Journal of Prenatal and Perinatal Psychology and Health 27(3), Spring 2013

The Embryo's Eloquent Form

Stephen L. Talbott

Abstract: Embryology can be investigated qualitatively by "reading" the expressive gestures of the development of the human egg and sperm, their approach to each other in the "pre-conception attraction complex," their union at conception, and the subsequent development of the embryo. These gestures tell a remarkable and consistent story. Much of this story has to do with the play of complementary opposites, and with the "conversation" that takes place, first, between the gametes, and then between the embryo and the mother. We can recognize complementary, or polar, opposites in the contrast between male and female, between center and periphery ("embryo proper," on the one hand, and the fetal membranes and placenta, on the other), and between self and other. But in each case the play of opposites is a tension within unity. Moreover, the gestures at issue here are not gestures in the usual sense where we speak, for example, of the use of our limbs. Rather, they are *growth* gestures—the expressive movements by which the limbs and organs first come into being.

Keywords: Embryology, Qualitative, Polarity, Growth, Gestures

Given the importance to us of questions about our own origins and destiny, and given all the conflicting views about our place in the cosmos, it is odd how rarely anyone thinks to *look* at our human origins and try to answer the questions directly. Where do we see the nascent human being coming from and going to? Can we not allow the new arrival to speak for itself?

Listening to how the developing embryo "speaks" for itself has, in fact, been the long-time interest of the anatomist and embryologist, Jaap van der Wal.

Giving and Receiving

In the fall of 2007, I sat in a workshop as van der Wal projected onto a screen a series of images showing how a human embryo grows

Stephen L. Talbott is a Senior Researcher at The Nature Institute in Ghent, New York. There he attempts to elucidate what it means to pursue a qualitative science. His current project, entitled "What Do Organisms Mean? Toward a Biology Worthy of Life," focuses on a molecular biological understanding of the organism and explores how this understanding requires a re-visioning of evolution. Articles on these topics are gathered at http://natureinstitute.org/txt/st/org. Email regarding this article can be addressed to: stevet@netfuture.org.

its arms, starting from the point where each arm appears to be nothing but a primitive precursor of the hand growing directly out of the "shoulder." As the arms grow, the hands reach forward, around, and slightly downward in a grasping gesture rather like an embrace. Having completed this movement, the arms (as they continue to grow) briefly move apart somewhat, with the now much more hand-like hands turning in a palms-up direction, as if giving or receiving something.

Embracing, giving, receiving: a fascinating sequence to watch, in some ways no different from the countless human gestures we see every day. But, of course, there is a great difference. The embryo is not *using* its arms in the way we do; it could hardly use its muscles and joints, given that it is busy *growing* them. What I was watching was, in fact, a *gesture of growth—a* gesture by which the arm and hand were being formed, as opposed to the later activity of an already formed limb that has become more or less fixed in its anatomical structure. But there is nevertheless an intimate relation between this first growth gesture and the later use of the arms, since the movement of growth is shaping the means for the later activity.

In purely mechanical terms, there are many ways the arm and hand might emerge from the early embryo. Therefore, it is noteworthy that the actual gesture of growth already expresses something about the character of the human upper limbs as organs for grasping and offering, receiving and giving. Van der Wal, who has earned both M.D. and Ph.D. degrees and is currently an associate professor of anatomy and embryology at Maastricht University in the Netherlands, calls this embryonic performance a "pre-exercising" of the later capacities. In this he follows another embryologist, Eric Blechschmidt, whose name is attached to the Blechschmidt Collection and Museum at the University of Göttingen, where he oversaw the creation of almost 200,000 serial sections of human embryos, and 64 enlarged, total reconstructions of embryos of different ages. It was Blechschmidt who developed the notion of embryonic growth gestures, noting that we do not *have* to remain fixated upon the static, lifeless forms of dissected embryos. Nothing prevents our reckoning with the fact that the meticulously recorded positions and structures of the embryo are frozen records of what are actually developmental movements. These movements, Blechschmidt (1977) writes, "are always more than just measurable changes of shape. They are always also the *expression* of living formations" (p. 4).

So it is that our legs—less devoted to giving and receiving than to holding us upright against gravity by "pushing away" the earth—do not exhibit the kind of growth gesture the arms do. The foot "grows out in a more stretching and extending gesture while the arm exhibits more a gesture of flexion and grasping" (van der Wal, n.d.). Likewise, the early "growth kicking" movements anticipate later transitions from sitting to standing and walking. "The gesture and action of stretching and standing upright is already being performed or pre-exercised by the human embryo in the fifth till tenth week of prenatal development as a gesture of its growth" (van der Wal, n.d., Morphology and Psychology section, para. 3; see also Blechschmidt 1977, pp. 93–4). And again, in Blechschmidt's words:

> Strictly speaking, it is incorrect to call the inspiration occurring after birth the "first" breath. The respiratory movements by which air is drawn in through the trachea are sequels of activities [of the thorax and diaphragm] preregulated long before birth in the most complicated fashion (pp. 78–9).

Blechschmidt (1977) even points to a "sucking" gesture of the growing mouth: while the embryo's forming lips are rolled together, keeping the mouth closed, the oral cavity continues to grow and expand in all directions, creating an internal suction that, in turn (like all embryonic performances) plays an essential role in the subsequent growth processes. And so also with a growth "biting" (p. 75).

The mature organism is "achieved" by means of all these growth gestures. This may remind us of an easily forgotten fact: fixed form is always the end result of process and movement. Given our current habits of thought, we tend to start by conceptualizing already formed "things," which we then bring into movement or make into the causes of movement. But, as van der Wal (2007) put it in his workshop, "Growing, flexing is the first gesture of the arm. Joints form where the flexes are, they don't come first." The physical arm comes into being, takes its own particular shape, through movement. The particular character of the movement is a causal prerequisite for the emerging structure. Likewise, as Schad (2002) remarks, embryological development shows that

> the body does not behave like a plumber, first connecting the water pipes in a house and then turning the water on . . . the first blood-like liquid . . . simply trickles through gaps in the tissues . . . Preferred channels develop only very gradually as

> blood cells are deposited along the edges and eventually merge into the beginnings of vessel walls. (p. 80)

Moreover, Schad (2002) states, "when blood vessels first start to form, the heart does not yet exist . . . early blood flow stimulates the development of the heart" (pp. 82–83). As we see everywhere in the world, fixed form not only shapes movement, but is first of all the result of movement. The human body is a formed stream. Thus, the spiraling fibers of the heart muscle that help to direct the blood in its flow are themselves a congealed image and consequence of the swirling vortex of blood within. Holdrege (2002) points out that this kind of mutuality holds even for the heart's basic structural divisions:

> Before the heart has developed walls (septa) separating the four chambers from each other, the blood already flows in two distinct "currents" through the heart. The [blood currents] in the right and left sides of the heart do not mix, but stream and loop by each other, just as two currents in a body of water. In the "still water zone" between the two currents, the septum dividing the two chambers forms. Thus the movement of the blood gives the parameters for the inner differentiation of the heart, just as the looping heart redirects the flow of blood (p. 12).

In sum, the embryo, at every stage of its development, is performing expressive gestures out of which specific structures congeal. That is, the physical "specifications" for the mature organism crystallize out of the gesturing; this expressing is the essential doing through which the organism takes form. The organism is being gestured into existence, and it is distinguished from other organisms by the character of the gesturing. This character does not disappear from the mature organism, but comes to expression at a different level. It is precisely because the finished arm and heart are stilled traces of the movements first enacting them that they can subsequently lend themselves so effectively to the service of those movements. In other words, the fixed structures of the body retain something of the original, constructive activity as their own functional potential.

Can we hope to achieve any profound understanding of an end result without first entering into the shape and language of the movement that produced it?[3]

A Fertile Tension

(For much of the following I am heavily indebted to van der Wal, and particularly to his 2007 workshop.)

There is no other cell in the human body like the egg cell, or ovum. It is, to begin with, almost perfectly spherical. Cells come in every size and shape—think, for example, of nerve and muscle cells—but only the egg cell is spherical. This shape combines maximal volume with the least surface for external contact. As far as movement is concerned, it is a shape of passivity, allowing the ovum to be moved (rolled) from outside with relative ease—and, in fact, the ovum is "brushed along" from the ovary toward the uterus by the fimbriae and cilia of the uterine tube.

Not only does the egg cell take a shape allowing the greatest volume for the least external surface, but its entire gesture is one of expansion, *growing large*—"huge" might be a better term for it.

---

[3] It is interesting that already in the first half of the nineteenth century Samuel Taylor Coleridge, speaking of the fundamental, shaping powers that give us physical objects, recognized that for every such power

> the first product of its energy is the thing itself . . . . Still, however, its productive energy is not exhausted in this product, but overflows, or is effluent, as the specific forces, properties, faculties, of the product. It reappears, in short, as the function of the body. (as cited in Barfield, 1971, p. 34).

The activity itself remains prior and primary; every activity precedes and stands at a higher level than its own finished products. So even in the formed adult it is not so much that the arm produces movement as that movement engages the arm, "incarnating" itself physically. This, in fact, is our natural sense of the matter, for we all believe it is *we* who move our own arms. And we can catch within ourselves at least an inkling of that shaping inner gesture and impulse of will through which we bring our arms into outer movement. No scientist or philosopher, whatever her cherished philosophical convictions, can purge herself of this belief in, and sense of responsibility for, her own free inner powers of movement, without which human existence would become impossible. Some day we may realize that the inner activity by which we move our arms is akin to the creative activity that first "gestured" the arms into physical form.

And, by the way, what is true of our arms, as well as our legs, lungs, hearts, and so on (see below in main text), can just as well be true of our brains. The activity that first shapes the brain from without is one with the inner activity that subsequently makes use of the brain in thinking.

Van der Wal (2007) describes the "enormous swelling and enlargement of volume during its ripening process: from 10 microns as a beginning (primordial) gamete to 45 microns at the end of the first phase of ripening and development till she reaches a diameter of more than 150 microns at the end." At 150 to 200 microns and about the size of the point of a pin, the oocyte (the not yet fully matured ovum, as it first emerges from the ovary) is visible to the naked eye—the only such cell in the human body. An average cell, by contrast, is something like seven microns in diameter.

A gesture, however, is never a matter of simple quantity. If, as van der Wal (2007) put it in his workshop, "the egg cell lives in the quality of growing large," size as such is less an issue than the one-sided and determined way in which the "urge toward expansion" takes hold of the cell. The egg swells with cytoplasm to the point where it is no longer independently viable. Therefore the ovary must act as a kind of incubator to keep it alive. When released from the ovary, it quickly dies if not fertilized by a sperm cell.

Picture the huge sphere that is the ovum, surrounded as it is by a kind of halo of supporting cells ("corona radiata"). If you think of the vast volume of the earth and then of the thin, surface layer of the biosphere, you will have at least a rough sense of the relative sizes involved. And then you can try to imagine the approaching sperm cells (spermatozoa). Each one is about 1/60,000th the size of an ovum by volume, with a head about four microns in diameter and a filamentary tail of 60 microns. Unlike the egg, it is not a containing space. During its genesis, the sperm cell shows the gesture of growing smaller, whereby it sheds most of its cytoplasm and assumes a more concentrated, streamlined, and intensively structured form. It is transformed from a sphere to a radius or vector. It is, moreover, capable of generating its own movement: not only is it far from being passive but, judging from the video images most of us have seen, it could almost be described as hyperactive, where the egg cell is swept along by its environment, the sperm cell moves actively and independently *against* the current in which it finds itself (van der Wal, 2003, p. 98).

There is, then, an apparent polar opposition, or complementation, between sperm and egg cell. But it goes much further than I have so far indicated. The oocyte has a very large cytoplasm-to-nucleus ratio, whereas the sperm has an extremely small ratio—indeed, it is almost nothing but nucleus and tail.

Further, the DNA in the egg nucleus exists in an expansive form, not at all tightly organized, whereas in the spermatozoon it is concentrated so much that it nearly crystallizes.

The egg cell, while passive in an external sense, is extremely active inside—that is, metabolically—and its cytoplasm is relatively mobile. The egg cell is open, expansive, and communicating, in intimate chemical interaction with its surroundings, and therefore vulnerable to the qualities of these surroundings. The sperm cell, on the other hand, while active externally, is as inactive internally as any cell can be without being dead. Almost nothing but fixed form and passive structure, it exists in self-enclosed isolation from its environment. This is why sperm cells, unlike egg cells, can be placed in lengthy storage and subjected to all sorts of extreme conditions—and can even be frozen for prolonged periods—without losing their viability. Where the egg cell is expansive, outward-growing life, always at risk of losing itself in this exuberant growth due to its lack of a structured center, the sperm has retreated from life processes as far as possible in the opposite direction, toward its own rigidly ordered center.

Oocytes are old cells and spermatozoa are young cells. A woman's primordial egg cells are formed while she herself is an embryo being formed in *her* mother's body, and normally only one of these eggs is released at each ovulation cycle. After puberty the male, on the other hand, continually produces millions of sperm cells per day (about a thousand every second), and releases some 200 to 300 million of them in a single ejaculation, of which 300 to 500 may reach the site of fertilization.

Of the other contrasts between the gametes, I will mention only two. The female gonads lie deep inside the body; those of the male are outside. And, no doubt related to that, egg cells require a warmer environment, whereas sperm cells require a cooler environment. It is perhaps not difficult to associate coolness with the sperm cell's tendency to move toward the mineral state, and warmth with the luxuriating growth of the egg cell.

We can summarize much of the foregoing by saying that the oocyte tends to develop very strongly the qualities of the cytoplasm of a normal cell, while the spermatozoon emphasizes the nuclear qualities. In making this point, embryologist G. van der Bie (2001), a researcher at Amsterdam's Louis Bolk Instituut, goes on to say that while the sperm and egg "develop in completely opposite directions, *there is a strong inner relationship between the two processes*, which is expressed by the reciprocal

characteristic of the process" (p. 12). Or, as van der Wal puts it, "They belong to each other; polarities make love, not war" (2007).

The Cell Turned Inside Out

The relationships we have observed suggest that the egg and sperm need each other; they belong to each other like the opposite poles of a magnet. Each gains its recognizable meaning, its distinctive character, only in relation to the other. All of which becomes even clearer when we look at what van der Wal calls the "pre-conception attraction complex."

At the time of fertilization we find the huge egg cell; the corona radiata, consisting of support cells loosely covering the entire sphere of the egg; and many sperm cells that have easily worked their way through the corona radiata and may have their nuclear heads more or less buried in the "zona pellucida" (a protein layer covering the outer plasma membrane of the egg cell), with their waving tails extending outward. This is the pre-conception attraction complex. Which brings us, of course, to the usual picture of competitive sperm cells struggling aggressively to be the first to penetrate the egg's barriers and so, by out-competing the others, to win the prize. The picture's sole value is to illustrate how easily crude and anthropomorphic biases can attach to images presented by science.

There is absolutely nothing, after all, to prevent our viewing the situation with entirely different eyes, as a kind of respectful dialogue. To begin with, it is good to realize that the pre-conception attraction complex may last for a number of hours. During this time the giant sphere, with the tiny sperm cells attached here and there to its surface, their tails streaming outward, tends to rotate slowly. Throughout this time there are intimate chemical exchanges and signalings going on between the sperm cells and egg. The egg cell's membrane never does get "broken." There is something rather more like a mutually agreed fusion of membranes between egg and sperm, a reconstruction through which the sperm eventually ends up inside the egg. And it is now thought (Sadler, 2000) that this process is aided by all the other sperm cells attaching to the egg (p. 38).

An ultimate "decision"—this sperm or that one—may or may not be made. Often, it happens that no fertilization takes place. The conditions, the available potentials, one might imagine, are not right. But whatever the outcome, it is perfectly reasonable to say, as van der Wal (2004) does, that "the very common and

somewhat *aggressive* image of a sperm cell *penetrating* the egg cell is not correct":

> In the pre-conception attraction complex there is no question of an active partner versus a passive partner, nor of a penetrating versus penetrated partner, nor fertilizing versus fertilized one. . . . Rather. . . a subtle equilibrium of exchange and interaction is maintained. The morphodynamic process of fertilization is like the gesture one may observe very often in the animal realm when mating behavior and mating rituals are taking place. In a nearly never-ending process of exchanging signals, of attraction and repulsion, a male and female animal can circumambulate each other before copulation happens (slightly paraphrased, van der Wal, Mating Dance section, para. 4).

Something like that circumambulation, van der Wal adds, is vividly imaged in the tendency of the entire pre-conception attraction complex to rotate. Rotation, which is "movement at rest," lies between the linear movement of the sperm cell and the resting condition of the egg cell. This in-between state is a delicate interactive meeting "in which everything might happen, but nothing has to happen" (van der Wal, 2007). You could hardly imagine a greater contrast than the one between this meeting and a technique of artificial fertilization such as IntraCellular Sperm Injection (ICSI), where a needle forcibly deforms and then punctures the wall of the ovum in order to inject sperm cells. The needle's action does indeed begin to look like a kind of rape at the cellular level—a process far removed from what van der Wal refers to as "the subtle are-we-going-to-or-are-we-not dynamics of a pre-conception attraction complex" (2004, Artificial Fertilization Techniques section, para. 1). The latter looks more like a "marriage made in heaven"—a metaphor that may resonate more strongly as we follow the developing embryo after fertilization.

Incidentally, we witness a similar sort of dialogue a little later, when the conversation between the early embryo (blastocyst) and the maternal body occurs. If a child's tissue were transplanted into the mother, her body would reject it, even if not as actively as in the case of a non-familial donor. The nidation ("nesting" or implantation) of the embryo in the mother's uterus, however, normally occurs without rejection. Physiologically, the mother's gesture is one of *reception*. Responding to the chemical "request" of the embryo, she may (or may not; many embryos never achieve implantation) withdraw herself and her own defenses, providing room for the new life. "The status of

pregnancy is not one of having or (even worse) of possessing a child, but one of receiving and hosting a child . . . . Asking and responding . . . is continued during the whole event of pregnancy" (van der Wal, n.d., Nidation and the Gesture of Pregnancy section, para 24). Pregnancy, van der Wal adds, is not so much a "war of genes," as many geneticists are apt to conceive it, as a nine-month conversation around the evolving theme, "shall we or shall we not?"

The pre-conception attraction complex, as we have already recognized, is a union of two things that belong to each other, two things whose existence is defined relative to each other. If only for that reason alone, curiosity requires some attention to the manner of their meeting. Van der Wal argues that the union presents us, during that pause before actual fertilization, with an unusual and significant biological configuration. It is as if the normal cell were turned inside out.

In a typical cell, there is a single nucleus near the center, with the metabolically active cytoplasm surrounding it. Here at the time of fertilization, however, we find a different picture. Many nuclei are active in the periphery, bringing the entire complex into movement around a sphere of cytoplasm as the resting center. The characteristic linear (radial) movement of the spermatozoa and the tendency toward rest of the ovum have combined to bring about a stately spherical rotation. Polar opposite qualities are here held in temporary and unusual balance, with a kind of reversal of center and periphery, radius and circle, concentration and expansion, nucleus and cytoplasm, form and process, open and closed. "There," writes van der Wal, "in those few hours when the normal dimensions of biology are turned inside out, a kind of *debiologicalization* takes place" (van der Wal, 2007).

Whatever we choose to call the process, it manifests itself to alert observation as a play of polar opposites—a play that, on the fundamental occasion of the meeting of egg and sperm, achieves a particularly striking picture of an inversion of the normal cellular configuration. For van der Wal, it seems to be a picture of the suspension of time and of normal biological process, a pause freighted with freedom and fate, when the terms of a human existence are quietly, if intensely, negotiated.

Growth of the Early Embryo

We have recognized in the oocyte and spermatozoon, and also in the pre-conception attraction complex, images of a polar

character. Polarities, as van der Bie (2001) notes, "can be understood as creating conditions and possibilities for new development" (p. 12). Think, for example, of the opposing, but mutually necessary phases of expansion and contraction that botanists, following Goethe's lead, have recognized in the typical herbaceous plant. First comes the expansive phase of leafing, then a contraction into the smaller, closed, and tightly clustered sepals. There follows the opening up and blossoming of the flower, which in turn leads "inward" to the formation of the sexual organs within the flower. Again there is an expansion, this time of the fruit, and finally a contraction of the plant's entire potential into the small seed.

The plant lives in this polar rhythm. Each phase, you might say, dies into the next, just as one ocean wave breaking on the beach exhausts itself and recedes, thereby making way for its successor. And, as we have already noticed with the human gametes, polar opposites testify not only to an opposition but also to an underlying unity of being. Things cannot meaningfully oppose each other except insofar as they are adapted to each other. Each has to "know what to expect" from the other, which it can do only by having the other, one way or another, inside itself—just as (if only in a static and mechanical way) one puzzle piece bears within itself the imprint of its complementary pieces. More dynamically, we can picture how the martial arts practitioner shapes herself to the movement and force of her opponent, turning the "opposing" force into an essential impetus for her own attack. We can wonder, in fact, whether progress and development are possible in any sphere, except through the creative and rhythmical play of opposing forces, each gaining from the other the resistance and traction it needs for its own forward movement.

We certainly see some such play in the development of the human zygote. The first week following fertilization, before implantation in the uterus, brings the development of a spherical body of cells known as the "morula." This results from successive "cleavage divisions" of the fertilized egg. Such divisions differ from normal cell division, where a cell divides in half and then each daughter cell grows back to the original size. Here there are only divisions without growth; after three days, the twelve- to sixteen-cell morula is no larger than the original oocyte. As a result of the cleavage divisions, the cytoplasm-to-nucleus ratio, which had become so great in the oocyte, returns toward the average for human cells. At the same time, the early, loosely connected cells

yielded by the first divisions become progressively more compact; their contact with each other is maximized and they stick together more tightly.

The entire process, as van der Bie (2001) describes it, is one of intensification and can be thought of as centripetal in direction (p. 53). And it illustrates a central truth of multicellular organisms: tissues and organs do not result from the agglomeration of cells, as if these cells were givens, like a child's building blocks. The cells of the morula did not previously exist and therefore cannot be "added" to the fertilized egg, or zygote. *The zygote is already the whole.* Instead of joining part to part in an additive manner, it develops and differentiates from within. It divides, reorganizes, and transforms itself; no one and no force is piling up pre-existing building blocks.

The two ways of looking at the matter could not be more profoundly different. It is the difference between starting with the whole or with the part—between imagining we can understand the organism as a collection of given bits and pieces simply by tracing their individual impacts upon one another, or else realizing that we always rely in one way or another upon our recognition of a unity preceding and giving direction to every fragmentary movement.

An organic unity always involves an interaction of opposites, and so we find that the intensifying and compacting, centripetal movement observable in the morula is followed by a centrifugal counter-movement.[4] In the morula, a distinction has already arisen between an inner cell mass and an outer cell mass. After the nidation, or nesting in the womb (sixth or seventh day), the outer cell mass goes through a more explosive phase of expansive growth—or, better, it exhibits an opening gesture. A result of this movement is the formation of a fluid-filled sphere whose outer shell is called the "trophoblast." Left behind, so to speak, is the small and much more slowly growing inner cell mass, which forms within the sphere and up against one side of the trophoblast. This is the embryoblast, which will become the embryo in the usual narrower sense. The trophoblast, on its part, will evolve into the fetal membranes and placenta.

---

[4] Actually, in any polarity both poles are always present and active, but with a varying predominance of one or the other. With respect to the example of the plant given earlier: the expansive, leafing activity may already be accompanied by a contraction into buds at the base of the leaves or stems.

And so, the one organism differentiates into a peripheral part and a central part. *Both* these parts arise from the zygote and belong to the developing organism. The peripheral body

> is an intrinsic part of the unborn human body and not something like a supplement as usually assumed by gynecologists and embryologists. There in its 'peripheral body' the embryo (and fetus) finds the physiological conditions for its existence, there it breathes, eats, excretes, and so on! There it lives, it exists . . . . the *dynamic* of the embryo shows that the central body is coming forth out of the peripheral body. It emancipates from it in a process of gaining independency (autonomy). (van der Wal, n.d., Two in One section, para. 2).

The functions of the trophoblast (and later the placenta) are neither concentrated in space nor centered in particular organs. As anatomist Johannes Rohen (2007) puts it, "All the life processes are still one great, almost incomprehensible unity" (pp. 57–8). For example, blood first shows up in tiny pockets distributed throughout the peripheral tissues, before there are blood vessels or a central heart. The development of vessels and heart proceeds from the outside to within. Here we require a reversal of our usual habits of thought. We should not think of the periphery as the *outside*, van der Wal (2007) tells us, but rather as the *origin*: "The organs are peripheral impulses and they descend into the body, with the heart impulse ahead and first. . . .The formation of the heart represents the archetype of organ formation, that is, from outside to inside."[5]

---

[5] The same sort of thing, according to Blechschmidt (1977), is true of the brain:

> It can be easily demonstrated in actual preparations that the growth of the brain centers is affected by the growth of the peripheral nerves and only later does the active brain exert effects on the periphery (p. 73).

The idea of the human being arriving from the periphery—being gestured into form from a wider horizon—is not only something like the picture we derive from embryological studies; it is also the picture the semantic historian Owen Barfield arrived at by looking at the evolution of human consciousness. The human psyche, in Barfield's terms, had first to be uttered into being before it could eventually learn to speak from its own center. We see in the early mythic consciousness of the human race a state of more or less dream-like unity with the surroundings. What spoke in the world also spoke in the human being—and it was indeed the world speaking, not man speaking "on his own account." Only slowly and over great periods of time did we acquire anything like the detached, centered, self-conscious, onlooker stance common in civilized societies today. All of which is why Barfield comments somewhere that the usual questions about the origin of language don't make much sense: it's like asking about the origin of origin. Footnote continued on next page…

In describing how structures "make the leap" from the periphery to inside the body, Rohen (who, incidentally, has authored what may be the most widely used anatomical atlas in the medical world) points out that as a corollary of this transition the placenta slowly dies off, a process that is completed at birth. "Ultimately, therefore, birth means slipping out of an initially all-encompassing functional periphery and taking hold of a body that has assumed these functions step by step" (Rohen, 2007, pp. 57–8). In van der Wal's words,

> Systematically the "proper" body emancipates from its "peripheral counterpart." Then at birth a process of untying takes place. As a morphological gesture, however, the baby is not born out of its mother. It is born by a kind of dying process, dying out of its self. What was linked and connected is being untied and dissolved. Birth as the literal morphological manifestation of de-velopment: unfolding, separating, emancipating from where one comes from. Is not the gesture of enveloping and de-veloping the actual principal gesture of human development? Every time again and again we envelop ourselves with mantles and we feed ourselves with nourishment from the context, the environment we are part of for that moment. But only by laying down the mantles that

---

Footnote continued from previous page …"In the beginning was the Word."
The earliest forms of language and consciousness were profoundly mythical, and the universal logos of myth, far from originating in individual minds and brains, is what progressively shaped those minds and brains so that they could eventually sound forth in their own right.
In this connection Barfield (1977) has written that:

> It was not man who made the myths but the myths, or the archetypal substance they reveal, which made man. We shall have to come, I am sure, to think of the archetypal element in myth in terms of the wind that breathed through the harp-strings of individual brains and nerves and fluids, rather as the blood still today pervades and sustains them. (p. 75)

And what is true of the race is also true of the developing consciousness of the individual child, who slowly emerges from a kind of dreamlike unity with her surroundings into an increasingly detached and independent awareness of herself and her separateness from the world. All of which appears very much like a continuation, on the level of consciousness, of the processes we observed on a physical level in embryological development. There is nothing in any of this to contradict the lines from George Macdonald's well-known verse for children:

> "Where did you come from, baby dear?"
> "Out of the everywhere into here."

Nor, suggests van der Wal (2007), will the child herself register dissent:
"You come from your mother's belly." No child believes this. "Where was I before I was in Mama's belly?"

> fed and enveloped us, may we come further, break out to a new phase, a new environment. (n.d., Two in One section, para. 3).

And, in fact (returning to the early phase of the embryo's growth), the expansion of the trophoblast is followed in the third week by a more centrally directed development of the embryo "proper." The latter goes through a process of invagination, whereby its own inner space is created, so that now there is a new and ever more complex stage for the play of developmental melody and counterpoint—a play that continues right on through birth and the growth of the child.

On Recognizing the World

One of the provocative questions van der Wal asked at his workshop was, "When did Goethe become Goethe?" At age eighty? Forty? At puberty? Actually, none of us feels himself missing some part of his wholeness at *any* age. We may feel an urgent need to change ourselves, to undergo transformation, but this is quite a different matter. It takes a whole being to experience transformation. And that is what we find all the way back to the first appearance of the zygote as a fertilized egg cell—a whole and fully functional organism. New parts and new capacities never show up except as an unfolding of this whole. What we see unfolding at every step of the way is an integrated, coherently developing organism expressing itself—or being expressed—into the world. There is no "waiting for the real show to begin."

But, of course, the Goethe of 80 was very different from the Goethe of 15. So, too, the zygote is very different from the three-month-old embryo or the newborn. We have already seen one difference between the embryo and the adult: the gestures in the womb are first of all *growth* gestures. That is, the instruments of gesturing are themselves being produced. But this does not reduce the notion of a gesturing embryo to nonsense. It is just that if, following Blechschmidt, van der Wal, and the others, we try to read the growth gestures *as* gestures—that is, as a form of speech—then we have to recognize that the physical vessel for the nascent human being, which at that point lacks a functioning nervous system, is not so much *speaking* as *being spoken*. The newborn child is an announcement arriving from a larger surround, and it finds in the living terms of its annunciation an ever growing power to speak with its own voice.

This is doubtless a difficult notion for a science that has yet to reckon with what it means to deal integrally with wholes rather than analytically with parts. Every true whole exists only by virtue of *expressing* something; the wholeness we perceive is a unity of expression, and this unity is not some additional material thing. It is more like an idea, and without the idea we have only an aggregate of disconnected parts incapable of expressing anything.

The entire body of science consists, in fact, of the ideas we recognize as constituting the various unities of the world. Sometimes we call them laws. The only problem is that we have tried to reduce these laws as far as possible toward the formal emptiness of mathematical formulae and algorithms. The advantage of this is that mathematical formulations afford a kind of precision that is almost self-enforcing; we can remain nearly passive as we hew to the sharp-edged dictates of mathematical logic. Mathematical science is in this sense *easy*—much easier than the difficult work of reading gestures accurately and objectively (Talbott, 2007).

That the world speaks, then—that it bodies forth ideas—is hardly controversial. The question is only whether, as Galileo already contended, it speaks only in the restricted language of mathematics, or it speaks instead in a much fuller language. And on this point there is not much cause for debate. When we view certain characteristic movements of the human being in the womb, the question is whether these movements can be seen, with the right sort of attention, as meaningful gestures. If they can, then it is just as if we encountered some scribbling on a stone tablet and discovered it to be a meaningful text. In neither case is there much to argue about. We either recognize the material forms as a kind of language or speech, or we don't. Once the Rosetta Stone was deciphered, the decipherment was its own proof. We look for significant expression, and when we find it we know that the outer forms have an "inside," an inner content; they are *saying* something.

Once we get clear on these things, then the embryological viewpoints expressed above can be accepted as the legitimate and ordinary productions of science that they are. The question is simply whether the researchers have more or less properly read the gestures of the developing human being. If they have, then others will have no difficulty following in their footsteps and carrying the investigation further, correcting and adding new insights as they are able.

Of course, one could also speak much more dramatically about the work discussed here, since it could hardly differ more radically from certain deeply engrained habits in science today. The difference between looking at the world's expressive qualities, on one hand, and doing one's best to ignore them, on the other, is, after all, a huge one. Essentially, it is the difference between seeing the world and not seeing it—between confronting the actual being of things or retreating into a realm of abstractions increasingly cut off from reality except through the methodological requirement to demonstrate a certain utilitarian workability.

Some day, I am convinced, many scientists will be stunned to recognize how great is the gap between concepts possessing a narrow, if precise, workable dimension and concepts that reveal the eloquent forms of the world. And the dismay may be even greater when, beset by myriad technologically engendered crises of society and the environment, we find ourselves asking to what degree we can even claim that our science has been *working*.

But every new life brings with it hope, and our recognition of the meaningful life of the embryo may be just what is needed to stir new hopes for a more meaning-filled science (Talbott, 2013).

References

Barfield, O. (1971). *What Coleridge thought*. Middletown, CT: Wesleyan University Press.

Barfield, O. (1977). *The rediscovery of meaning, and other essays*. Middletown, CT: Wesleyan University Press.

Blechschmidt, E. (1977). *The beginnings of human life*. (Transemantics, Inc., Trans.). New York, NY: Springer-Verlag.

Holdrege, C. (Ed.). (2002). *The dynamic heart and circulation*. (K. Creeger, Trans.). Fair Oaks, CA: AWSNA.

Rohen, J. W. (2007). *Functional morphology: The dynamic wholeness of the human organism*. (K. Creeger, Trans.). Hillsdale, NY: Adonis Press.

Sadler, T. W. (2000). *Langman's medical embryology* (8th ed.). Baltimore, MD: Lippincott Williams & Wilkins.

Schad, W. (2002). A dynamic morphology of the cardiovascular system. In C. Holdrege (Ed.), *The dynamic heart and circulation* (pp. 77–97). Fair Oaks, CA: AWSNA.

Talbott, S. L. (2007). The language of nature. *The New Atlantis, 15* (winter), 41–76.

Talbott, S. L. (2013). What do organisms mean? Toward a biology worthy of life. Retrieved from http://natureinstitute.org/txt/st/org/

van der Bie, G. (2001). *Embryology: Early development from a phenomenological point of view*. Driebergen, Netherlands: Louis Bolk Instituut.

van der Wal, J. (2003). Dynamic morphology and embryology. In G. van der Bie and M. Huber (Eds.), *Foundations of anthroposophical medicine* (pp. 87–161). Edinburgh, UK: Floris Books).

van der Wal, J. (2004). Human conception: How to overcome reproduction? Retrieved from http://home.unet.nl/walembryo/epconcep2.htm.

van der Wal, J. (2007, September). *Man as embryo between heaven and earth*. Paper presented at The Nature Institute, Ghent, NY.

van der Wal, J. (n.d.). Highlights of a phenomenological embryology. Retrieved from http://home.unet.nl/walembryo/ehighlights.htm