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QUAESTIO DISPUTATA: DELAYED HOMINIZATION

A REJOINDER TO THOMAS SHANNON

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[Editor's Note: The author's note continues the discussion raised in this journal last year between himself and Thomas A. Shannon on the preimplantation embryo. Johnson is concerned that Shannon's manner of interpreting the biological data, incorrectly, he judges, leads him to deny the embryo's unity because of his misplaced dependence upon "totipotency."]

Thomas Shannon's response to my article[1] ranges over our disagreements, but the core disagreement, the one with the heaviest moral fallout, concerns the unity or individuality of the preimplantation embryo. One's position here largely dictates whether its manipulation or destruction is morally licit. That core disagreement is my focus in this rejoinder.

What is the problem? Traditional Catholic accounts of the entitative constitution of human persons share two allied assumptions: first, that one's personhood is incommunicable to others; and second, that God cannot infuse a single rational soul into two or more distinct bodies. Embryology indicates, however, that the newly conceived zygote can be the source of more than one human being—as occurs in identical twins, and even recently in quadruplets—and that, further, until about two weeks after fertilization, each individual cell of which the preimplantation embryo is composed has the root capacity (totipotency) to become a whole human being. It seems therefore that from fertilization to implantation the embryo has a capacity to "share itself around," thereby failing the test of incommunicability. And the totipotency of the cells correlatively suggests—because they can each produce a whole—that they are more wholes than they are parts-of-a-whole. It

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[1] Thomas A. Shannon, "Delayed Hominization: A Response to Mark Johnson," *TS* 57 (1996) 731–34, responding to my "Delayed Hominization: Reflections on Some Recent Catholic Claims for Delayed Hominization," *TS* 56 (1995) 743–63, followed by Jean Porter's "Individuality, Personal Identity, and the Moral Status of the Preembryo: A Response to Mark Johnson," *TS* 56 (1995) 763–70.

just does not seem that before the 14th day we have a single entity, an individual.

This is Shannon's answer to the problem,[2] which he develops in the language of Norman Ford.[3] For him there is a distinction between the embryo's "genetic uniqueness" and its "developmental individuality." Genetic uniqueness results from one's unique human genome, present from conception, which, while sufficient to classify the embryo as being of the human species, is not sufficient to guarantee that it will be one rather than many; identical twins are genetically the same, but are not the same individual. So what we must await is that state of the embryo at which its many cells have become incapable of producing another distinct organism. This occurs when the cells have undergone "restriction," so that, e.g., this particular cell can only be a liver cell. At that point the concrete has set, as it were, and the embryo is considered a developmental or ontological individual.[4]

In my article I argued that insufficient attention was being given to the multitude of biological activities the preimplantation embryo performs. My study of the data led me to conclude that there is a genuine biological, living unity in the embryo from conception forward, that this unity is sufficient for personhood,[5] and that those who employ the genetic/developmental distinction do not think that the preimplantation embryo is a living thing, an organism. Treating as functionally equivalent biological unity and ontological unity—the life of a biological reality is its ontology—I assumed that one was compelled to hold either that the embryo was a living organism or that it was no thing at all, but a cluster of things unified only by contact, what Aristotle calls "a heap."[6]

Shannon criticizes this last claim as a false dilemma. He holds that the preimplantation embryo is not a disordered heap, but an aggre-

[2] See also his "Cloning, Uniqueness, and Individuality," *Louvain Studies* 19 (1994) 283–306, and "Issues and Values in Genetic Engineering: A Survey," *Chicago Studies* 33 (1994) 196–204, both of which contain the same doctrines he holds here.

[3] Norman Ford, *When Did I Begin? Conception of the Human Individual in History, Philosophy and Science* (New York: Cambridge University, 1988). The book received some criticism; see Nicholas Tonti-Filippini, "A Critical Note," *Linacre Quarterly* 56 no. 3 (1989) 36–50, to which Ford replied in "When Did I Begin–A Reply the Nicholas Tonti-Filippini," *Linacre Quarterly* 57 no. 4 (1990) 58–66; Anthony Fisher, " 'When Did I Begin?' Revisited," *Linacre Quarterly* 58 no. 3 (1991) 59–68; and "Individuogenesis and a Recent Book by Fr. Norman Ford," *Anthropotes* 7 (1991) 199–244; Paul Flaman, "When Did I Begin? Another Critical Response to Norman Ford," *Linacre Quarterly* 58 no. 4 (1991) 39–55; and Ronald K. Tacelli, "Were You a Zygote?," *Josephinum Journal of Theology* 4 (1997) 25–36.

[4] Shannon, "A Response" 731–32.

[5] This claim, at the end of my article, would require more substantiation, as noted by Porter, "Individuality" (see n. 1 above).

[6] See Aristotle, *Metaphysics* 7.17 (1041b11-33) and Aquinas's commentary *In VII Metaphysicorum*, lect. 17, nos. 1672-80 in *XII Libros Metaphysicorum*, ed. M.-R. Cathala and R. M. Spiazzi (Turin: Marietti, 1977) 398–99, where he explains what a *cumulus* (a "heap") is.

gate, a union of entities that are related and connected in a biological way. He therefore recognizes three modes of unity in the embryo: genetic, biological, and developmental or ontological. The first is established at conception with the union of the egg and sperm; the second is a teleological unity possessed by the cells from their genetic material; the third, most important and last in time, occurs when the individual cells are restricted. But, despite Shannon's contention to the contrary, it still seems to me that he does not recognize the full biological unity of the embryo, because he unduly fixes upon the totipotency of the preimplantation embryo's cells,[7] rendering flawed his account of what a biological part in this organism might be, an account that prevents him, in my judgement, from seeing its full ontological status.

For Shannon the port of entry into this discussion—and indeed the reason to affirm a distinction between genetic and developmental/ontological individuality—is the so-called totipotency of early embryonic cells, a biological fact that serves as his principle of interpretation for all other data concerning the preimplantation embryo. While both he and I acknowledge this fact, our interpretations differ. Shannon's criticizes my understanding of the totipotency in the preimplantation embryo's cells, and I see in his criticism an understanding of totipotency that minimizes the biology operative in that multicelled organism.

In the early embryo the cells that compose it replicate the DNA contained in their nucleus, and when that is complete, they cleave themselves so that a half-size copy of the original is made, nucleus and all, and the original is now half of its earlier size. The DNA resident in the cell's nucleus remains fairly constant through these early cleavages, so that the DNA in a cell at, e.g., the sixteen-cell stage mirrors that of the DNA that was in the nucleus of the single-celled zygote. Over time, certain genes in the DNA are switched on and off in the process of restriction, the goal of which is to produce tissues of cells fitted to certain functions (e.g. liver, heart, arterial tissues). Those cells in turn produce other cells containing their restrictions (certain genes switched on and off), but will sometimes add new restrictions that will be passed down to their descendants in cascading restriction. This process is gradual, however, because of the embryo's important need for regulative development. In this type of development, predominating in vertebrates, an individual cell's fate is determined primarily by its interaction with other cells around it, which influence it to modify its DNA in certain, specified ways. Regulative development differs from the mosaic development of invertebrates, whose cells' characteristics are defined more by the nonnuclear factors of a cell (e.g. the

[7] Shannon proposes to present the process of embryogenesis, but speaks almost exclusively of totipotency, and not about intercellular communication, mutual regulation, etc. ("Cloning, Uniqueness, and Individuality" 285).

cytoplasm, which is successively partitioned during cell cleavage), so that the loss of a particular cell can mean that the cells that would descend from it, and their corresponding functions, would be entirely absent in the organism (e.g. missing structures, parts of tail or wings, etc.). But in regulative development the loss of a particular cell simply means that the remaining cells that were with the now-lost cell will alter their own cell fates—which they can do because their DNA has not yet been irreversibly restricted—and can themselves provide for the DNA specification and functions that the missing cell had once provided. These cells (blastomeres) are able to take full advantage of the genetic information they possess, and, working in concert with the other cells that constitute the embryo, insure its self-regulation. This is the primary sense of "totipotent"; these cells have the root ability to fulfill any other cellular functions in the embryo of which they are part.

A side-effect of this ability to aid in regulation is that, if an early cell should be removed from the embryo and be separated from the influence of other cells, it is able to make full use of its genetic information and to produce a completely other embryo! Because of this characteristic such cells are said to have "totipotency" in a second sense; they are able, on condition of separation, to produce another whole.

As I explained in my article, this latter totipotency of a cell in an early embryo to become an entirely other embryo is conditional. To speak of it with no qualification implies that such a cell could activate its own potency entirely from within, and at any moment—which is not the case here. So I suggested that it was best to term the early embryonic cell "potentially totipotent," because that indicates that its ability to become a full-blown embryo is dependent upon an external change that results in a new state of affairs for it. In short, the cell must be physically removed from the embryo in a laboratory, or through some accidental means (e.g., via a spontaneous genetic mutation preventing intercellular communication, or being dislodged during the hatching from the zona pellucida, as some speculate is a cause of twinning).

Shannon does not share my concern to delineate these types of totipotency in the early embryo's cells. For him my attempt is "somewhat misleading," because, when we are speaking of these cells and their ability to become other organisms, to say "that they can" is enough: "they really can become other organisms; such a capacity actually resides within the organism. . . . To describe this developmental capability as a potential is to misstate the reality somewhat."[8] I would argue that it is crucial to delineate the character of those capacities, deter-

[8] Shannon, "A Response" 733. Shannon uses the same language in speaking of the early embryo and the eventual time of its restriction: "Any of its individual cells until that time can be a whole other being . . ." ("Cloning, Uniqueness, and Individuality" 301).

mining what comes from within and what comes from without, for these are signs of the thing's status as a self-standing entity. "To be able" has many possible meanings. Clay is able to become a pot (a passive potency). My two year-old son is able to play the piano—both a passive potency (he must be taught) and an active potency (he will instill the habit through practice). Yo Yo Ma is able to play the cello (a habitual active potency). And a rock I hold over my head can fall when I let go (an active potency awaiting only the removal of a prohibition by some outside force).

But the early embryonic cell seems to be a different case. In one way it is like the rock just mentioned in that its ability to grow into a whole other embryo depends upon the removal of some outside, prohibiting influence. In another way, however, it differs, because, while it is a functioning part of the embryo, it is not working to actualize that ability to become another embryo; this is in contrast to the rock, whose heaviness indicates that it "works" to get down to the ground, even when held up. In short, the early embryo's cell is not "chomping at the bit" to be free of the other cells so that it can realize its ability to become a whole other embryo. While part of the embryo, it receives messages from other cells and reacts to them in an appropriate way, and sends messages to them to regulate their activity. The early embryo's cells are other-oriented, contributing parts of the whole to which they belong.

I write this for two reasons. First, it is characteristic of individual entities, of substances, to initialize the realization of their potencies or abilities without the aid of some external thing. Thus the early embryo's cells could not really be considered "individuals" when they are contributing parts of the embryo. Second, an unannounced but important shift takes place in Shannon's attributions of totipotency, for he first speaks of the totipotency of the cells ("they [i.e. the cells] really can become other organisms"), but ends attributing this selfsame totipotency to the whole early embryo ("such a capacity [i.e. totipotency] actually resides within the organism"). He regards early embryo as a homogeneous entity; the character of the parts can be fully predicated of the whole, and vice versa. The parts are apt to become other organisms, and the whole is apt to become other organisms.

Focusing on the early embryo's cells in this uniform way sets the stage for Shannon's thinking about its ontological status as a whole. If he fails to note the cell's character as an ordered, contributing, heterogeneous part of the early embryo, a cell whose totipotency is checked and conditioned by the others that surround it, cells whose own totipotency that cell itself checks through its own influence upon them, then it is no wonder that he fears for the whole embryo's durability or staying power; for, since he takes totipotency to mean at-any-moment-capable-of-producing-another-organism, his biological account has the

preimplantation embryo in immanent danger of spontaneous disintegration.[9]

This threatening disintegration also underlies Shannon's understanding of parts and their correlative wholes. For him, the ultimate explanation for the ontological individuality or unity of some thing is an inability of its parts (their eventual inability to become other wholes), not a unifying ability or function of the whole of which they are parts. Thus his account of the parts of the embryo—its cells—has little to do with any contribution they make to the biological success of the whole; it rather has to do with what happens when they cease to be members of the whole. Evincing an almost geometrical notion of the contribution the embryo's parts make, Shannon speaks of an ontological unity as something which, "if [it] is divided it will consist of parts only."[10] He then contrasts this with the pre-ontological unity which "can actually be divided into parts . . . each of which can become a whole."[11] So parts for him seem to be the matter, the stuff, that comprise the whole—in short, its quantity. Hence, he is comfortable with terming something a part when it is no longer with the whole, though something is usually considered a part precisely because it has its being and *telos* in the whole; his focus seems to be on the whole and the part in virtue of their shared quantity and the physical contact their boundaries had. But is not the point about a part in a living thing the qualitative function it has relative to the whole, the contribution it makes to the life of the whole?

Although Shannon does use "organism" to speak about the early embryo, he never indicates what the life function of the whole is, and perforce how its parts serve the whole's activity. He does claim that it has "a teleological unity in that its genetic code directs it to a particular end,"[12] and that it is a "living, dynamic organism that bears the human genome."[13] He does not indicate what that particular end is, or how the concerted efforts of the cells produce it. Nor does he explain why bear-

[9] Shannon claims that the early embryo is "biologically indifferent to singleness until after restriction occurs" ("Cloning" 301). Would it be as normal for it to become many as it would be for it to become one?

[10] Shannon, "A Response" 733–34.

[11] What grounds the axiom that "a thing's ability to be divided into parts, each of which can become a whole, means that the thing from which the parts are divided is *not* a whole," which Shannon assumes? There are counter-examples to this. A shoot can be cut from a plant, and then planted elsewhere, to form a whole other plant. Is the first plant therefore not a whole, individual plant? Similar cases involve worms and the insect called the "walking stick," neither of which we would likely call "pre-worms" or "pre-walking sticks." Shannon perhaps thinks of the elements that comprise the whole as being, in reality, other whole entities, or on-the-way-to-being other whole entities, even while they help comprise as "parts" another whole different from themselves. He does speak of the cells in the aggregate that is the embryo precisely as "entities." In short, these "parts" are more wholes than they are parts ("A Response" 733, n. 10).

[12] Shannon, "A Response" 733.

[13] Ibid. 734.

ing the human genome is an accurate description of the unifying activity of the early embryo. Were he to follow through on these claims, however, he would be taken down roads he has not yet traveled. Examining the early embryo's unifying activity would lead him to cells that cooperate with one another in an ordered way, perform heterogeneous functions, and thereby serve the interests of something other than themselves.[14] In short, he would find cells that are truly parts of a unified, individual organism, rather than cells that are whole organisms unto themselves.

I close with three points. First, an organism's life and its need to interact with its environment are the reasons for all its developmental structures and characteristics, and biological data need to be read in that light. Second, it is a life-serving, biological advantage for the early embryo to be comprised of cells that perform specific functions, but perhaps other functions as well, should the need arise, occasioned by the damage that the loss or death of other cells inflicts upon the whole. The totipotency of the early embryo's cells works therefore to preserve the living unity of the whole embryo, and is not a reason for denying that unity from the outset. Third, and finally, by focusing on a conditional "totipotency" of an early embryo's cell Shannon's account treats it not in accord with what it is, but rather in accord with what it might be if it ceased to be a contributing part of the embryo. This I take to be biology by hypothetical possibility, rather than by current actuality. But the current actuality leaves us with an organized body of heterogeneous parts, influencing, and influenced by, each other, which works to preserve its existence and enhance its ability to interact with its environment—an organism like us.[15]

[14] This may be why Shannon was displeased (ibid. 732) with my suggestions that the blastomeres were quasi-organs, and that there must exist in the embryo some central organizing agent, because to accept these is to accept priority and posteriority (i.e. hierarchical causality) within the embryo, and therefore to accept heterogeneity, not the homogeneity that he thinks predominates.

[15] I write this rejoinder in the wake of the announcement of Dolly, the cloned lamb (see I. Wilmut, A. E. Schnieke, et al., "Viable Offspring Derived from Fetal and Adult Mammalian Cells," *Nature* 385 [27 February, 1997] 810–13, and Colin Stewart, "An Udder Way of Making Lambs," ibid. 769–71). At first glance this scientific *tour-de-force* might seem damaging to Shannon's account of ontological individuality, for it appears that an adult mammal has given rise to another whole mammal, thereby failing Shannon's implied test of part-becoming-a-whole (see above, n. 11). But before one is tempted to suggest that the lamb from which Dolly was cloned should be now considered a "prelamb," it is important to note that the cloning was effected by taking the *nucleus* of an udder cell from that adult lamb, and implanting it into a different cell (an oocyte, or egg cell) which had had its nucleus removed. Thus the single udder cell was not returned to the "totipotency" of, say, the zygote; rather, a *part* of the udder cell, and admittedly its principal part, was returned to an unrestricted state, because of the cytoplasm of the egg cell into which it was placed. But we do now know that cell restriction at the level of the nucleus is *not* irreversible, contrary to what Shannon had assumed ("A Response" 733). I suspect, though, that our eventual returning of a whole differentiated cell to its undifferentiated state would necessitate some modification of Shannon's theory.