What Brain Research Says About Learning
Brain-based or brain compatible learning is based on how research in neuroscience suggests our brain naturally learns best.
When you understand **how the memory works**.

You have the tools to improve your **job performance**, **school achievement**, and **personal success**.
Every brain is different
No brain is perfect
It is our responsibility to learn about ourselves and what gives us each a unique way of seeing the world
Your brain works on electrochemical energy and weighs approximately 3 pounds.

Size of fists together

More than 100 billion brain cells called neurons

Connections more important than number
In Fact, the Only Way We Learn

is by

MAKING CONNECTIONS
Neurons

Nucleus directs activity inside cell (electrical)

Axon sends messages to other cells (chemical)

Dendrites receives messages from other cells (chemical)
Neurotransmission

The transfer of a message from axon of one cell to the dendrite of another

Many connector points in both axon and dendrite so neuron receives and sends many messages at a time.

No contact made between from axons to dendrites

Communication through release of chemical substances into the spaces between the axon and dendrites

This space is known as the Synapse
Synaptic connections

Subject of much of current brain research

• Most learning and development occurs through the process of strengthening or weakening of these connections

• Each of hundred billion neurons may have 10,000 synaptic connections to other neurons

• Theoretical number of connections possible in a single brain is forty quadrillion.
Neurotransmitters

Carry information across synaptic clefts
- 53 known to date

Learning depends on the strength of the connection combined with the neurotransmitters

Brain changes its connective patterns every second in response to everything we perceive, think, or do.
Stimulus enters the brain through senses

Promptly processed by an electrical chemical reaction in a complex network of neurons.

Prioritized by value, meaning, and usefulness as well as how it relates to prior learning
Learning originates in concrete experience.
This is called experiential learning-- but that’s just the beginning.
Learning depends on experience, but requires reflection, developing abstractions, and actively testing abstractions.
Not like personal computer
- More like an ecosystem

Composed of maps--- arrays of neurons that apparently represent objects of perception or cognition

- color, texture, credibility or speed

Most cognitive functions involve the interaction of maps from many different parts at once
Memory is not stored in one place in the brain, bits and pieces of memory are stored in various functional areas – neuroscientists are beginning to map the different parts of the brain where memory resides.
The brain *assembles perceptions* by simultaneous interaction of *whole concepts, whole images*

Rather than logic of microchip, the brain is an *analog processor*

Works through *analogy* and *metaphor*

Relates *whole concepts* to one another

Looks for *similarities* and *differences* or *relationships* between them
If we learn new material by making connections to what we already know - by trying to figure out what it’s like, let’s try that with what we just covered.

Neurons are like ___________________________ in that they ________________________________.

The Nucleus is like ___________________________ in that it ________________________________

Axons are like _______________________________ in that they ______________________________

Dendrites are like _______________________________ in that they ______________________________

Groups--each group responsible for one.
Groups keep same color and try one more.

**Synapses** are like_____________________________
in that they________________________________________

**Neurotransmitters** are like_____________________________
in that they________________________________________

**The connections made** are like_____________________________
in that they________________________________________

**Learning** is  like_____________________________
in that it________________________________________
Your brain is exposed to billions of bits of information every second but is not equipped to handle that much. Filters are necessary to control the flow of information to approximately 2,000 bits of information a second.
New information enters the brain through the senses and is routed either to the prefrontal cortex (the thinking brain) where you can consciously process and think about that information

Or
to the lower automatic brain (the reactive brain) which instinctively reacts to information without thinking it through by ignoring it, fighting against it, or avoiding it.
If information ends up in the reactive brain, you probably won’t remember it at all.
With focus, you can actually control where new information goes and direct it to the prefrontal cortex.
Three major brain elements that control where new information goes are the reticular activating system, the limbic system and the neurotransmitter dopamine.
Activity

Before we talk about the RAS

Spend ten seconds (and only ten seconds!) looking around you, trying to find all of the red objects you can see.
Now, try and answer this question: How many blue objects are there around you?

Can you explain what happened?
The first filter information from your senses passes through is the reticular activating system (RAS). If you focus enough on what is most valuable, relevant and important, the information goes to your thinking brain.
If you are tired, bored, anxious or overwhelmed, it is sent to the reactive brain.
When new information gets through the RAS, it must then pass through the limbic system, the emotional core of your brain. Here the amygdala and the hippocampus determine where information brought in by the senses goes.
The **amygdala** makes routing decisions based on **emotions**. If you experience negative emotions like fear, anxiety or even boredom, the **amygdala essentially blocks entry to the prefrontal cortex**.
Next to the amygdala in the limbic system is the **hippocampus**. It is the hippocampus that links the new sensory input to memories of your past and knowledge that is already stored in your long term memory to make relational memories.
These relational memories are ready for processing in your prefrontal cortex.
The prefrontal cortex is where executive functions such as judgment, analysis, synthesis, organizing, problem solving, planning, creativity and impulse control take place.
Executive function networks can convert short term memory into long term memory. When you are focused and in a positive emotional state, your executive functions organize newly coded information into long-term knowledge.
Memory Principles are strategies developed from brain research--

--So that you can learn the way the brain naturally learns.