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Exploring A Model: The 4 Architectures of Trauma to The Brain/Mind

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Abstract

Eight years ago, I was asked to evaluate a National Hockey Player for a traumatic brain injury. You can read about the details in this case in my book "The Complex Architecture and Healing of Traumatic Brain Injuries: Listening to The Brain." (Chapter One). This was the beginning for me of working to understand trauma to the brain/mind and how to heal this trauma (both organic and psychological). I use the phrase brain/mind/body to indicate that they are inseparable. And the connection is: the human mind is the subject experience of the brain. What I take from this connection is that the brain matters a whole lot in our day to day lives. Yet it is mostly ignored in our day-to-day lives. And that the human brain/mind is really very fragile. In my experience, all trauma to the head (blows, strokes, epileptic seizures, infections, major mental illness, and illnesses and diseases of the brain) disrupts brain/mind functioning, and eventually leads to a breakdown in brain/mind functioning.

To support this conclusion, I developed a model of the neurodegenerative progression of trauma to the brain/mind. Originally, I was working with TBI and professional athletes. But I soon discovered that there were many traumatic brain injuries incurred by professional athletes in all sports that never made the headlines and were never treated. Professional athletes who are injured (and brain injuries are very, very subtle) are no good to the team, and cost money (especially head injuries). So, the athletes suck it up and move on as best they can. Are there consequences down the road? Yes, and very serious ones!

Let's look at a case and then see if the model can help us understand and treat these types of complicated cases.

Keywords: C-PTSD, Traumatic Brain Injuries, Head injuries

The Case

Ms. S. grew up with a severely abusive mother and a father who never protected her. From an early age, if she didn't win a competition she was beaten when she got home. At times, her mother would lock her in her bedroom, without food and water, and she was not allowed to come out for several days. Sadly, this abuse went on through high school until Ms. S. received a new car from her father and finished high school living out of her car. ("Not that much fun, but at least I was safe from my mother").

When she first got in touch with me, it was about all her Complex-PTSD issues (C-PTSD as in long term and something that was very difficult for a person to free themselves of). Part of the reason she had consulted me was feeling very strange after withdrawing from 10 years of medication, another complicating factor in her treatment. I note that MS. S was on Trazodone, an antidepressant given to help restore the balance of serotonin in the brain, and Clozapine, an antipsychotic often given to help prevent suicide. She was prescribed these medications for over 10 years with no significant improvement in her condition. Rather it was a distraction that kept her somewhat stable during this period. However, no psychological work was being done, which in my opinion equals very little improvement in her state of severe anxiety, depression and PTSD.

About 4 months into her treatment, she started to complain of some unusual symptoms: not being able to keep food down, going hungry, feeling very weak, and having periods of backout. When these occurred, she would begin to feel dizzy and weak and then black out often falling in very dangerous places (the stairwell for example). Once this occurred while she was out walking her dog, and she collapsed on the sidewalk. She blacked out for an unknown period, but she was eventually able to get up and walk home. The

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obvious reason was a generalized weakness from not eating, and maybe some issues related to her withdrawal from medication. But…….

Around this time, I had some intuition and asked her about any head injuries she might have sustained (and yes, I should have asked her this earlier). ("Oh my God yes, I've had plenty of concussions during my life!") Based on this "twist" in her case I gave her my brain assessment form. (See the results at the end of the article). Right away it was obvious that she was suffering from PCS (post-concussion syndrome), and probably had been since she was a teenager. This is a situation I see all too often, concussions which are not addressed very well by current medicine (the prevailing idea is go home from the ER/clinic/Urgent Care and rest for a week or two and you will be fine). But this does not in fact work, because trauma to the brain always (in my experience) creates a neurodegenerative disease process in the brain/mind. This is a far cry from "You'll be fine. Just go home and rest."

So, what was going with Ms. S?

As her treatment progressed more of her history came out, with more examples of the concussions that she had suffered. Sadly, I see this clinical picture too often, when injuries to the brain are not followed up on.

In addition to being physically abused almost daily by her mother, she was involved in a serious, head-on auto accident at age 19. The accident left her unconscious and then hospitalized for a week because of brain swelling. During the collision her head hit both the steering wheel and the driver's side window necessitating a very slow recovery. Sadly, due to the accident she was not able to graduate from high school on time. Thus, as a high school student she was already dealing with both severe emotional abuse and struggling with PCS (post-concussion syndrome). We now understand this as the perfect storm in the brain/mind. And as if this wasn't enough to deal with, she had been struggling with an eating disorder since age 7 (bulimia). The eating disorder continued until she was 35 years of age, when she was diagnosed with ovarian cancer, and she ended her eating disorder.

I note that with most of my brain injured patients, they struggle with multiple medical problems (physical, cognitive decline, social and emotional, sleep disturbances, dissociation, and impulse control), as exemplified by Ms. S.

As her treatment progressed more of her concussion history came to light. One, as a young horse rider in competitions, she suffered several blows to the head. No follow-up. Two, during her senior year high school she was pushed down on a concrete floor striking her head hard. Her high school figured she was unconscious for approximately 3-5 minutes. When she finally "came to," she couldn't see well, and her memory was impaired for several days after the incident. But again, no follow-up. By the time she was age 19 she could remember at least 5 concussions (with no follow-up). Three, in 2017 she was involved in another head-on car collision. Once again, no follow-up. Approximately 4 years ago she was attacked from behind while walking her dog one evening. She was dragged off the sidewalk and kicked in the head several times. Then dragged her back on the sidewalk and slammed her head onto the sidewalk breaking the skin on her chin. At which point she blacked out until she realized that someone had found her and called an ambulance. Aside from a CAT scan, she had no further treatment. I note that part of this lack of treatment had to do with the fact that she had no health insurance. Sadly, all this trauma to her brain/mind and no real sustained, long-term treatment. No wonder she was experiencing so many disabling symptoms and no real understanding of what was happening to her.

Now, what does all of this have to do with the development of brain trauma, and what are the consequences for her life because of this?

The Model

Over the past 8 years I have been working on a model of the neurodegenerative progression of trauma to the brain/mind/body. My clinical research led me to an understanding of the various "architectures" the brain works through attempting to rebalance itself, not successfully, however. As has already been pointed out, trauma to the brain is not a single isolated event. It is the beginning of a disease process in the brain/mind/body.[1,2] The model tracks this neurodegenerative disease process through 4 interlocking architectures. The details are explained below.

Architecture One

In the model I have developed (figure in ref.1) the first architecture refers to the shock trauma/traumatic shock a person experiences when there is a blow to the head, a stroke has happened, a seizure or multiple seizures, an infection in the brain, serious mental illness (schizophrenia or manic depression), and/or illness or disease of the brain. All these situations shock the normal flow of energy in the brain and disrupt normal brain/mind functioning. For some of my patients the shock trauma manifests within an hour of the accident (mostly in the form of cognitive decline), but for other patients the shock to normal brain/mind functions takes several days to manifest. I rarely see any attention paid to Architecture One, but in my experience shocking the brain/mind this way can have lasting effects up to death.[3]

When we look more closely, and listen more carefully, shock trauma to the brain/mind can cause almost immediate effects on the brain's emotional networks causing a person to over or under react to stressful situations. Shock trauma to the brain/mind can also create fixed neural networks that are isolated from other parts of the brain, and very resistant to change. Very important to recovery from trauma to the brain/mind, is understanding that avoiding treatment often works (in my experience, always) to create further damage in the brain. Overall, the person experiencing

shock trauma experiences a sudden shock to the total body system disrupting the person's well-being and overwhelming their ability to cope with life. In turn, this often causes (almost always on some level) dissociation as a coping mechanism. With dissociation, the mind and body feel disconnected and very little can seem real.

Following a natural shut down state of the body for survival, the shock trauma will reduce physical awareness, and the awareness of the emotional trauma, dulling the senses, increasing overall numbness in the brain/mind/body, and reducing conscious cognizance of the world around them. In general, following trauma to the brain/mind there is a collection of symptoms (symptomatology) including chills, shaking, changes in blood pressure, rapid breathing, and fear and panic. Exploring further we see physical symptoms:[4]

1. Dizziness and Lightheadedness
2. The person may be unconscious
3. Nausea and Vomiting
4. Stomach Pain
5. Rapid Heart Rate
6. Headache
7. Muscle Tension
8. An Increase in Blood Pressure
9. Rapid Shallow Breathing

In terms of emotional symptoms, we see:

1. Fear and Panic
2. Denial
3. High Anxiety
4. Anger and Irritability
5. Numbness and Withdrawal
6. Helplessness
7. Brain Fog
8. Emotional Outbursts
9. Inability to Concentrate
10. Decreased Awareness of Surroundings
11. Feeling Unsafe
12. Dissociation

And there are further problems with extreme shock trauma to the brain/mind that are life threatening.

Hypovolemic Shock where there is a severe loss of blood and fluids, the heart has difficulty pumping, and vital organs can stop functioning.

Distributive Shock where there are abnormalities in the blood vessels distributing blood around the body, and blood pressure becomes dangerously low.

Cardiogenic Shocks when the heart is unable to pump blood.

Neurogenic Shock when there are spinal cord injuries damaging the nervous system and interfering with blood blow.

What we are seeing here is the brain/mind pushed to its limits, desperately working to recover and rebalance itself. These kinds of symptoms may be seen as evidence of an acute stress disorder, PTSD, or dissociation. But I believe the above symptomatology goes way deeper to the very core of who we are as human beings. Unfortunately, again, I don't see a lot of evidence that this is very well recognized. Sports injuries to the head, victims of car crashes, adults, teens, and children who have fallen and hit their head, the results of strokes, seizures, infections in the brain, major mental illness (schizophrenia and manic depression), and brain illness and disease are all reflection trauma to the brain/mind and huge disruptions in normal brain/mind functioning. Again, if disruptions to brain/mind functioning are not treated, then we can expect to see huge breakdowns in brain/mind functioning and major brain illness and disease: Alzheimer's Disease, CTE, Parkinson's Disease, Multiple Sclerosis, ALS, and dementia. I believe it all comes from trauma of some type, is neurodegenerative, and begins with a shock trauma to the brain/mind. This is Architecture One.

And in many cases that I have seen, the Shock Trauma reverberates throughout the mind, brain, body leading to eventual death. It is worth remembering here that trauma to the brain/mind is subtle, and most often progresses over time. It is not well recognized in the beginning unless we start paying to these symptoms and "listening to the brain."[5]

Architecture Two

Within Architecture Two the brain/mind shifts from a direct response to being traumatized to dealing with disruptions to normal brain/mind functioning. Primarily, this involves disruptions to the electrical and chemical processes in the brain that allow the neurons to communicate with one another. These disruptions to normal brain/mind functioning involve 3 major problems encountered in Architecture Two: damage to the small energy producing factories in the nerve cells, the mitochondria; damage to the autophagy processes in the brain, and damage to the immune system's ability to function effectively. This is all considered secondary damage from trauma to the brain/mind, but equally damaging to the individual as that which occurred in Architecture One. In other words, the damage continues to cascade through the brain/mind through neurodegenerative pathways.

I want to note a differentiation here between physical trauma to the brain/mind (sports, car crashes, falls, and accidentally hitting your head hard), which causes the neurons to physically become

twisted, bruised, torn or sheared (TBI problems). And impairing brain functioning. And damage to the brain/mind from internal problems including strokes, seizures, infections, major mental illness, (schizophrenia and manic depression), and brain illnesses and diseases. Whichever the pathway, the result is the same, through the impairment of brain functioning.

Looking at the specifics of Architecture Two we begin with damage to the mitochondria. Mitochondria are dynamic double membraned organelles (tiny energy factories) involved in the regulation of cellular health. They vary in size, shape, and number depending upon the cellular needs to combat stress, their location, and their specific roles in neuronal structures. But their most significant role is with energy production in the brain/mind/mind. Damage to these little energy factories leads to problems with oxidate stress, mitophagy, apoptosis, calcium homeostasis, deficits in mitochondrial bioenergetics, biogenesis, transporting, and autophagy.[6] Is it any wonder then, that all these patients struggle with chronic fatigue. They don't have the ability to create the energy necessary to sustain their lives. My patients will often say to me that:

"I have the thought, Doc. But I don't have the motivation to make it happen. And this happens to me pretty much every day." My conclusion is that because of their brain trauma these patients literally don't have the energy necessary to follow through with what they are thinking.[7]

The second major aspect of Architecture Two involves the presence of autophagy in the brain/mind. Autophagy is the brain/mind's "vacuuming system" that literally cleans up the buildup of waste and toxic products in the brain.[8] These toxic products can quickly accumulate in the brain slowing down brain functioning and interfering with recovery from the injury. I have observed that all my patients struggle with their brain/minds running like "a slow computer." And I believe this is one of the major reasons why.

The third major aspect of Architecture Two is the breakdown in immune responses in the body, worsening brain injury outcomes. Research at the University of Maryland School of Medicine has shown that after a traumatic brain injury the brain's immune system cells internal functioning is dramatically slowed down allowing waste products in the brain to begin to accumulate and interfere with the process of recovery.[9]

This is Architecture Two, brain/mind functioning is beginning to break down as can be seen using the 4 Baskets of Symptoms[10] (See Concussion Legacy Foundation) including physical symptoms, cognitive decline, social and emotional problems, and sleep disturbances. And finally, I note that if the clinician is not "listening to the brain," many of the subtle symptoms of trauma to the brain will not be seen or recognized. (See the case histories presented in "The Complex Architecture and Healing of Traumatic Brain Injuries: Listening to The Brain).[1]

Architecture Three

Architecture Three explores the damage that trauma does to homeostatic balance in the mind, brain, body. Again, these are interlocking architectures, and this is a cascading process in the brain. In working with trauma to the mind/brain/body, and developing this model I noticed that concussions, post-concussion syndrome, strokes, seizures, and infections in the brain, illness and disease involving the brain all caused multiple symptoms in the body. Why is this? My conclusion was that trauma to the brain/mind involves damage to the homeostatic mechanisms in the brain creating multiple symptoms throughout the mind/brain/body.

In working on the research for this article I finally came across an expanded reference for my perspective. Interesting to me, the book (a series of articles) was published in 2015.[11] Yet I had never seen the book, nor seen a reference to the book or the idea that there are long-term consequences from homeostatic disruptions to brain/mind functioning. But this book does it all exploring "homeostatic control of brain functioning" and exploring what happens when there are homeostatic disruptions to brain functioning.

Homeostasis refers to the physiological processes that keep the internal environments of all living things stable and balanced. In our case, the human body is constantly involved in monitoring and maintaining our internal states. This is especially true when the external environment is changing rapidly, and our internal environments are challenged to provide a constant equilibrium between our internal and external environments. The tasks of homeostatic balance involve 1) Having a clear defining point for achieving homeostasis. 2) Being able to know when there is a deviation from the individual's homeostatic balance. 3) Being able to respond to these deviations and restore balance in the mind/brain/body.

These constant tasks, all done automatically and outside our awareness, involve:

- Body Temperature Regulation
- Regulation of Glucose in the Body
- Maintaining constant Ph Levels
- Cleaning up toxins in the blood stream harm cells and disrupt homeostasis
- Blood Pressure
- Calcium levels
- Levels of oxygen in the Blood
- The amount of Water available

So, from disruptions to the effective functioning of the neurons in Architecture Two we now have a breakdown in homeostatic function and the myriads of symptoms that result from this breakdown. By now a person is in very real but subtle trouble. They

can no longer function normally. And this breakdown in functioning can be serious, including hemostatic disruptions which are capable of threatening death.[12]

Architecture Four

This architecture is the brain/mind/body's final, interlocking attempt to cope with trauma to the brain, now with the addition of PTSD. And in this case, it's Complex-PTSD/. What is so difficult about this architecture is the fact that there are now opposing forces in the brain. Trauma to the brain slows down brain/mind/body function, while at this point in the downward spiral of neurodegeneration, PTSD is speeding up the stress hormones roaming throughout the brain/mind/body. Architecture Four addresses the fact that trauma to the brain is a traumatizing experience to the individual's (mind/brain/body). Then how exactly do these opposing forces clash in the mind/brain/body.[13]

The clinical course and presentation of C-PTSD is variable and highly individual highlighting the heterogeneity of this disorder. The symptoms, duration, and severity of C-PTSD are highly individual but at the same time revolve around 5 core symptoms.

- Intrusion (re-experiencing)
- Persistent Avoidance
- Negative changes in Cognition and Moon
- Alterations in arousal and reactivity
- Distorted Perceptions of Self and World
- Dissociation
- Impulse Control Problems

The clinical course and presentation of trauma to the brain (highly individual) revolves around the 4 interlocking attempts by the brain/mind/body to cope with insults to its structure and function. Reviewing the clinical course here involves:

The brain's response to the initial shock trauma.

Disruption to the electrical and chemical functioning of the brain giving rise to symptoms of cognitive decline, physical pain and loss, increases with depression and anxiety, social and emotional withdrawal from the world, and finally sleep disturbances (which may well have occurred within hours of the initial insult to the brain)

A breakdown in brain/mind/body functioning resulting from a lack of homeostatic regulation. This is what gives rise to the numerous symptoms that accompany these injuries.

And we have now arrived at the "perfect storm" in the brain/mind. The clash of C-PTSD and TBI. And what could be worse than this: your own brain colliding with itself!

Back with our case. How does this model help us understand Ms. S's symptomatology and impairments, and what kind of "healing ecology" does she need.

(P) "I did not have a good time on Thursday!"

(D) "What happened?"

(P) "I had a severe panic attack on my way to meet some new friends."

(D) "Any idea what you were panicking about? Our brains are built for survival, for keeping us alive. And this would be an example of your brain operating an unconscious level letting you know that there was a threat out there somewhere."

(P) "I have no clue. Out of the blue I'm panicking and for no good reason that I could figure out!"

(D) "Do you think it is possible that your brain, because it is injured, is having difficulty keeping up with what appears to be a new situation. You're meeting new people. This will require adjustments, and your brain will need to come up with more energy than usual because the demands of meeting new people will require more energy. More energy than usual. And more energy than an injured brain is capable of producing. So, essentially your brain is panicking because it knows on some level that it won't be able to keep up."

(D) "What do you think about this explanation?"

(P) "Well, it did come out of the blue and wasn't feeling any conscious worry about meeting some new people."

(D) "Yes, the brain does a lot of work outside of, or maybe more accurately, below consciousness. And, again, your injured brain/mind is struggling to find a way to heal itself. Although as you can see, not so very successfully."

(P) "And there is another thing that's bothering me. I have these crying spells out of nowhere, and then last night while I was sitting with my boyfriend watching a movie, he noticed that I had just blanked out and wasn't responding. He asked me if I was alright. And I had no idea what had just happened. This is happening to me a lot!"

(D) "I'm wondering if you are experiencing episodes of dissociation, a common symptom of brain injuries, or these are episodes of absence seizures?"

(P) "Feels to me more like seizures."

(P) "Now that we are talking about this, I have noticed that I go through stages that go something like this. First, I get scared. Then I get frustrated. Then I get angry. And then I begin to cry out of nowhere. And finally, I get some release/relief."

(P) "But I don't understand what starts all this in the first place?"

Summary and Conclusion

In terms of the model, Ms. S. had experienced a long period of neurodegenerative progression with no medical diagnosis, and no understanding of her symptoms, which were getting progressively worse with time. She had several severe experiences of shock trauma from car accidents and being assaulted (Architecture One) that were not addressed. The neurodegenerative disease that follows trauma to the brain was progressing slowly outside of her awareness (Architecture Two), except for memory lapses that she didn't understand. Over time these symptoms increased (high anxiety and major depression) and she would have episodes of black outs that she just pushed through (Architecture Two). Then the disruptions with her brain functioning became a breakdown in brain functioning because homeostatic balance in the brain was severely affected. And now she was experiencing multiple symptoms on a daily basis (headaches, chronic fatigue, nausea, a loss of focus and concentration, memory loss, sleep disturbances, and dissociation/absence seizures) all of which were a result of a breakdown in homeostatic balance (Architecture Three).

Finally, Ms. S found herself feeling crazy and wanting to commit suicide to end this crazy experience that was just getting worse (Architecture Four). Because trauma to the brain is also a very, very traumatizing experience for the individual. Note what happened to All-Pro Center, Mike Weber, of the Pittsburg Steelers as portrayed in the movie "Concussion" (2015). He felt he had no choice but to take his own life to stop the craziness that he was experiencing. These are the very serious consequences of dealing with trauma to the brain/mind. The person feels that they have no choice but to take their own life in order to end the craziness they are experiencing.

Now comes an even greater challenge: how to heal the brain/mind/body when an individual reaches this stage in the progression of a neurodegenerative disease process. How to set up a healing ecology for these patients. (See the cases presented in: "The Complex Architecture and Healing of Traumatic Brain Injuries" by Leighton J Reynolds, Cambridge Scholars Publishing, August 2023).[1]

Over the past 8 years that I have been working with trauma to the brain/mind/body I have developed a protocol that is individualized for each patient.

Supplements for the brain (rather than drugs).

Stimulation to aid the brain in healing (I prefer music through noise canceling headphones).

Total immersion in the healing process (having an everyday schedule that includes many rest periods throughout the day to reduce demands on the brain so it can heal).

Creating "flow experiences" which reduces demands on the brain (again, see "Flow: The Psychology of Optimal Experience," by Dr. Mihaly Csikszentmihaly, Basic Books 1990).

Having at least one neuro-psychoanalytic session per week to monitor the progress of the treatment (Neuro-Psychoanalysis is the combination of psychoanalytic work with a neuroscience understanding of how the brain works).

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Conflicts of Interest

Regarding the publication of this article, the author declares that he has no conflict of interest.

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