FIRE AND WIRE... AND THEN PRUNE

"I have even better eyesight and everything is not freaking me out.

~ Meaghan Buckley

The key to an efficient brain is "fire and wire," then prune.

The brain wants to be streamlined. So it builds connections through neuroplasticity and, as soon as a memory is formed or a skill is learned, it cuts the no longer necessary synapses and strengthens the connections between new brain regions that require more robust lines of communication. 62

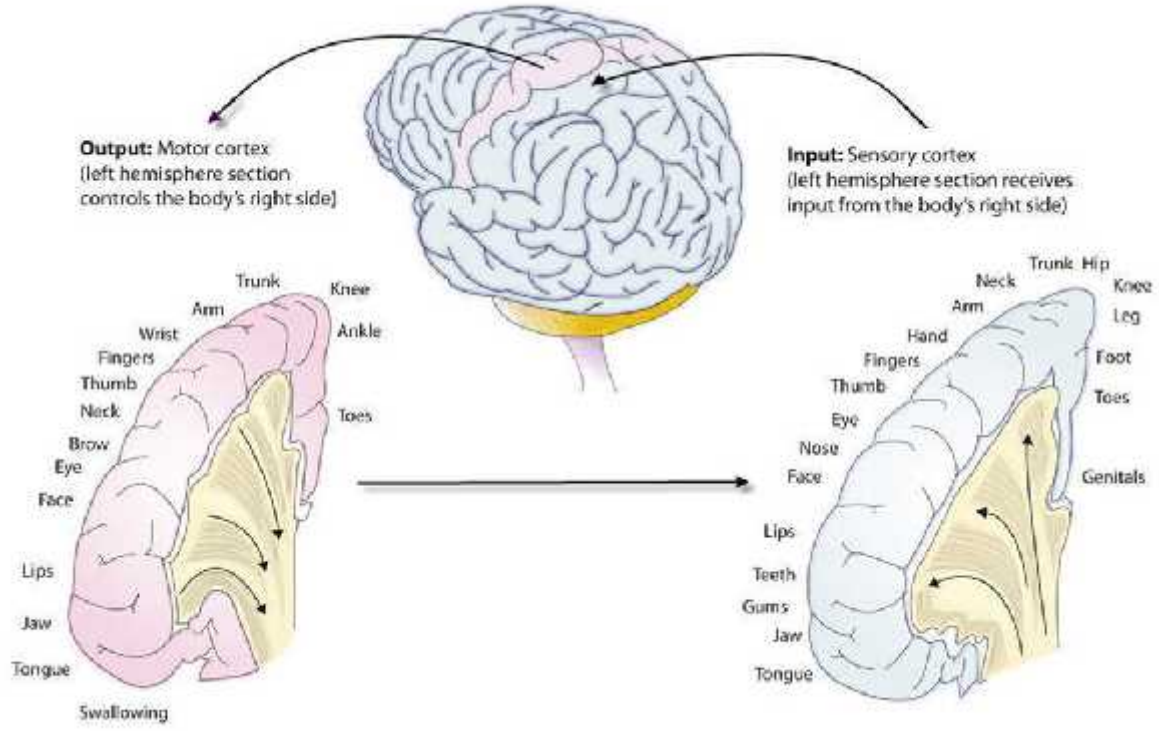
How does it know when to "fire and wire" and when to prune?

Like I've said, it basically operates on a feedback loop system. This means that information travels from one end of the brain and central nervous system (CNS) to the other, getting progressively more refined with each pass. This is true of all sensory and motor neural impulses.

So, if we know that "fire and wire" and prune makes a brain more efficient, it stands to reason that if this process is screwed up, a brain would become less efficient. If a brain just fired and wired, for example, this would lead to an excess of wires or neural connections that could get in the way of smooth processing.

This excess connectivity would be exacerbated if no pruning was taking place. The only thing that could make it worse would be if the same neurons were firing over and over again, so that the connections that were being made in the brain were not new, but were simply the same old, same old being reinforced over and over again.

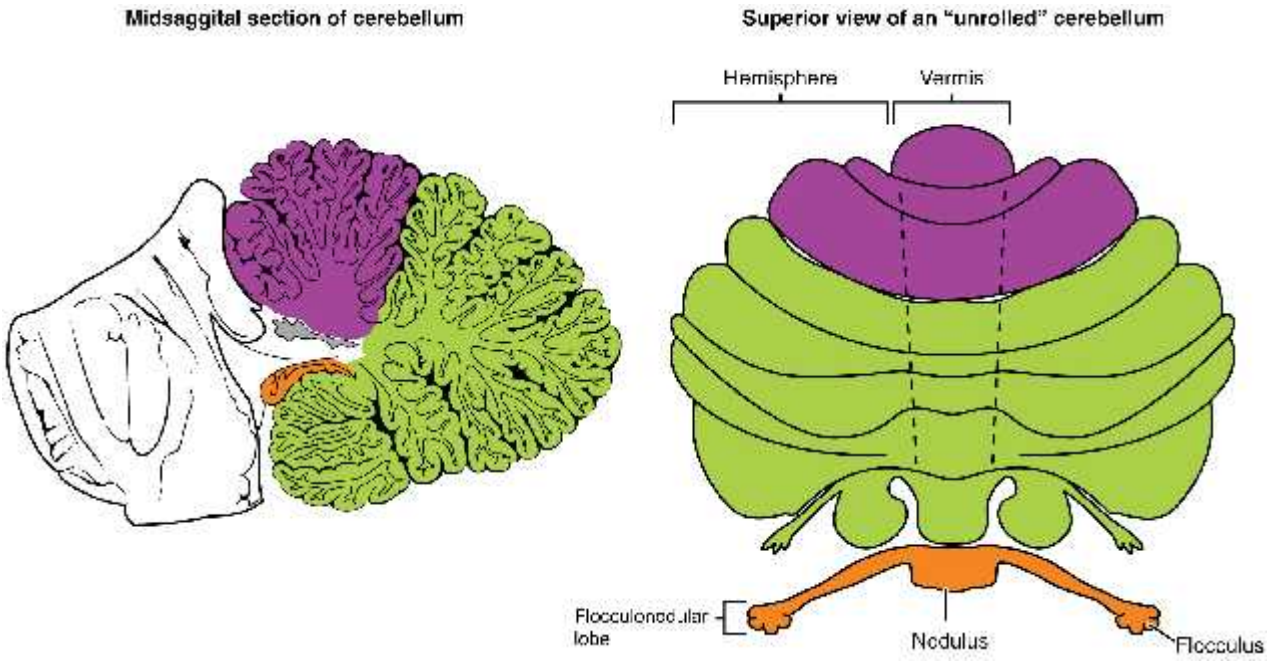
Picture the operation of the brain and central nervous system (CNS) as a closed system feedback loop.



Information goes in at one end, circles around the various lobes and regions where it is progressively improved upon, and then makes its way back to the starting point where it is fine-tuned again before being sent out to make its way around the loop again for further refinement.

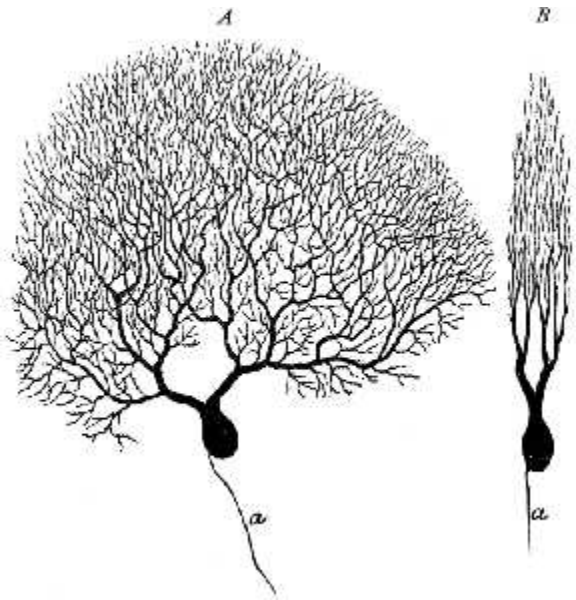
The cerebellum is the central, control cog in the closed system feedback loop.

More specifically the cerebellum vermis. As we said in the previous chapter, it receives input from our senses (eyes, ears, fingers and tongue) as well as from the muscles and joints in our body. These messages reach the cerebellum through a complex web of millions of neuronal projections called *climbing fibers*, which pulsate rhythmically, giving us an awareness of ourselves in space.



In a typical brain, thousands of *Purkinje neurons* tap into this *climbing fiber web* and, with each successive passage through the brain body feedback loop, they send back more fine-tuned, modulated messages, enabling us to execute coordinated actions like walking and talking and using body language to communicate.

Purkinje cells rely on connections with climbing fibers to receive an infinite number of fine-tuning updates that keep the cerebellum and cerebrum aware of when things are going right, and when there are errors or disturbances. 63



Signals from climbing fibers can trigger an appropriate sensorimotor response in milliseconds. When pruning is working normally, each Purkinje cell receives only one climbing fiber input. Tests with ASD model mice, however, show they possess an overabundance of climbing fibers which could make it more difficult to interpret an 'error signal.' 64

This means that in ASD mice, the climbing fibers are not getting pruned as they should. "Inefficient synaptic pruning seems to be a common motif in autism," Christian Hansel, PhD and professor of neurobiology at the University of Chicago,

concludes. "There are not many types of synapses in the brain where pruning can be measured easily, but climbing fibers provide an excellent model and allow us to make predictions about synaptic pruning deficits elsewhere in the brain as well." [65]

Remember, ideally synapses that fire together wire together and those that are not used regularly are pruned. [66]

If there is a problem with the rapid fire, ongoing interplay between the climbing fibers and Purkinje cells in the cerebellum vermis, this would impact the overall operation of the brain's feedback loop. There would be less fine tuning, less modulating of the sensory motor messages being recycled.

Currently, there appear to be three main cerebellar abnormalities observed in patients with ASD: diminished Purkinje cells, reduced cerebellar volume, and interrupted feedback pathways between the cerebellar and cerebral areas. Research on post-mortem ASD brains has shown that not only are their Purkinje cells reduced in size, but that many are defective. [67]

Let's take a closer look at the key finding here: Purkinje cells that are reduced in size. The reason I am zeroing in on this is because it could be the root cause of the other three problems. Also because it fits in with our thesis of diminished or erroneous information being fed into the system.

1. If proprioceptive insensitivity and hypo or hyper sensory sensitivity is causing sensorimotor information to be under or over registered by Purkinje cells in the vermis, this could explain their reduced size and defective formation.

2. Since Purkinje cells release the inhibitory neurotransmitter GABA (*gamma-aminobutyric acid*), a reduction of these cells would result in a decrease in the inhibition of impulses going forward to the cortical areas, leading to more excitatory connections, more hypersensitivity and more impulsivity.

3. Purkinje cells that are reduced in size would have fewer synapses and connections to the climbing fibers that reach out into other regions of the brain. The fewer the connections, the more restricted the repertoire of one's thoughts, actions, emotions and behaviors.

4. And since the synaptic plasticity of Purkinje cells is dependent on old ones becoming inhibited and new ones forming as new skills are mastered, unless new learning is constantly taking place, pruning of old, defective, diminished cells is going to be stalled.

We talked about how learning something new takes a lot of "fire and wire" connections to start, but the more you master it, the fewer connections you need to retain it. **So the most efficient brains actually have fewer connections than the least efficient, unless you are literally "a master of all trades."**

But here's the thing - one of the most basic traits of people with autism is their restrictive range of interests and repetitive behaviors. Beginning in infancy they become obsessed with doing things a certain way - mouthing objects, stacking blocks, spinning wheels, flapping hands.

Perhaps this need for sameness is due to the fact that everything else in their lives is so uncertain. Since they cannot feel their bodies, they have no real sense of themselves as being real. But if you are doing the same thing over and over, it is going to trigger the same sensations in the body and brain. **Rather than expanding your neural connectivity, this is going to keep reinforcing the connectivity that already exists.**

So along with getting very little body sense information, the information the cerebellum is getting from their other senses: vision, hearing, touch etc. is pretty limited. While neurotypical children set out to explore the world, getting into anything and everything, ASD children retreat from it. They are content with their restricted repertoire of interests and activities. They are content to do the same thing over and over.

Why is this? What goes awry with the way their brain forms in the womb and early infancy that lays the foundation for problems to follow? Yes, the problem could be genetic but, since most autistic kids have a completely normal physical appearance, if genes play a part, it is not likely to be a major one. In Meaghan's case, all genetic testing came back normal.

However, what has definitely been abnormal is her primitive reflex profile. Most people haven't even heard of primitive reflexes, and that is understandable, because they are simple, automatic neural responses that help a baby survive in the womb and in the first few months of life. And they are typically gone by the age of six to nine months.

However, **primitive reflexes are the building blocks of the brain**. **They lay the ground work for all the neurological development that follows**. There are about twenty of them in all, and each one lays the foundation for a higher level motor and/or cognitive skill. If they are retained, that ability does not develop properly, if at all. [69]

Typically, primitive reflexes begin integrating into more mature postural reflexes as a baby becomes more active and begins to explore his/her environment.

These postural or response reflexes support a toddler's growing ability to control his balance, flexibility and movement as he begins to crawl and walk. 70

However, for some children, this transition process either doesn't happen or it is incomplete, so they wind up in a reflexive "no man's land" where traces of primitive reflexes or whole primitive reflexes remain. **This failure of the central nervous system to develop automatic movement, coordination and balance control contributes to a poor body sense or poor proprioception**. 71

In Meaghan's case, she had retained reflexes across the board, but the worst were those that impacted her vision and vestibular development. Of course, I hadn't a clue to any of this until she was in her 30s. So when I say "retained" reflexes, I am not kidding around. You would think that after all the various activities and therapies she's participated in over three decades, some of these reflexes would have integrated, but apparently not.

I can tell you that reflex integration therapy is by far, the best treatment you can give a child or adult with autism.

> I use a low level laser form of reflex therapy with Meaghan called Quantum Laser Reflex Treatment. I'm not going to go into what it is (Google it) but she has responded very well to it. I was actually very surprised when I asked her how she was feeling after our first session, and she responded as follows...
>
> Good. I can see much better. A light has been turned on in my brain.
>
> The impact on her vision was not something I had expected at all. Here is Meaghan's description of how she felt after her 2nd Quantum Laser Treatment.
>
> The treatments make everything easier. And I can see even better.
>
> Meaghan's description of how she felt after 4th Quantum Laser Treatment.
>
> I have even better eyesight and everything is not freaking me out. Yes, my goofy geeky personality really is starting to retreat.
>
> Her vision is still over-sensitive and, when her eyes tire, she struggles a bit more with hand eye-coordination, but each week brings improvement.

Below is a chart of some of a few primitive reflexes and the symptoms of their retention, if you are interested. You can find a lot more information online.

Primitive Reflex	Purpose of Reflex	Appears	Should Integrate By:	Signs of Retention
Moro Reflex	Primitive Fight or Flight Reaction	Birth	2 to 4 Months	Hyper Sensitivity, Hyper Reactivity, Poor Impulse Control, Sensory Overload, Social & Emotional Immaturity
Rooting Reflex	Automatic Response to Turn Towards Food	Birth	3 to 4 Months	Fussing Eating, Thumb Sucking, Dribbling, Speech and Articulation Problems
Palmer Reflex	Automatic Flexing of Fingers to Grab	Birth	5 to 6 Months	Difficulty with Fine Motor Skills, Poor Manual Dexterity, Messy Handwriting
ATNR	To Assist Baby Through Birth Canal and Develop Cross Pattern Movements	Birth	6 Months	Poor Eye-Hand Coordination, Difficulty with Handwriting, Trouble Crossing Vertical Mid-line, Poor Visual Tracking for Reading and Writing
Spinal Gallant Reflex	Assist Baby with Birth Process	Birth	3 to 9 Months	Unilateral or Bilateral Postural Issues, Fidgeting, Bedwetting, Poor Concentration, Poor Short Term Memory
TLR	Basis for Head Management and Postural Stability Using Major Muscle Groups	In Utero	3 1/2 Years	Poor Muscle Tone, Tendency to Walk on Toes, Poor Balance, Motion Sickness, Spatial Orientation Issues
Landau Reflex	Assist with Posture Development	4 to 5 Months	1 Year	Poor Motor Development
STNR	Preparation for Crawling	6 to 9 Months	9 to 11 Months	Tendency to Slump While Sitting, Poor Muscle Tone, Poor Eye-Hand Coordination, Inability to Sit Still and Concentrate

Since retained primitive reflexes can affect a person's sensory perceptions, causing hypersensitivity in some areas and hyposensitivity in others, a lot of children with autism have some retained reflexes. [72] And if they do, the sensory information that is being processed by their brains is going to continue to be over or under registered until the problem is addressed.