

NEURODEVELOPMENTAL
INTERVENTIONS & ITS IMPACT ON
SERVICES TO PERSONS WHO ARE
DISABLED

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NEURODEVELOPMENTAL INTERVENTIONS AND THE
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- The most exciting and productive research in disability services is neuroscience studies of the brain.
- No matter what the diagnosis is of your clients, the one thing we are all working with is the human brain. The diagnosis is a label, but the brain is unique and growing with every person...forever.
- We now know that the brain continues to develop across the lifespan of the individual.
- My task is to try to interpret the new findings in brain study and apply them to services with persons who are disabled.

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IMPACT ON SERVICES TO PERSONS WHO ARE DISABLED

- There are 3 terms I would like to review with you and ask that you learn more about them beyond this short presentation:
- 1. NEUROPLASTICITY
- 2. NEUROGENESIS
- 3. AUTONOMIC NERVOUS SYSTEM

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- Neuroplasticity means flexible. The plastic part of the word means that is it pliable or can change. Of course the Neuro part of the word means that is relates to the brain.
- Neuroplasticity means that the brain has the power to redirect where growth, development, maturation, and function happens. It used to be (and was how I was trained) that you were born with all the brain cells you would ever have (WRONG!). And that as you aged, your brain lost brain cells so there was a slow decline of your brain's ability. (WRONG!...again).
- Interestingly, the first studies along this line were in the field of visual impairment.

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IMPACT ON SERVICES TO PERSONS WHO ARE DISABLED

- In studying how vision was processed, researchers back in 1958 (Hubel and Wiesel) found that when one eye of a kitten was closed at birth, the other eye used that part of the brain that would have stored visual information. In other words, the brain would use parts of the brain that were not used as intended.
- What this means is that if the brain has areas not being used, it will use it for other things. This is what plasticity means. So if the brain needs space, it will use unused space.
- When I was trained, back in the 1950s, we were told that the brain was like a telephone system. Each part was “wired” to do only one thing and one thing only. (WRONG !)



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IMPACT ON SERVICES TO PERSONS WHO ARE DISABLED

• Neuroplasticity



- Why is it so that the brain can use space and is not “wired” to only do one thing?

- The brain is pre-determined to accomplish two tasks:

– The brain seeks to SURVIVE

– The brain seeks to CONTINUE THE SPECIES

NEURODEVELOPMENTAL INTERVENTIONS AND THE
IMPACT ON SERVICES TO PERSONS WHO ARE DISABLED

- So, the brain must use what it has to accomplish what it needs to do to meet its reason for being.



- Our task is to learn how to work with the neuroplasticity of the brain to help it reach its goals of surviving and using all its space and resources.

- NEUROGENESIS the genesis part of that word means “beginnings” just like in the Bible.

- The neuro part of that word means brain.

- So, neurogenesis means the beginning of the brain in terms of cell development, growth, and use.

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IMPACT ON SERVICES TO PERSONS WHO ARE DISABLED

• Neurogenesis

- The research is finding that the brain continues to make new brain cells all throughout life.



- This means that we do not have all the brain cells we will have when we are born.

- The brain continues to make new cells and to make new connections (synapse) that allow our brains to change, develop, and function throughout life.

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IMPACT ON SERVICES TO PERSONS WHO ARE DISABLED

- As early as 1962, Joseph Altman demonstrated that the adult human brain generated new brain cells (glia cells, neurons, astrocytes).

- Think about Representative Gabby Gifford who was shot in the head. The bullet went through her skull just above the left eye and went out of her skull just above her right ear. Yet she survived and is making progress in regaining speech, ambulation, and thinking.

- This is because medical interventions stopped brain swelling after the bullet left the skull and immediate treatments were started to maintain current functioning.

- She will always have the remains of the shooting but she is slowly recovering far more than she would have even 20 years ago.

NEURODEVELOPMENTAL INTERVENTIONS AND THE
IMPACT ON SERVICES TO PERSONS WHO ARE DISABLED

- What we are NOT doing is applying the same knowledge to disability services as we are to the general population.

- Do you as a provider expect your adults with disabilities to learn, make progress, become more independent?

- Granted that you do, do you know how to do that? Do you know how to apply neuroscience to your clients' IP's/IPP's, their programs, and their future?

- I would like to share with you how to bring neuroscience into your practice.

- I would like to help you learn how to APPEAL TO THE HUMAN BRAIN TO HELP IT CONTINUE ITS ROAD TO SURVIVING

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IMPACT ON SERVICES TO PERSONS WHO ARE DISABLED

- First of all, let's get a picture of the brain and then learn something about how to join with it and go where it wants to go. Then we can shape these patterns of brain behavior into socially appropriate patterns to improve function, socialization, and behavioral control.

- On your paper (use the handout if you need to), I want you to draw a stack of 3 boxes one on top of the other. Make them large enough you can write inside them or at least leave enough space you can make notes about each box even outside the box.

- The lowest box is labeled the Brain Stem (*reptilian brain*), the middle box is labeled the Middle Brain (*the mammalian brain*) and the top box is labeled the New Brain (*or Neocortex brain*).

A BRAIN MODEL



- The brain grows and develops from bottom to top, from back to front, and from right side to left side (that is the right hemisphere to the left hemisphere).
- The old brain stem is where the spinal cord enters from the spinal column into the brain itself.
- In the old brain stem and midbrain, neurotransmitters are manufactured and released. These are the brain's messengers that allow cells to communicate:
 - **Serotonin:** modulates anxiety, moods, sleep, appetites
 - **Norepinephrine:** influences sleep, stress responses, fight or flight, alertness
 - **Dopamine:** body movements, motivation, rewards, reinforcements, addictive behaviors, and in theory psychotic conditions.
 - **Epinephrine:** From the adrenal system but is used in by the brain for stress
 - **Acetylcholine:** muscle activation, learning and memory (maybe Alzheimer's)

A BRAIN MODEL

- The old part of the brain model is very primitive. It does not think in language. That requires a more developed and sophisticated part of the brain.
- Focuses on survival, being safe, impulses, aggressiveness and being fearful
- Mainly the old brain feeds up to the next "box" the Middle Brain. Don't confuse the Middle Brain of this model of the Midbrain that is listed in anatomy pictures. The Midbrain is part of the first "box" the Old Brain.
- The Middle Brain (*or the mammalian brain*) is the emotional brain. It is where the neurotransmitters are released and sent out to all parts of the Nervous System.
- The Middle Brain is like an Air Traffic Controller. It sorts messages, sends them out, receives messages back and coordinates motor movements and very key components: *Hippocampus, Amygdala, and Hypothalamus* are key parts of this very complex part of the brain.

A BRAIN MODEL



- In this part of the brain very important functions take place. This is where memories become based upon language. So, while the older part of the brain (*the survival part that manufactures neurotransmitters*) is concerned with survival, fight or flight, or seeking; *the mammalian brain* is concerned with action, doing, thinking, developing communication (*both chemical communications and language communication*).
- The most advanced part of this mammalian brain is the *Limbic System* that links older parts to newer parts through nerve connections, electrical signals, as well as neural connections. *Limbic* comes from the Latin word for "border" meaning that it borders on older parts of the brain and newer parts of the brain.

A BRAIN MODEL

- This part of the brain is so important to motor movements, learning, memory development, and interacting with others that is cannot be covered totally in this short lecture. Please refer to more lengthy sources (*The Dragons of Eden* by Carl Sagan, *The Synaptic Self* by Joseph Le Doux, *The New Brain* by Richard Restak or *Rewire Your Brain* by John Arden).
- Understanding the structures of the brain is important, but in terms of working with persons who are disabled, the real focus is on how does this structure we call a brain impact on persons who are disabled?
- The first step in understanding that is *to learn to observe behavior*
- The brain is telling us constantly what it wants to do, we have to learn to observe the message, behaviors, and content of the brain's communication. **IT MAY COMMUNICATE VERBALLY OR BEHAVIORALLY.** Both are important.

STRATEGIES FOR INTERVENTIONS

- Let me introduce you to another goal of this presentation: The Autonomic Nervous System
- The Autonomic Nervous System is very old and very independent. It is automatic. It sometimes is that part of the brain that has its own brain. Think about that for a minute.
- It actually is found in all 3 boxes of our Brain Model. It starts in the oldest part of the brain, is very critical in the *mammalian* part of the brain and continues even when the higher *neocortical brain* is working.
- Again, there are 3 parts of this Nervous System (as compared to the Central Nervous System that consists of the spinal cord and brain).

STRATEGIES FOR INTERVENTIONS

- The Sympathetic Nervous system consists of those survival parts we have identified as being in the older part and the limbic part of the *reptilian and mammalian brain* components.
 - The Sympathetic Nervous System is the alerting part of the Autonomic Nervous System. It increases behaviors. Included in the Sympathetic Nervous System are:
 - Aggressive behaviors
 - Fight or Flight
 - Alertness
 - Movement (*running away, leaving, hiding*)
 - Vigilance (*watching out, being cautious in new settings*)
- In the areas of developmental delays the SNS is seen as the struggle for the brain to find stimulation, to resist rest, and to act.

STRATEGIES FOR INTERVENTIONS

- The **Parasympathetic Nervous System (PNS)** is the calming component of the Autonomic Nervous System.
- It brings the brain down from action
- It calms the body
- It allows the brain to “shift” gears to go to sleep
- It allows the brain to rest the body
- It allows the brain to monitor what is happening without actions (observing)
- This system is very important in helping persons with developmental delays because it allows a person to observe, organize, and process information
- It allows the person to use various types of memory (working memory, short term memory, long term memory, proprioceptive memory)
- Non-verbal interventions seem to appeal to the brain to activate and use the Parasympathetic Nervous System



STRATEGIES FOR INTERVENTIONS

- The **Enteric Nervous System** is involved in:
 - Biting
 - Chewing
 - Swallowing
 - Breaking down (*digesting*)
 - Eliminating (*bowel and bladder control*)
- It is the Autonomic Nervous System that controls the sphincters of the bowel and bladder. Until these sphincters are mature enough to release and close it is impossible to address toilet training.



STRATEGIES FOR INTERVENTIONS

KEY IMPLICATIONS FOR WORKING WITH A PERSON WHO HAS DEVELOPMENTAL DELAYS:

1. The approach is to appeal to the brain to allow the provider to join with where the brain is and let it take us where it wants to do.
2. Persons with disabilities have “a longer growing season.”
3. By appealing to the brain (and not the label) interventions require 10,000 repetitions to activate neuroplasticity to create new behavior patterns.
4. All persons learn. Persons with IDD learn by drill and repetition to move information along the memory building process (working, short, long, proprioceptive). Once learned it remains forever.

