history," he comments:

> Let us borrow our terminology from Aristotle, and let that fact in life phenomena which we have shown to be a factor of true autonomy be called *Entelechy*, though without identifying our doctrine with what Aristotle meant by the word *entelechia*. . . . His word is to be a mould which we have filled and shall fill with new contents.[5]

As Driesch developed this argument in these lectures and in subsequent works over several years, his "neovitalism," although introduced with a quasi-positivist justification,[6] drew considerable criticism from contemporaries. It implied that in addition to ordinary scientifically conceived matter and currently accepted chemical and physical forces, one needed to employ causal explanations in terms of extraneous powers. The ensuing conflict between those adopting the reductionist and determinist standpoint of Loeb and those following the tradition of Driesch involved many of the leading theoretical biologists of the time.

I focus on Driesch because his reflections have two important consequences for the second, more contemporary, focus of my talk. The first consequence is that writing before the establishment of the strong gene-centered biology that emerged in the 1920s, Driesch was able to maintain a place for the robust plasticity and indeterminacy of living systems. He never lost sight of the organism itself, nor dissolved

it into a product of purely efficient and material causes. And he recognized as a biologist that the obvious goal-directedness of living things can be achieved by different routes, with the organism itself directing these alternatives from within.

The second consequence is more negative and has much to do with the rejection of Driesch's arguments by a long line of biological theorists. His solution to the experience of dynamic and teleological properties of the organism was achieved by moving away from what I would consider to be an authentic Aristotelian hylomorphism, and substituting for it a form of dualism. By this I mean that his neovitalism ignored some fundamental metaphysical issues that the Aristotelian tradition has kept clear, and a distinction here could have avoided certain problems with Driesch's solution. For example, there is a failure to maintain a distinction of the concept of *substance* from that of empirical *matter*. Instead, his theory essentially accepted a contemporary theory of matter from the science of his day, and then added to this the causal principle of the *entelechy*. The result was that Driesch's neovitalism is reduced to a kind of vital principle–matter dualism rather than an expression of genuine hylomorphism.[7] As he expands on his concept, this takes on more the appearance of Galenic facultative biology than Aristotelian hylomorphism:

> different kinds of entelechies may be said to be at work in the organism. . . . In fact, we may speak of an order concerning the rank or dignity of entelechies, comparable with the order of ranks or dignities in an army or administration. But all entelechies have originated from the primodial one. . . . Every part of these organic systems has been placed by entelechy where it must be placed to act well in the service of the whole, but the part itself acts like a part of a machine.[8]

If we are today to find some viability in the Aristotelian theory of the organism, it is necessary to be clear on the point that Aristotle is not a "vitalist" in the Drieschian sense. The difference between

Aristotle's views and those typically labeled "vitalistic" is seen in a careful reading of Aristotle's discussions in *De anima* 2.1. In this discussion, soul (*psuche*) is envisioned as so intimately tied to the primordial matter that Aristotle's example of "seeing" in relation to the eye captures the argument more adequately than any kind of soul–matter or vital force–matter dualism.

It is also important to see that Aristotle's discussion of *entelecheia* occurs at the level of "substance" and "first matter" rather than that of secondary empirical matter as would be encountered in empirical biology and chemistry. This is made clear in Aristotle's distinction of the two levels of *hule* in *Physics* 1.7.

Once the issues were formulated as a controversy between Loeb-style reductive "mechanism" and Drieschian neovitalism, however, a controversy was opened that, like the evolution–creation debates, obscured several issues of importance. [9] These debates, which in English, at least, peaked around 1928,[10] were resolved historically in favor of a strong reductionist program that became integral to the new biophysics programs forming the historical roots of what became termed "molecular" biology.

This development in the life sciences drew upon a new layer of philosophical discussion of the nature of life that originated in the 1930s in the wake of the revolution in physics produced by the development of quantum mechanics in the late 1920s. Some of the key architects of this new physics then attempted to engage biological questions in light of these new physical principles. At least one strand of this discussion led to a conscious elimination of teleological principles and their replacement by what later became termed "teleonomy." I shall limit my focus to the views of physicist Erwin Schrödinger, whose formulations of these questions seem to have affected several important theorists of more recent molecular biology, such as Francis Crick.

Schrödinger, Mayr, and the Teleonomic Solution

Although his major work was in wave mechanics and quantum theory, work for which he was a joint recipient of the Nobel Prize for physics in 1933, physicist Erwin Schrödinger (1887-1961) has played an unusually important role in discussions of teleology, biological reductionism, gene-centric biological theory, and the concept of the organism since the 1940s. Many early founders of the field of "molecular" biology were drawn from other fields – physics, mathematics, physical chemistry, crystallography – into the study of biology by the inspiration of Schrödinger's 1943 Dublin lectures, published in 1944 as *What is Life?*. In this imaginative, and often biologically naïve, venture into biological theory, Schrödinger popularized the work of several contemporaries who had more deeply explored the relation of physics and biology, genetics, and physical chemistry in the wake of the rise of quantum mechanics in the late 1920s.

When he published his remarks in 1944, he used these to articulate concerns with these questions that date back to 1933. His original interest of the early 1930s developed in response to attempts by his contemporaries and fellow quantum physicists, Niels Bohr and Ernst Pascual Jordan, to use quantum mechanics as a means to revive teleological principles and even vital causes.[11] In response, Schrödinger argued that the new quantum mechanics, and particularly its interpretation of the chemical bond by Walter Heitler and Fritz London, supplied a principle of order-maintenance of minute microscopic systems over time – the key to the stability of the gene over generations. This became the physical foundation for an argument for a form of "gene essentialism" that became then important in molecular biological thought.[12]

As part of this new physically interpreted gene essentialism, Schrödinger developed in a series of influential metaphors how the presumably material "genes" and the chromosomes containing them

could supply a "bottom-up" explanation of subsequent organic development: the chromosome constituted, in the novel set of metaphors generally introduced in this work, a "code-script" that constituted an "architect's plan and builder's craft – in one."[13]

The central claim that then emerges from the *What is Life?* lectures was that quantum physics undermined any recourse to vitalism or to new and unknown laws in physics.[14] Instead, it grounded a causally deterministic interpretation of living processes. It explained stability and the transmission of order from order, and it also implied the control of life by the gene. Rather than supplying any basis for vital action or inner freedom, as argued by other quantum physicists such as Schrödinger's contemporary Pascual Jordan, physics supplied the basis for strong reductionism and genetic determinism.

Although Schrödinger himself does not explicitly draw out these consequences and does not attach a specific name to his position, the themes he outlines were to become later the basis for the claimed elimination of the residual teleological explanations and vital principles that continued to hang on in the literature of embryology and developmental biology. Replacing traditional teleological insights was to be accomplished by a combination of natural selection theory and deterministic genetics that would explain apparently purposeful action. In 1958 the Princeton biologist Colin Pittendrigh defined this combination with the new term, "Teleonomy." As he commented:

> Biologists for a while were prepared to say a turtle came ashore and laid its eggs. These verbal scruples were intended as a rejection of teleology but were based on the mistaken view that the efficiency of final causes is necessarily implied by the simple description of an end-directed mechanism. . . . The biologist's long-standing confusion would be removed if all end-directed systems were described by some other term, e.g., 'teleonomic,' in order to emphasize that recognition and description of end-directedness does not carry a commitment to Aristotelian teleology as an efficient causal principle.[15]

Pittendrigh's introduction in 1958 of this new terminology to describe goal-oriented activities of organisms forms the background of the influential discussions by the Harvard biologist and philosopher of biology Ernst Mayr.[16] In these commentaries, Mayr distinguished between "teleomatic," "teleonomic," and "teleological" explanations. Teleomatic accounts are deterministic achievements of changes of state in a passive, law-governed way in response to ordinary thermodynamic principles, such as the cooling of hot iron, or radioactive decay. Teleonomic explanations are presented as replacements for behavior that would seem to violate thermodynamics and that have been explained traditionally by either internal or external teleological causation. Teleonomic accounts are defined by Mayr as events or processes that owe "goal-directedness to the operation of a program."[17] A teleonomic process may have as an end point "a structure (in development), a physiological function, the attainment of a geographical position (in migration), or a 'consummatory act' in behavior."[18]

It is important to see that in this definition, the goal-seeking is defined as something pushed deterministically "from behind." In living organisms, this is interpreted to be the working out of the DNA-inscribed "genetic code." But a more general teleological purposiveness of life is denied. This "code of life" is simply the historical product of the supposedly nonteleological outcome of Darwinian natural selection.

In such teleonomic accounts, the existence of multiple pathways and complexities entailed in developmental biology, the "harmonious equipotentiality" that led Driesch to posit the action of vital causal agencies, is not denied. It is simply reduced to the combined action of a deterministic preexisting genetic program interacting with developmental constraints and environmental input. An obvious nonbiological model of such a system would be the action of a self-guided missile that receives environmental input and corrects course by feedback mechanisms, with the goal-seeking defined by the

engineering-designed program. In the organic case, this program is simply internal rather than externally imposed by the designer.

Why Not Teleonomy?

There are two aspects of teleonomic perspectives that need to be addressed if we are to recover some more adequate analysis of living phenomena. One is the conception of genetic determinism; the second is the role of organismic-level phenomena that have come into play with theoretical developments in biology in what we might term the "postgenomic" period. I will outline both of these.

The notion of determinism from "behind" or "below" imbedded in teleonomic accounts lies particularly in the appeal to the concept of a "fixed genetic code" that presumably underlies the process of development and other subsequent purposeful organic actions. On this view, the emergence of structure is a generally deterministic outcome of the process of gene expression. Emergent phenomena resulting from this complexity may supervene on this, but these supervienient properties have no causal power and the causation is all bottom-up.

Although public-science, textbook, and even professional scientific discourse continues to reinforce this image of gene action with the assumption that the simple nucleotide base sequence of a given section of the DNA is "the gene," and that material genes therefore form a deterministic "code of life," there are important conceptual reasons to challenge this view.[19]

One primary reason to reconsider these assumptions has emerged from the Human Genome Project's own results. When the mass-sequencing project was completed in 2003, and some estimate was made of the relation of sections of DNA to functional gene expression, the number of structural genes was not in the order of hundreds of thousands, as some scientists expected, but more on the order of 20,000,[20] with many of these structural "genes" also found in model

organisms such as yeast and round worms, and at least 96 percent of these currently estimated to be in common between human beings and chimpanzees, although the subtleties of the differences involved are glossed over in such simple comparisons.[21] But it is clear from these outcomes of the mass-sequencing project that the differences we find in the forms of life are due not simply to material "genes" defined by sequences of base pairs in DNA, but are also the result of complex processes of cellular and whole-organismic regulation.

This has led to a deeper consideration by several biological theorists of the role of upper-level regulating factors in gene expression. What becomes important is not so much the presence of structural genes in the nucleus of every cell in the organism, but how and when these are turned on and off such that there is an orderly cascade of development that leads to a goal. In other words, gene regulation is of considerable importance.

This also involves careful consideration of the relationship between the nucleotide sequence in nuclear DNA and eventual protein synthesis. This is understood at present as a complex and multiple-pathway process involving exons, messenger and transfer RNAs, redundancies in codon to amino acid relations, and alternative pathways to single phenotypic effects. Within certain restraints, the relation of phenotype to underlying DNA is only loosely determinate. For example, we cannot speak of a simple "gene" for eye color,[22] let alone for more complex structures.

The second main challenge to the teleonomic perspective has been through a return of attention to upper-level organismic properties and the role of the organism itself in this project of regulation and development.[23] Hans Driesch captured aspects of this through his own early interest in the concept of the organism, and the way in which this underlay the phenomenon of "harmonious equipotentiality." This has focused new attention on the efforts of several theoretical and primarily developmental biologists in the 1930s – R. S. Lillie, E. S. Russell, Joseph Needham, Paul A. Weiss, Conrad Waddington, and

Ludwig von Bertallanffy as some of the most prominent – who attempted to articulate theories that involved not specially added vital forces, but instead utilized appeals to concepts of "organism" and "organization" as necessary components of biology. These views had been developed in the 1930s as a rational middle position between the claims of reductive "mechanism" and Driesch's neovitalism.[24]

This organismic perspective suffered from its own vagueness, and was overshadowed by the strong development of gene-centric biology in the 1920s and 1930s as these emerged in early molecular biology. It has once again returned to the stage in company with the greater recognition of higher-level regulatory properties. It forms an aspect of a reshaping of the theoretical landscape in several key areas of biology associated with systems theory, evolutionary-developmental biology or "evo-devo," and critiques of gene-centered genetics. We now have an expanding literature, developed by European, Latin American, and a growing body of Anglo-American philosophers of science, that emphasizes the role of organization, top-down causal agency, and a new level of plasticity of the organism as being necessary to account for the data of biology.[25] In this literature, there is place given to nongenetic causes that play an important role in development and in the general adaptation of the organism to its environment. We hear discussion of the concept of the "reactive" genome, meaning one that responds to higher-level causes and external input.

I am cautious about overinterpreting what this all means, and I acknowledge substantial pushback from prominent philosophers of life science typically identified as the "new" mechanists.[26] But this new recognition of organismic-level phenomena opens up a way to recover certain fundamental Aristotelian biological insights that supposedly had been excluded from physical science in the seventeenth century, and from life science by the development of biophysics and its successor – molecular biology – in the nineteenth and twentieth centuries. This particularly concerns the role of formal and final causation.[27]

The concepts of formal and final causation in biology are central to these insights, but it is necessary to be clear about what these concepts mean.[28] Although a common truism asserts that these causes were simply rejected by science in the seventeenth century, the issue is considerably more complex. Early biomechanism strongly relied on externally imposed design that supplied the formal and final causal principles of life.[29] But once this "theocentric" mechanism was critiqued by naturalistic alternatives in the eighteenth century,[30] other principles entered in surreptitiously or overtly that replaced Aristotelian causality with a new array of entities – Newtonian micro-forces (Montpellier Vitalists); internal moulds (Buffon); "sensibility" (French materialists); the *Bildungstrieb* (Blumenbach). More recently this has been expressed in the concept of the *Lebenskraft* (Müller) or in this century by the entelechies of Driesch; "codes" (Schrödinger, Crick); "information" (Monod); and "systems" (Turing, Shannon, and Weaver). We find in contemporary biology the subtle introduction of teleological principles in such concepts as "robustness," "systems," "error correction," "functions," "organization," and other terms that seek to capture the phenomena that are contained in Aristotle's notions of immanent purposiveness and dynamism of life.[31] These developments question the "causation from behind" teleonomical solutions to the problems of biological form and development.

What I draw from these developments is the conclusion that issues emerging from within the life sciences themselves are undermining the strong teleonomic thesis that has played a dominant role since Schrödinger and early molecular biology. Biological teleonomy carries with it deep and often implicit ontological commitments to the completeness of philosophical materialism, and these commitments in turn have important implications for bioethics and philosophical anthropology. I will turn to these issues in the closing portion of this paper.

One critical issue concerns the notion of organism and its relation to some issues of concern surrounding the ethics of experimentation

on human embryos and the general issue of determining when life begins. I am not convinced by the arguments that try to resolve this problem in terms of deterministic genetic codes. This solution, which I sometimes hear from Catholic sources, plays too easily into the hands of a teleonomic replacement. What seems more important is to recover the dynamism and plasticity of the organism that Driesch attempted to articulate with his concept of "harmonious equipotentiality," the ability of the organism to develop alternative solutions and realize goals through alternative pathways, and even correct for error. This point has been developed well by Maureen and Sam Condic in an important article that sought to address the issue of stem cell research.[32] Their analysis is valuable because they do not make a teleonomic argument, but instead focus on the issue of organization and the inherent teleology of the intact organic system.

First, they recognize, with reference to Saint Thomas, that the "soul is not united to the body as a motor" – the vitalist solution – "but is rather, the *form* of the body. . . . As such, the soul is ultimately responsible not only for the physical 'shape' the body has (right down to its molecular composition), but also for the operations it performs."[33]

This seems to me an important correction that avoids the problems of the neovitalist solution on one hand, and a teleonomic solution on the other. It also allows a looser connection between what may be the material genome and the teleologically realized organism. There can be defects in development. A material genome does not simply dictate a given result. There can also be organismic-level repair mechanisms that correct for developmental abnormalities even given structural genetic abnormalities. This also makes room for what might be considered to be systems approaches which, as Fr. Nicanor Austriaco has put this, sees the organism as "a dynamic, complex and seamlessly integrated network not of organs or of cells but of molecules . . . connected by reaction pathways."[34]

This does not imply an effort to go at the biomedical establishment with concepts of substantial form, appeals to souls, or some blunt defense of Aristotelianism. It requires instead a sophisticated hylomorphism, the articulation of which is a large task and requires several elaborations that cannot be attempted here.[35]

Where I feel a more fruitful dialogue can occur is by finding ways of translation and reworking the language employed in contemporary life science that is emerging from the science itself in ways that no longer pretend that science, and especially life science, can do without formal and final causation and a recognition of teleological realism.

There is, of course, the question that would obviously be asked by a scientist hearing this: How would any of this function in current biology? Is there some viable research program attached to it? Why should one prefer a more complicated perspective to a simpler approach via reductive mechanism, which has proven to be, and continues to be, so successful in life science?

In answer I make two points. First, the issue of the teleological purposiveness of organisms and the appeal to formal and final causation does not need be a question of appeal to special vital forces in matter or new laws of physics. I think it can be argued that sound Aristotelian hylomophism avoids these worries because it is dealing at the level of substance and the relation of form to primary matter, and is not offering a replacement causal account dealing with empirical issues in biological science.[36] Second, it does not mean a denial of the possibility of reductive biological explanations and even the positive value of pursuing such approaches in biology. Indeed, most of the breakthroughs in the understanding of cellular processes and the development of new medical therapies on the basis of this understanding have been products of a highly analytic and "mechanistic" approach.

Where, then, is the proper place to raise these issues in our discussions of science? I would reply that it is at the level of the philosophy of nature and that of the epistemology of science and the

warrant for its philosophical claims. To elaborate on the latter point briefly, Niels Bohr somewhat clumsily in the 1930s tried to articulate the point I wish to make with his notion of "biological complementarity." This was weakly developed and badly misunderstood at the time.[37] More helpful than Bohr's formulations I have found to be the concepts I have drawn from Michael Polanyi's epistemological approach to the issue. In *Personal Knowledge* he develops the important distinction of the two forms of awareness – focal and subsidiary.[38] On this distinction, as I would apply it to this set of issues, the recognition of the role of formal and final causes in life may legitimately be rendered "subsidiary" in analytic biological science when the explanation of organic process by commonly understood efficient and material causation is "focal." The purposeful and teleological dimensions of life become simply background, preconditions for doing biology.

But to pursue Polanyi's distinctions further, it is also possible, and in human philosophical biology even necessary, to direct the focal attention in our biological inquiry on the teleological and purposive dimensions of life to which we also grant metaphysical reality. It is at this level that we deal with a wide range of theological, ethical, and theoretical interests. It is here where the "freedom" of life is recognized and accepted in its full reality. In this situation, the material and efficient causes of life, as these are encountered or assumed within empirical science, become only subsidiary conditions underlying a robust experience of the organism. Both insights apply validly to a single reality, but in ways that may be mutually exclusive when applied at the same moment, similar to the kind of exclusion that one finds in the inability to perform a piece of music expressively and attend at the same time to the mechanics of fingering. We can, in this respect, acknowledge a realistic stance toward the teleological purposiveness of organisms without lapsing into vitalism of some traditional form.

I should emphasize that this is not offered as an easy "perspectivalism" or "alternative realities" position, nor is it a defense

of a Kantian subjective projectionism on a reality which is better known through reductive mechanism. The issue deals more fundamentally with the issue of the *intentionality* behind our scientific inquiries, reaching back into Franz Brentano's and Edmund Husserl's phenomenology and the concept of intentionality developed in that tradition.[39] It is precisely this dimension of scientific knowing that is forgotten by bioprophets like Francis Crick and others captivated by biological reductionism elevated to a general philosophy of nature. These confuse a valid thematizing of the natural world for certain intentional human interests with an eliminative metaphysics that in the end must render the status of the claims of science, and the scientific knower, ultimately paradoxical and self-destroying.

By acknowledging both the validity of our reductive science, and its limitations by epistemology itself, I suggest we can open up a dialogue that can achieve some greater balance in our life science between the drive to the mastery of nature embodied in the reductive program, and the appeal to recover a more contemplative view of a science of nature articulated by Pope Francis in *Laudato si'*:[40]

> It can be said that many problems of today's world stem from the tendency, at times unconscious, to make the method and aims of science and technology an epistemological paradigm which shapes the lives of individuals and the workings of society. The effects of imposing this model on reality as a whole, human and social, are seen in the deterioration of the environment, but this is just one sign of a reductionism which affects every aspect of human and social life.[41]

Phillip Sloan is professor emeritus in the Program of Liberal Studies and the Graduate Program in History and Philosophy of Science at the University of Notre Dame.

[1] Francis Crick, *Of Molecules and Men* (Seattle: University of Washington Press, 1966), 14.

[2] Francis Crick, *The Astonishing Hypothesis: The Scientific Search for the Soul* (New York: Touchstone, 1994), 3, as quoted in Mary Midgley, *Are You an Illusion?* (London: Routledge, 2014), 4.

[3] See Philip J. Pauly, *Controlling Life: Jacques Loeb and the Engineering Ideal in Biology* (New York: Oxford University Press, 1987).

[4] Aristotle's notion of *entelecheia* is not that of a causal agent, but instead denotes the final attainment of form, typically translated as "reality" in the Oxford Aristotle. See *Metaphysics* 9.3.1047a.30; 8.1050a.23; *De anima* 2.412a.22.

[5] Hans Driesch, *The Science and Philosophy of the Organism*, 2nd ed. (London: Black, 1929), 106.

[6] This enters the discussion in the first half of the book on grounds similar to Newton's appeals to gravity – that is, as an inference from phenomena to proximate cause. As these arguments are elaborated in the second part of *The Science and Philosophy*, however, Driesch's vitalism takes on a more emphatic ontological status.

[7] I am indebted here to valuable comments from Fr. Mariusz Tabaczek, O.P. and extended discussions in his forthcoming *Metaphysics of Emergence: Causes, Absences, and Dispositions* (unpublished ms., used by personal permission).

[8] Driesch, *Science and Philosophy*, 246.

[9] The early Logical Empiricists – Moritz Schlick, Otto Neurath, Philip Frank, Hans Zilsel, and others – were careful to develop a critique of Driesch not by advocating an alternative metaphysics, but by attacking him on the level of empirical adequacy. I have explored some of this in my "Biophysics in Berlin," in *Creating a Physical Biology: The Three-Man Paper and Early Molecular Biology*, ed. P. R. Sloan and B. Fogel (Chicago: The University of Chicago Press, 2011), 61-98. I am also indebted to the researches of my student Bohang Chen, who has explored the interactions of Driesch's neovitalism and early logical empiricism in this period in his "The Death of Early Twentieth-Century Vitalism," (unpublished MA thesis, Program in History and Philosophy of Science, University of Notre Dame, 2016).

[10] This is shown by a Google n-gram search for the term "vitalism" for the period from 1910 to 1940.

[11] See my introduction to Sloan and Fogel, *Physical Biology*; and my "How Was Teleology Eliminated in Early Molecular Biology?" *Studies in History and Philosophy of Biology and Biomedical Sciences* 43 (2012): 140-51.

[12] See L. Moss, *What Genes Can't Do* (Cambridge, MA: The MIT Press, 2003), chap. 2. Moss is a former research molecular biologist as well as a philosopher of life science.

[13] Erwin Schrödinger, *What is Life?* new ed. (Cambridge: Cambridge University Press, 2000), 22.

[14] D. McKaughan, "The Influence of Niels Bohr on Max Delbrück: Revisiting the Hopes Inspired by 'Light and Life'," *Isis* 96 (2005): 507-29.

[15] Colin Pittendrigh, "Adaptation, Natural Selection, and Behavior," in *Behavior and Evolution*, ed. A. Roe and G. G. Simpson (New Haven: Yale University Press, 1958), 390-416, at 394. His interpretation of teleology as an "efficient causal principle" indicates how far this view has departed from Aristotelian hylomorphism.

[16] E. Mayr, "Teleological and Teleonomic: A New Analysis," in *Methodological and Historical Essays on the Natural and Social Sciences*, ed. R. S. Cohen and M. Wartofsky (Boston: Reidel, 1974), 91-117; E. Mayr, "The Idea of Telelogy," *Journal of the History of Ideas* 53 (1992): 117-35. A wide range of meanings of "teleonomy" is encountered in the current literature, and multiple definitions have been offered since the term was first introduced by Pittendrigh, with only some of these usages mapping on to Mayr's definitions. A. Pross ("On the Chemical Nature and Origin of Teleonomy," *Origins of Life and Evolution of Biospheres* 35 [2005]: 383-94), for example, interprets this to apply to any systems which violate thermodynamic principles, without requiring conformation to an underlying "program" in Mayr's sense. My usage will follow Mayr's more restrictive definition.

[17] Mayr, "Idea of Teleology," 127.

[18] Ibid.

[19] Moss, *Genes.*

[20] E. Pennisi, "Genomics. ENCODE Project Writes Eulogy for Junk DNA," *Science* 337 (2012): 1159-61.

[21] See the exhaustive analysis by Mikkelsen et al., "Initial Sequence of the Chimpanzee Genome and Comparison with the Human Genome," *Nature* 437 (1 September, 2005): 69-87.

[22] See for example F. Liu et al., "Digital Quantification of Human Eye Color Highlights Genetic Association of Three New Loci," *PLOS Genetics* 6, no. 5 (May 2010): e1000934.

[23] S. Gilbert and S. Sarkar, "Embracing Complexity: Organicism for the 21st Century," *Developmental Dynamics* 219 (2000): 1-9.

[24] On this history, see E. L. Peterson, *The Life Organic: The Theoretical Biology Club and the Roots of Epigenetics* (Pittsburgh: The University of Pittsburgh Press, 2016); and D. Nicholson and R. Gawne, "Neither Logical Empiricism nor Vitalism, but Organicism: What the Philosophy of Biology Was," *History and Philosophy of the Life Sciences* 37 (2015): 345-81.

[25] M. Mossio, M. Montevil, and G. Longo, "Theoretical Principles for Biology: Organization," *Progress in Biophysics and Molecular Biology* (2016) available at: http://dx.doi.org/10.1016/j.pbiomolbio.2016.07.005.

[26] See for example C. Craver and L. Darden, *In Search of Mechanisms: Discoveries across the Life Sciences* (Chicago: The University of Chicago Press, 2013).

[27] This is not to claim, however, that these new "organismic" perspectives accurately capture the most important features of Aristotelian hylomorphism. For example, these tend to develop the issues in terms of mereological part–whole relationships, and focus on empirical concepts of matter, neither of which represent genuine hylomorphism. I am indebted to Fr. Mariusz Tabaczek, O.P. for this important clarification.

[28] For example, they are not to be interpreted as occult efficient causes of some kind, a common view one often encounters, and an interpretation that was sometimes given in the early modern period.

[29] Even with Descartes, formal and final causes, particularly in biology, is placed in the domain of externally imposed design, but is not denied. See opening discussion to his *Treatise of Man*, trans. T. S. Hall (Cambridge, MA: Harvard University Press, 1972).

[30] See S. Gaukroger, *The Collapse of Mechanism and the Rise of Sensibility* (Oxford: Oxford University Press, 2010), esp. chaps. 9-10.

[31] See for example, H. Kitano, "Biological Robustness," *Nature Reviews*

Genetics 5 (November 2004): 826-37.

[32] Maureen Condic and Sam Condic, "Defining Organisms by Organization," *National Catholic Bioethics Quarterly* 5 (2005): 331-53.

[33] See *Summa theologiae* I, q. 76, quoted in Condic and Condic, "Defining Organisms," 335.

[34] Nicanor Austriaco, "On Static Eggs and Dynamic Embryos: A Systems Perspective," *National Catholic Bioethics Quarterly* 2 (2002): 661. I would, however, disagree with what I consider to be Austriaco's teleonomic argument which directly appeals to a deterministic working out of a genetic program.

[35] This is the larger project Fr. Mariusz Tabaczek is currently pursuing.

[36] See on this David S. Oderberg, *Real Essentialism* (New York: Routledge, 2007) 199-200.

[37] See my "Teleology Eliminated" for details.

[38] M. Polanyi, *Personal Knowledge*, new ed. (Chicago: The University of Chicago Press, 1962), esp. 87-95.

[39] See useful analysis in J. Kockelmans, *Phenomenology and Physical Science* (Pittsburgh: Dusquesne University Press, 1966), esp. chap. 2.

[40] See my "Toward a 'Franciscan' Biotechnology: Three Perspectives on the Domination of Nature," *Omega* 15, no. 2 (2016): 89-117.

[41] Francis, *Laudato si'*, 106.

Science without Faith Is Like Eyeballs without a Face

Stacy A. Trasancos
Holy Apostles College & Seminary

NO, I AM NOT GOING TO COMPARE the faith and science relationship to a Billy Idol song about angst and the lack of human grace, but the simile is admittedly a rather garish one. It comes from Frank Sheed in his 1946 book, *Theology and Sanity*. In chapter 1, section 2, Sheed explains how to develop a "Catholic intellect as well as a Catholic will." He asks, "What does the Church see when we look out at the Universe?" This seemingly simple question is, I contend, the foundation for a correct scientific worldview. The scientific method starts with observation, so if science is a study of reality, then we have start out seeing reality as it is.

Sheed says it is not enough to see what the universe is made of; that is only the beginning. We must see everything that exists in relation to everything else. Is that not the purpose of science? To discover the relationships in the natural world? Sheed says we must go even further, bigger, and see the details of the natural world in their fullest context. "Nothing," Sheed says, "is rightly seen save in the totality to which it belongs." He gives the example of the human eye, but let me tell it in my own words.

The Beauty of Eyes

Say a man named Steve has a girlfriend named Sheryl, and Steve finds Sheryl's eyes beautiful. Steve tells Sheryl so often, "My, Sheryl, you have the most beautiful eyes I have ever seen."

What Steve does not realize is that Sheryl is very literal. He also does not know that Sheryl has a high tolerance for pain. In desiring to give Steve a gift to show her appreciation for his affections, Sheryl

plucks her eyeballs out of their sockets and presents them to Steve on a plate. "Here, Steve, I thought you might like to have my eyeballs since you find them beautiful."

Do you think Steve might feel the same emotions for Sheryl's eyes sundered from their living context? The answer is obviously no. They are no longer beautiful sitting alone on a plate. Sheed's point about the Catholic intellect and our view of the universe is that, like eyes in a face, we must see nature, and all its parts, all the universe, in its proper context, as creation with "God as the Source of the existence." Truly, if a person were to accumulate vast knowledge of eyeballs by studying them in the lab, dissecting them, elucidating the structure of the proteins, the functions of the parts in relation to the other parts of the eyeball, every chemical mechanism and rate, but if that person never saw eyeballs in a face, he would never really know what eyeballs are.

There is a profound lesson about faith and the scientific method here. If we see science without seeing God, then we really do not know what science is at all.

Materials Chemistry without Faith

I know what it is like to live with this mechanical, lifeless view of the universe. I have lived like the one in a lab unable to see the bigger picture. Before I attended graduate school, I had decided to become a chemist because I wanted to help find alternative energy sources. I was not religious, but saving the planet seemed like a noble pursuit, even if I did not have the words to express it as such.

I joined Professor Thomas E. Mallouk's Chemistry of Nanoscale Inorganic Material Research Group at Penn State University and was assigned to the artificial photosynthesis project. My first research team was trying to simulate electron transfer in the light dependent reactions. I need to describe what we were attempting in order to explain my perspective.

We were trying to simulate photosynthesis on nanoscale materials because those biological processes harvest light energy from the sun using a system of molecular machinery to make the precursors for many biological molecules. Photosynthesis happens in plant cells, in organelles called chloroplasts, in the membrane of thylakoid disks. In those membranes resides precisely positioned pigment molecules, called chlorophyll, that absorb certain wavelengths of sunlight.

The double bonds in the carbon rings of the chlorophylls provide (P680), basically, a place for electrons to hang out – like a shopping mall – and the metal ion provides extra electrons, so some of them want to get away. They are easily oxidized. The light energy (captured as photons) gets the already enthusiastic electrons even more excited, and they are like, "I'm out of here." They leave the chlorophyll.

The electron is transferred to another protein molecule, and then to another and another and another and so on, much as people might toss a hot potato down a line. Each passing of the potatoes, so to speak, allows some energy to be lost, but not wasted. The controlled release of energy is used to power other reactions. Chlorophyll and the accessory pigments and proteins are the solar batteries that keep life pumping. Therefore, if you are a nanoscale materials chemist trying to make alternative energy sources, it makes sense to try to design molecular machines that replicate photosynthesis.

We were trying to simulate only one electron transfer – one. We were not trying to design an electron transfer chain. We were not trying to do anything useful with the energy or the electrons. We were merely trying to get excited electrons to jump from one randomly oriented polymer layer on our composites to another polymer layer and stay there long enough to measure a charge-separated state.

Our nanocomposite designs were intelligently designed for sure, and I remember how that thought struck me. Again, I must explain some of the details. We grew concentric monolayers, roughly one molecule thick, of photosensitive (like the chlorophyll) redox-active (able to accept and lose electrons) organic polymer layers on high-

surface-area silica particles. We could not actually see the layers. We had to perform analyses to ascertain the presence and organization of the layers, knowing that we would not be able to know for sure how much the polymers were separated into layers on the silica surfaces.

The silica particles were "fumed silica," a thickening agent typically used in cosmetics, paints, adhesives, and even cat litter. We wanted to use cheap and available products wherever possible, in anticipation of possible future industrial uses. To make fumed silica commercially, quartz sand is vaporized in a >1500°C flame so that droplets of amorphous silica agglomerate into an extremely fine powder with a high surface area (5 grams has about one-fifth of an acre) and irregular shape. The irregular shape further complicated our ability to assess organization of layers.

We grew layers on the silica by charging the surface and immersing them in successive solutions of negative inorganic sheets and cationic polymers. We visualized our composite assemblies of polymers grown on these silica particles somewhat like lasagna noodles coated on squashes. The cationic polymers were separated by an inorganic layer of an inorganic compound, small-particle alpha zirconium phosphate, α-Zr(HPO4)2, exfoliated into thin sheets. The composites were immersed in a solution of a molecule, disodium methoxyaniline-N,N'-diethylsulfonate that acted as a reversible electron donor, nicknamed $MDESA^{2-}$, to help keep the electron transferred to the other polymer. The names of the photoreactive polymers were poly(styrene-co-N-vinylbenzyl-N'-methyl-4,4'-bipyridine) dichloride and poly[Ru(2,2'-bipyridine)2(4-vinyl-4'-methyl-2,2'bipypridine)] dichloride. We called them [Ru(bpy)32+]n and (PS-MV2+)n for short.

The process of building the composites and analyzing them took weeks. Since we could not see the layers growing, we first grew them on planar surfaces and measured their thicknesses. Assuming the same layering would occur on the silica surfaces, we used a transmission electron microscope to see if we had grown the lasagna layers on the silica squashes as we were trying to do. We very scientifically called the

layers a "mottled coating" because that was the best description for what we saw. It took some hard staring to convince ourselves to proceed with the next phase of the experiment – the attempt to simulate that one measly electron transfer.

That phase required going into the basement and setting up our sun – the second harmonic from an Nd:YAG laser that produced 532-nanometer light – so that it would hit a pinky-sized quartz cuvette of our polymer-coated silica particles and excite the electrons. We split the beam to time the mechanical shutters to detect the excitation and electron transfer. It was honestly like trying to thread a needle with a wet noodle behind your back in the span of time it takes brain cells to tell your eyes to blink. I look back now and wonder if we were crazy.

Nevertheless, we determined that our experiment worked. About 30 percent of the electrons transferred to another polymer layer, staying there for a half-life of about 21 microseconds. We published a paper in the *Journal of the American Chemical Society* and a chapter in an advanced textbook series about photochemistry. But that only set the stage for my comeuppance.

Following that initial project, it then became my lead project to do *two* electron transfers. I tried everything. I even learned to make perfectly spherical 30-nanometer silica balls using a surfactant solution such that the silica polymerized in the water inside soap molecules. The hydrophobic ends of the surfactant were outside in an organic solvent; the water-loving ends were inside, and I used that space like an atomic-scale mold. But nothing worked. I tried and tried. After a year, I was actually worried I might not graduate. Imagine the panic that started to pile up in me.

One day, I decided to consult my Voet and Voet *Biochemistry* text to see if I could spur an idea for my project. While turning to the photosynthesis chapter, I saw a full-sized page insert that detailed not only the major photosynthetic pathways, but also the major metabolic pathways connected to photosynthesis in organisms. Right there on one page were the basic chemical reactions that show how life on the

entire planet for all time is interconnected precisely at the molecular scale. I had the strange and overwhelming sense staring at those life-sustaining reactions that that I was surely missing something I would never discover in my graduate work, regardless of how badly I wanted to find out the truth of nature's mechanisms.

Real Photosynthesis in Nature

It is hard to describe the emotions a chemist feels when allowing herself to glimpse the chemical orchestration in the universe outside the usual isolated system of beakers and test tubes on the lab bench. I remember thinking of the futility of my work, realizing that no matter how much I wanted my project to work, no matter how much I wanted to graduate and become a scientist, no amount of passion would make my molecules do what I wanted them to do. They followed their laws; I was but a puny manipulator of them, except I barely could figure out how to do it.

I very distinctly remember turning to the window next to my desk that day and gripping the ledge, hiding tears. My eyes fell on an old *Ginkgo biloba* at the end of the building, a big tree I had never really noticed before. With trepidation, I fixated on the funny-shaped leaves. There were thousands. And they flapped in the wind carelessly, mindlessly achieving what I never would. My brain started clicking through the process.

In every square millimeter of every leaf, there were a million or so chloroplasts, five microns long. In those little factories, there were thylakoid membranes containing chlorophyll molecules – highly conjugated cyclic tetrapyrrole molecules with Mg2+ ions in the center, and each with slight chemical differences in the side groups such that together the pigments absorbed the full spectrum of visible light reaching the earth from the sun – photons of light, discrete quanta whose energy is given by Planck's constant (E=hf). Protein complexes oriented these antenna systems in the thylakoid membrane with exactly

the right angstrom-scale (tenth of a nanometer) spacing so that they would be oxidized. And the antenna system was transferring that energy to a reaction center in less than 10^{-10} seconds (a tenth of a nanosecond) with an efficiency of greater than 90 percent. That was only the beginning.

Excited electrons were entering the Z-scheme of photosynthesis, a dual system of electron transfer pathways that happen simultaneously. Some electrons were going to a Photosystem II complex, moving to a bound plastoquinone (Q_A), then to a second plastoquinone (Q_B) to a pool of plastoquinone molecules (Q_{pool}), so that the resulting plastoquinol reduced the cytochrome b_5f complex and translocated protons into the thylakoid lumen before the electrons were transferred to plastocyanin (PC), which was reducing another photooxidized chlorophyll in Photosystem I.

Then, through another chain of transmembrane units (called sidechains A_0 then A_1 and ferredoxins F_x, F_A, F_B, and F_d) the electrons were reducing nicotinamide adenine dinucleotide phosphate ($NADP^+$) to NADPH, thereby generating a transmembrane proton gradient, which supplied the energy for the synthesis of adenosine triphosphate (ATP) from adenosine diphosphate (ADP) and a phosphate group donor (P_i).

And all the while the oxidized pigment molecules were being reduced by water (H_2O) to generate oxygen gas (O_2), which we breathe. In the light-independent reactions, NADPH was simultaneously reducing ATP to produce CO_2 and fix carbon into the three-carbon precursors of carbohydrates – sugars, starch, and cellulose, which play many roles in living organisms such as the storage of energy, formation of structural components, not the least of which is dietary fiber and the 5-carbon monosaccharide ribose, an important component of the backbone of the genetic molecules ribonucleic acid (RNA) and deoxyribonucleic acid (DNA).

And photosynthesis was globally consuming about six times more energy than the human race each year, fixing some 1011 (100 billion)

tons of carbon to make biological molecules, using some 1018 (quintillion) kilojoules of energy. The chloroplasts? They evolved from photosynthetic bacteria, over the eons generating all the oxygen gas in the earth's atmosphere. It struck me: It is not just life on this planet that is interconnected at the atomic level; far beyond the grasp of the human mind, matter and energy from the stars all the way back to the beginning of time are connected too.

I saw my science in the "totality to which it belongs" for a moment. I saw God in creation, as reason so easily leads us to do if we allow it. To this day, I still sit and stare at that chart of the photosynthetic hub among the metabolic machinery of life, the chart of reactions from my Voet and Voet *Biochemistry* textbook, except now I understand that I am looking at the handiwork of God.

Seeing Science in the Light of Faith

You might think I fell to my knees that day in the lab, accepted the gift of faith, and wept for joy right there on the spot, but that is not what happened. I was not ready to face God. I was focused on a narrowly defined scientific project and on graduating. I did the only thing I could do at the time. I cursed the tree for all its impossible mysteries, hurled my vial of intelligently designed artificial photosynthesis, world-saving nanotechnologies, data included, into the metal trashcan behind me, tightened my ponytail, and got back to work. I never got two electrons to jump on inorganic-organic multilayer composites grown on high surface area silica.

A knack for simplicity saved my career. Other groups of chemists were trying to synthesize crystalline materials with ordered pore networks, but they could not do it in the 30-nanometer size range because the crystal structures collapse at those sizes. A colleague and I had the idea to fuse together a pellet of our famous 30-nanometer silica balls and to use that pellet as a mold to polymerize a Bakelite resin around the fused silica balls using divinylbenzene. Bakelite is hard.

When we washed the silica away by dissolving it in hydrofluoric acid, the replica was left. Then we used incremental mole ratios of a flexible monomer, ethyleneglycol dimethacrylate, to make the replica shrinkable with heat. So it came to be that while materials chemists were wrestling with collapsing crystalline materials, our invocation of an old industry technique, the same one used to make pipes and fountain pens, produced the first report of any bulk material with a crystalline pore network in the 10-50-nanometer size regime. We published in *Science* journal, what was referred to by a popular science writer as "nanobubblepack."

A year later, I was granted a Ph.D. in chemistry, a funny name for me if ever there was one since the word "philosophy" either made me stare blankly into space or shudder. I worked for DuPont for five years before my husband asked me – to make a very long story short – how I define success. By then, the words in the *Catechism of the Catholic Church* about children being gifts had convicted me. I realized it was time to face the big truth about creation I had earlier turned my back on.

I left my career to be with my own inorganic-organic highly complex composite systems with rational souls, those offspring who called me Mommy. When I stated I was excited about conducting research in my in-home food lab to serve up to hungry analytical machines, my husband gently suggested I might find other interests besides chemistry, and I did. I became Catholic three years later, earned a dogmatic theology degree while rocking babies, and now I have found a vocation teaching and writing from home, which led to the moment when I stood in front of a room full of Catholic scholars in Washington, D.C., to tell my story about what science without faith is like.

Now a cured materialist, I am proud to say that I have made peace with the trees. We live tucked away in a 100-year-old lodge in the foothills of the Adirondack Mountains, surrounded by the most majestic evergreens and hardwoods. I walk among them daily, but my amazement at the machinery of life never ceases. I like to say that I

now see science "in the light of faith," God-bathed, as Frank Sheed called it, with a Catholic intellect.

In Closing, Go Bigger

There are a lot of good suggestions to teach science in the context of philosophy and theology, and now that I know what a classical education is, I am on board with this idea. But I also hear statements in the faith and science dialogue, even among scholars, that are frustrating, almost as if some Catholics are the Sheryls handing the Steves plates of eyeballs instead of shining the full beauty of faith and the scientific method. In closing, let me state five problems that are easily righted with a bigger view of creation.

Christians talk about "intelligent design" in nature, pointing to this or that marvelous aspect of science to prove that God exists, but is not all of nature intelligently designed, and don't we start there in faith? Just like when we sit down and bless our meals?

Christians talk about evolution as if it is the opposite of nature, as if evolution must be shown to be impossible lest God is shown somehow not to exist, but what happened to praying the Creed in confidence before looking out at the world? Nature is creation. This is not an either/or question.

Christians talk about the "anthropic principle" to express awe and wonder at the physical constants inherent in the universe that are necessary for life, a truly astonishing realization. But what about the mechanisms of photosynthesis? What about all the ways life – happening right now, here, out there, in every breath and heartbeat and thought – that depend on physical laws to hold us in existence? Fine-tuning is not just a story about the past. It is reality right now, down to every last electron in your body.

Christians opine that quantum mechanics leaves a "space" for free will, but why are believers looking to physics to explain a power of the soul? God created us with the powers of intellect and free will in our

rational souls, and therefore we can move matter in ways the laws of physics would not cause objects to move otherwise. One has but to note the difference between the surface of any other planet and the surface of earth to see that humans are cocreators, albeit in limited ways.

Christians often say that "biology proves life begins at conception." It does, but that is obvious. Why not use the conversation to teach others that the truth about our existence, purpose, and destiny requires more than reason alone? It takes faith to understand that a human life in its earliest stages is worthy of unconditional love. Saying "life begins at conception" is the simplest unity of humanity, science, and faith. We have to get comfortable talking about faith in the same sentence as science.

Now that I see science in the light of faith, I know that the scientific method does not even make sense without faith in Christ. This is an easy concept to grasp, but perhaps it is so simple as to be overlooked. Reason compels us to see God in creation. Science points us to faith. Since scholars are also leaders, I would like to end with this question: How do we take back the that thing modern culture calls "science" and return it to the totality to which it belongs?

Stacy Trasancos is chair of the science department for Kolbe Academy, adjunct professor at Holy Apostles College & Seminary, and executive editor of Catholic Stand.

From the Cosmos to the Curriculum: Integrating Faith and Science in Catholic Education

Christopher T. Baglow
Notre Dame Seminary

IN THIS PAPER I WILL REVIEW recent studies suggesting that the topic of this conference, science and religion, is at the center of an emerging crisis among young Catholics in their faith and their relationship to the Church. Then I will provide a strategy for faculty professional development that is very effective at creating awareness and understanding of the relationship between the Catholic faith and modern science among high school faculties.

Very recent research paints a somber picture regarding the perspective of young Catholics, and young people at large, on the relationship between faith and science. In February 2014 I participated in a special symposium on this topic for the United States Conference of Catholic Bishops sponsored by the Institute for Church Life of the University of Notre Dame. Sociologist Christian Smith gave a presentation entitled "How American Youth (Mis)Understand Science and Religion."[1] Dr. Smith is director of the Center for the Study of Religion and Society and the principal investigator of the National Study of Youth and Religion (NSYR), a longitudinal nationally representative study (now in its nineteenth year) of the religious lives of young people. According to his presentation,

- 72 percent of all Roman Catholic emerging adults in the study adopted the "inherent warfare" model of science and religion; that is, they saw the two as contradictory and incompatible.

- 62 percent of Roman Catholic emerging adults in the study said that their own views about religion have *not* been strengthened by the discoveries of science.

- 78 percent of Roman Catholic emerging adults in the study who have stopped practicing their faith cited the "conflict" of science and religion as one of the reasons why they no longer practice their faith.

- 59 percent of Roman Catholic emerging adults in the study were of the opinion that science should *not* be accountable to moral and religious teachings and constraints.

These findings were reinforced by two very recent studies conducted by the Center for Applied Research in the Apostolate (CARA), both of which were broadly summarized in an *Our Sunday Visitor* article on August 27, 2016.[2] The studies focused on roughly the same age group as the NSYR. A significant segment of these youth described the faith as "incompatible" with what they learned or are learning in high school and university science education. Typical responses to questions were: "It [the Catholic Faith] no longer fits what I understand of the universe"; and "As I learn more about the world around me and understand things that I once did not, I find the thought of an all-powerful being to be less and less believable." CARA asked adult Catholics in the Religion and Science Poll if they could name "any famous scientists in history" who were Catholic. Thirteen percent could correctly name Galileo. No other single figure topped 4 percent, and many who were named were not Catholic (for example, Einstein, and Newton).

Now I am sure that this data, sobering as it is, may not be very surprising. We have all come to expect bad news regarding evangelization and faith formation, as well as the inability of the Church to impact social and cultural trends. But it is interesting to me that the practical atheism of today's youth, even among those who were raised Catholic, continues to rise even though we no longer have

the usual culprits to blame. The dissenters of the 1970s, 1980s, and 1990s are no longer the dominant group in catechesis. The urgently necessary redoctrinalization of catechesis has been robust if admittedly uneven, as have the proliferation of quality youth outreaches and ministry programs. Anecdotally, my 17-year-old daughter and 15-year-old son have opportunities I never did in the 1980s for receiving sound presentations of the faith and for developing strong friendships with other committed Catholic youth, as well as for receiving good mentoring in parish life and at their Catholic high schools.

So where is problem? I think it is to be found in the failure of Catholic schools and parishes to adopt an integrative approach to educating young people. We are reaching out to them with the orthodox faith in catechesis, and we are doing a better job at cultivating good peer and mentoring networks. But we are not bringing the faith into direct and compelling dialogue with the rest of the arts and sciences. We are educating and catechizing children and young adults to love God in religion classrooms and in other faith-formation contexts. But we have utterly failed to realize that, in order to educate someone in the love of God, we have to show her how to find God in the things she passionately loves. We have largely renovated the ghetto of Catholic culture, or at least reintroduced doctrinal literacy into it, but a ghetto it has remained. And so the young people who remain in the Church too often become fearful and distrustful of the world beyond the ghetto, such as the laboratory, while the majority of their peers are walking, indeed have already walked, away. Ironically, both those remaining and those leaving will agree that science and religion are incompatible, but will do so for very different reasons.

My own work to address this problem has been inspired by a description of Catholic schools offered by the Sacred Congregation for Catholic Education in which interdisciplinary integration and harmony are presented as vital goals in Catholic education and, in fact, as the very essence of what a Catholic school should be. In the 2007 document "Educating Together in Catholic Schools," we are told that

a Catholic school should be "a synthesis between faith, culture and life . . . reached by integrating all the different aspects of human knowledge through the subjects taught, in the light of the Gospel."[3] This description is offered in a section devoted to the formation not of students, but of educators who are charged to create this synthesis. It is here, in the formation of Catholic educators, where I have done most of my nonseminary classroom work of the past eleven years. My experiences have led me to believe that forming these educators according to this vision is priority number one for confronting what the data we have considered suggests is the number one intellectual issue involved in the loss of young people from active participation in the Church.

I have had a unique opportunity to think about the proper way to form educators in this vision. In July 2011, during my tenure as director of the Pope Benedict XVI Institute for Faith, Ethics and Science of McGill-Toolen Catholic High School in Mobile, Alabama, McGill-Toolen became the first Catholic high school to receive a program grant from the John Templeton Foundation. The grant was to fund three years of summer seminars we entitled the "Steno Learning Program in Faith and Science: A Seminar for Catholic Secondary Educators." The "Steno" in our program title refers to Blessed Nicholas Steno, the seventeenth-century Danish scientist who, after a brilliant scientific career in which he became the founder of fossil study and one of the founders of modern geology, went on to convert to Catholicism and then become a very holy priest and bishop.

Over three years, ninety-six science and religion teachers from forty U.S. Catholic high schools engaged in a reading program focused on works that covered issues such as Faith and Science in the Classical Catholic Tradition, Faith and Science in Contemporary Magisterial Teaching, the Galileo Affair, Physics and the Catholic Faith, and Biological Evolution and the Catholic Faith. The teachers then spent one week of their summer break at St. Joseph Abbey and Seminary College in Covington, Louisiana, in dialogue with experienced

moderators: particle physicist Stephen Barr, philosophy professor Cory Hayes, and evolutionary theorist Matt Rossano, all faithful Catholics. This was followed by a full academic year of implementation in which these teachers led full-faculty in-services, interdepartmental dialogues, and curricular implementation at their respective schools, with the goal of educating their faculties and students in a deeper understanding of the harmony that exists between the Catholic faith and scientific discovery.

The grant agreement called for careful tracking of the results of these endeavors, a task that was masterfully undertaken by my Notre Dame Seminary colleague Dr. Rebecca Maloney.[4] Participants completed pre- and post-surveys measuring their agreement with correct assertions about the faith/science relationship, many of them directly from John Paul II, such as, "There are no difficulties for the Catholic Faith in explaining the origin of man, in regard to the body, by means of the theory of evolution"[5]; and from Saint Thomas Aquinas, such as, "Chance exists in the universe because it is God's intention that the potential of the material cosmos be fully realized."[6] In the pre-survey, only 33 percent of the answers given identified these statements as compatible with the Catholic intellectual tradition; after the reading and the seminar, 68 percent did. More significantly, only 41 percent of educators regarded themselves as having the competence with their current level of knowledge to plan, implement, and evaluate lessons in faith and science topics before the reading plan and seminar; afterward that number rose to 91 percent.[7]

These teachers then presented to their own faculties, and afterward administered a similar, although much shorter and more basic, survey to them, a survey which they created together. The wider faculty evaluated some true assertions, such as, "The Big Bang Theory (not the T.V. show!) poses no difficulty to the doctrine of the Catholic faith"; and some false assertions, such as, "Science conflicts with a genuine Catholic interpretation of the creation account in Genesis." The reports by the seminar participants regarding the openness and

enthusiasm of their faculties to the presentations were well supported by the survey data: 74.9 percent of the responses given after the presentations reflected a correct evaluation of these assertions.[8]

If representative, these numbers demonstrate that Catholic high school faculties are quite receptive to learning and even embracing the Church's understanding of the faith/science relationship. It also demonstrates that they are mostly ignorant of it. Given that the SLP could never be replicated for every Catholic high school science teacher or religion teacher, how can the "expanding dialogue" model of the SLP be replicated with faculties? I recommend the following approach, which includes something for the entire faculty and then an extended dialogue between the science and religion departments.

There is no more effective way to introduce entire faculties or any large group to faith/science dialogue than to reeducate them regarding the Galileo affair, beginning with Copernicus and ending with John Paul II's October 31, 1992 response to the report of the Commission of Cardinals that reinvestigated it. Simply setting the record straight about this event is worth every effort; unaddressed it casts a pall of doubt over any other efforts. I will never forget the Vietnamese sister who at one Galileo presentation came to the podium in astonishment and said, "I was taught in the convent that Galileo had been burned at the stake by the Church." (Of course Galileo was not burned, nor even made to step out of his high standard of living, at any point before, during, or after his trial. Also, the real tragedy of the Galileo affair was not a deep conflict between science and religion, but an abuse of papal power by Urban VIII in the face of a perceived mockery at the conclusion of the very book he had encouraged Galileo to publish.)

Plus, the Galileo affair is historical drama par excellence. No one drifts off or gets bored during a good Galileo presentation. At the SLP every year we would have one science teacher read the condemnation out loud so that all could consider it and offer their reactions, usually of anger or sadness. Later, after the whole story was told, the same science teacher was asked to read the following quote from John Paul

II: "Galileo, a sincere believer, proved himself to be more perceptive [regarding biblical interpretation] than the theologians who opposed him," and the sun shone again. It was a moment of paradigm shift all three years; you could see the change in the quality of the dialogue from that point forward. Science teachers who came to the seminars wary or incredulous began to reconsider; if the old cliché about Galileo and the Church is a thorough falsehood, then maybe religion and science don't really have to be opposed to each other.

The primary documents are in print and readily available; the pope's address is available online; Lawrence Principe has an excellent one-hour consideration of the affair in his Science and Religion series of lectures from The Great Courses online.[9]

Obviously there are many questions and issues that cannot be covered with an entire faculty. The next step is to create an extended dialogue between the science and religion departments. I recommend eight 90-minute meetings over two academic years. The first year is for learning and discussing ideas, overcoming prejudices, and creating a foundation for interdisciplinary cooperation by reading some excellent and very accessible resources.

There is no better resource with which to begin the conversation than the Magna Carta of faith/science dialogue: John Paul II's 1988 Letter to Fr. Coyne, director of the Vatican Observatory, which is available online.[10] In this letter the pope identifies faith/science dialogue as part of the Church's continuation of Christ's mission of reconciliation; he lays out ideas for the path this dialogue should take and the principles that should animate it; he upholds the legitimate autonomy of the sciences; he identifies the lack of dialogue with science as a pressing need for theology, which he says is "sterile" without it; he even says that science can purify religion from error and superstition and that religion can purify science from idolatry and false absolutes. With a gentle and compelling eagerness he shows the promise that faith/science dialogue offers to both theology and

science, but above all to healing the human spirit and what Walker Percy once called "The San Andreas Fault in the Modern Mind":

> Unity involves the drive of the human mind towards understanding and the desire of the human spirit for love. . . . We move towards unity as we move towards meaning in our lives.[11]

> Only a dynamic relationship between theology and science can [ensure] that theology does not profess a pseudo-science and science does not become an unconscious theology. Our knowledge of each other can lead us to be more authentically ourselves. No one can read the history of the past century and not realize that crisis is upon us both. The uses of science have on more than one occasion proved massively destructive, and the reflections on religion have too often been sterile. *We need each other to be what we must be, what we are called to be.*[12]

The second meeting follows suit with a consideration of chapter 3 of the International Theological Commission's *Communion and Stewardship: Human Persons Created in the Image of God*, specifically the section entitled "Science and the Stewardship of Knowledge," which is only about thirteen pages in length.[13] This section begins with the declaration that the scientific endeavor is part of God's plan for humanity and declares that "Christians have the responsibility to locate the modern scientific understanding of the universe within the context of the theology of creation." It then summarizes the modern scientific understanding, from the Big Bang to the social and cultural evolution of human beings. The rest of the document takes up key issues that often trouble the faithful, such as the Church's openness to evolution, the difference and relation between creation understood theologically and Big Bang cosmogony, the difference and relation between divine causality and creaturely causality, why words like "random" and "chance" in biology are not actually a threat to belief in God, why we must avoid a "God of the gaps" crypto-creationist approach to

scientific problems, and guidance on interpreting the doctrine of the immediate creation of the human soul. It ends with a short primer on Catholic environmental ethics and another on bioethics. *Communion and Stewardship* has the merit of briefly and succinctly introducing a faculty to the big questions involved in the dialogue between science and religion and giving brief but insightful answers that can be expanded in the third and fourth seminars.

The third and fourth meetings are dedicated to discussions of two excellent books that take on questions like these in more detail: first *Modern Science and Ancient Faith* by Stephen Barr,[14] and then *Thomistic Evolution*[15] by Fr. Nicanor Austriaco and several of his fellow Dominicans. Why these books? First, the authors are scientists, and this helps to avoid an insult often unintentionally dealt to science faculty members when they are subjected to theologians rambling on outside of their expertise. Second, both books are well informed about the Catholic philosophical and theological tradition and take great pains to explain their subjects in a way that both theologians and scientists can understand. Finally, they do so with faithful attention and obedience to the Church's Magisterium and the best thinkers of our tradition, above all Saint Thomas Aquinas.

In the case of Stephen Barr's book, the SLP participants overwhelmingly identified it as the most informative and helpful book in the program. His subtle recovery of the argument from design successfully avoids creationist-style divine interventionism while still leading to awe at the Creator's presence to his creation. Regarding my second choice: I was delighted when *Thomistic Evolution* was published, and at the same time was rueful that it had not been available sooner. It is a perfect fit for an interdisciplinary seminar because it begins with the important philosophical and theological issues that must be understood before we can see the harmony between evolution and the Catholic faith, addressing questions such as "What is Reason? What is Faith?" and moving to causality, God's providential governance of creation, and the problem of evil, the meaning of Genesis, and the

proper interpretation of Sacred Scripture. From there, the reader is well equipped to follow the concluding section on "Catholic Theology and Evolution," with chapters dedicated to the evidence for evolution, the theological fittingness of evolution, human origins, the historicity of Adam and Eve, a response to intelligent design theory, and finally, the beatific vision as the goal of human evolution.

This seminar process must be about developing a rapport and an open dialogue. But this must be done in way in which each discipline is respected. John Paul II gives us the Golden Rule:

> [T]he unity that we seek . . . is not identity. The Church does not propose that science should become religion or religion science. . . . *Each of these members should become not less itself but more itself in a dynamic interchange*, for a unity in which one of the elements is reduced to the other is destructive, false in its promises of harmony, and ruinous of the integrity of its components. *We are asked to become one. We are not asked to become each other.*[16]

The process, if well moderated, will produce not only greater awareness but also some priorities for considering curricular implementation. The four discussions of the second year are dedicated to the curriculum, with one meeting dedicated to examining each of the grade levels and the opportunities that each level provides for faith/science dialogue and instruction in both religion and science classes. This must be a collaborative, faculty-led, interdepartmental effort to identify places where Catholic philosophical and theological ideas can be considered in their relation to the core ideas studied in science classes. The respective curricula should be placed side-by-side to see where opportunities exist for interdepartmental cooperation. Faculty can discuss what is appropriate to a theology class without turning it into a science class, and vice versa. Strategies for collaborating across the curriculum can be developed. Above all, engaging science and theology departments in a common effort of

academic integration helps to stimulate a faculty culture of ongoing learning and pedagogical excellence.

Of course, this must be done delicately or else collaboration will become confusion. In the faculty development phase of the STREAM™ program at St. Mary's Dominican High School, which I directed with Cory Hayes, we hit on a very effective method for creating good disciplinary boundaries. At Dominican, every science class from tenth through twelfth grade begins with a reintroduction to the scientific method. The science teachers have simply added to that a clear distinction between the scientific method and the questions it answers, on the one hand, and the theological method and the questions it answers, on the other. Religion teachers have adopted the same approach, introducing the theological method and distinguishing it from the scientific method. Attention should be given here to what is lost when we accept only one method of inquiry, as well as humble recognition of the need for the other discipline because of its unique perspective. This approach addresses major misconceptions before they even arise, and becomes a helpful lesson to which students can be referred when questions arise. In the words of Rabbi Jonathan Sacks, "Science takes things apart to see how they work; Religion brings things together to see what they mean."[17] The sooner this is understood, the better.

As I conclude, I would like to note that while this kind of faculty formation for science and religion is a good beginning, it is only a beginning. In the STREAM™ program we began with faculty development in religion and science, but this was followed by faculty development in religion and mathematics, then history and the social sciences, then literature, and now fine arts and foreign languages. In December we will begin faculty development with religion and the Guidance/P.E. departments. Not only teachers but also administrators have actively participated in the reading and discussion. This easily omitted element is crucial, for a well-informed administration is a vital part of such a process.

We are in the third year of faculty development in the STREAM™ program, and recently the efforts of the Dominican H.S. community to bring science and religion together was given a physical instantiation – the new Gayle and Tom Benson Science and Technology Complex. It features not only labs but a Eucharistic Chapel and a special room for dialogue, the *Disputatio* Room. As curricular implementation begins to emerge from the faculty-development process, this room will be a place where teachers and students will meet to discuss interdisciplinary and ethical questions, expanding the dialogue from the faculty to the students.

Next to the complex and at the center of the campus stands the new Veritas Tower, an icon of the search for truth in the light of the gospel to which the school is committed. Together, the building and the tower make a powerful statement about what Catholic education must regain if it is to speak to the needs of young Catholics in our thoroughly scientific age. I will conclude by sharing with you a brief excerpt from the STREAM™ mission statement that captures the spirit of the program and the hope for the future of Catholic education that animates it. It begins with a quote from Saint John Paul II:

> "Faith is capable of generating culture. . . . [I]ts certitude has nothing in common with the rigidity of ideological bias; it is the bright light of the truth that does not oppose the riches of intelligence, but only the darkness of error. . . ."
>
> In a contemporary society where all too often methods are turned into mentalities, and the pursuit of truth is reduced to the pursuit of self-centered purposes, STREAM™ seeks to form the souls of young women in such a way that their eyes are open to the bright light of truth wherever it shines.[18]

Christopher Baglow is professor of dogmatic theology and director of the Master of Arts Program in Theological Studies at Notre Dame Seminary in New Orleans.

[1] This presentation was given at the University of Notre Dame on February 14, 2014, at a symposium for diocesan bishops and diocesan superintendents of Catholic education entitled "Science and Human Dignity" and cosponsored by the USCCB and the Institute for Church Life, University of Notre Dame, South Bend, IN. The video of the presentation is available at: https://youtu.be/OaS1SV7xwWQ.

[2] Mark Gray, "Young People Are Leaving the Faith. Here's Why," *Our Sunday Visitor Newsweekly* (August 27, 2016), available at: https://www.osv.com/OSVNewsweekly/Article/TabId/535/ArtMID/13567/ArticleID/20512/Young-people-are-leaving-the-faith-Heres-why.aspx.

[3] Congregation for Catholic Education, *Educating Together in Catholic Schools: A Shared Mission between Consecrated Persons and the Lay Faithful* (September 8, 2007), 24, available at: http://www.vatican.va/roman_curia/congregations/ccatheduc/documents/rc_con_ccatheduc_doc_20070908_educare-insieme_en.html.

[4] Rebecca Maloney and Christopher Baglow, "FR614 Final Report," submitted to the John R. Templeton Foundation on May 31, 2014, unpublished. For information about the grant itself, go to https://www.templeton.org/what-we-fund/grants/steno-learning-program-in-faith-and-science-a-seminar-for-catholic-secondary-edu.

[5] John Paul II, "General Audience based on Wisdom 8:5-9" (April 16, 1986), 7.

[6] St. Thomas Aquinas, *In Aristotelis Metaphysicorum*, XII, §1403.

[7] Maloney and Baglow, 2.

[8] Ibid., 3.

[9] For the primary sources regarding the Galileo affair, see Galileo Galilei, *The Essential Galileo*, ed. Maurice Finocchiaro (New York: Hackett Publishing, 2008). For John Paul II's address, see John Paul II, "'Faith can never conflict with reason;' Address given on October 31, 1992 to the Pontifical Academy of Sciences regarding the Galileo case," available at: file://localhost/accessible at http/::bertie.ccsu.edu:naturesci:Cosmology:GalileoPope.html. Finally, Lawrence Principe's lectures on Galileo ("The Church, Copernicus and Galileo") can be purchased at

http://www.thegreatcourses.com/courses/science-and-religion.html.

[10] John Paul II, "Letter to Reverend George V. Coyne, S.J., Director of the Vatican Observatory" (June 1, 1988), available at: https://w2.vatican.va/content/john-paul-ii/en/letters/1988/documents/hf_jp-ii_let_19880601_padre-coyne.html.

[11] Ibid.

[12] Ibid. Italics mine.

[13] International Theological Commission, *Communion and Stewardship: Human Persons Created in the Image of God* (July 23, 2004), available at: http://www.vatican.va/roman_curia/congregations/cfaith/cti_documents/rc_con_cfaith_doc_20040723_communion-stewardship_en.html.

[14] Stephen M. Barr, *Modern Physics and Ancient Faith* (Notre Dame, IN: University of Notre Dame Press, 2003).

[15] Nicanor Pier Giorgio Austriaco, Thomas Davenport, et al., *Thomistic Evolution: A Catholic Approach to Understanding Evolution in the Light of Faith* (Tacoma, WA: Cluny Media, 2016).

[16] John Paul II, "Letter to Coyne." Italics mine.

[17] Jonathan Sacks, *The Great Partnership: Science, Religion and the Search for Meaning* (New York: Schocken Books, 2011), 2.

[18] St. Mary's Dominican H.S., "STREAM™ and the Mission of St. Mary's Dominican High School," STREAM™ Document, unpublished. See also John Paul II, "Message to the 6th National Meeting of Catholic University Professors" (October 4, 2001), 5, available at: http://w2.vatican.va/content/john-paul-ii/en/speeches/2001/october/documents/hf_jp-ii_spe_20011005_docenti-cattolici.html. For more information on the STREAM™ Program, go to http://www.stmarysdominican.org/stream/.

Trouble with Thomists: The Modern Intelligent Design Argument and the Fifth Way

Michael J. Behe
Lehigh University

IN THE PAST FEW DECADES I and others have argued that the sophisticated structures of the molecular machines of the cell revealed by modern science, such as the bacterial flagellum, show that they were deliberately designed by an intelligent agent. Not surprisingly, the argument has engendered much controversy, especially in Darwinian biological circles. Rather unexpectedly, it has also been criticized by some Catholic Thomist philosophers. In this essay I will respond to several of their concerns.

Introduction

Saint Thomas Aquinas began the *Summa theologica* by examining the question of God's existence, and he offered five proofs (or "ways") to affirm it. Aquinas's Fifth Way is often dubbed the argument from design. Here is the argument in its entirety:

> The fifth way is taken from the governance of the world. We see that things which lack intelligence, such as natural bodies, act for an end, and this is evident from their acting always, or nearly always, in the same way, so as to obtain the best result. Hence it is plain that not fortuitously, but designedly, do they achieve their end. Now whatever lacks intelligence cannot move towards an end, unless it be directed by some being endowed with knowledge and intelligence; as the arrow is shot to its mark by the archer. Therefore some intelligent being exists by whom all natural things are directed to their end; and this being we call God.

Notice that Aquinas says nothing about the intricacies of either biological or artificial machinery. The single example he gives – an arrow shot to its mark – is remarkably simple. On the other hand, like the eighteenth-century Anglican clergyman William Paley's famous watchmaker argument, modern proponents of what's called intelligent design (ID) emphasize functional complexity and how it is put together. Here's how I put it in the afterword of the tenth anniversary edition of *Darwin's Black Box*:

> Here, then, is the argument for design in a nutshell: 1) We infer design whenever parts appear arranged to accomplish a function. 2) The strength of the inference is quantitative; the more parts, and the more intricate and sophisticated the function, the stronger is our conclusion of design. 3) Aspects of life overpower us with the appearance of design. 4) Since we have no other convincing explanation for that strong appearance of design, Darwinian pretensions notwithstanding, then we are rationally justified in concluding that parts of life were indeed purposely designed by an intelligent agent.[1]

Why are the paradigms of the two arguments so different – an arrow versus a watch? One important reason is that Aquinas and ID proponents are arguing for different things. Aquinas was arguing *from* what is sometimes called "design" to the existence of God. On the other hand, ID argues from the particular arrangements of physical systems *to* the conclusion that they were intentionally designed. Despite both arguments using the word "design," Aquinas and ID have in mind two distinct aspects of nature. In modern parlance Thomas is speaking primarily about *teleology* – goal-directedness. In Aquinas's reasoning, an arrow flying toward a target, a rock falling toward the earth, and an acorn growing into an oak tree are all examples not of the arrangement of parts, but of natural bodies reliably moving toward an end, always or nearly always traveling along the

same sort of path, faithfully headed for the same goal. Yet unintelligent things can't have goals, so the consistency of the result in each instance points to intelligent governance, which entails a governor – God.

Another way of framing his argument is that Aquinas sees design in natural regularities or what we moderns now call simple *natural law* – the law of momentum, the law of gravity, the law that living things reproduce after their kind. That's a fundamental difference with modern ID proponents. ID takes natural law for granted, brackets it, and then asks whether there are any indications of design *beyond* the laws of nature, in organization that is not directly specified by law – in the purposeful arrangement of parts.

Granting for the sake of argument Aquinas's claim that the laws of nature do demonstrate the existence of God, modern ID proponents think that an interesting further question is whether any other aspects of nature are discernibly designed. The fact that stones reliably fall to the ground may indeed show governance, but it says nothing about whether the Governor cares what they do after they land. On the other hand, a bucketful of colored pebbles that fell to the ground, bounced, and came to rest in the form of a sharp image of the Blessed Mother would point to design that went well beyond the mere law of gravity. An arrow that flies true shows the governance of the archer. Multiple arrows that strike a wall and spell out the phrase "Tantum ergo sacramentum" show purpose far past a single straight flight.

It is such purposeful arrangements of parts that contemporary ID focuses on, not on the simple regularities of natural law, which are relegated to background assumptions. ID goes beyond simple laws to ask how deeply into nature's living structures design extends.

The Objection of Edward Feser

One Thomist who has criticized the modern ID argument is Edward Feser, professor of philosophy at Pasadena City College. In addition to his scholarly publications Feser maintains a blog. In one

post he succinctly summarized three fundamental objections to ID.[2] I will skip over the first and third, and concentrate on the second, which I think brings up an interesting issue that may help illuminate some philosophical and scientific concerns. Professor Feser's objection is the following:

> 2. ID theory presupposes – whether in an unqualified way or at least for the sake of argument – a conception of the natural world that is "mechanistic" *in the sense* of denying that there is any teleology or final causality *immanent to* or *inherent* in natural substances qua natural (as we Aristotelians claim there is). Any teleology or finality would for ID have to be in nature only *extrinsically* or in a way that is *entirely* imposed from outside, after the fashion of artifacts like watches and other machines.

First, I must say I don't know how Feser arrived at his conclusion. ID theory certainly does not "presuppose" a "mechanistic" conception of the world. To Feser, the phrase "immanent teleology" is a way of saying that the natural behaviors described by natural laws – by which Thomas Aquinas proved the existence of God – are of a piece with the matter that obeys the laws. Yet there is no reason that would be incompatible with ID. As I mentioned earlier, ID takes the laws of nature as a given, as background information, and simply seeks to discern whether collocations of matter evince further design through a purposeful arrangement of parts.

That said, the strong distinction that Feser and other modern Thomists make between intrinsic and extrinsic teleology puzzles me, at least as it concerns life. I can understand that it seemed like a significant difference in the age of Aquinas, but with our greatly increased understanding of how nature works, it strikes me as no longer a major point. Let me explain.

To illustrate the superiority of life's intrinsic teleology, Thomas Aquinas pointed to the craft of shipbuilding. An ordinary shipbuilder imparts teleology extrinsically to the pieces of the ship by physically

shaping and putting them together. The parts – the wood and iron – by themselves have no tendency to form much of anything. Rather, the shape of the ship is imposed on them by the builder from the outside. Contrast that with living things, for example an acorn. An acorn grows into an oak tree with no significant outside direction. Its principle of arrangement is intrinsic, contained within itself. To emphasize just how fantastic nature is compared with extrinsic teleology, Aquinas reportedly remarked, "This is as though the builder of a ship could impart the capacity to the wood pieces of being moved from within themselves to bring forth the structure of the ship."[3]

That certainly is an evocative image. Yet a contrarian might wonder, what if the shipbuilder attached a number of powerful magnets to pieces of wood at just the right positions? Then, perhaps when the pieces were brought within range, they could attract each other, and so move into the shape of a ship. Would that count as "impart[ing] the capacity to the wood pieces of being moved from within themselves"? Maybe. Maybe not. An objection might be that, while the magnets do permit the pieces to move themselves, a builder still would have to place the right pieces near each other. What's more, a Thomist might reasonably object that the magnets aren't themselves wood – they were artificially attached to it. So the wood wasn't really being moved from within itself.

Whether or not those kinds of objections are a problem for magnetized ships, I don't think they hold at the molecular and cellular levels of life, which of course were unknown to Thomas Aquinas and his contemporaries. Since the earliest scientific use of microscopes in the seventeenth century, it has been realized that some living creatures are too small to be seen by the naked eye. Since the cell theory of life was proposed by Schleiden and Schwann in the nineteenth century, it has been increasingly understood that large, visible plants and animals are clever arrangements of microscopic cells.

What's more, with the advance of physics and chemistry, it has been discovered that molecules are made of particles that have

electrical properties, so that two similarly charged particles repel each other and two oppositely charged particles attract. It seems to me that, as much as a rock falling to earth under the influence of gravity, those electrical particles have intrinsic teleology in a Thomistic sense – the ability to move themselves toward a goal. Crucially, at the molecular level of life the very small size of the particles – plus the fact that they are often dissolved in liquid water – allows them to drift around freely and contact each other. They don't need a shipbuilder or anyone else to move them.

I think those considerations greatly blur the distinction between intrinsic and extrinsic teleology at the molecular level of life. As an illustration, consider the protein ribonuclease, which is a small enzyme made in the pancreas. Like all proteins, it is composed of a specific, linear chain of amino acid residues. In order to exhibit its RNA-degrading activity the chain must fold into a particular three-dimensional shape; the unfolded chain is inactive. The protein chain folds into a definite shape because the intrinsic electrostatic forces of its amino acid residues are properly arranged.[4]

Forty-five years ago some researchers chemically synthesized ribonuclease in their laboratory and showed it had the same properties as ribonuclease that was isolated from cells.[5] In other words, chemicals were reacted in flasks – entirely outside of cells – under the direction of skilled organic chemists to make a protein that was identical to one that occurs in life. To paraphrase Aquinas, the chemists imparted the capacity to the atoms of the molecule of being moved from within themselves to bring forth the structure of the enzyme. The synthetic protein behaved identically to the natural one. It seems to me that, just like the natural one, the synthetic enzyme has intrinsic teleology in a Thomistic sense. Thus intrinsic teleology can be conferred either by the intrinsic activity of a cell, or by the extrinsic activity of chemists working in a lab. What difference, then, does the source of the enzyme's own teleology make? None that I can see.

Although the question of intrinsic versus extrinsic teleology blurs badly at the molecular level of life, the question of design sharpens. Does ribonuclease require the purposeful arrangement of its parts? It most certainly does. If the amino acid residues of its sequence were not placed in the proper order, it simply could not work. It wouldn't be directed in the correct manner by its electrostatic forces to form the right shape to allow it to degrade RNA.

So does the purposeful arrangement of the parts of ribonuclease reliably point to intelligent design? In the case of its laboratory synthesis there is no question. No random mixing of chemicals would ever be expected to yield the enzyme. The purposeful intelligent activity of the chemists is essential. How about the enzyme isolated from a cell? Did it require design? ID proponents strongly affirm that it did, for the same reason that the artificial enzyme required design – only an intelligent agent capable of planning for a distant goal could successfully arrange for the parts to be brought together in the proper way. For the reasons detailed in my own books and other ID writings, despite the hopes and dreams of Darwinists and others who invoke unintelligent explanations for life, nothing besides intelligence is known to have the power to order complex arrangements of parts for a purpose.

It may be the case, as Thomists argue, that simple natural laws such as those of gravity and momentum point to a governor, which points to God. It is a serious mistake, however, to include living things in this category. Although it was obscure in earlier ages, we now know that an acorn grows into an oak tree not because of a simple law akin to gravity, but because of an astoundingly complex arrangement of very many sophisticated parts, almost all of which are much too small to be seen by the naked eye. Laws such as those of electrostatic interactions are necessary for an acorn's growth, but are radically insufficient. If its many protein and nucleic acid components were not arranged properly, it would not develop. In living things the shipbuilder truly has given "the capacity to the wood pieces of being moved from within

themselves to bring forth the structure of the ship." But the capacity to move effectively comes from the purposeful arrangement of many attractive and repulsive forces in the wood, as if small but powerful magnets had been cleverly placed so that when the pieces were thrown into the water they would self-assemble.

Just as we recognize extrinsic teleology in the shape of human-built ships, we recognize the intrinsic teleology of living "ships" in the precise placement of both the "wood" and "magnets" that allow the parts to move into their correct positions. *In both cases we recognize design not by simple laws, but by the purposeful arrangement of parts.*

The Objections of Marie George

On Common Descent. Another Thomist interested in the intelligent design argument is Marie George, professor of philosophy at St. John's University, New York. Unlike Edward Feser, George argues that eighteenth-century clergyman William Paley's famous watchmaker argument for design that I alluded to earlier does not run afoul of the Thomistic distinction between intrinsic and extrinsic teleology.[6]

> There is no doubt that Paley makes reference to "mechanisms" as existing in both art and nature. But is the idea of "extrinsic teleology" essential to Paley's argument? I maintain that it is not. . . . [O]ne cannot deduce from his conclusion "the parts of organisms, such as the eye, are things that have an intelligent being as cause of their order" whether the intelligent being so orders parts to their ends by imposing the ordering extrinsically or intrinsically.

Yet, although she finds Paley's basic argument generally acceptable, George is a critic of modern ID arguments such as I make. I think her objections are based on a misunderstanding about what the ID argument actually is, along with confusion about what non-ID evolutionary positions such as Darwinism entail, as I will now briefly try to explain.

In another paper Professor George paraphrases Paley's argument in three statements, the better to analyze them. I list them in the first column of Table 1. In the second column are extracts of my summary of the ID argument (quoted earlier). Let's compare them.

Table 1. Comparison of design arguments of Paley versus modern ID.

Summary of Paley[7]	Summary of modern ID[8]
"All things that have a multiplicity of parts ordered to achieve a goal are things that have an intelligent being as cause of their order."	"We infer design whenever parts appear arranged to accomplish a function."
"The parts of organisms, such as the eye, are things that have a multiplicity of parts ordered to achieve a goal."	"Aspects of life [such as the bacterial flagellum and other molecular machinery] overpower us with the appearance of design."
"The parts of organisms, such as the eye, are things that have an intelligent being as cause of their order."	"We are rationally justified in concluding that parts of life were indeed purposely designed by an intelligent agent."

As can readily be seen, the two sets of claims are slightly different ways of saying the same thing. William Paley proceeds to identify the designer as God. Modern ID does not. However, Marie George, Edward Feser, and other Thomists they reference agree that Paley's argument does not reach as far as the existence of God. Thus the modern ID argument is both more circumspect and more accurate because of that.

So why does George approve of Paley while ruling out modern ID? Because she mistakenly ascribes to it further claims that it does not make.[9]

> To Aquinas's mind what both [Michael Behe and William Dembski] fail to distinguish is that causes which physically produce the object may be other than the causes responsible for the plan according to which the object is made. Planning and actually constructing may be found in one agent, but need not be.

Yet neither I nor Bill Dembski would disagree at all. I completely concur with Professor George that the cause that physically produces an object may be different from the cause of the plan of the object. For example, an eye is made in every developing human by molecular and cellular machinery. Yet the molecular machinery did not plan the object. Even the first eye, or stages of the first eye, could certainly have been made by ordinary biological machinery. Like Paley's argument, the modern ID argument deduces purposeful design by the arrangement of parts of a system such as a watch. Exactly how the watch came to be, whether through a short process or a very long and circuitous one, is a distinctly secondary issue.

Although Professor George did not spell it out, I think she has an issue in mind that in my experience concerns a number of other Catholic intellectuals as well. I strongly suspect she just wants to affirm that purposeful design doesn't require special, instantaneous, ex nihilo, "puff-of-smoke" creation by God, such as is favored in some circles of Evangelical Protestant Christianity. If so, then she can rest assured that it does not. ID does *not* entail special creation – although, as befits its careful, limited argument, it does not rule it out either. (George points to brief statements by Dembski and myself that are at worst ambiguous.) For example, in the final chapter of my book *The Edge of Evolution* – published several years before George's article – I took great pains to explain that ID is perfectly compatible with the completely seamless unfolding of nature.

> The purposeful design of life to any degree is easily compatible with the idea that, after its initiation, the universe unfolded exclusively by the intended outplaying of

> natural laws. The purposeful design of life is also fully compatible with the idea of universal common descent, one important facet of Darwin's theory. What the purposeful design of life is *not* compatible with, however, is Darwin's proposed mechanism of evolution – *random* variation and natural selection – which sought to explain the development of life explicitly without recourse to guidance or planning by any one or any thing at any time. [10]

Design could be effected by a very long causal chain, indeed. But, no matter the length of the causal chain, it remains deliberate design, which we recognize in the purposeful arrangement of parts. Modern ID doesn't require special creation any more than does William Paley.

There Is No Design by Accident. I would like to address one other important point from Professor George's work. In a 2010 article she tries to reconcile Darwin's theory with the work of Thomas Aquinas.[11] Unfortunately it seems to me the attempt goes astray on all-too-common ambiguities about what counts as accident, what counts as design, and what exactly is Darwin's theory.

Let me clarify. I think we would all agree that if a killer dispatched his victim with such care and planning that every investigator concluded it was an accident, it would be murder nonetheless. Similarly, if God intended an outcome and somehow arranged the world to produce it, even if we finite humans could not distinguish it from a chance occurrence, it would have been designed.

If the killer dispatched ten victims in the same careful manner, his means might remain undetectable. Yet if all ten victims had been scheduled to testify as witnesses in his upcoming drug trial, we would be certain it was murder (even if we couldn't tell if the perpetrator were he or, say, his girlfriend). In the same way, God could arrange numerous events that we humans could not distinguish from chance. But if the end result were a sophisticated molecular machine, then, unless we let ourselves be talked out of it (as many people have), we can and should be certain that it was designed. The bottom line of both

William Paley and modern ID is that design is apprehended in the purposeful arrangement of parts (broadly understood to include even dead bodies), no matter whether we can or can't discern the means by which it was produced. A critical corollary is that in the absence of design such seemingly purposeful arrangements would not occur.

Professor George actually affirms all of the above, even in the midst of baptizing Darwin and the ancient Greek materialist philosopher Empedocles. In the same article she imagines how Aquinas and Empedocles would view current biological knowledge. An "updated" (by George) Aquinas is made to claim that "the ordering of parts in a single animal in such a manner as to render it viable must be traced back to an intelligent being; blind forces alone cannot do the job." Empedocles dismisses the claim with a modern-sounding Darwinian assertion: "the blind forces of nature are capable of doing the programming." Reverting to her own voice, George makes a stunning (to me) admission.

> I think a person can say [Empedocles' words], but he can't really think it. I think it is self-evident that where non-intelligent causes are coordinated to achieve an end, this must be the work of intelligence, and that all one can do is try to show the absurdities that follow from saying other. [12]

In so many words she forthrightly asserts that design is apprehended in the purposeful arrangement of parts. Yet, contrary to Professor George, plenty of people certainly do seem to think like Empedocles. What's more, one can do much more than just "try to show the absurdities that follow." For example, he could write a book such as *Darwin's Black Box* to point out the formidable empirical obstacles to blind forces making complex systems, such as, say, irreducible complexity. Or write another one such as *The Edge of Evolution* about the enormous difficulties blind mechanisms encounter even when faced with comparatively simple evolutionary problems, such as the

development of malarial resistance to chloroquine. In other words, one can offer reasoned scientific criticisms.

George goes on to critique Richard Dawkins's well-known computer analogy for Darwin's mechanism.[13] How can unguided evolution make something like the protein hemoglobin, whose straightforward statistical improbability is much less than one chance in 10^{100}? Easy, says Dawkins. Imagine a target sentence such as "Methinks it is like a weasel." If a computer starts with a nonsense string of letters, but each time a random change in the sequence matches a letter in the target the computer retains it in memory, it will match the target in a mere few score attempts. The same for hemoglobin. Q.E.D.

Professor George is having none of it:

> But wait a minute. How was the computer able to retain the correct letters? Dawkins programmed it. The whole point of his analogy was to show that natural causes can produce hemoglobin and the eye without the input of intelligence. But what has his analogy in fact indicated? That intelligence is required to generate complex forms of order.[14]

Yes, exactly! It is stupendously obvious that intelligence is indeed needed. For all practical purposes, without intelligent direction the target phrase would never appear. Unfortunately, instead of concluding therefrom that Darwin's theory is utterly inadequate to explain the unfolding of life, George tries to force an unholy marriage between Darwin and Aquinas. Yet, despite Dawkins's unintentionally revealing example, Darwin's theory *means* what Dawkins claims – *means* what George just rejected – that even the most sophisticated living systems could arise without *any* guidance, without *any* planning, without *any* prearrangement by *anyone*, pointedly including God. Darwin himself said he would reject his own theory if it required guidance. Modern Nobel prizewinners explicitly insist that Darwinism means evolution is unguided or unplanned by anyone. *Darwin's theory*

by definition excludes <u>*any*</u> *intelligent involvement*. The utterly crucial point that is missed by many of even the brightest thinkers is this: Whenever *any* planning is needed, we have left far behind the realm of Darwin's theory – and indeed any unguided process – for intelligent design.

As both Professor George and modern ID proponents realize, Darwin's unadulterated claim is ludicrous. Instead of doing violence to his clear theory, I believe she and other Thomists should pay him the simple courtesy of just saying they think Darwin was wrong.

Toward a Brighter Future

Although I don't have time to discuss it, I think modern ID theory is about as natural a fit with Thomism as one could hope to find between a science and a philosophy. ID has different argumentative ends and epistemological requirements than does the Fifth Way, which arise from its status as a quantitative scientific theory, rather than a philosophical proposal. Nonetheless, I think that if a fourteenth-century Thomistic philosopher were told in a vision that distant future investigations would reveal the foundation of life to consist of enormously sophisticated functional systems, he would laugh to scorn any Empedoclean-Darwinian claim that "the blind forces of nature" were responsible for them, as does Professor George. Despite a rocky start, I sincerely hope that present-day Thomists move past misconceptions about what ID claims or entails, and engage it constructively and fruitfully in the future.

Michael Behe is professor of biochemistry at Lehigh University.

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[1] Michael J. Behe, *Darwin's Black Box: The Biochemical Challenge to Evolution*, 10th anniversary ed. (New York: The Free Press, 2006).

[2] Edward Feser, "Miracles, ID, and classical theism," available at: http://edwardfeser.blogspot.com/2014/05/miracles-id-and-classical-theism.html.

[3] Christoph Schönborn, "Reasonable Science, Reasonable Faith," *First Things* (April 2007), available at: https://www.firstthings.com/article/2007/04/reasonable-science-reasonable-faith.

[4] D. Voet and J. G. Voet, *Biochemistry*, 4th ed. (New York: J. Wiley & Sons, 2011).

[5] B. Gutte and R. B. Merrifield, "The Total Synthesis of an Enzyme with Ribonuclease A Activity," *Journal of the American Chemical Society* 91 (1969): 501-02.

[6] Marie George, "Thomistic Rebuttal of Some Common Objections to Paley's Argument from Design," *New Blackfriars* (2016): 266–88.

[7] Marie George, "'Intrinsic' and 'Extrinsic' Teleology: Their Irrelevance to Aquinas's Fifth Way and to Paley's Argument from Design," Evangelical Philosophical Society (2015), available at: http://www.epsociety.org/library/articles.asp?pid=285.

[8] Behe, *Darwin's Black Box*.

[9] Marie George, "On the Occasion of Darwin's Bicentennial: Finally Time to Retire the Fifth Way?" *Proceedings of the American Catholic Philosophical Association* 83 (2010): 209-25.

[10] Michael J. Behe, *The Edge of Evolution: The Search for the Limits of Darwinism* (New York: The Free Press, 2007).

[11] George, "On the Occasion of Darwin's Bicentennial."

[12] Ibid.

[13] Richard Dawkins, *The Blind Watchmaker* (New York: Norton, 1986).

[14] George, "On the Occasion of Darwin's Bicentennial."

Appendix

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- help one another to work through, in scholarly and prayerful fashion and without public dissent, any problem which may arise from magisterial teaching.

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2010 – Rev. John F. Harvey, O.S.F.S.
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