

# Psychobiology of the amniotic environment

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**Abstract.** Water, basic element of amniotic fluid (A.F.), is closely related to Life, Fertility and Motherhood in several cultures and religions. Through material evidences of an essential growth medium and useful diagnostic source, a new concept grew up: the fluid as a first real environment in which fetus lives and acts. Many studies confirm that in A.F. fetus starts his character-building, his memory and his intelligence. The fluid seems to be the first means of learning and acknowledgement. Sounds, smells and tastes are perceived as well as emotions and fears. Urinotherapy and staminal cells sampling shows how A.F. can be considered as an additional therapeutic resource.

**Key words:** Amniotic fluid, psychobiology, fetal neuropsychic development

## Introduction

In the general presentation of a subject so complex as the evaluation of amniotic fluid function, it might be appropriate to tackle the issue from an often neglected perspective: amniotic fluid is not only a means of fetus development and a precious source of diagnostic elements, but also the first true “environment” that the human being confronts and interacts with. The term “psychobiology” may appear far-fetched for a subject of this kind. In fact, it can encourage physicians and investigators to use a different approach: one that is not strictly technical, but more holistic in its consideration of all the various aspects of human well-being.

## Water as a source of life

The first aspect to consider is the nature itself of amniotic fluid, which is mostly made up of water. Man is born in water and it is in water that he spends the first crucial moments of his existence. Since ancient ti-

mes, this simple fact has engendered fancy theories and evocative interpretations that have preceded and sometimes anticipated more objective scientific evidence. As man's offspring develops in the womb, where it is protected and surrounded by the amniotic fluid, it was only natural that past religions, philosophies, and cultures – regardless of their differences – often shared a complex vision of water, which they took as a symbol of life, fertility, and motherhood. In ancient cosmogonies and Neolithic rituals, water was the driving force of cosmic events, as well as a symbol of fertility and fecundity. Ancient Greek philosophers, such as Thales and Heraclitus, thought that water was the beginning and the end of everything. Gods and goddesses connected to the cult of water are frequently encountered in ancient mythology, which is also rich in legendary tales of a deluge, when an angry god decided to punish humans for their behaviour, sparing only one or more couples – personified in Greek culture by Deucalion and Pyrrha (1). Ancient Roman religion associated water with fertility and gestation – the Nymph Egeria was the goddess of childbirth. First the Hebrew religion and then the Christian religion

saw water as the source of creation and the origin of life. For the Talmud, the rivers of Eden are the only link still existing between the human world and the lost paradise. Bathing is then often seen as a way for humans to reach back to the original Creation. In India, ritual bathing in the Ganges is also a symbol of purification. Christianity sees a new Humanity springing to life from the purifying waters of the Deluge; Christ is defined as the true Source of Life and in baptism, water is meant not only to purify souls, but also to save them (2). Modern psychoanalysis, too, suggests that, in the human unconscious, water is basically interpreted as a symbol of life. Both Freud (as clearly stated in his "Interpretation of Dreams") (3) and Jung (4) hypothesized a close relationship between life and water, focussing on the interpretation of that particular moment when the waters are broken and flow out of a woman's body, when the human being coming to life sheds the amniotic fluid and leaves the genital canal.

### Water and evolution

These sociocultural, philosophical and religious considerations are not merely a citation of the various observations and interpretations made at different times of human history, but they have a basis in the most recent scientific theories advanced on the origin of life on earth. One of the most reliable theories proposed by scholars is that life probably originated in the so-called "primordial broth" (5). According to this theory, life sprang from inorganic matter in an oxygen-deprived atmosphere rich in hydrogen and helium. As a result of a reaction chain triggered by volcanic eruptions and radioactive decay, the substances present in this matter fell into the primitive ocean and built up until they transformed the ocean in a solution that is now aptly called "primordial broth". This broth generated more complex substances, so-called "coacervates", leading to a chemical evolution that in turn brought about a biological evolution. The first organisms were probably anaerobes and they were followed by the appearance of phototropic phytoplankton, oxygen, atmosphere-protecting ozone, and finally aerobes and multicellular organisms.

In early intrauterine life, man goes through all the evolutionary stages of water-born creatures and in his later life he preserves many of these original characteristics.

### Amniotic environment and neuropsychic development of the fetus

Psychoanalysis generally assumes that an individual's mind and personality originate in the so-called "oral phase", represented by the experience of sucking and feeding in the first year of life. In fact, a large number of accurate ultrasound evaluations of fetal behaviour in utero have come to suggest that this experience may start even before that, during prenatal life (6). After the 14<sup>th</sup> week of pregnancy, the fetus is able to control amniotic fluid swallowing, reducing it when alcohol or nicotine are present in maternal blood. From the 15<sup>th</sup> week, the fetus clearly develops a finger-sucking habit, which anticipates the oral phase and has led investigators to assume that this is a genetically predetermined movement to get infants used to future breast- or bottle-feeding. From the 16<sup>th</sup> week, with its sucking and swallowing movements the fetus clearly demonstrates that it likes any sweet-tasting substances injected in the amniotic fluid. By contrast, it reacts to bitter-tasting substances by shutting its mouth (7). Studies have shown that the fetus can recognize its mother's diet through the amniotic fluid and this capacity is bound to influence its food behaviour after childbirth. Esther Bick's method of infant observation, applied to both pre- and postnatal life, has made it possible to find out that, from the 13<sup>th</sup> week onward, the fetus's postures, reactions and movements become highly individualized, helping investigators to study its character and personality (8). These behavioural patterns are more marked after the 17<sup>th</sup>-18<sup>th</sup> week, probably because of the maturation of related neuronal structures. The fetus seems to focus its interest on the placenta and the umbilical cord, which probably stimulate its tactile sense with their warmth, texture and pulsatility, favouring a sensorimotor exploration and eliciting inward and outward knowledge processes that are crucial for mind development. Fetal hearing is completely developed by the

6<sup>th</sup> month of pregnancy and the fetus is able to hear both internal and external sounds. The most audible internal sound is the mother's heart beat, which is amplified by the amniotic fluid to 72 dB, masking all other sounds (9, 10). External sounds are dampened by the abdominal wall and the amniotic fluid (-50%), but they can nonetheless be heard and memorized by the fetus, which is able to recognize them after birth. The most pleasant external sound is certainly the mother's voice, while music may have a soothing (Vivaldi and Mozart) or unnerving (Brahms and Beethoven) effect. This perception of sounds (e.g., maternal voice) and flavours (e.g., maternal odours) through the amniotic fluid and their subsequent memorization and recognition after birth – for example, milk tastes just like amniotic fluid – are the basis of imprinting (11). Therefore, the emotional modelling of the individual clearly starts in the amniotic environment.

Maturation of a child's sensory tracts occurs almost entirely when he is still in his mother's womb. Psychoemotional development seems to originate from the communication between the pregnant mother and the fetus, and the amniotic fluid is the means and the way through which this communication takes place before birth.

In addition to the five senses, this drive to communicate interactively in the intrauterine life through a variety of stimuli eventually sharpens and refines such functions as memory, learning, and dreaming. The child's emotional sphere, too, is strongly influenced by the intrauterine environment and by everything that reaches the uterus through the amniotic fluid acting as a filter.

Several studies have shown that the microenvironment of the amniotic fluid can actually be regarded as a macrocosm where a combination of inputs and stresses mould the early personality traits of the fetus, beginning to shape its individual behaviour. Surprisingly, the fetus may be afraid and may show it through vigorous movements of its entire body and sudden accelerations of the respiratory rate, as is often seen during amniocentesis (12).

Ultrasound studies have shown that the fetal heart rate may change considerably in response to parental sexual intercourse (13) or simply to an increase in the mother's blood alcohol levels (14).

Other studies have proved that in utero the fetus begins dreaming as early as the 23<sup>rd</sup> week, when REMs can be easily detected and recognized.

Recently, reports have also confirmed that a child's future behaviour is closely related to his past experiences in the intrauterine life. Fetuses that during gestation exhibited a more marked voluntary motor activity or irregularities in the sleep-wake cycle, eventually became more irritable and less balanced children.

Finally, studies conducted by the University of Pittsburgh suggest that even a child's intellect – his IQ – is not entirely and totally determined by his genetic pool, but is also influenced by many maternal variables, such as sleep-wake cycles, diet, hormonal cycles, exercise, chronobiological rhythms, and any other factors that can be passed on to the new life developing in the womb through the amniotic environment.

### A fetus-friendly environment

The function played by amniotic fluid is basically to protect the fetus against the external environment (injury, noise, temperature, etc.) and the internal environment (placental and cord pressure). Recently, however, studying fetal life more closely, investigators have begun to discover new, interesting elements suggesting that the amniotic environment is a complex ecological niche. Apart from phospholipids, which are known to help the fetus breathe with its lungs soon after birth, many other substances are present that prove active interaction between the amniotic environment and stressful events. For example, endorphins are found in the amniotic fluid after cordocentesis as a response to the painful stimulus unconsciously perceived by the fetus. Prostaglandins, too, which are produced by the umbilical cord, have the specific role of controlling labour in humans. More recently, studies (15) have shown that from the second trimester onward, total antioxidant capacity in the amniotic fluid increases with fetal gestational age and fetal or neonatal weight. The antioxidants try to protect cell membranes against the harmful effects of free radicals, which are present in various conditions during gestation – such as diabetes- and substance-abuse-induced

embryopathies, premature membrane rupture, pre-eclampsia, fetal growth retardation, smoking and maternal lung disease – but also at onset of labour. Unfortunately, amniotic fluid does not contain only protective factors for the fetus, but also other factors that may be a sign of an increasingly hazardous environmental pollution. In 30% of amniotic fluid samples, Canadian researchers have detected traces of harmful pesticides (16, 17), which can interfere with the development of a child's reproductive, immune, and nervous system (WG Foster).

### Birth in water

In modern obstetrics there is an increasing tendency to preserve the beneficial effects of the amniotic environment during and soon after childbirth through the use of different methods of delivery in water. The issue is still widely debated, opposing supporters, who strongly advocate the need for environmentally-friendly childbirth, and detractors, who adamantly claim that the procedure is useless and not entirely risk free. Among the advantages of birth in water is the attempt to mimic the physiological environment in which the fetus lives in order to make delivery a less traumatic event. This may also be beneficial to the mother, thanks to improved relaxation between contractions and improved secretion of labour hormones (oxytocin, vasopressin, endorphins, prolactin). Bathing in water improves blood circulation to the heart and stimulates the release of atrial natriuretic hormone, which in turn stimulates the pituitary gland and the release of pituitary hormones.

### Future prospects

A large number of well-designed and articulate studies are currently under way. Many interesting indications on amniotic fluid function are likely to emerge from these studies in the near future. Some of them are already there and may even have a therapeutic significance. Based on the somewhat unusual tantric practice of urine therapy (18, 19) so popular among Hindus who claim its beneficial effects on any kind of condi-

tion or disorder, and starting from the obvious consideration that amniotic fluid is mostly made up of urine, which the fetus drinks and breathes for many months improving its well-being, some authors have proposed the use of amniotic fluid for the same purposes. However, no scientific evidence has been found to date on the efficacy of this treatment, notwithstanding two *World Conferences on Urine Therapy* that were held in India in 1996, in Germany in 1998 and in Brazil in 2003. More interestingly, other authors have reported that it is possible to relieve neonatal distress by having infants smell their own amniotic fluid (20-22): recollecting the odours that they smelled in the tranquillizing, protective environment of their mother's womb, the infants adjust more easily to the new stressful environment they are born into. Even more interestingly, it is now almost certain that stem cells can also be isolated from amniotic fluid (23, 24) and these cells could be used in tissue engineering, replacing stem cells derived from embryos – a technique that has spurred a furious ethical debate.

### Conclusion

Only recently have investigators begun to discover the real significance of the amniotic environment, which represents the first encounter of man with life. Many studies suggest that man's health and well-being originate in the intrauterine life. In a period when much public focus is on environment protection and environmentally-friendly practices, research is going back to its roots to improve its knowledge of man, to promote his well-being, and to learn how to respect him and the natural environment in which he lives.

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