



Hello all,

Welcome to *Swan & Stone*, Volume 1, Issue 15: *The Breathing State Of Mind*. In this issue, I propose that breathing is necessary for proper brain function, specifically when we are erect, i.e. seated or standing. My fundamental assertion is that:

***Breathing is a circulatory function, gas exchange occurring in the process.***

This vs. the traditional way of seeing it, that *breathing is a gas exchange function, circulation occurring during the process*. In fact both are true, but most of us do not think of “breathing” as being about the movement of blood. Most of us think of breathing as being about the movement of air. Again, both are in fact true, but there is a problem with emphasis and understanding.

In [September 2010](#) I asserted the theory that in land dwelling vertebrates, the evolution and sophistication of the diaphragm follows uprightness – the degree to which the head is carried above the chest and the chest is carried above the legs, where the more erect, the more prone the blood is to pooling due to gravity. Referring to Figure 1, of course this is the reason that blood pressure in the feet is far higher than in the head – blood tends to pool in the feet and legs.

My argument is that it is the job of the diaphragm and organs that make up both thoracic and abdominal pumps to counter the effects of gravity. Diaphragm movement plays two major roles in this regard. First inhalation or downward movement of the diaphragm creates negative pressure in the chest to which venous blood naturally flows, specifically venous blood in the legs, but more generally, all venous blood. It is the job of the right heart to check and shuttle venous flow into the lungs during inhalation. (It is not the job of the right heart to vacuum blood from the venous tree.) Second, exhalation or upward movement of the diaphragm creates positive pressure in the chest that sends a wave of blood to the head and brain. When breathing is effective – when the range of diaphragm movement is significant and the motion is rhythmic – these pressures and resulting flows are generated with every inhalation and exhalation. Blood flow is wavelike, emphasis alternating between venous and arterial trees.

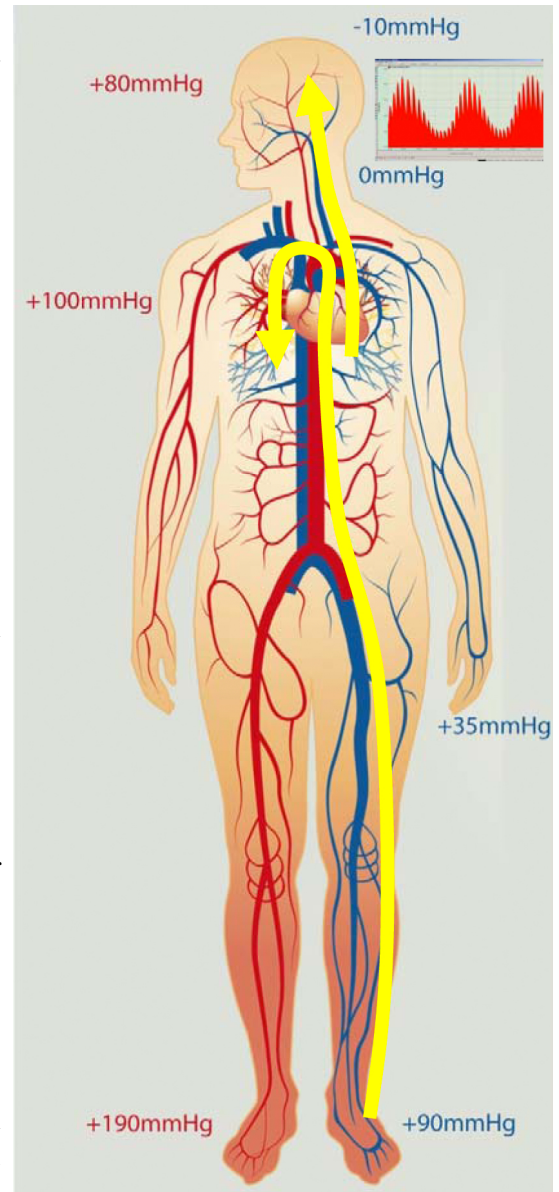


Figure 1: Arterial And Venous Blood Pressures In The Erect Human Body

There are at least two *dire* circulatory consequences of insufficient diaphragm movement: 1) the right heart bears the full burden of venous flow, which over time wears out the right heart, and 2) brain health is dependent on the presence of wave action, which when breathing is effective is approximately two times the magnitude of the heart beat alone as observed in the head. Researchers are discovering that it is variations in blood pressure that keep the brain clean and clear of metabolic waste via its motive effect on cerebrospinal fluid. In the research there is never any mention of the respiratory arterial pressure wave phenomenon or its contribution to pressure and flow, only the heart beat. This absence is a huge caveat in the popular medical understanding of circulation, contributing to the pandemics that accrue from circulatory malfunction including essential hypertension – the #1 mortality risk worldwide. But that is a topic for [Circulatory Physiology 101](#). In this issue, I want to posit that ***the quality of our diaphragm movement is a major determinant of how our brains function and consequently of how our minds work***. Secondly, I will assert that there are “higher order” human brain functions that are dependent on brain health, including mental clarity, compassion, empathy, foresight, insight, intuition, sense of purpose, sense of unity, ESPs...



Diaphragm movement is about more than the circulation of air and blood. It is the primary motive force that moves matter in the body: fluids, gases, & solids. Just as diaphragm movement is necessary for brain health it is necessary for the health of the organs of digestion. There is a phenomenon in Chinese medicine known as *arisa* of the clear. It refers to the essence that the digestive process extracts from our dietary intake. This essence nourishes the spirit and the spirit is credited with higher order functions of mind. Above the diaphragm, the autonomic nervous system synchronizes with diaphragm movement. Below the diaphragm, the enteric nervous system of the gut synchronizes with diaphragm movement. When diaphragm movement is “coherent”, multiple bodily systems synchronize with it such that the entire body, every cell and molecule is alive with coherent dynamism – “dynamic homeostasis” if you will – *vibration*.

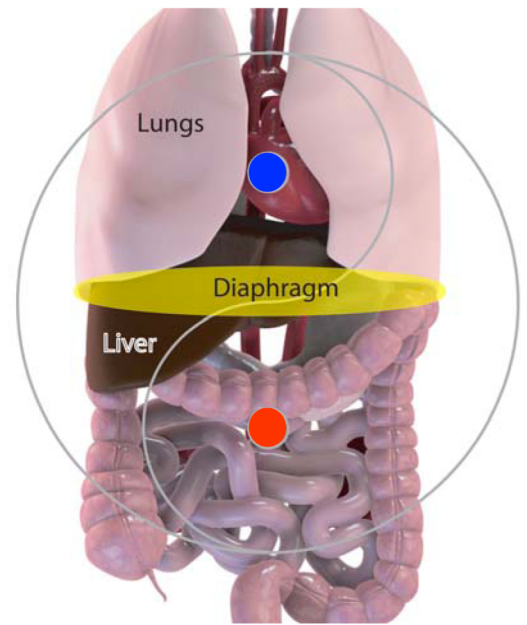


Figure 2: The Tai Chi Diaphragm

Certainly this is a reason that breathing well is critical to yoga and martial arts pursuits, without it one cannot progress, the required self governance is alone hurdle enough, *strong self governance being another higher order aspect of brain/mind*. It may be that brain development itself is dependent on circulatory effectiveness. Its something that we don't know very much about but certainly it stands to reason, as every cell in the body is suspended in extra-cellular fluid and relies on variations in blood flow and pressure across the capillary boundary for hydration, respiration, nutrition, and waste removal. In case this intellection turns out to be almost right, we must teach our children well so they have the opportunity to reach their human potential. *Children must learn to breathe well and they must have the opportunity for physical activity*. The stakes are too high.

If this makes sense to you – consider the alternative. In *The New Science Of Breath*, we introduced a table that is titled *the correlates of autonomic balance*. [An instance of it exists on coherence.com here](#). At the time of the writing, we were thinking of the correlates in terms of “present state”, i.e. the temporal autonomic state, and we could see changes in these correlates in-session, so there was and is evidence that autonomic state is malleable in the moment via breathing. We'd not given much thought to the *long term* effects of time spent in one state or another, breathing vs. not breathing. It is here that I am growing uneasy...

I am growing more and more concerned that the correlates are those of brain state and function which confers temporal autonomic status, and that both balance (via breathing) and imbalance (due to non-breathing) are self-reinforcing. This hypothesis says that if one aspires to realize balance (via breathing) and persists in that state of balance, this aspiration and persistence is self-reinforcing in the long run, months, years, decades, a lifetime... Alternatively, if one persists in the state of imbalance, with its concomitant biological issues and outcomes, the same is true: a virtuous vs. vicious circle. [The entire matter, both short and long term, is highly akin to “exercise”](#).

Exercise necessitates increased diaphragm movement due to cellular energy production and related demand for hydration, gas exchange, nutrition, and waste removal, diaphragm movement during exercise also generating wave action in the circulation. Interestingly, when the body is at rest or semi-active and breathing is *coherent*, the blood wave generated by breathing ([the Valsalva Wave](#)) and the heart rate oppose, the autonomic nervous system phase locking heart rate in opposition to the Valsalva Wave. This phase alignment is the definition of “resonance” while at rest or semi-activity. Blood *flow* is wavelike with emphasis shifting between venous flow during inhalation and arterial flow during exhalation. During exercise, the autonomic nervous system shifts this alignment such that the heart rate reinforces the Valsalva Wave. The effect of this adjustment is that blood flow becomes less wavelike and more constant. As exercise winds down, the autonomic nervous system shifts back to opposition, i.e. resonance. We have no choice but move the diaphragm when we exercise. But when we are at rest or semi-activity the choice is ours.

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