# A Theory of the Psychophysiological Consequences of Umbilical Cord Manipulation by the Fetus

**Author:** Straub, Mary F

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**Abstract:** None available.

**Full Text:** Headnote ABSTRACT: Imaging techniques have permitted us to observe the prenatal environment, and the human fetus has been caught in the act of grasping its umbilical cord. One aspect of what I had much earlier envisioned was thus confirmed. Yet to be confirmed is that the fetus, by that activity, takes a hand in its own creation. Fetal cord manipulation, or hand-umbilical contact, can be equated to self-stimulation. This act fortuitously initiates a primitive emotional conditioning and complements some phases of physical gestational development. It predisposes the fetus to emotional experience of a particular sort, and is a preliminary to the love-bonding so essential to the healthy maturation of all human children. The cord becomes a major "consoling presence" within the limited space of the fetus. In the past, the only means of gathering information about the effects of the umbilical cord on the well-being and development of the fetus would have been to surgically open the mother's abdomen, extract the fetus and ligate the cord. As a research procedure, this is obviously not acceptable in the case of live human women, although modern fetal surgery is now performed in the same way. Some data in this article, then, is derived from animal experiments by early researchers. Where more recent imaging studies on human fetuses are available, these are also discussed. OCCLUSION OF THE UMBILICAL CORD Cord occlusion-or ligation, or compression-refers to manual disruption of the umbilical cord (UC) and its vessels, and it affects a vital need for adequate oxygen. Any severe or sustained occlusion of the UC so alters the blood chemistry that it jeopardizes fetal life, exactly as a tight cord around your neck would imperil your life. Simply put, a person will die of suffocation when the brain succumbs to oxygen starvation and cardiac arrest. Three conditions can be responsible for fetal hypoxia (i.e., a state of relatively less oxygen supply that is just short of asphyxia). It ". . . can be induced by maternal hypoxemia . . . restricting uterine blood flow to the uterus or placenta ... or reducing umbilical blood flow by cord (sic) compression . . ." (Itskovitz et al. 1987, p. H100) A 50 percent reduction in UC blood flow due to a partial occlusion first disrupts cardiac output, then various other organs. In all cases of fetal hypoxia, even a partial occlusion is not totally unremarkable, and certain fetal reflexes are evoked before the fetus is overcome with asphyxia. Those reflexes will be described in a moment. Early researchers faced a grave difficulty. A sudden occlusion of the UC was too violent, resulting in immediate anoxia (oxygen starvation) or hypercapnea (excessive carbon dioxide). The animal fetus would die. Dawes and Mott (1962) devised a method of occlusion that eliminated that tragic outcome. By taping the UC of fetal lambs against a soft polyethylene tube for one or two minutes, relatively little happened, but after four minutes fetal reflex body movements began. The vessels of the UC did not spasm during that interval and the fetus recovered from the incident when the occlusion was released. This will be recalled when fetal self-stimulation and reflexes are addressed. As opposed to experimental manual occlusion, compression of the UC was reported by Martin et al (1984) on an in utero human fetus in distress due to superventricular tachycardia, a frequent disturbance of the fetal cardiac rhythm. Using an ultrasound scanner, the physicians saw a loop of UC caught in a space between the head and anterior shoulder of the fetus. While continuing the scan, manual pressure was exerted on the mother's abdomen directly over the looped segment of UC. With gradual increased pressure, a brief systole occurred, and the heart of the fetus returned to normal and remained so until it was delivered 9 days later. Before ultrasound, diagnosis of much fetal distress was understandably very difficult. Mueller-Schmidt (1959), concerned about fetal tachycardia, wrote that six out of 13 fetuses born cyanotic were successfully revived with oxygen, indicating that the irregularity was of minor importance. Mueller-Schmidt added that the tachycardia had no apparent cause, for the mother was normal in all aspects. However, based

on current observations, UC involvement in at least many of those cases is quite possible. Reflexes and the Occluded Umbilical Cord As noted, a partial or minimally interrupted UC flow may not be pathogenic, but it does initiate various reflexes. The circulatory system of the fetus reacts first, even causing the fetus to gasp. Gasping indicates a chemical/emergency situation (Barcroft &Barron 1962). Whatever the basic mechanism behind fetal respiration, gasping is evoked when the UC is "pinched." (Cross 1958) The animal fetus reacts to the stress of UC occlusion with body/ muscular contractions or spasms, tachycardia, kicking and generalized restlessness, peristalsis and passage of meconium (bowel sedimentation), gasping, and finally death. All from oxygen starvation. This syndrome can be compared to what happens when you or I undergo strong emotions such as fear or anger: the endocrine system is stimulated, body/muscular contractions set in, as well as possibly tachycardia, stomach upset, diarrhea, hyperventilation (gasping), extreme restlessness, changes in blood pressure, and, if the stressor persists, lasting disorders such as ulcers and depression. Heart attacks and strokes may also occur, and finally death. Under normal conditions, the fetus has hunger contractions and peristalsis, and those routine reflexes can also be evoked by an altered blood content. The type of peristalsis experienced by the stressed fetus is not strictly digestive, however, and if the stressor continues to fetal anoxia, peristalsis grows more agonal until finally meconium is passed. Meconium creates some problems in deliveries, and is said to pass only when the situation is grave. Yet in some deliveries complicated by meconium, no cause for asphyxia can be found. The nervous system and the brain cannot escape the effects of UC occlusion for long. In the course of embryological development, the limbic system (also called the primitive brain or visceral brain) evolves first, and from its structure arise the capacities for memory, pleasure, pain, and the ability to balance the extremes of emotion (The Brain 1984). During UC occlusion the fetus exhibits convulsions "like the symptoms of emotional stress or excitement, differing only in that convulsions are stronger in degree ... in both cases brain metabolism and oxygen consumption quicken (gasping), lactic-acid rises, and acetylcholine drops. Changes in natural sleep or anaesthetically induced unconsciousness are opposite." (Heedham 1931, 15) Emotions and the Occluded Umbilical Cord Turning to emotion, how may it be provoked by a self-manipulating fetus? First, and reducing a complex subject down to a few fairly simple observations, Paul McLean, neuroscientist, exclaimed that "the raw stuff of emotion is built into the circuitry of the limbic system." (The Brain 1984, p. 94). This observation is based on the findings resulting from electrical stimulation of the brain (ESB) in 1928 by Wilder Penfield. The limbic system is connected to the cerebrum above and the brainstem below, permitting the interplay between reason and emotion; a balance that can be easily upset, as we know. Just above the brainstem lies the hypothalamus, a small group of cells that can boast the richest blood supply in the whole body. To repeat, the limbic system allows for pleasure, anger, thirst, hunger, etc. It also coordinates the "flight or fight" reaction through setting off a chain of hormonal secretions that ready the body to cope with any threat to its well-being. As early as 1937, J. Papez wrote that the subcortical areas associated with the discharge of emotion are well defined by the third gestational month. The "flight or fight" responses have their fetal counterpart when the UC is occluded or hypoxia is present for any reason. Is the fetus able to incite the dramatic reflexes described? Apparently the fetus has a good grip reflex at the 19-20 week stage when it is about the size of a man's palm. Even earlier,". . . at 12 weeks there is a grip reflex." (Smith 1968, p. 116) By six months of age, the fetus responds to numerous stimuli with muscular contractions, often making a fist if the stimulus is applied to its hand. As for the strength required by the fetus to exert pressure on an erectile UC, note that a premature infant can support its own weight by gripping a bar or someone's fingers. While that ability fades after about two post-natal months, it strongly suggests the existence of a strong prenatal grip. Meanwhile, I have not overlooked the diminutive fetal hand in respect to the circumference of the umbilical cord. From six months on, they are relatively proportional. IMPORTANT PROPERTIES OF THE UMBILICAL CORD In addition, certain conditions of the cord may predispose it to being easily manipulated, as well as to being hazardous in itself. Wharton's jelly is a gelatinous substance that surrounds the UC vessels, and was cited by Wirsen and Nilssen (1967) as the main safeguard against perilous knotting or kinking of the cord. They also

state that: the UC can take vigorous squeezing, for it is stiff like a garden hose; that the fetus cannot be endangered if the UC wraps around its neck; and that the cord cannot kink or knot because it tends to automatically straighten out when bent. On the contrary, Smith (1968) states that long cords can curl about the fetus easily, some having up to four coils. Actual strangulation, however, is likely only if the cord is short to begin with. Moore (1982) writes that true knots occur in about 1 percent of all deliveries and are lethal, but the simple looping around the neck of the fetus that occurs in about 25 percent of all deliveries does not usually increase fetal fatality. Hill et al (1987) viewed the UC by ultrasound and confirmed other studies showing twisting of the cords occurring more often near the fetal body, and this noted as early as 6 weeks of gestational age. They also note, however, that "any segment of cord is potentially vulnerable," (p. 86) and cite others who noted an absence of Wharton's jelly in the portion of the cord affected. The absence of Wharton's jelly results in a flimsy UC, and, in the opinion of Hill et al, "Depletion of Wharton's jelly has been associated with diabetes, rhesus isoimmunization, and stillbirths . . . (and) with torsion of the UC . . . Most observers feel that torsion is a sequelae rather than a cause of intrauterine demise." (p. 82) Goodlin (personal communication) notes: "In five emergency caesarean sections done for fetal distress . . . there was essentially no Wharton's jelly around the umbilical arteries and very little around the umbilical veins, and the cord grossly appeared 'lean and flimsy'.. . the absence of Wharton's jelly has been held responsible for intrautero distress, death and hemorrhage of the fetus because of lack of support for the umbilical vessels." The UC is also subject to prolapse, cysts, tumors, hematomas, looping and strictures. According to Hill et al (1987), the latter shows an absence of Wharton's jelly in the involved segment. That same substance can, however, be so abundant as to cause enlargement of portions of the UC. What I have tried to point out in this brief summary is the susceptibility of the UC to many and various disorders, some of which may be life-threatening, and some of which are not. IMPACT OF THE MOTHER In addition to possible dysfunctioning UCs, another major obstacle to fetal health is the mother. Her health and habits can greatly antagonize her fetus. Her mere act of breathing is almost instantly imitated by the fetus. After she has exercised to her maximum capacity, the heartrate of her fetus increases, indicating decreased oxygen to the womb (Carpenter 1988). When she is breathless her fetus gasps. Even while sleeping, her more shallow breathing at that time can provoke fetal response, for blood saturation in a sleeper's arteries can drop below that normally tolerated in the waking state (Aserinsky and Keitman 1966): the sleeper then sighs and breathes more quickly for a moment. During the REM (dreaming) state, blood pressure and respiration can fluctuate wildly, cerebral blood flow can accelerate, and activated hormone secretions may sour the stomach, awakening the person (Linde and Savary 1974). And in orgasm, a man or woman hyperventilates, breaths increase to more than 40 per minute and cardiac rates climb from 110 to 180 bpm. Even in an "ideal" pregnancy (one uncomplicated by drugs, cigarettes, illness, etc.) the mother will bend, twist, stretch, sleep, eat, cry, laugh, tire, have sex, etc., and her fetus shares the changes reflected in her body. Unless her condition is serious, the fetus experiences restlessness, perhaps even hypoxia, at the worst. The best outcome is that the fetus takes the changes in stride, and practices fetal reflexes so that recovery is assured. THE DOUBLE THREAT MOMENT It may be inferred that, alone, the fetus cannot of itself cause selfharm by manipulation of its UC, nor will the mother's activities jeopardize her fetus to the point of death (although adverse fetal health may stem from extraordinary unhealthy activities such as unrestrained ingestion of drugs or alcohol by the mother.) However, consider what effects the combined action of those two agents-mother and selfmanipulating fetus-may ultimately produce. The fetus may be playing with its UC when the mother starts exercising, or cleaning house, or becoming raving angry at someone. She may be having a crying spell, or enjoying sexual intercourse. The fetus may let go of the UC or on the other hand may grip it more tightly as a result of the stimulus and thrash about with muscular contractions. The grip intensifies the moment once mother's actions or state of mind-body initiate fetal distress due to altered oxygen. The only available "other" to grip is the UC. Such momentary severity of action causes embryonic death-throes, as tachycardia, agonal passage of meconium, gasping, and generalized reflexes begin. Although the fetus may not be in actual danger, an experience of

these episodes is being recorded in the developing fetal brain. MEMORY OF PAIN Behavioral changes associated with pain in neonates undergoing painful clinical procedures was studied by Anand and Hickey (1987). They documented cardiovascular variables: "The magnitude of changes in heartrate was related to the intensity and duration of the stimulus, and to the individual temperaments of the infants." (p. 1324) The admitted that painful experiences in neonates could possibly lead to psychological sequelae, since "several workers have shown that newborns have a much greater capacity for long-term memory than was previously thought." They also affirm earlier opinions regarding the functioning limbic system and other primitive structures: that they are well-developed and functioning during the newborn stage, and that "the cellular, synaptic and molecular changes required for memory and learning depend on brain plasticity, which is known to be highest during the late prenatal and neonatal periods." (p. 1326) They do caution, however, that although painful experience may be stored in the "old brain", which is not accessible to conscious recall, those who look for the neurological substrate of neuroses or psychosomatic ailments in painful memories during early infancy may find that hard to prove. Significantly, however, "Numerous lines of evidence suggest that even in the human fetus, pain pathways as well as cortical and subcortical centers necessary for pain perception are well developed late in gestation . . . but pain cannot be remembered in itself, only the experiences associated with it can be remembered." (ibid., p. 1326) Chamberlain (1990, p. 170), like many hypnotists, believes the opposite concerning memory of prenatal pain. He wrote, "An awesome sign of memory is the reactivation of forceps bruises or a blue area on the throat when a person was being choked by the UC! That these marks come and go with the memory is a sure sign that memory has been preserved somewhere." More importantly, it seems the memories are accessible to recall. Chamberlain cites other hypnotherapists who have attested to clients accessing information from their gestion periods. I believe I once regressed to that phase during psychoanalysis, imagining the UC in my hand (Straub 1970). THE BRAIN In 1954, Craigie wrote that until birth, capillary meshes in brain tissue are very sporadic. While oxygen penetrates those tissues slowly prior to birth, he stated that capillary growth increases rapidly by the sixth gestational month, if not before. He further suggested that the anaerobic state can produce hypertrophy (nourishment) of nervous system fibers, and therefore, he theorized, that anoxia may actually promote the growth, development and penetration of the vascular bed. Johnson et al, (1979) studied regional cerebral blood flow changes from asphyxia induced by slow partial umbilical occlusion of fetal lambs. They remark on the well developed cardiac reflexes and how, during asphyxia, those reflexes are activated "to increase systemic vascular resistance and allow redistribution of cardiac output toward vital organs such as brain, placenta, heart and adrenals, and away from non-vital areas such as the trunk." Further, severe partial asphyxia damages the brainstem and deeper cerebral structures very little, for "... cerebral vasodilation and maintained arterial perfusion pressures resulting in high cerebral blood flows (to deep cerebral structures and brainstem] help explain why these structures are little damaged during severe partial asphyxia." (p. 51) SUMMARY I have attempted to show that fetal self-stimulation via its UC, combined with maternal influences, may at times produce significant changes in the organ systems of the fetus, ultimately mimicking the psychophysiological effects of high emotion. The extent to which maternal anxiety affects the fetus has been theorized by Verny and Kelly (1982), who said such anxiety disturbs the fetus's sense of oneness with its surroundings; and that to get away from anxiety becomes the fetus's goal. Its response is to initiate defensive motions such as kicking and squirming. I add to that response the prospect of UC manipulation. Stating the obvious, intrauterine space is limiting, especially during the final weeks of gestation. Fetal movement is restricted then, and while the mother's body and environment provide much stimulation, the growing and active fetus has only one object to "relate" to in a physical sense. Only one object to wrap its tiny fist around-the lifeline. The age of six gestational months has arisen many times in the literature cited, as an age when the human fetus 1) has a good strong grip; 2) not only responds to numerous stimuli by muscular contractions but also makes a fist when stimuli is applied to its hand (in utero, the accidental yet certain touch of the UC is such a stimulus); and when 3) tachycardia, unexplained in many cases, is seen most often. As to the

notion of love-bonding or a "consoling presence," in some respects the hand upon the cord, the sensing of its bulk and the warm pulsating blood flowing through it, may be a source of real comfort and "embryonic pleasure." However, those pleasurable sensations could abruptly disappear into "panic" when UC manipulation coincides with an onset of changes in the mother, be they enjoyable or otherwise exciting changes for the mother or not. As noted earlier, the fetal lamb, with gentle, partial UC occlusion, is said to start manifesting reflexes in about four minutes. Combined maternal and fetal states and activities may lead to reflexes manifesting even sooner in humans. I suggest that five phases are experienced by the human fetus: 1. Pleasure, often referred to in psychoanalytic writings as "oceanic bliss,"-a resting state. 2. Simple tactile enjoyment. Here is the love-bonding phenomenaThe fetus's hand upon the UC, sensing its presence, warmth and bulk. 3. Fear or panic. The double-threat moment evokes a primal struggle as oxygen starvation becomes acute. The fetus is agitated. 4. Losing the battle. The fetus as it starts to succumb to anoxia akin to death-throes. Circulatory reflexes are spreading to various other systems, resulting in gasping, spasms, meconium, all signs of acute distress. 5. More harmonious fetal milieu is restored as stressor-fetus or mother - withdraws. Cord pathologies remain potential hazards in the life of the fetus, but the five phases above refer to a generally normal gestational situation. Phases 1 and 2 are related to the bonding phenomena; phases 3 and 4 are possible indications or causes of some episodes of fetal distress; phases 1 and 5 blend into each other; 1, 2 and 5 may be the most commonplace phases, with phases 3 and 4 occurring less often. Obviously, phase 4 would be the most serious stage and would have the greatest impact on the fetus in terms of fear, panic, or death-throesthe "bad memories." Fetal physiology may allow intermittent anaerobic states, often through self-stimulation of the UC and maternal influences. If discomfort resulting from such contact does not lead to inhibition or avoidance of the hand upon the umbilical, the fetus could be participating in a primitive conditioning whereby its functional hands in union with the umbilical "instrument" promote the brain's development, due to the subcortical area's uptake of blood during traumas or general fetal play. The fetus starts to experience the physical corollaries of emotion, and by setting into practice some very vital reflexes, may essentially further its own maturation, in all making the fetus a co-builder of its precious budding life. References REFERENCES Anand, K.J.S. &Hickey, P.R. (1987). Pain in the neonate and fetus. The New England Journal of Medicine, Vol. 317, #21, 1321-1326. Aserinsky, E. &Keitman, N. (Sept. 1966) Your Hidden Life Asleep. Science Digest, 63. Barcroft, J. &Barron, D. Blood pressure and pulse rate in fetal sheep. (1962) J. Exp. Biol. 164, 465-477. The Brain: Mystery of Matter and Mind The Human Body. (1984), Torstar Books. New York, NY. Carpenter, Marshall. (Dec. 1988) "Womb Zoom." Science Digest. Chamberlain, David B. (1990) The expanding boundaries of memory. Pre- and Peri-natal Psychology Journal. Vol 4, #3, 171-189. Craigie, E. (1954). Vascular patterns of the developing nervous system. In H. Waelsch (Ed), Biochemistry of the Developing Nervous System Proceedings of the First International Neurochemical Symposium. Cross, K., Tizard, J. &Trythall, D. (1958). The gaseous metabolism of the newborn infant breathing 15% oxygen. Acta Paediat 47, 217-237. Dawes, G. &Mott, J. (1962) Changes in oxygen distribution and consumption in fetal lambs with variations in oxygen blood flow. Journal of Physiology, 170, 524-540. Heedham, J. (1931). Chemical embryology. University Press, Cambridge, Mass. Hill, Lyndon, M., Kislak, Sandy, &Runco, Cynthia. (1987) An ultrasonic view of the umbilical cord. Obstetrical &Gynecological Survey, Vol 42, #2 82-87. Itskovitz, J., Rodeck, C.H., Soothill, P.W. &Campbell, S. (1987) Effects of cord compression on fetal blood flow distribution and 02 delivery. Am.J. Phsiol 252 (Heart Circ. Physiol. 21) H100-H109. Johnson, G.N., Palahnuik, R.J., Tweed, W.A., Jones, M.V. &Wade, J.G. (1979). Regional cerebral blood flow changes during severe fetal asphyxia produced by slow partial umbilical cord compression. Am. J. Obstet. &Gynec. 48-51. Linde, S.M. &Savary, L.M., (1974) The Sleep Book. Harper &Row Publications. New York. Martin, C.B., Nijhuis, J.G. &Weijer, A.A. (1984) Correction of fetal supraventricular tachycardia by compression of the umbilical cord: Report of a case. Am J. Obstet. Gynec. (Oct. 1) 324-326. Moore, Keith L. (1982) The developing human. Clinically Oriented Biology. W.B. Sanders &Co., Philadelphia, PA. Mueller-Schmidt, P. (1959) [Paroxysmal tachycardia in utero] Geburtsch u. Frauenh #19, 401-407. Papez,

James. (1937) Proposed mechanisms of emotion. Arch. Neurol Psychiat. 29, 725756. Smith, Anthony (1968). The Body. Walker &Co., New York, NY. Smith, CA. (1958). The Physiology of the Newborn Infant Thomas, Springfield, IL. Straub, Mary F. (1970) Self- stimulation in utero. Psychological Reports, 28, 55-63. Wirsen, C. &Nilssen, L. (1967). A Child is Born. Dell Publishing, New York, NY. Verny, Thomas &Kelly, J. (Oct. 1982) How you influence your child's life before birth. New Woman, 40-42. AuthorAffiliation Mary F. Straub is a freelance writer and an independent researcher long interested in the human condition. She is a hypnotherapist and instructor of the history and practical application of meditation as it applies to health. Address correspondence to the author at: 7600 South Cork Avenue, Justice, IL 60458.

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