HIGHLIGHTS OF A PHENOMENOLOGICAL EMBRYOLOGY

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What I see is just the covering.
The most important is invisible....
From: *The Little Prince* by A. de Saint-Exupéry

Professionals in prenatal psychology most often refer to prenatal existence and prenatal experience in the sense of *fetal* existence. From a biological point of view however, prenatal existence also includes the phase of embryonic life. Embryonic life is a matter of organogenesis and somatogenesis. The *fetus* is distinguishable from the embryo by the fact that in the former the body plan has been completed in principle. In the embryo it is still developing and in progress. The limit between embryo and fetus is said to be at about 10 weeks of development after conception.

The prenatal psychologist considers a human being to pass through transformations or variations of our first prenatal experiences during later cycles of life, even before it comes to a special developed nervous system in our body. The conventional embryologist may object that it is inappropriate for an embryo to function in psychological respect when there is nothing more present than a very simple or primitive nervous system still developing. The confronting question is whether it is possible for an embryo to have experiences or to show motivated behavior when one assumes that soul life and behavior are restricted or limited to a functioning nervous system.

Embryonic behavior - behaving in forms

A possible key to this dilemma might be given in the definition of **behavior**. One may also read behavior in living organisms from their *morphe (form)* and *Gestalt*, from their continuously changing morphological appearance (van der Bie, 2001). An organism always presents itself as a unity of shape, function and environment, continuously changing *in time* (Rose 1998). The rose in the vase is not *the* rose. One has to include time into his (her) image of the rose: out of seed to plant, to knob and flower, to withering, etc. Far before it comes to acting outwardly, to performing so to speak, the organism already shows behavior in a morphological sense; it exhibits behavior by means of its forms, bodily organization and its shape.

The question “Does an embryo show behavior?” challenges the current (mostly reductionistic) paradigm of modern biology and psychology: most scientists nowadays would give a negative answer in the sense of “That is not possible yet”. Not before the fifth month of human prenatal existence any serious anatomical substrate is present that could be considered as a brain in which something as ‘function’ could be demonstrated by means of physiological phenomena like *electrical brain activity*. Muscle contractions and movements are present then, mostly interpreted as simple involuntary reflexes. Earlier in time however, during the embryonic phase even fewer phenomena may be observed that could be associated with the view that behavior is a kind of product of the brain or nervous system. In that phase the *Anlage* (plan) of the nervous system is still nothing more than a simply structured tube with outgrowing branches that represent future nerves. Many people nowadays therefore consider embryonic existence as purely a matter of biological growth, differentiation and metabolism of cells and tissues. Functioning or existing psychologically is out of order.

From this point of view the embryo is a whole or complete self-organized being that seems to fall apart into its bodily tissues and organs. The actual embryo is maintaining order or centering this process. During embryonic development one may observe at any time groups of cells subdividing into two populations of cells different from the cells they originate from. So one can describe a tree of cells, tissues, organs, which originate as a sequence *out of* each other and gradually differentiate in shape and function. This process that is so typical for embryonic development is called *differentiation*. The embryo is not the summation, result, or a consequence of its parts and organs. Organs and parts should be considered secondary, **the whole, the organism itself is primary**.

The German embryologist Erich Blechschmidt proposed for the human embryo as well as for every living being the *Law of Conservation of Individuality* (Blechschmidt 1977). By this is meant that the *shape of its appearance* might change over the course of time but that the essential *being* itself remains unchanged, present and active within these outer shapes and form. So a fertilized human egg (cell) for example is not just a cell, **it represents an organism**. It is a complete manifestation of the organism *man* at that very moment, under the circumstances and environmental conditions that exist one day after conception.

Like every living being, in *every* phase of its development the human embryo is a coherent whole, a unity of form, shape and function interacting with its environment. Every stage of the human embryo, in spite of homologies in form and shape with mammalian embryos, is a **human** manifestation (see figure 1).

We may look like a cell, or a fish (having homologies of gills) but *we* never **are** a cell or a fish! From the point of view considered here, there is no argument to regard any previous embryonic phase *less valuable* than a next one or as *not-yet-human*. Like every living being we are appearances **in time**. From conception till birth, from birth till death, the human biography is an entity, a whole (Blechschmidt 1982). **All** the appearances and the expressions of a human organism, be it morphological, physiological, psychological or mental, are to be understood and interpreted as human behavior.

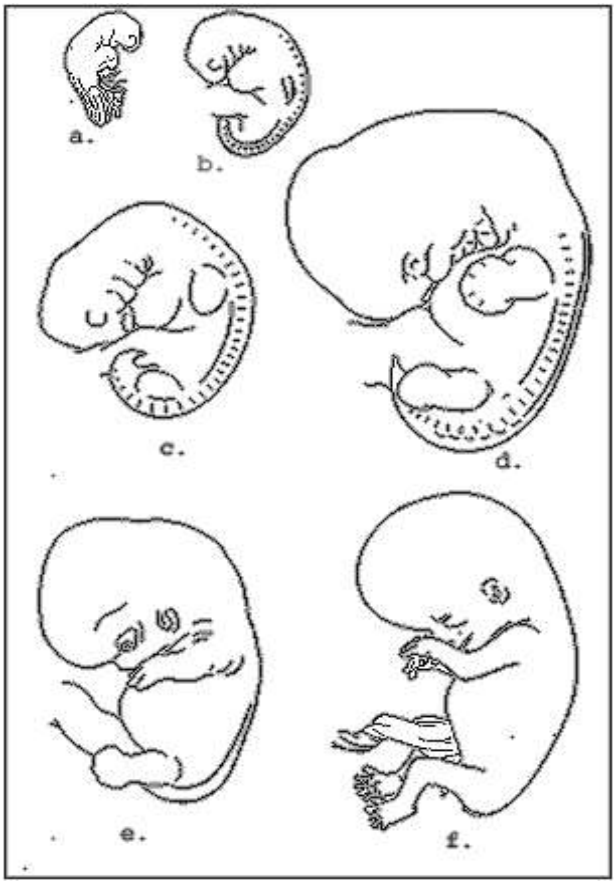

Figure 1. Embryonic stages of the human embryo. In series: age of 26 days (g), about 4 weeks (h), about 5 weeks (i), about 6 weeks (k), about 7 weeks (l) and 3 months (m). (Blechschmidt 1963).

Dynamic morphology, the speech of the embryo

To understand the language of the embryo as meant here, it is necessary to state that understanding the embryo means **understanding the whole, the entity**. Explaining – i.e. searching for causes of the shape, form, *Gestalt* of an embryo – brings one to the (body) parts, the cells, to DNA. Understanding on the other hand leads to the whole, to the manifestation of the organism as a whole. The methodology needed for this approach of an organism may be found in *phenomenology* in general and in *dynamic morphology* in particular.

The approach of *dynamic morphology* is rooted in Goethean science and phenomenology (Hartmann 1959; Bortoft 1986). Like the phenomenologist the dynamic morphologist is interested in the perception of the language of shapes and forms of living organisms rather than in explaining those forms in terms of causes. He describes the form of an organism in its appearance in order to understand the dynamics of the underlying formative gesture.

If one restates in his(her) own inner feeling the motion that is being expressed in the form, one may recognize the related underlying gesture psychologically. In this way one gets the sense of the movement instinctually so to speak. The next example might elucidate this. The containing character of the skull protecting and shielding a given content from the outer environment can be recognized and admitted by everybody as in opposition to the openness by which an extremity interacts with that outer environment. The gesture of the form is **evident** in this case. The related mental act may have aspects of an *(e-)motion* rather than of a rational objective fact, but this does not mean it is only *subjective* in the sense of 'related to personal and individual imagination that cannot be transmitted in an objective way' and therefore as 'nonscientific'.

Taken together this means that dynamic morphology does not apply an analytic process to describe shapes and forms. It tries to understand the gesture (*Gestalt*) and the form or shape in a more integrated and holistic way. In analytical science, the scientist has the attitude of '*onlooke*r'. In Goethean science, the scientist works with a *participative* attitude. By this the scientist is able to recognize movements and gestures working in morphological processes (Van der Bie, 2001).

Morphology and psychology: "Soul is being pre-exercised"

A human embryo functions, like a fetus or a newborn. However, not in the usual sense of a body that **has** a function but in the sense of forms that **are** (a) function. One can observe time and time again that in living nature, in living organisms form and function (mechanism) cope and fit perfectly. The relationship between those two is intimate, intricate, like a so-called *chicken-and-egg-what-is-first-relation*. It is difficult to unravel what is the primary or what the secondary condition, what is cause and what is consequence. Mostly people consider form and function (mechanism) as a kind of *duality*: either you consider form or you consider function and yet the two are linked and involved with each other inseparably. The same is valuable for mind (soul) and body. Is for example brain function **cause or condition** for a given psychological status?

In the view on human embryonic life that is propagated here, it is possible to overcome the *duality* of form and function (or, maybe more exact, of form and mechanism) and of body and soul. The embryo continuously changes its apparent shape in a steady metamorphosis of its form. As shown before changing form is a matter of movement. This concerns a special kind of movement, a particular kind of *behavior*. When one grasps a glass of water one performs an action by means of an arm and a hand. An arm (hand) is an anatomical-physiological substrate, a form that is applied and utilized in the function or action of grasping a glass of water. An embryo of about four or five weeks does not yet posses such an arm or hand in anatomical respect, but during succeeding weeks of embryonic development we may observe an arm growing out. The developing arm exhibits a growth movement or growing gesture. At the end of this long period of development an arm is the result, a structure, a form, perfectly fitted to bring glasses of water to ones mouth. Globally speaking one might state that at the end of a long-lasting process of transmutation and transformation there appears as a **result**, an arm, a very special form as the stilled end phase of a process of a growth movement. The way in which such an arm is achieved or accomplished also determines the shapes and form of that structure and therefore the eventual function (or potential function). In this way one might observe a completely different *growth movement*, a different functional gesture in a developing leg (and foot). It grows out in a more stretching and extending gesture while the arm exhibits more a gesture of flexion and grasping. The conclusion of the thoughts presented here could be that an embryo still *functions in forms*. In adult organisms we consider form and function usually as a kind of dualistic and separate, though strongly related and linked principles. In the embryonic organism, those two are **one and unified**. The embryo functions by growing and changing its form and shape. It is process in motion. The embryo performs or exhibits gestures and movements. This means: an embryo shows (growing) behavior (Blechschmidt and Gasser 1978).

The fact that form and function of an arm e.g. are tuned so perfectly and harmoniously may be due to the phenomenon that the function of the arm as an instrument for grasping has been *pre-exercised* while growing out during embryonic development. Bodily functions, physiological functions, psychological functions are *pre-exercised* as growth gestures and growing movements in the embryo. Considered in this way, an embryo looks, grasps, and walks. It also stays on its feet and holds its own. 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. This *standing during*

growth is a necessary condition for developing a body, a being that later on is able to stand and go upright physiologically and even psychologically.

To come back at the starting point of this chapter, we may state that embryonic gestures and actions of growth are performances. **They are performances as actions in growth** (Blechschmidt 1982) So we return to the statement made earlier: the embryo functions, behaves in forms and shapes. The language of forms and the language of the body in the case of a human embryo is a type of human language and human behavior! Embryonic existence therefore is a kind of silent, mute and introverted existence. As an adult human we express ourselves by means of our body: the world is our aim and the body is the instrument for this purpose (*centrifugal* orientation). The embryo on the other hand still impresses itself into a bodily organization (*centripetal* organization). The idea that an embryo is 'not yet doing anything' or 'is not acting yet' is a great misunderstanding and devaluation. The action, the performance is directed towards itself, inward. It represents human action and human behavior.

The Dynamic of the conception

Before conception the two gametes are produced. *Gametogenesis* starts with the primordial germ cell. From this stage on, differentiation into the oocyte in the female organism, on the one hand, and the sperm cell in the male organism, on the other, is a process of increasing divergence (Sadler 2002). For instance when we look at:

	Oocyte	**Spermatozoo**
Cell volume	++++	- - - -
Condensation of DNA in the nucleus	- - - -	++++
Mobility (externally)	------ (being moved)	++++
Dynamics of the inner content	++++	----- (only structure)
Total number of cells produced in a life time	400	Billions
Total of cells released at fertilization	1 (rarely 2, 3)	Millions
Localization of the gonad as to the body	inside	outside
Temperature quality needed for ripening	warm	cool
Shape of the gamete	ball; sphere	radius

We see immediately that a pronounced polarization takes place. The process of polarization includes germ cell differentiation in opposite directions. However, there is at the same time a reciprocal relation in development in germ cell differentiation (see figure 2.).

The spherical shape of the egg cell is the shape that couples a minimum of contact with the outside environment to a maximum of volume and content. The spherical shape of the egg cell represents the quality of a 'world on its own'. The egg cell relatively has a lot of *inner space* (content): it is the cell with the largest volume that may be found in the human body. The ripened egg cell is as big as a grain of sand and therefore visible with the bare eye, which is an extraordinary feature for cells. For the dynamic morphologist it is important to realize that the egg cell is not only large in the sense of quantity and measurement but that she, by sampling an enormous amount of cytoplasm, also exhibits the *gesture* of 'being large'.

In case of sperm cells there is a tendency to use the plural. Unlike the solitary egg cell a sperm is never on its own. The production of sperm cells (*spermatogenesis*) is characterized by the production of enormous numbers of cells while the process of *oogenesis* (production of egg cells) is characterized by a tendency of diminishing and reducing in number. The whole process of egg cell production and ripening might be described as a *converging* tendency (gesture). On the contrary the male process exhibits a *diverging* tendency: continuously enormous numbers of sperm cells are produced in the testes. This numerousness is also functional. Very many sperm cells will be sacrificed in the process of overcoming a lot of anatomical, physiological and biochemical barriers, which a sperm has to face in order to make contact with an egg cell finally.

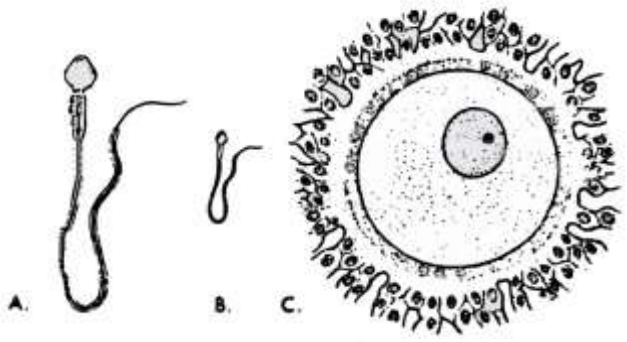

Figure 2. A sperm cell (left) and an unfertilized egg cell (right). In the center a sperm cell on the same scale as the depicted egg cell.

On the level of **extra**cellular mobility the sperm cell may be described as active and mobile. The egg cell should be characterized as passive on this level. When we however look at the **intra**cellular level, then the egg cell represents the active cell. This is in line with her characteristic as a metabolically active cell interacting with the extracellular environment. The cytoplasm of the egg cell is to be considered as relatively very mobile, such in strong contrast to the intracellular inactivity of a sperm cell! More than ninety percent of the content of the sperm cell is nucleus i.e. structuralized DNA-substance.

Summarizing we can say that as to gesture and behavior both cells are a *polarity* to each other. Developing in completely opposite directions, there is a strong inner relationship between the two processes, which is expressed by the reciprocal characteristic of the process. The polarization of the two gametes can be summarized as follows: the oocyte tends to express unidirectionally the features and qualities of the *cytoplasm* of a cell. The spermatozoon, on the other hand, exhibits the qualities and 'behavior' of the *nucleus*. Many more phenomena could be mentioned that support this view.

Conception or fertilization?

From *in vitro* fertilization procedure we know that in the next phase a so-called *pre-conception attraction complex* (PCAC) is generated for several hours (see figure 3). It is obvious that the mere existence of this biological (attraction) complex is a necessary condition for the actual process of conception.[1] We are dealing here with a *state of activity* that is more than just a kind of passive composition and sum of two cell types. Specific interactions take place within this biological complex. It is a biologically active interacting whole that occurs and functions here. Within the initial few hours that this complex exists, a conception is possible, but whether this actually happens or **not** depends on a large number of subtle reciprocal chemical interactions and exchanges. Eventually it **migh**t result in a fusion of the cell membrane of the egg cell with that of a sperm cell. If the circumstances and conditions at a given moment and at a given place are appropriate, only then the fusion of cell membranes may take place by which the content of the sperm cell is brought into the egg cell. The continuity of the egg cell membrane is **never** interrupted or broken. 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 versus a passive partner nor of a penetrating versus penetrated partner, nor fertilizing versus fertilized one. Rather cell and cell qualities are equivalent as a subtle equilibrium of exchange and interaction is maintained.

[1] It is for this reason that the biological complex at stake is indicated as **pre-conception**. Current biology usually indicates the moment of fusion of the two **nuclei** of the both gametes as the actual moment of conception.

For some hours the two gametes (sex cells) constitute a kind of receptive matrix. To understand this thoroughly the reader should consider the image of 'the cell' as it is usually presented. 'The cell' is usually marked as the fundament, the corner stone, the *archetypical entity of life*. On the other hand the pre-conception attraction complex (PCAC) is the complete reverse and inversion of *a cell*. At least if we take the morphodynamic of an egg cell as a *sphere of cytoplasm* and that of the sperm cell as a *nuclear head*. In the current relations of living nature and biology (so of *the cell*) the nucleus should be (in the) center; in the PCAC however, *nucleus* appears in the periphery. Normally a nucleus represents the coordinating and organizing center of a cell. In the PCAC however there nuclei are present *in the periphery* represented by the numerous sperm cells that group and gather around a sphere of cytoplasm. Cytoplasm as a rule should be metabolically active *around* a nucleus. Now however nuclei (plural!) are moving in the periphery and a sphere of cytoplasm acts as a resting center.

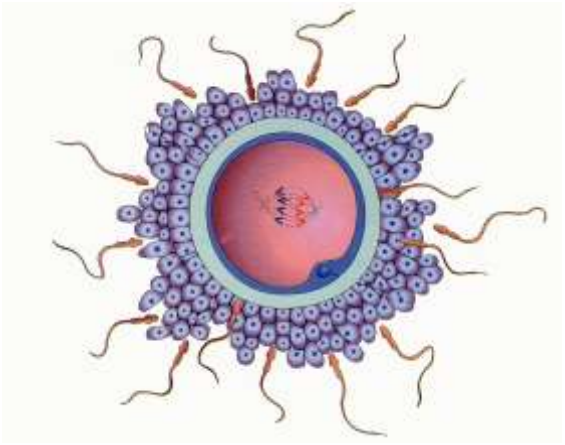

Figure 3. Egg cell surrounded by sperm cells: pre-conception attraction complex. (Saunders 1998).

The whole complex is not a matter of cell fusion in the sense of the mixture of two qualities on an energetically lower level. Considered in this way the two components of the PCAC seem to build, to achieve a biological complex that could be characterized at best as 'a cell turned inside'. The usual relationships of biology are so to speak ruled out and overcome. That is why the neologism *de-biologicalization* is applied: normal cellular biological relationships are reversed to its opposite. Considered as such the pre-conception attraction complex could be characterized as an opening or elevation of usual and normal cell life to its **opposite.** Within the dynamics of the whole process as analyzed and described here, the eventual fusion of the two nuclei and so on are to be interpreted rather as the result or **consequence** of conception than as the cause. At that moment the usual and conventional biological relationships are restored and normalized.

Implantation and the gesture of pregnancy

The processes of the first week are mainly characterized by a relative lack of vitality. There is no growth, only a process of subdivision in cells. The *morula* and later the *blastula* does not have an intensive metabolic interaction with the environment. Textbooks teach us that implantation of the human embryo (*conceptus*) occurs at the end of the first week of development, at about the sixth day after conception (Langman 1986; Wolpert 1991). Actually this is not true. Though the young blastula represents a 'living' organism, there is evidence that it does not have an own and intrinsic biological clock yet. That is related to the fact that the first phase ('week') of human development does not last a week, but is a phase that ends with the act of *nidation*. This might as well happen after some four to five days but also even at the seventh or eighth day after fertilization. The 'first week' of human development is also the period in which it is possible to preserve the embryo by freezing. When we do so, we preserve what we may consider as the *physical condition for development*, a status that can 'wait' for implantation. In fact we then create artificially a so-called *embryopause*, a phenomenon which is physiological for many mammals that are able to postpone the implantation for weeks or months.

The nidation or implantation therefore marks a complete and thorough revolution in the way of existence in the gesture and Gestalt of the human embryo. It looks like the phase of the first 'week' has come to an end and threatens to die out. The *conceptus* and the maternal uterine mucous membrane start to interact and establish an exchanging metabolic interaction, the so-called phase of *adplantation* (Hinrichsen 1998). If the embryo succeeds, the effect is dramatic. From now on the outer or peripheral part of the embryo (the so-called *trophoblast*) starts to exhibit all the qualities and characteristics of a living and growing organism. In an extensive gesture of peripherisation it starts to grow out and becomes metabolically very active. The growth in the periphery with a multiplication of cells form about one hundred at implantation to some thousands three days later has a nearly explosive character. The embryo grows

into the tissue of the uterine mucous membrane, even breaks up the biological and natural barriers of tissue (Langman 1995). The fact that the trophoblast now starts to produce substances that influence the hormonal status of the complete motherly organism (in order to 'prevent' her next menstruation) fits in this gesture. The nidation therefore represents a kind of discontinuity, a fracture. The embryo goes through a kind of crisis. This might 'explain' why relatively so many embryos fail to overcome this gap.

Many biologists consider the act of the implanting embryo as a kind of biological aggression on behalf of the child, the embryo. In the latter view the embryo invades the motherly organism, not respecting biological boundaries. Just like the so-called penetration of the sperm however turned out to be an act of reception (and not an act of aggression and penetration), also the gesture of nidation may be the image of a completely different relationship between mother and child than that of aggression and invasion. The embryo, the child differs from the mother in genetic respect. If a mother would be implanted ('transplanted') with tissue of her child, she would reject it, though not as active as in the case of a non-familiar donor. At the moment of nidation however a complete new biological entity i.e. her child is implanting into the body of the mother and (usually) mother does not attempt to reject it at all! Does this not mean that actually the physiological mechanism of pregnancy may be characterized phenomenologically as a gesture of **reception**, of providing room and of a kind of withdrawal of the maternal identity? The status of pregnancy is not one of having or of (even worse) possessing a child, but one of receiving and hosting a child. The interaction so typical for ad- and implantation, the one of asking and responding, of literally inter-action, is continued during the whole event of pregnancy. As to the biological phenomena this is typically the gesture of pregnancy, at least seen through the glasses of the dynamic morphologist.

Two in one

During the first days of development (first week), the fertilized egg (zygote) divides gradually into more and more cells by a process of subdivision (not by growth). Around the sixth day after conception the embryo is a small vesicle (*blastula*) fallen apart into an outer mantle (called *trophoblast*) and into a center or nucleus which is called the *embryoblast*. The *trophoblast* consists of some hundred smaller cells with some fluid within it, the *embryoblast* consists of a smaller number of cells (8 to 12). The latter represents what will later be indicated as the 'actual' or 'proper' embryo. From that moment on a human organism consists of a peripheral body (mantle body) – the wall of the vesicle, the *trophoblast* that will grow out to the later placenta and membranes – and a central body, the *embryoblast* to be called the 'proper embryo', the body that will become our 'proper' body at birth (Hinrichsen 1998).

Of course those two bodies will change and metamorphose thoroughly during our prenatal life but the duality stays present and is discernible during our whole prenatal life. Apparently it is essential and marks our prenatal existence. It is important to realize that the two 'bodies' have differentiated from **one** structure. And that therefore the 'peripheral body' – the *trophoblast*, later *amniotic sac* and *membranes* and *placenta* – doe **not** belong to the motherly organism. It is 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, its exist. Comprehensively one may conclude that the **dynamic** of the embryo show that the central body is coming forth out of the peripheral body. It emancipates from it in a process of gaining independency (autonomy). What was a one, gradually differentiates and separates in a twofold.

Morphologically the prenatal development may be considered as gesture of emancipation, of physiological individualization. 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 his/her 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 developing the actual principal gesture of human development? Every time again and again we envelop ourselves with mantles and we feed ourselves with the nourishment from the context, the environment we are part of for that moment. But only by laying down the mantles that fed and enveloped us, we may come further, break out to an new phase, a new environment. Is it not by a

primeval act of *Ent-bindung* (German for de-composition) that we are born, in this way pre-exercising the gesture that may be considered as most fundamental for human existence?

Conclusions

In this chapter the contours are indicated of a phenomenological embryology that searches for human embryonic behavior. Central issue of this approach is that man is a being of body **and** soul and that human expression or behavior includes the morphology and morphogenesis of the body. The process of body formation is psychological expression, human behavior. In this view it is not excluded that the embryo, the human entelechy present 'within' the embryo also experiences and that such experiences may lead to deep impressions, be it scars, pain or disorder, be it motives or skills, which may manifest psychologically in later life cycles. If one assumes to deal with a human organism and one considers such a being as a unity of body and soul (psyche) than one deals with **human** behavior the complete embryonic period long. Our body is a human body, fitting and serving human constitution, human soul and consciousness. The shaping of the body is human morphology and psychology.

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Glossary of embryological terms in alphabetical order

Adplantation: the process of contact and interaction between a human *blastula* and the maternal mucous membrane of the womb (*endometrium*) during which the conditions for a successful implantation (Or: *nidation*) are developed

Amniotic sac: the embryonic cavity filled with (amiotic) fluid that separates the so-called 'proper' embryo (or, later: fetus) from its amniotic sac (or, later: fetal membranes and placenta); it envelops the embryo i.c. the fetus and the umbilical cord.

Blastula: stage of the human embryo at five to six days after conception, consisting of some tenths of cells, shaped like a vesicle with in the center a cavity filled with fluid

Conception: the fertilization of an egg cell i.c. the fusion of the nucleus of the egg cell with the nucleus of a sperm cell

Conceptus: the early human embryo after conception and before implantation (*nidation*)

Differentiation: process in which from originally alike tissue or tissue components (cells) different types of tissue or tissue components (cells) are derived, leading to specialized tissues and cells

Embryo: first developmental phase of an organism. In humans: the phase of prenatal development from conception (fertilization) till the moment that the body plan is developed completely (about the first 10 weeks of pregnancy).

Embryoblast: the *inner cell mass* or central core of a human *blastula* from which the so-called 'proper' embryo will be derived

Embryopause: the postponing of the moment of implantation (nidation) of the embryo with weeks or months after it has reached the stage of a *blastula* after a period of five to six days

Fertilization: fusion of an egg cell with a sperm cell.

Fetus: phase of prenatal intra-uterine development. In humans: from the embryonic phase (10^{th} week) till birth (40^{th} week after conception).

Gametes: sex cells or reproductive cells

Gametogenesis: production and formation of sex cells (*gametes*)

Implantation: process of invading of an embryo of the mucous membrane of the maternal womb; in humans at about the sixth day after conception.

Morula: stage of the human embryo after the first meiotic cell divisions after conception at about three days old, consisting of about 12 to 16 cells

Nidation: the process of implantation

Oocyte: not yet ripened, primeval phase of a human egg cell (or: *ovum*)

Oogenesis: production and formation of female sex cells (or: egg cells)

Placenta: the part of the *trophoblast* (and later of the *amniotic sac*) that specializes to the specific function of metabolic interaction between mother and unborn child; it is attached to the inner side of the pregnant womb and by means of this organ the child a.o. gets its nutrition from the maternal organism.

Pre-conception attraction complex (PCAC): complex built by a human egg cell (or: *ovum*) and various hundreds of sperm cells, some hours before fusion of the egg cell with a sperm cell

Spermatogenesis: production and formation of male sex cells

Spermatozoo: sperm cell i.e. male sex cell (or: *gamete*)

Sperm cell or *spermatozoon* : male sex cell (or: *gamete*)

Trophoblast: the *outer cell mass* or outer cell layer of a human *blastula* by which the embryo (or: *conceptus)* invades into the *endometrium* and by which it establishes its nutritive and metabolic contact and interaction with the environment of the maternal womb. The later fetal membranes and placenta are derived form the *trophoblast*

Zygote: a fertilized egg cell (after *conception*)