

The Human Person's Beginning: The Biological Evidence

Angela Smith

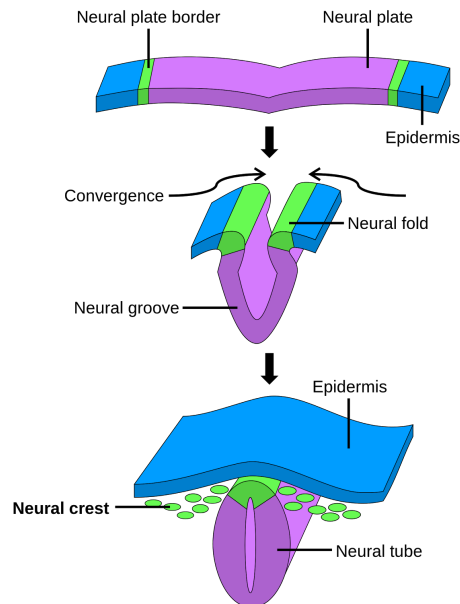
When did you become yourself? Each of us began as a fusion of a paternal sperm and maternal egg, progressing, through cellular division and growth, to a multicelled organism. When, in this process, did you cease being a part of your father joined to a part of your mother, and become a new creature?

What Defines a New Cell?

An underlying question is: when does a group of biological molecules constitute an independent cell?

Your body constantly creates new cells. 100 million of your red blood cells die and are replaced by new cells every minute!¹ As cells break down and new components are assembled to form replacements, a collection of these components can be said to constitute a new cell when that entity has established both **unique composition** (e.g., new genes, new proteins), and **unique behavior**.²

Embryonic neural cells provide a good example. All of these cells will eventually differentiate into various components of the adult nervous system: the brain, the spinal cord, and neurons. They begin as a layer in the embryo, which is then folded into a tube, a forerunner of the spinal column. Those at the crest of the fold are known as neural crest cells.



Eventually, some of these crest cells begin to specialize. They proliferate more rapidly (new behavior), and their descendants begin to express new genes (new composition) which firmly entrench them on the path to becoming neurons, and nothing else, in the adult nervous system. At this point, biologists consider these

¹ Ron Milo, *Cell Biology by the Numbers*. www.bookbionumbers.org. Accessed April 15, 2016.

² Maureen Condic, "When Does Human Life Begin? A Scientific Perspective," Thornwood, New York: Westchester Institute for Ethics & the Human Person, October 2008, p.2, http://bdfund.org/wordpress/wp-content/uploads/2012/06/wi_whitepaper_life_print.pdf. Accessed March 30, 2015

daughter cells to be so distinct from their parent cells that they apply a new name: sensory neural progenitors.³

Like the sensory neural progenitor daughter cell, the sperm-egg entity can be said to have differentiated into a new type of cell when it exhibits both new composition and new behavior, discrete from its sperm and egg antecedents.⁴

Unique Composition

Within the first second after the sperm penetrates the egg's outer layer, known as the zona pellucida (from the Latin for "transparent zone"), and fuses to the egg, the membranes of these two cells join.⁵



All components of what were previously the sperm and the egg are now contained together within one cell wall. Due to its distinct molecular and genetic composition, biologists give this new cell a new name: a zygote (from the Greek "zygotos" for yoked.)⁶

Initially, paternal and maternal DNA reside in separate membranes within the zygote. Within twenty-four hours after sperm-egg fusion, these membranes have broken down and melded, so that the zygote's entire genome-- all of the DNA from both mother and father-- is contained within one nuclear membrane.⁷ This process is known as syngamy: the synthesis of two gametes, or reproductive cells (named for the Greek terms "gamete" and "gametes" for husband and wife).

Does the zygote's unique existence begin when sperm and egg fuse, when their components combine within a new cell wall, or when their DNA commingles within one nuclear membrane? Dr. Francis Beckwith, Associate Professor of Philosophy and Jurisprudence at Baylor University, concludes, "It *may be* that one cannot, with confidence, pick out the precise point at which a new being comes into existence between the time at which the sperm penetrates the ovum and a complete and living zygote is present. But how does it follow from that acknowledgement of agnosticism that one cannot say that zygote X is a human being?"⁸ He

³ Ibid.

⁴ Ibid.

⁵ "Early Embryogenesis: Cleavage, Blastulation, Gastrulation, and Neurulation," *Khan Academy*, <https://www.youtube.com/watch?v=dAOWQC-OBv0>, cited March 30, 2015.

⁶ *MedlinePlus*, Merriam-Webster, <http://www.nlm.nih.gov/medlineplus/mplusdictionary.html>. Accessed April 15, 2016..

⁷ "Early Embryogenesis: Cleavage, Blastulation, Gastrulation, and Neurulation," *Khan Academy*, <https://www.youtube.com/watch?v=dAOWQC-OBv0>, cited March 30, 2015.

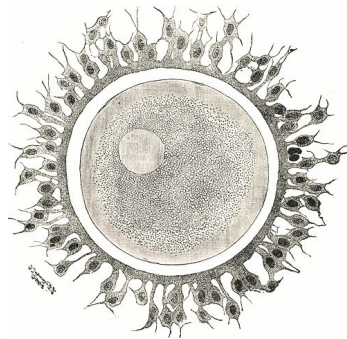
⁸ Francis Beckwith, *Defending Life: A Moral and Legal Case Against Abortion*. New York: Cambridge University Press, 2007, p.67.

warns against committing the “fallacy of the beard”: “just because I cannot tell you when stubble ends and a beard begins does not mean that I cannot distinguish bearded faces from clean shaven one.”⁹

Clearly, at some point during the first twenty-four hours after sperm and egg meet, each of them has ceased to be. Their components do not merely join forces; they amalgamate and set forth on a fresh path of existence as a new, distinct entity with a new name: a zygote.

Unique Behavior

Within minutes after membrane fusion, the zygote differentiates itself behaviorally from its predecessors. Within half an hour, chemical changes render the surface of the zona pellucida inhospitable to further sperm entry. Sperm and egg are relinquishing their existence as discrete cells. The goal of these parent cells was to achieve fusion of two cells into one. The goal of the new cell, the zygote, is the complete reverse: to *prevent* fusion of other sperm, since a new cell has already been formed.¹⁰



Within one to thirty minutes after sperm-egg merging, then, the zygote has oriented itself toward a new life objective, unique to itself, distinct from the objective of its parent cells. Does this separate entity constitute an entirely new organism?

Does Unique DNA Alone Define an Organism?

Like the zygote, each of your cells contains a copy of your entire genome, or complete DNA reference library.¹¹ Yet, in spite of containing instructions for an entire human being, most human cells are not also complete organisms. Why?

DNA tells a cell in which kind of organism it exists, and what its role is within that organism. Each species of bacteria, flower, dog, or fish has a pattern of DNA instruction common to all of its members.¹² One dog might have brown fur and another white, but no dog will naturally grow fins, because its DNA does not give the dog's cells instructions for growing fins.

Each cell within an organism reads only the segment of the DNA library containing instructions for its own configuration and role. Each of your skin cells, for example, reads DNA blueprints for taking on the form and function of skin. A type of chemical bookmark tells the cell where to begin reading, and another tells it where

⁹ Ibid.

¹⁰ Condic, p.3

¹¹ Reproductive cells are the exception: each sperm or egg cell contains only half the genes of your genome, because its purpose is to combine with its opposite sex counterpart to create a new whole genome for your offspring.

¹² “DNA is a Structure That Encodes Biological Information” *Scitable by Nature Education*.

<http://www.nature.com/scitable/topicpage/dna-is-a-structure-that-encodes-biological-6493050>. Accessed April 16, 2016.

to stop. Unless it is reprogrammed, accidentally or intentionally, a skin cell will not read the instructions to become a bone, hair, or blood cell.

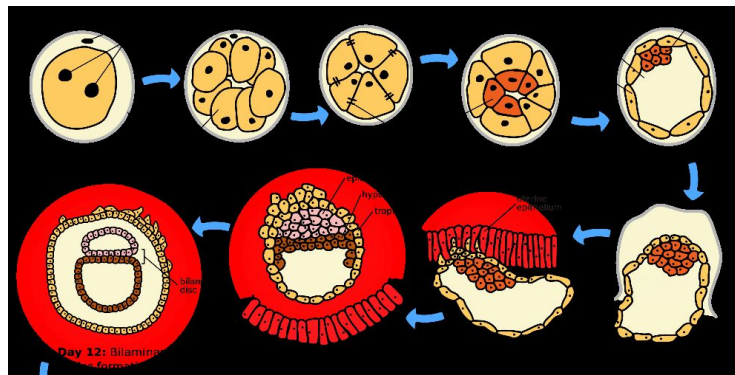
A skin cell is not an organism. It is a component of an organ, which is “a differentiated structure (as a heart or kidney) consisting of cells and tissues and performing some specific function in an organism.”¹³ All skin cells collaboratively function, as the largest organ in your body, to do the skin’s job of forming a barrier to protect the underlying muscles, bones, ligaments and internal organs. No skin cells participate in processes proper to other organs, such as digesting food with enzymes, for which the stomach is responsible,¹⁴ or metabolizing fat, as the liver does.¹⁵

An Organism Contains Interdependent Substructures

Most cells in the body are, like skin cells, *components* of an organ with a single purpose. The zygote, by contrast, is a *collection* of developing organs with differentiated purposes.

The hallmark of an organism is this presence of interdependent substructures. Merriam Webster’s medical dictionary defines an organism as “an individual constituted to carry on the activities of life by means of organs separate in function but mutually dependent: a living being”.¹⁶

Mutually interdependent substructures are programmed into the zygote from its inception. After syngamy, the zygote undergoes a series of divisions known as cleavage, ending with a sixteen cell entity called the morula. Cells form an outer layer, the trophoblast, forerunner of the placenta, and an inner cell mass, the embryoblast, precursor to the embryo. Differentiation has begun within the first two days of existence. By the fourth day, the primitive streak, antecedent to the nervous system, has developed. There are now three cell layers: the ectoderm, which will grow into the nervous system; the mesoderm, which will become bone, muscles, and connective tissue; and the endoderm, which will give rise to the lining of the gastrointestinal and respiratory tracts.¹⁷ Even within the first few days of its existence, the embryo is an entity of increasing subspecialization and interdependence: an organism.



First Days of Embryonic Differentiation and Specialization

¹³ Ibid.

¹⁴ “How Does the Stomach Work?” PubMed Health. <http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0072488/>. Accessed April 16, 2016.

¹⁵ “How Does the Liver Work?” PubMed Health. <http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0072577/>. Accessed April 16, 2016.

¹⁶ MedlinePlus, Merriam-Webster, <http://www.nlm.nih.gov/medlineplus/mplusdictionary.html>, Accessed March 30, 2015.

¹⁷ Ben Pansky, “Germ Layers and Their Derivatives.” *Lifemap Embryonic Development and Stem Cell Compendium*, <http://discovery.lifemapsc.com/library/review-of-medical-embryology/chapter-25-germ-layers-and-their-derivatives>, cited March 30, Mar 2015.

The Mammalian Life Cycle

When does the life of parental reproductive cells end, and the life of their offspring begin? Biologists agree that “A new cell arises when one cell divides or when two cells, like a sperm and an egg cell, fuse.”¹⁸ *Nature*, the most frequently cited scientific journal in the world¹⁹, states that “The life cycle of mammals begins when a sperm enters an egg.”²⁰ Thus the zygote which results from the union of sperm and egg is both a new cell, with unique DNA and behavior, and a separate new mammalian organism. This is true in the life cycle of cats, dogs, lemurs, armadillos, whales, shrews, bats, and all other mammals, including humans.

The Value of Human Life

We know from theology that what sets the human person apart from other organisms is his immortal intellectual soul. We understand that, in the words of Pope Francis, “All life has inestimable value: even the weakest and most vulnerable, the sick, the old, the unborn and the poor, are masterpieces of God’s creation, made in his own image, destined to live forever, and deserving of the utmost respect.”²¹

Yet as we advocate for the unborn in the public square, we need not expect that those who disagree with us will be swayed by such moral and theological arguments. Logic and scientific evidence are common ground to all of humanity, regardless of religious belief, and on their basis, we can affirm the existence of a new human person at conception. The human zygote has developed the unique composition and behavior characteristic of a distinct new type of cell within at least the first twenty-four hours of its existence. Moreover, the zygote exhibits a hallmark of an organism within its first few days: the formation of mutually interdependent substructures. Like all other mammals, the change in the life cycle for human beings occurs at conception. Reason and biology are our allies in the understanding and expression of a truth which we can also understand through faith. Pope John Paul II eloquently explained the integration: “Faith and reason are like two wings on which the human spirit rises to the contemplation of truth; and God has placed in the human heart a desire to know the truth-- in a word, to know himself-- so that, by knowing and loving God, men and women may also come to the fullness of truth about themselves.”²²

¹⁸ H Lodish, et al. *Molecular Cell Biology, 4th Edition*. New York: W.H. Freeman. 2000. Accessed online at <http://www.ncbi.nlm.nih.gov/books/NBK21685/> April 16, 2016.

¹⁹ “About Nature,” *Nature*, <http://www.nature.com/nature/about/>, cited March 31, 2015.

²⁰ Sarah Terzo, “41 Quotes From Medical Textbooks Prove Human Life Begins at Conception,” <http://www.lifenews.com/2015/01/08/41-quotes-from-medical-textbooks-prove-human-life-begins-at-conception/>, cited March 30, 2015.

²¹ “Pope Francis: All Life Has Inestimable Value,” Vatican Radio, July 2013, <http://www.news.va/en/news/pope-francis-all-life-has-inestimable-value>, cited March 30, 2015.

²² Pope John Paul II, *Fides et Ratio (On the Relationship Between Faith and Reason)*, Vatican City: Vatican Publishing House, 1998. http://w2.vatican.va/content/john-paul-ii/en/encyclicals/documents/hf_jp-ii_enc_14091998_fides-et-ratio.html, cited March 30, 2015.

