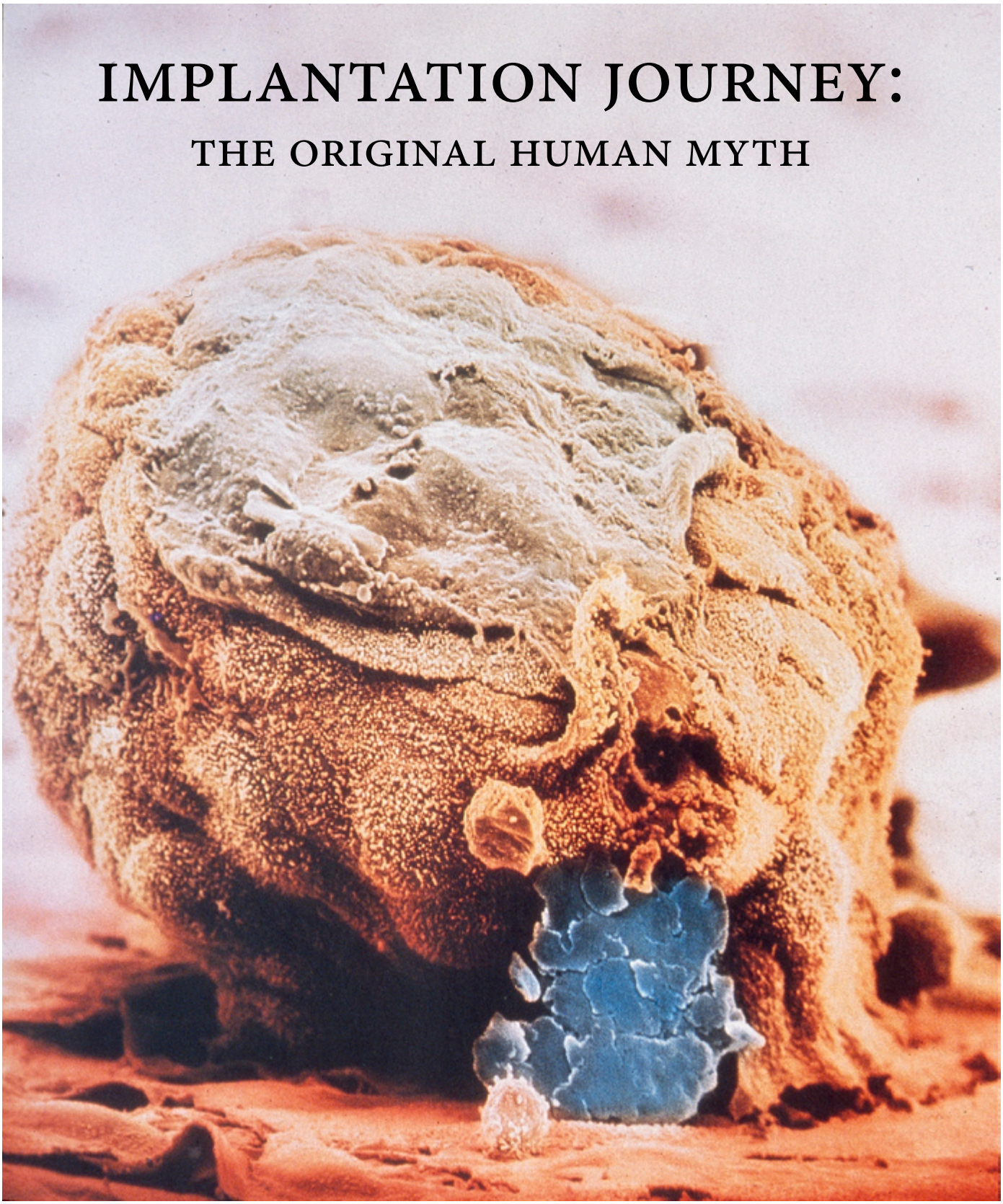
IMPLANTATION JOURNEY:

THE ORIGINAL HUMAN MYTH



By Karlton Terry

LENNART NILSSON, TT/SCIENCE PHOTO LIBRARY

Preface

With Freud we accepted that our early childhood essentially shapes and is therefore the architect of our adulthood. With Jung we accepted that forces from the collective unconscious structure and order our lives, motivate us and influence our condition as individuals. Why then is it still taboo to appreciate the impacts of early prenatal life upon every human system, including the psyche? Prenatal life, especially before the second trimester, is the bridge between the collective unconscious and human experience.

Our mothers rarely know when they conceive or when implantation occurs, so for the human blastocyst, the events of these early hours and weeks occur alone and in darkness. As a world culture we haven't given much credence to this little window of human development. But increasing evidence suggests that we human beings repeatedly act our primal cellular and biologic journeys, as children and adults, in our day-to-day lives. Even our myths, music and art reflect back to us our primal feelings, biologic sensitivities, longings, and fears. What is it that we can learn from our primal journeys so that we can continue to evolve and better know the human condition as well as our individual selves? If we can understand the forces that shaped us, then we have a better chance of catching a glimpse of the "Self" behind our persona. The "Self" is the unexplained mystery behind individual human consciousness, sometimes called the soul.

As evidenced by recent world events, human beings and human cultures are often still trapped in the impoverished attitude of reacting to our environments, or acting out from over-established patterns like mice who learn a single route through a maze. What would change if we understood the origins and inefficiencies of our unsavory behavior patterns: aimless repetitions, inefficient routines, narcissistic materialism, and destructive competitiveness? By looking into our own individual pasts we can review the forces that molded us into who we are now, and distinguish our vital, inspired activities from our dreary or destructive routines. If we are compassionate and patient while looking into this mirror, we will recognize a deeper, inspired self, a deeper meaning and harmony underneath the layers of rote.

"Every man's condition is a solution in hieroglyphic to those inquiries he would put. He acts it out as life, before he apprehends it as truth."

~ Ralph Waldo Emerson

Introduction

Throughout our school science books, the Bible, the theory of evolution, primitive creation myths and modern physics, there is little agreement about the origin of the universe, our world, or ourselves. Yet all human beings do hold something in common––an origin in the cellular biology of two gametes coming together, followed by an impressive and perilous journey as we develop into a human fetus. The sciences of cellular and molecular biology, embryology, and prenatal psychology suggest that our earliest "journey" exerts meaningful influences on how we develop into a person and how we experience ourselves as human. The impact of these influences can last a lifetime and can reside in all human systems, from the genes to the tissues to the psyche.

Who we are as individuals is as much a result of the events that shaped us (especially in our earliest days), as it is an expression of our genes. Probably more profound than any other event that shaped us, our implantation journey is a distinct personal process that can be approached and understood from many scientific, psychological and spiritual perspectives. Perhaps we begin as an unconscious batch of living cells, then, according to a grand genetic blueprint, we sequentially undergo processes until at some point we develop into the most intelligent and complex of living beings. Or perhaps this journey is undertaken by a trembling incarnating (or re-incarnating) soul. Whatever our orientation toward origin, creation, or creator, the imprints from these earliest hours and days are likely precursors for individual and collective human myths: our reference point for self-discovery and the calling to life. Greek mythology, as a reflection of the human experience,

"…tell[s] how the world came into being and how cosmic order was established…how the principal gods were born and acquired their individual prerogatives…how the first humans came into being…and why the quality of human life is such as it is." *1

My aim is to describe the implantation journey of the human blastocyst as the original human myth. The human zygote, created at conception, divides into a two-cell (or two blastomere) organism, and then goes through various stages becoming a blastula, morula, blastocyst, embryo and fetus. In this essay I will refer to the human organism, after the zygote stage and up to implantation, as a blastocyst for the sake of simplification. I intend to strike a balance between a soulful and humanistic portrayal and a clear scientific approach honoring the respectable skepticism of practical thinkers. Descriptions of the processes and stages of implantation will include metaphorical images and allusions to mythic parables to convey relevant psychological and sociological implications of the phases of implantation.

First we must consider that from the point of view of cellular biology, specifically embryology, implantation is a "miracle." That is to say, implantation is a phenomenon not fully understood at a chemical and molecular level; it is a biological transition that theoretically should not happen at all. The maternal immune system ought to be hostile to the human blastocyst, recognizing it as an invader and destroying it because it contains the paternal genome. Our implantation site is our "first home," *2 and the task of implanting can be likened to establishing a site of order and safety in the wilderness of the uterus. Throughout mythology such a task is frequently portrayed as when:

*"A god wishing to establish his cult or a hero wishing to found a city often encounters danger at the site in the from of a hostile creature, whom he must slay before he can construct his sanctuary or city… [the gods or heroes establish] a temple or town, a little cosmos where once there was found only the dangerous chaos of wilderness." *3*

Along the early human journey and within the entire prenatal realm with all its perils the most deadly transition is implantation. It is well known that prenatal mortality is a more likely outcome than a birth. The big business of In Vitro Fertilization is booming in our era, not just because it is hard to conceive, but mostly because it is hard to implant. During the prenatal stage of implantation alone, the biologic dangers are real and in fact only about 55% to 60% of implantations are successful, where the early human creature is accepted, tolerated, and nurtured by the maternal environment. *4 Even in these successful implantations the blastocyst will have experienced core starvation, later must transmute (or die) several times, and must survive biochemical hostilities from its environment.

Although implantation is a completely natural biologic phenomenon and happens every day, the genesis of individual human life is profound and mythic. Imagine the impact of harrowing physical experiences upon stem cells that will one day comprise the brain and body in which an individual psyche resides. Even as prenates we have a self-identity, and specific (conscious and unconscious) behavior, reactions, and emotional patterns. How does our adult consciousness express or experience itself as a consequence of preceding biologic events? If we accept the theory that a soul is present at conception, does this mean that each embodying soul is forged and formed just as its physical body is forged and formed in these early times? If there is no such thing as a soul, the consequences from this primal and universal biologic path, the gateway to human life, can be viewed as each individual's archetypal human myth, arising out of the most basic human experience.

Why are two brothers or two sisters so different from each other? Identical twins, presumably coming from the exact same genes pool, can be diverse, one becoming an artist the other a mathematician. What conditions personal diversity and why is each individual unique in character? 'It's in the genes.' 'It's one's parents.' 'It's wealth or poverty.' 'It's diet.' 'It's because of what happens in one's childhood.' Such typical suggestions don't reach far enough into the biological reality of our human experience. When we look into the oldest archives of our personal journey we begin to understand that basic individual human responses are programmed beneath our consciousness, even before we have a brain. Our basic interactions with our world are set up before we are offered the breast or the bottle, before we are given our names, long before we are even born. The effects of the implantation journey are relevant to the future human being, its behavior, reactions and interactions.

Darwin stated that his greatest error when he wrote "The Origin" was "not allowing sufficient weight to the direct action of the environment, i.e. food, climate, etc. independently of natural selection…." *5 Food, climate, and environment are the essential elements of the implantation journey. Each newly formed human organism is conceived in the environment of its mother's fallopian tube. As it struggles and maneuvers via creative means to obtain sufficient food for survival and growth, the blastocyst transmutes through many progressive forms––each a sort of evolution, and in combination these evolutions result in the human individual. Throughout this time the primal human being marinates in its environment. Fertility and embryological researchers, through ever improving technological methods, continue to observe cell behavior and the early human in relation to its environment. They are learning with conviction that the environment has far reaching impacts on any group of cells, whether it is a complete human being consisting of up to 100 trillion cells, whether it is a human blastocyst, or whether it is a group of cultured cells acquired for biological research. As Bruce Lipton, a cellular biologist explains, "…when the cultured cells you are studying are ailing, you look first to the cell's environment, not to the cell itself for the cause." *6 And the environment has direct impacts even upon single, isolated cells: "Single cells are also capable of learning through these environmental experiences and are able to create cellular memories, which they pass on to their offspring." *7 Let me point out that you, the reader, are the offspring of your blastocyst's cells and your original environment was the body of your mother.

William Irwin Thompson notes, "Science wrought to its uttermost becomes myth. History wrought to its uttermost becomes myth." *8 Our journey toward our birth when wrought to the uttermost becomes myth and it is reasonable to view the implantation journey as an epic myth. It consists of complex and rapid physiological transmutations. Multiple transitions and tests of integrity are encountered as in mythology where "…bizarrely evil characters, each with a special trick [challenge] passersby for their lives." *9 It is a journey where the stakes are high (life or death), and one that most blastocysts won't survive. It is a process through which the primal human endures the greatest of challenges: hunger, struggle, and commitment, testing the organism's right and ability to exist.

The protagonist, the human blastocyst, is the hero of the story, begotten from the miracle of conception. As it is for all epic heroes, ours undergoes substantial evolution––from an unattached wanderer to a creature who becomes stationary, taking up rather permanent residence once a wellspring of nourishment is discovered. New sources of nourishment are discovered after implantation and further development ensues as the blastocyst develops into a living human fetus. Even as we are transitioning through implantation, the embryonic disc is busy organizing and preparing to construct what will become our brain our heart our adrenals… even our fingerprints. The most formative, dangerous and important part of the prenatal journey is the first trimester when we pass hundreds of biological milestones, when our bodies are formed. After the first three months of life, the complexity and danger of gestation subsides. The body has been more or less completely established, risk of spontaneous miscarriage is low,

and all we have to do for the next six months is grow.

Human beings (no matter what age) exist and are present within the internal environment of the body and mind and within external environments, including the other human beings in it. The body of the mother is our first external environment and the first human being with whom we have direct contact. Our interpretation of and reaction to the world is heavily influenced by what is internally present at each moment: our predispositions, attitudes, beliefs, and neurological programming. What we bring to each moment is a rich, diverse, and complex mixture resulting from everything that has come before. In other words, our own personal myth colors everything.

In any particular moment, who we are and who we think we are is layered upon our cellular history and the early cellular responses that led to our most basic biologic functions. The early human cells, like primitive or simple organisms they were, grew and survived and learned while engaging in challenges and transitions marked by chemical and cellular processes. When challenges occur, transitions are faced, and successes achieved in our experiences as children or adults, we feel an intensity of life. Stimulating experiences translate into emotions and thoughts that echo our primal experiences: desire, hunger, hope, fear, struggle, and success––all of which are elements of myth. "Like humans, single cells analyze thousands of stimuli from the microenvironment they inhabit. Through the analysis of this data, cells select appropriate behavioral responses to ensure their survival." *10 Yet unlike the simple creature that learns (or acts out of instinct/biological intelligence) to find food, procreate, and avoid danger, the stem cells of the human blastocyst evolve into the most complex organism on earth.

Isn't it ironic that despite all its complexity, the basic functions of the human being are the same as those of an individual cell: to find food, procreate, and avoid danger? Perhaps all the variations of our complex behavior and thinking patterns, our interpretations, emotional responses and reactions are not so complex after all when viewed through the lens of myth. Our behavior, the gyrations of the human psyche, our thinking, and our emotional processing can be more easily understood if we know the origins behind them. Discovering how we survived the environment to which we were originally bound in implantation can give us some understanding. It is in the body of our biological mothers, our first environment and first human contact as human seed, that our story and thus our understanding begins.

To comprehend this journey, which we have each already made, it is best to acknowledge the basic storyline and the biologic processes that comprise the myth. Individual human creation normally originates in the landscape of the ampulla, the curved upper third of the fallopian tube.

The implantation journey begins after conception, upon the first mitotic division, when the single cell zygote shape-shifts, giving birth to a two-cell blastocyst. How this transmutation happens is still not completely understood by science, and therefore remains in a phenomenological realm beyond our immediate grasp. The two-cell blastocyst replicates and morphs into a four-cell blastocyst and the four-cell blastocyst then becomes the eight-cell, and so on. Leaving the ampulla, a colony of cells makes its way down the narrowing part of the tube, called the isthmus, and then into the interstitial portion of the tube that leads to the uterus. Upon arriving in the geography of the uterus, the blastocyst must then hatch out of its protective skin, and seek a site suitable for sustaining itself.

Technically, implantation is the process whereby the newly hatched blastocyst adheres to and then merges with the epithelial surface of the endometrium––the uterine wall. As it enters deeper into the uterine wall, the blastocyst and endometrium react to each other creating a syncytiotrophoblast, an area of merged, shared physical space where the body of the blastocyst and the body of the mother are

are intermingled. Tendrils growing out of the leading part of the blastocyst, the trophoblast, explore the area of the syncytiotrophoblast and encounter pockets containing pools of blood and other nutrients. Utilizing the newfound source of support, like a band of weary travelers settling down near a spring, the blastocyst next concentrates on self-propagation. Finally the chorion, placenta and umbilical cord begin to form as implantation is successfully completed.

Mission accomplished at long last, the hero(ine) has truly arrived and is likely to survive the remainder of its prenatal life to be born an individual human being. Because we are so vulnerable in our early life, human individuality is forged more by the implantation journey than by any subsequent prenatal, peri-natal or childhood events. To discover who we are we must understand what shaped us into ourselves as individuals. "The subjective experience of individuality is a profound mystery that we cannot hope to encompass by rational understanding… the experience of individuality is primary; it cannot be analyzed or reduced to simpler elements" *11

Whether it is viewed as a hero's epic journey or as a biological/embryological phenomena the implantation journey is best understood by organizing the process into the following main stages, each of which has thematic impacts upon the organism and the human being who evolves from that organism:

1. Post Conception Fallopian Tube Journey

2. The Fall (into the uterus)

3. Hatching

4. Uterine Exploration

5. Implantation and its Sub-stages

1. Post Conception Fallopian Tube Journey

At conception, the membrane of the oocyte (the egg) has the intelligence to become impermeable to all sperm but the conceiving sperm. Otherwise the cell would be filled with too many chromosomes and could not function. Called the zona pellucida, this membrane remains as the outer covering of the blastocyst during the fallopian tube journey. As the new cells continue to replicate and divide, the zona pellucida contains them. Except for a lining of cilia to help transport the blastocyst, the inner surface of the fallopian tube is similar to that of the uterus itself, and this surface secretes a substance called "uterine milk." The zona pellucida is permeable to this uterine milk, which contains water-soluble proteins, gasses (including O2), sugars, other nutrients, and other elements from the mother's system. In the early stages after conception all of the blastocyst's cells are able to absorb and utilize the uterine milk since the cells are few in number and all proximal to the surface of the zona pelucida.

Within each cell the many magnificent intra-cellular organelles and "machines" are at work, breaking down the uterine milk and delivering the components where they are needed. As with most body fluids, uterine milk contains, besides nutrients, many other elements present in the mother's system including traces of any exogenous toxins she has ingested, adrenaline, corticosteroids, other hormones, and neuropeptides expressive of her emotional condition. Each and every diverse component in the uterine milk will have an impact within the body of each of the new blastocyst cells: toxins will make the cells have to work harder; varying cotrisol levels will impact the density and plasticity of the cellular tissues; adrenaline will affect the rate at which the cell respires and processes its metabolic functions; and "neuropeptides, especially if they are excessive, can penetrate their receptor sites in a stacking format, growing like a stalactite, sometimes even into the core of the cell." *12 According to Lipton, receptor "antennas" on cell surfaces can even "read" the vibrations of nearby cellular or biologic activity and the energy fields emanating from cells and organisms. Imagine the biophysiological impacts of a blastocyst marinating in the uterine milk of a drug-addicted mother who suffers from severe depression, smokes three packs of cigarettes a day, and eats only packaged preserved foods. Compare this to the uterine milk of a healthy young mother who wants to become pregnant, who exercises regularly, and who eats home-cooked organic meals.

Each uterine environment is unique to the individual mother, and unique to a given time in her life reflecting her diet and her emotional state. Endlessly diverse possibilities converge to manifest a specific uterine environment, or landscape, that is present during the few days of the fallopian tube journey. Each myth has a background against which it is played. Imagine the interior of your own mother's body, many years ago when she was young, and most likely completely unaware she was about to get pregnant, it was within this realm that you took your "first steps" in human form.

Because the fallopian tube is so similar in quality to the uterus, one could say that the time spent in the fallopian tube is essentially the first contact with the uterine environment. We know that the environment in which cells, or clusters of cells, reside has immediate and long lasting influence. To better understand these influences it makes sense to classify uterine types based upon the general themes. Listed below are uterine types, identified by their varying qualities.

a. LUSH

A lush uterine environment is one in which there are plenty of high-quality nutrients available, but few toxic elements. Blood flow has been directed to the uterus because the mother-to-be wants to become

pregnant. She intends to embrace and nurture a blastocyst. She has a good diet, a positive attitude about sexuality and procreation, and is emotionally balanced.

b. BARREN/ARRID

This uterus is not yearning to grow a baby: it could be an old uterus, an unhealthy uterus, or the uterus of a young unmarried girl who has no desire to mother. From the perspective of a blastocyst, a barren/arid uterus would look something like how a dust bowl or desert looks to a farmer. Compare this to a Lush environment as exists in parts of Hawaii or Central America where clear streams run everywhere and fruit is falling off the trees.

c. FRIGID

A frigid environment, because if its inherent chemistry, will literally feel cold, just as you do when you get chills down your spine in reaction to a chilling feeling or thought. Such a chemical stew arises, as it does in all the uterine environments, because of the emotional state of the mother and the physio-chemistry of her system. A frigid fallopian/uterine environment resides in the systems of women who are themselves cold by nature. Withdrawn, unemotional, ungiving, analytic, parsimonious women are likely to develop a frigid intra-fallopian environment.

d. TOXIC

All sorts of teratogenic substances will make for a toxic womb. Bad foods and eating habits, excessive smoking and drinking, drug abuse, living in a polluted environment, and consuming preservatives all contribute to toxicity derived from exogenous sources. But emotional toxicity and the effects of neuropeptides must not be undervalued as womb-conditioning agents. Another form of toxicity is one that results from a condition referred to as a "Haunted Womb," describing one in which abortions or spontaneous miscarriages have occurred, resulting in the death of would-be siblings.

Each of these uterine types is identified by thematic qualities that are predominately physical in nature, yet it is important to understand that no uterus expresses only one theme. Most wombs express different levels and combinations of each type, and depending upon the interactions between the blastocyst and womb, limitless chemical and emotional possibilities will combine to result, ultimately, in limitless and diverse psychological possibilities. The prevalence of mood-altering drugs reminds us that our neurochemistry dominates our psychological states.

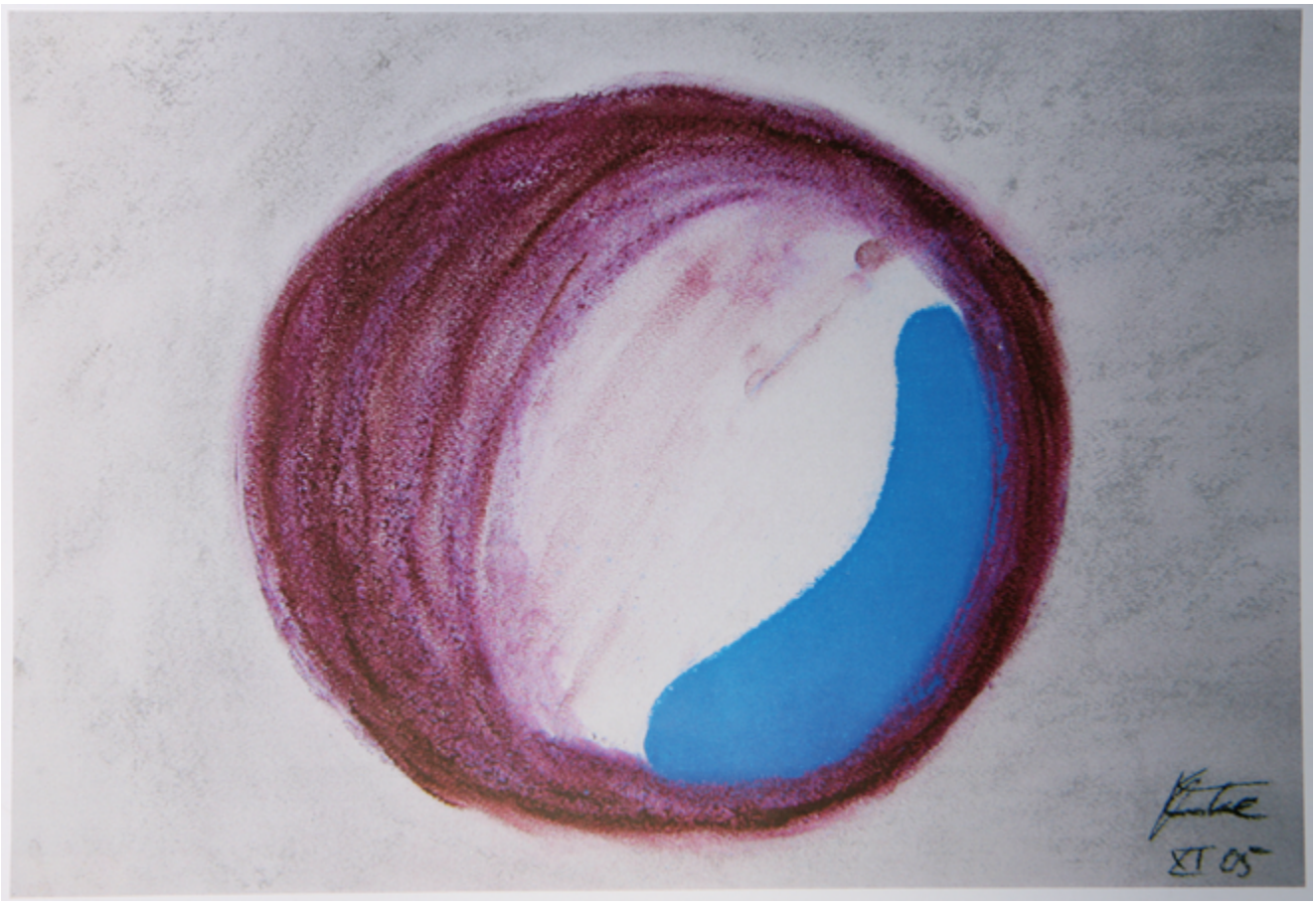
In the forty years or so since prenatal psychology has been developing, many therapists have reported instances where the quality of the mother's womb has had an impact on the psyche of their patients. Most of the womb environments could be included within one or more of the types listed here. My friend, Dr. William Emerson, urged me to specifically acknowledge what he has identified as the "narcissistic womb" in which the mother's self-obsession creates an isolated, empty environment, an existential prison, for the prenate. Such a womb would be emotionally toxic and could also have any of the various physical qualities in the foregoing list.

If a soul is present during the implantation journey, then exposure to the earthly realm must, at times, be quite shocking. Johannes Kepler in the first passage of Harmony of the World observes, "The faculty which perceives and recognizes the noble properties in what is given to the senses, and in other things situated outside itself, must be ascribed to the soul." John Davis depicts the soul thusly:

"*It is the soul that digests experience and that is transformed in the human being through experiences. The soul is the site and container of individual experience. It is the fabric of experience. The soul is the means through which Being experiences itself. All content of awareness is content of the soul. Sensa*tions, percep-

tions, emotions, thoughts and concepts are all forms flowing within the soul." *13

When we imagine the experience a soul has in its body, the classic myth of the "Fall" is conjured: the fall from heaven, the fall from grace, the fall of the soul into "…entrapment in grossness, in vulgarity, in the noise and squalor of the world…." *14 What is it like for the soul embodied, or embodying, in the material world of the flesh––a glistening clump of stem cells ripe with potential, but trapped in a solid state where gravity, time, and physical sensations are playing in the body relentlessly? If we as souls choose our parents because we are particularly attracted to them or to work out some kind of karmic issues, then we choose the chemistry of our mother's body. This means we choose whatever maneuvers are enacted upon our new cells by the armies of neuropeptides and waves of intra-fallopian biochemistry. So the soul, and not just the cells, is impacted, shaped, and modified by the fallopian tube journey.



What if a soul is not involved? One might argue that during the fallopian tube journey there is no brain or myelinated nervous system to report sensations to a consciousness…and therefore no consciousness yet. Do we need a brain, not a soul, to be considered human? In any case, we are discussing a living, responsive human organism. And such an organism acquires properties because it is subject to external influences. When a consciousness eventually forms in connection to an organism, then the preexisting properties of that organism manifest as a fabric through which the consciousness must be woven.

If humans are merely randomly (or logically) evolved animals on earth, then how might the fallopian tube journey have impacted us? How could our decisions, our responses and reactions, our relationships to food, money, power and intimacy be impacted and shaped by this completely natural biologic process of the blastocyst? How could the events that brush our early cells impact the consciousness that comes to reside in them? From the chemical and molecular perspective the early cells are literally shaped by the absorption of exogenous material. Cells are extremely complex and sensitive. They

contract in contact with astringent agents. They can recoil in reaction to substances with ionic properties just like a snail would if you dropped a grain of salt on its head. Our earliest cells are influenced by everything that happens to them. Resilient as they are, a bio-physicist will tell us that in one way or another an organism is permanently affected by whatever happens to it. Embryologic process is like the construction of a stone house. Each stone represents a stimulus and an event, and each stone in the foundation or the walls has an inherent effect on the whole system, resulting in a shape. Each event has a consequence and therefore each event nudges the system in some direction. All subsequent layers of stone are oriented by and built upon their predecessors.

Some researchers surmise that we are not truly "conscious" until we are three to five years old, when the myelenation process is finally completed. Most people don't have "normal" recollectable memories of events preceding this age. But mentally retrieving stored images or events in the brain is only one kind of memory. The body has its own form of memory called "cellular memory" or "somatic memory." A limp, for example, can be the memory of a broken toe. A scar is the memory of a cut. An automatic and persistent avoidance of fire could be the behavior pattern resulting from the memory of a burn.

Automatic responses or reactions are behavior patterns (not thought about or chosen in the moment) resulting from a kinesthetic memory. For example: Someone might recoil at the first moment they are physically touched, while someone else melts and relaxes at the moment they are touched. The recoil pattern is in place, probably not just in the brain. It has been somaticized. If such a behavior is always repeated by someone and can be recognized as more or less an unconscious response, it is memorized throughout the system. If we have recognizable but inexplicable patterns of behavior, surely the roots of such behavior grow deep into the past. Maybe the person who recoils upon contact had the experience as a blastocyst of nearly starving and needing to make uterine contact to receive food, but recoiled from first contact because of something lurking in the fluids beside good food (an acidic uterine wall, or nicotine for example). In this case contact, though necessary, is also experienced as harmful. If the blastocyst sustained its relationship and eventually received what it needed to live, then, by virtue of its patience or persistence a pattern based upon reward is established. It's a life or death issue, so the imprint will be potent. As a body memory, its efficacy can be profound, and set up a permanent pattern: the way to survive is to recoil first, sustain contact, then evaluate, digest and endure.

At some point our consciousness involves self-awareness: awareness of our body, awareness of our behavior, awareness of how our actions bring or don't bring us what we want and need. We develop awareness about the quality of our life, and we develop strategies to improve that quality: to get more attention, to earn more money, to eat better food, to receive more contact and love, to increase our happiness. When our consciousness develops, or arrives, it becomes aware of what has come before, what events and what lessons have accumulated along the path of our personal history. "Retroactive recognition" is the term I have coined to describe the gradual meditative/contemplative or sudden, epiphanic increase in expanded personal consciousness in connection with understanding how the details of the past have impacted the present.

One way to understand retroactive recognition is through the colorful analogy of the Mexican "vocho." A vocho is an old style Volkswagen Beetle, a "bug." In Mexico City they are painted green and white and are used as taxicabs. There are more VW taxis concentrated in Mexico City than anywhere else in the world, and so the word vocho can refer to a bug or to the famous, pervasive taxi. Each one has a completely different personality. You can sit in a vocho and tell quite a bit about what it has been through in its lifetime. Some have had the front passenger seat removed. Many are missing a headlight or a radio. In one an image of the Virgin of Guadalupe hangs from the rearview mirror, while in another hangs a little plastic soccer ball. In some of them the windows function smoothly and others the

window crank can jangle up through your elbow. Some of them pull to the left or the right, and some of them have brakes that seem like they will never really work despite having the ability to generate ear-piercing squeals. The seats, carpets, ceiling panels and all interior surfaces are variegated and unpredictable and appear in various conditions of repair and cleanliness. Each vocho has its own distinct aroma––the molecular trace of its history, its passengers, and the many events that occurred and objects that passed through: food, petroleum products, perfume, cleaning agents, and so on. Becoming a conscious human being, whether it happens at age five or twenty-five, must be something like waking up in a vocho. You can look around and see, smell, feel, touch, in general, experience the vehicle, the essential history of the entity so to speak. And you really can tell what it has been through, how healthy, lazy, fastidious, creative, expressive or sloppy its owners have been.

Everyone knows that children are more vulnerable than adults. Babies are more vulnerable than children. Prenates are more vulnerable than babies. This is one reason there is so much prenatal mortality. The younger the prenate, the more vulnerable it is, the more at risk it is to mortality and mutability. Therefore one could imagine that the meandering blastocyst is probably more significantly shaped and formed than the human organism is at any later time in its life. If this assumption is correct, then it means the cells that become the brain and nervous system, and the cells that become the heart and other muscles are already oriented in some way, even before consciousness develops and resides in them. If there is no soul along the way, then eventually, as consciousness arrives, it must be a bit like waking up and finding yourself inside your own personal vocho.

Besides being shaped by biochemical, molecular, and peptide influences, the blastocyst is also subject to various mechanical influences as well. There are cilia inside the tube that sway and vacillate, facilitating the journey. The smoothe-muscle tissue, of which the surface of the tube is comprised, contracts to create a peristaltic movement. Folds and flaps within the tube can look like a geologic landscape that has been eroded and washed by flash floods and flowing waters. Some blastocysts can get trapped in the folds, or hatch and implant in which case an ectopic pregnancy develops.

How does a blastocyst navigate the fallopian endometrium? Can it move, like a snail, sticking to the epithelial surface, until it finds its way down the tube toward the right location to settle down in the uterus? Apparently, blastocysts are not only transported by the cilia and the peristaltic contractions of the fallopian tube muscles, but they may be able to regulate their mobility as observed by Wiklund, et-al (1998):

"*…prejunctional inhibitory A2 and postjunctional stimulatory A1 adenosine receptors on noradrenergic nerve terminals have been observed in the oviduct… suggesting that endogenous adenosine, acting differently via its receptors, may play a role in modulating adrenergic neurotransmission and consequently modifying tubal contractility.…*"*15

To translate, the blastocyst, as it comes into contact with the epithelial surface of the tube or endometrium, participates in an interaction that creates something like a wave, contracting the tubal muscles

behind it and relaxing the ones in front to push or steer itself along the surface of the tube and the uterus.

Besides possibly having the ability to steer itself, it is widely postulated by researchers that the blastocyst has the ability to communicate and initiate complex interactions with its environment. Researchers are still not clear on how the embryonic/maternal cross-talk functions at a molecular level in the tube and in the uterus. "Communication between [the human embryo and the maternal endometrium] and their reciprocal effects on each other is new territory. Increasing evidence indicates that embryonic regulation induces reciprocal interactions that change throughout the implantation process." *16

If the embryo (blastocyst) is indeed regulating aspects of its journey, then is such regulation arising out of complex biologic and molecular interactions driven by the machine of nature, or is there already some form of consciousness within the organism? The process is one we have all traversed. Either because it is experienced by a soul while it is happening, or because retroactive recognition conveys its long lasting impacts, the consequences of the journey are embedded in the human body and psyche.

Whether or not our journey down the tube is part of the soul's "Fall" the imagery and descriptions of the tubes and the Fall are abundantly portrayed and symbolized in art, literature, architecture, and every day life and language: the rabbit hole in Alice in Wonderland; the trap door that leads to the dungeon; the Phantom of the Opera's watery catacombs; the tunnels and mazes (many with booby traps) in pyramids, and castles; the tubes and chutes in movies and TV (James Bond, Finding Nemo, The Matrix, Get Smart); the old style water well in William Blake's paintings; the wishing well in Disney's Snow White. Indiana Jones and other archeologists and adventurers have been through numerous "fallopian tubes." Fallopian tubes are everywhere in our culture in the form of tunnels, elevators, carwashes, amusement park rides (the tunnel of love for example), water park rides and slides, luge runs. Downhill skiers (especially on narrow runs), tobogganers, and spelunkers across the world are recapitulating the fallopian tube journey, and so are we if we feel something special when we enter a tunnel or see a tube symbolized in the arts. Finally, when everything falls apart (and the soul has to leave heaven) it goes "down the tube" or "everything just goes down the drain."

As the blastocyst descends, it continues to grow as the tube narrows. From within there is pressure against the zona pellucida, which is stretched thinner and thinner as more cells grow and as more uterine milk is absorbed. The portal to the uterus is no larger than a few strands of human hair, and it leads to the landscape of the endometrial surface of the uterus itself, the womb. The uterus is approximately the size and shape of an upside down pear.

2. The Fall

Humpty Dumpty sat on a wall,

Humpty Dumpty had a great fall,

All the King's horses,

And all the King's men,

Couldn't put Humpty together again.

Some of the most famous lines in English salute an archetypal character who undergoes a simple but dramatic experience. On reason the event is unforgettable is because it describes, in quite a precise portrayal, the next stage of the fallopian tube journey. Humpty, the egg––or the blastocyst, is sitting on the wall between the fallopian tube and the uterus. One could also accept, as Thompson points out, that "Humpty Dumpty is the cosmic egg, the wall, the edge between transcendence and existence.… Humpty Dumpty is the immortal soul before its fall into time and neither God nor his angels can put him back into the world beyond time." *17 Probably Thompson's and my interpretation of the poem are virtually the same, and the blastocyst and the soul are falling together at the same time. In the prenatal version, the transition is also between realms marking a shift in scale from the narrow, nurturing tube with its uterine milk, cilia, and peristaltic waves to a vaster landscape. In the uterus the blastocyst must hunt for and discover an appropriate site to call home: primal homesteading. Humpy's fall is "great" because, as Thompson points out, there is no going back. In the prenatal interpretation, Humpty literally falls apart (see Hatching, below) and nothing is ever the same again. The blastocyst loses its protective skin (shell). An exposed jellylike clump of vulnerable cells, like the innards of an egg, constitutes a vulnerable stranger in a strange land. This primal creature, also an archetype––the unformed, potential human––must fend for itself against the possibly hostile wilderness of the uterus and find a way to feed itself.

We can all relate to the image and the pithy ramifications of the existential "fall" and maybe it is one of our more visceral relationships to myth, owing to our direct personal participation in it. If we consider mythic and poetic depictions of the fall there are many parallels to the prenatal fall. The soul presumably falls from the world beyond time, more proximal to the creator, just as the blastocyst, materializing from the miraculous event we call conception (the biologic "creator"), rolls down and falls into the uterus. The fall in all cases is a one-way trip, and the consequences have no less than profound existential implications. Residing in the heart of this myth is the painful theme of separation, for when we fall, we fall alone. The soul distills out of the unmanifest, or heaven, to become an individual and the blastocyst distills out of the egg and sperm union advancing not as a paternal cell or a maternal cell, but a separate individual, a single celled organism. Another prenatal theme parallel to the poetic and mythic

fall, and this is common throughout the prenatal and pre-conception stages, is the theme of journeying.

So what is it like for each developing consciousness or embodying soul to feel the fall? How do the ramifications of the fall develop in the human psyche? How do we humans, upon the face of the earth in our daily life, re-enact this phase of our early life? The most common recapitulation of the fallopian tube fall is the dream: who has not had, or heard of, the famous falling dream, where the dreamer always wakes up before landing? It is possible that sometimes the blasocyst literally falls through the cavity of the uterus and lands to implant somewhere near the cervix, but in most cases the blastocyst implants in the fundus (the uppermost part of the uterus, between the fallopian tubes), and in most cases the implantation site is closest to the fallopian tube in which conception occurred. Still, all the while, potential for literal falling is there. Gravity is an inescapable force, presumably irrelevant in the world beyond time. Clinging to and exploring the uterus is an exercise literally recapitulated by mountain climbers. And the fall is like descending or rappelling, only without the rope.

Ecstasy and surrender are states of being that can be affiliated with the fall, and surely these are acted out in many ways. My own son devised endless situations where he would shout, "Catch me Daddy," and before I knew it he was landing in my arms. Adults jump out of airplanes and run off cliffs (with parachutes attached to their backs). And bungee jumpers are able to take the fall without having to land. Especially if a Lush uterine environment is waiting, the fall can manifest as something like an ecstatic flight as enacted by the famous Mexican cliff divers of Acapulco. Specially prepared Mayan virgins were ceremonially brought to the edge of cenotes (portals in the earth leading to underground water systems) and then tossed in, a ritual performed to propagate life and abundance.
When we "fall into money" we fall, like the blastocyst, into something that can sustain us. When we "fall in love" we fall, like the blastocyst, into intimate contact. When we "fall into our soup" we fall, like the blastocyst, into a food source.

There are many "falls" in the myth of the human being: the soul falls from heaven, Adam and Eve fell from grace and were expelled from the Garden of Eden, the ovulating egg falls from the ovary, the blastocyst falls down the fallopian tube then falls from the fallopian tube into the uterus and then falls into the uterine wall, and finally, the newborn falls from the birth canal into an alien external world.

The entire implantation journey takes about seven days, and if it is not successfully completed the blastocyst dies. The fall marks, approximately, the halfway point. Temporal symmetry here invokes the image of a grain of sand, falling from one cone of the hourglass into its symmetric opposite. In all of the examples cited above the salient meaning of the fall is that a transition point has been passed, a threshold has been crossed, and a metamorphosis is occurring.

Once the threshold has been passed, in the case of the fall from the fallopian tube, a metamorphosis is in fact necessary. For by now the blastocyst has out-grown its own skin, and in order to survive, it must shed that skin. If it doesn't it will starve and die.

3. Hatching

As we know, the growing blastocyst's cells are increasing at a "doubling" rate with two becoming four, sixteen becoming 32, and a bit later 128 becoming 256. Eventually, sometimes while still in the tube, cells can begin to differentiate, with the greatest number of cells beginning to form what will become the placenta. Opposite these are the ones that will become the fetus. Cell density within the zona pellucida increases, and with that increase, permeability within the zona decreases. As Peter T. Ellis suggests, eventually the cells at the center are unable to access nutrients of the uterine milk.*18 There are too many other cells proximal to the wall of the zona through which the milk arrives. The core cells begin to starve. There is no blood or respiration system, and the cellular colony cannot feed its inner core. "… when cells band together in creating multi-cellular communities, they follow the collective voice of the organism, even if that voice dictates self destructive behavior." *19

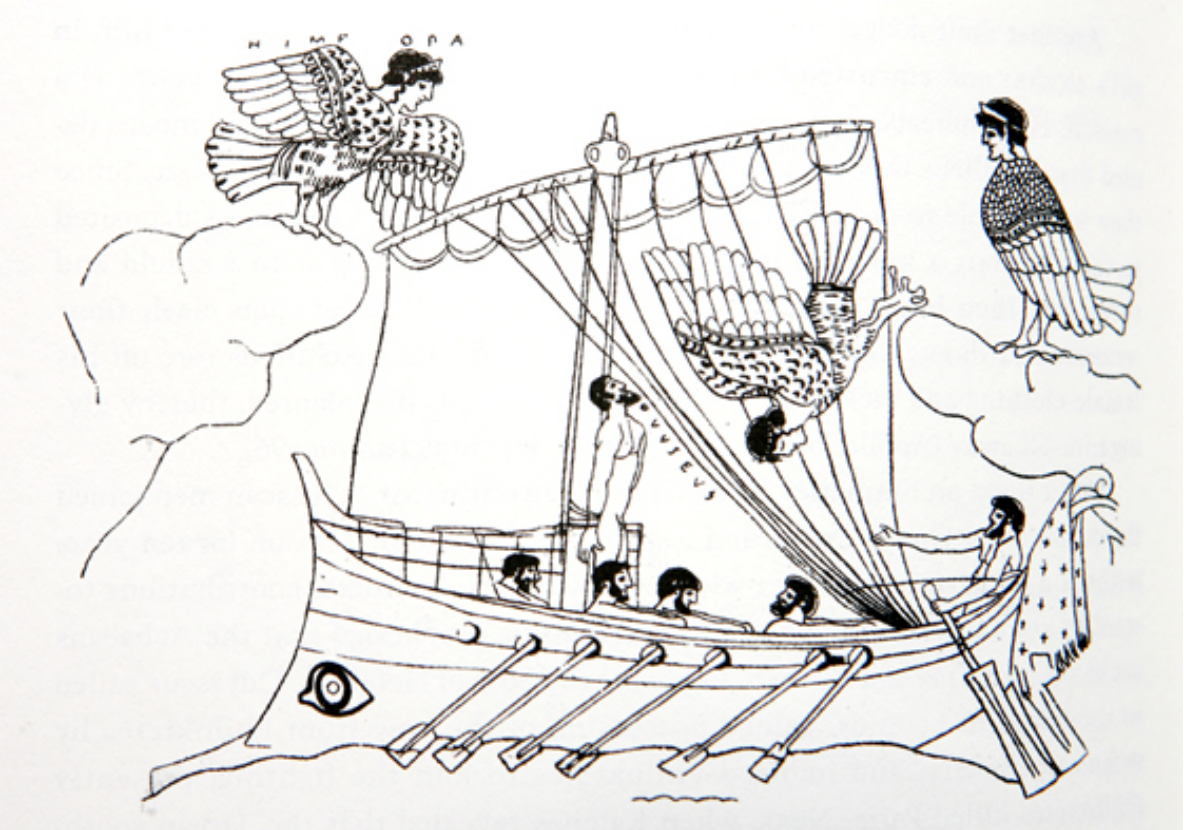
With a starving core, and more and more hungry cells dividing, it becomes necessary for the early human organism to evolve. Without a radical change in the feeding arrangements, it will die.

I believe that "core starvation" in the blastocyst prior to hatching is a universal phenomenon, a "template-generating event horizon," resulting in an important "somatic memory." One of the ways in which a somatic memory can be observed or experienced is through behavioral patterns arising out of it. The root cause of addictive behavior, for example, may be rationally explained in relation to "core starvation." No matter how much uterine milk the blastocyst absorbs prior to hatching, the core is not fed, remaining instead hungry, unsatisfied––potentially starving. Individuals with over-eating disorders usually describe their situation with hopelessness, "No matter how much I eat, I can never get enough." Core starvation theory is relevant to sex addiction, alcohol addiction, drug addiction, religious fanaticism, gambling and any other addiction in which satisfaction is never adequately sustained. Addicts, like the starved core cells of an old blastocyst (four to six days of age) never reach a sustained point of satiation, and are compelled to indulge themselves more and more in an attempt to feel "full." Such indulgences can lead to unsavory endings.

Lucky addicts though are the ones who recognize the impending self-destruction in their behavior, often only at the last moment when it is nearly "too late." These are the addicts who are eventually compelled to seek help, and transform their lives. Somehow the destructive pattern serves the purpose of compelling the organism to transform. Persistent pain whether it is physical or emotional can be a gift if we are able to "listen" to it, and understand how the pain is asking us to change, to seek genuine transformation. We can transform our patterns, our habits, even our physical shape. All blastocysts must transform their physical shape, and their way of eating in order to live. The early human undergoes a morphogenesis from a nomadic "milk" drinker to a stationary blood drinker. But the transformation is not an easy one. Because of genetic disorders, uterine inadequacies, or other weaknesses in the biologic systems, it fails nearly 45% of the time.

Some somatic memories result in deep impulses and compulsions because they were crafted at a time in personal history when urgency forced them into mythic proportion. Like the Greek Odysseus and in Roman mythology Ulysses, blastocycts can encounter many "life or death" situations. How blastocysts survive such challenges probably generates behavior templates at cellular levels; remember, "… cells are capable of learning through environmental experiences and are able to create cellular memories, which

they pass on to their offspring." *20 The behavioral templates are stored in the cellular system and passed on to the descendants of each cell.



A "template-generating event horizon" is a challenge (or ongoing situation) that is serious enough to the well being of an organism that, if the organism survives, its behavior will be modified. Descendant cells arriving after a template-generating event horizon somehow recognize certain challenges in life (external triggers) and respond automatically based upon the programmed template. As the prenatal organism develops, persistent cellular programs end up defining themselves in neurological patterns in the brain, thus, some babies are born with predispositions toward eating, affection, sleeping and so on. But these behavioral predispositions can lead to unconscious behavior patterns that might not serve the highest good of an adult person.
For example, conditions such as anorexia and bulimia may derive from early starvation experiences (template-generating event horizons) in which the blastocyst first nearly starved to death, or took in mother's blood at a time when the blood needed to be avoided or expelled because it was full of toxins. If the metabolic continuity of a cell is shocked during such a crisis the distorted template could read: "Starvation leads to acceptance and life," or "Anything that comes in must be expelled for me to survive." When the blastocyst survives, learned behavioral reactions transfer to its ultimate descendant, the adult. Exogenous triggers activate old survival patterns.

The adolescent or adult who feels unacceptable (as probably most blastocysts do) enacts a now irrational pattern that is compelled into repetition even though it makes no sense at all to outside observers. In less anxious forms a pattern arising from the pre-hatching starvation phase of the blastocyst could be as simple as saying "I'm starving to death" when I've become aware that I've waited too long to eat.

Before implantation can be attempted the blastocyst must hatch and it is likely that hatching itself, like core starvation, is a template-generating event horizon and carries with it the possibility for somatic

memories. We all know how vulnerable a chick is when it pecks its way out of its shell. The chick though is quite well formed. It can wobble around and it has a beak, an esophagus, a stomach, and intestines with which to begin eating and digesting. The blastocyst is a much more vulnerable creature. It has no feathers to protect it from its environment; it has no eyes with which to look for food. Blastocyst cells in the ejected cluster, through their own thin membranes, will have direct contact for the first time with the multiversity of the uterine environment. We know that the environment can be toxic or lush, barren or frigid, sometimes even deadly, and we know that each cell analyzes thousands of stimuli from the micro-environment it inhabits. Pre- hatched blastocyst cells have had, as their environment, only each other and "filtered" uterine milk within the protective encasement of the zona pellucida. Without the zona pellucida there is no outer skin to modify the sensations of uterine contact. Imagine also how the skin of a newborn baby feels when it has left the amniotic waters to emerge into the much colder air. The process of hatching is a precursor to birth, a precursor, even, to any sense of deep vulnerability experienced while emerging into a new situation. Exposure, over-exposure, vulnerability, hunger and nakedness are the themes.

If we follow the theory of template formation as the precursor of behavior patterns, emotional responses, and psychological tendencies, the list of likely results from the hatching experience is impressive. Hatching and how we hatch could impact: how we reveal ourselves, how we come out into the world, how we enter a room, how our skin feels when we come into contact with something surprising, how we escape old patterns, how we feel when we are expanding or stretching ourselves in new ways, how we feel when we are naked, how we feel when we can no longer hold it together, how we feel when we are lost or when we run out of money, and how we feel when we have to surrender and let ourselves become vulnerable. Idioms and sayings relevant to the hatching phase can easily be understood by all of us because we have all passed through the same experience. Hatching experiences by which we were wounded can be described with day-to-day language. Stimulating present moment conditions similar to the hatching experience can be described by the language of hatching as it has organized itself in idioms: "She is thin-skinned." "He is spilling his guts." "I feel turned inside out." "You wear your heart on your sleeve." "One more word and I'm just going to explode." "I can't hold it together any more." "I feel like he can see right through me."

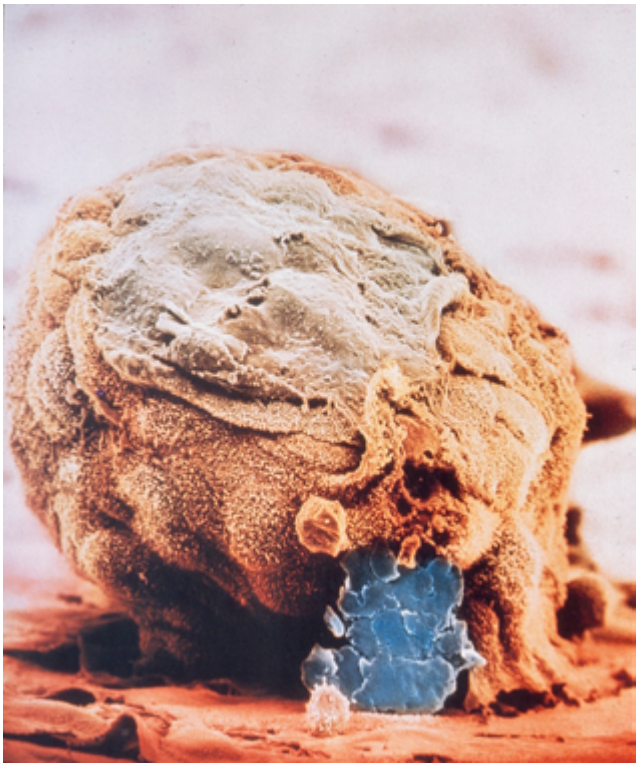
The blastocyst cannot force its trophoblast (the leading, implanting part) to protrude through the zona pellucida to make direct contact with the endometrium. In order for its hungry inner cells to venture forth and seek the nutritious maternal blood, it must shed the skin that has kept the blob of cells together. The cells are hungry (those that have been on the inside especially) and as a colony they have common goals. The following excerpt from Bruce Lipton's book, The Biology of Belief helps us understand what might be going on for the newly hatched blastocyst cells:

"*I also made it clear to my students that each cell is an intelligent being that can survive on its own, as scientists demonstrate when they remove cells from the body and grow them in a culture...these smart cells are imbued with intent and purpose; they actively seek environments that support their survival while simultaneously avoiding toxic or hostile ones. Like humans, single cells analyze thousands of stimuli from the microenvironment they inhabit. Through analysis of this data, cells select appropriate behavioral responses to ensure their survival.*" *21

Before the blastocyst can implant, before the inner cells can contact and experience the epithelial surface of the endometrium, hatching must occur. From the perspective of organism function and process, hatching is about letting go and about coming out, about release and transformation, about arriving, eating, and growth, and, hatching is driven by hunger. Some implantation researchers describe the hatched blastocyst not as vulnerable, but as aggressive and hungry, on the prowl for food. Seen from

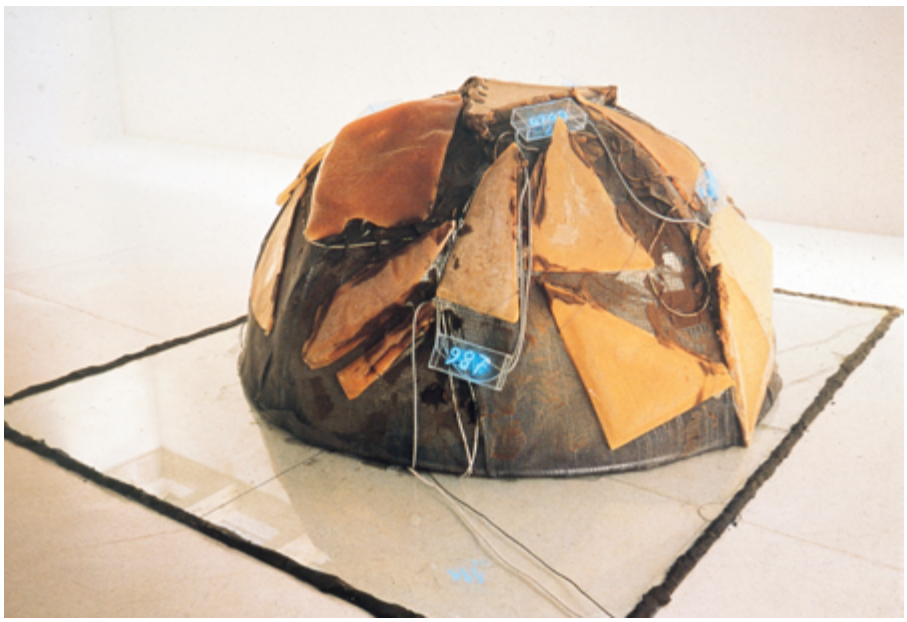
this perspective, the blastocyst eats, or "digests" its way into the endometrium. Maybe vulnerable blastocysts also have an aggressive aspect as well, driven by hunger to take what is needed to live.

4. Uterine Exploration



Once the hatched cells are free from the zona pellucida, this outer skin no longer protects them and the hungry inner cells are directly exposed to the uterine environment for the first time. In order to examine the relative existential circumstances of this situation, let's refer to a biblical parable and ask what it was like for Jonah inside the belly of the whale. If you let your imagination wander, meditate on the question, or allow your own body feelings to communicate with you, a portrait imbued with essentials of your own uterine exploration might arise. What did it smell like? What was there to eat? Jonah has been portrayed in art, literature and cartoons as: starving, eating rotten fish parts, freezing, sitting by a fire, and even enjoying abundant multiple-course sea meals. Perhaps these various depictions represent the uterine environments (and the consequential early experiences) of different artists and writers as projected onto the biblical character. Very few people remember how he got there or what he did after he got out, but his time in the belly is memorable. In some way we can all relate to his predicament, and we each probably transfer some of our own experience onto him. This is why his story is so visceral and memorable.

Mythology has many stories of uterine activity and of deities spending time inside the body of others. Kronos, for example, while inside the uterus of his mother, Gaia, lopped off the genitals of his father, Ouranos. Later, as king of the gods, Kronos swallowed each of his children, except Zeus, when they were born. A year after his birth Zeus was fully grown and caused Kronos to vomit up all of his siblings who together with Zeus overthrew the old king. Throughout Classical and primitive mythology human beings experiencing life on earth are portrayed virtually as vulnerable as blastocysts experiencing the uterine wilderness: "… the myths show a world full of evil forces, unpredictable change, difficult conditions...the world



portrayed in traditional myths is full of uncertainties and surprises. It is assumed that no mortal can avoid suffering, that any human being is continually at the mercy of forces beyond his or her control" *22

Meanwhile, human beings, subject to uncertainty and the influences of the Olympian gods, pursue their lives on an earth that can be likened to the uterus. "… The earth is… a huge anthropomorphic female named Gaia, mother of gods and humans…she furnished the soil from which the first human beings were fashioned and… she continues to nurture human beings by sending up the plants that sustain them." *23 "Indeed, features of the earth's surface are sometimes spoken of as though they were parts of a female body: caves are wombs, stones are bones, and the center of the earth is a navel, not to mention the terrestrial waters that interconnect and move through the earth like blood in a mammalian body. The earth's surface has the feel of a largely female realm dotted with small places staked out by men for human habitation and worship" *24 Individual implantation sites in the uterine wilderness are symbolically described as a background against which much of mythology takes place.

Meanwhile the actual blastocyst, while exploring its uterine world, is actively looking for food and a place to call home. Membranes of its cells, receptor sites on the membranes, and the integral membrane proteins (the gateways through the membranes) are functioning on high alert. Researchers have suggested that the blastocyst has an uncanny ability to orient toward a microenvironment that is richer in possibilities for encountering nutrients, the fertile hunting ground. Then, as if shooting an arrow, the blastocyst pierces the flesh and draws blood into its center so that it can survive. How does the original "hunt" impact our primal human qualities? One is reminded of the Greek goddess Artemis (in Roman mythology: Diana) who takes pleasure in roaming the mountains and forests. She is the goddess of

wild creatures and places and she slays wild boar and deer with her bow and arrows. With her brother Apollo (Roman: Apollon) she invented the art of hunting which was then passed on to become the general knowledge of the mortals so that they could sustain themselves and augment their diets. If offended, she can destroy people's herds and prevent their farmlands from being sown. From the point of view of the blastocyst, nutrients must be "hunted" and obtained in high enough amounts and at high enough quality or the journeying creature will suffer or die. Like the journeying heroes of mythology such as Jason and Odysseus, maybe blastocysts, also "learn through suffering and danger." *25

Cells have intelligence, sensitivity, and are capable of learning, or being programmed. The blastocyst is a community of cells with a collective intention: to survive the transition from feeding on uterine milk through the zona pellucida, to feeding on the blood of the mother. Raw exposure to the surface topography of the uterus will impact the intent, purpose, and searching activities of the individual and collective cells of the hatched blastocyst. The primitive form of the human is able to move away from danger or toxicity and move toward nutrients. This explains why very early in our lives the rewards and pains of our efforts program our primal cells creating "template programs," master patterns of responses and reactions to circumstances and events. If these "programs" reside in the stem cells themselves, the cell membranes, and the proteins turning our genes off and on, then all of the organs and body parts that derive from these early cells will also possess the information and the template programs. This concept explains the phenomenon of the "whole body feeling," "cellular memory," and maybe even intuition. This concept explains the "knee jerk response" and certain functions of the amygdala, neurological programming in the brain and other parts of the nervous system. If we have a "gut feeling" about something, or a "pit in our stomachs" or if we're "starving to death" we are experiencing impressive body feelings and memories derived from early precursors at cellular levels deep within the archives of our personal evolution. Furthermore we are likely to respond and react to such feelings pursuant to our template program, or conditioned affect.

We have survived our early journeys and transitions because of how we survived. Cells learn and remember such milestones, and a blastocyst is a colony of cells organized around its collective voice. If an event of megalithic proportions relative to the size

and viability of the colony is survived, then the organism is convinced of the efficacy of certain behaviors in the face of special stress circumstances. Probably this explains how our earliest cells, the ones that develop into our brains and bodies, might have built-in tendencies, template programs, including convictions of how to best get things accomplished. This could explain why sometimes stubborn behavior patterns in the offspring of these cells (adults and children) are only relinquished after surrender becomes the only option. How often do we see family members or friends or ourselves endlessly repeating unsuccessful patterns even when, from a logical or cognitive perspective, the behaviors prove ineffective? What is it that makes old patterns so hard to change? You can't teach an old dog new tricks because the puppy learned patterns deep in its core, and having survived, hangs on to these patterns with conviction.

The grand theme of journeying, which has prevailed since conception, is about to come to its end. Like a dowser who discovers water, or an energy company drilling for oil that hits a gusher, the blastocyst orients toward a fertile spot in the uterine wilderness. Known by cellular biologists as a nurturing microenvironment, by fertility researchers as the 'privileged site,' by Bedouins as the oasis, this is the Promised Land where the blastocyst will finally settle down.

5. Implantation and Its Sub Stages

Most implantations occur in the endometrium of the fundus (the upper wall, or ceiling of the uterus) near the fallopian tube in which conception occurred. However, implantations can occur anywhere in the uterus. As stated above, cellular biologists and fertility researchers sometimes refer to the vicinity around the location of implantation as the "privileged site." This moniker addresses the curious phenomenon of the viability zone in which the blastocyst is not only able to survive, but is ultimately accepted by the epithelial surface of the endometrium, then invited deeper into the endometrium itself, until finally it moves completely inside the uterine wall. Once inside, the blastocyst develops an interface with the mother. This area, appearing under magnification as a part of the leading edge of the blastocyst is called the syncytiotrophoblast.

Within the syncytiotrophoblast molecular "fingers" from the trophoblast (trophoblastic tendrils) creep in various directions until a lacunae, or pool of maternal blood from an endometrial vessel is encountered. After a successful union with this source of nourishment, the implantation process is considered to be complete. New processes begin, including chorion formation and the other early stages of placental and umbilical formation.

Beginning at the end of the first week, and lasting only about another week, implantation is quite a short transition, but it is the most difficult to achieve from the biological/developmental perspective since about two-thirds of all conceptions never successfully implant. Fertility and In Vitro Fertilization labs meet this challenge with all kinds of chemical and hormonal augmentations and also sometimes use a laser to slit the zona pellucida of a blastocyst so that it can hatch and implant more easily. These interventions in the biological process, developed to force pregnancy in infertile couples, are referred to as ART, or "Assisted Reproduction Technology."

Considering implantation from the scientific perspective, there are all kinds of unanswered questions and so scientists do not yet know the full story of how implantation is possible. According to immunological theory, the mother's body should recognize the hatched blastocyst as a foreign invader with a genetic makeup different from her own. Therefore the immune system and defense systems of the mother should organize to destroy the blastocyst, just as these systems organize to confront and destroy a bacterial infection. A splinter in the skin is surrounded by white blood cells that eat away at the invading wood and form a ball of pus around the site of the invasion. The successful human blastocyst however is first allowed to attach to the epithelial surface of the endometrium, and subsequently allowed to enter into the layers of the endometrium and grow. Embryologists have not determined whether these anomalous molecular and chemical processes are initiated by the blastocyst or the endometrium. During this process, which has been observed and photographed microscopically, it can be difficult to determine where the blastocyst ends and where the endometrium begins. "Stalks" or "fingers" develop, looking like stalactites merged with stalagmites, and cell membranes disappear and the nuclei of fetal cells are seen next to the nuclei of maternal cells.

The process of implantation is a miraculous, microcosmic rite of passage, miraculous because it is an extremely outstanding, unusual event and accomplishment. As regards such a phenomenon, the human mind is often compelled to reach for explanations in the realm of divine intervention or acknowledge the event as a special operation subject to or guided by unknown scientific or mysterious laws. That human beings themselves derive from such an event adds to the relevance of the monikers

"miracle" and "myth." From the perspective of normal biologic function, implantation shouldn't happen but it routinely does. It abounds throughout all cultures and is responsible for the existence of the individual human being in all its diversity. We all have this special existential phenomenon at our origin.

At the epicenter of the implantation transition is a dance of viability occurring in the context of an intimate negotiation between two organisms. One organism could die if their mutual "conversation" does not end in acceptance. If acceptance is realized, the other organism will be more or less permanently transformed into a "host" or mother. The chemical exchanges and molecular processes operating between the two organisms during this tentative time are aptly referred to in the scientific community as "maternal/embryo cross-talk." The name "cross-talk" describes a situation whereby two different organisms are "communicating" at a chemical level, and through such communication a life or death bargain is agreed and struck. Maternal/embryonic cross- talk as bilateral communication is something like a chemical negotiation that has relevance at the molecular, cellular, and personal levels. Something peculiar occurs at the implantation site. For unknown reasons, the trophoblast (the "leading" part of the blastocyst, proximal or adhering to the endometrium) does not provoke an attack from the maternal antibodies. Cell walls in the syncytiotrophoblast of the embryo and endometrium have been observed to dissolve so that the cell parts of the trophoblast can be seen next to the nuclei of endometrial cells, although they are in different cytoplasm. When the cell membranes disappear, the nuclei of the trophoblast and endometrium are in a merged but not necessarily mixed cytoplasm. At this stage the rudimentary human being is living in a world completely different than the biological environments at any other time in human life. The implications at all levels––biological, psychological, spiritual, existential––are portent.

Given our current level of scientific understanding one can only wonder what is happening in the mysterious crevices at the cellular and molecular levels in this environment where the membranes of cells have vanished. Is the hungry blastocyst begging for food? It is an elegant dance of the ultimate union? Or is the little being aggressive, demanding? Sneaking, stealing? Biologic organisms have a strong innate drive to live. The impetus of a human being, coming into human form, must be active, vitalized even, during this urgent, vigorous, and life or death stage. It has been observed during human implantation that the embryonic disc has an almost constant orientation toward the food source, the endometrium, and specifically those parts of the endometrium that are more densely laced with lacunae, small pits or cavities filled with blood. Not sprouting from its outer surface, which is dissolving at the cell wall frontier, but from inside the dense part of the trophoblast, finger-like villi develop with the mission of garnering nourishment. The tendrils and the searching parts of the trophoblast have a definite and selective orientation to parts of the endometrium where there are blood vessels. It is as though the hungry blastocyst somehow knows where the "cookie jar" is and orients in that direction. There don't appear to be many stages between the recognition of the blood supply and the vigorous penetration into it, suggesting that once the blood is "discovered" by the trophoblast a rather quick penetration into it is accomplished, as when a child's straw slips quickly into a milkshake. It is probable that the endometrial stromal cells transform into decidual cells that will disintegrate and allow penetration by the blastocyst… but how does this happen? No one yet knows, but for now researchers agree that there is "talk" between the mother and "child" (embryo). "The implantation process requires a receptive endometrium, a functionally normal embryo at the blastocyst stage, and a dialogue, or cross-communication, between the maternal and embryonic tissues." *26

Maybe the hunger of the blastocyst is expressed through chemical actions at the cellular membrane level, similar to the function of peptides or "feeling" molecules. Maybe this need is recognized and the maternal response of the most "feminine" organ in the human body thereby activated. "Increasing evidence demonstrates that embryonic regulation induces reciprocal interactions that change throughout

the implantation process. During apposition [surface contact between the blastocyst and the endometrium] this dialogue is mediated by soluble proteins produced and received in a bi-directional fashion." *27

"Embryonic regulation" as used here could also mean embryonic initiation. The blastocyst initiates a dialogue. After all it is the blastocyst that is in need. The uterus does not need the blastocyst for any particular reason any more than soil needs a seed… but the blastocyst will die if the uterus does not accept it. Whether or not the uterus is acceptable to the blastocyst, if it wants to survive, the blastocyst will take what is there and make the best of it. In my own case, and in the case of you the reader, our blastocysts had all the potential to become a complete human being. It is tempting here to give a nod to the great debate: when does a human being become a human being? At conception? At implantation? At birth?

At some deep level within the body of a mother-to-be, a micro-domain of maternal endometrial cells listens to a special "visitor" long enough to become engaged in the dialogue of acceptance, nurturing, and sustaining a new life: reciprocal interactions that change throughout the implantation process. These reciprocal interactions constitute the most primal biologic interplay, one that lays down the biological, chemical basis, the actual physical structure of what will become an individual human being. It is known that environment affects morphogenetics, so it can be surmised that whatever happens at the earliest stage sets up an inherent resonance that inhabits and informs the prima materia of the emerging, still unformed, organism. The chemical, biological and psychological field in which we were formed influences everything germinal to becoming human, including the cells that become the brain, organs and bones. One can imagine that the circumstances of implantation will govern some of the physical, emotional and psychological dispositions of the developing baby. The cells that become the adrenals and the brain parts that control hormones, the organs of emotion and the balance of neuropeptide chemistry are all at least prejudiced by early interactions between the hungry cells of the implanting blastocyst and the biochemical soup of the endometrial fluids within the syncytiotrophoblast.

Most mothers, even ones who are trying to get pregnant, have no idea if or when they have conceived, nor if or when implantation has occurred. Mothers are usually not conscious that they are pregnant until the stage of "Discovery." Discovery is a prenatal stage that has been assigned significant biologic and psychological attributes and it occurs when the mother realizes and obtains objective verification that she is pregnant. This stage has been well researched and described by Dr. William Emerson. In most pregnancies discovery occurs approximately four weeks after conception and is usually heralded by an anxious or hopeful time after a missed menstrual cycle. Implantation usually begins about a week after conception and therefore is an event that takes place, in most cases, outside the realm of maternal consciousness, in the fertile darkness of biologic function. Still, the physical and psychological dispositions of the mother-to-be have either harmonic or dissonant influences upon the microenvironment that determines the viability of the implantation site.

It is astonishing, as more is discovered about the complexity and responsiveness of individual cells, how they function as something like miniature human entities, especially in that they are entities possessing memory that informs their daily operations. In regard to all of our basic biologic functions such as respiration, eating, reproduction, we whole humans are seeking positive experiences and avoiding danger and as such we can be seen as expanded fractal expressions of the microcosm. Meanwhile it has become more compelling to respect and appreciate the interactive principle between the macrocosm and the microcosm: what we think, what we eat and what we do affects our individual cells; and what our individual cells do and how well they do it affects our whole self. Countless transactions, decisions, maintenance functions and other operations that take place daily within a single cell are expressed and

symbolized in the day to day actions reflected by grown human beings in their outer lives.

What survival strategies and growth patterns are put in place by the manner and circumstances of our implantation? On a cellular or on a whole person level, if we get hungry, we eat. If we are very hungry, we'll eat whatever is nearby. If we are starving, we'll eat whatever we can, even if it is a bit old or carries something disagreeable within it. What are we willing to swallow if we are starving? On the embryologic level we will swallow whatever is floating around in our mother's blood along with the soluble proteins, gasses (such as O2), sugars, and other nutrients we need for our developing bodies. Many elements are floating around in our mother's blood, perhaps thousands of neuropeptides, for example, that express her emotional frame of being, her attitudes about life, her sexuality, and her sense of motherhood.

As prenates we swallow through our umbilical cords, but we contract our bellies if our mother has eaten something too spicy or if she had a bad morning because of a vigorous quarrel and "spicy" neuropeptides are flowing in her blood. As newborns we swallow mother's milk, but if she has eaten something tainted, if she is suffering an intense bout of flu or even self-loathing we might reject the milk or spit it up because of its undesirable sub-contents. As social and biological organisms, and not just on the symbolic level, children have swallowed their parents' less than optimal diets, scornful biases, unethical prejudices, and other dysfunctions in order to be fed and feel safe. Whole cultures and nations have swallowed preposterous politics and outrageous abominations in order to be safe members of the society: fed, nurtured and empowered––even if it means participating in genocide of other human beings. What are we willing to swallow if we suffer as the starving blastocyst has suffered? What agreements and contracts did we make when we implanted and how do those play out in our adult lives?

Besides the contents contained within our first drops of nutrition at implantation, the nature of how we implanted is worthy of consideration. Our original implantation style likely expresses itself today in relationship to metaphoric parallels such as our interactions in connection with consuming food, engaging in intimacy and obtaining money. These are all the basic needs we humans require in order to go on in our lives, similar in significance to the original needs of our own blastocyst. The style or manner in which we obtained our first food at implantation orchestrates the paradigm for future relationships.

Surely there are implantations into lush uterine environments where wanted babies of the right gender are coming at exactly the right time after conscious conceptions. Such an implantation could be mutually blissful. In other scenarios though, the blastocyst as a colony of cells desiring to survive could be experiencing challenges if not desperation. It is striving to eat and survive by engaging in methods never before attempted. Survival desperation is not only a state of being experienced by humans. We see desperate behavior in the animal kingdom as when the grizzly bear eats her own cubs to survive the scarcities of a drought. Is the starving blastocyst in its dialogue and negotiations with the endometrium begging for food or fighting for food? Is it possible that the kernel human could be both vulnerable and aggressive?

By projecting upon the blastocyst our own mature anthropomorphic attributes and interpretations in an attempt to better understand ourselves, are we glorifying a banal biologic function or can we acquire clues to the puzzles of human origins, human relevance, specific individual patterns enacted over and over again by adults? Can we imagine, meditate upon, or even have some strange form of memory about how our own implantation happened? Can we ask our mothers if they were ready to conceive, what their diets were, if they wanted a girl or a boy, if they had miscarriages, if they were really happy in their marriage? If so, we might learn more about our implantation environment and discover the origins of some of our own patterns, functional and dysfunctional. If we examine the cellular drives and

the ensuing chemical operations, we can translate the primal interactions into equations or portraits of some of our most basic human behaviors. After all implantation is one of the most formative realms in which we human beings originate.

Assume that through its inherent intelligence the blastocyst organizes a plan based upon what it encounters, and the uterine environment influences the implantation strategies that develop at the trophoblastocysctic edges. Maybe this is what scientists are observing when they describe "reciprocal interactions that change." Is the blastocyst willing or able to sneak or steal or barter or bargain? Is it able to merge, dance, embrace? I postulate that whatever particular molecular strategy succeeds then permeates into the future of the organism: its cells, its organs, and its functional biologic and even psychological tendencies. The successful implantation mode, a template-generating event horizon, results in a self-generating continuum. Beginning with the multiplication and amplification of the successful molecular processes, the ability of the organism to continue to thrive and perform is encouraged or discouraged based upon previous successes. New challenges might first be met with old strategies.

Certain biological processes (like certain muscles) are developed over others because of repetitive engagements or movements, as in the big strong arm of a tennis player. Based upon previous successes, innate or instinctual tendencies develop to engage in certain biologic styles and behaviors over others in order to accomplish survival and growth tasks. I call this "template programming" because the successful survival strategies create templates beginning at a cellular level and might eventually reside in the neurological programs in our brains, resulting in behavior patterns. These behaviors are consequences of rudimentary conditioning and reflect emotional and psychological tendencies. At an early organismic level of function, (contrasted with the intelligent or conscious functions we experience with our developed brain) we may develop the perception that we must accept the unacceptable in order to get by. If our mother smoked we had to swallow nicotine and tar in order to get oxygen.

If we sneak or steal our first food are we more inclined later in life to sneak or steal our first dollar? If we barter or bargain as a blastocyst will we be more inclined to barter or bargain in order to get romance or sex? Do we eat voraciously and carelessly as if out of desperation, or are we picky and careful so as to avoid a toxic particle that might "break the camel's back" for a wobbly blastocyst already too full of toxins? Do we invite and expect union? Is intimacy nourishing? Maybe the implanting blastocyst is nothing more than a differentiating mass of primal cells that will consume anything it can, but we know that cell colonies develop a collective consciousness. It is a curious debate as to whether or not there is anything like a soul affiliated with this process and whether or not cellular memory is being laid down. In any case, the little organism is extremely busy during this phase of its life, and template programming is a consequence of its activities.

Embryologists generally agree that implantation begins about a week after conception, and that it takes about another week for implantation to be complete. The syncytiotrophoblast organizes as the leading aspect of the blastocyst. As we know, it is a mass containing areas with multiple nuclei and no individual cell walls: the "blob." It contacts and invades the endometrium, then erodes and dissolves the connective tissues that organize the continuity of the endometrium. The dissolution occurs within the proteins of endometrial stromal (cell formations creating structure and form). The byproducts of the breakdown of the stroma and deciduating (dissolving/melting) cells in the area of the syncytiotrophoblast are a rich source of nutrition that is engulfed by the syncytiotrophoblast. Some observers say that the blastocyst "eats" its way into the endometrium. Others, observing the same event, say it is sucked in and sustained.

Surviving blastocysts are able to produce human chorionic gonadotropin (hCG) in the mass of their

syncytiotrophoblast. If this hormone is produced in quantities sufficient to enter the maternal bloodstream, it serves to maintain the endocrine activity of the corpus luteum. The corpus luteum is a body of yellow-colored cells that have formed around the stigma of the ovary where the egg ovulated, and these cells become an endocrine gland. So the surviving blastocyst is communicating with the organ that used to be the home of its egg cell. The signals from the blastocyst are received at the exact location on the organ from which the egg departed its "former home." The hCG is something like a letter from a foreign land, sent back home, as if to say," I'm still here, keep sending support." Care packages in the form of estrogen and progesterone are generated by the corpus luteum, and sent via the blood stream to maintain and stabilize the nurturing uterine environment allowing the pregnancy to continue. The uterus is thereby maintained in a receptive mode and becomes a more secure "home" for the blastocyst.

Meanwhile, cellular differentiation begins to occur in the central part of the blastocyst. The cytotrophoblast is well in place. What the zona pellucida was to the egg, the cytotrophoblast is to the blastocyst: a peripheral or skin-like organ, the outer part of the organism. Within the cytotrophoblast there is vigorous activity: the amniotic cavity develops; the embryonic disc is constructed; and the primary yolk sac is formed.

The syncytiotrophoblast though, overlying the cytotrophoblast, is still perhaps one of the busiest parts of the blastocyst. Yet it is not just an organ of the blastocyst. It is also a biological result or consequence of its function: something like a chunky soup, or a sloppy field of battle where the organization of the endometrial cells are broken down, dissolved and absorbed. Lacunae in the syncytiotrophoblast fill

with maternal blood, bringing oxygen and nutrients that are absorbed by a rudimentary system of the blastocyst that will soon develop into the placenta. Both arterial and venous vessels from the mother's blood system are within (or in contact with) the syncytiotrophoblast, so oxygenated and nutrient-rich blood can flow in and deoxygenated or toxified blood can be collected and taken away.

At ten days after conception the blastocyst is fully embedded in the endometrium, except for a portal remaining at the original invasion, or merger, site. Staying open for two or three more days, this little window is the last biological bridge exposed to the blastocyst's past: the long path journeyed and the many transitions traversed. Finally a fibrous coagulum of blood called the "closing plug" covers up the implanted blastocyst, and it is completely engulfed by the endometrium. If there has been a soul participating in the journey of embodiment and body formation, once the closing plug is in place, yet another significant transition has been traversed: there is no going back. At this stage of life the new human being becomes more and more likely to survive to its birth. Only a few steps remain for the placenta and umbilical cord to begin to take shape, the mesoderm develops and constellates into well-functioning organs, securing the source of nutrients for the remaining eight and 1/2 months of pregnancy.

Conclusion

Certainly, at implantation we may swallow the positive things of life too: love and joy, health and happiness. However, these diets do not wound us so they do not contribute to personal or cultural pathologies. When healthy organisms, economies, and cultures get plenty of what they need there is no such thing as "too much of a good thing" because balance, wholeness and strength are appreciated without the urgency or need that provokes overindulgence or greed.

Except for a few, such as Midas, we don't have myths exploring the problem of too much good turning bad. Most myths concern an injustice that needs correcting, or a problem that must be solved, or a difficult task that demands undertaking with the consequence that a lesson is learned. I think Midas suffers from a template program of core starvation as a blastocyst. Even though he already has more than enough, he is voracious for more. Midas teaches us that unresolved template programs and the unconscious pattern of behavior arising out of them could be fatal.

The myth of Psyche (soul) and Eros (Roman: Amor or Cupid) can be viewed as the story of a reluctant embodying soul who finds it difficult to be here on earth. Like Humpty Dumpty she falls, or tries to fall of a cliff and then a tower, but she is rescued and encouraged to go on by benevolent aspects of her world. She twice throws herself into a river (the fallopian tube) only to find herself washed ashore (the uterus). She has to sort through an enormous pile of tiny grains like an individual cell that must analyze thousands of stimulants from its microenvironment. This task is accomplished with the assistance of ants, just as tiny worker proteins and cellular machines assist cells. Like a hatched blastocyst that must figure out how to get blood from the wall of the uterus, she has to access water from the sheer wall of a rocky cliff. Finally she makes a mistake because of her "reckless curiosity" (hunger) and opens up to something (an ointment belonging to Persephone) that makes her pass out and almost die, but she is rescued by Eros (love) and finds a place among the gods, becoming immoral. This is the story of a soul incarnating, embodying, thriving.

Most heroes, like Odysseus (Roman: Ulysses), learn through suffering and danger. Perhaps we always need pain and suffering in our lives to help keep us growing, for whenever we approach the glory state of Camelot, rumors of a malevolent dragon are surely nearby. Gluttony and avarice exist as reactions to lack and need, not in reaction to good and plenty. But if the experience of lack and need arises from a template program constellated in early times, lack and need may seem like reality in times of good and plenty. An example of this is seen in the generation of Americans who survived the Great Depression and although most of them are living in relative abundance, many behave as if the depression is still a threat.

Fetal biochemistry transforms into myth only if there is a soul present to experience it or a consciousness present to imagine it. The biochemistry of implantation is unique compared to other cellular experiences. At the edges of the cellular membrane a kind of chaos prevails with cellular priorities and directives shifting from nanosecond to nanosecond. We have learned that membranes themselves breakdown and cytoplasm is mixed. The situation can be visualized as chaos full of portent, like the canvas of an abstract expressionist action painter.

When we make decisions and act out from the contracted confines of pain or in the haste of desperation we lose our objectivity and our clear sense of what is in harmony. By harmony I mean that which

vibrates expands and flows to the natural rhythm of the universe. Harmony means what is best for us as individuals within our sphere of influence as well as within the bigger picture. Universal laws govern us in relationship to the material world, the earth, our communities and our personal relationships––the outer world. Evolving as individuals we recognize that personal harmony is subject to states of balance and order within our minds, our bodies, our feelings, and our psyches––the inner world. When states of harmony are compromised or broken, our life tilts out of balance and the gates guarding against chaos and distraction crumble.

The gods of myth, despite their anthropomorphic jealousies and rivalries, ultimately manage to take actions resulting in justice and harmony. Their individual natures are expressed until excess is reached. Discord is then corrected by other gods, and harmony returns. This function of balance and justice is not always clear to mortals living brief lifetimes of uncertainty and vulnerability. Unlike us, the gods (or archetypes) never age. They live on forever, oiling the wheels of the universe and changing the gears when necessary. Healthy individual genes and cells, like the gods, function within the natural laws of the universe. Individual cells and colonies of cells undertake tasks as and when necessary and generally work logically and in harmony, even when challenges and crises occur.

After we are conceived we are a one-celled organism, then we become a two-celled organism. Like all healthy cells, these are busy functioning according to chemical, molecular, and biologic laws. Chemical and molecular and most biologic reactions and interactions are like mathematical equations in that they are predictable and consistent (like the gods). But unlike other established cells, blastocyst (or stem) cells have the magical ability to morph and change. This is precisely where the equation becomes less stable, the individual more vulnerable to the environment, the outcomes more unpredictable. In embryology, body parts in a more critical stage of development are more vulnerable than established body parts or dormant body parts. An individual human is forming out of these basic cells, and these individuals are not as subject to rigid equations. In fact eventually they develop free will. This free will tends to get us humans into all kinds of stimulating situations that we must sort out and learn from. Many of our problems arise from choosing incorrectly out of our free will, or from our unconscious reliance on a template program. Sometimes we consciously, unconsciously, or semi-consciously select actions or behaviors from amongst our repertoire that aren't always the ideal choice. These selections, behaviors and their consequences bring pleasure or pain, and in order to change the ones that bring us pain we must grow and change at a core level, underneath our programmed patterns and knee-jerk responses.

Despite the urgency of our day-to-day lives, or of our implantations, we mortals seem to be reminded over and over again of the value and virtue of patience, trust in biologic design, and trust in the so-called cosmic plan. There is always the potential for balance and wholeness, and everything we need to thrive. Often it is present within our immediate grasp, if only we can develop the consciousness and wisdom to recognize it.

A healthy organism is satiated when it is satiated, and individual cells which seem to possess inherent consciousness and wisdom simply seek balance, undertaking actions only when necessary and within the appropriate timing. The same is true for conscious and wise individuals and cultures. A lot could be learned if we could understand and emulate a normal healthy cell. We could learn a lot if, like Odysseus, we could listen for the words of Zeus and Athena. We can also learn to identify our own unhealthy patterns that have been maintained by template programming and evolve out of behavior patterns when they are not in our best interest.

References:

1 William Hansen (2004), Classical Mythology A guide to the Mythical World of the Greeks and Romans, Oxford/New York, Oxford University Press, p4
2 Lennart Nilsson, (1990), A Child is Born, NY NY, Delacorte Press/ Seymour Lawrence, p66
3 William Hansen (2004), Classical Mythology A Guide to the Mythical World of the Greeks and Romans, Oxford/New York, Oxford University Press, p18
4 Implantation Success Statistics:
• Moore/Persaud (1998), Before We Are Born Essentials of Embryology and Birth Defects, Philadelphia, Penn., W.B. Saunders Company p44
Early spontaneous abortion rate: 45%
• Nikki Bradford (1998), The Miraculous World of Your Unborn Baby, Chicago Ill. Contemporary Books p18
40% of conceptions fail at implantation
5 Charles Darwin (1888). Letter to Moritz Wagner [Darwin, F 1888]1
6 Bruce Lipton (2005) The Biology of Belief, Santa Rosa, CA, Mountain of Love/Elite Books, p49
7 Ibid, p38
8 William Irwin Thompson (1981), The Time Falling Bodies Take to Light, New York, St. Martin's Press p3
9 Hansen, p18
10 Lipton, p38
11 Edward F. Edinger (1972), Ego and Archetype, NY NY, Penguin Books, p162
12 Candace Pert (1997), Molecules of Emotion, NY NY, Scribner
13 John Davis (1999), The Diamond Approach, Boston, Mass, Shambala Publications, Inc., p46
14 Thompson p35
15 Sayegh & Mastroianni (1991), Recent Advances in Our Understanding of Tubal Function, Annals of New York Academy of Sciences, Vol.626, June 28, 1991, p266-75
16 Carlos Simon et-al (2001), Embryonic Functions in Human Implantation, (Embryonic Regulation of Endometrial Molecules in Human Reproduction), Annals of New York Academy of Sciences, Vol. 943, Sept. 2001, p1
17 Thompson p9
18 Peter T. Ellis (2001), On Fertile Ground, Cambridge, Mass./London, Harvard University Press p29-30
19 Lipton p165
20 Lipton p38
21 Lipton p37-8
22 Mary Lefkowitz (2003), Greek Gods, Human Lives, New Haven Conn. and London, Yale University Press p236-7
23 Hansen p26
24 Hansen p26-7
25 Lefkowitz p12
26 Carlos Simon et-al p1
27 Carlos Simon et-al p1