Mindful Physiology Institute

CapnoBreath Training

Good respiration requires neither relaxation nor a specific mechanical prescription, save one:
"The varied melodies of breathing mechanics must ultimately play the music of balanced chemistry."

Breathing is a behavior. Breathing behavior meets multiple objectives, including, among others: respiration, acid-base balance, prophylactic intervention, communication, relaxation, performance enhancement, psychological access, flight-fight preparation, consciousness exploration, and meditation. The fundamental objectives of breathing behavior, however, are respiration and acid-base balance. CapnoBreath Training is about meeting these two objectives while setting the stage for the others.

Although nearly everyone agrees that good respiration is basic to healthy physiology and psychology, only a very few people who do breathing training know much about respiration and how its chemistry regulates fundamental physiology critical to good health and optimal performance. Deregulated respiratory chemistry is commonplace, and may have profound immediate and long-term effects that trigger, exacerbate, and/or cause a wide variety of serious emotional, perceptual, cognitive, attention, behavioral, and physical deficits in health and performance. Breathing evaluation and training, without regard to chemistry, leave out perhaps the most fundamental, practical, and profound factors that account for the far-reaching effects of deregulated breathing, as well as for the surprising benefits of proper breathing re-education.

Breathing chemistry is about carbon dioxide (CO_2) regulation. Carbon dioxide plays a critical role in acid-base physiology and in the acquisition and distribution of oxygen. Although CO_2 is, of course, excreted in the exhale, a significant portion of it is retained in the blood where it regulates pH levels vital to the distribution of oxygen and glucose to tissues such as the brain. In fact, while at rest, only about 12 to 14 percent of the CO_2 that travels in blood through the capillary bed of the lungs is actually excreted. In a healthy person, arterial CO_2 is precisely maintained (40 mmHg), even during exercise when CO_2 production may increase by tenfold. Deregulated CO_2 chemistry results from either underbreathing or overbreathing. Underbreathing behavior, contrary to popular opinion, is rare; it results in respiratory acidosis, which precipitates obvious, immediate and uncomfortable sensations which in most cases are easily overcome by more rapid and/or deeper breathing. Overbreathing behavior, on the other hand, is common; it precipitates respiratory alkalosis (increased pH) brought about by a deficiency in extracellular carbon dioxide (e.g., in blood plasma and cerebral spinal fluid), a physiological condition known as *hypocapnia* (CO_2 deficit). The effects can be insidious and dramatic.

Hypocapnia leads to physiological changes such as hypoxia (oxygen deficit), hemoglobin alterations (effecting release of oxygen and nitric oxide), cerebral vasoconstriction, coronary constriction, cerebral glucose deficit, ischemia (localized anemia), buffer depletion (bicarbonates and phosphates), bronchial constriction, gut constriction, neuronal excitability (sodium shifts), magnesium-calcium imbalance, hypokalemia (plasma potassium deficit), antioxidant depletion, platelet aggregation, and muscle fatigue, spasm (tetany), weakness, and pain. These disturbances in physiology can trigger and exacerbate health-related complaints of all kinds, as well as deficits in physical performance (e.g., sports), including: phobias, migraine phenomena, hypertension, attention disorder, asthma attacks, angina attacks, heart attacks, cardiac arrhythmias, thrombosis (blood clotting) panic attacks, hypoglycemia, epileptic seizures, altitude sickness, sexual dysfunction, sleep disturbances (apnea), allergy, irritable bowel syndrome (IBS), repetitive strain injury (RSI), and chronic fatigue. The symptoms precipitated by overbreathing are entirely dependent upon individual predispositions. Overbreathing may also constitute a compensatory response to metabolic acidosis, e.g., ketoacidosis (e.g., diabetes)

The potentially debilitating combination of cerebral hypoxia and cerebral hypoglycemia (reductions of up to 50 percent), along with hemoglobin that is disinclined to give up its oxygen and the nitric oxide required for vasodilation, can result in profound psychological and behavioral changes: (1) deficits in ability to attend, focus, concentrate, imagine, rehearse the details of an action, engage in complex tasks, perform perceptual motor-skills (e.g., piloting vehicles), parallel-process information, problem solve, access relevant memory (e.g., test performance), think, and communicate effectively (e.g., public speaking); (2) emotional reactivity (e.g., marital conflict) that may trigger or exacerbate debilitating stressful states of consciousness, including, apprehension, anxiety, anger, frustration, fear, panic, vulnerability, and low self-esteem; and (3) personality shifts or dissociative states that result in social disconnectedness, emotional withdrawal, defensive posturing, emotional numbness, and inability to be present.

Overbreathing is undoubtedly an insidious and debilitating response to everyday challenges, insidious because its presence goes unrecognized and its effects unidentified. In fact, surveys suggest that 10 percent or more of the US population suffers from chronic overbreathing and that up to 60 percent of all ambulance calls in major US cities are the result of overbreathing! For every person who shows up in emergency, how many more show up in physician's offices with unexplained symptoms? For every person who goes to see a physician, how many more simply go to work? And for everyone who reports a "medical symptom" how many more suffer with performance deficits? Overbreathing is a behavior that precipitates changes in chemistry that can mediate these "unexplained symptoms," misunderstood performance deficits, and acute and chronic "effects of stress." The resulting effects of hypocapnia are profound and deserve full attention on the part of virtually anyone doing breathing training.

Faulty assumptions and understandings about respiratory physiology are implicit in breathing training practices everywhere, which unfortunately, in many cases, may actually lead to counterproductive practice. Teaching good respiration through insistence on the mechanics associated with relaxation, for example, may create a problem rather than offer a solution; good respiration should not depend on being relaxed. And, teaching deep breathing for relaxation can, as a result of CO_2 deficit, trigger emotions, cognitive deficits, and misunderstood physical effects. Breathing objectives, such as relaxation, must be ultimately subordinated to good respiration, and not the reverse as some would have it. Evaluating, monitoring, and teaching respiration deserve serious attention by virtually anyone, layperson or professional, involved in learning and/or teaching breathing.

Breathing training should not simply statistically favor good respiration, where the mechanisms responsible for positive outcomes are (1) only implicit in the training methodology, (2) unknown by both practitioner and client, and (3) often dismissed as not important in the name of "what we do works and that's what counts." Emphasis on slow breathing rather than on deregulated chemistry, for example, may *statistically favor* improvement of respiration, however it is easy to overbreathe while breathing slowly and does not by itself constitute better chemistry. Focusing directly on chemistry, and on the basic mechanics that serve it, point the way to far greater efficacy, not to mention credibility. It is important to know what the mechanisms are, and to make the implicit explicit, wherein relevant mechanisms are addressed directly rather than incidentally. These mechanisms are ones well documented in the fields of pulmonary and acid-base physiology.

Optimal respiration means regulating chemistry, through proper ventilation of CO2, relaxed or not, such as during the acrobatics of talking, emotional encounters, and professional challenges. Good breathing chemistry establishes a system-wide context conducive to optimizing physical and psychological competence, where chemistry needs to be balanced regardless of what we are doing, thinking, or feeling. Nevertheless, overbreathing behavior, like any other maladaptive behavior can be quickly and easily learned, and unfortunately, like so many habits, are often challenging to disengage, manage, modify, or eliminate; the learning principles, however, are the same.

Overbreathing can be learned as a defensive response to specific challenges (e.g., performing before an audience, or confronting a distressed partner), or it can mediate shifts in consciousness that set the stage for learning constellations of defensive behaviors that serve to protect against trauma, including people, things, and oneself. The desire or need for "control" is a metaphor frequently embedded in deregulated breathing behavioral patterns. These defensive behaviors, like many vicious circle behaviors, may come at a high cost, as described above: physical symptoms, emotional reactivity, cognitive deficits, and performance decrements with immediate, long-term, and profound effects. Herbert Fensterheim, an internationally prominent psychotherapist, points to these considerations in speaking to mental health professionals (Behavioral and Psychological Approaches to Breathing Disorders, 1994) when he says:

> "Given the high frequency of incorrect breathing patterns in the adult population, attention to the symptoms of hyperventilation [overbreathing] should be a routine part of every psychological evaluation, regardless of the specific presenting complaints. Faulty breathing patterns affect patients differently. They may be the central problem, directly bringing on the pathological symptoms; they may magnify, exacerbate, or maintain symptoms brought on by other causes; or they may be involved in peripheral problems that must be ameliorated before psychotherapeutic access is gained to the core treatment targets. Their manifestations may be direct and obvious, as when overbreathing leads to a panic attack, or they may initiate or maintain subtle symptoms that perpetuate an entire personality disorder. Diagnosis of hyperventilatory [overbreathing] conditions is crucial."

CapnoBreath Training (where "capno" means CO_2) is about learning and teaching adaptive respiratory chemistry within a wide range of breathing mechanics. It means precision coordinating of breathing rate and depth through reflex control of the diaphragm, a brain stem coordinated reflex mechanism which can be easily deregulated, consciously or unconsciously. CapnoBreath training is about reinstating this reflex mechanism. It means integrating knowledge of respiratory chemistry with the mechanics of breathing, where emphasis is on the relationship dynamics of breathing mechanics for achieving good chemistry, rather than on specific "mechanics" prescriptions, where the effects of breathing chemistry are neither accounted for during initial evaluation nor included as a part of self-regulation learning.

CapnoBreath training, in the larger context, is about learning "to embrace" (or to engage) a challenge rather than to "defend from" a challenge. Embracing means "being present," connecting, and learning, where defending means armoring, isolating, and disconnecting. The whole body breathes, every cell breathes, not just the lungs. Learning good respiration is learning about what this "feels like," and is ultimately not about "how to do it right**."** CapnoBreath training is about learning to breathe inside-out rather than outside-in.

Good respiration requires neither relaxation nor a specific mechanical prescription, save one: the varied melodies of breathing mechanics must ultimately play the music of balanced chemistry, e.g., verbal and nonverbal language. CapnoBreath training includes:

(1) knowledge-learning: understanding basic concepts;

(2) sign-learning: recognizing symptoms of overbreathing;

(3) mechanics-learning: diaphragmatic, rate, & depth awareness;

(4) visceral-learning: developing an internalized sense of chemistry; and

(5) state-learning: developing a sense of chemistry for consciousness.