

# Theories of the Craniosacral Rhythm

By Thomas Rasmussen, PhD, MSc, CST-D

Science is again and again amazed with Mother Nature, who keeps surprising us with a complexity and brilliance that we learn from. Systems of rhythms regulating our health at a profound level, the many ways Cerebrospinal Fluid (CSF) is moved in the Central Nervous System (CNS) to allow nourishment, cleaning, and communication, has shown that the simple bulk flow of CSF and regulating system in the Pressurestat Model, is today replaced by a growing understanding of rhythms and CSF circulation and function.

***History of Rhythms in CST.*** As part of the foundation of osteopathy in the cranial field, its creator William Garner Sutherland formulated an idea that in complex organisms such as humans, there must be a mechanism for the whole system regulation, from the central down to the single cellular respiration. Sutherland named his postulated mechanism The Primary Respiratory Mechanism (PRM). The term primary respiration was used to highlight that PRM respiration precedes the respiratory breathing mechanism. Sutherland believed that the origin of the PRM was in the brainstem in the area of the 4th ventricle. Sutherland's idea of a PRM for whole system regulation is similar to the scientific understanding of master rhythms regulating and unifying the homeostasis of our physiology. The main question is whether there is a master PRM in addition to or unifying with the master rhythms of circadian, lunar, and cell cycles?

***The Pressurestat Model.*** At the time of founding CST, Dr. Upledger and others had suggested different possible sources/models for the generation of CSR. A hydraulic pressure theory suggesting rhythmic variations in the production of CSF by the choroid plexus was proposed by Magoun. Upledger and Vredvoogd expanded the choroid plexus hypothesis by adding neurological and mechanical mechanisms and formulated a Pressurestat Model.

Upledger's Pressurestat Model describes a semi-closed hydraulic system contained within the dura mater which envelops the brain and the spinal cord. Within this system the production, circulation, and reabsorption of cerebrospinal fluid (CSF) was hypothesized to take place. The production and reabsorption of CSF within the dura mater was to produce a continuous rise and fall of fluid pressure within the craniosacral system, generating the CSR as an expansion and contraction we can palpate. The Pressurestat Model was based on the bulk flow model of CSF that is widely accepted and found in most anatomy book, and Upledger's own preliminary research on a neuromechanism for the regulation of CSF production. The Pressurestat Model has served as a model for teaching CST for many years and served its purpose.

Science is again and again amazed with Mother Nature, who keeps surprising us with a complexity and brilliance that we learn from. Systems of rhythms regulating our health at a profound level, the many ways CSF is moved in the CNS to allow nourishment, cleaning, and communication, has shown that the simple bulk flow of CSF and regulating system in the Pressurestat Model, is today replaced by a growing understanding of rhythms and CSF circulation and function.

***Rhythms in the Cranial Field and Heart Rate Variability (HRV).*** In CST and osteopathy in the cranial field, different rhythms have been associated with the cranial field and theorized to be involved in human health from a wide range of perspectives. Different rhythms have been identified under other names, and a link between the various rhythms as a harmonic system has been hypothesized. Recently 4 rhythms of the movement were identified on the head and everywhere on the body. Rates are 6 cpm (main range 5-7 with outliers 4 – 8cpm), 2 cpm, 0.6 cpm, and very slow 0.1 cpm area. All the identified rhythms are in the frequency areas observed in HRV four frequency bands with oscillations into ultra-low-frequency (ULF), very-low-frequency (VLF), low-frequency (LF), and high-frequency (HF) bands classified in the HRV.

The HF band corresponds to the effects of respiratory breathing, and the LF band contains the impact from the 6 cpm movements. The slower LF and VLF frequencies are much less known, but interestingly the slower rhythms are strongly associated with human health.

***The Craniosacral Rhythm.*** The highest frequent regular rhythm is called the Craniosacral Rhythm (CSR); other names used are the Cranial Rhythmic Index (CRI) and Short Tide. Different research fields have also studied a 6 cpm rhythm, as the baroreceptor reflex is one of the body's homeostatic mechanisms to maintain blood pressure levels at a narrow range. The baroreceptors rely on specialized neurons located in a strategic place and, from there, send information to the brainstem. The 6 cpm rhythm can be measured concerning the movement of blood. The 6 cpm rhythm is part of the Heart Rate Variability and is measured by international standards today. HRV is the fluctuation in the time intervals between adjacent heartbeats and is a popular measure related to rhythms to health. In addition, smooth muscle in the walls of microcirculation exhibits "spontaneous" oscillation of 6 cpm. The 6 cpm rhythm can be palpated and measured as a movement everywhere on the head and body. The 6 cpm rhythm has been firmly documented to be part of the array of rhythms expressed by the human body.

The origin of the CSR is unknown today, and both a heart/baroreceptor reflex model and a model with a centralized origin in the brainstem have been suggested. In favor of a central origin is the identification of a group of 6 cpm oscillating neurons in the brainstem and that the 6 cpm rhythm is still observed when the baroreflex mechanism is blocked. The observation that the 6 cpm rhythm is stable with a stable frequency variation (4-8 cpm) among humans, and narrow range variation in the individual, suggests a centrally generated autonomous rhythm originating in the brainstem. In addition, to a model of autonomous rhythm originating in the brainstem that communicates with a master rhythm, the possibility that the rhythm is a harmonic of one of the master rhythms cannot be excluded.

***Low-frequency rhythms.*** There are many low-frequency rhythms of more unknown origin; nevertheless, these rhythms are often strongly associated with our health. In the cranial field, a rhythm of 2 cpm, often associated with the mid-tide, has been identified as a palpatory and measured rhythm. A few studies have postulated a neuron oscillator in the spinal cord with the same frequency range as the mid-tide rhythm. At a lower frequency, a 0.6 cpm rhythm has been measured and is often named the long tide. A new rhythm related to the cranial field was measured with an even lower frequency of 0.1 cpm. The 0.1 cpm rhythm is in the frequency area of the ULF band of the HRV. As described above, the cellular process is linked to the master rhythms of the circadian, lunar, and cell cycles, creating a unifying hierarchy with communicating strategies. Low frequent rhythms may contain rhythms that are harmonic to the master rhythms, be autonomous rhythms, or include unknown master rhythms.

***Primary Respiratory Mechanism.*** Is there a mechanism in the human body for a whole system regulation, from the central down to the single cellular respiration, a PRM postulated by Sutherland? One such mechanism has been intensively studied, the 24/12-hour interplay of the circadian and lunar master rhythms having a unifying regulation of autonomous subdivisions rhythms down to the level of subcellular processes, thus having primary regulation of known life processes.

A central question in the cranial field has been whether a master rhythm, a PRM similar to the other master rhythms, has a central organizing function in human physiology and at the core of our health. In search of a possible PRM concerning the cranial field, the ultra-slow 0.1 cpm rhythm was identified. The 0.1 rhythm was the slowest rhythm observed, expressed as a head and body movement. As a rhythm of the lowest frequency, this is a fundamental frequency or 1st harmonic. Most interesting, the 0.1 cpm rhythm was identified in the respiratory breathing as cycling in the breathing pattern, suggesting unifying properties above the level of autonomous respiratory breathing. The 0.1 cpm rhythm is a possible candidate for a unifying rhythm, with the higher frequent rhythms as harmonic or autonomous subdivisions rhythms in the system.

Most importantly, the 4 rhythms are all expressed as a movement of the entire head and body, explaining the experiential discovery of the rhythms before experimental measurements were possible.