

## STRESS AND THE BRAIN

Being able to recognize a picture of the human brain is more than enough understanding of neuroanatomy, for the purposes of delivering PFA. However, understanding how our brains respond to psychological trauma does help in knowing how and why we will deliver PFA.

The human response to stress takes many forms, and first starts within fractions of a second (e.g., auditory startle), and under certain conditions, can go on for months (changes in the nervous system). Other responses occur in between, and include our sympathetic nervous system ramping up after a few seconds, and the full activation of the brain's "HPA" axis tens of minutes later (Post, 1992).

In the context of our cushy lives, responses to extreme stress strike us as exceptional, but are quite essential to our survival, from an evolutionary point of view. But in addition to our instinctive reactions, there is a learning component that is just as essential to our survival. If you think about a small child who, for the first time touches a hot stove, there is that instinctive jerking back of the hand, which actually occurs before the child even feels the pain. Just as importantly, there is also the remembering, so that the next time a stove is encountered, the child gives it a wide berth. On a bigger scale, there is a tribe in Thailand whose lore included the story of a tsunami that had struck hundreds of years ago. For generations, they told of the need to head to higher ground, should the sea ever recede from shore. When the tsunami of 2004 struck, this was one of the few coastal peoples in the region to survive intact, a result of the learning that had occurred and been passed down from a tragic event that had transpired hundreds of years ago. Learning from traumatic experiences would appear to be an integral part of our survival.

Ironically, while essential to our survival, it is our capacity to learn, remember, and re-shape our behaviour in the wake of traumatic events that also leads to many of the negative consequences we can experience in the wake of stress.

As social, familial, and territorial creatures, humans also react and learn from harm done to others. We are vulnerable to the impact of loss and separation, and affected by displacement and relocation. In short, our reactions to stress are amplified by the fact that we are not solitary animals. The importance of survival exceeds that of just the individual, and extends to families, generations, tribes, military units, fire platoons, neighbours, nations, etc. Interestingly, the survival of the community at times may conflict with individual safety and survival, which leads to risk-taking behaviour (i.e., heroism or altruism).

While there are other animals that will jeopardize their own existence for the survival of the group, humans appear to be unique in their need for meaning. Once again, there is irony that this uniqueness may result in even greater susceptibility or vulnerability to the impact of stress. There were instances of people developing post-traumatic stress disorder (PTSD) in the wake of 9/11, not because they were there when it happened, but because of the feelings of helplessness and the inability to make sense of the event as

they had watched it unfold on television from the safety of their easy chair hundreds or thousands of kilometres away.

So, it would appear that our brains' responses are divided between immediate, instinctive reactions, and those that are more prolonged, and related to post-processing and learning from the experience – both of which may be important to not just our survival, but potentially that of subsequent generations, as well.

### **The Stress Response**

When the brain first perceives a potentially traumatic event, it responds with the release of hormones from the pituitary gland (ACTH or adrenaline) and adrenal glands (cortisol), essentially ramping up for a potential threat. The release of adrenaline results in an increase in heart rate and respiration, a decrease in blood coagulation time, and in short, we're ready for a fight. The brain's second response with cortisol diverts blood from the gut and sends it to the muscles where we can use it, gives us a burst of energy by releasing glucose reserves, improves certain memory functions, and activates our immune system. Other brain responses involve the activation of the areas related to perceiving and responding to the environment, facial expression, breathing rhythm, startle response, and the modulation of heart rate.

Selye (1956) neatly explained the human response to stress by breaking it down into three phases: alarm, resistance, and return to equilibrium or exhaustion. This sequence is fairly short in duration, and individuals can reach exhaustion quite quickly. The alarm phase involves the preparation to fight or flee, as summarized in the paragraph above. The ensuing resistance can lead to sharp, goal-directed behaviour, if faced with an enemy to fight or an obvious means of escape. However, if sufficiently distressed and uncertain about a solution, we can experience difficulties shifting goals, scanning alternatives, and effecting a change in solution strategies – instead of escape, we can compound our difficulties (e.g., wandering lost in the woods). Heightened sensory acuity levels which in one situation may be helpful, allowing us to identify the source of threat, may in another situation lead to over-focusing (e.g., gun barrel, rock on the road) or even dissociative experiences. In short, the resulting persistence of ineffective action, loss of resourcefulness, and increased anxiety creates a mental situation of "crisis." This leads a vicious cycle of ineffective coping, inability to disengage from so doing, failure to shift attention and efforts to use other resources, and increasing distress further.

Compounding matters, adversity can persist and at times grow worse, following a disaster. Missing family members, uncertainty about living arrangements and physical safety, re-exposure to distressing stimuli, lack of food, water, sanitation, and health care, and a sense of hopelessness and despair can all contribute to individuals feeling increasingly traumatized by their experiences.

## Trauma and Learning

Our brains remember trauma in two different ways. First, there is the logical memory, the kind of learning that is sequential and can be explained in story form, with a beginning, middle, and end – this part of learning seems to take place in a part of the brain called the hypothalamus. There is also a more implicit form of learning that takes place, and seems to involve an automatic kind of learning. We often are unaware such learning has occurred until realizing that we've had a change in habits or have become conditioned to something. In contrast to the more sequential, rational memories, it can be difficult to explain our reaction to an old song we hear on the radio after not having heard it for several years, or why the smell of play-doh or crayons can transport us back to our childhood (or the smell of perfume or aftershave brings us back to a previous girlfriend or boyfriend) - this type of learning appears to happen in the area of the brain called the amygdala.

Such implicit recollections are much more influenced by emotion than are the more explicit, sequential memories. Research also suggests that this kind of learning is more likely to come into play when an event is perceived as immediately threatening (LeDoux et al., 1989). Difficulties emerge when conditioned responses start to take over in response to a threat that is perceived but not real (e.g., the sound of breaking glass may remind a person of a traffic accident they survived, but the reaction will be excessive if the sound was caused by someone dropping a glass on the floor). False alarms in response to such triggers can cause significant distress and constitute one of the hallmarks of acute stress disorder (ASD) or post-traumatic stress disorder (PTSD).

Shalev (2003) summarized the circular or cyclical relationship between psychological and physiological components of the human response to trauma. This cycle starts with a perceived threat being met with an intense bodily reaction that, in turn, shapes the way the event is remembered. This memory then forms the basis for which additional adverse events will be interpreted. “While this cycle can be self-limiting and decay with time, additional adversity, such as often seen in the aftermath of major disaster, can create a chain of mutually reinforcing reactions, the memory of which may be etched forever in a person’s brain. *Efforts to reduce the stressfulness of events (e.g., by providing shelter, information, orientation, warmth and hope) have an essential role in mitigating this bio-psychological cascade*”(p. 61 – bold Italics are mine).

In other words, repeated psychological trauma that often happens after a large-scale disaster can have a longstanding or even permanent negative impact on an individual’s ability to cope with stress as s/he goes on with her/his life. **The mandate of PFA, therefore, is to interrupt the ongoing traumatic impact of the event, through the provision of comfort, safety, shelter, information, and just as importantly, hope.**