



# Intervention Options: Informed Parents

## Rely on Informed Professionals



### Developing spoken language through listening

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# Learning Objectives



- **Neurological auditory development**
- **Language acquisition**
- **Auditory feedback loop**
- **Best practices in spoken language acquisition**
- **Resources for information**

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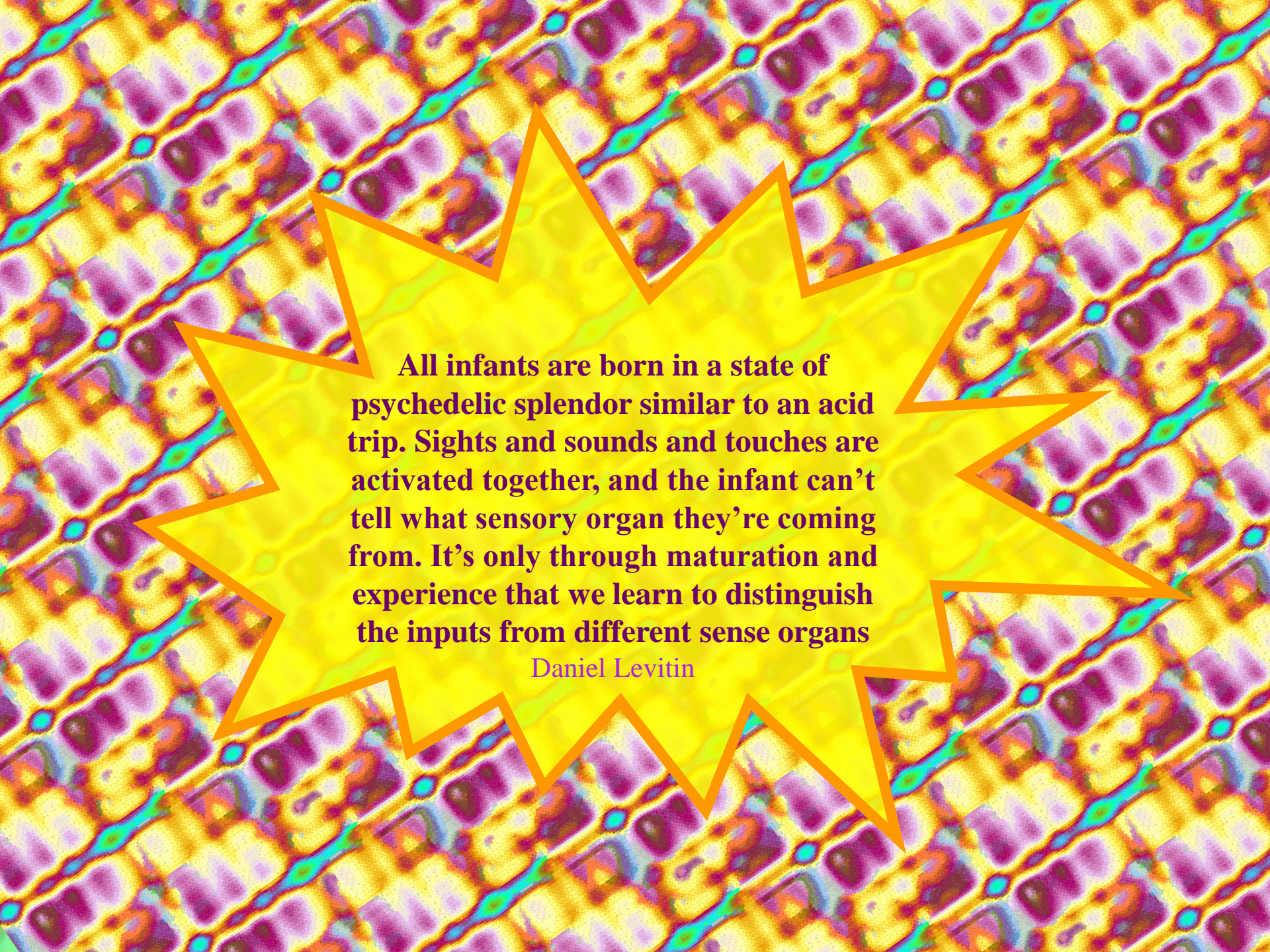
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# Why do families need a spoken language option?



- 9 out of 10 children who are born deaf are born to parents who can hear\*
- ~70% of families, when presented with all options, choose spoken language programs\*\*
- Residual hearing can be found in individuals with thresholds up to 105dB\*\*\*
- Unprecedented auditory access with today's technology\*\*\*\*
- Professionals need to have specialized knowledge and skill in developing listening and spoken language, not provided in traditional preparation programs\*\*\*\*\*

\*NIDCD, \*\*agbell.org, \*\*\*Lamore, et. al., \*\*\*\*Nevins, \*\*\*\*\*Cosby; Teller, et.al.



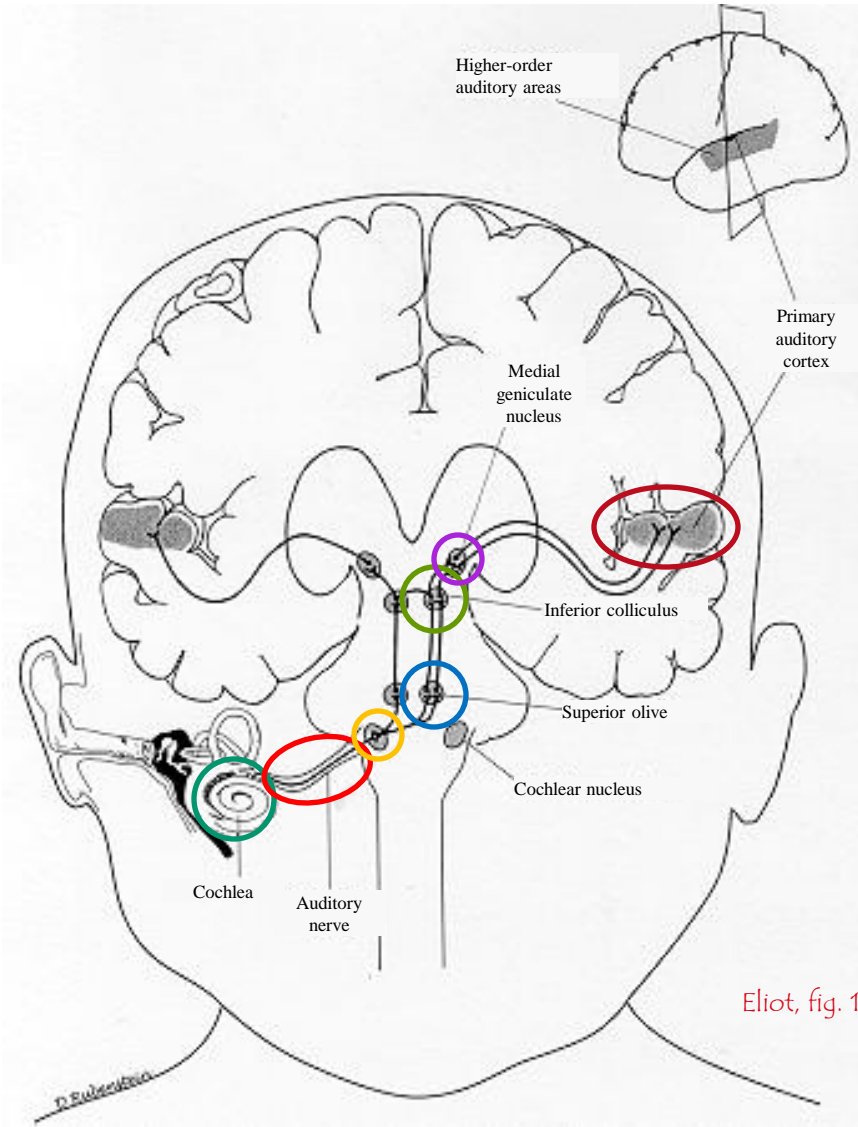
**All infants are born in a state of  
psychedelic splendor similar to an acid  
trip. Sights and sounds and touches are  
activated together, and the infant can't  
tell what sensory organ they're coming  
from. It's only through maturation and  
experience that we learn to distinguish  
the inputs from different sense organs**

Daniel Levitin

# Hearing



- How the Auditory System Develops
- What the Fetus Can Hear
- Prenatal Auditory Development

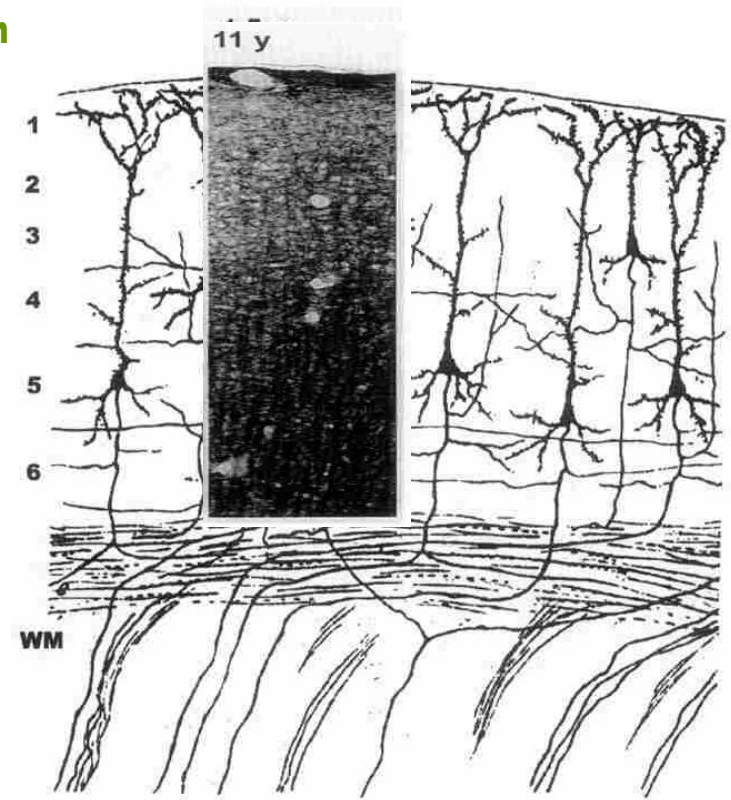


Eliot, fig. 10.2

# Maturation of Auditory Cortex



- **Perinatal Period** - 3<sup>rd</sup> trimester to 4<sup>th</sup> postnatal month
  - Layer 1 – Marginal Layer
  - Brainstem level of processing
- **Early Childhood** - 4.5 months to 5 years of age
  - Layers 4,5,6 – Deep axonal system
  - 4.5 months – 12 months of age
    - Axons begin radiating into deeper layers (4, 5, 6)
    - Shift to cortical level of processing
  - 12 months to 5 years of age
    - Axon network becomes denser
    - Onset and development of perceptual language
- **Late Childhood** - 5-12 years
  - Layers 2 & 3
  - Corticocortical connections
  - Inter- and intra-hemispheric networks



(Moore, 2002)



# Synaptogenesis



Newborn



3-month-old



2-year-old

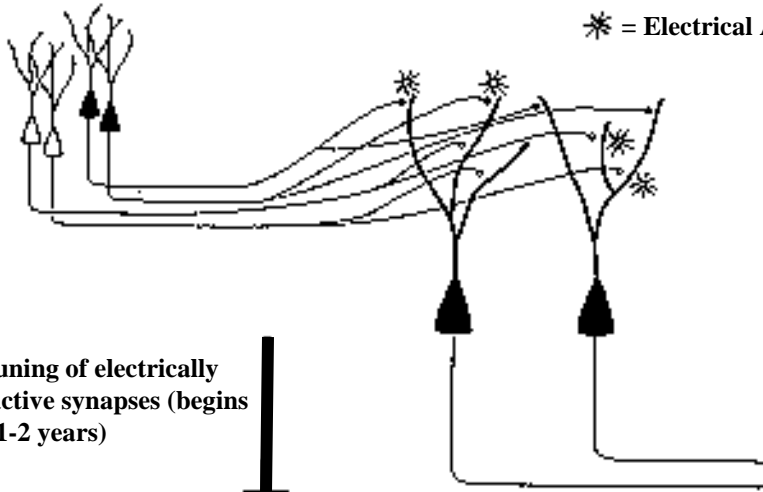
Eliot, fig. 2.6

# Exuberant Period vs. Pruning



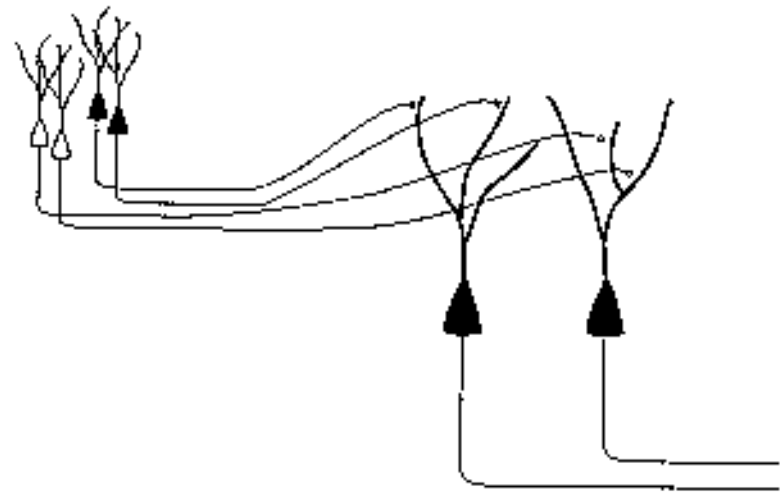
“Exuberant” period (1-8 years)

\* = Electrical Activity



Pruning of electrically inactive synapses (begins at 1-2 years)

Adult



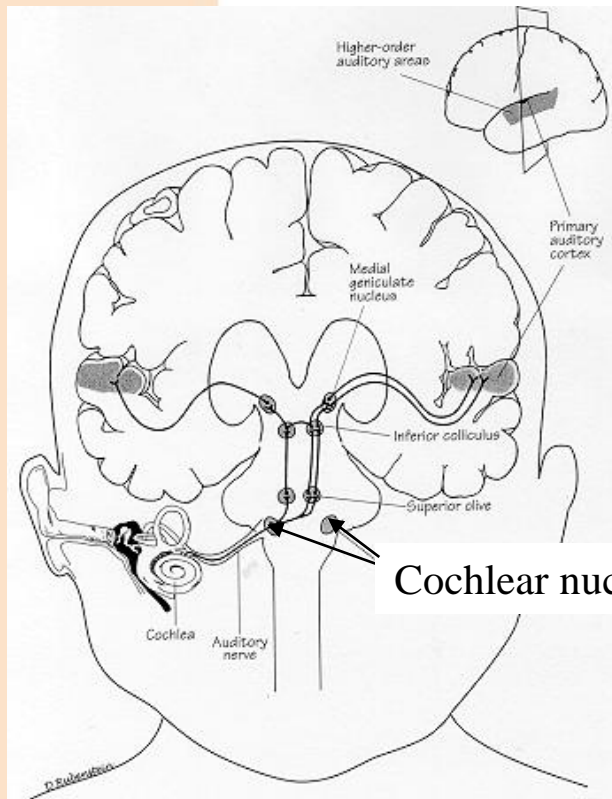
Eliot, fig. 2.7

# Hearing

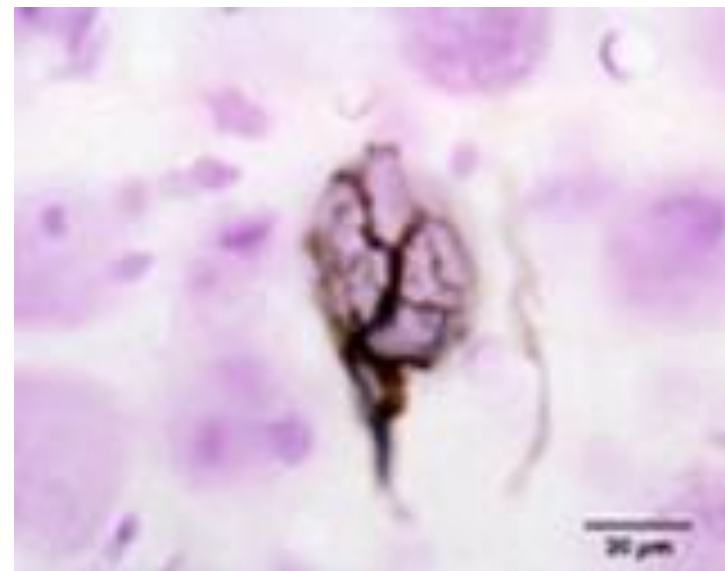


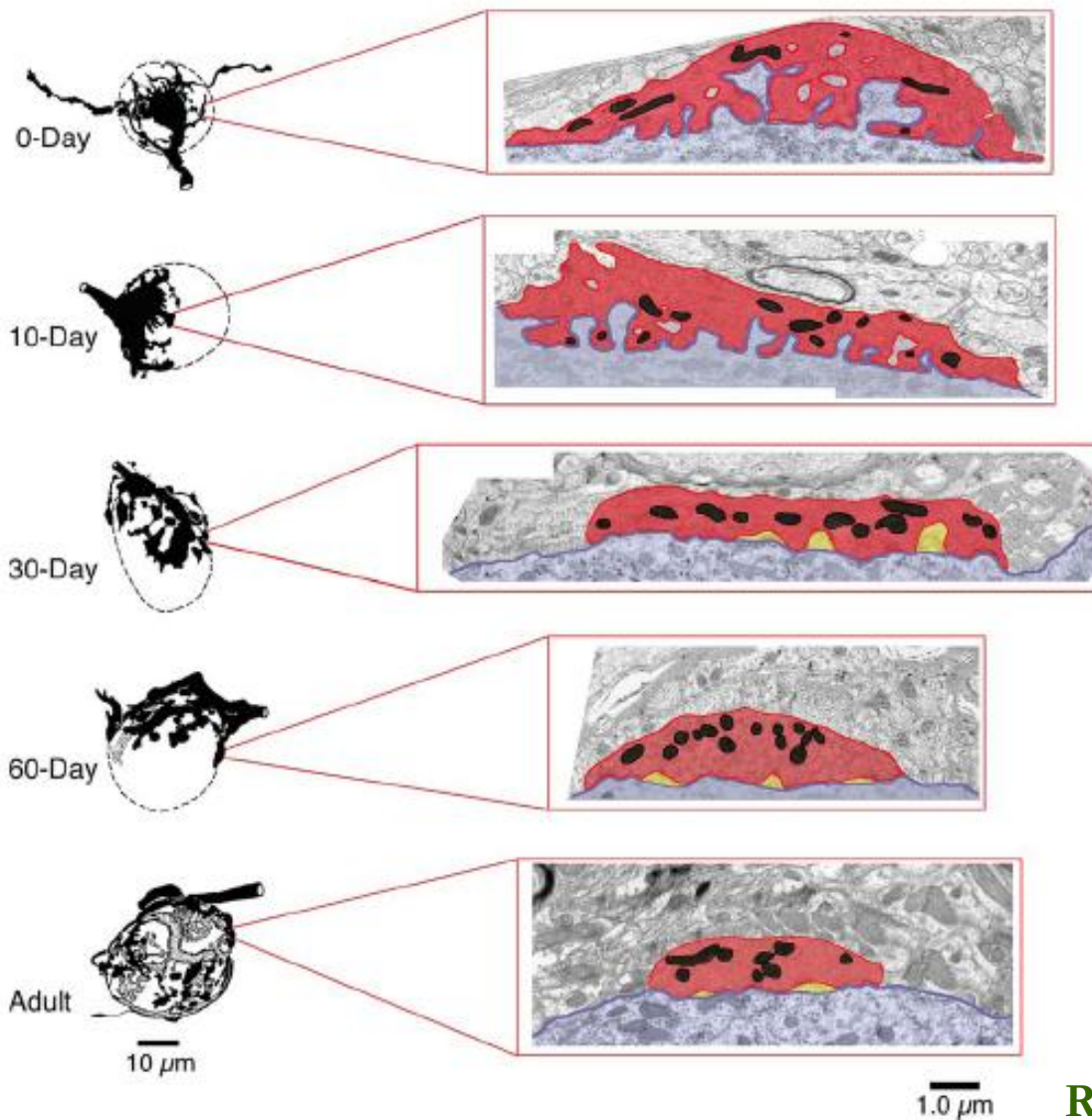
- **Effects of Reduced Stimulus**
  - no stimulus
  - diminished stimulus
- **Sensitive Periods**
  - For language development
  - for auditory development
- **Deafness**

# Endbulbs of Held



**RYUGO LAB**  
Auditory Anatomy  
& Physiology  
Center for Hearing and Balance  
Johns Hopkins University



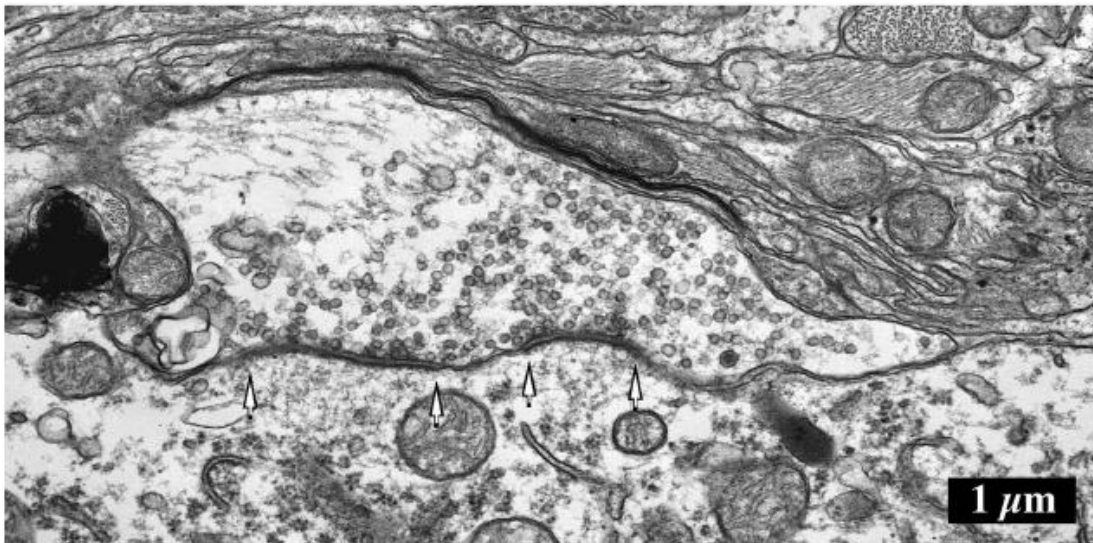
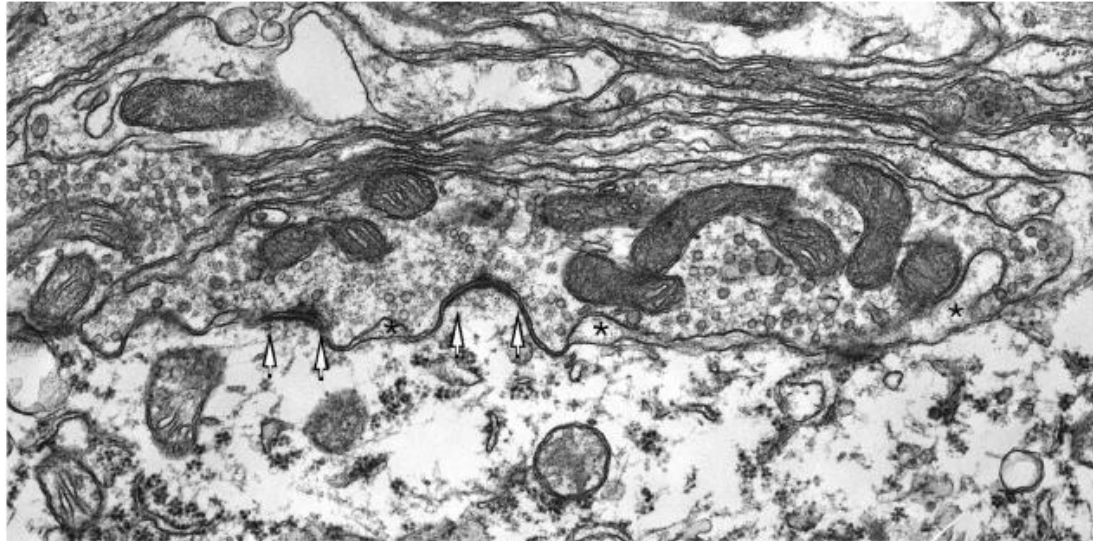


# **Patterns of stimulation alter synaptic connections**



**Auditory stimulation has direct physical effect on the anatomy of the central nervous system at the cellular level.**

# Cellular anatomy



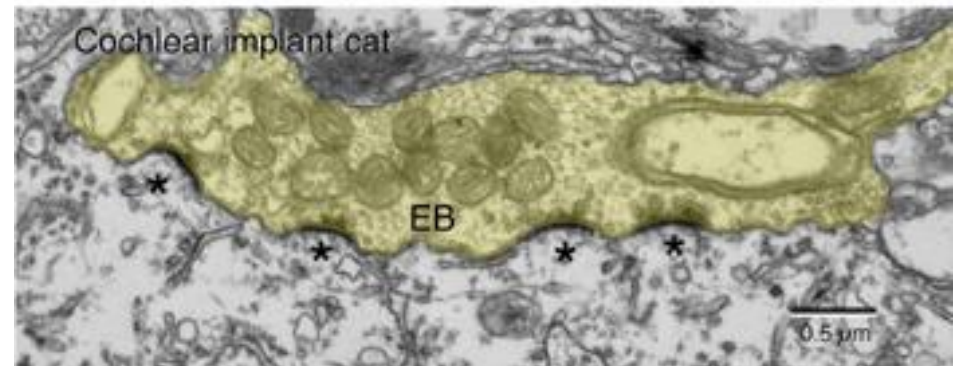
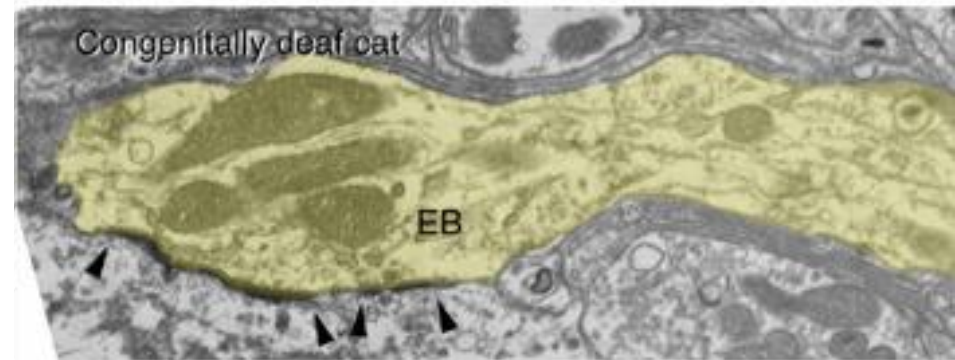
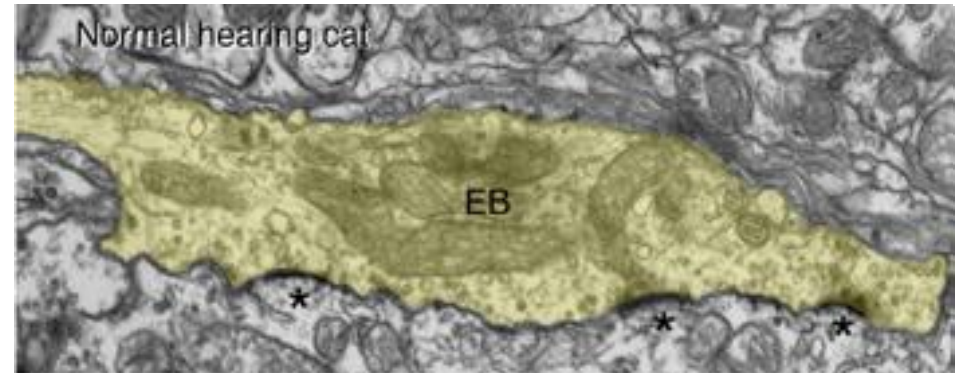
# **Patterns of stimulation alter synaptic connections**



**Lack of auditory stimulation has direct physical effect on the anatomy of the central nervous system at the cellular level.**



# Cochlear Implants



# **Patterns of stimulation alter synaptic connections**



**Introduction of auditory stimulation has direct physical effect on the anatomy of the central nervous system at the cellular level.**

# The Language Instinct

## *The Mind Creates Language*



*“People know how to talk in more or less the same [way] spiders know how to spin webs... because [spiders] have spider brains which give them the urge to spin and the competence to succeed”*

**Steven Pinker**



# Role of the Central Auditory System



**To establish a representation of the speech signal that is then available for perceptual or linguistic elaboration.**

**Phillips, 1998**



# **GIGO Theory**

## **(Garbage In - Garbage Out)**

**Unless the information carried from the ear to the brain is of high quality, the brain will be working with faulty input.**

# The Speech Chain

Did that sound the way I expected?

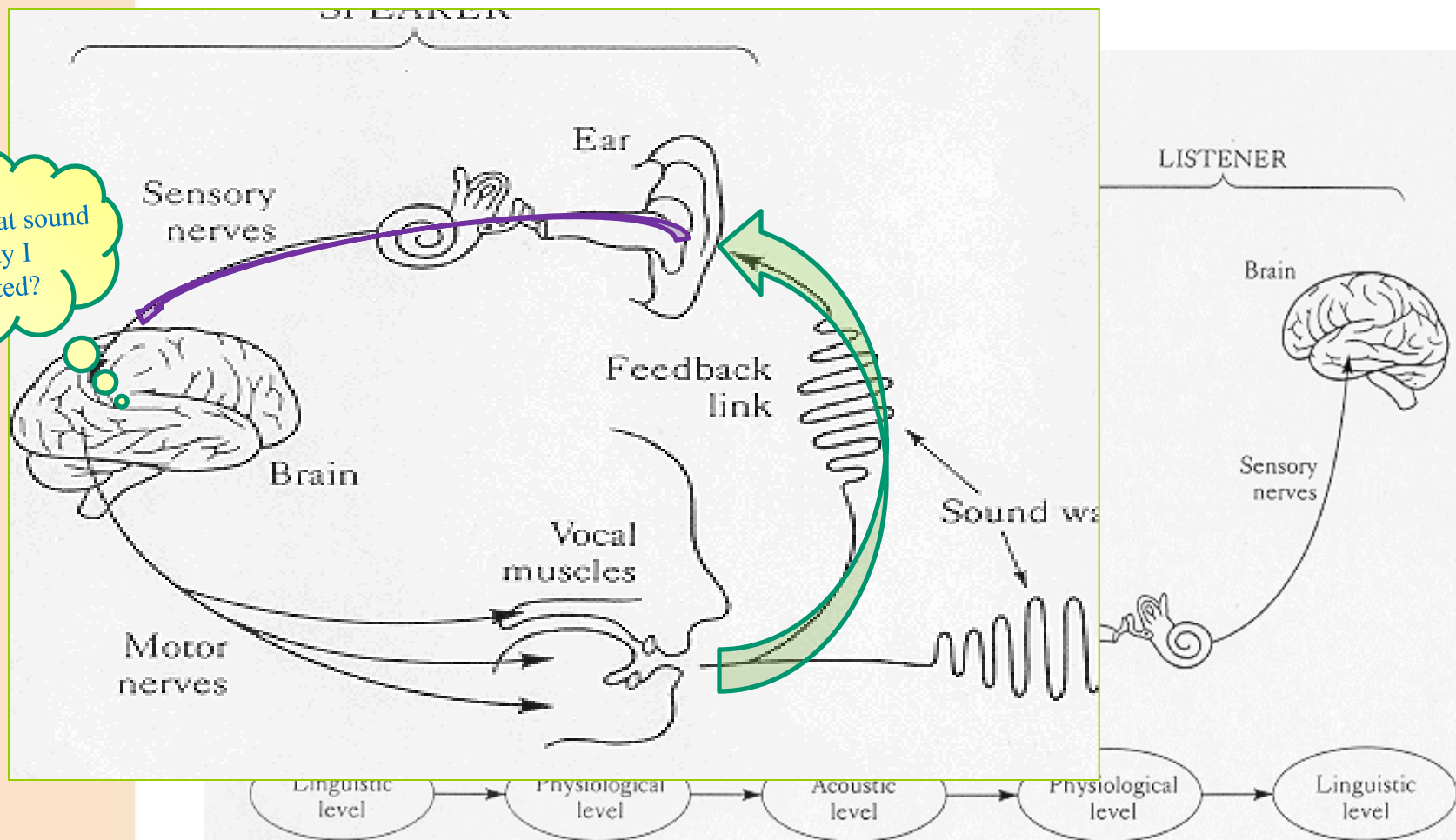


FIGURE 1.1 The speech chain: the different forms of a spoken message in its progress from the brain of the speaker to the brain of the listener.

# **Listening and Spoken Language: COMMUNICATIVE COMPETENCE**



## **The child will:**

- **Develop understanding through listening**
- **Establish audition to be as strong a sense as all others**
- **Become confident with his/her auditory sense**
- **Discover that his/her words have the power to change his/her world**

# Best Practices in Spoken Language Stimulation



## Strong tie between audition and language

- Establish and strengthen feedback loop
- Stimulate child's ear to listen for language
  - Auditory anticipation
  - Spontaneous alerting to sound
- Make auditory input meaningful
- Foster precision in speech perception and comprehension
  - Discourse tracking
  - Answer matching
- Reinforce reliance on auditory signal
  - Sabotage



# Best Practices in Spoken Language Stimulation



## Supportive Environment for Communication

- Ensure clear, complete and consistent sound
- Carryover goals in real-life situations
  - Auditory lessons + Auditory Experiences = Auditory Life
- Have appropriate expectations
- Set the stage to compel communication
  - Offer choices
  - Critical elements
- Make language use meaningful and rewarding

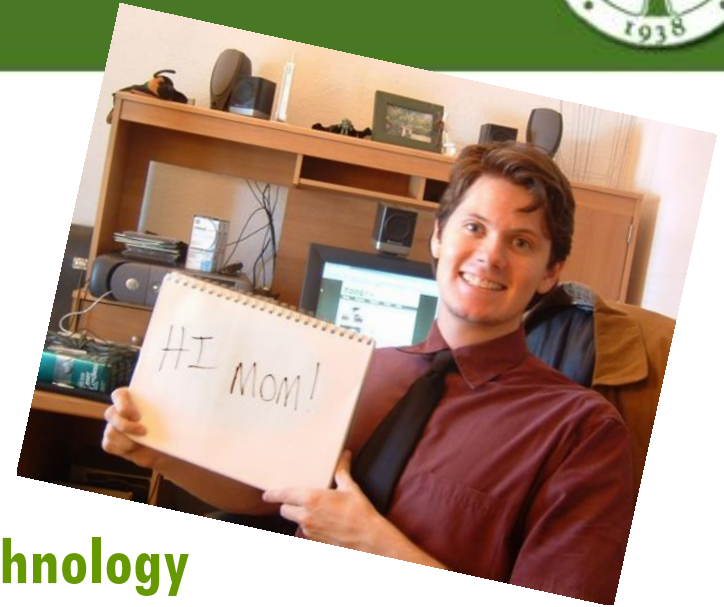
# Best Practices in Spoken Language Stimulation



## Facilitate and accelerate the child's creation of language

- **Provide comprehensible input**
  - Auditory hierarchy
  - Highlighting/lowlighting
- **Foster child's active engagement in language acquisition**
  - Expectation of comprehension
  - Fast mapping
- **Link language and cognition**
- **Language growth will come more naturally for child**
  - Empowerment
  - Self-esteem

# What are the keys to success?



- **Informed and empowered families**
- **Early intervention with spoken language stimulation**
- **Attention to all aspects of the child's development**
- **Optimum function and use of hearing technology**
- **Collaboration among family and professionals**
- **Commitment to the development of spoken language**
- **Professionals with specific knowledge and skill with children who are deaf or hard of hearing learning to talk**
  - **Providing comprehensible auditory stimulation**
  - **Promoting the developing child's active engagement in spoken language acquisition.**

# A successful program for developing spoken language consists of:



- Auditory/oral communication
- Individualized instruction
- Integrated educational placements
- Structured, skilled teaching
- Involved families

Mussleman & Kiracaali-Iftar,  
*Journal of Deaf Studies and Deaf Education* (1996)

# Resources



- **A.G. Bell Association for the Deaf and Hard of Hearing**
  - [agbell.org](http://agbell.org)
- **First Years: Professional Development through Distance Education**
  - [firstyears.org](http://firstyears.org)
- **PPCI: Professional Preparation in Cochlear Implants**
  - [wchop.edu/service/cochlear-implant-program/training](http://wchop.edu/service/cochlear-implant-program/training)
- **Smart Ears**
  - <http://www.smart-ears.com/>
- **We Listen International, Inc.**
  - [welisteninternational.com](http://welisteninternational.com)



**The greater danger for most of us  
is not that we set goals too high  
and miss them,  
but that we set goals too low  
and reach them.**

**Michelangelo**