**Title: Toward a “Franciscan” Biotechnology: Three Perspectives on the Domination of Nature”**

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**Abstract**: This paper addresses the challenges of modern biotechnology by consideration of the views of three “Francises”—Francis Bacon, Francis Crick, and Pope Francis I. It first discusses the original concept of technology within divine limits, set forth by Francis Bacon, and its transformation in the Enlightenment into a human centered drive for power over nature without divine reference. This opens up the quest for a limitless biotechnology built upon reductionist foundations as advocated by Francis Crick. It closes with reflections of Pope Francis in *Laudato Si’* on the need to position our biotechnology within a Christian anthropology.

*Introduction*:

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. *Pope Francis, Laudato Si*, para. 106.[[1]](#footnote-1)

A deeply religious view of the cosmos not only does not hinder scientific inquiry, but even leads to the discovery of its deepest structure. This relation of theological vision and what I would term the classic Greek search for “contemplative” knowledge, has given us a profound tradition that we can follow up into the great work on modern cosmology and theoretical physics, illustrated by the work of Einstein, Teilhard de Chardin, Fritjof Capra, Paul Davies, Stephen Barr and others who have seen a convergence of religious vision and a deep understanding of nature.

But this has been only one tradition of science, and the focus of this essay is on the other powerful thrust of modern science—the combination of science, technological innovation, social structure, and economics—often termed “technoscience”— that emerges in the early modern period in some respects in opposition to the “contemplative” tradition of theoretical physics and cosmology. This is the tradition initiated by the first Francis I will discuss in this essay— Francis Bacon (1561-1626)— in his seminal writings of the early seventeenth century. This Baconian tradition has now given us a science that seeks not only understanding, but also mastery and domination of nature through a wedding of rationality and technology that Pope Francis has seen in the quotation above as part of the larger problem of the “care for our common home.” This essay will address some key aspects of this problem with a particular focus on modern biotechnology and the place of the human being in relation to this.

The problem of developing a rational, and also humanistically-sensitive, use of our modern biotechnological power is one that concerns many of us engaged in the history and philosophy of science as well as those interested in a new level of a science and theology dialogue. This issue has become particularly important in the domain of the life sciences. If the twentieth century was the “century of physics,” the twenty-first promises to be increasingly the century of the life sciences. The ideals of this biological enterprise we might see set out prominently in the middle of the last century by another Francis—the molecular biologist Francis Crick (1916-2004), one of the co-discoverers of the structure of DNA. In a visionary set of lectures, Crick envisioned a project through which “eventually. . . we hope to have the whole of biology ‘explained’ in terms of the level below it, and so on right down to the atomic level.”[[2]](#footnote-2) This reductionist program, applied to human biology, and pursued at the mega-science level through such collaborative enterprises as the Human Genome Project of the 1990s, is just one manifestation of a scientific enterprise that has given us contemporary biophysics, robotics, cybernetics, nano-biotechnology, and dramatic developments of instrumentation in the fifty years since Crick delivered this oration. On the horizon is now the International Human Brain Initiative, intent on developing a “molecular biology” of consciousness, with its stated goal that of producing “a revolutionary new dynamic picture of the brain that, for the first time, shows how individual cells and complex neural circuits interact in both time and space.”[[3]](#footnote-3)

To be sure, critiques of this agenda have been offered repeatedly by an impressive array of authors from different disciplinary perspectives. [[4]](#footnote-4) But these function, it seems, only as “external” critiques that have little real impact on the interdigitating connections of technology, biology, economics, and social organization that constitute modern “technoscience” today. We seem instead to be confronted by an autonomous power that is pushing us to ever new explorations of living phenomena that defines the education of students in biology and medicine, determines the grant funding of science, and shapes the professional careers of workers in the field. This systemic interconnection of issues develops the professional lifestyle of the modern bioscientist-entrepreneur, keeping them distant from engagement with ethicists, theologians, and philosophers interested in more than systematizing and validating modern reductive bioscience.[[5]](#footnote-5)

My concern is not to repeat complaints about modern biophilosophy and its institutional manifestations. Instead I shall reach back as a historian of science into some crucial moves made by our predecessors that bear on the way the “technoscientific” tradition today impacts the science and religion dialogue. My focus will be on some developments in what has been termed the “radical” Enlightenment of the eighteenth-century— the effort to establish a philosophical program that sought a human-centered science and technology focused on human needs to be satisfied through the domination of nature, and that denied the possibility of a non-material and spiritual insight into reality.[[6]](#footnote-6)

My interest in this question was initially generated by an observation of the great Islamic scholar of science and religion, Seyyed Hossein Nasr. In his Gifford Lectures, delivered in 1981, Nasr identified a crucial element in Western intellectual history that has driven a wedge between Occidental thought and the traditions of the East. This is the divorce of rational knowledge from the sacred and transcendent. Speaking of Descartes and his radical reform of philosophy and natural philosophy, Nasr writes:

[H]e made the thinking of the individual ego the center of reality and the criterion of all knowledge, turning philosophy into pure rationalism and shifting the main concern of European philosophy from ontology to epistemology. Henceforth, knowledge, even if it were to extend to the farthest galaxies, was rooted in the *cogito*. The knowing subject was bound to the realm of reason and separated from both the Intellect and revelation, neither of which were henceforth considered as possible sources of knowledge or an objective order. Knowing thus became depleted of its sacred content to the extent that anything that partakes of reality *can* become divorced from the sacred which is ultimately inseparable from reality.[[7]](#footnote-7)

This knowledge would finally enable humans to “make ourselves, as it were, the lords and masters of nature.”[[8]](#footnote-8)

But alongside Descartes is the even greater importance I see in the project laid out his contemporary, Francis Bacon. It is the interaction of these two visionary enterprises that creates some of the difficulties we now face in the biotechnological enterprise. I focus on this Francis because it was he who brought the theoretical tradition of inquiry of classical astronomy, demonstrative mathematics, and natural philosophy into direct contact with the manufactory and practical skills—enterprises which Bacon himself calls “illiberal” arts.[[9]](#footnote-9) These were the practical skills passed on by craftsmen, typically organized at the time into guilds governed by secrecy in master-apprentice relationships. Although these arts had not been regarded as worthy of philosophical interest by the mainline philosophical and university traditions, in Bacon’s view, it was these that had led to an actual increase of practical mastery over nature

In the prefatory discourse that preceded the publication of the *New Organon* in 1620, entitled the *Great Instauration*, Bacon sets forth the larger plan of his work of intellectual reform. We quickly discern a common theme that runs through his argumentation: ancient learning has led to no practical results, it simply involves endless disputations, and it needs to be replaced by a new form of inquiry. The “wisdom” derived from the Greeks is only the “boyhood” of knowledge. It gives us only non-progressive knowledge. For genuine learning that does “progress,” one must look to the “mechanical” rather than “theoretical” domain. It is the practical arts— originally “rude, clumsy, and shapeless”—that in time have acquired new “arrangements and constructions” that seem to advance human society.[[10]](#footnote-10) Paramount in this contrast is the discovery of the arts of “printing, gunpowder and the magnet” which have literally transformed the “face and state of things throughout the world,”[[11]](#footnote-11) and it is his intent to bring under rational purview these practical activities and their principles. This new beginning will bring about “a true and lawful marriage between the empirical and rational faculty, the unkind and ill-starred divorce and separation of which has thrown into confusion all the affairs of the human family.”[[12]](#footnote-12)

It is important to see that Bacon’s proposals were not simply presented at the level of rhetorical advocacy in his influential writings. He also outlines practical proposals that subsequent generations were to pursue in an organized form, even if he did not see them realized in his own time. In the latter portion of *The*  *Great Instauration*, Bacon sets out what he calls the “Foundation of a True Philosophy.” Here he is more explicit about the way in which the practical arts of the craftsman and skilled artisan are to be brought within the purview of philosophical understanding. This is to be done by a kind of descriptive history of these practical skills. This proposed history will exhibit,

things in motion, and [lead] more directly to practice. Moreover it takes off the mask and veil from natural objects, which are commonly concealed and obscured under the variety of shapes and external appearance. . . .Upon this history, therefore, mechanical and illiberal as it may seem (all fineness and daintiness set aside), the greatest diligence must be bestowed.[[13]](#footnote-13)

Specifically, Bacon seeks with this proposed history to understand those arts “which exhibit, alter, and prepare natural bodies and materials of things, such as agriculture, cookery, chemistry, dyeing, the manufacture of glass, enamel, sugar, gunpowder, artificial fires, paper, and the like.”[[14]](#footnote-14) This new history is to receive “things most ordinary, such as it might be thought superfluous to record in writing”[[15]](#footnote-15) and also “things mean, illiberal, filthy,” It is also to include “things trifling and childish,” and also things that may initially seem to have no use.[[16]](#footnote-16)

This attempt to bring together craftsmanship and rational analysis through what Bacon calls a “history” of these activities is a feature of Bacon’s project that has profound implications. First, it assumes that it is a worthy inquiry to spend intellectual and material resources to find out more in detail about the nature of craft principles and manufactory skills. Second it requires some way of finding out the underlying forms and principles that underlie such crafts where we do not have such knowledge, a situation that in Bacon’s era meant the situation for most practical activities.

Here we see a novel enterprise emerging, an intensive inquiry into practice itself. The principles of these crafts are to be found out inductively, it seems, by actually writing down and describing what artisans do when they make iron, tan leather, or blow glass. This is a new kind of inquiry into actual *practice* with the goal of finding out what are the operative principles of these crafts. It is by recording, describing, and tabulating that we presumably can come to some understanding of these activities.

The rationale for this great enterprise is to better human practical life and to cure disease, and this is achieved by the mastery of the underlying principles of nature.

But there is also an important contrast between the project set out by Bacon and that of his contemporary science-prophet Descartes. This is in the degree to which there are conceived to be *limits to* the extent to which this combination of technology, philosophy, and social organization can be extended. In Descartes’s project, captured aptly in the image of the “tree of philosophy” sketched out in the introduction to the second edition of his *Principles of Philosophy* (1647), any divine relation to science and technology is essentially a-priori. God’s existence, grounding one of the “roots” of the tree, guarantees the certainty of knowledge and the validity of human reason as it builds the tree of philosophy, ensuring that the reasoning developed as one moves from the trunk in physics to the practical fruits of a new medicine, applied mechanics, and eventually “*morale*” is valid and safe from corrosive scepticism.[[17]](#footnote-17) But there seem to be no limits of another kind that define how far this inquiry can legitimately be pursued.

Bacon is less ambitious and more circumspect about these possibilities. It can be claimed that Bacon’s vision of an applied technology, oriented to the improvement of the practical life of humankind through technology, is more sweeping than anything Descartes actually envisioned for the future. But it is also critical to observe that Baconian technoscience is also *restrained within* divine limits. As Bacon describes this in the “Preface” to the *Great Instauration*, the goal of this wedding of rational knowledge and technology is “restorative” in that it is to recover knowledge lost at the Biblical Fall. But such knowledge is not to go beyond this:

My first admonition (which was also my prayer) is that men confine the sense within the limit of duty in respect of things divine….My next, that in flying from this evil they fall not into the opposite error, which they will surely do if they think that the inquisition of nature is in any part interdicted or forbidden. . . .Lastly, I would address one general admonition to all: that they consider what are the true ends of knowledge, and that they seek it not either for pleasure of the mind, or for contention, or for superiority to others, or for profit, or fame, or power, or any of these inferior things, but the for the benefit and use of life, and that they perfect and govern it in charity. For it was from lust of power that the angels fell, from lust of knowledge that man fell. . . .[[18]](#footnote-18)

*Enlightenment Transformations:*

The remarkable development I wish to isolate in the century following the writings of Bacon and Descartes concerns the uniting of the two strands I have isolated in the previous section—Cartesian unlimited domination and Baconian practical technoscience—in a project that was able to be realized practically. This unification is taking place in the late 18th century. To illustrate this, I will focus on the project of the French *Encyclopédie* that began publication in 1751 (completed in 1772), edited and masterminded by Denis Diderot and Jean D’Alembert. In its better-known dimensions, it is a work of philosophical analysis and social critique with numerous philosophical and theoretical articles on a wide variety of topics in the arts, philosophy, political theory, theology, and social criticism. But it is also a vast attempt to flesh out Bacon’s practical project and instruct the learned world on how best to accomplish these goals. This Baconian inspiration is evident from the classification of the branches of learning in the “Introductory Discourse,” and is illustrated by the remarkable eleven volumes of plates illustrating manufacturing and technology that close the project. As indicated by its full title—*Rational dictionary of the arts, sciences and trades—* the *Encyclopédie* is also a sustained effort to bring theory and rational science into contact with technology and manufacturing, purveying to a wide international audience the principles of glass-blowing, leather tanning, book-binding, carriage manufacture, iron smelting, gunpowder manufacture, and many other practical arts. The numerous articles on practical crafts and their accompanying plates were in many ways constructed by carrying out one of Bacon’s prescriptions—descriptive natural histories of the actual techniques employed by craftsmen and guilds.

It is in this context that I would like to focus in on a crucial change we can see in the original Baconian project taking place in the century and half after Bacon’s proposals. I will use as a focus the long article “Encyclopedia” (1755) by its primary editor, Denis Diderot. Ostensibly an article about what an “encyclopedia” is intended to be—a “circle” that gathers all knowledge together—, it is also a manifesto proclaiming the aspirations of humanity to develop knowledge freed from restraints of governmental control, theological dogma, and established tradition, all of which are to be “trampled underfoot.” Instead it envisions the possibility of unending human self improvement through applied technology and philosophy: “No one knows just where this limit may be. Still less does anyone know to what heights the human race might have attained nor of what it might be capable, if it were in no way hampered in its progress.”[[19]](#footnote-19)

Striking about the project envisioned in this article, especially when compared with the earlier reflections of Bacon, is the new centering of this enterprise purely on the satisfaction of human interests. Any transcendent dimension is absent:

It is only the presence of men that makes the existence of other beings significant. . . .Why should we not make him the center of all that is? Is there, in all infinite space, any point of origin from which we could more advantageously draw the extended lines which we plan to produce to all the other points? With man at the center, how lively and pleasing will be the ensuing relations between man and other beings, between other beings and man![[20]](#footnote-20)

This inquiry into nature, now incorporating the “dominational” dimensions of Cartesianism, is to be pursued by a vanguard who will be able to discover the underlying “metaphysical” principles of the arts and sciences and give these a clear explanation.

Although the *Encyclopédie* confines itself mainly to the principles underlying the manufacturing trades and arts, it can be seen that there is laid down in these aspirations of major intellectual leaders of the French Enlightenment a vision of a rational technology set free from the divine restraints that later could also be applied to life itself. By the late eighteenth century, at least in limited areas, this Baconian enterprise had begun to yield the promised practical fruits of this new technoscience. The great release of power by the invention of the self-governing steam engine by James Watt concurrent with the completion of the *Encyclopédie* then supplied the means by which the technology illustrated in the plates could be readily realized in practice.

The aspirations we find in the *Encyclopédie* to wed a secular vision of humanity at the center of the natural world with the aspirations to dominate nature through technology, expressed in Diderot’s article, can be seen expressed with some eloquence in one of the most widely read works of the late Enlightenment by Diderot’s contemporary, George Louis Le Clerc, comte de Buffon (1707-1788). Amidst the descriptions of animals, biogeography, and even human varieties Buffon put forth in his massive *Histoire naturelle*,générale *et particulière*, published between 1749 and 1767 with supplements appearing up to 1778, Buffon inserts comments on how humans relate to this natural world. In two long discourses on “Nature” published in the 1760s, Buffon expresses with some eloquence this view of humanity as the lord over nature who must dominate and perfect it in a kind of war against its natural tendency to degenerate. Envisioning humans faced by the historical degeneration of the solar system as the sun cools, Buffon envisions a constant struggle of man against nature:

How beautiful is this cultivated Nature, that is made brilliant and splendid [*pompusement*] by the care of man. He has made himself the principal adornment, he is its most noble production. . . .A thousand other monuments of power and glory demonstrate that man, master of the domain of the earth, has changed it, renewed its entire surface, and from remote times he has divided his empire with that of Nature.

But he reigns only by right of conquest; he enjoys it, but does not possess it. He conserves it only by his constant renewing care; if this ceases, all languishes, all is altered, all is changed, and is returned to the hand of Nature. It reclaims its rights, effaces the works of man, covers with dust and moss his most magnificent monuments. . . .[[21]](#footnote-21)

There can be no limit to this technological mastery. It is necessitated by this constant tendency of nature to “degenerate” and efface the human presence that pits humanity in a dominating war against nature.

It is important to return to these Enlightenment discussions to replace the misleading view that has been established in the literature of modern environmental science. These familiar accounts place Christianity and Monotheism somehow at the basis of the modern environmental crisis.[[22]](#footnote-22) This so-called “White Thesis” has been examined several times for its deficiencies, but it remains a common misperception. As I think we can see more clearly by returning to the discussions of the Enlightenment, it is precisely the loss of the transcendental reference to a divine creator that releases human activity from any limits on this technological drive.

*Recovering the Contemplative Vision of Science*

The foregoing discussion of some of the crucial developments of the Baconian project in the eighteenth century provide a way to assess some of the great developments since the nineteenth century in the mastery of life through a combination of rational theory, instrumentation, social organization, and economic incentives. This intervening history of life science is complex and too involved to summarize here. It involves the new wedding of physical science and life science; it builds upon the development of powerful new instrumentation; it builds upon the complex intersection of theoretical biology, practical medicine, informatics, computerization, and new forms of social organization. This has given us the heritage of modern life science. What we now confront in the present century is a powerful interlocking system of relationships between the various inquiries of the science of life financed by major economic resources. This has given us “Big Science” international research efforts such as the Human Genome Project and the current Human Brain Initiative. As with Francis Bacon, this is all justified by the goal of human improvement, the cure of disease, and the prolongation of life. The pressing question is now not *whether* we can we do remarkable things with this knowledge—positive germ-line modification, human cloning, regenerative medicine through the use of stem cell technologies—but whether we *should* we move in these directions. The practical success of the program of one of our Francises—Francis Crick—who envisioned a deep understanding of almost all biological processes through the application of a “bottom-up” analytic and reductive biology— leaves us with questions raised by Francis I in *Laudato Si’*. In the Pope’s sweeping discussion of the relation of human beings to their natural world, Francis addresses specifically an issue that I have placed at the heart of the current problem. In Section III of this Encyclical, “The Crisis and Effects of Modern Anthropocentrism,” Francis attends to the crux of the Enlightenment revision of the Baconian project I have outlined—the combination of technological prowess, a dominational view of the relation of humans to nature, and the centering of this on human interests divorced from any divine limits:

Modern anthropocentrism has paradoxically ended up prizing technical thought over reality. . . . Modernity has been marked by an excessive anthropocentrism which today, under another guise, continues to stand in the way of shared understanding and of any effort to strengthen social bonds. . . .This situation has led to a constant schizophrenia, wherein a technocracy which sees no intrinsic value in lesser beings coexists with the other extreme, which sees no special value in human beings. But one cannot prescind from humanity. There can be no renewal of our relationship with nature without a renewal of humanity itself. There can be no ecology without an adequate anthropology.[[23]](#footnote-23)

This need for an “adequate” anthropology is indeed the key issue here. Is there some way of embracing the great human benefits that have been produced by our technological mastery over the forces of nature and of life itself, which at the same time can preserve the truly precious and sacred dimensions of human life? The comprehensive approach of Francis Crick to explain all biology and even human life by a physico-chemical analysis, and on this build a technological science, leaves us with the scepter of a totalizing metaphysical materialism and even scientific determinism wherein we become problematic to ourselves. With this we lose ultimately any reason to care about the rest of nature. As Francis I continues:

A misguided anthropocentrism need not necessarily yield to ‘biocentrism’. . . .Human beings cannot be expected to feel responsibility for the world unless, at the same time, their unique capacities of knowledge, will, freedom and responsibility are recognized and valued.[[24]](#footnote-24)

To articulate an anthropology that can adequately ground the “unique capacities of knowledge, will, freedom and responsibility” is, of course, the pressing problem and is a work requiring many hands. It requires recovery of the intentionality behind all of human science, even the most reductive and analytic; it also requires a repositioning of ourselves in relation to nature in a way that recognizes human freedom and dignity behind all our scientific endeavor.[[25]](#footnote-25) And it demands recovering the contemplative dimensions of science that seek in knowledge of the cosmos the understanding of harmony, order, and even the divine, revealing the deeper intentionality of human thought to understand and contemplate. To have such a science at all requires that we acknowledge the magnificence of the human mind and the power of self-reflection and human inquiry. To reach back to ancient Greek sources, Claudius Ptolemaeus put this elegantly in the *Almagest* to describe the reasons for studying astronomy and the heavenly motions:

. . .this same discipline would more than any other prepare understanding persons with respect to nobleness of actions and character by means of the sameness, good order, due proportion, and simple directness contemplated in divine things, making its followers lovers of that divine beauty, and making habitual in them, and as it were natural, a like condition of the soul.[[26]](#footnote-26)

In this examination of the insights of three different Francises, we can see both the challenges and the pitfalls in our modern scientific endeavor and its relation to the transcendent.

1. Pope Francis I, *Laudato Si’: On Care for Our Common Home* (Huntington, IN: Our Sunday Visitor Press, 2015). All subsequent quotations from this edition. [↑](#footnote-ref-1)
2. Francis Crick, *Of Molecules and Men* (Seattle: University of Washington Press, 1966), p. 10. [↑](#footnote-ref-2)
3. National Institutes of Health Brain Initiative Home Page, <http://braininitiative.nih.gov/about.htm#A>. Accessed 10/16/2015. [↑](#footnote-ref-3)
4. See Hans Jonas, *The Phenomenon on Life* (Chicago:University of Chicago Press, 1966); Michael Polanyi, *Personal Knowledge* (Chicago: University of Chicago Press, 1962); Leon Kass, *Toward a More Natural Science* (New York: Free Press, 1985); Francis Fukuyama, *Our Posthuman Future: Consequences of the Biotechnology Revolution* (New York: Farrar, Straus and Giroux, 2002); William Hurlbut, “St. Francis, Christian Love, and the Biotechnological Future,” *New Atlantis* (Winter, 2013): 92-99. [↑](#footnote-ref-4)
5. Steven Shapin, *The Scientific Life: A Moral History of a Late Modern Vocation* (Chicago: University of Chicago Press, 2008) [↑](#footnote-ref-5)
6. Jonathan Israel, *A Revolution of the Mind: Radical Enlightenment and the Intellectual Origins of Modern Democracy* (Princeton: Princeton University Press, 2010) [↑](#footnote-ref-6)
7. Seyyed Hossein Nasr, *Knowledge and the Sacred* (New York: Crossroad Press, 1981). 41-42. [↑](#footnote-ref-7)
8. Descartes, *Discourse on Method*, trans. Robert Stoothoff in John Cottingham, Robert Stoothoff, and Dugald Murdoch (eds.) *The Philosophical Writings of Descartes*, Vol. I (Cambridge: Cambridge University Press, 1985), 142-43. [↑](#footnote-ref-8)
9. Bacon, “Preparative Towards a Natural and Experimental History,” in R. Sargent (ed.), *Francis Bacon: Selected Philosophical Works* (Indianapolis: Hackett, 1999), 195. Subsequent references to this edition. [↑](#footnote-ref-9)
10. Bacon, *Great Instauration*, *Works*, pp. 69-70. [↑](#footnote-ref-10)
11. Bacon, *New Organon*, Book I, Aph. 129, *Works*, p. 146. [↑](#footnote-ref-11)
12. Bacon, *Great Instauration*, “Preface,” *Works*, p. 74. [↑](#footnote-ref-12)
13. Bacon, *Great Instauration*, “Preparative,” *Works*, p. 195. [↑](#footnote-ref-13)
14. Bacon, *Great Instauration*, “Preparative,” *Works*, p. 195. [↑](#footnote-ref-14)
15. Bacon, *Great Instauration*, “Preparative,” *Works*, p. 196. [↑](#footnote-ref-15)
16. Bacon, *Great Instauration*, “Preparative,” *Works*, p. 196. [↑](#footnote-ref-16)
17. Descartes, “Preface to French Edition of *Principles of Philosophy,*” (1647), in *Philosophical Writings* I, p. 186. [↑](#footnote-ref-17)
18. Bacon, *The Great Instauration*, *Works,* pp. 74-75. [↑](#footnote-ref-18)
19. Denis Diderot, “Encyclopedia,” (1755) trans. Jacques Barzun in *Diderot: Rameau’s Nephew and Other Works*, ed. and translated by Jacques Barzun and Ralph Bowen (Indianapolis: Library of Liberal Arts, 1956), 289. [↑](#footnote-ref-19)
20. Diderot, “Encyclopedia,” pp. 292-93. [↑](#footnote-ref-20)
21. Buffon, “De la Nature: Premìere vue,” *Histoire naturelle* XI (1764), in Jean Piveteau (ed.), *Buffon: Oeuvres philosophiques* (Paris: Presses Universitaires de France, 1954), 34. Translated by the author. [↑](#footnote-ref-21)
22. Lynn White, “The Historical Roots of Our Ecological Crisis,”*Science* 155 (1967): 1203-07. For responses see David M. Lodge and Christopher Hamlin (eds.), *Religion and the New Ecology* (Notre Dame: University of Notre Dame Press, 2006). [↑](#footnote-ref-22)
23. *Laudato Si’*, paras. 116, 118. [↑](#footnote-ref-23)
24. *Laudato Si’*, para. 118. [↑](#footnote-ref-24)
25. I have explored aspects of this in my “Being Human and Christian in a Darwinian World,” *Logos* 15 (2012): 150-77; and “Questioning the Zoological Gaze: Darwinian Epistemology and Anthropology,” pp. 232-66 in: Phillip R. Sloan, Gerald McKenny, and Kathleen Eggleson (eds), *Darwin in the Twenty-First Century: Nature, Humanity, God* (Notre Dame: University of Notre Dame Press, 2015). [↑](#footnote-ref-25)
26. Ptolemy, *The Almagest*, trans. Catesby Taliferro (Great Books of the Western World, Vol. 16; Chicago: Encyclopedia Brittanica Press, 1989), p. 6. [↑](#footnote-ref-26)