

“Asymmetry, Lateralization, and Alternating Rhythms of the Human Body”

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Part 5: Connecting Asymmetrical Ultradian and Neuromuscular Rhythms of the Human Body

The following piece is primarily based off David Shannahoff-Khalsa's article “Lateralized rhythms of the central and autonomic nervous systems.” (Shannahoff-Khalsa, 1991)

In addition to the need for the neuromuscular system to be able to laterally shift amidst an inherently asymmetrical system, the autonomic nervous system (ANS) and central nervous system (CNS) have evolved to coupling in lateralized rhythmical patterns, referred to as ultradian rhythms. This represents further specialization of each side of the body for increased adaptive and evolutionary potential. More specifically, the ability of the ANS and CNS to lateralize can facilitate the conservation and production of energy whereas one side functions in an ergotrophic state (energy production) while the other is simultaneously in a trophotropic state (energy conservation). This may be referred to as a basic rest activity cycle (BRAC). It has been proposed that ultradian rhythms serve as a neural matrix for coupling mind and metabolism manifesting as a pendulum of ANS-CNS activity to help maintain allostasis of two polar states. This dynamic alternation allows for increased specialization in congruence with energy efficiency.

The first example of an ultradian rhythm in the body is the nasal cycle as defined by an alternation of vasoconstriction in one nostril and vasodilation in the other that tends to average 3-4 hours per cycle with ranges anywhere from 2-8 hours. Nasal tissue is highly innervated by the sympathetic nervous system where increased activity is associated with increased vasoconstriction and less congestion. Nasal shifting is also coupled to lung inflation. Forced inhalation through one nostril is paired with increased ipsilateral lung inflation referred to as the pulmonary reflex mechanism. There is a sympathetic coupling mechanism where vasoconstriction in one nostril is associated with vasodilation of the ipsilateral lung.

The nasal cycle is also coupled with contralateral hemispheric function. Increased performance of verbal (L hemisphere dominant) tasks is associated with R nasal breathing while better spatial (R hemisphere dominant) task ability is associated with the left nasal cycle. Strength of verbal and spatial performance has been shown to correspond to 90 minute cycles. The nasal cycle is associated with REM (rapid eye movement) and NREM (non-rapid eye movement) stages during sleep where the right nostril dominates with REM and the left with NREM stages. Insomnia has shown to be associated with unilateral nasal obstruction. There are hemispheric dominance EEG patterns during REM (left) and NREM (right). Waking during either stage can reflect differences in spatial and verbal performance. Furthermore, spiral aftereffect (an illusion in visual perception) exhibits an ultradian rhythm coupled with the nasal cycle and sleep state.

There are coordinated rhythms between hemispheric dominance, sleep stages, autonomic, digestive, and endocrine systems. Hemispheric cerebral metabolic rates are consistent with these patterns. There are lateralized alternations of peripheral concentrations of norepinephrine, epinephrine, and dopamine in the body. Generally, as concentrations rise on one side they fall on the other side. The nasal cycle is also paired with these patterns. Extracellular hippocampal norepinephrine and serotonin concentrations measured in rats have demonstrated substantial fluctuations which correlate with activity level as well as 8 cycles over a 24 hour period. Measurement of adrenal blood flow in dogs showed no times where there was not a significant difference between sides in conjunction with a 90 minute cycle. It was also observed that the right adrenal gland weighed more than the left. Corticotrophin-releasing hormone from the hypothalamus directed to the pituitary to signal adrenocorticotrophic hormone (ACTH) release has shown to have a lateralized alternating ultradian rhythm during the day as well as being coupled to REM and NREM sleep. During R sympathetic/L parasympathetic states there is a stronger hunger drive that is associated with increased salivary flow, stomach contractions, and gastric acid production. Gastric pH has been shown to fluctuate between 1.07-5.5 hour periods with cycles averaging around 2-3 hours. Increased gastric acidity is coupled with decreased motility while increased motility is enhanced during the REM stage. During sleep, 100 minute gastric cycles have been found to be loosely related to REM stages.

Growth hormone (GH) secretion is paired with NREM sleep while lutenizing hormone (LH) is coupled to the REM stage. It has been shown that an injection of lutenizing releasing hormone in men (but not women) prevents improvement in a spatial orientation task but enhanced performance in a verbal fluency task further deducing that LH is correlated with left hemisphere function. Testosterone production via the pituitary-gonadal axis is linked to cortisol secretion thus coupling with the pituitary-adrenal axis. Testosterone secretion is also associated with penile tumescent cycles, and REM sleep. Parathyroid hormone, elevated calcium levels, and endorphins are paired with REM sleep. Prolactin production is correlated with NREM cycles.

Other examples of ultradian cycles and lateralization are:

- Oxygen consumption in a resting state demonstrates cyclic patterns of about 90 minutes.
- Body temperature has an ultradian rhythm where a rise is associated with increased grip strength and thus left hemisphere dominance.
- Cerebral rhythms impact immune function. It has been shown that lateralized neocortical lesions affect spleen weight, thymus weight, number of T cells, percent of helper T cells, percent of cytotoxic/suppressive T cells, and antibody production, T and B lymphocyte proliferation, and natural killer cell activity.
- A case of a woman with multiple personality disorder revealed significant hemi differences depending on which personality (aggressive vs. timid) state she was in. In the aggressive state, there was a pattern of hypersensitivity to touch, smell, vision, on the right coupled with increased right nasal clarity. Salivation and abdominal reflexes were also reduced, pupils were constricted, and there was absent sweating on the sole and palm. When she switched over to the timid personality, these lateral findings shifted over to the left side of the body.
- The right adrenal gland averages 1.8 g vs the left at 1.3 g.
- When babies are born they can exhibit unilateral harlequin color changes.
- Perspiration can occur laterally on one side of the body. Lying on a side can cause increased perspiration of the superior side. This effect can be mimicked by manual pressure to the axillary point near the 5th intercostal space which can result in contralateral increased sympathetic tone.

The hypothalamus couples the BRAC, nasal cycle, sleep stages, eating-oral-gastric activity, pituitary cycles, and cerebral rhythms. It is the main regulator responding to the needs of the individual and environmental stressors. More specifically, the suprachiasmic nucleus, a part of the hypothalamus sitting above the optic chiasm seems to regulate these rhythms. It is hypothesized that stress may be induced if rhythms become out of sync, demonstrate altered temporal characteristics, or cease to alternate. In other words, if a pattern becomes locked in an ergotropic state of increased left brain and right sympathetic dominance, patterns of stress sequelae may ensue. The “Integrative Systems Model of Stress and its Potential Clinical Patterns” (Carr, 2014) may explain some of the possible manifestations of a stressed system.

It is a logical correlation to connect the prevalent asymmetrical right body neuromuscular dominance controlled by the left hemisphere with the dominant right sympathetic nervous system, right nasal cycle, and ergotropic state. This common pattern of existence is quite prevalent in modern society. Many individuals are functioning in a narrowly focused, egocentric, objective reality characterized by left hemisphere dominance. This dominance is being fueled by both the natural physiological evolutionary development of our powerful language, reasoning, and motor control skills in addition to a culture that prizes rewards thus further reinforcing these traits.

In order for the asymmetrical body to exist in a healthy and balanced state, it is essential for it to be able to fully shift between both the left and right sides. This is imperative for not only the neuromuscular system but the autonomic, central nervous, endocrine, and gastrointestinal systems as well. There needs to be an appropriate balance between lateralized ergotropic and trophotropic states for efficient energy conservation, production, and system restoration. Furthermore, health care practitioners utilizing an approach focusing primarily on movement with the goal of achieving proper left to right neuromuscular shifting may also consider the impact they are having on other systems in the body and vice versa. It is possible that as one gains better neuromuscular ability to ground through their left leg they are also

facilitating their nondominant right cerebral cortex, left sympathetic nervous system, right parasympathetic nervous system, and trophotropic state.

How can one facilitate alternating rhythms amongst an asymmetrical system?

1. **Learn how to breathe properly.** Most R sympathetic/L hemisphere dominant individuals are predominantly in a respiratory state of inhalation (L>R), not properly exhaling, nor properly using their diaphragm which is associated with increased neck tension. The neck muscles then attempt to compensate for reduced diaphragm function. This is coupled to inefficient postural patterns putting additional stress and strain on the body. Be aware of your breathing pattern. If you tend to hold your breath and breathe shallowly and rapidly then you are not breathing correctly and need to focus on longer exhalation periods. A great breathing technique to help decrease R sympathetic/L hemisphere dominance is to inhale gently through the nose (with your tongue resting on the roof of your mouth) over the course of a few seconds, purse your lips (teeth apart) and slowly exhale for 7-8 seconds, followed by a 4 second pause. This can be repeated 4-5 times. Yoga techniques associated with alternating nostril breathing can potentially facilitate better ultradian rhythms. Alternating nostril breathing has been shown to impact angina pectoris. Forced right nostril breathing has shown to increase blood glucose while left lowers. Finally, deviated septums and other factors negatively impacting the ability to primarily nasally breathe can potentially affect ultradian rhythms. If you are unable to breathe through your nose it is in your best interest to address this problem. Finally, your tongue should normally rest on the roof of your mouth (palate) during all activity except eating, drinking, and talking. This provides a beneficial expansion force to the palate, helps decrease excessive muscle tension in the body, and facilitate nasal breathing.
2. **Learn how to properly shift and synchronize your body between right and left stance phases of walking.** Typically, the human body needs to be better able to shift into left stance phase. The following is an activity to help facilitate this ability. If you are unable to perform this exercise or it creates pain you likely need the assistance of a professional to guide you for proper training and neuromuscular re-education.

Left Stance Phase Training

- a. Place the majority of your weight through your left leg. Your right foot will be placed in front of the right as if you were walking.
 - b. Feel the center of your left heel pushing down into the floor. Imagine your tailbone anchoring down to your heel.
 - c. Left knee should be unlocked and slightly bent.
 - d. You should be able to feel the front of your left thigh (quad), inner thigh (hamstrings and adductors), and buttocks (gluts) engage.
 - e. Pelvis should be slightly rotated to the left. Your zipper should be aligned with your left big toe.
 - f. Engage your left abdominals by reaching down to the ground with the left arm 1-2 inches. This will slightly sidebend your trunk to the left. Your left shoulder will be slightly lower than your right shoulder.
 - g. Reach forward with your left arm and backwards with your right arm.
 - h. Fully exhale and allow your ribs to drop down into your belly.
 - i. Gently bite down with your left teeth (bicuspid/molars) only. Try to not have any teeth touching on the right.
 - j. Keep head straight or turned to the right. Look to the left with your eyes only.
 - k. Keeping your tongue on your palate, inhale and exhale through nose. Pause 4 seconds after each exhale. Allow your ribs to drop down as you exhale.
 - l. Repeat for 4-5 breaths. Perform periodically throughout the day.
3. **Learn how to manage your stress levels and experience a relaxed and regenerative state of being at least during some parts of your day.** This will help engage the typically nondominant R parasympathetic/L sympathetic state. The following articles (“The Flow of Open Focus” and “Rediscovering our Rhythmical Connection to Nature”) (Carr, 2015a) (Carr, 2015b)) discuss how being in natural environments as well as modulating the way you focus can help facilitate this.

4. **Engage in enjoyable rhythmical activities.** Because our systems are entrained to be alternating, participation in one type of rhythmical activity such as walking can potentially help the other systems shift. Other examples are listening to music, being in nature, dancing, and Thai Chi. Even our primal procreation method is based on rhythm!

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