# The Story of AUTISM

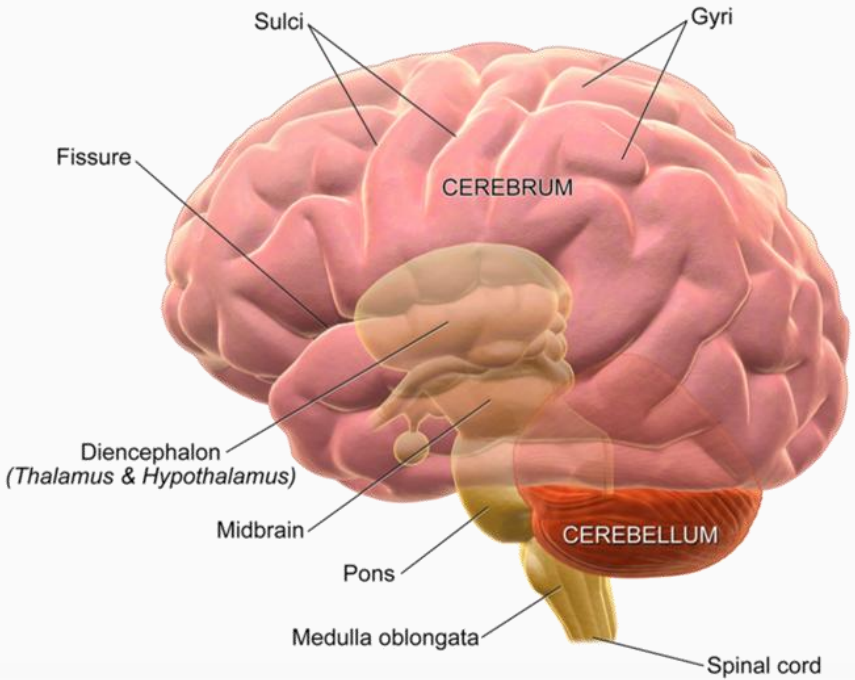
## PART 19:

## THE IMPACT OF DEEP BRAIN STRUCTURES ON AUTISM

# THE STORY OF AUTISM: Impact of Deep Brain Structures

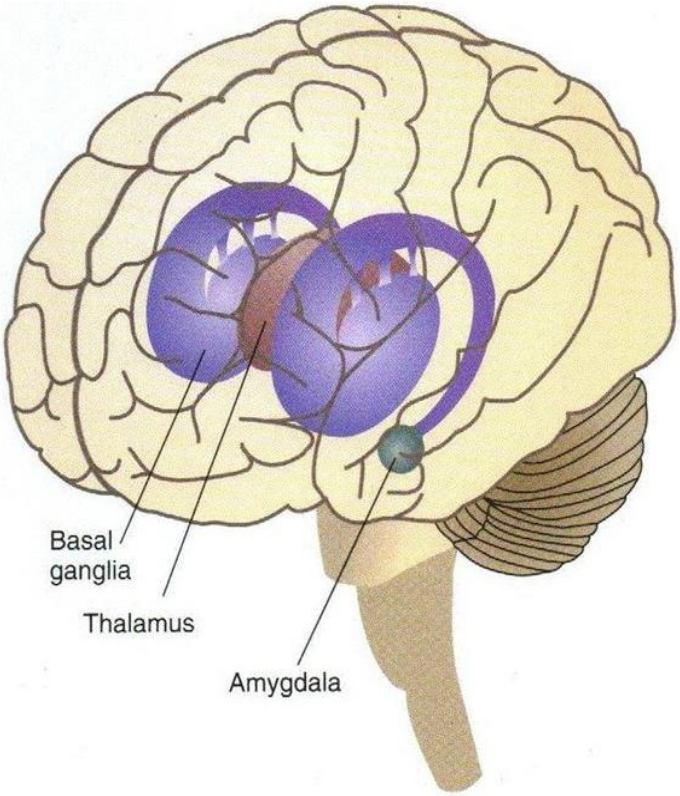
From lower brain we move slightly upward to the **deep brain structures:** a step higher on the brain developmental ladder.

Many of these structures also play an active role in the way autistic brains operate.

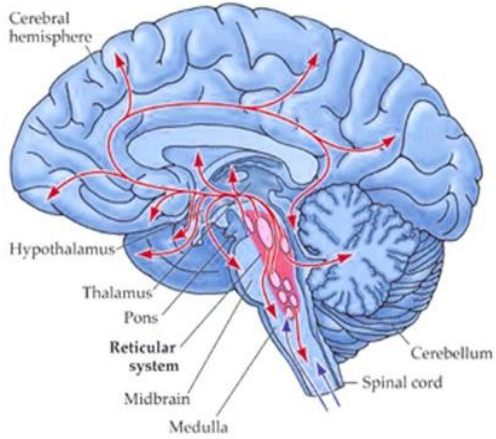


**The Reticular Activating System (RAS) -** A loose network of neurons and neural fibers running through the brainstem and up through the brain. The RAS **filters and prioritizes sensory information, allowing the mind be focused and aware.** There are two parts to the system: the ascending and descending RAS. The ascending RAS connects to the thalamus, hypothalamus and cerebral cortex. The descending RAS connects to the cerebellum and to nerves responsible for the various senses.

**If the RAS is not doing its filtering job effectively, is not dampening down the effects of repeated or excessive stimuli, the senses could easily become overloaded.**



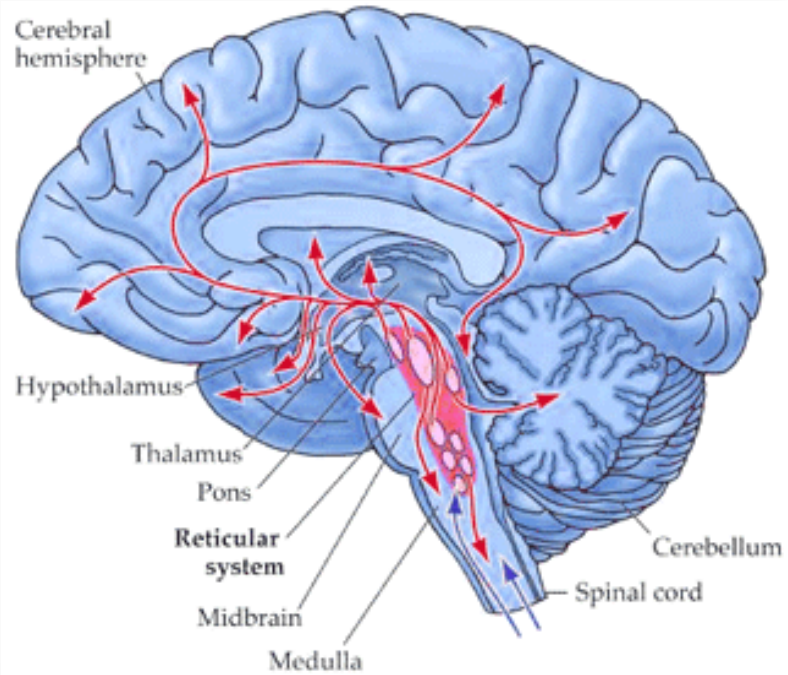

**The Basal Ganglia -** This neural network plays **a key role in motor control, primarily in facilitating intentional movement and inhibiting competing, impulsive movements.** It does this by blocking any motor plans sent out by the motor cortex that might interfere with smooth functioning. **In this way it works to control unwanted physical movements and behaviors and may also play a role in controlling obsessions and compulsions.**



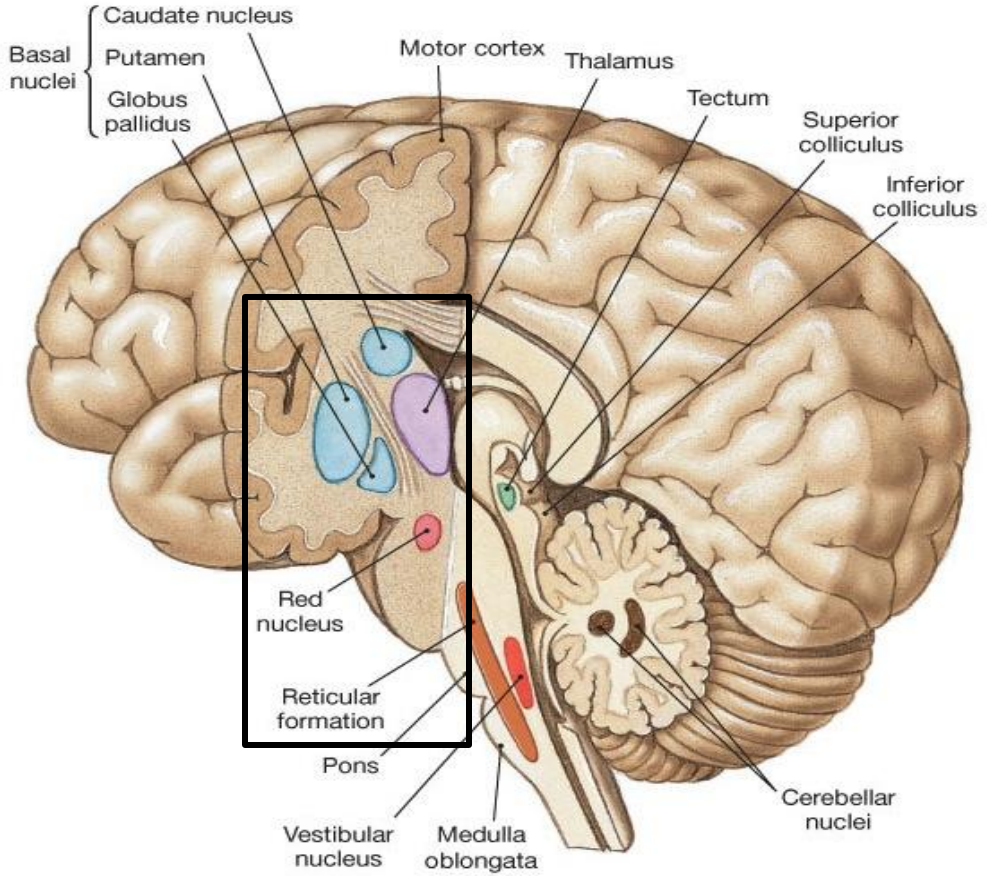

**The Thalamus - The thalamus is the relay station in the brain.** Most sensory signals - auditory, visual and somatosensory - go through the thalamus on their way to other parts of the brain for processing. It also plays **a role in motor control as it communicates motor commands from the cerebrum to the brainstem and cerebellum. It also mediates all the interactions between the basal ganglia and the motor cortex,** so it influences the effects of the basal nuclei in facilitating or impeding smooth, balanced thought and movement.

# THE STORY OF AUTISM: Impact of Deep Brain Structures

The **reticular activating system (RAS)** is a part of the reticular formation that extends from deep brain structures through the **thalamus** with connections distributed throughout the **cerebral cortex**.



# THE STORY OF AUTISM: Impact of Deep Brain Structures



# THE STORY OF AUTISM: Impact of Deep Brain Structures

**The Reticular Activating System** controls the degree of activity of the central nervous system.

**It filters and prioritizes sensory information**.

# THE STORY OF AUTISM: Impact of Deep Brain Structures

If the RAS is not doing its job of modulating or dampening down the effects of repeated or excessive stimuli, **the senses could easily become overloaded…**

**…as they are, most of the time, in autism.**

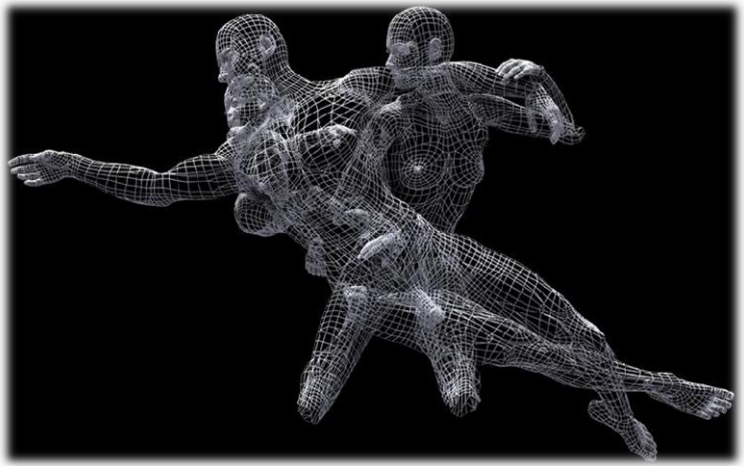
# THE STORY OF AUTISM: Impact of Deep Brain Structures

**The basal ganglia** plays a key role in facilitating motor control, **primarily in facilitating intentional movement and inhibiting competing, impulsive movements.**

For example, if you are sitting in a waiting room waiting for a doctor's appointment, the basal nuclei keep you from giving in to the urge to jump up and shout "This is taking too ____ long!"

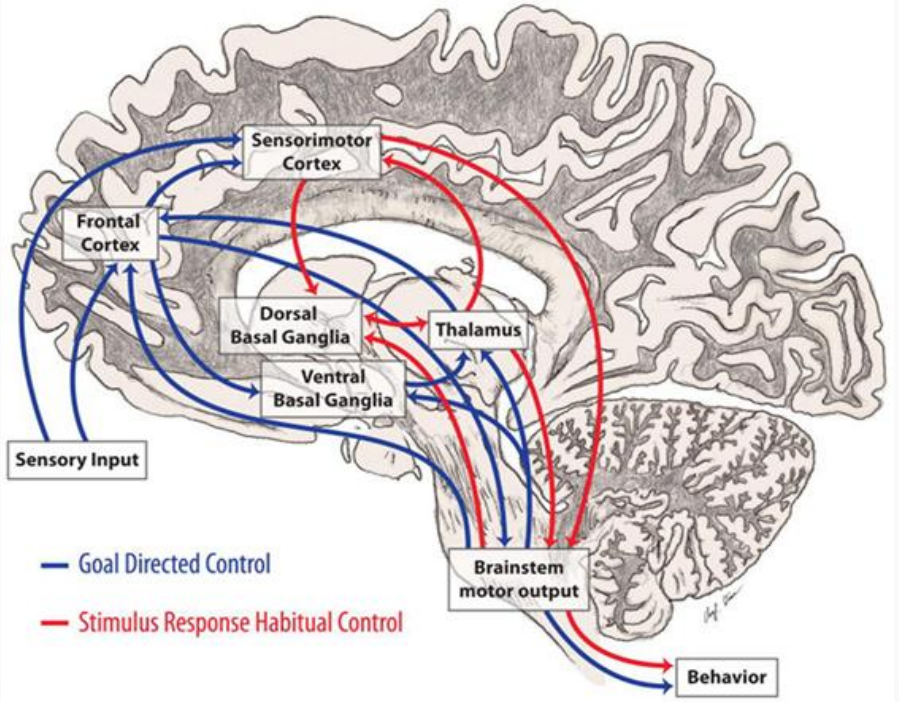
# THE STORY OF AUTISM: Impact of Deep Brain Structures

We know that the **basal ganglia is NOT doing its job in autism**. At least it is not doing it very well, **because individuals with autism are invariably impulsive**. You can never predict what they are going to say or do. They have no idea themselves, since many have little control over their own bodies.



# THE STORY OF AUTISM: Impact of Deep Brain Structures

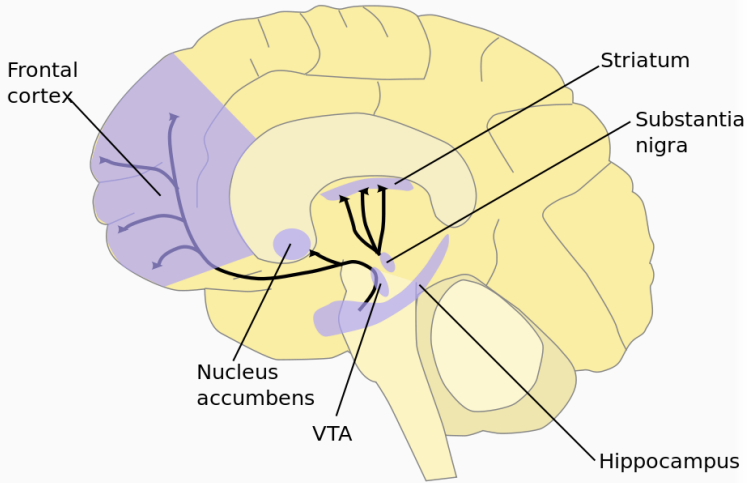
In order to perform its function of controlling impulsive actions, the **basal nuclei** need to receive input from the **motor cortex** and the **thalamus**, via the **brainstem**.



# THE STORY OF AUTISM: Impact of Deep Brain Structures

At the very tip of the brain stem is a structure called the **substantia nigra (SN).**

The SN releases the neurotransmitter **dopamine**, which acts as a switch to either inhibit or not inhibit (turn on or off) the likelihood of impulsive movement.

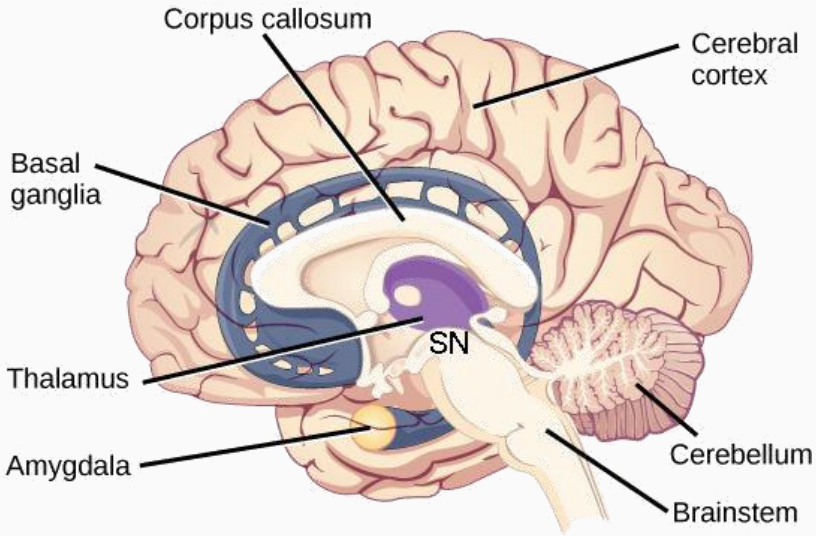


# THE STORY OF AUTISM: Impact of Deep Brain Structures

When the SN is firing, the body is in an active state.

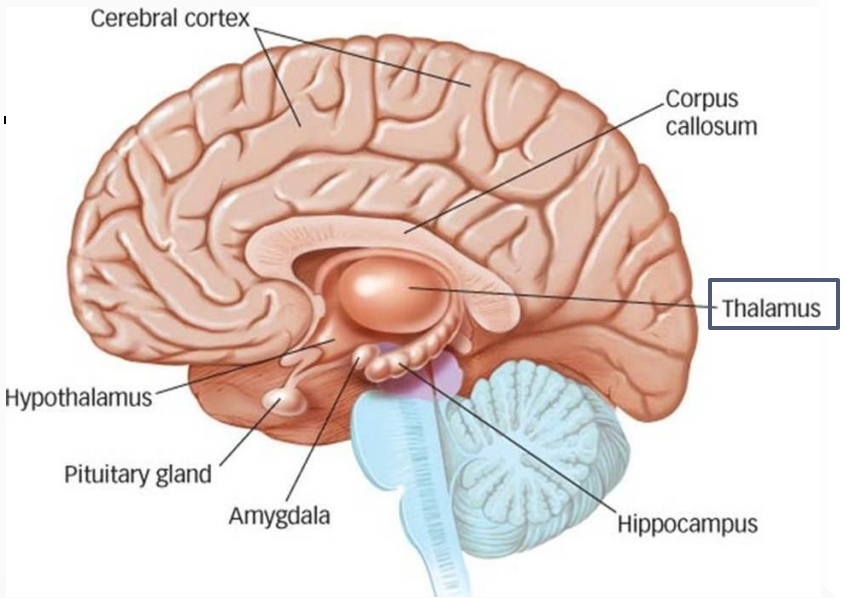
When the SN is silent, the body is in a passive state.

In autism, it appears that the SN is firing more than it should. This impacts their ability to exert control over their bodies.



# THE STORY OF AUTISM: Impact of Deep Brain Structures

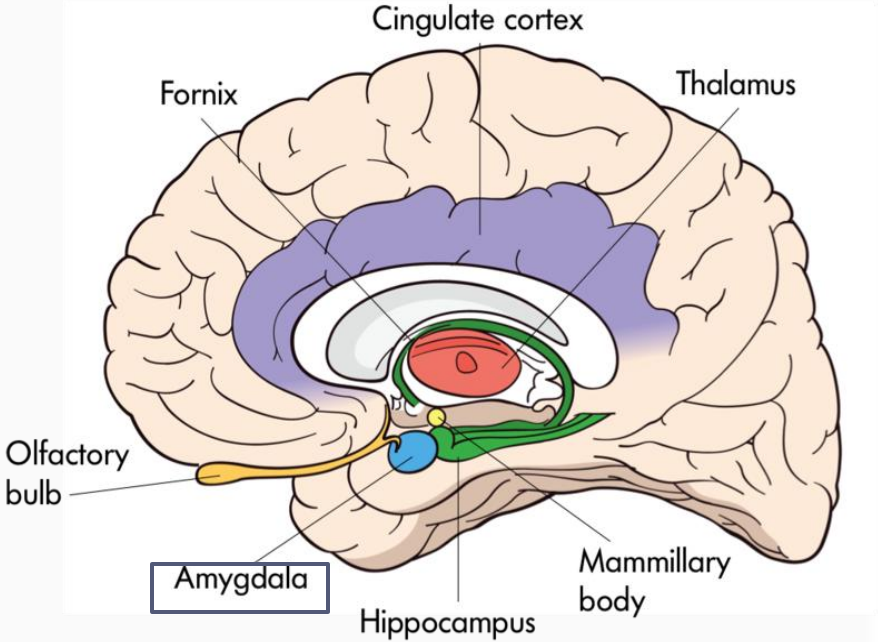
The **thalamus is the central relay station for all sensory motor information** in the brain. All incoming and outgoing information from the brainstem and cerebellum to the cerebral cortex must pass through it.



# THE STORY OF AUTISM: Impact of Deep Brain Structures

There are two more deep brain, **limbic structures** I want to touch on that have a bearing on autism.

The first is the **amygdala**. This structure controls our aggression and emotions.



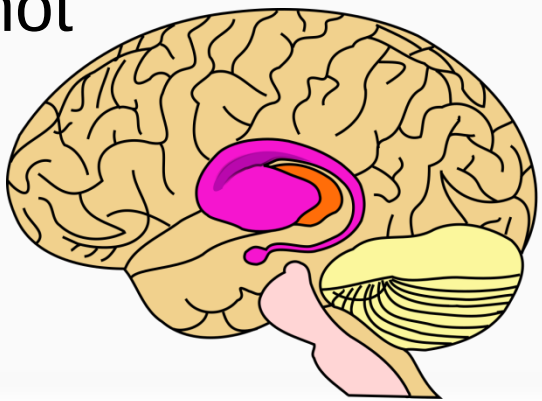
# THE STORY OF AUTISM: Impact of Deep Brain Structures

Many autistic individuals are aggressive towards themselves or others. Then, there are others who are extremely passive. There are also many who appear emotionless or whose demeanor is essentially flat, even though we know they have very strong feelings.

# THE STORY OF AUTISM: Impact of Deep Brain Structures

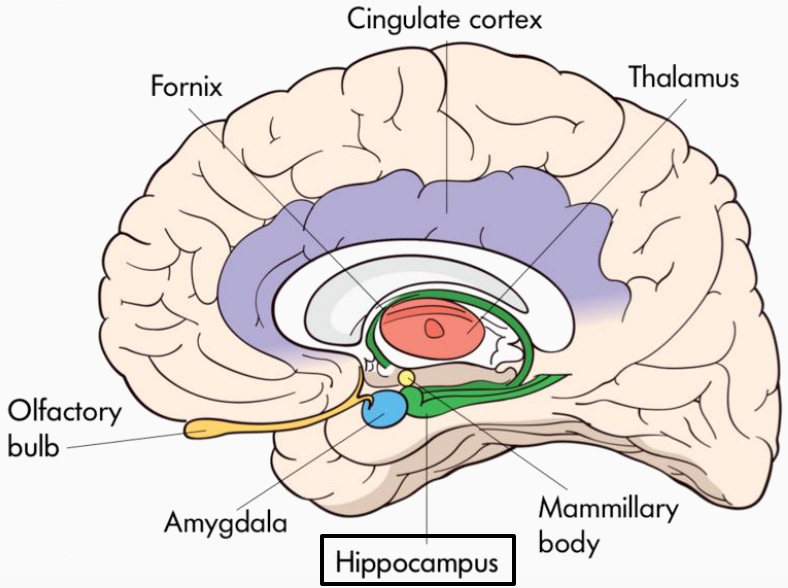
Animals who have had their amygdalas removed or damaged exhibit autistic-like behaviors, such as social withdrawal, OCD, failure to appreciate danger and difficulty adjusting to new places and/ or situations.

This indicates that the amygdala is not functioning as it should in autism.



# THE STORY OF AUTISM: Impact of Deep Brain Structures

Another **limbic system** structure that has implications for autism is the **hippocampus**. This structure is important for learning and memory; primarily for turning
short-term memories
into long-term memories.



# THE STORY OF AUTISM: Impact of Deep Brain Structures

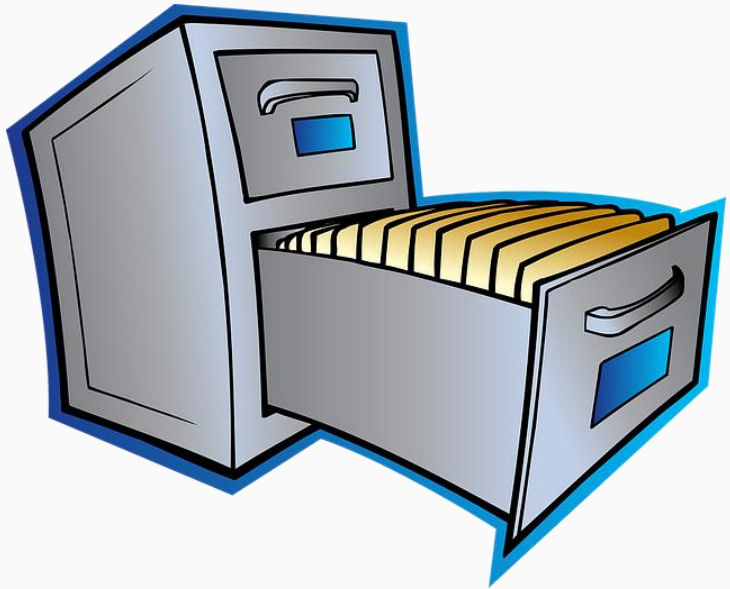
The hippocampus also plays an important **role in vision. It determines the salience or significance attached to WHAT a person pays attention to**.

# THE STORY OF AUTISM: Impact of Deep Brain Structures

What you see is largely determined by previous experience or memories. In the case of autism, this sometimes translates to a narrow range of visual elements rather than the “big picture.”

# THE STORY OF AUTISM: Impact of Deep Brain Structures

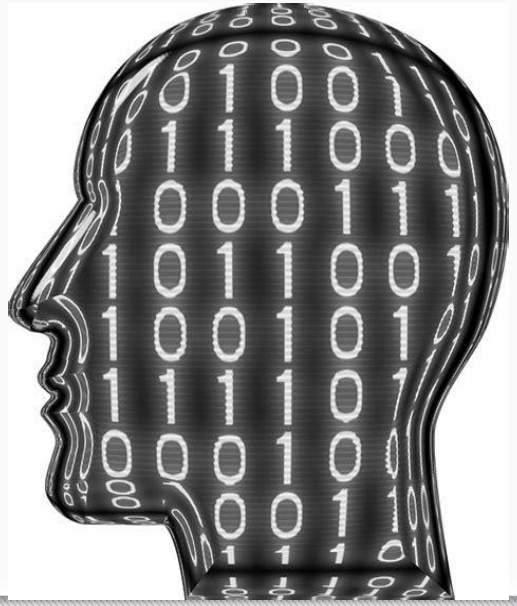
The hippocampus abnormality in autism is that **new learning is not always related to previously learned or stored information**. There appears to be no orderly system for categorizing or organizing the information they take in, which is why it often takes them a longer time to retrieve it and respond.



# THE STORY OF AUTISM: Impact of Deep Brain Structures

Animals who have had their hippocampus removed or damaged tend to display the same stereotypic, self-stimulatory behaviors as individuals with autism, along with the hyperactivity.

This indicates that the hippocampus not functioning as it should in ASD.



# THE STORY OF AUTISM: Impact of Deep Brain Structures

| Deep Brain Structures | Function in Typical Brains | Atypical Output of Cerebellum Due to Lack of Pruning and Unbalanced Purkinje Cell Firing |
|---|---|---|
| **Reticular Activating System** | Filters and prioritizes sensory information.<br><br>Modulates and dampens down sensory input. | Sensory input enters the cerebral cortex unfiltered and unprioritized.<br><br>No modulation = sensory overload. Often leads to shut down of one or more senses. |
| **Basal Ganglia** | Facilitates motor control – primarily intentional movement vs. impulsive movement. | Little or no impulse inhibition.<br><br>Feeling like you are a slave to your body. |

| Limbic System Structures | Function in Typical Brains | Atypical Output of Cerebellum Due to Lack of Pruning and Unbalanced Purkinje Cell Firing |
|---|---|---|
| **Amygdala** | Controls aggression and emotions.<br><br>Calms fear and anxiety. | Outbursts of aggression or extreme passivity.<br><br>Can appear emotionless or get emotions confused, such as crying when happy.<br><br>Social withdrawal, anxiety and OCD behaviors. |
| **Hippocampus** | Categorizes and organizes new information.<br><br>Role in formation of new and long term memories, determines stimulus salience. | No organization of information taken in, resulting in sensory overload and long retrieval time.<br><br>Stereotypic, self-stimulatory behaviors and hyperactivity. |

# GO ON TO THE NEXT PRESENTATION