

Transforming Anger and Anxiety One Brain at a Time: An Overview of Sensory Processing

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[The following is not meant to be a scientific paper but rather analogies that illustrate the research. These are excerpts from a larger discussion on the neurobiology of anxiety.]

*As people we utilize our senses to explore and react to our environment. Indeed, our external five senses are the main tools for education. Information that comes into the brain needs to be “worked through” for us to utilize it effectively for learning. The work of Jane Eyres and Bonnie Hanchu led the way in understanding how our internal senses work to ensure our sensory experiences are effectively processed. Many physical activities are an excellent source for creating optimum sensory processing environments to ensure the neurochemicals that drive behaviour are at the “just right” balance.

*The Neurochemicals of Behaviour

Everything you know to be true is learned via your body and brain. The environment is perceived by the five “far” senses (sight, smell, taste, touch, sound) and travels through the body into your brain, specifically the cerebellum. The vermis (or lining of the cerebellum) “gates” information into the cerebellum much as the gates in a horse race ensure everyone is off to a good start. Information travels through specific ventricles (areas) of the vermis en route to the cerebellum.

People with autism may have insults (injuries) to the 7th and 8th ventricles (known to be responsible for language) which can be seen on an MRI [Courchesne & al [1988]. Those “language horses” can’t get out of the gates efficiently. In Joubert Syndrome, Dandy Walker and several other cerebellar disorders, many gates are damaged or completely missing. Just imagine a horse race where the gun goes off and some of the horses are not even facing the right way!

*Behaviour is dictated by many different reasons: some behaviour is learned, some is due to reasoning and some is “instinct”. Imagine sitting at a computer and your little brother comes in and yells “BOO”! Your system is flooded with cortisol: a steroid hormone secreted by the kidneys. This triggers an automatic response and one of three things will happen: a fright response (Freeze with eyes wide open); a flight response (duck or veer away from the sound) or a fight response (punch the little rugrat). This response happens immediately: you don’t even think about it. This is cortisol at its best. Its job is to get you out of danger immediately.

Now, if your little brother makes a habit of scaring you at the computer and after a day or two you are typing away and waiting for him to come in: punching him as soon as he comes up behind you is not a cortisol-driven response. You have cognitively learned that it feels good to punish him for his joke and the line “My cortisol made me do it!” is not going to stand up in a “sensory-court” of law. That last punch was definitely a learned response!

*A biogenic amine (or neurochemical) called dopamine wants you to always be rewarded and feel good. When cortisol floods the system, dopamine pays attention and says, “Hey! What’s happening? Why aren’t I being rewarded?!”

*Another important neurochemical is norepinephrine. Its main job is to figure out why there is so much cortisol and keep you focused on the problem. This is a very useful tool when walking across the road to the doughnut shop and a big red truck comes barreling down on you. The cortisol will cause you to have a fright response (deer-in-the-headlights,) a fight response (yell at the driver), or a flight response (Run away!). Norepinephrine keeps you alert to the problem – rather than planning your next shopping trip for shoes the same colour as the truck! The fact that norepinephrine keeps your brain focused on the reason for the influx in cortisol is very important when the problem is an obvious, solvable problem.

*After you realize it was your little brother scaring you, your body releases a third neurochemical called serotonin. Its job is to bring your body chemistry back down to a normal level. As that happens, the norepinephrine is reabsorbed. After you get out of the path of the truck, it may take several hours for your body to produce enough serotonin and bring you “back down”. Sometimes, after a particularly devastating situation (accident, death of loved one, etc.) it may take months for you to feel “equal” again. You may even experience “flashbacks” as your body tries to compensate for the large influx of stress. Eventually, however, all things go back to normal. In some cases, the cortisol is elevated for no one observable reason. Perhaps a child’s parents are not acting like grown-ups at home. This child goes home never knowing who might get yelled at or hit.... or when.... or why. The stress level is always high in order to run or duck as soon as necessary.

*Some people have brains that do not work the same as others. If the vermis is missing or compromised, as in many cerebellar disorders, the world is not processed in the same way. This is very confusing. Confusion and stress increase the amount of cortisol. Signals come crashing into the brain in an unorganized way and the brain struggles to make sense of it all. Quite often, “normal” sensory information is perceived as a war-zone of lights, sounds, textures, and smells. As a result of this constant “stress-high”, a person often feels anxious or angry for no apparent reason. If you ask them why they feel angry, they honestly cannot tell you. They just feel it. They may have a heart-wrenching sob at the slightest upset. It may appear that they are overreacting, but in essence, that event was the “last straw” for them to withstand.

The norepinephrine is still there, of course, trying to figure out why there is all that cortisol. It may arbitrarily focus on someone or something. A child may suddenly become angry at the pizza you have served for lunch... the same pizza you serve most days... the same pizza served with exactly four pepperonis, one per slice... at the same temperature as always (routine is very important for kids with sensory processing problems). But today, the pizza triggers a screaming fit. One reason could be that the norepinephrine has decided that the pizza is the reason for the increase in stress and therefore, a fight response is in order. When you try to explain that the pizza is what is for lunch, the cortisol may decide on a flight response... and fling the pizza across the room!

Now, the dopamine and norepinephrine are not sentient beings living inside your head. They are very powerful neurochemicals that drive behaviour and it is extremely difficult to ignore the impulse to act on their commands. Just as it would be almost impossible to stand still while the truck was coming at you or not to duck when someone startles you, to ask a child on a “cortisol-high” to be reasonable is UNreasonable: they are reacting to a message that is not coming from a learned response. A sensory processing therapist works under the philosophy that some behaviour is driven by a person’s neurochemicals and these can be manipulated to change

behaviour. Bonnie Hanschu spoke of people with special needs as a “rose within an onion”. There is a sweet, beautiful person in there, and glimpses are caught, but the vision is blurred and opaque. The layers of need can be peeled away with different therapies (sensory processing, cognitive, medication, etc.) until only the person remains. This is the goal of any advocate: ensure that all needs are addressed.

*How to Increase Serotonin

There are a variety of ways to increase serotonin in the system. There are many different types of medications which alter the amount to serotonin: Prozac, Celexa and Zoloft are some names of commonly prescribed SSRIs (selective serotonin reuptake inhibitors). Also, some natural plants such as St. John’s Wort may elevate serotonin. Everyone will have a time in their life when there is a strain on the neurochemistry balancing act: a death; divorce; new child; etc. These events are all very emotional and disrupt your body’s normal routine.

*Diabetics constantly need to monitor their sugar levels to be able to stay healthy. People with brains which work differently need to have their neurochemistry “monitored” to interact positively with their environment. Just as a diabetic uses insulin to keep their body’s chemistry at an optimum level, some people require boosts of serotonin before, during and/or after a stressful event to help their neurochemistry remain efficient.

*In a normally functioning brain, a difficult day is usually soothed by a walk in the sun, perhaps sitting in a green field, listening to music, or eating chocolate. All these coping strategies utilize your far senses to increase serotonin. The effect of the serotonin on your system would be a “few drops” (although it’s not really drops, that is just a convenient visual analogy).

*If you have been experiencing a larger amount of stress over the past few days, you may choose to get a massage, sit in a warm bath or wrap up tightly in a warm, heavy blanket. This strategy uses deep pressure to stimulate the receptors under your skin and serotonin increases. The analogy would be a “shot glass”.

*An incredibly difficult period in your life may cause you to go for a run or begin an exercise program. These activities stimulate the proprioceptive sense of where your body is in space and it has a latency effect of one to two hours. The proprioceptive system has its receptors in muscles, tendons and joints (Hansch, 1997). Each time you activate the deep tendons at the joints, your brain makes a better connection to that part of your body. Serotonin is also created in this process. There are other aspects of your body chemistry at work here: endorphins, etc. but for this discussion, we will stick to the biogenic amines. The amount in our visual analogy would be a “full water glass”. Because of the latency effect, the running or weightlifting will keep your serotonin elevated for an hour or so after the activity has ended.

*The most stimulating sense is your vestibular sense or “where your head is in space”. It is sensed in your inner ear and has a latency effect of four to eight hours. If you have ever spent a few hours on a boat then closed your eyes on land and still FELT like you were on a boat, you have experienced the latency effect of your vestibular sense. The analogy of the amount of serotonin enhanced by the vestibular sense is a “full bucket”. It is the most alerting and focusing

of the seven senses and is particularly beneficial for the special needs population that we are discussing.

***Practical Ideas**

In order to meet elevated amounts of stress in the brains of people with sensory processing spectrum disorders, there need to be “buckets” of serotonin available at regular intervals. A physiotherapist or occupational therapist with sensory integration or sensory processing training can assist the person’s caregivers in setting up a series of activities (also called a sensory diet) that are designed to provide the boosts of serotonin needed.

*A child who screams every time they are put into the family car, may need to bounce on a trampoline for ten minutes before being told it is time to go. A person who refuses to eat may need to spend ten minutes on a vestibular swing followed by some time with an electric toothbrush before going to the supper table. A student who becomes restless in math class may need to carry some textbooks to the book room, preferable one upstairs.

*A person who has ‘tried everything’ to get past a stressful event may need to spend some time elevating their serotonin... through medications AND naturally. Using a hammock swing or a trampoline is very helpful to many people.

*The most important thing to remember is that it is NOT YOUR FAULT! You are not doing anything to deserve this. You are not ‘less than’ someone else. Your brain is doing exactly what it was designed to do. Our daily living has changed and creates stressful event that we cannot control. You are not alone!!

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