

# It's All in Your Head.....

(Okay, your body too!)

My epiphany arrived in Kundalini yoga class. The teacher said that class was about the central nervous system. “You know” she said, “ the brain and spinal cord.....”

She was very specific, “touch the floor in front of you with that place on your forehead between your eyebrows and the spot where the bridge of the nose descends from the forehead.”

Diligently I performed,..... once, twice....light bulb on!

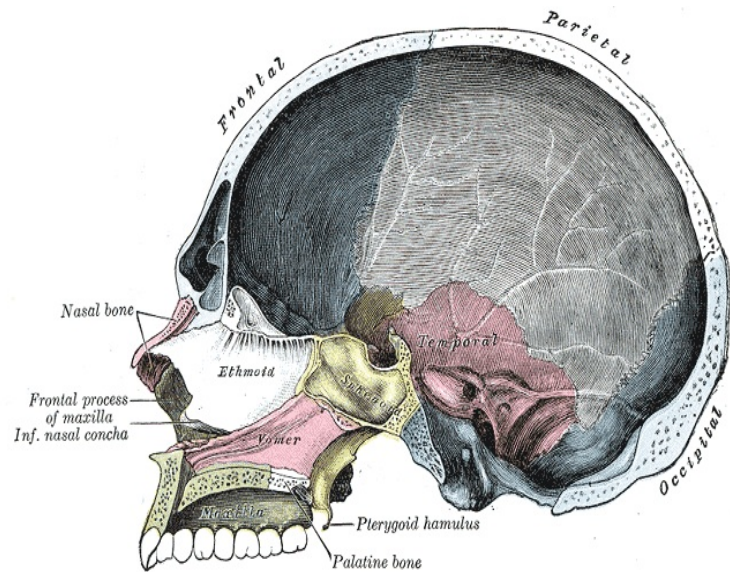
This is my ethmoid bone I am tapping to the floor! The cribiform plate of the ethmoid contains the spaces thru which the olfactory nerve tract travels to the many structures that make up the “olfactory cortex”; an area that evolved before the cortical areas that give us consciousness. These areas have connections to the limbic system. This is where the falx cerebri, one of the intracranial membranes of the craniosacral system is; and the falx cerebri's attachment is to the crista galli of the ethmoid. This is the seat of my wisdom, my third eye.....

To take a look at the ethmoid bone:

“ Remember to BREATHE!”

Teacher says, .....another light bulb! My mind (which should be paying attention to my movement) races to my deep cervical lymphatics which lie in the connective tissue of the carotid sheath,..... my olfactory epithelial cells and ..... my essential oils back at my office! I am thinking, “I wish I had some *Laurus nobilis* with me”..... Fluids, membranes and nerves, oh my!

I began wondering about the intelligence of the human body and its systems. In the craniosacral pressurestat model, as developed by Dr. John Upledger, could we view cerebrospinal fluid as the systems “fluid” intelligence? If all connective tissue is comprised of three forms of fascia : collagen, elastin and ground substance; and ground substance includes the various forms of fluid and



gel like connective tissue..... could I deduce that the fascial system had a “fluid” intelligence as well? Essential oils wafted into my stream of consciousness, ... are essential oils not the “fluid” intelligence of plants? And then there is blood and lymph and their “fluid” intelligence.....

Visions of water crystals, Dr. Masaru Emoto, and “hado”, ( the energy or vibration inherent in all things), bubbled up. My phylogenetic history whirled inside my mind. We are at least 70% water!!! The Greek philosopher Thales said, “water is the first principle of all things”. Dr. Emoto’s stunning body of work, that water changes its quality according to the information ( words, music, vibration,...) it takes in, and this sudden free flow stream of thought, is now driving the desire for me to discover, “ Is there, .... and what is, the nature of the relationship between all these “fluid” forms of intelligence?” What does this tell us about our understanding of who we are, our health and our ability to heal?

I will admit here that before essential oils and Aromatherapy became a love, my first love was CranioSacral Therapy. Thank goodness they are NOT jealous lovers. I hope to share some research I discovered ( thank you Mr. Tisserand!) on the olfactory nerve, and its route through the cribiform plate of the ethmoid bone (one of our cranial bones), and the fluids/membranes of the cranial system. Does cerebrospinal fluid pressure impact cranial nerves? Is there a link between cerebrospinal fluid absorption, the olfactory nerve and lymphatic vessels in the submucosa of the olfactory and respiratory epithelium? What role does the reciprocal tension mechanism of the meninges play in olfactory dysfunction?

One could write volumes about the anatomy of the Craniosacral System, ... I am going to try to make this as painless as possible. The Craniosacral System is a semi-closed hydraulic system contained within a tough waterproof membrane (the dura mater) which envelops the brain and spinal cord. An important function of this system is the production, circulation and reabsorption of cerebrospinal fluid. Cerebrospinal fluid is produced within this system and it maintains the physiological environment in which your brain and nervous system develop, live and function.

Bones and Sutures:

The cranium is the bony bubble that surrounds and protects the brain. It is made up of 14 bones. The keystone bone in craniosacral therapy is the sphenoid, because it has an important articulation with the occiput deep in the skull base, and articulates with most of the other bones of the cranium. Living bone is flexible; cranial bones have the ability to bend and deform, which is part of the strength of the cranial

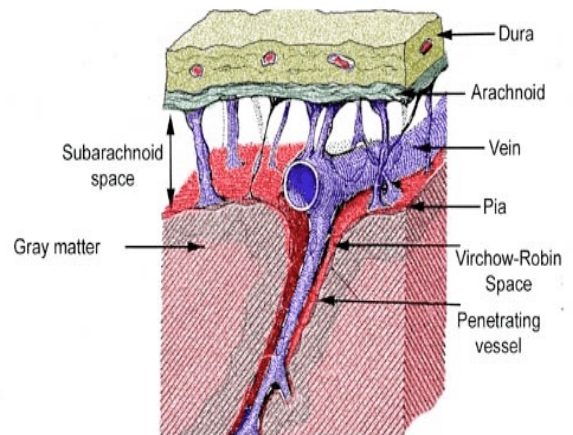
system ( but also the reason we have anomalies that cause dysfunction).

Where the cranial bones meet is called a suture. Some sutures “interdigitate”, like lacing your fingers; some sutures have sliding plates and others butt up against one another. The sutures are not fused, but actually have the ability to allow for movement, about 1 ten of a millimeter. Sutures allow for compression and tension release, much like the vertebral discs of the spine. Sutures also allow micro-movements as well in response to intracranial pressure.

### Membranes, Dural Tube and Cerebrospinal Fluid:

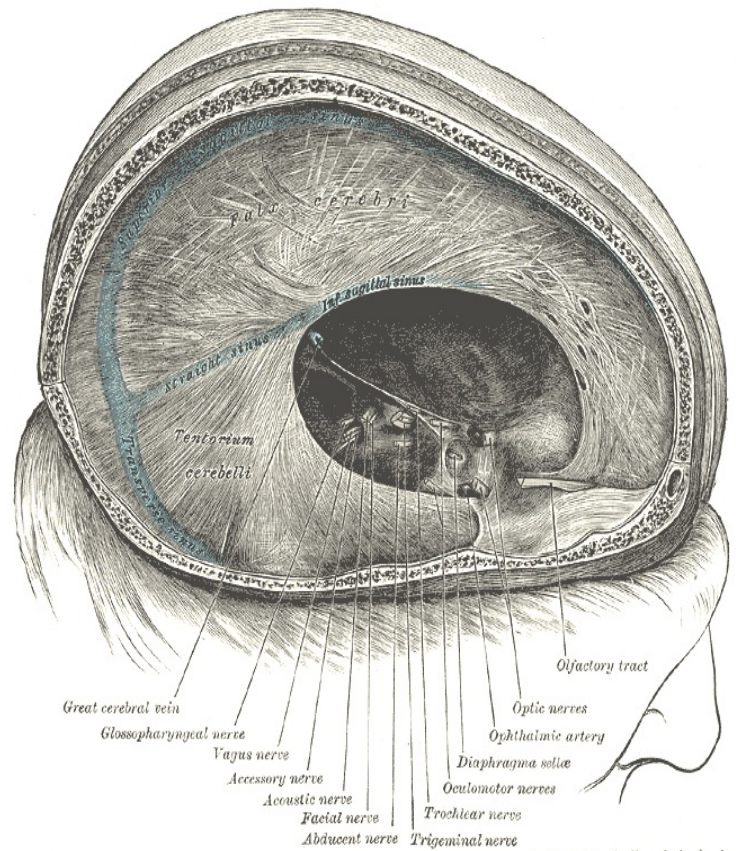
The membranes of the craniosacral system include the dura mater, the arachnoid membrane and and the pia mater. These three concentric membranes, known as the meninges surround the central nervous system - the brain and spinal cord.

The dura mater ( “tough mother” in Latin) lines the entire cranial vault and descends thru the foramen magnum into the spinal column. The pia mater (“faithful mother”) is the innermost membrane and it adheres directly to the contours of the brain and spinal cord. The membrane between the dura mater and the pia mater is the arachnoid membrane. This sheath is stretched over a delicate layer of reticular fibers known as the arachnoid trabecula, and this forms a weblike space which reaches down to the pia mater. This weblike space between the arachnoid and pia mater is filled with cerebrospinal fluid, and is known as the subarachnoid space. In an extension of the subarachnoid space, called the perivascular space, arterial vessels enter the brain tissue, taking arachnoid and pia with them. This means that cerebrospinal fluid circulation penetrates into the brain tissue itself and that increased pressure or inadequate drainage can compromise brain function.



Where the dural tube separates from the lining of the cranial vault ( the skull bones ) and reduplicates upon itself, partitions are formed that separate both the cerebrum and cerebellum into right and left hemispheres - the falx cerebri and falx cerebelli

respectively. The dura mater also forms the tentorium cerebelli which separates the cerebrum from the cerebellum. The tentorium covers the sella turcica (an indentation of the sphenoid bone), which houses the pituitary gland. As these membranes are connected directly to the cranial bones, their tension patterns have a great effect upon the movement of the cranial bones. Each of these intracranial membranes is continuous with the meningeal dura and through direct or reciprocal relationship with each other. Dr. Sutherland, one of the fathers of cranial osteopathy, called this the “reciporcal tension membrane system”. The falx cerebri is the membrane that attaches to the crista galli of the ethmoid bone, which is lodged within the frontal bone. It is through this location ( the cribiform plate of the ethmoid ) that the olfactory nerve passes ( Cranial Nerve I ). The cranial dura ensheathes the cranial nerves within their osseous foramina (bony openings) and fuses with each cranial nerves epineurium.

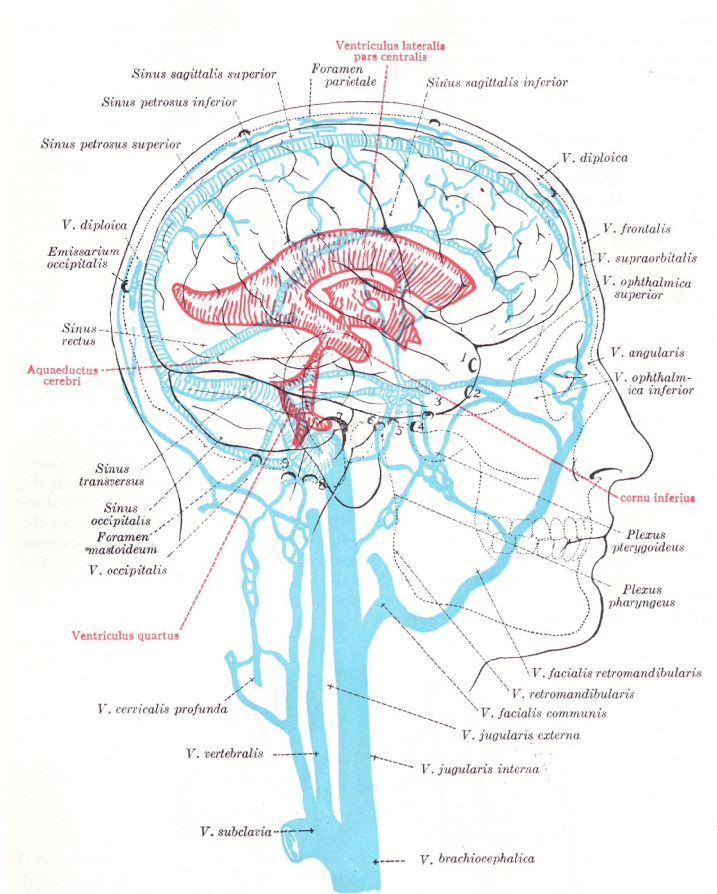


See Membranes and Nerves here:

In addition the reduplication, or invagination, of the dura also forms much of what is used in the formation of the venous sinus system. Used cerebrospinal fluid (carrying metabolic waste, toxins, etc.) is absorbed by specialized one-way valve structures (shaped like cauliflower) known as arachnoid villi or arachnoid granulation bodies, which draw the fluid out of the subarachnoid space into the venous sinuses. The bulk of cerebrospinal fluid reabsorption then enters the venous blood flow via the jugular veins, where it will be filtered. Blood can not go into the subarachnoid space where most of the cerebrospinal fluid circulates.

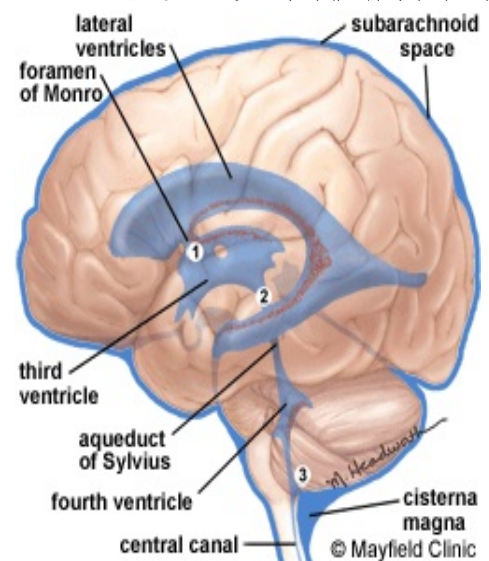
See ventricles and sinuses here:

The cerebrospinal fluid circulates around the brain and through the center of the spinal cord in the central canal. This central canal extends upward into the cranium to form the ventricle system - a system of specialized hollows, that are connected to one another. Blood comes into this system from the posterior and middle cerebral arteries where it moves into special one-way cell membranes called choroid plexuses. The choroid plexuses lie along the two largest ventricles, called the lateral ventricles and to a lesser extent along the third ventricle as well. The job of the choroid plexuses is to filter out cerebrospinal fluid, which is an extract of the blood, and circulate it around the brain and spinal cord. This important fluid transports nutrients, hormones and peptides to the brain and spinal cord.



Since cerebrospinal fluid travels around the brain, and within the ventricles and venous sinuses, any distortion in the meninges (dura, arachnoid or pia) or brain tissue itself (ie infection, tumors, hemorrhage) will cause an impediment on normal inflow/outflow of the fluid. This will result in increased intracranial fluid pressure. Fracture of the cranial bones, or shifting, will increase intracranial pressure as well.

So cerebrospinal fluid pressure increases anywhere within the system will have a direct impact upon it. And if this pressure exists around the cranial nerves themselves, as they pass thru the osseous foramina (taking meningeal membranes with it), this will then directly impact the particular nerve/and its function. Internal fluid pressure changes effect the cranial bones themselves, as does a blow to the head or intracranial



membrane tension ( remember reciprocal membrane tension?). This shifting of cranial bones will distort the foramina and the meningeal lining, again impacting on the cranial nerves and their functioning.

Blows to the head can shear off the olfactory nerves that pass through the ethmoid bone and cause anosmia, an irreversible loss of the sense of smell and a great reduction in the sense of taste (most of which depends on smell). This can also cause cerebrospinal fluid to leak into the nasal cavity, which is very dangerous and potentially life threatening. The presence of arachnoid granulations along the cribriform plate may also lead to spontaneous cerebrospinal fluid leaks ( Hegazy HM, Carrau RL, Snyderman CH, et al. Transnasal endoscopic repair of cerebrospinal fluid rhinorrhea: a meta-analysis. *Laryngoscope*; 2000;110:1166-1172)

See Cerebrospinal Fluid leak here:

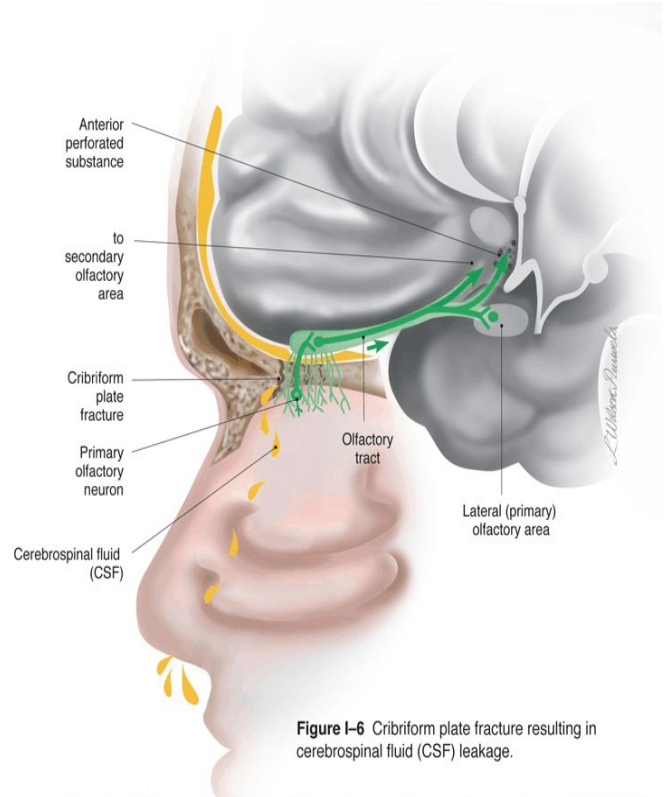


Figure I-6 Cribriform plate fracture resulting in cerebrospinal fluid (CSF) leakage.

From *Cranial Nerves* 3rd Ed. ©2010 Wilson-Pauwels, Stewart, Akesson, Spacey, PMPH-USA

So the challenge now is to read and hopefully understand some findings, new to me, regarding cerebrospinal fluid circulation. Some of these studies suggest that the arachnoid villi are not the only structures responsible for cerebrospinal fluid uptake. And there is some strong evidence that the lymphatic system, the nasal mucosa and nasal lymphatics, and olfactory nerve play an important role.

So let's quickly review the Lymph System:

In the body of mammals including humans, the lymphatic system is a network of thin tubes that branch, like blood vessels, into tissues throughout the body. Lymphatic vessels carry lymph, a colorless, watery fluid. The lymphatic system transports infection-fighting cells called lymphocytes and is part of the body's immune system. It

also returns interstitial fluid (fluid in the tissues) to the blood system and transports fats from the small intestine to the blood.

Now let's read some of the data ( yeah! This is where I get excited! ):

Research dating back to the 1800s has shown that there is a connection between the subarachnoid space, perineural space of peripheral nerves and cervical lymphatics. Cerebrospinal fluid is generally regarded as draining mainly into the arachnoid villi. Several authors have demonstrated that various substances introduced into the nasal cavity migrated along the olfactory nerves and bulbs to the cranial subarachnoid space. Others have shown that viral infections could travel to the central nervous system by the same route. Tracers injected into the cisterna magna have been found in the perineural space of the olfactory, facial and acoustic nerves. They were also detected in the perilymph of the inner ear and lymphatic vessels of the nasal cavity and middle ear. It has been concluded that the deep cervical lymphatics serve as the first filtration site for degradation products carried in the cerebrospinal fluid from the central nervous system. ( Yoshihara H, Miller C, Abelew T, Cerebrospinal Fluid Flow Along Cranial Nerves Proceedings: Conference on Current Topics in Chiropractic: Reviews of the Literature May 19-20 1984; F4: 1-6)

In another study, researchers have postulated two possible mechanisms for CSF uptake into lymphatics. The first is the "open cuff model" in which the perineural sheath cells disappear distal to the cribriform plate, allowing CSF to dissipate into the interstitial space where it is absorbed by the initial lymphatics in the olfactory and respiratory submucosa. The "closed cuff model" depicts the perineural space as a cul de sac. In this case, lymphatic vessels may fuse with the perineural cells and in some way get direct access to CSF that has convected along the olfactory nerve.

(Jackson RT, Tigges J, Arnold W. Subarachnoid space of the CNS, nasal mucosa, and lymphatic system. Arch Otolaryngol. 1979;105:180–184.)

Other data suggests a third possibility. Since the parenchyma of the brain does not contain lymphatics, it has been assumed that arachnoid projections into the cranial venous system are responsible for cerebrospinal fluid (CSF) absorption. The evidence that nasal lymphatics have the major role in CSF transport in sheep, may suggest the applicability of this concept to other species, especially to humans, although this never been clarified. The purpose of this study was to compare the CSF and nasal lymph

associations in human and non-human primates with those observed in other mammalian species.

The fact that the pattern of Microfil distribution was similar in all species tested, suggested that CSF absorption into nasal lymphatics is a characteristic feature of all mammals including humans.

Johnston M, Zakharov A, Papaiconomou C, Salmasi G, Armstrong D. Evidence of connections between cerebrospinal fluid and nasal lymphatic vessels in humans, non-human primates and other mammalian species. *Cerebrospinal Fluid Res.* 2004;1:2. doi: 10.1186/1743-8454-1-2.

The last piece of data ( I promise! ):

.... there is some circumstantial data that cribriform-lymphatic CSF transport occurs in humans as well, and whether the cribriform route has the same quantitative significance. For example, in human autopsy material, intracranially administered India ink was observed to fill the perineural spaces around the olfactory nerve branches and was found in the nasal submucosal tissue. Similarly, with subarachnoid hemorrhage, red blood cells were observed around the olfactory nerves and within the nasal mucosa. Additionally, in nonhuman primates, the injection of radioactive albumin into the CSF compartment leads to elevated concentrations of tracer in the cervical lymph nodes.

McComb JG, Hyman S., (1990) Lymphatic drainage of cerebrospinal fluid in the primate. in *Pathophysiology of the Blood Brain Barrier*, eds Johansson BB, Owman C, Widner H. (Elsevier, Amsterdam), pp 421–438.

Löwhagen P, Johansson BB, Nordborg C., (1994) The nasal route of cerebrospinal fluid drainage in man. A light-microscopic study. *Neuropathol Appl Neurobiol* 20:543–550.

My Conclusions:

I started by asking if there are any connections between our “fluid” intelligences, and if

so, what is the significance. The data we explored strongly supports the existence of cerebrospinal fluid - nasal - lymphatic connections. While some of these authors believe it is “high time” to create a new conceptual foundation for the parameters of cerebrospinal fluid, I believe that this data actually supports my theory that all our fluid systems engage in a “dialogue” that creates, protects and supports us. Where I disagree with the data is I do not maintain the belief that the lymph system is primary to cerebrospinal fluid uptake. If, in fact, that were the case why would we have such a magnificent system, with such extraordinary and specific components that play such highly specified roles in the craniosacral system, if they were not primary to cerebrospinal fluid creation and reabsorption. I admit, I am a “ form and function” kind of gal! I will maintain that some cerebrospinal fluid is absorbed by the cells and the lymphatic system, which is not present in the brain, but indeed lie on the fringes of the craniosacral system of the skull, dural tube and spine. I will also maintain there must be a fluid exchange mechanism that we have not as yet understood, and for now my jury is out on any definitive conclusion.

