



Auditory Brain Development: The Foundation of Spoken Communication and Literacy for All Children

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Family's Desired Outcome

- The family's desired outcome guides us – ethically and legally.
- ◆ What is your long term goal for your child?
- ◆ Where do you want your child to be at age 3, 5, 14, 20?
- What does it take to get there?
- *95% of children with hearing loss are born to hearing and speaking families.*
- 21% of US citizens speak a language other than English at home. About 400 languages are spoken in the US. More than ½ the world's population is bilingual.
- This talk is all about the **context** of service delivery and professional collaboration if the family chooses listening and talking for **today's child** who is deaf or hard of hearing.

Main Ideas

- Hearing is a first-order event for the development of spoken communication and literacy skills.
- Anytime the word “hearing” is used, think “auditory brain development”!!
- Acoustic accessibility of *intelligible* spoken language is essential for brain growth – **no “earlids”**.
- Signal-to-Noise Ratio is the key to hearing intelligible auditory information – speech must be 10 times louder than background sounds. Download **SLM APP on iPhones or Tablets**
- ***Our early intervention programs must take into consideration the baby’s brain access of acoustic/linguistic information.***

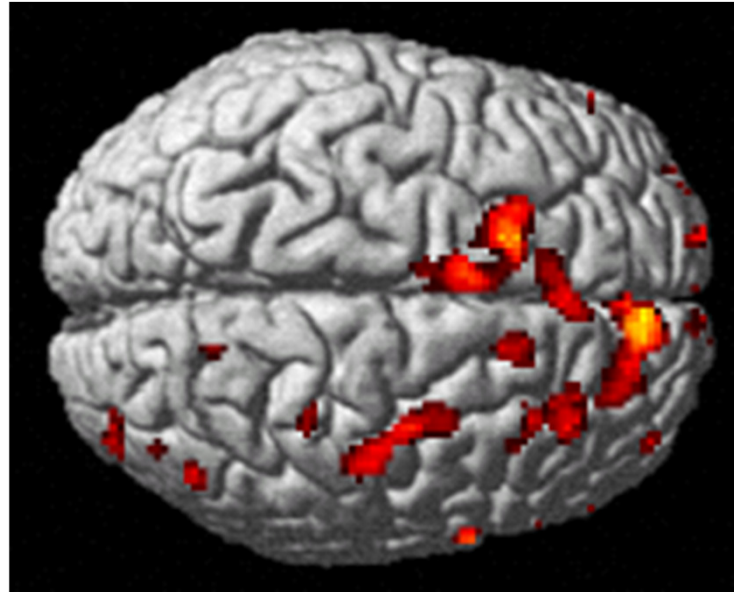
Think about Hearing Loss as a “Doorway” Problem

- The ear is the “doorway to the brain” for sound/auditory information.
- Hearing loss of any type and degree obstructs that doorway, preventing sound/auditory information from reaching the brain.
- Hearing aids and cochlear implants break through the doorway to allow brain access, stimulation, and development of auditory neural pathways with auditory language.



The purpose of technologies (e.g. hearing aids, cochlear implants) is to get sound -- auditory language information -- through the doorway to the brain.





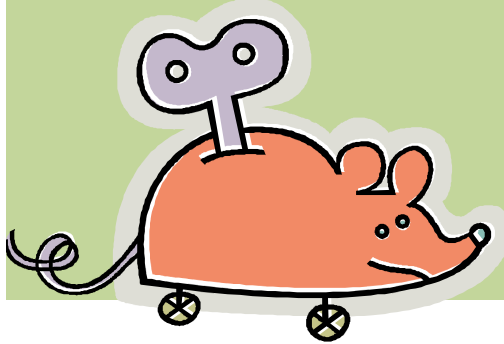
It's All About The Brain

Hearing loss is not about the ears; it's about the brain!

Hearing aids, FM systems and cochlear implants are not about the ears; they are about getting auditory information to the brain!

They are "Brain Access Tools."

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The Big Picture: The World Has Changed!

- *Who Moved my Cheese?* by Spencer Johnson, M.D. – a book about change.
- We are an Information/Knowledge-based economy that demands high levels of spoken communication and literacy.
- We are educating children to take charge in the world of 2030, 2040, and 2050....not in the world of 1970 or 1990 or even 2016.

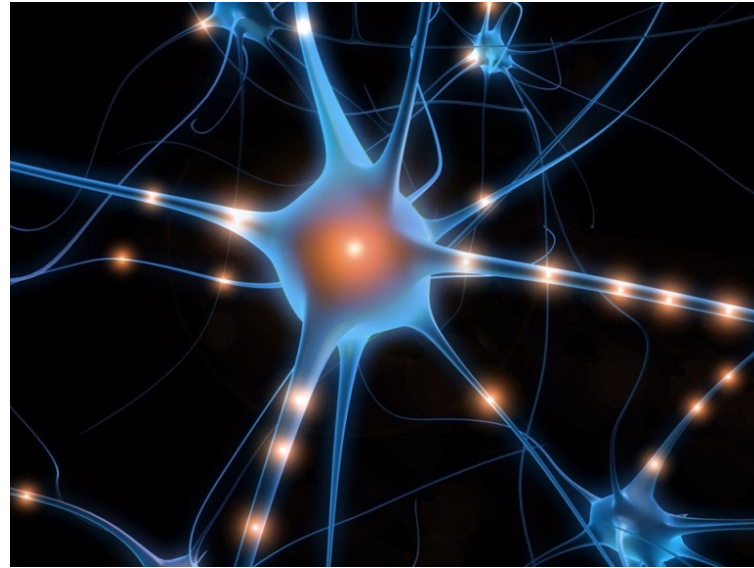
The World Has Changed For Hearing Loss, Too.



What Does “Deaf” Look Like in 2015?

- Does 2015 “Deaf” look like 1990 “Deaf”?
- We have used the same words for decades, but the context and possibilities have changed, dramatically!





New Brain Research

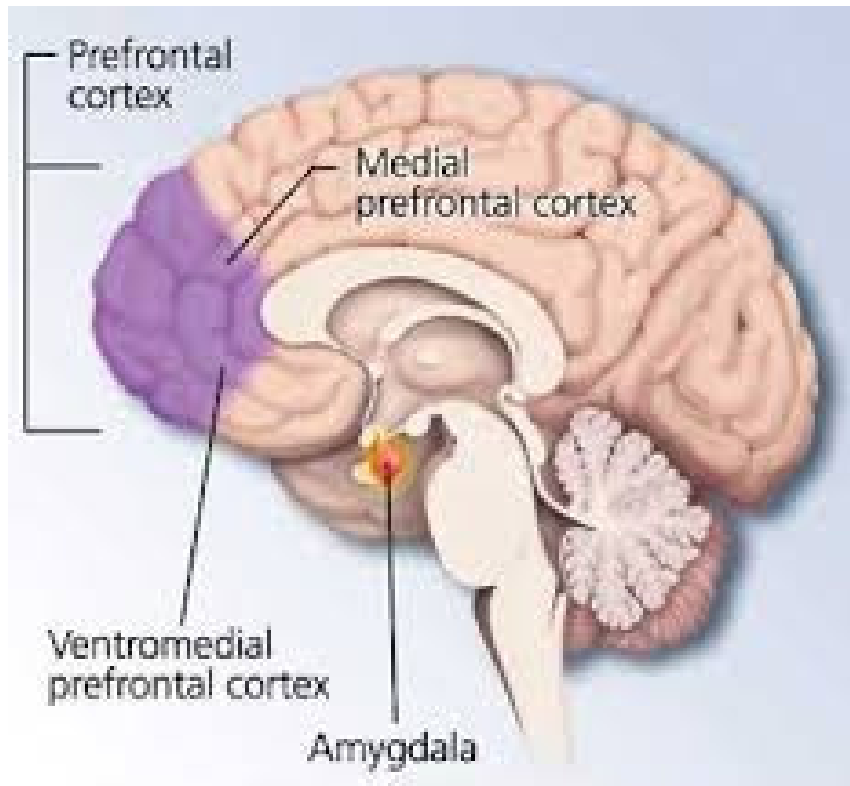
Basic neural research offers increasingly robust information about neural plasticity and about the necessity of accessing and stimulating auditory brain centers with auditory/linguistic information early and often.

There is a science behind our practice!

Neuroplasticity – Some Generalizations

- We are in a brain plasticity revolution -- much interest and attention – every parent knows their child has a brain.
- *Experience dependent plasticity: Repeated auditory stimulation leads to stronger neural connections. (Kilgard, 2006)"time on task"*
- Sensory experience directly shapes the rewiring that makes learning possible....especially guided neural reorganization. (Merzenich 2010)
- The skills and abilities that we develop are a product of our culture -- our exposure to information, our life experiences and our conversational practice – **“the brain is a cultural organ”**.
- Attention (pre-frontal cortex) plays a major role in activation of the auditory cortex. (Musiek, 2009)

Prefrontal Cortex



More Generalities

- The linguistic environment at home best predicts the child's language and IQ outcomes (Quittner et al 2013).
- Therefore, we need to increase a parent's talk time and turn-taking time.
- Talk helps children become smarter. Children are not born smart – they are made smart.
- Parents have the power to use their words to grow their children's brain and make them smarter (Project ASPIRE, 2013).
- Children must wear their technology every waking moment in order to develop their brains with knowledge.
- **Children speak what and how they hear!**

Infant Auditory/Linguistic Development (Golinkoff, 2014)

- At 4.5 months of age, babies recognize and prefer to listen to their own name.
- By six months of age, babies get the idea that things/objects/people have names.
- *Language is not about objects but about the relationship between objects.*
- *Babies learn words by noting the social intent of the speaker.*

Infant (Auditory-Verbal) Development

- If babies don't hear till they are one year of age, they need massive auditory input to make up for that deficit – do not delay getting auditory information to the brain – fit technology immediately!
- Specifically, babies need a great deal of conversation to extract social patterns and generate statistical probabilities of certain meaning units occurring.
- **How much parents converse with their child is the best predictor of the child's language competence, whether or not the child has a hearing loss.**

Therefore, Have Multiple and Ongoing Brain Talks with Families **because *Hearing Loss is a Neurobiological Emergency!***



Include multiple embedded “Brain Conversations” with the parent as part of audiologic/therapy/coaching sessions

- How is the brain impacted by technology?
- How is the brain impacted by reading to the child?
- How is the brain impacted by singing with the child?
- How is the brain impacted by structured activities?
- How is the brain impacted by informal conversations during daily routines?

How Much Practice is Needed to Influence Neural Structure?

- Malcolm Gladwell: 10,000 hours of practice
- Hart and Risley: 45 million words heard by age 4
- Dehaene: 20,000 hours of listening as a basis for reading
- Pittman: Children with hearing loss require three times the exposure to learn new words and concepts due to the reduced acoustic bandwidth caused by the hearing loss.



Therefore, early intervention is not about the child, it is about the family.

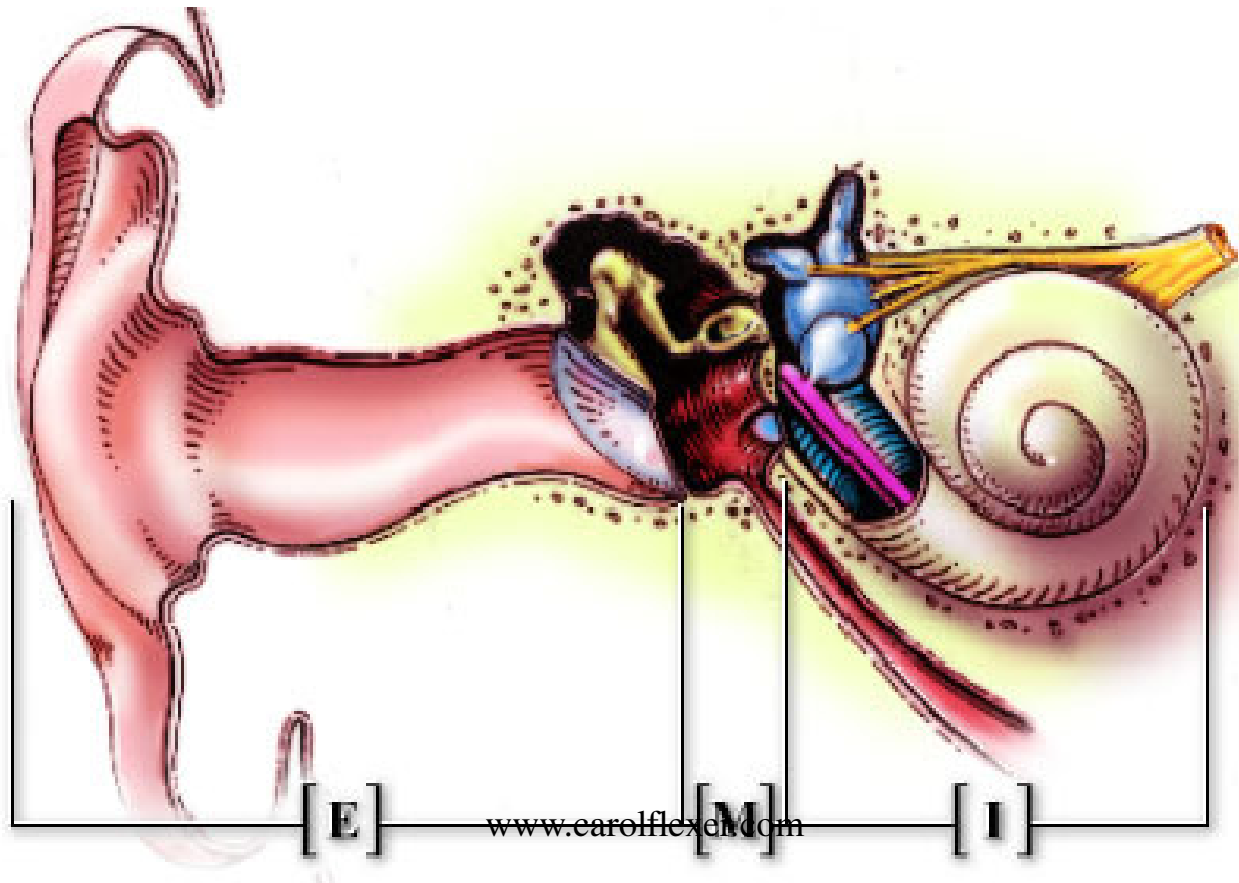
Think of early intervention as “adult education”.

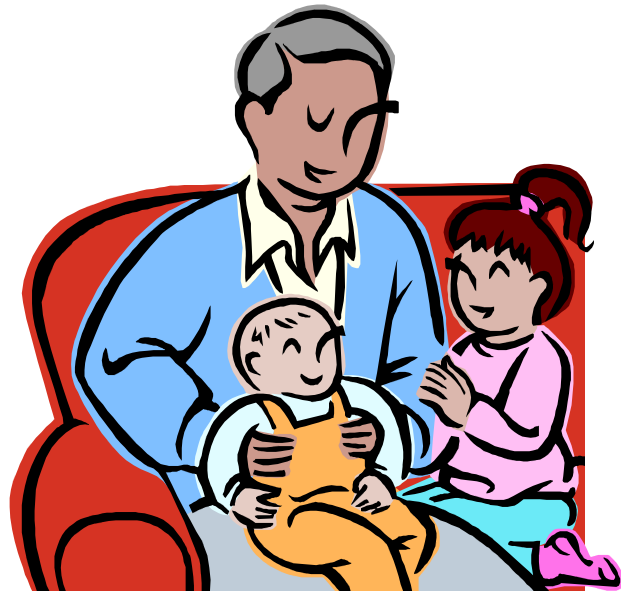


THE EAR

**First display a picture of the “Brain Ear”,
and then the more traditional picture of the
“doorway” ear, showing:**

Outer (external), Middle and Inner Ear

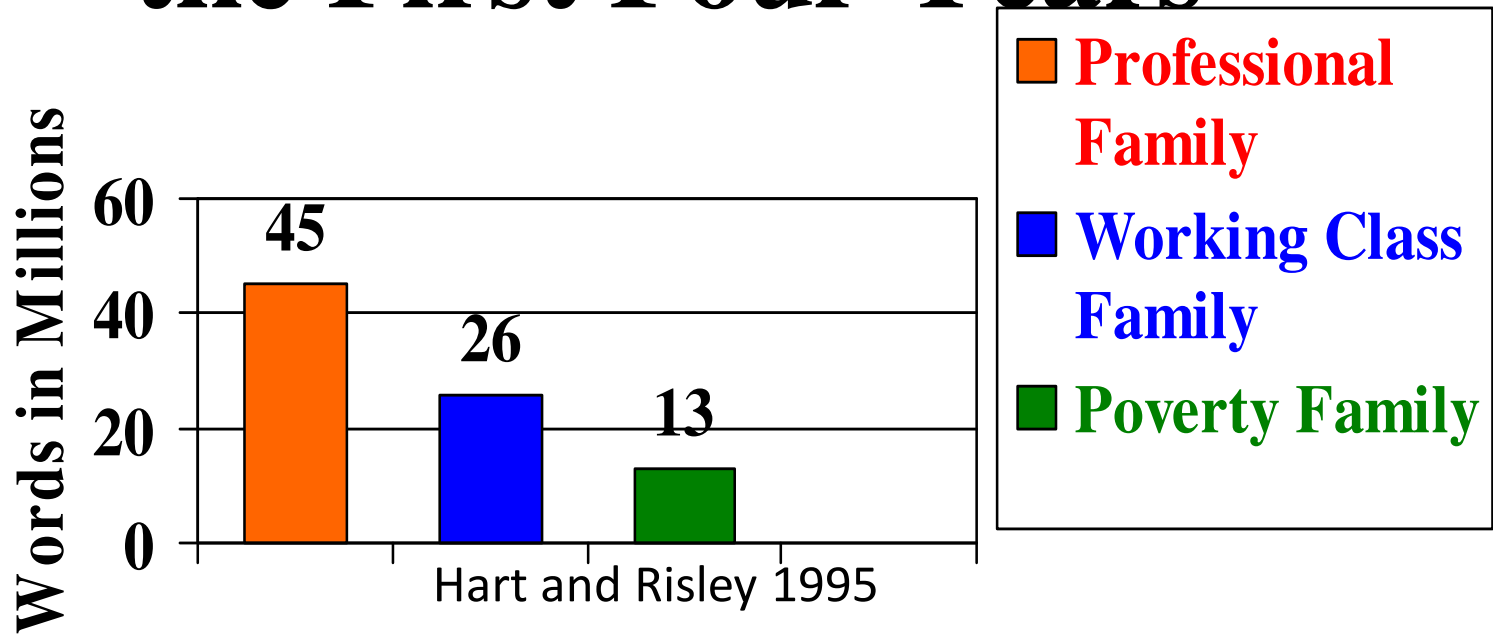




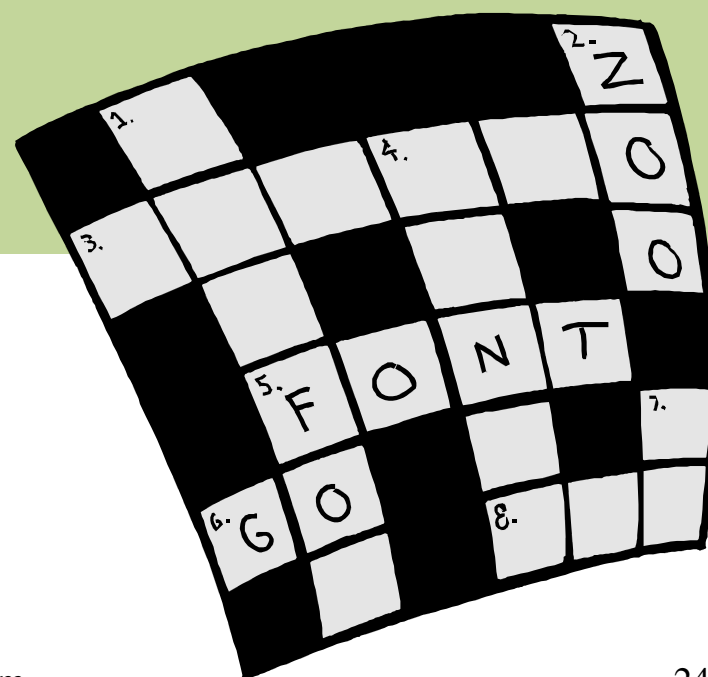
Key Study By Hart And Risley Showing How Much Auditory Information Is Needed

Meaningful Differences in the Everyday Experience of Young American Children

Cumulative Words Addressed to a Child in the First Four Years



Vocabulary is one of the biggest predictors of kindergarten success...therefore, early intervention is not about the child, it is about the family learning about vocabulary/information development.



Number of Words Understood by Typically Developing Children

<u>Age</u>	<u># of Words</u>
2	300 words
2.5	500 words
3	900 words
4	1,500 words
5	2,500 words
6	13,000 words
7	20,000 words

Numbers of Spoken English and Sign Language (ASL) Words

- The Second Edition of the 20-volume *Oxford English Dictionary* contains full entries for **171,476 words** in current use.
- Random House Webster's Unabridged Sign Language Dictionary (2008) by Elaine Costello, Ph.D. identifies **5,600 up-to-date signs** with full torso illustrations.

Work in Harmony with Our Organic Design

- Human beings are designed to listen and talk....if we do what it takes to develop their auditory brain centers with spoken language information!





Brain, Brain, Brain!!!

The purpose of hearing aids, cochlear implants, personal-worn FM, classroom FM and IR systems, and auditory-based intervention is to access, grow and develop auditory brain centers for language and literacy.

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Pediatric Audiology

Diagnosis, Technology, and Management

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Pediatric Audiology Casebook

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