Altered Nuclear Transfer, Gift, and Mystery

An Aristotelian-Thomistic Response to David L. Schindler

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At the December 2004 meeting of the President's Council on Bioethics, Dr. William Hurlbut presented a paper in which he articulated his proposal for altered nuclear transfer (ANT).[1] He hopes the procedure can produce embryonic-type pluripotent stem cells without necessitating the destruction of an embryo in the process. Drawing upon natural occurrences of fertilization gone awry, which in turn produce tumors, Hurlbut suggested that ANT could artificially create similar

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[1] See William Hurlbut, "Altered Nuclear Transfer as a Morally Acceptable Means for the Procurement of Human Embryonic Stem Cells," *National Catholic Bioethics Quarterly* 5.1 (Spring 2005): 145–151. A version of this paper with the same title was simultaneously published in *Perspectives in Biology and Medicine* 48.2 (Spring 2005): 211–228. All references to this paper are from the version published in the *National Catholic Bioethics Quarterly*. Hurlbut had first suggested the concept of an altered nuclear transfer at a meeting of the same council two years prior. See William Hurlbut, "Statement of Dr. Hurlbut," in *Human Cloning and Human Dignity: An Ethical Inquiry* (Washington, D.C.: President's Council on Bioethics, 2002): 275.

conditions that might lead to the creation of unorganized tumor-like structures of pluripotent stem cells. Such a biological entity would "by design and from its very beginning, [lack] the attributes and capacities of a human embryo."[2] While recognizing that ANT could be used to manipulate any number of genes in the somatic cell nucleus, he isolated the gene *Cdx2* as a particular example. Studies have shown that the expression of *Cdx2* is crucial for the development of the trophectoderm and, therefore, for the organization of the inner cell mass of the primordial embryo that will eventually give rise to the organizational structure of the fetus.[3] By manipulating the expression of *Cdx2* before nuclear transfer and eliminating its expression, the trophectoderm is certain not to form and the inner cell mass not to organize, or so the theory goes. Hence, "the resulting cell system would have no inherent principle of unity, no coherent drive in the direction of the mature human form, and no claim on the moral status due to a developing human life."[4]

The crucial principle of ANT-*Cdx2*—and of any variation of ANT—is that the manipulation must occur prior to nuclear transfer, lest the process actually create and then debilitate a human embryo.[5] But ANT-*Cdx2* generated heated disagreement between ethicists and Catholic moral theologians who are otherwise agreed on all other matters pro-life.[6] Critics were concerned that the being created with ANT-*Cdx2* is not a non-embryo but rather a highly defective embryo destined from the beginning to fail in its development as the result of a technical intervention.

Seeking a compromise in the debate, thirty-five renowned theologians, ethicists, and scientists signed a joint statement titled "Production of Pluripotent Stem Cells by

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[2]Hurlbut, "Altered Nuclear Transfer," 149.

[3]See K. Chawengsaksophak et al., "*Cdx2* is Essential for Axial Elongation in Mouse Development," *Proceedings of the National Academy of Sciences USA* 101.20 (May 18, 2004): 7641–7645.

[4]Hurlbut, "Altered Nuclear Transfer," 150.

[5]See ibid., 150: "The crucial principle of any technical version of ANT, however, must be the *preemptive* nature of the intervention. This process *does not* involve the creation of an embryo that is then altered to transform it into a non-embryo entity. Rather, the proposed genetic alteration is accomplished *ab initio*, the entity is *brought into existence* with a genetic structure insufficient to generate a human embryo" (original emphasis).

[6]This sharp division was most prominent in the journals *Communio* and the *National Catholic Bioethics Quarterly*. See *Communio* 31.4 (Winter 2004): Roberto Colombo, "Altered Nuclear Transfer as an Alternative Way to Human Embryonic Stem Cells: Biological and Moral Notes," 645–648; and Adrian J. Walker, "Altered Nuclear Transfer: A Philosophical Critique," 649–684; and *Communio* 32.1 (Spring 2005): Nicanor P. Austriaco, O.P., "Altered Nuclear Transfer: A Critique of a Critique," 172–176; Adrian J. Walker, "The Primacy of the Organism: A Response to Nicanor Austriaco," 177–187; and David L. Schindler, "*Veritatis Splendor* and the Foundations of Bioethics: Notes Toward an Assessment of Altered Nuclear Transfer (ANT) and Embryonic (Pluripotent) Stem Cell Research," 195–201. See also the *National Catholic Bioethics Quarterly* 5.2 (Summer 2005): W. Malcom Byrnes, "Why Human 'Altered Nuclear Transfer' is Unethical: A Holistic Systems View," 271–279; Maureen L. Condic and Samuel B. Condic, "Defining Organisms by Organization," 331–353; and Paul J. Hoehner, M.D., "'Altered Nuclear Transfer': Probing the Nature of Being Human," 261–269.

Oocyte-Assisted Reprogramming."[7] Some of the joint statement's signatories included persons who had been critical of Hurlbut's earlier ANT-*Cdx2* example. ANT-OAR was developed in response to one of the primary criticisms of ANT-*Cdx2*. Specifically, more than a few of the critics noted that *Cdx2* was not expressed in the initial single-cell phase of the organism. It is only expressed after the first division. Thus, in the initial stage, it would seem the single-cell product of ANT-*Cdx2* remains a totipotent cell (hence, an embryo) predesigned to disorganize.[8] Unlike ANT-*Cdx2*, ANT-OAR proposes to manipulate both the cytoplasm in the enucleated oocyte and the somatic nucleus in order to direct the inevitable process of reprogramming that any nucleus undergoes when inserted into the oocyte cytoplasm. The transcription factor *Nanog* "is *not* present in oocytes or single-celled embryos, but first becomes expressed weakly in the morula and then highly in the ICM [the pluripotent inner cell mass of the blastocyst, which normally becomes the fetus]."[9] ANT-OAR would seek to over-express *Nanog* in the somatic nucleus or the cytoplasmic sac (i.e., the enucleated oocyte), or both, to prejudice the reprogramming process in favor of the expression of *Nanog*, thus guaranteeing that the resulting product would not be totipotent but pluripotent *ab initio*. It would, in other words, never exist in totipotency before pluripotency.

This attempt at compromise hardly settled the matter. If anything, it increased the debate.[10] Most of the critics simply marshaled their previous objections to ANT-*Cdx2*

[7] Joint Statement with Signatories, "Production of Pluripotent Stem Cells by Oocyte-Assisted Reprogramming," *National Catholic Bioethics Quarterly* 5.3 (Autumn 2005): 579–583.

[8] After the development of ANT-OAR, new research indicated an earlier expression of *Cdx2* than previously thought, leading some critics (e.g., Edward Furton) to reassess their earlier criticism. See Edward J. Furton, "Prospects for Pluripotent Stem Cells: A Reply to *Communio,*" *National Catholic Bioethics Quarterly* 6.2 (Summer 2006): 223–232. The study suggesting an earlier expression of *Cdx2* is K. Deb et al., "*Cdx2* Gene Expression and Trophectoderm Lineage Specification in Mouse Embryos," *Science* 311.5763 (February 17, 2006): 992–996. Since its publication, however, this study was subjected to an investigation by the University of Missouri, where it was conducted, and it was recently retracted. See D. Kennedy, "Editorial Expression of Concern," *Science* 314.5799 (October 27, 2006): 592; and "Retraction of Deb et al., *Science* 311 (5763) 992–996," *Science* 317.5837 (July 27, 2007): 450.

[9] "Joint Statement," 580–581 (original emphasis). See K. Mitsui et al., "The Homeoprotein *Nanog* Is Required for Maintenance of Pluripotency in Mouse Epiblast and ES Cells," *Cell* 113.5 (May 30, 2003): 631–642; S. Hatano et al., "Pluripotential Competence of Cells Associated with *Nanog* Activity," *Mechanisms in Development* 122.1 (January 2005): 67–79.

[10] See Adrian J. Walker, "A Way around the Cloning Objection against ANT? A Brief Response to the Joint Statement on the Production of Pluripotent Stem Cells by Oocyte Assisted Reprogramming," *Communio* 32.1 (Spring 2005): 188–194; and David L. Schindler, "A Response to the Joint Statement, 'Production of Pluripotent Stem Cells by Oocyte Assisted Reprogramming,'" *Communio* 32.2 (Summer 2005): 369–380. See also *Communio* 32.4 (Winter 2005): José Granados, "ANT-OAR: Is Its Underlying Philosophy of Biology Sound?" 724–743; Stuart W. Swetland and William L. Saunders, "Joint Statement on the Oocyte Assisted Reprogramming (OAR) Proposal: A Response to Criticisms," 744–752; E. Christian Brugger, "ANT-OAR: A Morally Acceptable Means for Deriving Pluripotent Stem Cells: A Reply to Criticisms," 753–769; Adrian J. Walker, "Reasonable Doubts: A Reply to E. Christian Brugger," 770–783; Adrian J. Walker, "Who Are the Real Aristotelians? A Reply

against ANT-OAR.[11] The leaders of the resistance against not only ANT-OAR and ANT-*Cdx2* but any ANT procedure are two editors of *Communio*, David Schindler and Adrian Walker. The debate has offered them the opportunity to clarify repeatedly their objections, which reach a more mature (but likely not final) form in their most recent articles on the issue.[12] In these two essays, both scholars offer what they hold to be an Aristotelian-Thomistic objection to any ANT procedure. While many of their intuitions resonate with Aristotelians and Thomists, I do not believe they have represented either the Philosopher or the Common Doctor accurately.

Since Walker's recent essay is a defense of Schindler's objections, in this paper I will focus almost exclusively on the latter's reading of Aristotle and St. Thomas Aquinas. I will isolate the precise lacunae in Schindler's presentation and, thereby, demonstrate why his reading of Aristotle and Aquinas cannot be used to mount an effective objection against ANT on strictly Aristotelian-Thomistic grounds. Let me be clear. I am not here defending the ANT-OAR proposal per se. I am simply arguing that Schindler has misused Aristotelian-Thomistic categories to buttress his own objections.

This paper will proceed in three sections. First, I will offer a brief synopsis of the ANT-OAR procedure along with the basic argument of its proponents. Second, I will present Schindler's Aristotelian-Thomistic objection against it. Finally, I will respond to Schindler's reading of Aristotle and Aquinas with my own review of Aristotelian-Thomistic sources.[13]

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to Edward J. Furton," 784–794; and David L. Schindler, "*Agere Sequitur Esse*: What Does It Mean? A Reply to Father Austriaco," 795–824. See also Edward J. Furton, "A Defense of Oocyte-Assisted Reprogramming," *National Catholic Bioethics Quarterly* 5.3 (Autumn 2005): 465–468; Nicanor P. Austriaco, O.P., "Are Teratomas Embryos or Non-Embryos? A Criterion for Oocyte-Assisted Reprogramming," *National Catholic Bioethics Quarterly* 5.4 (Winter 2005): 697–706; Furton, "Prospects for Pluripotent Stem Cells," 223–232; Nicanor P. Austriaco, O.P., "The Moral Case for ANT-Derived Pluripotent Stem Cell Lines," *National Catholic Bioethics Quarterly* 6.3 (Autumn 2006): 517–537.

[11] For the most explicit example of this, see Granados, "ANT-OAR," 736–743.

[12] See Walker, "Who Are the Real Aristotelians?" and Schindler, "*Agere Sequitur Esse*."

[13] Since this article was written, Shinya Yamanaka, M.D., of the University of California, has published his research on inducing specified cells (such as mouse skin cells) to revert to a pluripotent state. The possibility of induced stem cells would make the present debate surrounding ANT moot. Nevertheless, it remains a worthy exercise for Catholic moral theologians to discuss variant philosophical and theological methodologies when confronted with such potentially powerful advances in medical and scientific research. See S. Yamanaka et al., "Generation of Germline-Competent Induced Pluripotent Stem Cells," *Nature* 448.7151 (July 19, 2007): 313–317, and "Strategies and New Developments in the Generation of Patient-Specific Pluripotent Stem Cells," *Cell Stem Cell* 1 (June 7, 2007): 39–49. For a review of the scientific literature on these studies, see the section on induced pluripotent stem cells and nuclear reprogramming technology in Nicanor P. Austriaco, O.P., "Science Notes," *National Catholic Bioethics Quarterly* 7.3 (Autumn 2007): 569–571.

ANT-OAR

It is important to recognize, first, that both the signers of the joint statement and the defenders of ANT-OAR have suggested, up to this point, only research on animal cells.[14] Like other ANT proposals, ANT-OAR rests primarily upon what may be called the "epigenetic assumption." This assumption is best described by the joint statement itself: "Possession of a human genome is a *necessary* but not *sufficient* condition for defining a human embryo with its inherent dignity. Rather the nature of each cell depends on its epigenetic state, i.e., which subset of the approximately thirty thousand human genes is switched on or off and, if on, at what level."[15] Additionally, like other ANT proposals, ANT-OAR hinges on the fact that any alterations to either the enucleated oocyte or the somatic nucleus will be prior to the transfer and fusion.[16] Hence the term, "altered nuclear transfer."

The insistence upon alteration before transfer concerns the power of the cytoplasm within the oocyte to reprogram the somatic nucleus. In somatic cell nuclear transfer (SCNT), the process by which the sheep Dolly was cloned, a nucleus is taken from a donor cell (e.g., a skin cell) and transferred directly into the cytoplasm of an enucleated oocyte. The cytoplasm reprograms the somatic nucleus from its previous epigenetic state in the donor cell (in this case, a skin cell) to a new epigenetic state for the newly created cell (in the case of SCNT, a totipotent single-celled embryo).[17] The reprogramming thus gives the new cell the ability to follow its own self-directed path as governed by its unique genome. This same process of reprogramming occurs naturally when the haploid nuclei of the gametes fuse into a new and unique diploid nucleus, which is then reprogrammed by the cytoplasm of the oocyte to the epigenetic state of a totipotent cell.

ANT-OAR proponents claim to have discovered certain transcription factors present in pluripotent cells that are not present in either oocytes or single-celled embryos. Simply put, transcription factors are proteins present in cells which interact with the cell's DNA to control suppression or expression of various genes as the

[14] See "Joint Statement," 579; Swetland and Saunders, "Joint Statement on the Oocyte Assisted Reprogramming," 744; Brugger, "ANT-OAR," 755; Furton, "Defense of Oocyte-Assisted Reprogramming," 465, and "Prospects for Pluripotent Stem Cells," 227.

[15] "Joint Statement," 580 (original emphasis). See also Swetland and Saunders, "Joint Statement on the Oocyte Assisted Reprogramming," 745; Austriaco, "Altered Nuclear Transfer," 173–174; and Brugger, "ANT-OAR," 755. See also Austriaco, "Moral Case," 519–521, for a summary of the scientific understanding behind the epigenetic assumption. For a more thorough overview of epigenetics, see Bruce Stillman and David Stewart, eds., *Epigenetics*, Cold Spring Harbor Symposia on Quantitative Biology, vol. 69 (Cold Spring Harbor, NY: Cold Spring Harbor Press, 2004).

[16] "Joint Statement," 581.

[17] See Brugger, "ANT-OAR," 755–756. For a review of the scientific literature on the programming potential of the cytoplasm in the oocyte, see Austriaco, "On Static Eggs and Dynamic Embryos: A Systems Perspective," *National Catholic Bioethics Quarterly* 2.4 (Winter 2002): 659–683.

cells divide and specialize into the various cells required for the human organism. One of the uniquely pluripotent stem cell transcription factors is *Nanog*. ANT-OAR proposes to over-express *Nanog* in either the somatic cell nucleus, the cytoplasm of the oocyte, or both, in order to guarantee that the reprogramming process will be prejudiced. The new cell would be pluripotent, but would never have passed through the initial totipotent state of an embryo.[18]

The proponents of ANT-OAR argue that the over-expression of *Nanog* prevents the newly created cell from ever being a totipotent cell. Further animal studies are necessary in order to confirm (or refute) this point, but it seems that this cell would not have the intrinsic ability to follow a self-directed path toward organization. Thus, Nicanor Austriaco, O.P., introduced the concepts of active and passive potentiality. An active potentiality "is actualized wholly from within. It is indicative of an entity's nature—its ontological status."[19] A passive potentiality, "is actualized from without. It requires the active causal intervention of an external agent in order to be realized."[20] To use Austriaco's own example, an acorn has the active potential to become a tree but only a passive potential to become a desk. It may be that the cell created by ANT-OAR has a passive potential to be a human embryo even though it did not pass through a totipotent stage, but proponents claim that this would only be the case with additional scientific intervention post–nuclear transfer.

The goal of the proposal is to use animal cells to determine whether the product of ANT-OAR has an active potentiality to develop into an embryo. The determination would be made through material and temporal analysis.[21] Citing the scholastic maxim *agere sequitur esse* ("action follows being"), Austriaco declares that if the thing does not act as an embryo, we can have prudential certainty that it is not, in fact, an embryo.[22] Wanting to maintain the Aristotelian-Thomistic hylomorphic theory of the unity of body and soul, ANT-OAR proponents point to the need for material disposition before receipt of a proper substantial form. They are arguing that the ANT-OAR product is not an apt material (*materia apta*) to receive the human form (i.e., a soul) because of the material's inherent lack of biological organization.

[18] "Joint Statement," 580–582. See Hatano et al., "Pluripotential Competence of Cells Associated with *Nanog* Activity," 67–79; K. Mitsui et al., "The Homeoprotein *Nanog* Is Required for Maintenance of Pluripotency in Mouse Epiblast and ES Cells," *Cell* 113.5 (May 30, 2003): 631–642.

[19] Austriaco, "Are Teratomas Embryos or Non-Embryos?" 701. See also the appendix to his article "Moral Case," titled "Knowing Embryos, Princes, Toads: A Further Response to *Communio*," 531–537.

[20] Ibid., 701.

[21] See Brugger, "ANT-OAR," 763–764; Austriaco, "Are Teratomas Embryos or Non-Embryos?" 697–706.

[22] Austriaco, "Are Teratomas Embryos or Non-Embryos?" 705–706.

David Schindler on Aristotle and Aquinas

David Schindler and Adrian Walker have led the charge against ANT. In his most recent article on the subject, Schindler has finally provided a systematic outline of his philosophical objections to the claims of ANT proponents. His primary interlocutor is Austriaco. I will outline here Schindler's stated points of agreement and disagreement with Austriaco. These disagreements lead Schindler to articulate his objections in an apparent Aristotelian-Thomistic mode, which, in turn, confirms his primary philosophical categories of "gift" and "mystery" in reference to the beginning of human life.

Schindler agrees that the epigenetic state of a cell can tell us something about its substantial identity.[23] His concern, however, is that Austriaco is effectively relying entirely on the empirically verifiable epigenetic state of a cell to determine its ontological identity. On the contrary, Schindler says that the epigenetic state cannot conclusively determine ontological nature. He holds that Austriaco is confused on precisely this point—namely, that Austriaco believes the epigenetic state determines, rather than simply reveals, the cell's ontology. He claims that Austriaco has thus apparently made an a priori judgment by which he interprets his empirical observations. But according to Schindler, "[the] *indispensable role of empirical observation is not, and cannot be, the sole or indeed most basic criterion for ascertaining the ontological identity*."[24] It seems that this core disagreement between Schindler and Austriaco is not scientific but philosophical.

Fundamentally, Schindler is convinced that, "in principle, an organism (embryo) might behave in a disorganized fashion (like a tumor), not because it is a non-organism, but because on the contrary it is, or was in its original constitution, a radically defective organism."[25] In other words, the later disorganization in an organism's life cycle does not reveal its original ontological status. He suggests, then, that teratomas (tumors) may have originally been human organisms. In Aristotelian-Thomistic terms, this is to say, "that a *distinction* (not a separation) must be made between the manifest organization/behavior and the substantial identity of a biological entity."[26] He claims that Austriaco misses this fundamental philosophical point in his reading of the principle *agere sequitur esse*.

As Schindler reads him, Austriaco's understanding of the principle *agere sequitur esse* can be summarized in three assertions. First, empirically accessible properties account for our knowledge of ontological identity.[27] Second, far from being an example of mechanism, this follows straightforwardly from the maxim

[23] See Schindler, "*Agere Sequitur Esse*," 797, 799.

[24] Ibid., 797 (original emphasis).

[25] Ibid., 800–801.

[26] Ibid., 801 (original emphasis).

[27] Austriaco, "Are Teratomas Embryos or Non-Embryos?" 706. See also Schindler, "*Agere Sequitur Esse*," 802.

agere sequitur esse. Finally, according to Schindler, Austriaco equates the meaning of this maxim with the claim that cells are "different ontologically because they are organized and behave differently."[28] Schindler concludes that, according to Austriaco, "it is the empirically accessible epigenetic state (acting) that accounts for the *respective ontological identities* (being) of these different cells."[29] The philosophical flaw Schindler highlights here is that Austriaco has confused the ontological claim of the Aristotelian-Thomistic principle with its cognitional claim. While being is revealed in acting, i.e., the substantial identity is revealed in the epigenetic state, this is only in the cognitional order. In the ontological order, however, changing action does not change being, since action follows from or flows from being itself (*agere sequitur esse*). Therefore, a difference in epigenetic state does not necessarily indicate an ontological difference.[30] The maxim *agere sequitur esse*, Schindler asserts, "rightly Thomistically understood, does not imply that being ('in itself') is knowable *apart from* its empirical effects, only that the being ('in itself') that is known *in* its empirical effects is not thereby reducible *to* those effects, either cognitionally or ontologically."[31] Being is always something more than acting, and its revelation is not exhausted by action. Therefore, Schindler says, Austriaco's position cannot claim Aristotelian-Thomistic authority.

In contrast to Austriaco, Schindler offers his own understanding of the Aristotelian-Thomistic principle *agere sequitur esse* in five points. First, "an organism is defined first by its substantial form, not by its manifest organization, which on the contrary is the first (ontological, not temporal) consequence of form."[32] Active and passive potentialities are important only secondarily. There is a "downward causality" from the form to the matter according to Schindler. For Aristotle and Aquinas, he says, "the soul, in accounting first for the unity of the organism, (thereby) exercises a 'downward' causality through the entire organism, in whole and in all of its 'parts.' Which is to say, this 'downward' causality operates in the organism from an organism's instantaneous, all-at-once beginning until its death."[33] Second, and following from the first assertion, "*substantial unity* characteristic of an organism is thus not synonymous with the unity constituted by the coordination of parts. … Rather, these various parts *are organized* because the substantial form of the organism *organizes* them."[34] For an Aristotelian, the unity of a system presupposes a substantial form.

Third, "substantial form is the internal principle *of* organization: it is what first accounts for the order that is manifest in organization. Which is to say, organization

[28] Austriaco, "Are Teratomas Embryos or Non-Embryos?" 706.

[29] Schindler, "*Agere Sequitur Esse*," 802 (original emphasis).

[30] Ibid., 803.

[31] Ibid., 805 (original emphasis).

[32] Ibid., 806.

[33] Ibid., 807.

[34] Ibid., 807 (original emphasis).

is the (external) manifestation of the (internal) principle of order."[35] The immaterial substantial form exerts an immanent activity on the matter of the organism to bring the matter into order according to the form. Fourth, though the substantial form is the principle of organization, "in accord with a rightly understood Aristotelianism, this priority of form in establishing the organization of the whole does not at all deny, but on the contrary simultaneously presupposes, a material platform, as it were, upon which form itself depends."[36] The "all-at-once" unity of the form "necessarily presupposes the progressive development and integration of material parts."[37] The form unfurls its organization in the matter to which it adheres. Schindler asserts, "The crucial point for Aristotle, however, is that this progressive development and integration of material parts itself occurs only always from within, and simultaneously by virtue of, the (absolutely) prior all-at-once unity and agency of form."[38] Thus Schindler acknowledges that there is a commensurability between form and matter (*materia apta*), but, and this is important, the "mutuality is *asymmetrical*. What may be termed the *relative priority* of matter/material parts ('potency') in accounting for that unity always presupposes what may be termed the *absolute priority* of substantial form ('act')."[39] For Schindler, then, the substantial form is the immanent cause of biological organization and has absolute priority over matter.

Finally, though the asymmetrical priority of substantial form vis-à-vis the *materia apta* indicates a hierarchical nature of the organism, Schindler insists that this hierarchy is not tyranny. He writes, "The causal agency within an organism, in a word, remains *simultaneously* 'downward' from the whole to the parts and 'upward' from the parts to the whole, with the absolutely prior causal movement and agency of the form that renders the organism as such whole always presupposing the relatively prior causal movement and agency of the parts."[40] By allowing for the mutual interaction and causality of form and matter, Schindler undercuts what would have been a sharp critique of his interpretation of Aristotle; namely, without this final point, Schindler could be accused of emphasizing substantial form to such a degree as to allow for no influence of the *materia apta*. Ignoring matter's influence would lend credence to the claim that Schindler is anti-science. As it is, though, he clearly accepts a mutual interaction between the two ontological principles of an organism even if he does not thoroughly explain the contribution of the *materia apta*.

For Schindler, unlike Austriaco, fusion is "the first and all-at-once moment in which the somatic cell nucleus fuses with the enucleated oocyte"[41] and, therefore, is the all-at-once moment when "*a new human cell, endowed with a new and exclusive*

[35] Ibid., 808 (original emphasis).

[36] Ibid., 809.

[37] Ibid.

[38] Ibid., 809.

[39] Ibid., 800 (original emphasis).

[40] Ibid., 810.

[41] Ibid., 818.

informational structure that forms the basis of further development, begins to operate as a unit."[42] For Austriaco, the constituting event of the organism is the coming into existence of a cell with a totipotent epigenetic state, having had its nucleus reprogrammed thus by the oocyte cytoplasm. This is the case whether the nucleus to be reprogrammed is the combined nuclei of gametes or a somatic nucleus. Schindler maintains, on the contrary, that reprogramming is a "second stage" moment and is, in fact, an action resulting from the already present substantial form, which, as we have seen, guides all subsequent ordering processes. He maintains that Austriaco makes this error not only because of his apparent empiricism but because of his philosophical assumptions. "Having already confused substantial identity with manifest organization … Austriaco has just so far lost any principled capacity to consider the ontological implications of the fusion of the somatic cell nucleus and the enucleated oocyte."[43]

The preceding explains Schindler's previous emphasis on the fusion of gametes (or a somatic cell nucleus with an enucleated oocyte) and his two favored philosophical categories: gift and mystery. Given the dependence of matter and form on each other, the whole composite must itself be dependent in order to avoid an infinite regress. Therefore, the composite "must somehow *be given to itself, not self-generated but received*. Thus Aquinas insists that substantial form itself is not able finally to account for the being of the organism."[44] The creation of the human composite is a gift and reason must recognize its limits in the face of the mystery of the origins of human life. This is the intrinsic conceptual flaw in all ANT procedures. Given the limit of our knowledge in the nature of being in itself, and the gift of the human composite, ANT proponents can never exhaustively demonstrate that the product of ANT-OAR is *not* a human embryo.[45]

Response

Much is to be commended in Schindler's (and, for that matter, Walker's) critique of the ANT procedure and of Austriaco in particular. What is striking about Schindler's most recent article, however, is that while he claims to be arguing from an Aristotelian-Thomistic perspective, and the jargon he uses certainly evinces his claim, he cites Aquinas only once and never cites Aristotle.[46] It would seem that if one

[42] Angelo Serra and Robert Colombo, "Identity and Status of the Human Embryo: The Contribution of Biology," in *Identity and Status of the Human Embryo: Proceedings of the Third Assembly of the Pontifical Academy for Life*, eds. Elio Sgreccia and Juan de Dios Vial Correa (Vatican City: Libreria Editrice Vaticana, 1998), 153 (original emphasis), quoted in Schindler, "*Agere Sequitur Esse*," 816.

[43] Schindler, "*Agere Sequitur Esse*," 818–819.

[44] Ibid., 821–822, citing Thomas Aquinas, *Summa theologiae*, I, Q 44 (original emphasis). This is Schindler's lone citation of either Aquinas or Aristotle.

[45] See Ibid., 823.

[46] The same critique can be made of Walker's article, "Who Are the Real Aristotelians?" Walker never cites either Aristotle or Aquinas. In fact, none of the articles by Schindler and Walker concerning ANT ever cite Aristotle or Aquinas, with the exception of the instance mentioned in note 44 above.

were going to argue that one's interlocutors are not authentic Aristotelian-Thomists, one should refer to the sources of Aristotle and Aquinas to prove the point. Since he often invokes the authority of Aristotle and Aquinas but fails to cite the relevant texts to support his claims, Schindler is ill-equipped to withstand a counterargument from the relevant texts. In this section, I will show that though Schindler is right in many respects in his apparently intuitive understanding of Aristotle and Aquinas, he has missed some important subtleties in their thought.

Certainly Schindler is right that substance is a primary category of definition. A substance is the "what" of a thing, simply put.[47] He is not accurate to imply, however, that Aristotle is only secondarily concerned with act and potency after defining the substance.[48] Yes, the substance is the definition of a thing but we can only define that thing after having studied its activities and its potentialities. Aristotle spends two chapters in Book IX of the *Metaphysics* explaining this.[49] There Aristotle reveals his typical concern with potentiality (or capacity) as a defining characteristic of substance as he distinguishes between active potentialities (capabilities) and passive potentialities (capabilities) just as Austriaco and other ANT proponents have done.[50] Though he is concerned with being *qua* being in the *Metaphysics*, Aristotle does not leave the sensible (empirical) world behind to engage in mere abstraction and ethereal speculation. Rather, the *Metaphysics* oscillates between what is universal and what is concrete, using the tools of experience, rational abstraction, and analogy.[51]

In this debate, we are not concerned with being in itself, but with the nature of the concrete beings created by the ANT procedure. The limiting factors of potency and matter must, therefore, be considered in any Aristotelian-Thomistic discussion. Yes, the human person is a composite of matter (body) and form (soul).[52] And certainly, the (first) act of the soul's existence (ontologically speaking) gives rise to all the activities of the body.[53] Schindler uses this point to ground his theory that the soul, from the moment fusion begins, guides the ordering process of the material.

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[47] See Aristotle, *Metaphysics*, III, 3, 1028b33–1029a9. All English translations of Aristotle's works are from Jonathan Barnes, ed., *The Complete Works of Aristotle: The Revised Oxford Translation*, 2 vols. (Princeton: Princeton University Press, 1984). See Thomas Aquinas, *Summa theologiae*, I, Q 3.5, reply 1; Q 77.1. All English translations of the *Summa theologiae* are from *Summa theologiae*, trans. Fathers of the English Dominican Province (New York: Benziger Brothers, 1948; repr. Allen, TX: Christian Classics, 1981).

[48] See Schindler, "*Agere Sequitur Esse*," 813.

[49] See Aristotle, *Metaphysics*, IX, 6–7, 1047a25–1049b2.

[50] See Aristotle, *Metaphysics*, IX, 7, 1049a12–18. See also *Metaphysics*, V, 12, 1019a33–1019b15; V, 15, 1021a15–26; Aquinas, *Commentary on Aristotle's Metaphysics*, bk. 5, lec. 4, par. 961–963; bk. 5, lec. 17, par. 1023–1025; bk. 9, lec. 8, par. 1860.

[51] See Aristotle, *Metaphysics*, I, 1. The unique composite of soul and body demands that all knowledge have some sensible content. See, for example, Aquinas, *Summa theologiae*, I, Q 76.5, and reply 2.

[52] See Aquinas, *Summa theologiae*, I, Q 29.4; Q 76.1.

[53] See Aristotle, *On the Soul*, II, 4, 415a9–11; Aquinas, *Summa theologiae*, I, Q 76.3–4; and *Summa contra gentiles*, II, 58; 88, 11; 89, 21.

However, Schindler fails to note the importance of matter in Aristotelian-Thomistic metaphysics. Matter, Aristotle says, is the substratum of all change.[54] For Aristotle, all change in the physical world is matter acquiring and shedding various forms. A seed becomes a tree. It is the same matter, but a different form.[55] While forms can exist without matter (as when the form of a house exists in the mind before it is built), matter can never exist without a form.[56] All material things are composites of matter and form. We impress a form on matter in the things we make (for example, when we sculpt a block of marble to look like the Blessed Mother). But even for Aristotle, matter is always "given"; we never create matter, since this would lead to an infinite regress. Matter is fundamentally in potency until actualized by form.[57] This, after all, was the basis for Aquinas's first proof for the existence of a Creator.[58]

Furthermore, Schindler seems oblivious to the fact that both Aristotle and Aquinas insisted that the soul could only be the form of a matter suitably disposed and suitably organized. Aristotle writes, "The soul must be a substance in the sense of the form of a natural body having life potentiality within it. … The body so described is a body which is organized."[59] Aquinas agrees with this observation.[60] Different forms (or souls) are limited by the different levels of organization of their bodies. A body organized as a plant can be informed only by a sensitive soul, a body organized as an animal by an animal soul, and a body organized for a human being by a human soul. Both Aristotle and Aquinas emphasized this point so strongly that they hypothesized a succession of souls in the human embryo from the sensitive through the animal to the intellectual in order to allow for a sufficiently organized material (*materia apta*) to receive the intellectual soul.[61]

Here, I will not address Schindler's concerns about defining organisms by organization. That work has already been done.[62] The need for organization need not be thoroughly addressed, because Schindler circumvents the issue by referring to

[54] See Aristotle, *Physics*, I, 9, 192a24–35.

[55] Aristotle's *Physics* is concerned with the concept of motion and change. For a preview of his project, see Aristotle, *Physics*, I, 7, 189b30–191a22.

[56] Aquinas verifies his understanding of Aristotle on this point in *Summa theologiae*, I, Q 66.1.

[57] See Aristotle, *Metaphysics*, VII, 8–9, 1033a24–1034b19; XII, 6, 1071b3–1073a12.

[58] See Aquinas, *Summa theologiae*, I, Q 2.3; and I, Q 44.1–2.

[59] Aristotle, *On the Soul*, II, 1, 412a20–21, 27–28.

[60] See Aquinas, *Commentary on Aristotle's* De Anima, bk. 2, lec. 1, pars. 229–230; and *Summa theologiae*, I, Q 76.4, reply 1.

[61] Aristotle, *On the Generation of Animals*, II, 3, 736a24–21; Aquinas, *Summa theologiae*, I, Q 118.2; and I, Q 76.3, reply 3; Aquinas, *Summa contra gentiles*, II, 89, 9.

[62] See Condic and Condic, "Defining Organisms by Organization," 331–353. The article's suggestion that there might be species-specific souls seems to me a valid updating of the Aristotelian-Thomistic concept of the relationship between the organization of a body and the soul which informs the body.

his philosophical categories of gift and mystery. Recall that Schindler holds that the coordination of the parts, or the external manifestation of organization in the material (*materia apta*), is the result of the ontologically and temporally prior internal ordering principle of the substantial form (the soul), which is the organism's wholeness. To use one of Schindler's own confusing but catchy phrases, "The organism in its actual wholeness is prior to the organism in the coordinated action of its parts, even as the coordinated action of parts is simultaneously and subordinately necessary for that actual wholeness."[63] This is why he maintains the soul comes into existence all-at-once at the fusion of gametes (or the fusion of the somatic cell nucleus with the enucleated oocyte, as the case may be) and then unfolds its organization materially, initially by guiding the reprogramming process of the nucleus.

Presuming that he does not want to posit the pre-existence of the soul before its union with matter, Schindler is left in an awkward position to explain how the matter is sufficiently organized in the first place to receive the soul. After he has dismissed the legitimacy of the Aristotelian-Thomistic principle of the necessary organization of the *materia apta* to receive a specific form, Schindler reduces the union of the two principles (soul and body) to mystery and dependency. The whole composite "must somehow *be given to itself, not self-generated but received*."[64] He cites the question in the *prima pars* of the *Summa theologiae* in which Aquinas argues that God is the creator of all being. This is hardly a disputable assertion among Christians. Yet Aquinas holds that God's governance of the world and interaction with the world is not as immediate as Schindler implies. Specifically, Aquinas says that while all things are governed by God, they are not all governed immediately by him. Rather, God makes use of creatures as instruments, that is, as secondary causes of his primary causality.[65] This fact impinges upon Schindler's apparent Aristotelian-Thomistic analysis.

The soul is the *only* principle of the human person that is *immediately* produced by God during reproduction, according to Aquinas. The human soul is a wholly immaterial substance. Unlike sensitive souls and the souls of brute animals, which are contingent entirely on matter, the intellectual soul has powers and functions not limited to the body (i.e., the power of reason). The intellectual soul cannot be the result of a transmutation of matter or mere material generation. It must be immediately created by God.[66] Even the pagan Aristotle held that the intellectual soul is an "extrinsic principle" in the generation of the human person.[67] The material principle, however, is *not* immediately produced (or "given") by God.

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[63] Schindler, "*Agere Sequitur Esse*," 821.

[64] Ibid., 821–822, citing Aquinas, *Summa theologiae*, I, Q 44 (original emphasis). This is the only reference to Aquinas by Schindler in the entire debate.

[65] See Aquinas, *Summa theologiae*, I, Q 103.6.

[66] See Ibid., I, Q 90.3; Q 91.4, reply 3.

[67] See Aristotle, *On the Generation of Animals*, II, 3, 736b28; 737a9–10. See Aquinas, *Commentary on the Metaphysics*, bk. 8, lec. 8, par. 1456.

In numerous places, both Aristotle and Aquinas insist that an actualized substance must exist prior to a new substance's coming into existence, and in the case of the human person, this prior substance must organize the matter for its eventual reception of the intellectual soul.[68] The Aristotelian-Thomistic distinction between mover and moved is maintained not only in the physical realm but also in the biological realm, both of which are necessitated by the basic metaphysical distinction between act and potency. A potential being cannot be brought into act but by the agency of another.[69] While Schindler's view of hylomorphism suggests that God himself is the being-in-act necessary for the formation of the human composite, according to Aquinas, God immediately infuses the soul but leaves the organization of matter to secondary causes.

Everyone agrees that the soul is the first act of the body.[70] But if the intellectual soul must be the act of a body sufficiently organized to potentially bear the operation of an intellectual soul, how is the matter first organized to receive, at least potentially, the intellectual soul? Even though the theory of delayed hominization allows the embryo to develop successively to a certain level of complexity, inferior souls such as sensitive or animal souls do not have the inherent capabilities of organizing the matter sufficiently to receive an intellectual soul. Neither the sensitive nor the animal soul has the ability to transcend their operations to prepare for the operations of a higher soul.[71] Aquinas concludes that the soul of the father is at work in the formation of the body for the child. He writes, "It therefore remains that the formation of the body, especially as concerns its primary and principal parts, is not due to the soul of the thing generated*, nor to a formative power acting by virtue of the generated subject, but to a formative power acting by virtue of the generative soul of the father*, the work of that soul being the production of that which is specifically like the generator."[72]

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[68] See, for example, Aristotle, *Metaphysics*, VII, 9, 1034b8–19; IX, 8, 1050a4–16; Aquinas, *Commentary on the Metaphysics*, bk. 7, lec. 8, par. 1437ff.

[69] See Aristotle, *Physics*, III, 3; *Metaphysics*, VII, 7, 1032a–25, and IX, 8, 1050a4–16. See Aquinas, *Commentary on the Metaphysics*, bk. 7, lec. 9, pars. 1391–1392.

[70] In the following, I am indebted in part to Stephen J. Heaney, "Aquinas and the Presence of the Human Rational Soul in the Early Embryo," *Thomist* 56 (1992): 19–48. Heaney is concerned with a different question, namely, the immediate hominization of the embryo. His article, however, offers a fine survey of Aristotelian-Thomistic sources on reproduction.

[71] See Aquinas, *Summa contra gentiles*, II, 89, 8.

[72] Ibid. (emphasis added). In the same chapter, Aquinas responds to an earlier objection that the soul of the begotten child forms the body, since Aristotle says the human soul is the efficient cause of the body (see Aquinas, *Summa contra gentiles*, II, 88, 11; Aristotle, *De anima*, II, 4, 415b10). Aquinas responds, "That the body is conformed to the soul and that, therefore, the soul forms a body like to itself, is partly true and partly false. This statement is true if referred to the soul of the begetter, but false if referred to the soul of the begotten; for, as regards its primary and principal parts, the body is not formed by the power of the latter's soul, but by that of the former. … So, too, is every matter configured to its form: a configuration which, however, is not brought about by the action of the thing generated, but

In Aristotle's and Aquinas's scientific worldview, the semen of the father is the active element operating on the menstrual blood of the mother.[73] Confronted with these facts, one might argue that that the child's soul must be in the semen to work on the material. Yet Aquinas explicitly rejects this as impossible.[74] This is not surprising since the material of the semen is obviously not sufficiently organized to be informed by an intellectual soul. Furthermore, a soul "is united only to a body of which it is properly the act."[75] Aquinas is left to conclude that the semen is an instrumental cause produced by the father. His soul works through the medium of the semen.[76] This point is also found in Aristotle.[77] As instrumental cause, the semen contains a formative power that acts on the material of the menstrual blood to form the embryo.[78]

Aquinas writes that the formative power in the semen is "permanently intrinsic and does not proceed from an extrinsic source, as does the power of a mover which is in the things that are thrown."[79] A thrown baseball receives the power of momentum from the pitcher, but the momentum is nonetheless the baseball's own (once it departs from the pitcher's hand). It would be a very different metaphysical scenario (and quite a different game) if the pitcher never released the baseball but walked it to the plate. In this latter case, the momentum remains the pitcher's and is never really imparted to the baseball. A thrown ball, however, is the action of the pitcher even though it is no longer under the pitcher's control. Similarly, the semen remains the action of the father even though, once released, it is no longer under the father's immediate control. Therefore, Aquinas asserts, "This active force which is in the semen, and which is derived from the soul of the generator, is, as it were, a certain movement of *this* soul itself."[80]

Once the embryo is formed, the semen dissipates because the purpose of its action is complete. An instrumental cause has only enough power of agency as is bestowed upon it by the principal agent to produce the desired effect. Thus, a

by the action of the generating form" (Aquinas, *Summa contra gentiles*, II, 89, 21). All English translations from the *Summa contra gentiles* are from *Summa contra gentiles: Book Two: Creation*, trans. James F. Anderson (South Bend: University of Notre Dame Press, 1975).

[73] See Aristotle, *On the Generation of Animals*, I, 20, 729a21–33; and Aquinas, *Summa theologiae*, I, Q 118.1, reply 4.

[74] See Aquinas, *Summa contra gentiles*, II, 89.

[75] Ibid., II, 89, 3. Furthermore, if the soul were to be in the semen, then the form would exist before the matter and this, we have already noted, is not possible. See *Summa contra gentiles*, II, 89, 4–5, 8; and *Summa theologiae*, I, Q 118.1, reply 3.

[76] See Aquinas, *Summa theologiae*, I, Q 118.1, reply 4; and *Commentary on the Metaphysics,* bk. 7, lec. 8, par. 1456–1457.

[77] See Aristotle, *On the Generation of Animals*, II, 1 and 3.

[78] Aquinas, *Summa contra gentiles*, II, 89, 8; and *Summa theologiae*, I, Q 118.1, reply 3.

[79] Aquinas, *Quaestiones de Anima*, Q 11, reply 2.

[80] Aquinas, *Summa theologiae*, I, Q 118.1, reply 3 (emphasis added).

thrown ball can travel on its own (bestowed) momentum only as far as the pitcher has intentionally thrown it. Aquinas writes:

> After the sensitive soul, by the power of the active principle in the semen, has been produced in one of the principal parts of the thing generated, then it is that the sensitive soul of the offspring begins to work towards the perfection of its own body, by nourishment and growth. As to the active power which was in the semen, it ceases to exist, when the semen is dissolved and the (vital) spirit thereof vanishes. Nor is there anything unreasonable in this, because this force is not the principal but the instrumental agent; and the movement of an instrument ceases whence once the effect has been produced.[81]

Once the embryo is formed, it is more akin to the seed of a plant which will necessarily become an image of the generators, i.e., a human being.[82] Directing its own operations from that point forward, the substance has an active potency to be a human being.

Clearly, both Aristotle and Aquinas are operating with false scientific facts. They did not have knowledge of the humane genome and its organization. They did not know that, in fact, the complexity for the human body is already encoded in the single-celled totipotent embryo. While there are some Aristotelian-Thomists who still argue for a theory of delayed hominization, and even though the Church has not definitively defined the moment of conception as the moment of infusion of the soul, most Thomists agree that given our increased knowledge of biology, the theory of delayed hominization is simply not tenable.[83] Apparently, the Philosopher and the Doctor also did not know how the gametes of the man and woman interacted in conception. (That both Aristotle and Aquinas thought that the menstrual blood was the element contributed by the female indicates they were oblivious to the existence of the oocyte.) Although their science may have been faulty, their underlying philosophical assumptions remain solid and can be incorporated with contemporary biological knowledge.

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[81] Aquinas, *Summa theologiae*, I, Q 118.1, reply 4.

[82] See Aristotle, *On the Generation of Animals*, II, 5, 739b34–740a4; *Metaphysics*, VII, 8, 1034a31–10434b7. See also Aquinas, *Commentary on the Metaphysics*, bk. 7, lec. 8, par. 1451ff.

[83] For Thomists who argue in favor of delayed hominization, see Joseph Donceel, "Abortion: Mediate v. Immediate Animation," *Continuum* 5 (1967): 167–171, and, "Immediate Animation and Delayed Hominization," *Theological Studies* 31 (1970): 76–105; William Wallace, "Nature and Human Nature as the Norm of Medical Ethics," in *Catholic Perspectives on Medical Morals*, eds. Edmund D. Pelligrino, John P. Langan, John C. Harvey (Dordrecht, the Netherlands: Kluwer, 1989): 23-52; Norman Ford, *When Did I Begin?: Conception of the Human Individual in History, Philosophy, and Science* (New York: Cambridge University Press, 1988); and Thomas Shannon and Allan Wolter, "Reflections on the Moral Status of the Pre-Embryo," *Theological Studies* 51 (1990): 603–626. Stephen Heaney has provided an excellent Aristotelian-Thomist response in his article, "Aquinas and the Presence of the Human Rational Soul." Additionally, Austriaco argues for immediate hominization from a systems perspective. See Austriaco, "Immediate Hominization from the Systems Perspective," *National Catholic Bioethics Quarterly* 4.4 (Winter 2004): 719–738.

It is still the case that the egg and sperm are intimately involved in the formation of the matter of the embryo. While Aristotle and Aquinas were influenced by societal factors to insist that the father was the primary agent and the mother the recipient, the fact that the gametes function as instrumental causes of the parents in the formation of the initial material of the embryo cannot be dismissed. If anything, the presence of a haploid nucleus in each gamete confirms their instrumental formative power. The interaction between the combined nuclei of the two gametes with the cytoplasm of the egg in the reprogramming process further indicates a material process prior to the infusion of the soul. It is not until the reprogramming process is finished that the one-celled organism has a diploid nucleus sufficiently programmed to be a one-celled embryo. That is to say, the two haploid nuclei come together and are reprogrammed by the cytoplasm to become a totipotent embryo capable on its own power of generating the body of a human person. Since the embryo has this active potency, it is more than reasonable to assert that the infusion of the human soul occurs at the moment the active potency is present (namely, once the reprogramming process is complete). Until that time, what we have is the interaction between two gametes. This interaction ceases and the gametes, strictly speaking, no longer exist as two isolated entities once the reprogramming process is finished, because their momentum has been exhausted and they have achieved their intended goal. Aristotelian-Thomists refer to this as substantial change.

What would happen if an instrumental power were defective—if, for example, some of the stitches in a baseball were undone? It would have to depend, of course, on the severity of the defect. An instrumental power has to be sufficiently capable of carrying out its intended purpose. We would not use a butter knife to cut down a tree. If the baseball could sufficiently perform with a few stitches undone, fine. But nobody would argue that the undone stitches have absolutely no effect on the pitch. If there were many stitches undone, the baseball would be removed from play. It simply could not function for its intended purpose. Similarly, gametes are sometimes defective (which is one cause of infertility).

What if the instrumental gametes were somehow defective in themselves and, therefore, in their interaction with each other? In commenting on Aristotle's line in the *Metaphysics* that a mule comes from a mule "unless there be some defect," Aquinas writes, "Further, since [Aristotle] said that there must be univocity to some degree because of that from which the seed comes, he adds that this must be understood, 'unless there should be some defect,' i.e., unless there is some shortcoming of the natural power in the seed; for then the generator produces something which is not similar to itself, as is evident in the birth of monsters [*sicut patet in monstruosis partubus*]."[84] It is not known what kind of monsters Aquinas is referring to. Nobody engaging in the debate today would argue that an organism reaching birth could be characterized as a monster. Yet it is reasonable to assert that Aquinas would allow

[84] Aquinas, *Commentary on the Metaphysics*, bk. 7, lec. 8, par. 1453; English translation from from Aquinas, *Commentary on the Metaphysics of Aristotle*, vol. 2, trans. John Rowan (Chicago: Henry Regnery, 1961). See also Aristotle, *Metaphysics*, VII, 9, 1034b1-5.

for the possibility that certain defects in the gametes might produce an organism that is not univocally human. The next question would be to determine where the line is between an embryo that is human (even if debilitated) and a non-embryo organism created from a defective gamete or two.

The proponents of ANT-OAR intend to use animal studies to determine precisely which sort of changes in the somatic cell nucleus (which, by Schindler's own argument is to be considered just the same as a diploid nucleus resulting from two gametes) and the enucleated oocyte would produce a non-embryo organism. They would do this by measuring the product against what we know is the necessary genetic and cellular organization required of a one-celled zygote to develop into a being similar to the parents (or, in this case, the donor of the nucleus).

Once it is resolved that form requires matter with a certain organizational potential for life proper to that form, the question as to whether this or that particular matter is or is not capable of receiving a particular form becomes a scientific question about material organization. The ANT-OAR proponents are interested in making modifications to the natural instruments governing the generation of the material of an embryo to determine if the product is totipotent in any sense of the word. They would do this in animal studies alone. If the product is totipotent, then we would have to presume that the same would be true of a human embryo. Schindler, on the other hand, has asserted that the method is flawed because of a priori philosophical presumptions. If he wants to make that argument, he cannot use Aristotle or Aquinas.

The Importance of Matter

Schindler believes Austriaco's position in favor of ANT-OAR is founded on a fundamentally flawed reading of the Aristotelian-Thomistic hylomorphic theory. In opposition to Austriaco, he has argued that an organism is fundamentally defined by its substantial form, not by its potencies (either active or passive). This substantial form is, in turn, revealed by manifest external organization, although the substantial form is never exhaustively revealed in material operations. The manifestation of organization in the material is, actually, the result of the prior internal ordering principle of the substantial form. The substantial form begins to exist in its first act, and to operate in the material (in its various second acts). The all-at-once unity of the substantial form, Schindler says, certainly presumes a contribution of material but only in an asymmetrical way; namely, the form draws the material into itself and organizes it according to the form's own pattern and operation. While form and matter are mutually dependent, form takes priority. This mutual dependence of form and matter reveals that the whole composite of the human person is itself dependent on another, i.e., on God the creator. This dependence thus accounts for the fact that existence is a gift and the beginning of life is a mystery.

In response, I have shown that Aristotle and Aquinas both say matter has to be specifically organized to receive a certain form. For example, a piece of matter organized as a plant cannot receive a human form. This is what is behind both Aristotle's and Aquinas's theory of delayed hominization, however wrong their science may be. While Schindler is right to emphasize the dominance of form over matter, he ignores

the fact that in Aristotelian-Thomistic metaphysical theory, matter is the continuity between successive forms. When a tree burns to ashes, it is the same matter but with a different form. Matter can never exist without a form of some sort. Substantial change is, by definition, the transition of forms in particular matter.

Clearly, Aquinas would agree with Schindler that everything is gift. But God does not always directly intervene in his creation. Rather, according to Aquinas, he makes use of secondary causes grounded in his own primary causality. Secondary causes are everything from physical and biological processes to free will. Since God makes use of secondary causes, we can both explain and count on the consistent operation of the universe. This is what allows science to function as it does and why medicine is generally expected to have intended effects.

The miracle of conception is the immediate infusion of an immaterial soul in a sufficiently organized body. The immaterial soul has to be infused because it cannot be generated from matter. For this reason, both Aristotle and Aquinas argued that a substantial form has to precede the coming into existence of another substance (i.e., matter and form). In the case of a human being, the prior form is not the soul of the one begotten. The soul cannot pre-exist in order to form the body to its proper level of organization (as Schindler seems to suggest); rather, the souls involved in the formation of the matter are the souls of the parents operating through the instrumental causes of their respective gametes, while God infuses the soul at the proper moment. Aquinas says defective instrumental causes in reproduction cannot produce a univocally similar organism to the generators. Defective instruments cannot achieve their intended purpose.

David Schindler would be right to accuse Austriaco of collapsing the ontological and epistemological orders if, in fact, Austriaco were suggesting that *after* fertilization, i.e., after the gametes cease to exist on their own terms, by manipulating the entity's epigenetic state we would essentially be modifying its ontological character, however slightly. Yet neither Austriaco nor any of the ANT proponents is suggesting manipulation after reprogramming or even during the reprogramming process. Rather, they are suggesting manipulating the instruments themselves, the somatic cell nucleus and the enucleated oocyte. They will test the effect these artificially introduced defects of the instruments might have on the reprogramming process and its product. Schindler is welcome to disagree with the project, but he cannot claim Aristotelian-Thomistic authority for a critique that rests almost exclusively on his own philosophical presuppositions.