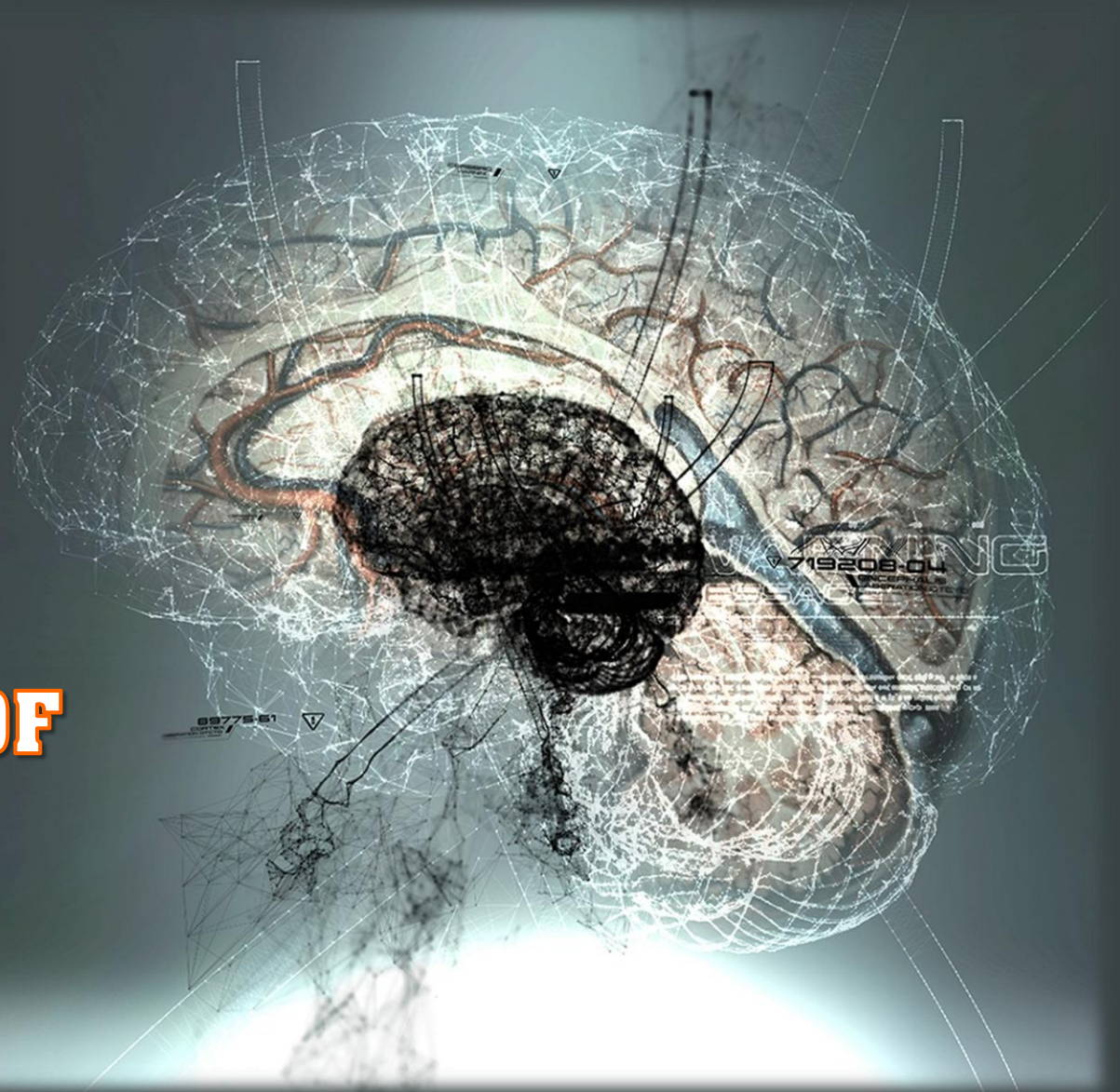
The Story of AUTISM



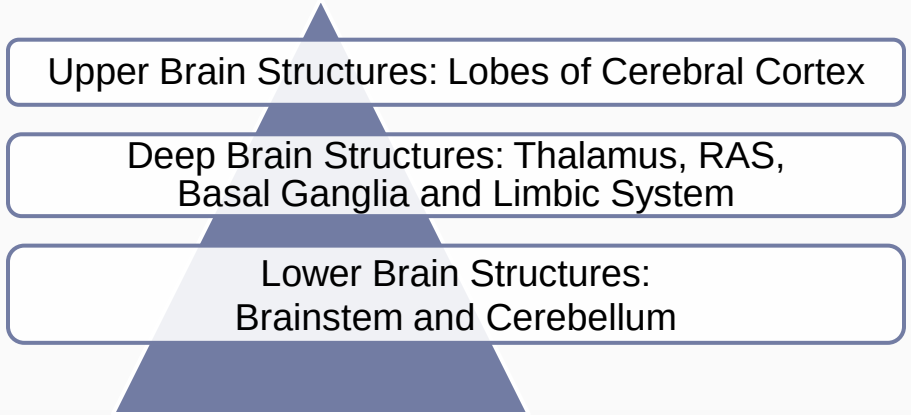
PART 18:

THE IMPACT OF LOWER BRAIN STRUCTURES ON AUTISM

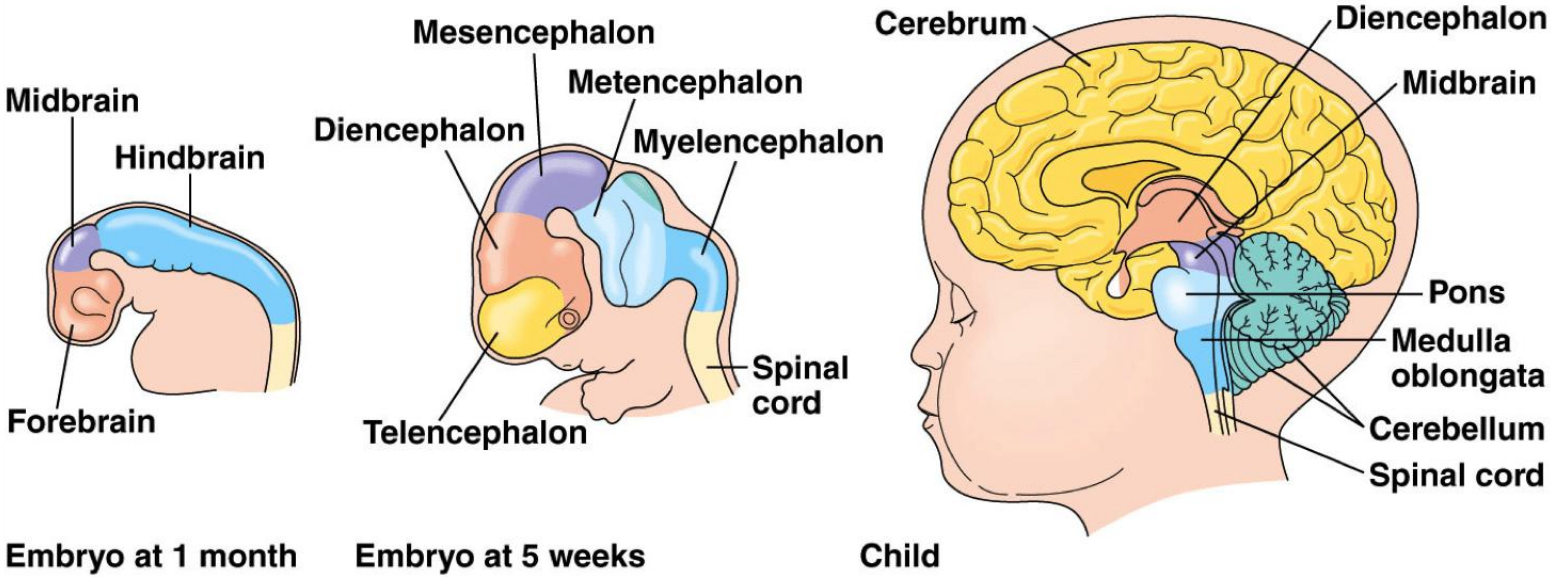
THE STORY OF AUTISM: Impact of Lower Brain Structures

Here's something interesting to think about:

Retained reflexes distort sensory motor processing from the ground up AND the brain builds itself from the ground up.

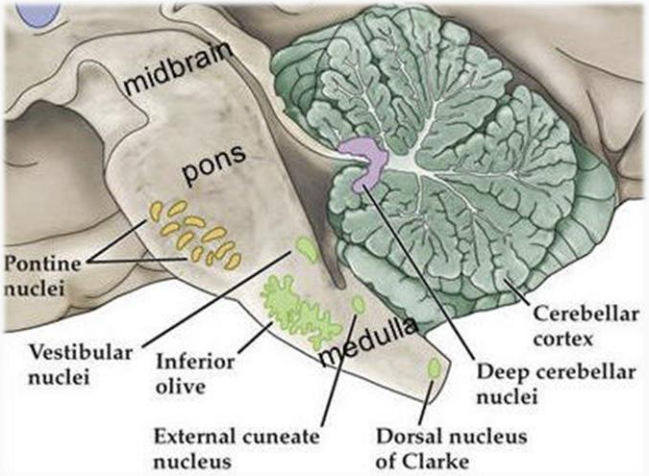


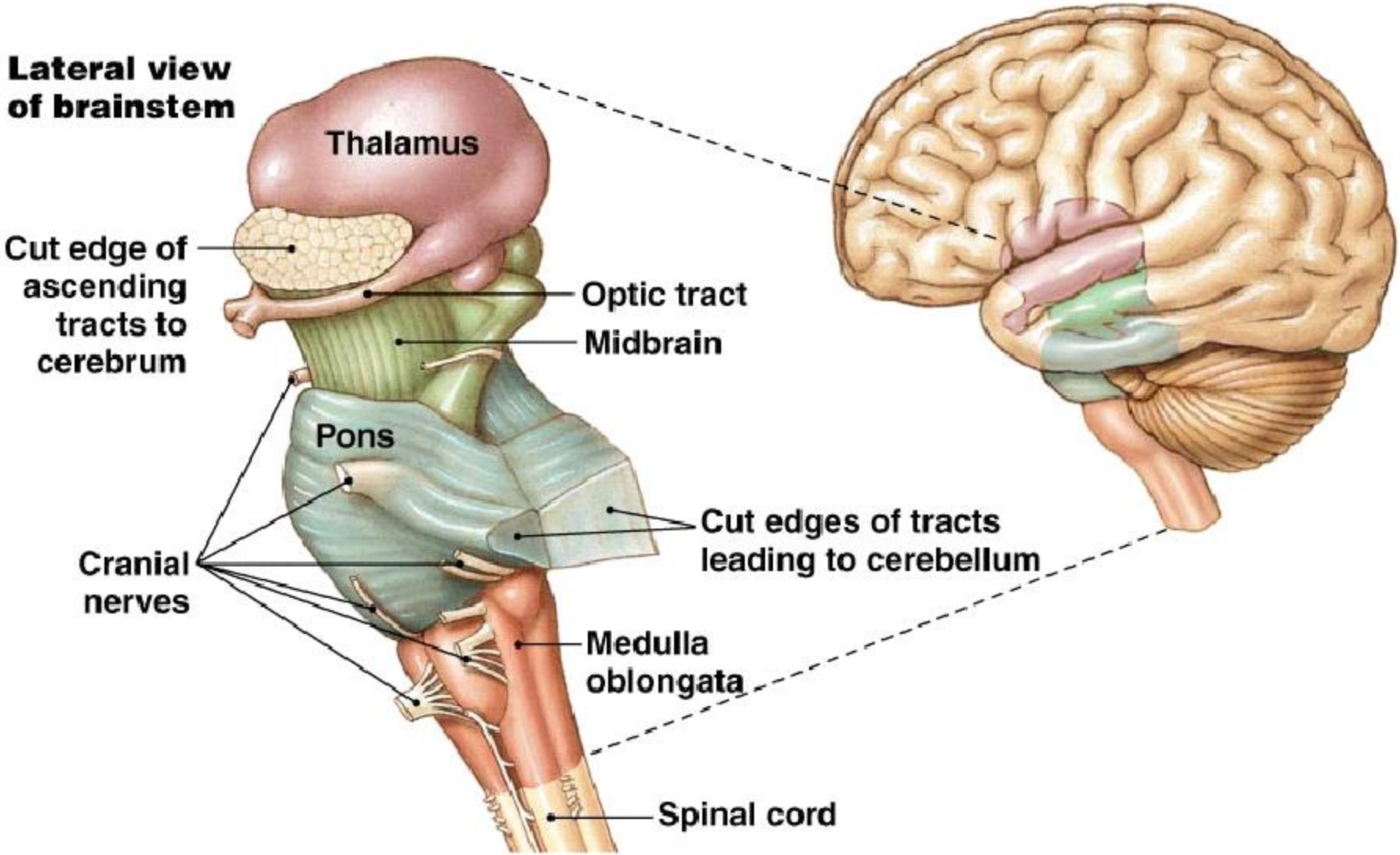
Embryonic brain regions		Brain structures in child and adult
Forebrain	Telencephalon	Cerebrum (includes cerebral cortex, white matter, basal nuclei)
	Diencephalon	Diencephalon (thalamus, hypothalamus, epithalamus)
Midbrain	Mesencephalon	Midbrain (part of brainstem)
Hindbrain	Metencephalon	Pons (part of brainstem), cerebellum
	Myelencephalon	Medulla oblongata (part of brainstem)



THE STORY OF AUTISM: Impact of Lower Brain Structures

Since the **lower brain structures** are the first to develop, and they mature right around the time the first primitive reflexes are supposed to integrate, we might expect that problems from the “failure to prune” or the retained wiring of the initial reflexes would first show up in one or more of **the structures that comprise the brainstem.**

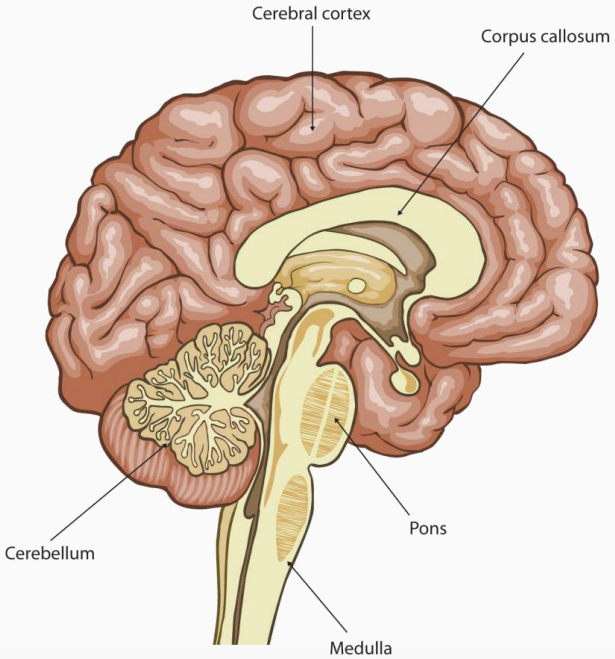



Lateral view of brainstem
Thalamus
Cut edge of ascending tracts to cerebrum
Optic tract
Midbrain
Pons
Cut edges of tracts leading to cerebellum
Cranial nerves
Medulla oblongata
Spinal cord

THE STORY OF AUTISM: Impact of Lower Brain Structures

The reason it is important to examine these structures is that they are KEY in impacting the input that goes into the cerebellar feedback loop.

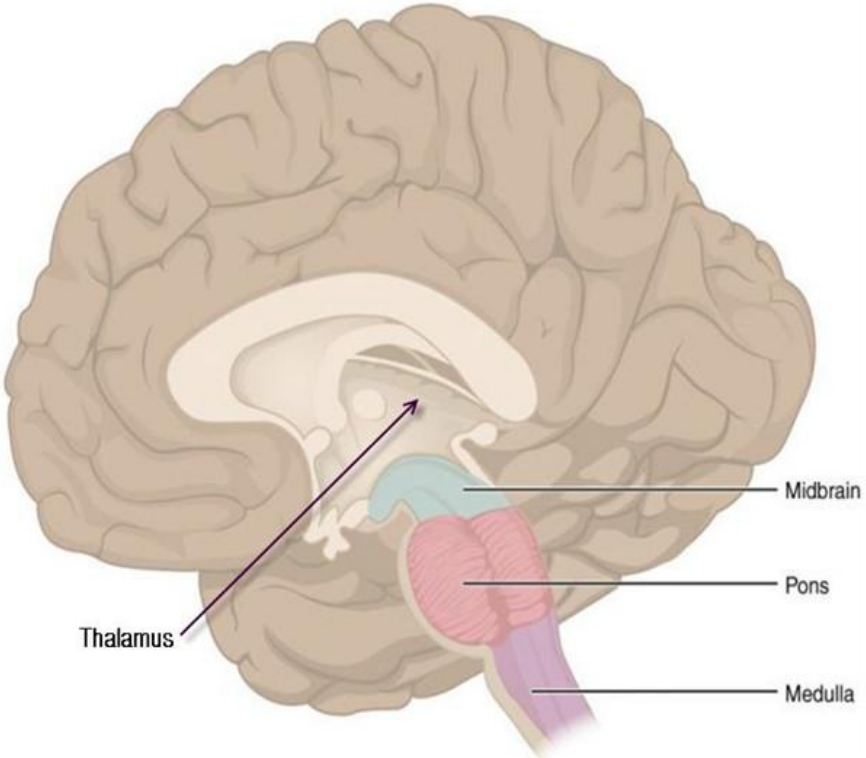
In this presentation I'm only going to focus on the structures that most impact the developing autistic brain.



The Midbrain - Located between the thalamus and pons, the midbrain is composed of four bumps, known as the colliculi, which means “little hill” in Latin. Two of the bumps (the inferior colliculi) are **part of the auditory brain stem pathway, influencing our conscious perception of sound**. The remaining two superior colliculi **combine sensory information about visual space, auditory space, and somatosensory space**. They help to orient our eyes to sound and touch stimulus. So... if you are walking along and you hear a chirping noise, they are what make you look up to see the bird in the tree above you.

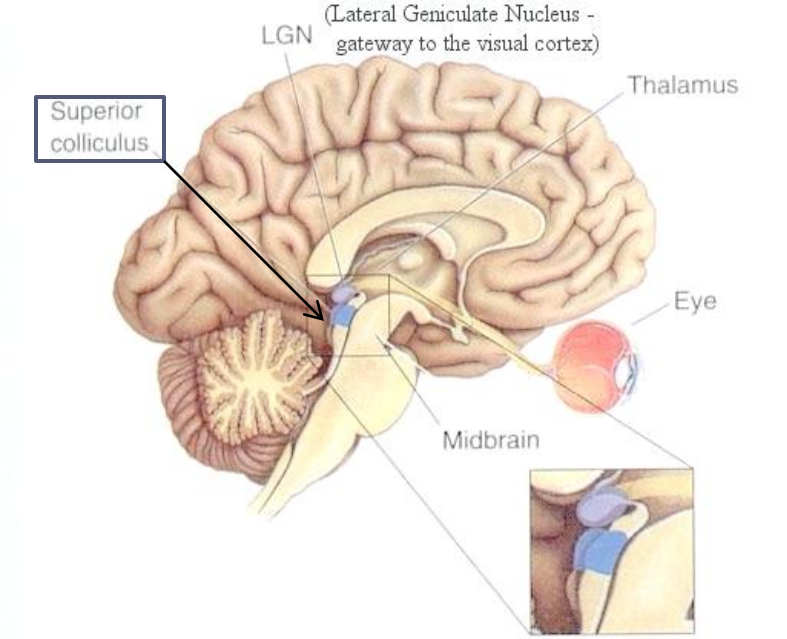
The Pons - Serves as a bridge that connects the cerebellum and the cerebellum and the cerebrum. Many important nerves originate in the Pons. **The trigeminal nerve is responsible for feeling in the face as well as controlling the muscles that are responsible for biting, chewing and talking, The facial nerve controls facial expressions. The abducens nerve allows the eyes to look from side to side and the vestibulocochlear nerve allow sound to move from the ear to the brain.**

The Medulla - Is the connecting link between the brain and the body, or rather the brainstem and the spinal cord. **All incoming and outgoing information must pass through this heavily myelinated structure**.



THE STORY OF AUTISM: Impact of Lower Brain Structures

The **midbrain superior colliculi** are part of the **auditory processing pathway**. They influence our conscious perception of sound and help to combine our senses of vision and hearing, orienting our eyes to look at a sound source when we hear something.



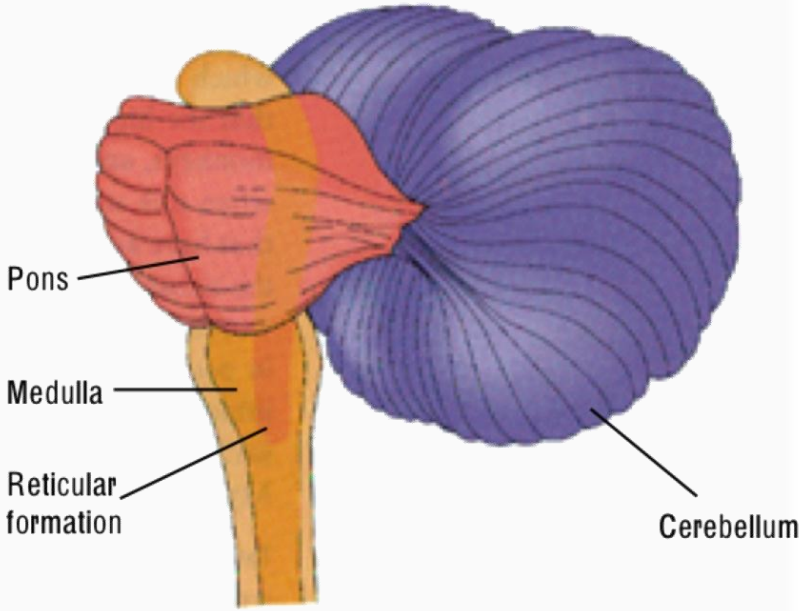
THE STORY OF AUTISM: Impact of Lower Brain Structures

Many children with ASD have a problem combining sight and sound. This could indicate a problem with the superior colliculi. When they are young, they often do not turn their heads when you call their names. They frequently tune out one sense in favor of the other.

THE STORY OF AUTISM: Impact of Lower Brain Structures

Various nerves in the Pons control the muscles in our face used for chewing, talking and facial expressions.

They also control **side to side eye movements** (scanning) and **allow sound to move from the ear to the brain.**

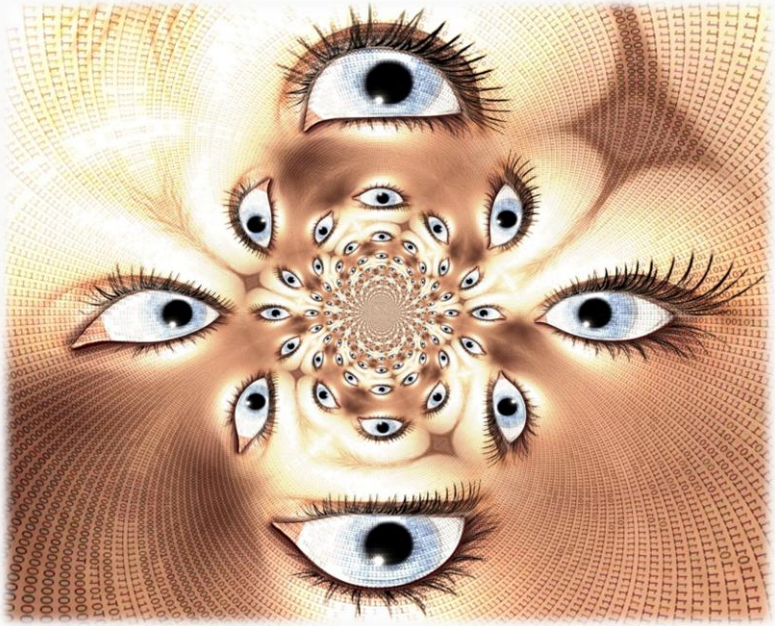


THE STORY OF AUTISM: Impact of Lower Brain Structures

The implications for autism here are clear. If the pons nerves are compromised, **proprioception from and control over the mouth muscles used for speech would be poor.**

THE STORY OF AUTISM: Impact of Lower Brain Structures

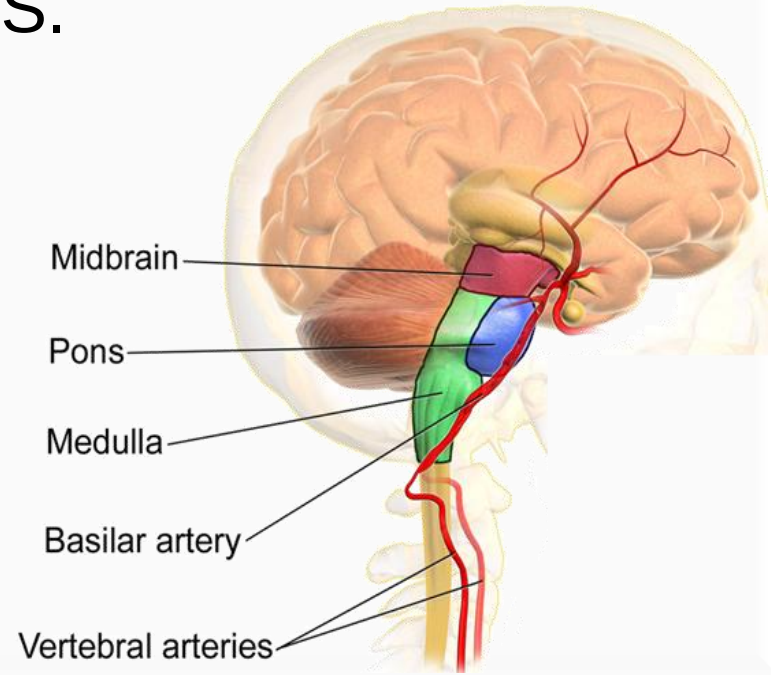
Scanning with the eyes and **auditory processing would also be impacted**, as it is with a great many individuals with autism – my daughter included.



THE STORY OF AUTISM: Impact of Lower Brain Structures

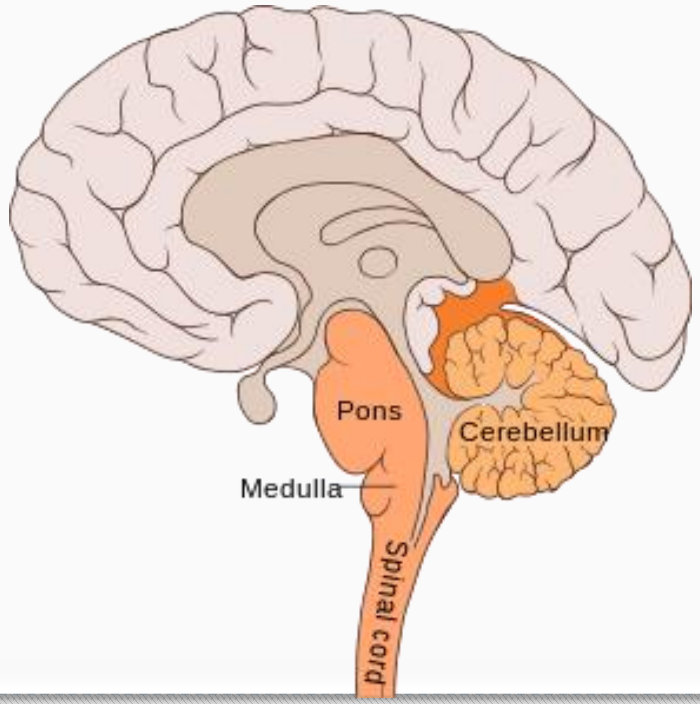
The medulla is the structure that the *Crossed Extensor Reflex* activates in the developing brain. It connects the brain to the CNS.

In typical brains it is heavily myelinated to insure swift passage of information.



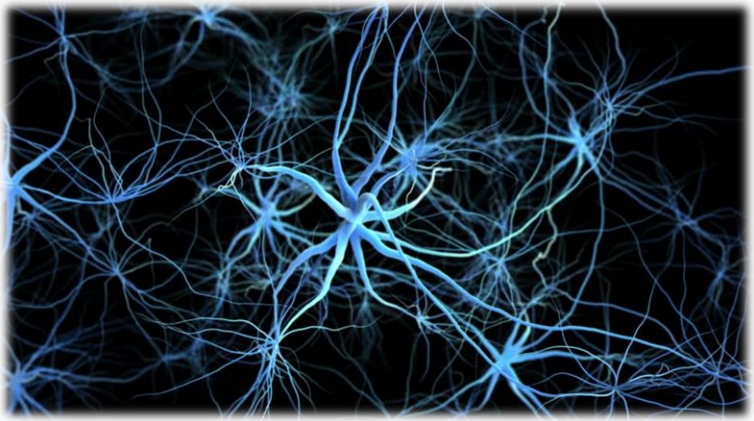
THE STORY OF AUTISM: Impact of Lower Brain Structures

We know that in autistic brains there is a problem with myelination. Less myelinated wiring would result in slower transmission of sensory and motor neurons back and forth from the spinal cord to the brain and to the control center for the brain, the cerebellum.



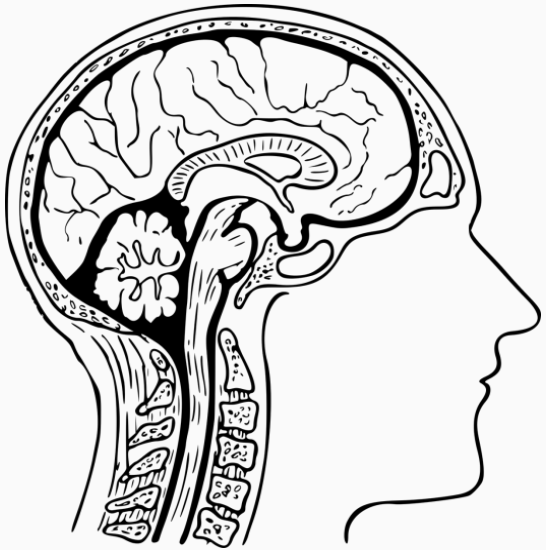
THE STORY OF AUTISM: Impact of Lower Brain Structures

Climbing fibers originate in the **inferior olive** of the **medulla** and extend into the cerebellum. These fibers have a major impact on the timing of **purkinje cell firing**, which determines the balance between excitatory and inhibitory output.



THE STORY OF AUTISM: Impact of Lower Brain Structures

As you can see from the charts below, a problem with any one of these lower structures, **structures that form first and influence the way the brain develops**, could easily have a powerful impact on the brain's higher up processing and interpretation of incoming data.



Lower Brain Structures	Function in Typical Brains	Atypical Output of Cerebellum Due to Lack of Pruning and/or Unbalanced Purkinje Cell Firing
Midbrain Superior Colliculi	Combines sight with sound	Distortion or dysfunction in combining the senses of sight and hearing.
Pons Nerves	Control facial muscles and eye movements Allows sound to move from the ear to the brain	Lack of control of facial muscles; poor eye tracking and unusual eye movements Difficulty processing auditory information
Medulla Inferior Olive	Heavily myelinated. Sends climbing fibers to cerebellum for sensory motor error correction	Poorly myelinated lower neural tracts. Sensory motor error correction mechanism is “off.”

GO ON TO THE NEXT PRESENTATION