The Impenetrable Mystery of a Literal Adam and Eve

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The human mind forever probes the mysteries of God's creation seeking to find ultimate answers which satisfy its enquiry. Normally, this involves a natural progression toward some single truth that essentially defines "the solution." Imagine a case in which there *is* a true explanation for a major human question and yet, it turns out that more than one answer is possible. An impenetrable mystery emerges when it cannot be discovered which answer is the correct one.

Such a noetic impasse appears in the quest for mankind's origin: the search for a literal Adam and Eve (assuming some sort of evolutionary scenario). I shall show that a literal Adam and Eve can be demonstrated to be rationally credible. Yet, equally demonstrable is the impossibility of being certain which of two alternative possible explanations of their credibility is correct. Perhaps the full truth requires elements of both.[1]

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[1] This article is edited by Mary Helen Klinge-Drucker. While I am indebted to Dr. Ann Gauger, Senior Research Scientist at the Biologic Institute, for her extensive discussions with me on current genetic research into our origins, all views expressed are my own. I want to acknowledge that I have published similar themes in other venues, including a short article, "The Myth of the 'Myth' of Adam and Eve," in the collection *Sztuka i realizm* [*Art and Reality*] (Lublin, PL: Polish Society of Thomas Aquinas [Catholic University of Lublin], 2014) and a peer-reviewed article offering more detailed scientific analysis of similar arguments in a Spanish journal: "The Rational Credibility of a Literal Adam and Eve," *Espiritu* 64, no. 150 (2015): 303–20 (accessed August 4, 2017, http://dialnet.unirioja.es/servlet/articulo?codigo=5244649). While the pres-

For much of Christian history, a literal set of first parents of all humanity, Adam and Eve, was accepted as factual. Today, claims made by some natural scientists have led to widespread doubt or even denial of this once universal belief.

Catholic doctrine clearly affirms theological monogenism, the teaching that all human beings are biological descendants of the first genuinely human individual, Adam. Pope Pius XII's 1950 encyclical *Humani Generis* proclaims that "revealed truth . . . and the *magisterium* of the Church" propose that original sin "proceeds from a sin truly committed by one Adam [*ab uno Adamo*], and which is transmitted to all by generation, and exists in each one as his own."[2] Pius XII insists that "the faithful in Christ cannot accept" the "conjectural opinion" of polygenism, which he defines in theological terms as "this view, which holds that either after Adam there existed men on this earth, who did not receive their origin by natural generation from him, the first parent of all; or that Adam signifies some kind of multitude of first parents."[3] This papal decision follows logically from the dogmatic teaching of the Council of Trent affirming that all true men must inherit original sin from Adam through generation.[4] Having other genuinely human first parents not descended from Adam (polygenism) would contradict that doctrine, since they could not then have inherited original sin from him as the dogma declares.

Decades later, the *Catechism of the Catholic Church* affirms this same teaching when it tells us, "'The whole human race is in Adam 'as one body of one man.'"[5] Further, it declares, "Adam and Eve committed

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ent article includes some genetic analysis similar to the earlier articles, newly examined in expanded detail is a possible philosophical difficulty entailed in the "interbreeding hypothesis," which has been widely accepted as an apparent solution to the well-known "problem of genetic diversity."

2 Pope Pius XII, *Humani Generis* (1950), §37, in *The Companion to the Catechism of the Catholic Church: A Compendium of Texts Referred to in the Catechism of the Catholic Church*, 2nd ed. (San Francisco: Ignatius Press, 1994), 113. For the Council of Trent's teaching on the transmission of original sin, see Heinrich Denzinger, Heinrich and Peter Hünermann, *Enchiridion symbolorum definitionum et declarationum de rebus fidei et morum* [hereafter, "Denz."], 43rd ed. (Freiburg: Herder, 2010), nos. 1511–14.

3 Pius XII, *Humani Generis*, §37.

4 Denz., no. 1513.

5 *Catechism of the Catholic Church* [hereafter, CCC], 2nd ed. (New York: Doubleday Religion, 2003), §404. see also St. Thomas Aquinas, *De malo*, q. 4, a. 1. For a more complete explanation of why theological monogenism is authentic Catholic doctrine, see Dennis Bonnette, "Monogenism and Polygenism," in

a *personal sin*, but this sin affected the *human nature* that they would then transmit *in a fallen state*. It is a sin which will be transmitted by propagation to all mankind."[6]

Current Objections Answered

From the scientific disciplines of paleoanthropology and genetics, two basic objections to theological monogenism have been posed. The first is that the standard evolutionary narrative speaks of slow changes in anatomy and behavior as early primate populations evolved into modern human beings. Thus, paleoanthropologists argue that intellectual abilities manifested gradual development as tool-making activity became more and more sophisticated over vast time periods, and similarly, early experience with fire led eventually to its controlled use.[7] Contemporary paleoanthropologists would scoff at the Catholic doctrine of a literal Adam and Eve instantly appearing with fully human rational abilities.

While paleoanthropologists may fail to see the sudden appearance of true human beings in the paleontological record, classical philosophy offers a different perspective on the same data. Sourced in Aristotle's observation that man is distinguished from lower living things by possession of a rational nature, the definition of man as a rational animal became common in Scholastic philosophy.[8] Man distinguishes himself from lower animals through abilities to understand abstract concepts, form judgments, and engage in discursive reasoning. St. Thomas Aquinas uses such specifically intellectual powers to demonstrate the spirituality and immortality of the human soul.[9] An individual hominin must either possess a spiritual soul (substantial form) or not. Since, as Aquinas points out, "no substantial form is participated according to more or less," becoming human cannot be

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New Catholic Encyclopedia Supplement 2012–2013: *Ethics and Philosophy*, ed. Robert L. Fastiggi (Detroit, MI: Gale, 2013), 3:1013–16.

6 CCC, §404 (italics original).

7 James Steele, P. F. Ferrari, and L. Fogassi, "From Action to Language: Comparative Perspectives on Primate Tool use, Gesture and the Evolution of Human Language," *Philosophical Transactions of the Royal Society B: Biological Sciences* 367, no. 1585 (2012): 4–9.

8 See Aristotle, *Nicomachean ethics* 1.13, as well as *De anima* 3.11.

9 St. Thomas Aquinas, *Summa theologiae* [hereafter, *ST*] I, q. 75. See also Dennis Bonnette, *Origin of the Human Species*, 3rd ed. (Ave Maria, FL: Sapientia Press, 2014), 103–10.

a gradual process.[10] While paleoanthropologists may not be able to discern the exact point in the paleontological record at which true man first appears, sound philosophy demonstrates that such a singular event must exist.[11] At some point in time, the first rational-souled, genuine human beings must have suddenly appeared: Adam and Eve, created by God radically superior in nature to all previous primates.[12]

The second major objection to monogenism comes from geneticists who claim that, since the time when the lineages leading to chimpanzees diverged from those leading to modern man—known as the *Homo* (human) / *Pan* (chimpanzee) split—millions of years ago, never has there been a bottleneck (reduced population) of a single mating pair of hominins (members of the human lineage).[13] Since an evolutionary scenario would have our first true human parents appear within this hominin lineage, and since they are commonly believed to have appeared within this time frame, this claim would seem to render a literal Adam and Eve to be impossible.

This second objection to a literal Adam and Eve is from the science of genetics. In 1995, geneticist Francisco J. Ayala published a study in *Science* entitled "The Myth of Eve: Molecular Biology and Human Origins."[14] Examining the HLA-DRB1 gene that is part of our immune system and has hundreds of variant forms known as alleles, he concluded that thirty-two ancient alleles existed at the time of the *Homo–Pan* split, which is now dated at least seven million years

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10 *ST* I-II, q. 52, a. 1, corp. See also *ST* I, q. 76, a. 4, ad 4. All translations of the *ST* cited in this article are taken from the *Basic Writings of St. Thomas Aquinas*, ed. Anton C. Pegis (New York: Random House, 1945).

11 Pope St. John Paul II, Address to the Plenary Session of the Pontifical Academy of the Sciences on the Subject "The Origins and Early Evolution of Life," October 22, 1996, §6: "The sciences of observation describe and measure the multiple manifestations of life with increasing precision and correlate them with the time line. The moment of transition to the spiritual cannot be the object of this kind of observation" (*Papal Addresses to the Pontifical Academy of Sciences 1917–2002 and to the Pontifical Academy of Social Sciences 1994–2002* [Vatican City: The Pontifical Academy of Sciences, 2003], 373).

12 *CCC*, §343.

13 John Hawks, K. Hunley, S-H. Lee, and M. Wolpoff, "Population Bottlenecks and Pleistocene Human Evolution," *Molecular Biology and Evolution* 17, no. 1 (2000): 2–22; Heng Li and R. Durbin, "Inference of Human Population History from Individual Whole-genome Sequences," *Nature* 475, no. 7357 (2011): 493–97.

14 Francisco J. Ayala, "The Myth of Eve: Molecular Biology and Human Origins," *Science* 270, no. 5292 (1995): 1930–36.

ago.[15] According to Ayala, there are too many alleles to pass through a bottleneck of a single mating pair of hominins at that time or any time thereafter.[16] The total elimination of any such hominin bottleneck in that time frame would entail that our biblical first human parents would also be impossible.

The importance of Ayala's claims lies not simply in the study itself, but in the fact that this study was accepted by many in the intellectual community as clear proof that Adam and Eve must be mythological—never again to be taken seriously.

Still, just three years later, Uppsala University geneticist Tomas Bergström and his group completed a similar study of the HLA-DRB1 gene.[17] Unlike Ayala, who had examined the exon 2 region of the gene, this new study focused on intron 2, the intron next to exon 2, "expressly to avoid the confounding effects of strong selection, a high mutation rate, and/or gene conversion."[18] Using this improved methodology, this 1998 study concluded that only seven HLA-DRB1 ancient alleles existed.[19] Nine years later, in 2007, yet another study in Bergström's group, headed by Jenny von Salomé, concluded that only four allelic lineages of that same gene predated five million years ago, with a few more appearing thereafter.[20] Since two hominins can pass along four such lineages, a bottleneck of two mating individuals appears possible. Still, several additional HLA-DRB1 lineages appearing shortly after that time needs explanation. Also, this possible bottleneck of two mating hominins would not have been the biblical Adam and Eve, given that it occurred some five million years ago, much too early for any realistic time frame for their appearance.

The above scenario is not intended to demonstrate the actual

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15 Ibid. While Ayala thought the time of the *Homo–Pan* split was some six million years ago, more recent estimates place it at least seven million years ago (see Catherine Brahic, "Our True Dawn: Pinning Down Human Origins," *New Scientist*, no. 2892 [2012]: 34–37).

16 Ayala, "The Myth of Eve," 1931.

17 Tomas Bergström et al., "Recent Origin of HLA-DRB1 Alleles and Implications for Human Evolution," *Nature Genetics* 18, no. 3 (1998): 237–42.

18 Ann Gauger, "The Science of Adam and Eve," in Ann Gauger, Douglas Axe, and Casey Luskin, *Science and Human Origins* (Seattle, WA: Discovery Institute Press, 2012), 113.

19 Bergström et al., "Recent Origin," 239, figure 2a.

20 Jenny von Salomé et al., "Full-Length Sequence Analysis of the HLA-DRB1 Locus Suggests a Recent Origin of Alleles," *Immunogenetics* 59, no. 4 (2007): 261–71. While the *Homo–Pan* split is generally dated to at least seven million years ago, this 2007 study does use five million years as a division point.

origin of the first true human beings. What it does show, though, is that the number of ancient HLA-DRB1 genes to be explained was significantly fewer than that which Ayala claimed. This raises the interesting possibility that, perhaps, with further investigation, a more complete explanation might be discovered as to how a founding population of just two first true human beings could exist.

And yet, does this analysis of Ayala's study from 1995 reflect the current or possible future literature? The answer is that such radically retrospective studies are, by their very nature, subject to the same difficulties found in Ayala's research: there is no way to assure that the assumptions inherent in such population genetics studies will fit what actually occurred.[21]

Often not realized are the epistemic weaknesses of retrospective calculations of genetic conditions hidden deep in the recesses of past time. These highly speculative studies employ computer models that rely on assumptions about such things as constant mutation rates, random breeding among individuals, constant population size, valid schema of common descent, and other conditions—variables that are capable of introducing substantive errors in claimed conclusions.[22] Because such assumptions might not accurately depict actual populations, some geneticists have concluded that DNA sequence differences, considered in themselves, may not allow calculation of effective population size (an idealized size of a breeding population).[23]

Minimal reflection upon the above conclusions renders it obvious that statements such as "Adam and Eve are scientifically impossible" are themselves "scientifically impossible."

Nonetheless, the possibility remains that too much ancient genetic material *actually did* exist to have passed through the single mating pair of first true human beings. Still, given the inherent limitations

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[21] For example, see Li and Durbin, "Inference of Human Population History," 493–97. Molecular biologist Ann Gauger notes the paucity of genomes used in that study and inherent epistemic limits which render such studies not definitive ("On Retrospective Analysis and Coalescent Theory," Evolution News & Science Today, August 6, 2012, accessed August 4, 2017, http://www.evolutionnews.org/2012/08/on_retrospectiv062881.html).

[22] Gauger, "The Science of Adam and Eve," 111–12.

[23] P. Sjödin et al., "On the Meaning and Existence of an Effective Population Size," *Genetics* 169, no. 2 (2005):1061–70; John Hawks, "From Genes to Numbers: Effective Population Sizes in Human Evolution," in *Recent Advances in Paleodemography: Data, Techniques, Patterns*, ed. Jean-Pierre Bocquet-Appel (Dordrecht: Springer, 2008), 9–30.

of retrospective genetic speculation, there is simply no way ever to be certain as to what actual conditions existed in the past. Genetic studies alone can never tell us whether or not theological monogenism actually took place, since models are only as good as their assumptions.[24]

If there is too much ancient genetic material to have passed through a single pair, is there another and different direction that can be taken? The next section ponders such a possible alternative answer, yet one which itself turns out not to be free of all difficulties.

The mystery is about to deepen.

Interbreeding Solution: A Philosophical Difficulty

The above analysis shows (1) that Ayala's initial claims were overstated as to the number of ancient HLA-DRB1 alleles to be explained and (2) that the genetic case against a literal Adam and Eve is not definitive. Unfortunately, in recent decades, discussion about mankind's origin involving genetics tends toward the false assumption that Ayala and other scientists have relegated our biblical first parents to the scrapheap of mythology.

In 2011, philosopher Kenneth W. Kemp, citing Ayala's study and findings of other scientists, concluded that "modern science suggests not a monogenetic, but a polygenetic, origin for man."[25] In response to this challenge to Catholic doctrine, Kemp proposed an alternative defense of theological monogenism: that significant interbreeding had occurred between Adam and Eve's descendants and the subhuman population in which Adam and Eve appeared, thus providing the added genetic material needed to explain present genetic diversity.[26] Kemp's analysis is currently accepted in many quarters as the only

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[24] An alternate model starting from a single pair has been recently proposed, since the submission of this paper. This model may be able to account for current genetic diversity as well or better than current retrospective models. While we can never recreate history, if there are two competing models, both of which can explain existing genetic diversity, the claims of the current model against Adam and Eve are considerably weakened. Since the alternate model has not yet been tested, I do not consider it at all in the speculative scenario I offer in my postscript. See Ola Hössjer, Ann Gauger, and Colin Reeves, "Genetic Modeling of Human History Part 1: Comparison of Common Descent and Unique Origin Approaches," *BIO-Complexity*, vol. 2016, no. 3 (November 11, 2016):1–15 (doi:10.5048/BIO-C.2016.3).

[25] Kenneth W. Kemp, "Science, Theology, and Monogenesis," *American Catholic Philosophical Quarterly* 85, no. 2 (2011): 217–36, at 225.

[26] Ibid.

credible explanation consistent with the realistic possibility of a literal Adam and Eve. Nonetheless, philosophical difficulties can arise with this hypothesis.

Following the assumed standard evolutionary scenario for human origins, it is arguable that there would be few morphological or genetic differences between the subhuman population in which Adam and Eve appeared and Adam and Eve's descendants.

Understandable is the presumption that Adam and Eve's immediate descendants would belong to the same biological species as the subhuman hominins, and thus, interbreeding would be successful. After all, many instances of successful interbreeding between diverse biological species are known to modern science, even where there are notable morphological differences, as in the case of the lion and tiger producing tigons and ligers. From a purely scientific perspective, an interbreeding hypothesis seems to be unassailable, since we cannot trace back to the exact genetic and fertility conditions that existed in the subhuman hominin population with which Adam and Eve's descendants may have mingled. Moreover, since interbreeding appears to be solely a biological process, some might argue that no philosophical or theological objections would be relevant.

However, regarding possible interbreeding, two major philosophical considerations are crucial and generally overlooked: (1) the distinction between biological species and philosophical natural species, and (2) the ontological fact that substantial form—not matter—determines the ultimate disposition of the matter of a substance.[27]

All biological species concepts are based solely upon "accidental characteristics," such as morphology or genetics or even intrinsic reproductive isolation. They fail to discern philosophically essential differences between species. Because biological science as such never reaches to the intrinsic essence of organisms, evolutionists today tend to define the biological species concept in terms of "lineages" or "populations," which are viewed as evolving separately based upon such abovementioned "accidental characteristics" or "contingent properties."[28] Such "contingent properties" are no longer viewed as absolutely necessary to a given population or lineage.[29] Still, all of

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[27] Bonnette, *Origin of the Human Species*, 27–39, 232–35.

[28] Kevin de Queiroz, "Ernst Mayr and the Modern Concept of Species," *Proceedings of the National Academy of Sciences* 102, supplement 1 (2005): 6600–07.

[29] Ibid.

them can be used as significant markers of a population that is evolving so as to be separate from other populations or lineages.[30]

This explanation does not resolve adequately the "species problem" because it fails to address the essential nature of organisms, what it is in the organisms themselves that makes them essentially one with each other and diverse from other species. The biological species concept has historically proven itself to be inherently problematic.[31] Eminent biologist Ernst Mayr observed long ago that we must get past empirical terms—like "phenotypic, morphological, genetic, phylogenetic, or biological"—so as to reach the "underlying philosophical concepts" in order to analyze properly the "species problem."[32]

Conversely, the philosophical natural species concept penetrates beyond mere sensible accidents to the metaphysical essence of living things expressed in essential properties (*per se* accidents) that are simply either present or absent.[33] Animals have sentient powers lacking in plants. True human beings have intellect and will, utterly missing in brutes. Defending the natural species concept, Australian theologian and philosopher Austin M. Woodbury writes, "Therefore men and brute animals and plants differ from each other according to natural species and specific essence."[34]

Generally assumed in any hypothetical evolutionary scenario is that the subhuman hominin population in which Adam and Eve

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30 Ibid.

31 Ibid.

32 Ernst Mayr, *The Species Problem* (Washington, DC: American Association for the Advancement of Science, 1957), 17.

33 Bonnette, *Origin of the Human Species*, , 34–39. See also: Etienne Gilson, *The Philosophy of St. Thomas Aquinas* [*Le Thomisme*], trans. Edward Bullough (Cambridge: W. Heffer & Sons, 1929), 154; Kemp, "Science, Theology, and Monogenesis," 230.

34 Austin M. Woodbury, *Philosophical Psychology* (Sydney, AU: Aquinas Academy, 1945 [unpublished manuscript]), 57. Woodbury was a Marist priest who studied under Reginald Garrigou-Lagrange. He founded the Aquinas Academy in Sydney, Australia, in 1945, which he directed until 1975. Shortly thereafter, the University of St. Thomas in Rome (the Angelicum) granted the Academy the right to offer the degree of licentiate in philosophy. Woodbury wrote several extensive, deeply scholarly manuscripts dealing with the classical philosophical sciences. Although these works were never actually published, they were distributed to many thousands of students at the Aquinas Academy for over a quarter century. They are highly technical philosophical works that far exceed the depth and breadth of most published works in the discipline today.

would appear shares their same biological species. Hence, interbreeding between their descendants should be no problem. Still, Adam and Eve are not in the same philosophical natural species as that subhuman population, because the first true human beings possess intellective powers, which are essential properties not found in mere animals. Diverse natural species entail diverse substantial forms. Substantial form determines an organism as to its natural species.[35]

Interbreeding among organisms in diverse biological species is possible, for example, between lions and tigers, sheep and goats, and camels and llamas, all of which belong to the same philosophical natural species. Analysis of genomes of modern humans indicates that they mated with at least two groups of ancient hominins: Neanderthals and Denisovans.[36]

Still, these ancient hominins appear to have belonged to the same philosophical natural species as true human beings, because their fossils are associated with artifacts that evince rational powers.[37] This would imply that interbreeding between modern man and such rational hominins, all of whom are true human beings, was simply not an instance of interspecific natural species interbreeding. Moreover, Adam must have lived prior to them all, since the doctrine of original sin entails that all true human beings inherit the "state" of original sin from him by propagation.[38]

Examples of interbreeding, even between diverse biological species, invariably appear to be between organisms that share the same philosophical natural species. No examples whatever of interspecific interbreeding between diverse philosophical natural species seem to exist.

Hence, arguments taken from examples of interbreeding between diverse biological species that are in the same philosophical natural species do not tell us whether successful mating is actually possible between subhumans and humans, which, while facilely assumed to belong to the same biological species, are actually in diverse philo-

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35 Etienne Gilson, *The Elements of Christian Philosophy* (New York: New American Library, 1960), 170: "Furthermore, the form is that which places the thing in its own species."

36 Alanna Mitchell, "DNA Turning Human Story Into a Tell-All," *New York Times*, January 30, 2012.

37 Tim Appenzeller, "Neanderthal Culture: Old Masters," *Nature* 497, no. 7449 (2013): 302–4; Ann Gibbons, "Who Were the Denisovans?" *Science* 333, no. 6046 (2011): 1084–87.

38 Denz., no. 1513. See also *CCC*, §404.

sophical natural species. Moreover, "subhumans" or "prehumans" are simply not human at all. Every bit of a true human being differs radically from a subhuman hominin, even assuming seemingly identical morphology and many similar behaviors. That, as philosopher Steven Baldner points out, is because the essential nature of the human being pervades every part and element of its being and body.[39] The substantial form determines that the nature of every part of a true human is human and that the nature of every part of a subhuman hominin is not human.[40] To say that a human being is simply a subhuman hominin with rationality is an essential error. Yes, man is a rational animal. But, the phrase, "rational animal" does not mean that "rationality" is simply added, as an extrinsic principle or part, to "animality."

Since, as Aquinas maintains, "there is no substantial form in man other than the intellectual soul," "rational animal" is a unitary substantial nature essentially different from an irrational animal nature in every part of its being.[41] Cartesian misunderstanding makes one think that just adding a "rational soul" to an animal would produce a human being, as if the animal nature or form is untouched by the "addition" of rationality. Rather, the irrational animal nature specifies one kind of substance and the rational animal nature specifies another essentially distinct and qualitatively superior kind of substance. They share some common attributes, but that does not make their essential natures the same; nor does it place them in the same philosophical natural species; nor does it assure us that they can mate successfully.

Form's Role in Natural Species' Origin

According to Darwinian naturalism, random material mutations and natural selection are claimed to account for the origin of new biological species. However, substantial form plays a unique role in

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[39] Steven Baldner, "An Argument for Substantial Form," *The Saint Anselm Journal* 5, no. 1 (Fall 2007): 8–9.

[40] *ST* I, q. 76, a. 8, corp: "The soul is a substantial form, and thus must be the form and act, not only of the whole, but also of each part." See also Aquinas, *Summa contra gentiles* [hereafter, *SCG*] II, ch. 72, no. 3: "That the soul is the substantial form both of the whole and of the parts [of an organic body], is clear from the fact that not only the whole but also the parts owe their species to it" (all translations of *SCG* cited in this article are taken from St. Thomas Aquinas, *On the Truth of the Catholic Faith*, vol. 2, trans. James F. Anderson [Garden City, NY: Image Books, 1956]).

[41] *ST* I, q. 76, a. 4, corp.

the coming-to-be of new and more perfect natural species.[42] Form places an organism into its proper species.[43] Since Aquinas maintains that "matter must be proportionate to form," it appears to follow that a qualitative difference in forms between diverse natural species must entail a real difference in the disposition of the matter receiving those forms.[44] He insists that "form and matter must always be mutually proportioned and, as it were, naturally adapted, because the proper act is produced in its proper matter."[45]

Since substantial form actively determines primary matter in the formation of a material substance, substantial form renders the material organization of the composite substance specific to the natural species produced. Hence, the material organization of the new substance must be constituted in accordance with the specificity of the new substantial form.

Until the new substantial form is actually present, the material disposition needed for it cannot be present, since it is form (which is act) that places matter (form's corresponding potency) into its proper natural species, *not* vice versa. While prior forms and causal agency may account for the penultimate disposition of the matter, solely the new and higher form actuates the matter to its ultimate disposition. Aquinas maintains that form is "the specifying principle" of matter and "absolutely speaking form is prior in time because the potential is brought to actuality only by means of something actual."[46] Form is ontologically prior in determining the final organization of the matter needed for that self-same new and higher form. Woodbury, writing about the coming-to-be of philosophical natural species, concludes that "the ultimate disposition [of the matter] is never found with the prior form, but solely becomes present when the new and

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42 Dennis Bonnette, "The Philosophical Impossibility of Darwinian Naturalistic Evolution," *Faith & Reason* 33, nos. 1–4 (2008): 55–67, at 61–62 (this article appears also in Bonnette, *Origin of the Human Species*, third edition, 227–238, at 234).

43 Ibid. See also Gilson, *The Elements of Christian Philosophy*, 170.

44 *ST* I, q. 76, a. 5, ob. 1. See also Gilson, *The Elements of Christian Philosophy*, 170: "A prerequisite for the form is a certain mensuration and commensuration of its principles. For instance, a due proportion of matter to form."

45 *SCG* II, ch. 81, no. 7.

46 Aquinas, *In* VII *Meta.*, lec. 2, no. 1278, in *Commentary on the Metaphysics of Aristotle*, trans. John P. Rowan, Library of Living Catholic Thought 11 (Chicago: Henry Regnery Company, 1961), 498.

succeeding form is actually present."[47]

Moreover, this material disposition is dynamic, varying throughout an individual organism's life—and between biological species *within* the same natural species. The zygote exhibits micro-organization suitable to the form, even prior to its development of the organs specific to its species, while its macroscopic appearance is utterly diverse from that of the adult. Philosopher John N. Deely depicts the form as setting the boundaries of such diverse material organization by "establishing a 'reaction range' outside of which the organism cannot be pushed without ceasing to be itself."[48]

While natural science can never assure us that the matter is properly disposed for actuation by the substantial form, what is more important and, in fact, decisive is that philosophical analysis alone tells us that form determines the ultimate disposition of the matter so as to assure that the matter is properly organized to be actuated by the form of a certain natural species.

This means that no prior state of matter can account for matter's final organization—neither through mutations or other biological mechanisms nor through the presence of any prior form. Prior material states do not include that which differentiates the ultimate material state from them. Since they cannot give that which they lack, they cannot account for the ultimate material state. Prior forms cannot dispose the matter to the new form, since that is the role of the new form exclusively. That alone that can account for the final organization of the matter must be the new substantial form of the new philosophical natural species.

This philosophical analysis forced me to revise my own earlier position and conclude that "natural evolutionary processes alone cannot adequately explain new and successively higher philosophical natural species."[49]

I have shown in the "Current Objections Answered" section that studies indicating that Adam and Eve are "scientifically impossible" without interbreeding can never be definitive. And yet, assuming that no interbreeding occurred, present day genetic diversity might

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47 Austin M. Woodbury, *Cosmology* (Sydney, AU: Aquinas Academy, 1949 [unpublished manuscript]), 68.

48 John N. Deely, *The Philosophical Dimensions of the Origin of Species* (Chicago: Institute for Philosophical Research, 1969), 306.

49 Bonnette, "The Philosophical Impossibility," 63, and *Origin of the Human Species*, 235.

still render a literal Adam and Eve impossible. Given that successful interspecific interbreeding would involve the question of how the human form can interact with a subhuman hominin's matter, I need to examine more closely how the above philosophical analysis of matter and form might apply to the interbreeding hypothesis.

Why Interbreeding Cannot Be Assumed

Given today's evolutionary mindset, genetic markers are accepted as determinative of species and their properties. DNA is viewed as what makes an organism to be what it is. Because of this, the philosophical analysis that insists that the ultimate disposition of an organism's matter is determined by the succeeding substantial form, not preexisting material conditions, looks virtually anti-scientific .

Aquinas appears to support the notion that matter might *not* be, in some instances, proportionate to form. He maintains that "the matter need not always be commensurate with the form."[50] He affirms that human beings with intellective souls, through the act of understanding, are "capable of an operation which is accomplished without any bodily organ at all."[51] The human spiritual soul thus "transcends the condition of corporeal matter" and "must not be wholly encompassed by or imbedded in matter, as material forms are."[52]

Aquinas grants that "the human soul's act of understanding needs powers—namely, imagination and sense—which function through bodily organs."[53] Indeed, it might be argued that any sufficiently developed hominin body would meet the material conditions needed for the infusion of the intellectual soul, for example, by possessing a sufficiently developed brain and sense organs. This appears to support the claim that the descendants of Adam and the subhuman population in which they appear belong to the same biological species, since they might manifest virtually no differences in bodily organization and sense powers. Hence, successful interbreeding could occur.

In this scenario, the only change manifested in the coming-to-be of Adam would have been the infusion of a soul that was like that of a subhuman hominin in almost all respects, except that it was also spiritual in nature as evinced by its ability to perform intellectual functions. No bodily changes need be entailed.

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50 *SCG* II, ch. 68, no. 7.
51 Ibid., no. 12.
52 Ibid.
53 Ibid.

In the case of a new natural species arising purely within the *subhuman level*, with no spiritual soul or spiritual powers involved, the form of the new and higher species *would* necessitate a proportionate change in the material disposition of the new organism, as demonstrated above. Unlike the human spiritual soul, material forms are "wholly encompassed by or imbedded in matter."[54] Since material forms in no way transcend the matter that they actuate, matter must be strictly proportionate to form such that potentially gene-altering material changes must always occur with the coming-to-be of a new and higher natural species.

On the other hand, in the case of the origin of the first man, Adam, one might argue that no change in the disposition of matter was required, since the higher perfections found in human nature arise solely in spiritual powers that in no way depend on bodily organs for their existence or proper operation. Matter would not be commensurate with form because the only change would be in the added powers of the spiritual soul, perhaps nothing being altered in the matter itself.

Still, it is possible that spiritual faculties operate more perfectly when the material sense organs themselves are more perfect in some fashion. While the intellect in its own proper operation would be in no way dependent upon a bodily organ, still, some added perfection in the brain or senses or imagination, for example, might render the image more suitable to the act of abstraction. Hence, while the new substantial form's spiritual faculties might not, as such, entail a *commensurate* change in the material disposition, still, a more perfect material organization within the bodily organs would be produced.

In fact, Aquinas argues, when speaking about the apt disposition of the body of the first man, Adam, "that God fashioned the human body in that disposition which was best according as it was most suited to such a form and to such [rational] operations."[55] He goes on to say that the human body is "suitably proportioned to the soul and its operations."[56] What is "most suited" to rational operations might, indeed, entail more perfect sensory organs than those found in earlier hominins, thus requiring a change in material disposition. Because such a material change could affect the genetic makeup in such manner as to affect the procreative process with subhuman

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[54] Ibid.

[55] *ST* I, q. 91, a. 3, corp.

[56] Ibid.

hominins, the assumption that interbreeding could take place might prove ill-founded. There is no way to go back in time and ascertain whether or not these genetic changes would impede successful procreation.

The more likely explanation appears to be the following. God did not infuse spiritual souls into lower primates, such as gorillas and chimpanzees, even though they have sense organs and faculties with which to form images. Genuine human beings are so qualitatively superior to subhuman hominins that it is reasonable to expect their radically superior intellectual cognition to be accompanied by more perfect sensory organs and faculties essentially ordered to such qualitatively more perfect cognition.

Paleoanthropologists assume a gradual progression in organic formation and function during the last almost two million years, since *Homo erectus* appeared. If, at some point, a new behavior definitively evincing intellectual presence is found, such as the making of artistic Acheulean stone hand-axes, a corresponding improvement in material organization would appear reasonable.[57]

Note that highly sentient lower primates and hominins appear, at least prima facie, to have requisite material organization for the human form. That is, gorillas, chimpanzees, orangutans, and so forth appear to have the sense organs needed to form phantasms, which the intellect could use as instrumental causes for intellective acts. Such sense faculties appear present also throughout the evolutionary development of hominins from the prior arboreal primate stock of early Australopithecines to later ones ending some two million years ago with such designations as *africanus*, *robustus*, and *boisei*. Such sense organs and powers are evident as well in the genus *Homo* beginning about two million years ago with designations such as *habilis*, *erectus*, and *sapiens* in its various forms, including, finally, modern humans. During this immense span of time, physical characteristics better suited to the human substantial form gradually appear in terms of arms, legs, hands, erect posture, and larger brains. At some point in time, the presence of genuine human beings becomes evident, measured by signs of intellective behavior. Following Aquinas, the matter must have then become "most suited" for rational operations. Today, we would speak not only of larger brains, but of more perfect brain architecture and neural function, reflected in appropriate genetic modifications.

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[57] Bonnette, *Origin of the Human Species*, 163–64.

Such genetic modifications might serve to impede natural species interspecific interbreeding.

Still, while other primates and earlier hominins might not have been *most suited* for rational operations, this does not preclude them from possibly being simply *suited* for rational operations. If all that is needed is the material organs associated with the sense power of the imagination—so that the intellect has phantasms from which to abstract concepts—what would then prevent God from infusing an intellective soul into a mastodon, a monkey, or even a mouse? The exact material disposition needed for rational operations is subject to speculation. It appears that God waited well into the evolutionary development of hominins before he chose to create a human soul, thus transforming preexisting organic matter into a true human being, Adam.

Was this (1) because the matter was not actually apt for the presence of the spiritual soul until then, or (2) because God simply chose to wait until the bodily organization was "most suited" to rational operations?

If the subhuman hominin matter was not apt for the human soul, then there must be a real material difference between Adam's descendants and the subhuman hominins, since their less perfect material organization was apparently not yet apt for the spiritual soul's infusion. I am not saying that the change in matter's disposition enabled God's infusion of the human spiritual soul, since, as shown above, form determines the ultimate disposition of the matter, not vice versa. Rather, when God freely infused the human soul, the matter was then so changed as to befit that new and higher substantial form or soul. A change so radical as to enable matter suddenly to become "apt" for actuation by the human spiritual soul might well entail genetic changes that could impede future interbreeding.

If, on the other hand, God freely chose to infuse a spiritual soul at that point in created time in which a particular hominin body was "most suited" for rational operations, no such required material change to "aptness for the human form" would have taken place, because lower hominins would already possess the material organization needed for a human soul. Therefore, no procreation-impeding genetic difference would then distinguish Adam's descendants from the subhuman hominin population.

In that case, there is the possibility that God could infuse the human spiritual soul into the offspring of any two mating hominins—be they human or subhuman. Because this population of subhumans

have a material body (matter) "suited" for rational operations, there is even the possibility for a subhuman mating with another subhuman and producing a true human—provided God infuses a spiritual soul.

Under these conditions, God's decision to infuse the human spiritual soul into the offspring of any two mating individuals becomes strictly a question of divine choice and intention, since there would be no procreation-impeding material difference between these two natural species.

This begs the question as to what was God's original intention in making Adam and Eve and in founding the human natural species. We cannot presume to know God's intention. He might have intended to create the human soul solely in cases of intraspecific procreation between members of the human natural species. Arguing that present genetic diversity requires interspecific interbreeding presupposes that there is no other way in which to defend theological monogenism except through such interbreeding. But I have shown that other explanations may indeed be possible, since the genetic case against a bottleneck of two true humans cannot be definitively demonstrated.

Following the hypothetical assumption that no procreation-impeding material differences might have existed between Adam's descendants and the subhuman hominins, then (1) God could have chosen to infuse the human soul solely in the case of mating between Adam's descendants. Or, (2) God could have ordained that interbreeding between Adam's descendants and subhuman hominins be fruitful as well. In fact, (3) God could have willed that mating between any two subhumans would produce genuinely human offspring. It becomes purely a matter of divine choice. God's ways are inscrutable, unless which alternatives were actually fulfilled have somehow been revealed. God's will excludes the third alternative, since, in that case, true humans would be born who have not inherited original sin from Adam, contrary to Catholic dogma.[58] Still, the status of the first and second alternatives is indeterminate, since divine revelation does not directly address these two possibilities.

Therefore, the interbreeding hypothesis cannot be strictly demonstrated, even assuming that no procreation-impeding material differences existed between the natural species involved. For, even without such differences, unless God freely intends to create the human

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[58] Denz., no. 1513.

substantial form needed for successful interspecific interbreeding, such interbreeding becomes objectively impossible.

On the alternative supposition that real material differences do exist between the aforesaid natural species, resulting potential genetic differences could impede successful mating. Following either alternative, the assumption that interspecific interbreeding *must* have occurred is not licit. I have demonstrated above that the genetic arguments against a bottleneck of two first human beings, such as posed by Ayala, are not definitive, which possibly obviates the necessity of any interbreeding solution at all.

Why the True Solution Ever Eludes Us

Scripture appears to suggest that God somehow used prior matter to occasion the creation of the human soul in Adam's case.[59] And yet, the line "God formed man of the slime of the earth" could imply merely that man was a material as well as spiritual composite substance.[60] God could simply have created the first human being *ex nihilo*. Still, any hypothetical evolutionary scenario requires some use of preexistent matter, some material connection leading to the first true man. It is this evolutionary hypothesis that I explore.

Evolving material substances in themselves could not educe the human form, since God alone can create the human spiritual soul.[61] This ontological shift from subhuman hominins results in the first true human being, Adam.

Having initiated the human natural species in Adam (and Eve), God then blessed our first parents, telling them to, "Increase and multiply, and fill the earth."[62] After the Flood, God told Noah and his sons again to "increase and multiply, and fill the earth."[63]

Since God's injunctions to "increase and multiply, and fill the earth" were directed to clearly rational, fully human creatures, one can reasonably assume that God's intention was the propagation of that natural species through sexual intercourse between its members. Extending procreation to include interbreeding with subhuman

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[59] Gen 2:7: "And the Lord God formed man of the slime of the earth: and breathed into his face the breath of life, and man became a living soul" (Douay-Rheims translation).

[60] Ibid. See also *CCC*, §355: "In his own nature [man] unites the spiritual and material worlds."

[61] *SCG* II, ch. 87, no. 3.

[62] Gen 1:28 (Douay-Rheims).

[63] Gen 9:1, 7 (Douay-Rheims).

hominins appears possible, since God could create a human soul in those cases as well. But, as seen above, nothing necessitates that God choose that option. While interbreeding remains possible, there is no way of proving that God embraced this choice on the grounds that it is the one and only way in which to explain present genetic diversity. That is because, in the section "Current Objections Answered," I have clearly demonstrated that the arguments against a possible explanation of present genetic diversity in terms of a bottleneck of just two first true human beings are not definitive.

On the other hand, what if there is, in fact, a potentially procreation-impeding difference between two distinct natural species involved? Then, it might be the case that the human substantial form of the human being involved in such interbreeding, in virtue of its formal superiority, could so dominate the generative process that what is effected is the same embryonic material found in procreation between two human beings. God might then will that all such embryonic material receives the human soul, regardless of the objectively morally perverse act (bestiality) through which it was produced. Or perhaps the fact that such unions might occur only in those instances when a subhuman male forces himself upon a human female—entailing no sin on the part of the true human being—might constitute conformity to a general law that God wills for successful procreation. None of these genuine, but very contingent, possibilities constitute proof of any necessity for the "interbreeding solution."

Whether possibly procreation-impeding differences in the material disposition of the diverse natural species involved in interbreeding be affirmed or denied, the result is the same: interbreeding, though seeming to be theoretically possible, might also turn out to be, de facto, impossible.

All these various uncertainties contribute to doubts about the "interbreeding solution" as an explanation of genetic diversity. It is facilely assumed that interbreeding between Adam and Eve's descendants and members of the hominin population in which they appear should be possible, since they are taken to belong to the same biological species. But the fact that they belong to diverse philosophical natural species ultimately makes such assumed possible interbreeding indemonstrable and legitimately doubtful.

Paleoanthropological claims of gradual hominization were answered earlier by pointing out that the human spiritual/intellective soul must be either fully present or entirely absent in any given

hominin, thereby making gradual emergence of human intellectual powers impossible.

Still, the true answer to the objection against a literal Adam and Eve posed by contemporary genetic diversity remains an "impenetrable mystery" for the following reasons. There are three possible solutions to the genetic problem: (1) the fact that the objections raised by molecular biology are not definitive leaves room for a genetic solution not presently known, (2) interbreeding between true humans and subhuman hominins may account for that diversity, or (3) some combination of (1) and (2). The problem with these possible solutions is that both alternatives (1) and (2) are open to factual contradiction; that is, it may be that one or the other is not actually possible, as shown above. Worse yet, the true solution can never be discovered, since there is no way to be fully certain about actual genetic conditions existing deep in the distant past. In addition, philosophical analysis reveals inherent uncertainties about the possibility of interspecific natural species interbreeding.

What is certain is that one of these two alternative explanations, or possibly some combination of both, is, in fact, a viable solution. We know this not because of the molecular biology or philosophy involved but because revealed truth affirms the existence of a literal Adam and Eve, as attested by two thousand years of miracles confirming the truth of the Catholic religion, beginning with the death and resurrection of Jesus Christ Himself—a death and resurrection that atoned for that original sin committed by the first man, the literal Adam, whose spouse was the literal Eve.

Because people tend to think in biological rather than philosophical terms, most observers will continue to prefer the interbreeding hypothesis. But that does not lessen the force of the above philosophical analysis, whose implications might, de facto, preclude an interbreeding solution and, thereby, dictate that the true solution lies in a molecular biology that is de facto open to a bottleneck of a single mating pair of first true humans, Adam and Eve. Moreover, some combination of both alternatives is also possible, wherein significantly fewer ancient alleles might need to be explained than Ayala claimed and, yet, interbreeding remains necessary in order to explain present genetic diversity.

While theological certitude demands that a literal Adam and Eve must exist, an impenetrable mystery shall ever remain as to *which* exact scenario explains precisely *how* they are scientifically possible.

And, yet, such possibility remains scientifically credible. Even in the twenty-first century, intelligent, reasonable, scientifically educated Christians still have every reason to believe in a literal Adam and Eve, the first true human beings, the founding parents of all mankind.

Postscript

While the above analysis offers a definitive explanation of epistemic limitations surrounding the ways in which a literal Adam and Eve are possible, in no way does it prevent speculation about the most probable actual solution to this fascinating mystery. Here I will offer my own attempt at such speculation, while assuming some sort of hypothetical evolutionary scenario.

Theological certitude demands that a literal Adam and Eve must exist. Still, the question remains as to whether the truth of their historic existence lies in there being (1) a way to resolve the genetic diversity problem through a single mating pair of true humans within a realistic time frame for Adam and Eve without recourse to interbreeding between subhuman hominins and the first true humans, or (2) actual interbreeding between subhuman hominins and true human beings in order to account for present genetic diversity, or (3) a combination of these two.

Speaking solely in probabilistic terms, the following might be argued. Regarding a direct genetic solution allowing for Adam and Eve, the von Salomé study cited in the section entitled "Current Objections Answered" suggests that, while a bottleneck of a single mating pair of hominins is theoretically possible, the timing of that extreme population reduction would have been at least some five million years ago, seemingly far too early to fit any realistic scenario for the biblical Adam and Eve. Moreover, even that same study, which gave the most helpful result of merely four ancient alleles to be explained, indicated the presence of more HLA-DRB1 alleles shortly after about five million years ago, thereby entailing problematic ancient genetic diversity.[64] Nonetheless, that 2007 study also indicated that most of the genetic diversity occurred in the last half million years, which would appear non-problematic, since Adam and Eve probably predate that time period.[65]

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[64] Von Salomé et al., "Full-length sequence analysis of the HLA-DRB1 locus suggests a recent origin of alleles," 264–66.

[65] Ibid., 269. Since artistic artifacts apparently requiring true intellect for their formation date back to the early Middle Pleistocene period, true man appears

The result of all this genetic information would be to suggest that a significant reduction in ancient alleles compared to Ayala's estimate would allow for fewer such alleles needing to be explained, and yet, too many might still exist in order to be explained by a single mating pair: Adam and Eve. The need for interspecific natural species interbreeding thus remains. Still, such interspecific mating between diverse natural species might have been less frequent than what some have assumed.[66]

Although the term "evolution" has been used to describe the scenario by which Adam and Eve appeared on Earth, the step from subhuman to human is not, in fact, any form of purely naturalistic biological evolution. Rather, it is a radical ontological upward step initiated by God introducing the new and qualitatively superior spiritual human substantial form into an instantly transformed and elevated human substance. As Pope St. John Paul II points out in a 1996 address to the Pontifical Academy of Sciences: "Theories of evolution which, in accordance with the philosophies inspiring them, consider the mind as emerging from the forces of living matter, or as a mere epiphenomenon of this matter, are incompatible with the truth about man."[67]

If any natural species interspecific interbreeding occurred, as I have shown was possibly necessary to achieve present genetic diversity, then the most likely explanation is either (1) that, in the case of material diversity between the subhuman hominins and Adam's descendants, the formal superiority of the substantial form of the human being so dominates the procreative process as to assure that God will then create a new human soul for its embryonic product, or (2) that God freely wills to create human souls for such interbreeding's offspring, where there is no possibly-procreation-impeding material difference between the diverse philosophical natural species involved.

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to date at least that far back in time. Adam would have to be the first true human being. See Bonnette, *Origin of the Human Species*, xiv–xv; see also Thomas Wynn, "Archeology and Cognitive Evolution," *Behavioral and Brain Sciences* 25 (2002): 389–438, esp. 398; Naama Goren-Inbar et al., "Evidence of Hominin Control of Fire at Gesher Benot Ya'aqov, Israel," *Science* 304 (2004): 725–27.

66 Kemp, "Science, Theology, and Monogenesis," 232. Following Ayala, Kemp speaks of "several thousand hominid ancestors."

67 Pope St. John Paul II, Address on "Origins and Early Evolution of Life," §5 (*Papal Addresses*, 373).

There is no way to be certain that the above scenario is the actual way that the human origin took place. Still, if one speaks in terms of mere probability, the hypothesis just given would appear to be the most reasonable *evolutionary* explanation of how a literal Adam and Eve came to be—in spite of the seeming difficulty posed by contemporary genetic diversity.

Since speculative probabilities can never equate to objective certitude, the doctrine of a literal Adam and Eve remains, as shown above, an impenetrable mystery as to the exact manner in which theological monogenism actually occurred. Still, since natural science offers no definitive case against a literal set of first parents for the entire human race, and since perfectly reasonable scenarios have been presented that comport fully with their literal existence, it remains perfectly rational—both scientifically and philosophically—to believe in this Genesis-based doctrine concerning our own uniquely superior natural species, a teaching consistently affirmed by the Catholic Church and still accepted by most Christians throughout the world as factually true. NOV