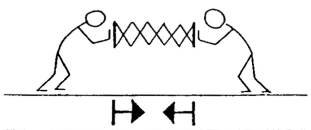
Is Embryology Relevant for Rolfing®?

By Konrad Obermeier, Certified Advanced Rolfer™

Note on the vignettes heading the text sections: Blechschmidt identified and depicted a set of "late metabolic fields" that signify biophysical forces. The employed stick figures illustrate these forces. They are actively involved in organizing the change of position, shape and structure of (biochemical) metabolic fields. They represent specific kinetics of ontogenetic developmental movements.



CONTUSION

The subject of human embryology is a marvelous and fascinating field, embracing aspects of mythology and science, religion and politics, as well as economy and medicine. The question "where do we come from and how do we unfold into this world" has inspired many philosophers in many different cultures and is central to a long-lasting and ongoing quest of understanding human origin.

When we talk about "human origin" it is crucial right in the very beginning to understand what our subject is: the ontogenetic development – that is, the differentiation and growth – of the human embryo. This is not to be confused with the phylogenetic evolution of the human species! Both the embryo on one hand, and the human species on the other, not only operate in completely different time scales but also are distinctly different in obeying specific laws and underlying principles. Nevertheless, the misconception about these two distinctly different fields in biology still floats around in minds and magazines and contributes to avoidable confusion. Scientifically, it is absolutely clear today that ontogenetic differentiation and growth does not recapitulate phylogenetic, evolutionary development.

So our interest focuses on ontogenetic development, and it seems appropriate here to ask the question: is the field of embryology relevant to the domain of structural integration at all? Are there some aspects in ontogenetic development resonating with the philosophical background, the theoretical positions – and maybe even the practical work – of Rolfing?

During my education as a Rolfer in 1991, the subject of embryology played only a marginal role. Embryology was mentioned several times as something quite helpful and important for the understanding of structure, but why this was so did not become clear to me during my classes. My later attempts to study this field were not very fruitful either. It was too confusing, with many details and highly specific terminology – and no guidelines to make growth and differentiation of the embryo relevant for the work I was doing.

Nevertheless, there always were – and still are – relevant and profound questions remaining on how the human structure and form establishes itself in the first place. As we change structure and shift the shape of a human body by introducing specific external forces through our techniques, does the understanding of embryology yield any additional and helpful knowledge, to deepen the ongoing elaboration of principles supporting the practical work? Are there rules underlying the manifestation and morphology of structure in the embryo? If so, are these rules the same we apply and evoke – maybe unknowingly – when changing structure in an adult body?

CORROSION

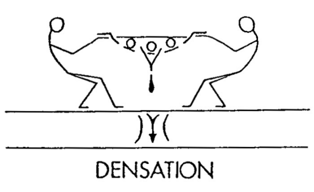
In the beginning of my studies, in familiarizing myself with the standard literature on embryology, I concluded that this was not so. Lewis Wolpert in *Triumph of the Embryo* summarized the basic and practically unquestioned assumption in the field by stating "genes control development." He continues: "It is remarkable that a cell as overtly dull and structureless as the fertilized egg can give rise to such a varied and complex form." By and large that was it – back then I could not see how Rolfing would evoke structural change through influencing specific genes or the DNA as a whole.

Many years later my colleague and friend Kevin Frank introduced me to the work of the anatomist and embryologist Dr. Erich Blechschmidt (1907-1992). During the process of diving into Blechschmidt's writings and trying to understand the principles underlying his elaborate observations, it started to dawn on me that, after all, there might be some hidden treasure in embryology. In fact, there are concepts in embryology that are worth considering for the domain of structural integration. Blechschmidt offers an elegant and unique point of view on ontogenetic development, in some aspects obviously resonating with a number of assumptions underlying the work we do. Nevertheless, with my ongoing studies of Blechschmidt's work I also learned to resist the temptation of unjustified "occupation of foreign territory" – those resonating analogies and parallels not necessarily legitimate enough to claim more than what they are.

When we want to understand ontogenetic development we can focus on different aspects and so have different options entering the field. As already mentioned above, we can look into the field of genetics and try to understand the aspect of *information* necessary to organize a complex organism like the human embryo.

This direction of thought ultimately goes back to the monk Johann Gregor Mendel (1822-1884), who demonstrated through his famous experiments that genes carry – in digital form – instructions necessary to control the making of an organism. His work is a major contribution to the foundation of genetics and evolutionary biology. The Nobel laureates James Watson and Francis Crick finally proposed in 1953 the well-known double-helix structure of DNA in their article "Molecular Structure of Nucleic Acids." Identifying the structure of DNA gave rise to the enormously fruitful field of genetics, dominating biology for the past sixty or so years.

Another way of looking at the ontogenetic development is to focus on the *forces* that are involved in developmental movements. In modern terminology this is often referred to as "self-organization of complex patterns," which can occur without specific control. This holistic point of view was introduced by Johann Wolfgang von Goethe (1749-1832). It suggests that dynamic systems – here the biodynamic movement called an embryo – are governed by relatively simple rules and biomechanical forces. An example of this would be the picture of a drop of water falling onto a fluid surface, transitorily manifesting a predictable (but in this case unstable) form as a response to the impact. The idea of self-organization and dynamic processes later became a central aspect of modern chaos theory and specific aspects of computer programming.



The difference between these two points of view is elegantly conceptualized and illustrated through a model developed by Blechschmidt. Following the model of "genetic control" implies that the DNA inside the cell nucleus is actively orchestrating differentiation and growth. Somewhere inside the DNA there is a kind of "blueprint" of the organism and somehow the genes "know" what to do and when and where to do it. This could be visualized as an "inside-out" direction of development – the genes run the show (see Figure 1).

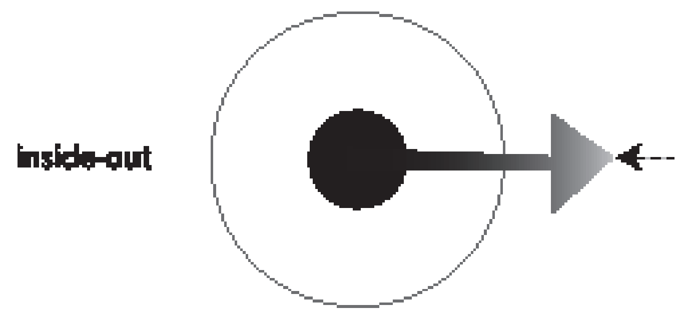


Figure 1: The inside-out direction of development

When we follow the model of "biodynamic systems" it implies that external forces stimulate a cell. The cell then responds to this external activation through genetic activity to differentiate and multiply. This could be visualized as an "outside-in" direction of development (see Figure 2). In other words, we could say that in this model the context is primarily active, while the cell nucleus and its DNA activation, along with successive expression of the genes, are secondarily *re*active. This does not contradict the fact that a gene is contributing to the production of a specific protein with coded information, but offers answers to the questions: what initiates cell activity and when is a cell activating the very gene it expresses? An analogy would be that the surroundings of the cell are introducing a kind of "question" to the cell. Then, and only then, the cell correctly "answers" this question by expressing the specific gene necessary for the appropriate protein. As practically all cells of an organism possess identical DNA, every single one of them can draw from the same pool of coded information. This enables an unerringly accurate response according to the momentary and locally given circumstances.

Initially, the idea that development and growth operates with an outside-in direction might seem counterintuitive. When we see

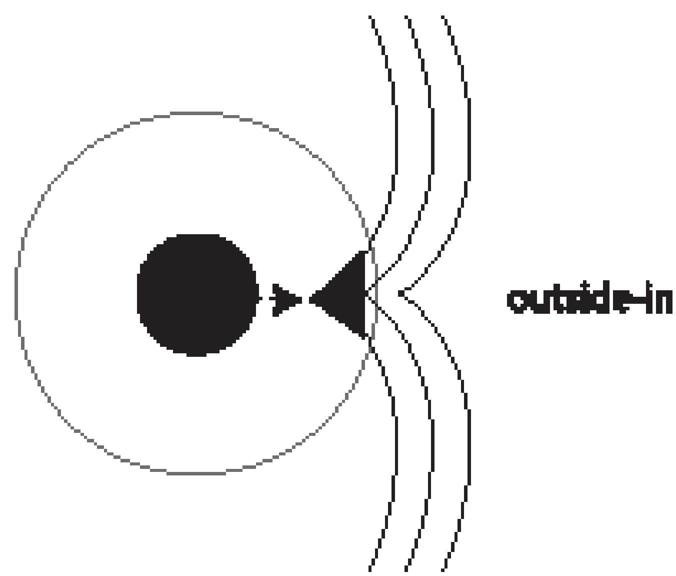


Figure 2: The outside-in direction of development

the phenomenon of a rosebud opening or a fern unrolling it clearly appears as an inside-out movement – but only as long as we do not account for the prerequisite of an outside-in movement of nutrients and water and sunlight underlying and preceding all expansive growth!

So it becomes quite interesting and worthwhile to ask how this "question" is orchestrated and where it comes from. Following this line of thought we understand that the initial "question" to a human ovum is the sperm. Only when an ovum gets fertilized does it manifest its potential in developing towards an adult form. The sperm is the original "question" to the ovum – the one and only stimulus evoking predictable morphological activity. It does so by disturbing the metabolic balance of the ovum. After the sperm ignites the metabolically dormant ovum through fertilization, the following ontogenetic development manifests a continuous, cascading compensation to this initial trigger. Differentiation and growth are the ongoing attempt of the organism to reestablish metabolic balance. To do so successfully, the surroundings of the cell play a crucial role. This topographic context of a cell inside an organism is referred to as the *extracellular matrix*. We should not overlook the fact that the embryo, while starting cell differentiation inside the zona pellucida after fertilization, is simultaneously creating its own extracellular matrix – distinctly different and separate from its maternal equivalent.

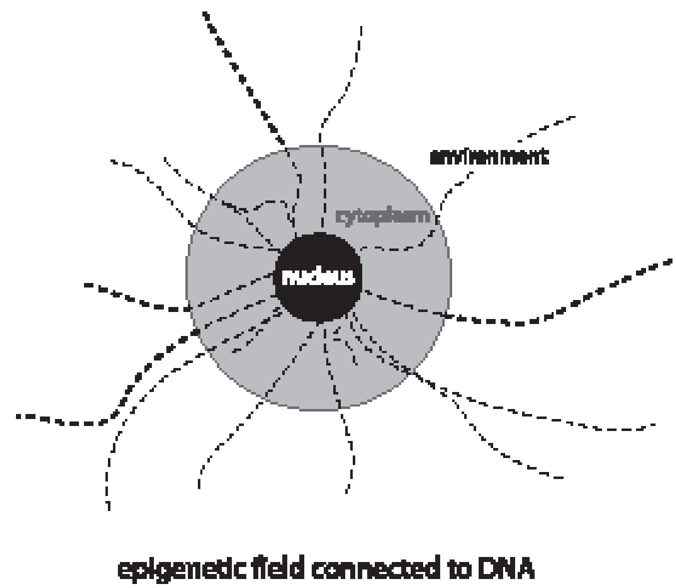


Figure 3: The epigenetic field

Jim Oschmann in *Energy Medicine* observes that the cell is "filled with filaments and tubes and fibers and trabeculae – collectively called the cytoplasmatic matrix or cytoskeleton" and, even more interesting for us here, "that the cellular matrix is connected, across the cell surface, with the connective tissue system or extracellular matrix." He continues: ". . . the cytoplasmatic matrix also links to the nuclear envelope, nuclear matrix, and genes." The outside and inside of cells are intimately related not only in terms of chemistry and metabolic activity, but also through pathways transmitting forces from the extracellular space right into the DNA by way of the cytoskeleton (see Figure 3). And it is obvious that any change of cellular form through physical forces encompasses transitory local modifications in balancing the distribution of *membranous tension* and *fluid pressure* (see Figure 4). Every Rolfer, being very familiar with introducing specific changes of pressure and tension to a client, is in good company. Through expansive growth the embryo actually is applying these changes to itself!

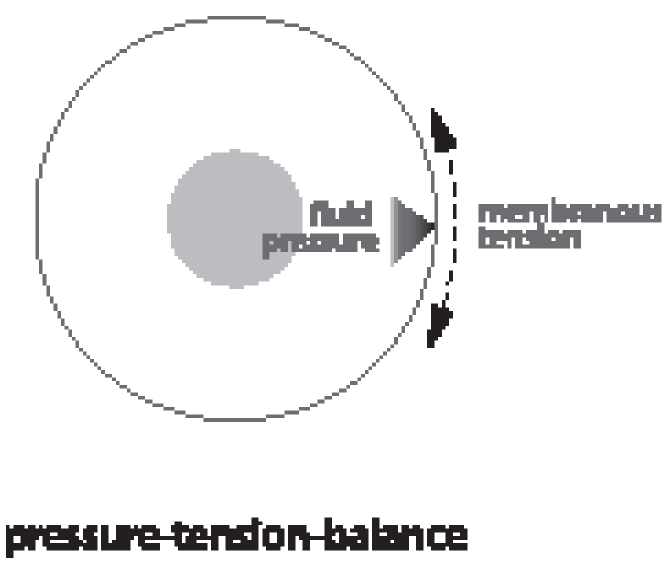
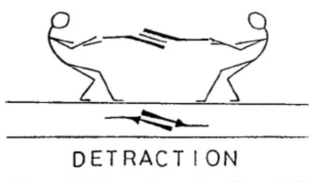


Figure 4: Pressure-tension balance

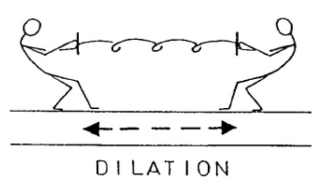
When we switch the point of activation from the informational (genetic, or inside the cell) to the environmental (extragenetic, or outside the cell), then the DNA becomes the servant of development instead of the director. With this perspective we can see how the introduction of external forces influences DNA activity in a meaningful way. The mediation of pressure and tension is an indispensable and imperative aspect for cell differentiation while the embryo grows, as well as for cellular maintenance later in life. The assumption then would be that a dysfunctional cell reorients to becoming functional again when exposed to the correct "question." We could say that structural integration then is nothing but a special case in this process: by introducing specific epigenetic information – forces evoking changes in pressure and tension – the practitioner manifests an intentional aspect of the epigenetic field to the organism. Rolfing as a technique can be thought of as a "question" to the organism, with structural integration the natural answer. When the ontogenetic process is the original manifestation of an integrated structure – precisely organized metabolic movements generating growth and form – we could say that the embryological process is the original process of structural integration.



We have to be clear here that Blechschmidt was unaware of cytoskeletal connective structures. His technical options then were quite simple compared to the standards scientists operate with now. But his concepts already were clearly worked out when he published a book debating the mechanical effects on genes in 1948 with the title *Mechanische Genwirkungen*. Nevertheless, even then – despite the ridicule and vehement disregard of his peers – he insisted on the contribution of mechanical forces to the manifestation of genetic information in morphological activity. Basically, he was pointing out that "there can be a lot of information in a cookbook – but who is cooking?" Membranous tension and fluid pressure as physical forces are unavoidable aspects to all life forms on this planet as they are fluid-based organisms. This cannot be disregarded when we want to comprehend growth, development, movement, replication, signaling, and function of any organism at any time. Every step in ontogenetic development must necessarily contain physical *and* chemical aspects.

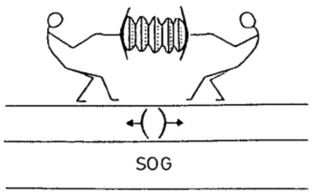
By the early 1940s, Blechschmidt already was referring to the cell as a field. This innovative concept is central to appreciating the implications of his work. Initially, in 1839, Schleiden and Schwann described the cell as the basic element of life. Quite habitually we tend to refer to a cell as being the basic "building block" of an organism, as in: the cell as a fluid-filled container is for an organism what a brick is for a house. Way ahead of his time, Blechschmidt referred to a cell as a *field of relationship*. A cell, for example a fertilized ovum – but also a tissue or an organ – can be understood as a fluidic and metabolic field of relationship where forces (pressure and tension) and metabolic gradients are negotiated. Conceptualizing three aspects of the cell – the cell membrane, the nucleus, and the cytoplasm – we can see the cell-limiting membrane as the place where *adaptation* to external stimulus happens, as every stimulus (or "question") naturally and always meets the cell on the surface first. This is the domain of physiology. We can understand the nucleus (never changing) as the place of maximal metabolic *stability* – the domain of genetics. And we can realize the cytoplasm – the domain of microbiology – as being the fluid *field of relationship* between periphery and center.

In this sense the cell is not a thing but a movement – a highly specific and integrated metabolic movement. This cellular field mandatorily relates to the complete context of the multi-cellular organism, and the organism relates to the environment. Frequently in modern terminology, the contextual environment is referred to as the "epigenetic field." The parallel is unavoidable – a practitioner of structural integration participates in cellular activity as an aspect of this very epigenetic field. Any intervention, as local as it may seem to be, always and inevitably involves the whole organism and relates back to the practitioner as part of the field.



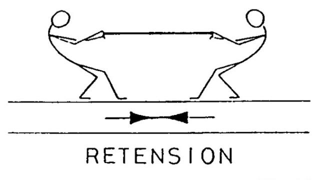
Simplistically speaking, when the cell is seen as a thing and the tissue and organ as an assemblage of things, then the organism would be a complex accumulation of different units. In our culture we classify and describe these things through descriptive anatomy, based on the work of Andreas Vesalius (1514-1564), the founder of modern systematic anatomy. In his epochal work *De Humani Corporis Fabrica*, the very complex adult form of the human body is systematically described for the first time. Today, this is still the scientifically valid foundation of all western medicine.

When the cell is not understood as a "thing" but as a unifying metabolic movement, we have to add time to the topographic relationships. The *position* of a cell, a tissue or an organ, the *form* of a cell or of the whole organism, and the cellular or overall *structure* of the being is moving in time. Actually, it is the developmental movement that unites position, form and structure in a field! In this way, the classical descriptive anatomy of *space* becomes *space-time* anatomy. Form has a kinetic aspect – shape is a process. This becomes most apparent when considering the rapidly shifting processes of embryological unfolding, in both shape and size, but also holds true for later stages of development – it is merely more difficult to see. An analogy here would be that Vesalius is taking a photograph of a dead human organism, whereas Blechschmidt attempts to shoot a movie about human life. Not only is the ontogenetic process of the embryo a developmental movement, organically shaping the gestalt of the organism from moment to moment, but also the adult form is reorganizing itself constantly. We can attempt to understand this "*gestaltungsanatomie*" in the embryo by studying a series of developmental phases. This is what Blechschmidt (laboriously, in more than thirty years of meticulous work) actually did by creating enlarged models of embryos in a unique technique he called "serial-cut-reconstructions." Also, we can observe structural and functional change in an infant, an adolescent, or an adult body shifting shape during the process called life. Considering the time factor in the practical work of structural integration is indispensable – maybe so much so, that it seems almost superfluous to point out a correlation here. But why not refer to a Ten Series of sessions as a "serial-intervention-reconstruction?" When "processes of development are spatially ordered movements" we could refer to a series of sessions as "an integrative process of sequentially executed and spatially applied movements" (Blechschmidt & Gasser, 1978).



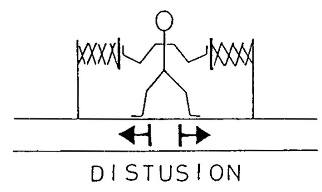
I'm sure it did not escape your attention – as Blechschmidt concluded from his observation, and as we mentioned above – that what holds true for the cell also applies to a tissue, an organ, or the organism as a whole. On the microscopic level we can identify molecular and submolecular components as the material aspects of all developmental movement. But rules to differentiation and growth consistently manifest on different orders of magnitude in a time-space continuum. Growth and change of shape as a kind of kinetic morphology ultimately are based on the flow of molecules being absorbed and incorporated from the outside into the organism. The single cell (but also the organism as a whole as a relational, fluidic, biochemical field) employs the laws of metabolic gradients and distinctly obeys them. Moving molecules through a fluid equals overcoming friction and resistance. In terms of physics: work is executed and forces are applied. Again, physical forces and biochemical activity cannot be separated but are always dependent on each other and are always instantly affecting the organism in its entirety. Physics and biochemistry are mandatorily interrelated and ultimately are governed in their cooperation by laws of efficiency. This definitely holds true for the domain of structural integration as well. Any structural movement of the organism is ruled by laws of efficiency, in its effort to reorganize in its relationship to gravity.

We have selected a few specific concepts of Blechschmidt's ontogenetic observations and attempted to relate those concepts to structural integration. Hopefully, pointing out some aspects of his work here will stimulate your interest, but obviously this article cannot be more than an introductory appetizer, a mere taste of Blechschmidt's scientifically and philosophically profound writings. Blechschmidt was a scientist of the old style – working long hours with simple, non-computerized equipment and a sharp, relentless intellect, dedicated to human embryology exclusively. He insisted on straightforward thinking. It certainly is tempting to read between the lines and apply his observations and ideas about the embryo to non-biological organisms (for example, to companies, family structures, an entire society, the human mind, or other dynamic systems), but it will not serve anyone to overstretch correlations and resonating aspects between embryology and Rolfing with their neighboring fields. Analogies and comparisons can truly stimulate our quest for understanding Rolfing as the craft it truly is, but they hardly yield explanatory, scientifically valid results. We want to respect this and resist the temptation of molding Blechschmidt's data and observations to fit the therapeutic art of practicing structural integration.



We want to conclude here by illustrating the beauty and implicit stringency of Blechschmidt's approach with one more example. Repeatedly, he insists that neither cells, tissues, nor the organism as a whole are planning for future tasks to be executed, so that a mindful observer might evaluate a developmental step as becoming functional later in life! Consequently, this approach makes all explanatory efforts from a functional position obsolete and irrelevant. Forces and biochemistry operate in the present moment – and only in the present moment. All structures of an organism are at all times fully functional and contributing to development, growth, maintenance and reorganization. Expansive growth and activities of sustaining the continuity of the organism are not intended to serve a later purpose. A cell, a tissue, an organ, or even a limb will mandatorily expand and morph in the direction of least resistance, not in a way to become useful later. Also, how would the embryo – at any stage of development – know that its differentiation and growth is serving the human species? As mentioned earlier, ontogenetic development is not a result of genetic mutation or the result of evolutionary selection only. Blechschmidt's observations bring him to the conclusion that there is no need for a "genetic blueprint," or for substances that determine morphological steps – like the never-found chemical "organizer" of developmental activity. There is no need for abusively forcing embryology into matching evolution, or for a "master mechanic" designing an "energetic blueprint in the fluid within the fluid"(a concept of the osteopathic making) in order to orchestrate ontogenetic development.

Consequently, to fully appreciate his valid concepts we simply have to ask the correct questions. For example, Blechschmidt starts with the question "how does the human eye develop?" and then meticulously describes his observations. This is how he understood science. The question "why is the human eye developing?" is completely irrelevant for ontogenetic consideration. The question "why" ultimately results in a teleological explanation of a phenomenon. This is like assuming that the development of any structure serves a purpose. This is useless in biology. Blechschmidt explicitly points out this pitfall – and avoids it. Initially, from a common-sense point of view, it seems difficult to accept that an eye does not develop for seeing. Rather, an eye develops because it is participating in the developmental movement of the organism, not because the organism wants or needs to visually orient later.



The temptation to point out a final parallel to our therapeutic approach seems legitimate here: the relevant aspect is not so much "why" but much more – "how" did a structure or organism deviate from its proper home and "how" can it regain its natural state of serving the flow of life? Our answer to this last question would be: through structural integration. In this sense Rolfing can serve as a profound contribution to the ongoing biodynamic process of life – a process of continuously applied morphology initiated by the developing embryo.

References

Blechschmidt, Erich, *The Ontogenetic Basis of Human Anatomy: A Biodynamic Approach to Development from Conception to Birth*. Edited and translated by Brian Freeman. Berkeley: North Atlantic Books, 2004.

Blechschmidt, Erich, and R.F. Gasser, *Biokinetics and Biodynamics of Human Differentiation: Principles and Applications*. Springfield, IL: Charles C. Thomas, 1978.

Blechschmidt, Erich, *Mechanische Genwirkun*g. Göttingen: Musterschmidt KG, Wissenschaftlicher Verlag 1948.

Blechschmidt, Erich, *Vom Ei zum Embryo*. CH-8260 Stein am Rhein, Switzerland: Christiana Verlag, 1989.

Maitland, Ph.D., Jeffery, "Toward a Phenomenology of Biodynamic Therapy" and "How Two Biodynamic Theories Masquerade as One." Unpublished manuscripts that you can download from my website www.Embryolution.de.

Oschmann, James L., *Energy Medicine: The Scientific Basis*. Edinburgh: Churchill Livingstone, 2000.

Smith, John Maynard, *Shaping Life: Genes, Embryos and Evolution*. New Haven, CT: Yale University Press, 1999.

Wolpert, Lewis, *The Triumph of the Embryo*. Oxford: Oxford University Press, 1993.

Konrad Obermeier works as a Rolfer in Munich, Germany. He teaches anatomy for the European Rolfing Association and is a candidate for the Life Science Faculty of the Rolf Institute®. He also teaches embryology classes internationally based on the work of Erich Blechschmidt and currently is producing a DVD on this subject. More information is available on his website: www.Embryolution.de.