Autonomic balance and the treatment of psychophysiological disorders
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The relationship between mind and body, in particular the autonomic nervous system (ANS), has been explored for many years. Cannon’s paper (1914) “The interrelations of emotions as suggested by recent physiological researches”, reviewed the literature on the physiology of emotions from 1892-1914. In the 1920’s, Cannon further elucidated the relative contribution of the sympathetic nervous system (SNS) and the parasympathetic nervous systems (PNS) to homeostasis (a term he coined). And, as there remains today, there was some dispute about the relative contribution of these two subsystems of the ANS to autonomic balance. Cannon (1930) placed a strong emphasis on the role of the sympathetic nervous system. Kling (1933), on the other hand argued that the parasympathetic system had important role in emotion, which had been largely ignored by Cannon and others.

Dysfunction in the autonomic nervous system has also been long considered as a significant factor in the development of many disorders that involve the end-organs of the autonomic nervous system. For example, in 1927, Wolf and Thomas wrote a paper entitled “Gastroduodenal ulcers and autonomic balance” in the Archives of Neurology and Psychiatry. To this day, research continues in the relationship between autonomic function and irritable bowel syndrome (Orr et al., 2000) and abdominal pain Sowder (2007). Work on the relationship between the ANS, psychological profile and other diseases and disorders continues (Panzer & Viljoen, 2003, Thayer & Brosschot, 2005). A relationship between autonomic dysfunction and disorders ranging from panic disorder (Friedman & Thayer, 1998) to cardiovascular disease (Recordati, 2003) has been shown. An excellent review of the relationship between ANS dysfunction and a variety of clinical disorders, including chronic orthostatic intolerance, essential hypertension, panic disorder, congestive heart failure, and chronic fatigue syndrome is provided in a published NIH symposium entitled “Dysautonomias: Clinical Disorders of the Autonomic Nervous System” (Goldstein et. Al., 2002). Further, an interesting evolutionary displacement model that purports to explain why many diseases reflect
dysfunctions of autonomic balance, was published by Yun et. al. (2004) in Medical Hypotheses.

Since there is a long and continuing literature showing a relationship between the mind and the ANS, and since ANS dysfunction appears to be a significant factor in end-organ and other disorders, it is logical that there is a literature examining both ways of measuring the relative state of balance of the ANS in individuals and ways of intervening at the mind/body interface to improve functioning and alleviate distress (both physical and mental/emotional).

The principal method, from a psychological perspective, of examining autonomic function is psychophysiological stress profiling. This is usually a laboratory-based manipulation of one or more psychosocial factors with various dependent measures such as heart rate (HR), blood pressure (BP), respiration being observed. Hand skin temperature, skin conductance, and muscle tension are also often used. While there continue to be issues in individual psychophysiological stress profiling around the use of personal versus impersonal stressors, lab-based versus real-life stress, and one or two dependent measures versus response patterns of four to six measures, appropriately applied stress-profiling in the laboratory has the potential to make important contributions to the understanding an individual’s difficulties with a psychophysiological disorder (Tomarken, 1995). One of the best examples of the utility of psychophysiological stress profiling is in post traumatic stress disorder (PTSD). A series of studies by Edward Blanchard show that heart rate (HR) response discriminates PTSD from controls at a rate of 80% to 95% despite design flaws such as group discrepancies in age, education, combat experience, use of medicated subjects or not specifying medication status and group baseline differences in physiologic arousal (Pitman et al., 1987).

The results from the PTSD literature suggest a dominant response by the SNS. However, it is not clear whether this is the result of an exaggerated SNS response or a withdrawal of the PNS. This uncertainty would appear to be the case in many psychophysiological
disorders. For example, in migraine headache, Micieli et al. (1995) found that migraineurs’ responses to a cold pressor test revealed an excessive SNS response compared to a control group. The study also showed that giving the migraineurs Clonidine prior to the test could normalize their response. Since Clonidine suppresses SNS pathways, this suggests that excessive SNS activity is a significant factor in the production of migraine headache. On the other hand, there is also some recent evidence that there may be a dysfunction in the PNS rather than the SNS. Sanya et al. (2004) found a normal SNS response in migraineurs, but they also found an abnormal PNS response.

Since the PNS is designed to counterbalance the SNS, an impairment of the PNS could allow a normal SNS response to be more predominant than it would normally be.

Heart rate variability (HRV) is a more recent addition to the dependant measure arsenal of the applied psychophysiological and it has the advantage of potentially being able to detect the relative contributions of both the SNS and the PNS (Thayer & Brosschot, 2005, Zhong et. al., 2006). An interesting line of research in this regard would be to test Yun et. al.’s (2004) hypothesis that proposes that many of the conditions of aging are manifestations of sympathetic bias, but that it is a gradual loss of PNS function that results in this progressive predominance of the SNS.

Whether it is an overly active SNS, or an SNS that won’t shut off properly once activated, or a PNS impairment that is not properly counterbalancing the SNS, or a combination these, the ANS appears to be implicated in a significant number of psychophysiological disorders. As a result, another area of research has been focused on attempting to teach individuals who are suffering from psychophysiological disorders how to regulate their autonomic nervous system responses using biofeedback training.

Biofeedback is the act of showing someone real time recordings of one or more physiological systems (such as muscle tension in the jaw or brainwaves) as they are made. This permits both the person being recorded and any coach or therapist who may be present to be instantly aware of (1) the level the system is functioning at and (2) changes in the system’s level of functioning. This information can be used to increase the person’s awareness of the system’s functioning and / or to correct the level if it is not
optimal for the given circumstances. The person being recorded does the correcting with the aid of a coach / therapist.

(Richard A. Sherman, PhD, AAPB website, 2007.)

The literature on biofeedback training is too large to review here. A current search of Medline yielded 5,751 research papers on the topic of biofeedback training. A current search of Psychinfo yielded 5003 papers (there may be some overlap in these two search engines). It is safe to say that the literature is generally positive in terms of the efficacy of biofeedback in controlled studies. Perhaps one of the best examples of the utility of biofeedback for improving a psychophysiological disorder is migraine headache. In a large meta-analytic study, Holroyd & Penzien (1990) found that biofeedback training for migraine was at least as effective as prophylactic medication. And these were studies that did not differentiate subjects on the basis of learning. In other words good learner data was averaged with poor learner data. Thomas & Mizener (1993), reported that migraineurs who developed good control (as determined by a performance score derived from each training session) showed double the improvement of poor control subjects. Moreover, the good control subjects were using less analgesic medication at the end of the study while the poor control subjects were using more. If the Thomas/Mizener results can be generalized to other biofeedback treatment studies for migraine, it seems likely that biofeedback is more effective than prophylactic medication for those who are able to learn autonomic control.

A review of disorders that are amenable to intervention by biofeedback is available on the website of the Association for Applied Psychophysiology and Biofeedback at http://www.aapb.org/i4a/pages/index.cfm?pageid=3327. The efficacy of biofeedback for treating these disorders is determined according to criteria (LaVaque et. al., 2002) equivalent to those recommended by the American Psychological Association for setting the level of evidence for efficacy. More detailed information on the biofeedback treatment of disorders such as headache, Raynaud’s, essential hypertension, irritable bowel syndrome, tinnitus, and fibromyalgia can be found in "Biofeedback: A Practitioner's Guide," edited by Mark Schwartz and Frank Andrasik (2003).
References


