

Cardiac coherence: a new, noninvasive measure of autonomic nervous system order.  
- Tiller WA, McCraty R, Atkinson M.  
- Altern Ther Health Med. 1996 Jan;2(1):52-65. PMID: 8795873.

## Abstract

Although **cardiac** sympathovagal regulation has been studied during stress using power spectral density analysis of heart rate variability, little is known about its regulation during emotional states. Using heart rate variability measurements, we studied autonomic balance in 20 subjects trained in a mental and emotional self-management technique called Freeze-Frame. The study was conducted in two environments: under controlled laboratory conditions, and under real-life stressful conditions in the workplace. Power spectral density plots of R-R intervals obtained from electrocardiogram recordings were divided into three regions: low frequency (predominantly sympathetic activity), midfrequency, and high frequency (parasympathetic activity). Measurements were taken for a 5-minute baseline period, followed by a 5-minute period of positive emotional expression. Three unique conditions of autonomic nervous system order can be clearly discriminated in the data: (1) normal heart function mode, (2) entrainment mode, and (3) internal **coherence** mode. The internal **coherence** mode is new to the electrophysiology literature. We provide supporting data for modes 2 and 3 and show that a group of 20 subjects trained in this technique can enter and maintain these states at will. We found that, when one is in the entrainment mode, other physiological systems lock to the entrainment frequency, which is approximately 0.1 Hz. The results suggest that emotional experiences play a role in determining sympathovagal balance independent of heart rate and respiration and further suggest that positive emotions lead to alterations in heart rate variability that may be beneficial in the treatment of hypertension and reduce the likelihood of sudden death in patients with congestive heart failure and coronary artery disease.