The concept and practice of mindfulness can enrich the biofeedback process in several ways: interpersonally, intrapersonally, and in the "triad" relationship that includes two people plus the ongoing biofeedback data display. Improving the relationship between clients and their somatic changes underlying the biofeedback data—including sensations, emotions, and the ever-fluctuating self-image—seems central, and benefits from mindfulness are apparent—specifically, the act of pulling back and accepting instead of striving for change. Even the familiar "body scan" promotes a detached observing attitude, with transient benefits similar to a more formal mindfulness focus. Knowing the related brain-processing correlates of meditation can enhance confidence in the process, and a prime element of modern mindfulness training—compassion—can be extended toward one's own bodily processes being revealed during biofeedback.

Mindfulness and Biofeedback Practice
This brief article presents some ideas and techniques for applying mindfulness principles to the process of doing biofeedback training. Guiding clients to interact with their bodies with the assistance of biofeedback is a complex matter. A biofeedback signal provides a sharpened trace of some somatic variable so that reactions to a stimulus, word, question, or shift in attention are magnified—introducing a new element into the therapeutic dyad. Regardless of the emphasis on instrument monitoring, biofeedback is an interpersonal process.

A galvanic skin response (GSR) spike, for example, when perceived by the client in the presence of an observing therapist, can trigger shame ("I look like a nervous Nellie!"), frustration ("Why can't I control myself better?"), or alienation ("I don't know why my body does that. I give up."). The responses of both parties to the initial reaction introduce new interactive factors; mindfulness principles provide some ideas for how to understand and work with these reactions.

The main aspects of mindfulness are detailed in other sections of this issue, defined both narrowly (the discipline of practicing present moment awareness and learning to focus one's attention) and more broadly (applying a mindful attitude to everyday living, and including empathy and compassion). Mindfulness includes many techniques that can enhance the biofeedback process for both practitioner and client, and many of these are used routinely by clinicians without any knowledge or reference to mindfulness.

Opportunities for applying principles of mindfulness can be specified for both interpersonal and intrapersonal aspects of the biofeedback process: within the therapist, between therapist and client, within the client, between the therapist and the biofeedback signals, between the client and his or her biofeedback signals, and between the client and his or her somatic changes underlying the biofeedback data—including sensations, emotions, and the ever-fluctuating self-image.

Therapist to Self
This opportunity might include practicing mindfulness meditation in a disciplined way, learning to accept the variability in one's mental and emotional status, preventing emotion from interfering with best judgment, being aware of one's biases toward particular premature conclusions ("Most stress symptoms are related to relationship problems!") and maintaining compassion for oneself. Knowing one's countertransference tendencies, for instance, permits self-observation from a vantage point outside an emotion-laden response.

Therapist to Client
This includes a continuously observing, nonjudgmental attitude toward the client's behavior, avoiding quick judgments, and conveying to the client principles of mindfulness; for example: "...success might come faster when you can slow down and be patient with yourself."

Client to Self
This includes learning and applying the basic principles of mindfulness with regard to limiting self-judging, impa-
tience, and competitiveness about controlling muscles, breathing, etc. It emphasizes impassive observation of the ebb and flow of feeling states (“micro-moods”), and of attentional shifts stimulated by momentary impulses, mean thoughts, defensiveness, and urges to withdraw from the biofeedback process.

**Therapist to Client’s Biofeedback Signals**
This includes observing the biofeedback signals dispassionately and with patience, avoiding pouncing on premature conclusions, and leaving room for alternative interpretations of the data.

**Client to Biofeedback Signals**
The client can cultivate maintaining steady attention, letting go of control, accepting whatever the signal shows at the moment, and calmly holding an intention for change.

**Client to Physiological Sensations**
The client can also practice expanding awareness from the biofeedback signals to their source: correlating the signals with body sensations (muscle tension, heart rate, breathing, etc.). Most broadly this includes learning to identify and label sensations and pain as perturbations of baselines, and correlating stress sensations with both emotions and biofeedback data. The latter amounts to increasing rapport with the psychophysiological self, merging more with the body image. It also involves differentiating between having a “symptom” to resist and noticing the natural sensations associated with having an emotional life.

**Analogies and Metaphors**
Observing without acting or judging does not come easily to everyone. It is helpful for therapists to use analogies and metaphors on occasion to link mindfulness strategies to the client’s prior experiences. For instance:

- While canoeing or kayaking, consider pulling out of the rushing river into the shallows or onto the riverbank. Instead of being carried along by the river of thoughts and sensations, you can stand outside it and observe with a larger perspective.
- Stepping out of the rush of people on a crowded sidewalk into a doorway, you will be better able to see people passing but not react to them. This is the same concept as above: Cultivate not engaging the people (thoughts, feelings, and sensations) as they pass by.
- Hiking through a forest and feeling uncertain of the direction, consider climbing to a high point or the top of a tree to reorient yourself to the landmarks. Meditation is not action, but an awareness that can inform and perfect one’s action.

The popular procedure in biofeedback practice of the “body scan” is a variation of these “stepping out” maneuvers: The body scan is basically a status check, focusing on one’s body section by section, not trying to change anything but simply noting sensations. This in itself can reduce tension and arousal as effectively as guided imagery or relaxation suggestions.

**Empathy, Compassion, and Rapport toward Self and Body**
If it is possible to have self-compassion, then it should be possible to have self-rapport also, where the “other” is one’s physiology. Understanding the feeling state behind a psychophysiological reaction amounts to having compassion toward oneself; there is a clear link between focusing on the body sensation and on the feeling behind it. A person experiences an emotional event both psychologically and physiologically.

The memorable research by Taub and School (1978) suggested that personal warmth of the biofeedback trainer had a big effect on how well a person learned the hand-warming skill. Biofeedback trainers who acted warmly enabled the trainees to learn hand-warming well, while a trainer who acted less caring and more aloof produced little or no learning.

This same principle applies within the individual as well; a forgiving and accepting attitude toward oneself during the biofeedback process is more likely to bring success. The biofeedback display is a constant announcement of success or failure if the person chooses to see it that way, but bypassing judgment and avoiding competition leaves only the bare feedback. And of course, “success” is more likely to occur for individuals operating from a relative indifference to success or failure.

It is common to regard one’s own stress or pain symptoms with anger, fear, frustration, impatience, or blame. This produces alienation, and alienation from one’s body abandons it to default reflexes. Many stress-related symptoms and conditions can be understood as archaic and overemphatic alarms related to physical survival. Perceiving one’s physiological components (muscles, heart, intestines, breathing, etc.) as having acquired their own sensitivities, trauma histories, priorities, and mandates for survival, increases appreciation and acceptance of their functioning.

Many people can feel abundant compassion for suffering animals and children, but then withhold it from themselves. Developing this appreciation toward the suffering self and
its symptoms will increase success with biofeedback, since the body state reflects one’s attitude toward anything, including itself. Resistance, fear, and bracing can be softened into acceptance. The injured or overstressed body part may be seen as struggling valiantly to keep up, trying to do its job, striving to recover full function. Body awareness such as that derived from a body scan can be infused with self-empathy and compassion; this is very helpful for those with troublesome somatic symptoms.

**Physiological Correlates of Mindfulness**

As a “recovering materialist,” I am reassured by physiological parallels underlying the concept and practice of mindfulness. The complexity and volume of parts of the frontal lobes and subcortical structures (insula, cingulate cortex) have been shown to increase with regular mindfulness meditation in as short a time as 8 weeks (Davidson et al., 2003). The brain components involved in maintaining attention, moderating impulses, and resisting distraction are the ones being strengthened, in the same way that parts of the motor cortex are enlarged and elaborated when a child practices the violin.

The insula and cingulate, both subcortical structures, serve as preconscious interpreters and filters of mostly visceral body sensations. The insula is integral to our body image; together with the cingulate cortex, meanings and labels are attached to afferent input so that consciousness is kept informed about possible threats and damage. It may be that the process of biofeedback, involving both attending to subtle body sensations and trying to influence them, is providing useful input to these brain structures to assist in the interpretation process. Biofeedback may represent consciousness reaching deep down into its data sources to improve preprocessing (see Davidson & Begley, 2012, “The Emotional Life of Your Brain,” for details). Persons with greater sensitivity to body sensations, such as accuracy at estimating pulse rate, tend to have larger insulas, for example, and they also show more empathy (Critchley, Wiens, Rotshtein, Ohman, & Dolan, 2004).

Long-term meditators clearly improve their brain function, developing better stability, more frontal lobe connectivity, reduced amygdala activity, increased gamma activity, better impulse control, and superior attentiveness (Davidson et al., 2003; Germer, 2009; Lazar et al., 2005). These changes seem to be in the same direction as from drunkenness to sobriety; the ordinary sober state may not represent the end of a continuum, but is somewhere in the middle, with “super sobriety” as the potential endpoint reachable by meditation.

**Mindfulness and Panic**

Anxiety reduction is a frequent goal of meditators. Intense anxiety, or panic, typically includes pounding heart, rapid breathing, a sense of foreboding, and narrowed thinking. Observing the symptoms objectively, appraising their meaning, and understanding their reflexive nature is hard to do during a panic attack. This requires a larger perspective, and panic is a breakdown of that larger perspective. The mindfulness approach suggests a new mindset of not struggling against the symptoms, but instead observing rather than acting, basically witnessing the natural course of the panic—letting it extinguish by dispassionate attention, like witholding fuel from a fire.

For practice, small proto-panic symptoms can be generated by describing the last attack verbally, or sometimes by hyperventilating, running in place, spinning in a chair, or breathing through a straw. Using biofeedback monitoring (GSR, heart rate variability, respiration, or heart rate biofeedback) provides validation of the effects of passive observation, accurate labeling (“It’s anxiety, and it’s transient”), acknowledgment of distress without escalating it, and observing the natural course of a small surge of panic. Practicing this with biofeedback establishes a valuable coping template (similar to “stress inoculation”), but gives practice in maintaining a detached attitude in the face of a self-generated storm.

**Other Ideas for Practice**

A good way to develop skill in “mindfulness-under-fire” is to practice with an itch that arises spontaneously. It is not usually as disturbing as pain, but can create the same “do something!” urgency. Between resisting (fiercely blocking the urge to scratch) and giving in (scratching) lies the possibility of indifference to the sensation. This indifference can be deepened and prolonged by patiently observing the fluctuations in the intensity of the itch. Without scratching, the itch typically reaches a natural plateau, falters, and then fades away. Emotional reactions such as annoyance, bargaining, and giving up can be observed and labeled, without yielding to them. The same practicing for pain tolerance can be done with a clothespin or binder clip on a fingertip or earlobe. The whole event can be monitored with biofeedback of various sorts, and the signal will generally follow the client’s course of emotion, dropping as a sense of mastery develops.

**Case Example of Mindfulness in Action**

During a single 30-min demonstration, a young woman described chronic, painful tension in her neck and shoulders “like a tight cape.” Brief monitoring of muscle tension with
electromyography confirmed excessive resting muscle tension. She often felt her pulse in this area, and she tended to consciously tense her shoulder muscles in an attempt to block it, which suppressed the pain and pulsations temporarily. The pain and tension would soon increase, and her only response was to tense more against it.

I confirmed that her strategy had been in place for a long time, and it wasn’t working very well, so I suggested completely reversing her strategy, letting go rather than bracing against the pulsations and pain. She was surprisingly willing to try this, and in the next 2 minutes she felt an increase in the pulsation and a moderate surge in pain, but this was followed by both the pain and pulsations subsiding. She seemed stunned at the simplicity of this maneuver.

The electromyograph monitoring showed a drop to near normal, confirming for her the validity of what she did. Mindfulness was never mentioned. The brief intervention required accepting rather than fighting or resisting, and also choosing how to respond rather than letting reflex and habit take over. Checking with her the next day revealed that she had been practicing this new strategy and it was working very well. The principle here was essentially to abandon her grim, perpetual battle against the pain (resistance to suffering is like arm wrestling with yourself), and to let it peak instead, and then dissipate.

**Conclusion**

With biofeedback, I try to help clients extend their “self” to a body part or system so that they’re no longer so separate from it. This accentuates the natural feedback present, increases discrimination of tiny changes, and can restore a body–mind harmony that was absent because of alienation, fear, anger, denial, avoidance, or something else. (It also gives the person more responsibility for controlling it, but that can come slowly.) Once resistance to the symptom is reduced, biofeedback tends to show reduction of parts of the symptom complex: GSR and muscle tension drop, heart rate variability improves, hand temperature rises, and breathing becomes calmer—as if the frightened crew of a ship during a storm settles down and decides to trust the captain, because the captain knows what to do.

**References**


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