COHERENT BREATHING®
VOLUME 4, ISSUE 2 - DECEMBER, 2025

Hello all,

Welcome to Coherent Breathing®,Volume 4, Issue 2, December, 2025: ***Coherent Breathing, Gravity, & Life On Planet Earth.***

**Major Body Fluid Compartments**

| Compartment | Approx. Volume (70 kg adult male) | % of Total Body Water |
|---|---|---|
| **Total Body Water (TBW)** | ~42 L | 100% |
| **Intracellular Fluid (ICF)** | ~28 L | ~67% |
| **Extracellular Fluid (ECF)** | ~14 L | ~33% |
| • Interstitial Fluid | ~10–11 L | ~25% |
| • Plasma | ~3 L | ~7% |
| • Transcellular Fluid (specialized) | ~1 L | ~1–2% |

Figure 1: "Compartments" of Body Fluids (Microsoft Copilot)

Planet Earth is made of stardust and our bodies of Earth. When stardust accumulates it forms mass. All of the "objects" in the universe as we know it possess mass, including our own bodies and the bodies of all things, animate and inanimate. Gravity acts on mass. Whether we are playing, walking, working, sitting, standing, or sleeping, gravity is always at work. As we grow, we assemble the mass of Earth into the structures that make up the body, taking in Earth elements by lifting those elements upward, consuming, and integrating them into the structure/mass of the body, water – a solvent, transporting/hydrating, and food breaking down, building, and nourishing cells. Mitochondria use the chemical and electrical constituents to produce ATP, which fuels cellular life. What is left returns to Earth via gravity.

Gravity has influence on all of the elements comprising the body, specifically fluids. This is simply because fluids are mobile – contrast with bones which are relatively stationary. Yet, it is the circulation of fluids which pervade every cell whether the structure is soft (brain) or rigid (bone), bringing hydration, nutrition, and facilitating gas exchange. Without the "circulation" of fluids, cells cannot generate energy, suffer harm, and potential cell death. This sounds like the natural entropy of aging, which can be likened to Earth's gravity calling back all of the material makeup of the body, where we are not unlike trees in this regard.

Figure 1 depicts where the nominal fluid volume of 42L exists in the body, where blood is only ~5L (~12%) of total body fluid. The majority (67%) of the 42L being in the cells , i.e., intracellular fluid (~28L). ~55% of blood is plasma, 92% of plasma being water, the remaining 8% consisting of proteins and other solutes. The majority of the remaining 45% of blood consists of ~44% red blood cells which contain hemoglobin, the carrier of oxygen and carbon dioxide to and from cells, <1% white blood cells (immunity), and <1% platelets (clotting). Yet, it is the role of this 5L of blood to service every cell in the body, estimated to be in the trillions. It accomplishes this via circulation, *blood flowing in a circle*, being nourished by the intestines and liver, filtered by the kidneys, and aerated by the lungs. Blood services and is serviced by the pervasive capillary circulation where the microscopic boundary between arterial/venous structures and the extracellular environment exists, the total length of all capillary vessels is currently estimated at 96,000 kilometers, or ~60 thousand miles, twice as long as once thought. This is due to a modern re-estimation of the density of the capillary bed throughout the body using state of the art microscopy and measurement technology.

Living cells with their respective intracellular fluid environments float in extracellular fluid (~14L or 33% of total fluid) taking in hydration and nutrients and giving off metabolic waste byproducts. Of course their intake includes oxygen and their output carbon dioxide. Fluid flows from the microscopic capillary membrane into extracellular fluid, and from extracellular fluid into cellular fluid, cells exchanging fluid between intra and extra-cellular environments, and between extracellular environmment and capillary circulation on a continuous *circular* basis, the capillary circulation being refreshed every moment, venous blood leaving and arterial blood arriving.

The arrangement of the human body is as it is because of an evolutionary imperative to stand and locomote in a vertical orientation. The same general arrangement exists in all mammals, but not fish, birds, or reptiles, each of these having different anatomical structures that facilitate "breathing". This difference can be attributed to the different gravitational circumstances in which they reside, e.g., fish in water, and birds in air. Because of our general vertical orientation, the human body can be likened to a column of fluid – on which gravity is omnipresent, exerting it's constant downward pull. This of particular consequence to fluids in the head/brain and the hands and feet. This because they are at opposite ends of the fluid column, where fluid pressure in the head/brain is lowest and highest in the feet. The hands and feet is where we begin to see signs of edema when fluid is not moving, a common consequence of right heart shortcoming, which I attribute to the failure to breathe with significant depth.

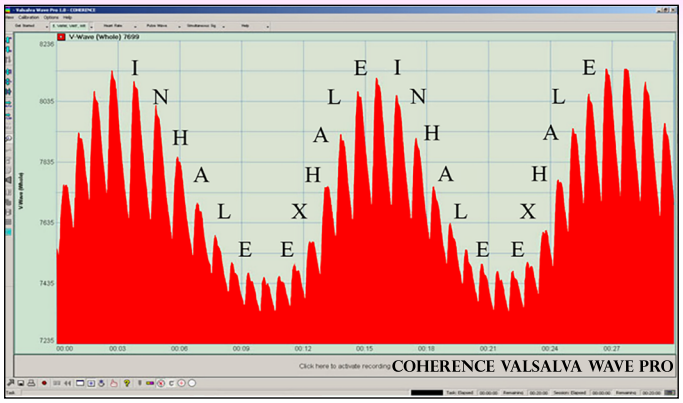

Figure 2: Valsalva Wave Pro at capillary circulation.

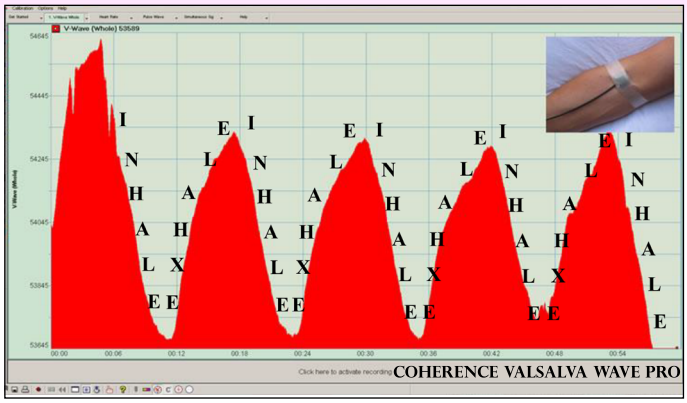

Figure 3: Valsalva Wave Pro at medial cubital vein.

1L of water has a mass of 1 kilogram, 42L a mass of 42 Kg. Our body weight is a function of it's mass times the gravitational acceleration constant of Earth, 32 feet/sec$^2$. When we stand stationary, as when we assess our own weight, because our bones are stationary they are not subject to gravitational acceleration, however fluid is, specifically fluids that are not compartmentalized, but my primary interest is the blood.

The arterial tree holds ~15% of total blood volume or ~.75L. As blood flows downward in the arterial path, it is accelerated by gravity. Because the instantaneous rate at which blood flows in arterial and venous trees is difficult to measure, it isn't spoken of in terms of gravity. Instead the gravitional effect on pressure is used, where the difference in arterial pressure between head and feet is 70-90mmHg (millimeters of mercury – units used to measure blood pressure). As blood flows upward in the venous path, it is decelerated by gravity. The venous system holds ~3.5L or 70% of the 5L of blood that exists in the average adult circulatory system. The difference in pressure between head and feet on the venous side is ~130mmHg. It is higher than on the arterial side because the volume of blood held in the venous tree is 5 times greater than in the arterial tree, hence the effect of gravity is greater, i.e., it weighs more and therefore exerts more pressure.

Discounting capillary circulation, the length of arterial and venous trees are estimated at a few thousand miles each. The relatively open portion of each on which gravity acts en masse is 1.5 - 2 meters. The arterial tree functions to both accelerate blood (when slowed) and throttle arterial blood (when hastened), providing a degree of regulation. The venous tree has check valves preventing reverse flow, *but no innate mechanism* for moving blood upward, thereby countering gravity. It is this inequality between arterial and venous flows when we are erect that is problematic to our health. I credit this inequity with setting the stage for essential hypertension, *the mysterious form of elevated arterial pressure with no known etiology*. When blood in the vena cava is not moving, the autonomic nervous system forces the issue. An interesting fact is that for every pound of flesh we gain, weight being a function of gravity, we add 300 miles of capillaries, this length adding to the circulatory burden placed on the heart, specifically venous circulation and the right heart.

*My statement of above regarding no innate mechanism is wrong.* The innate function existing on the venous/right heart side of the circulatory system is "breathing", specifically, "inhalation". Lowering of the diaphragm and expanding the volume of the lungs creates negative pressure in the thoracic cavity that is reflected through the pulmonary artery and right heart and into the vena cava, presenting a lower pressure than that existing in the lower extremeties. Consequently, the relatively low elasticity of the venous tree is capable of sending blood upward, even against gravity, i.e., working against gravitational deceleration. Inhalation is a right heart centric/sympathetic action involving muscular contraction of the diaphragm and intercostals – heart rate increases and left heart output decreases. *Inhalation is the principal anti-gravitational mechanism that exists to promote upward flow of blood and fluids in the body.* It does this by generating a vacuum (relatively negative pressure) to which venous blood flows. I am heartened to find that Microsoft Copilot now lists "respiratory pump" as a "supporting mechanism" to facilitate upward flow in the vena cava, the primary mechanism identified being the "skeletal muscle pump" – where there is only one problem with this, what if the muscles of the legs and arms are not active? To my knowledge, I coined the term "thoracic pump" as it relates to breathing and circulation 15 years ago. It is "the respiratory pump" or thoracic pump and abdominal pumps that produce the wave action depicted in Figures 2 & 3, not skeletal muscle pumps, even when we are standing completely still.

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In 2013, a study led by Dr. Maiken Dedergaard of The University Of Rochester Medical Center titled *A Paravascular Pathway Facilitates CSF Flow Through The Brain Parenchyma And The Clearance Of Interstitial Solutes, Including Amyloid Beta* was made available on NIH public access. It articulates that there are two circulatory systems in the body, one that transports blood and a second, the lymphatic system, that transports lymph, where cerebrospinal fluid performs the function of lymph in the brain and spinal cord, i.e., sweeping away metabolic waste, of major concern re., Alzheimer's. Their interest was in understanding *how* CSF flows through the brain. The study reports that CSF flows along channels adjacent to cerebral arteries and is compelled to move forward by the arterial pulse, CSF sweeping its way through brain regions and eventually accumulating around veins where it is absorbed for recycling. There is no mention in this study of breathing induced changes in cerebral arterial pressure/flow. This is as anticipated because the subjects of the study were mice.

Its worth mentioning that while cerebro-spinal fluid originates in the brain, it also and flows *down* the spinal cord, contained within the dura to join venous return, dural venous sinuses aiding in its absorption. The heart beat is known to cause oscillations in CSF flow such that the cardiac systole pushes CSF down the spinal canal whereas during cardiac diastole, it tends to move back up slightly. Several more-recent studies have found that *breathing* moves cerebrospinal fluid in the brain. (Please search on: "Studies demonstrating that breathing moves CNS in the brain.")

I presented *The Search For The Wave In The Brain* (Elliott & Sokhadze) at the 2013 annual meeting of the International Society For Neuroregulation And Research (ISNR), where I shared evidence that the brain does experience the breathing induced Valsalva Wave, resulting in brainwave amplitudes that are on the order of 10X those of functional bands. Historically, it has been understood that the heartbeat alone moves blood through the brain. Referring to Figure 2, compare amplitudes of the slow wave induced by breathing with the heartbeat. Each is approximately 1 inch in height at its peak. Given fluid dynamics, this suggests that their contribution to pressure and flow is roughly equal. While Figure 2 is plethysmographic detection at the earlobe, hemoencephalographic (HEG) detection at the forehead demonstrates that the slow wave component is several times higher than the hearbeat component. It is important to note that both instruments have equal low frequency response down to zero Hertz. Please refer to The Search For The Wave In The Brain for more detail.

I am advocating that we train our breathing via conscious practice to generate and sustain wave action in the circulatory system, specifically the "inhalation" phase. Inhalation requires muscular contraction and is for this reason more effortful. Exhalation is simply about letting go, relaxing and letting the air flow out of the lungs through the nose. The nose is a regulatory mechanism governed by the autonomic nervous system, regulating the rate at which air flows into and out of the lungs. The nasal turbinates perform this function in real-time.

Billions of dollars are spent annually on the myriad consequences of suboptimal breathing, but little by little, the role of breathing in facilitating healthful circulation is coming to the fore. Based on my current search results, the term "thoracic pump" appears to be more and more widely used across multiple health fields. If in fact I did coin the term in the English language, which I cannot know for sure, I am very pleased that it is becoming common knowledge, as it has been my aim since 2005 to spread the understanding of breathing and *how and why* it works.

Since I've already exceeded my 2-page limit, here at the end let's try a simple Coherent Breathing experiential:

1) Let's get comfortable and allow our eyeslids to close gently (of their own weight).
2) Inhale gently and then exhale through the nose. (The nose is a regulatory mechanism governing air flow).
3) At the end of exhalation (when the lungs feel comfortably empty), inhale for the count of 6 (nominally 6 seconds).
4) When inhalation ends (lungs feeling comfortably full), exhale through the nose, letting go. No need to count, just relax and let the air flow out through the nose. (How long does it take?)
5) Pay attention to sensations in the face, head, hands, & feet. What do you feel during inhalation? During exhalation?

Try this a few times by yourself or with a group.

Please let me know if you have any questions.

Stephen Elliott, President, & Life Scientist, COHERENCE LLC

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