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# Brain Research What you need to know

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Iowa Business Council Summit March 1, 2006

# Why talk about Brain Research?

- Data Driven
- Evidence Based
- Findings relate to Actions
- Window of Opportunity

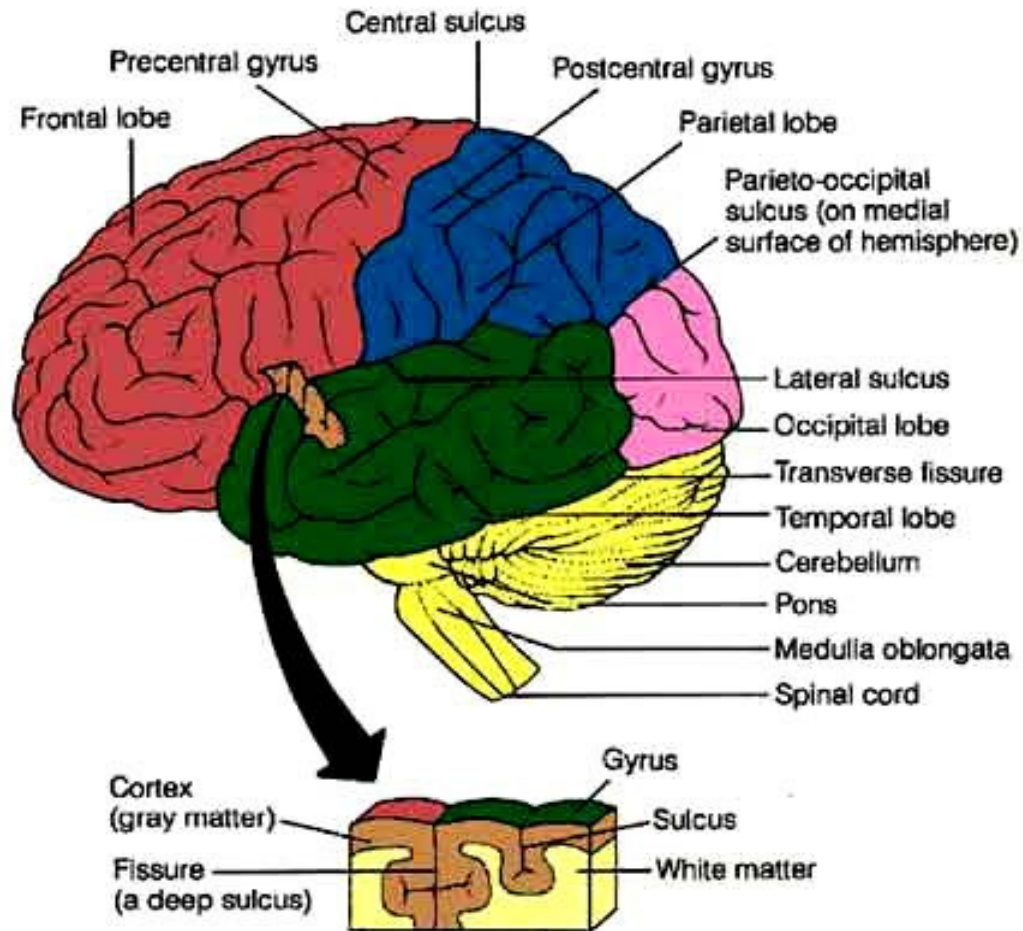
# Early Childhood Brain Research

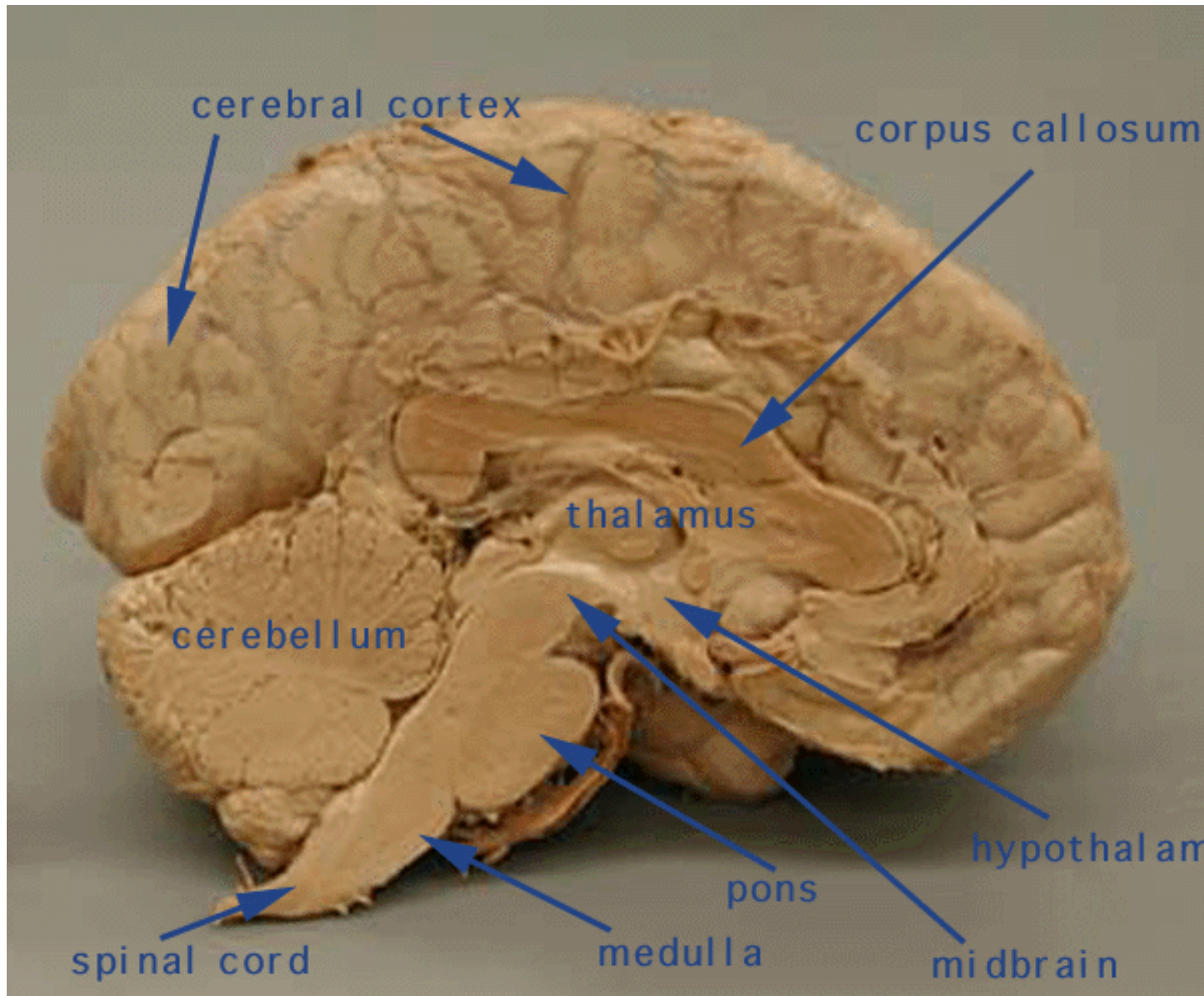
- Brain Anatomy, Cellular function and neuropathways
- Brain Research Studies of Early Childhood
- Conclusions

# NeuroAnatomy

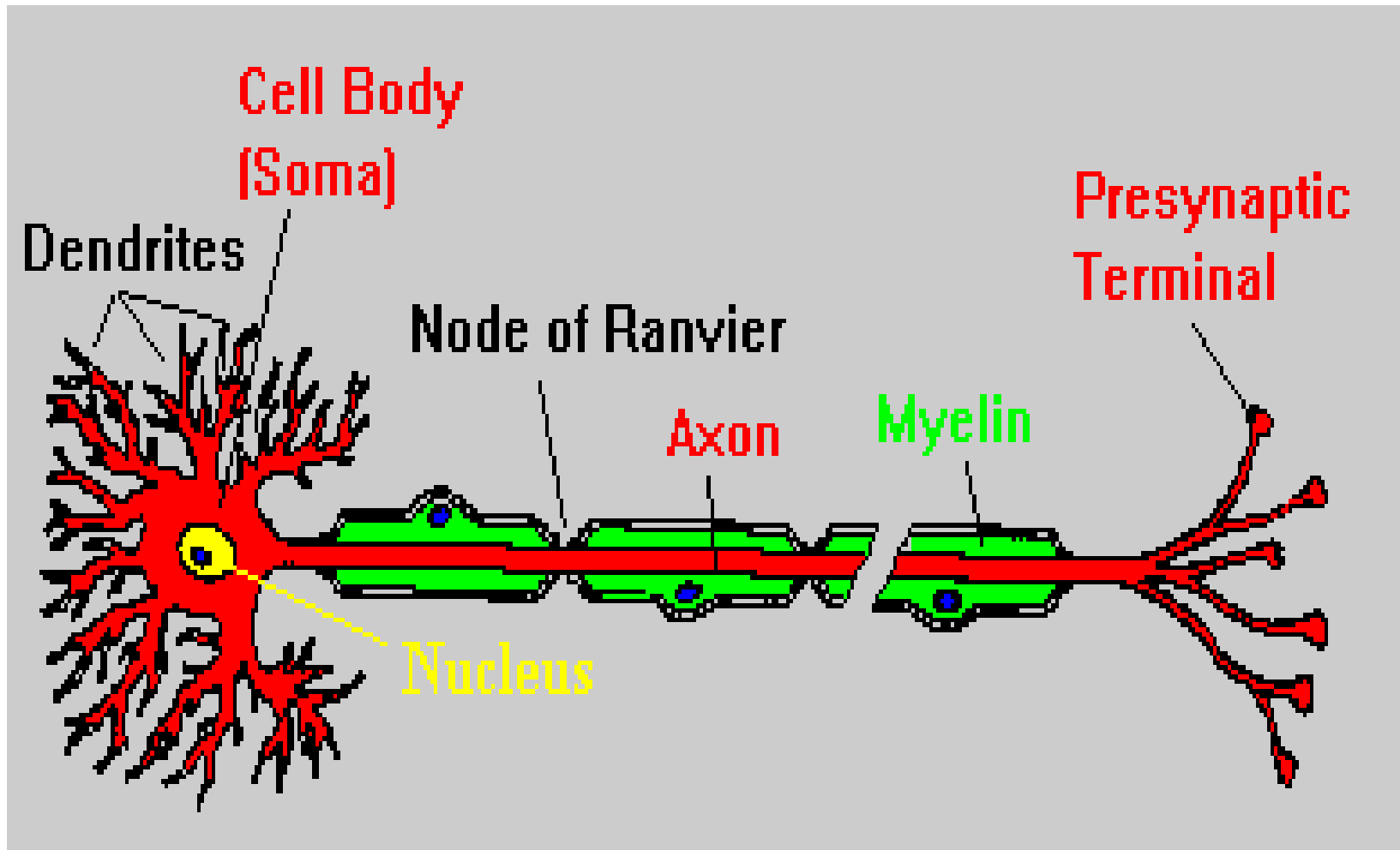


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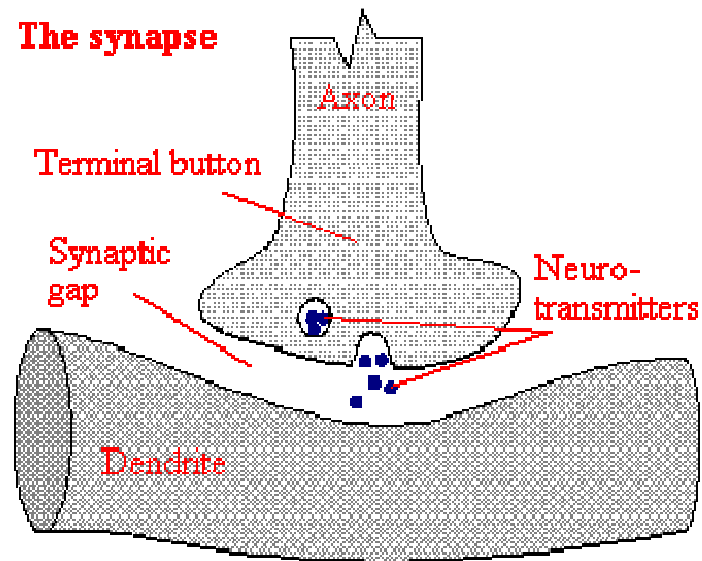


# NeuroAnatomy

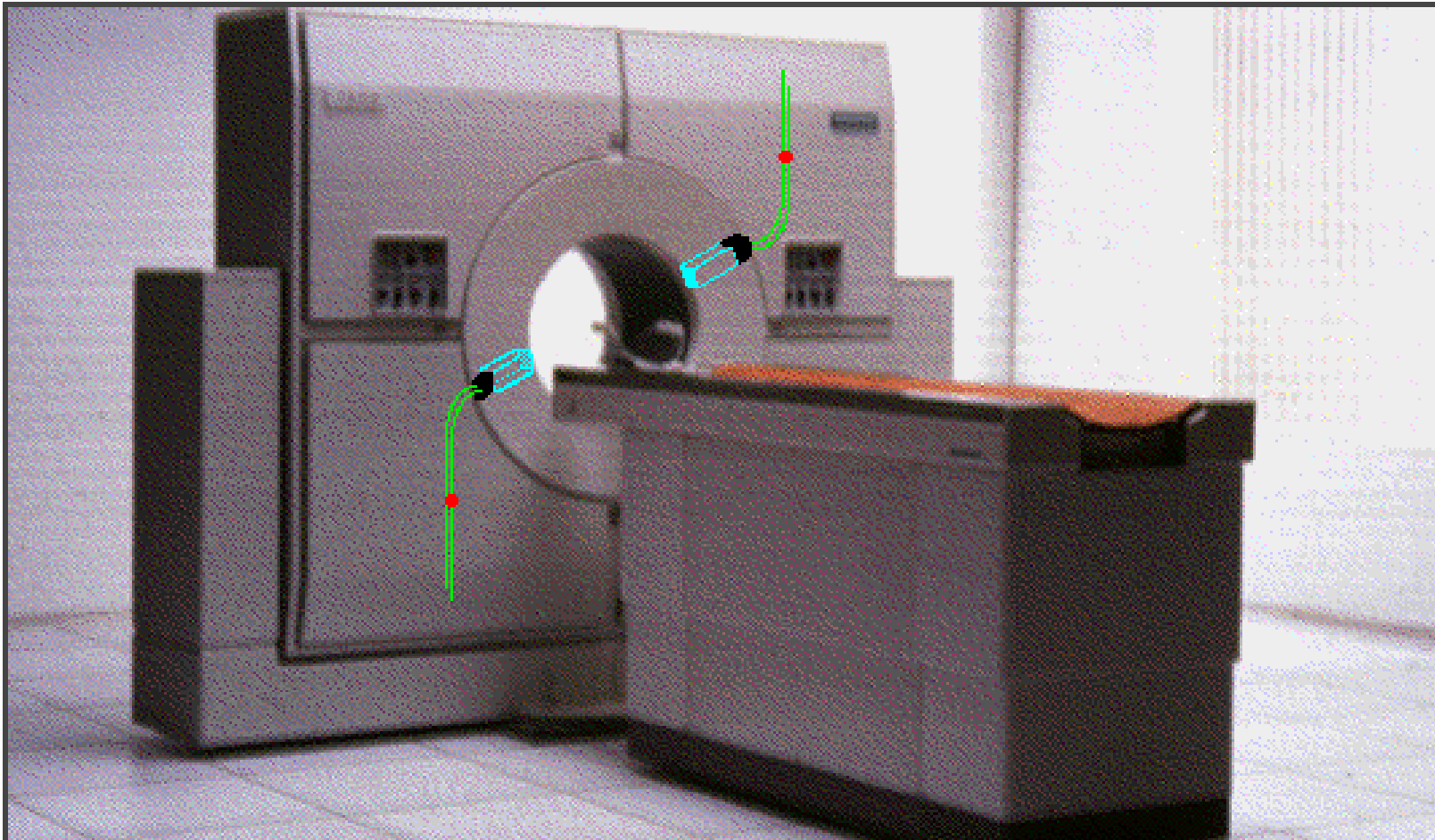


# NeuroAnatomy

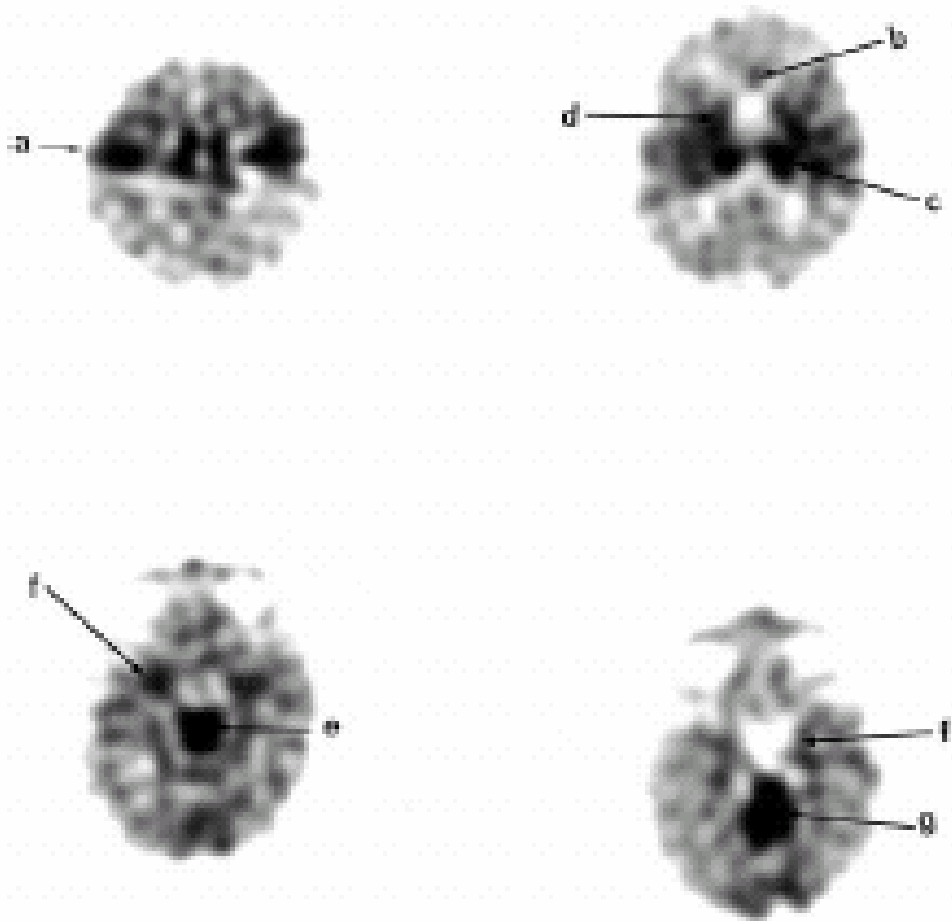
## Synapse



# Positron Emission Tomography

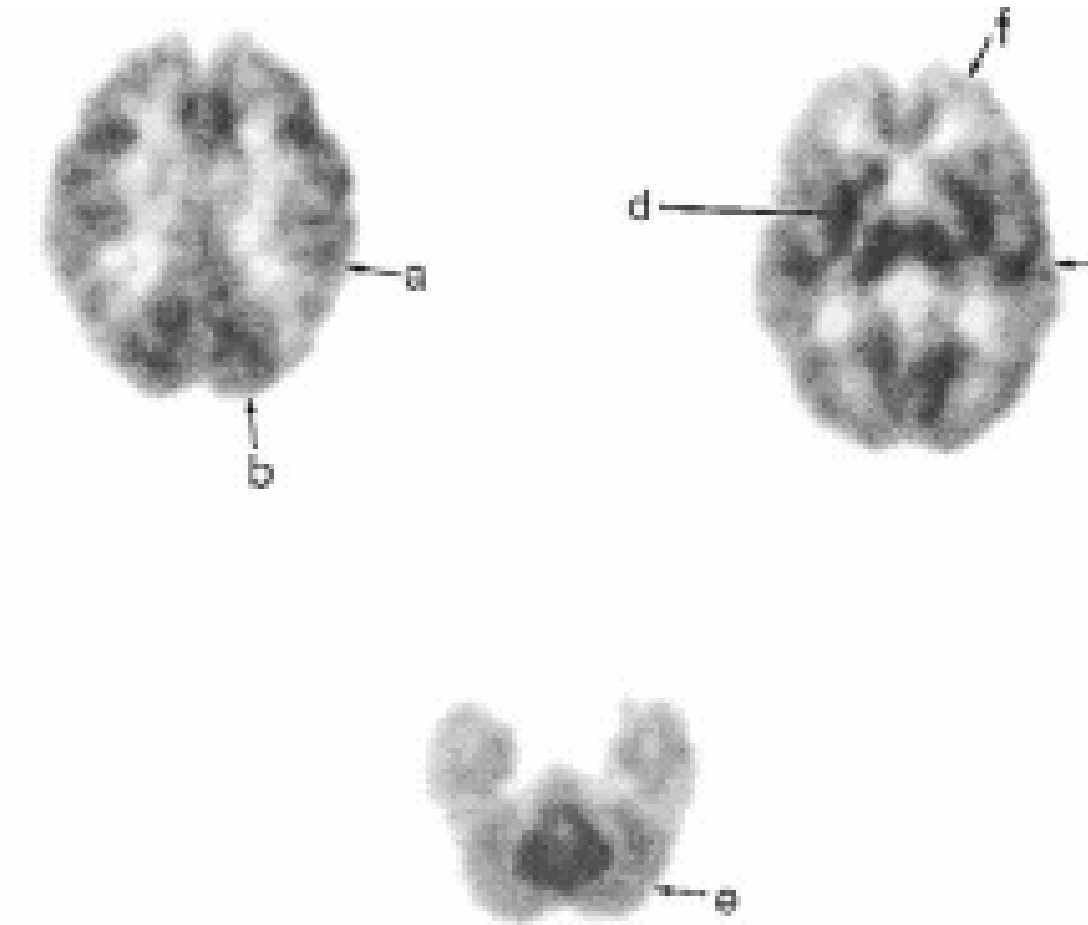


# Newborn Brain Pet Scans\*



\* Harry T. Chugani - Biological Basis of Emotions: Brain Systems and Brain Development - Pediatrics, Nov 1998; 102: 1225.

# 2-3 months\*

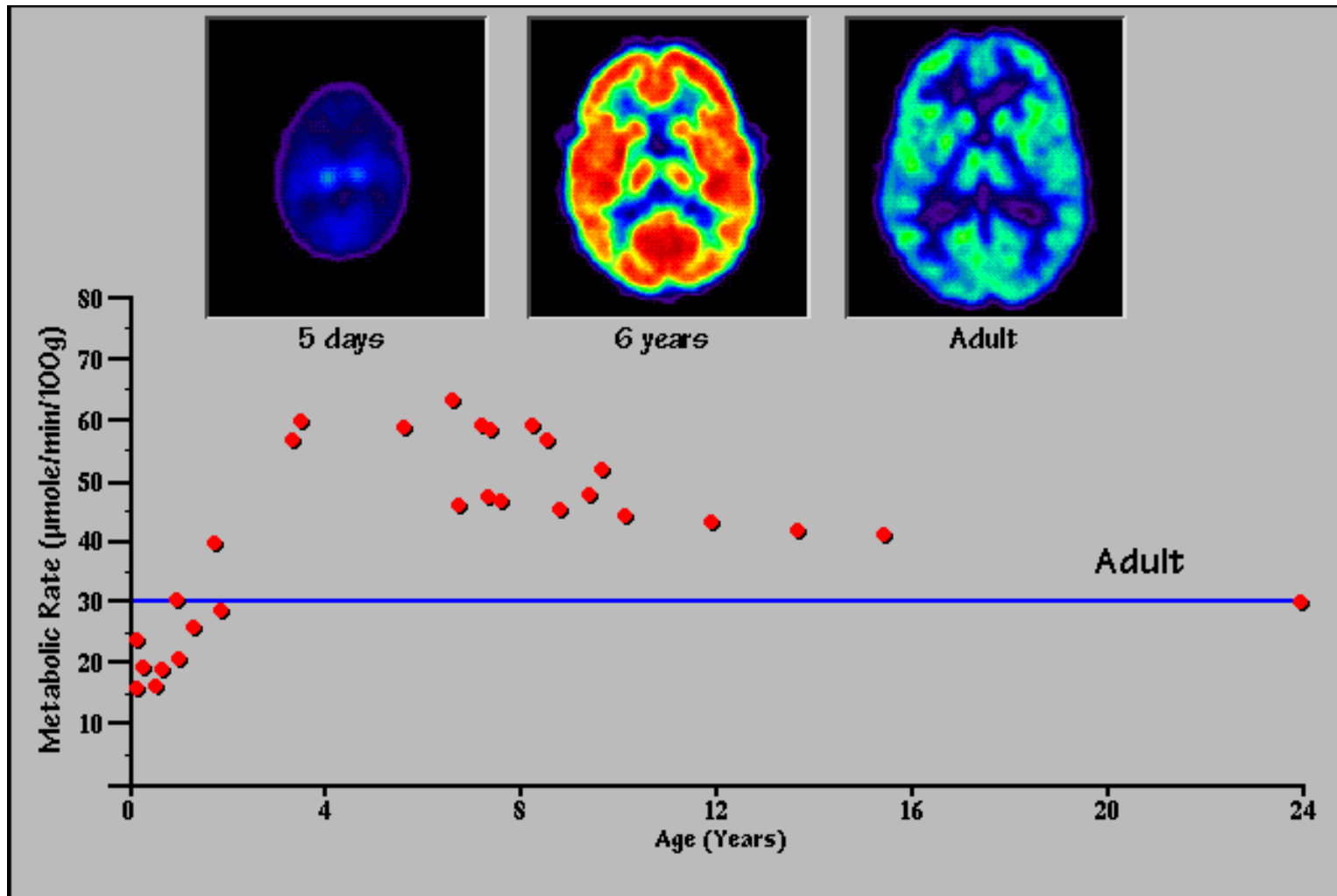


\* Harry T. Chugani - Biological Basis of Emotions: Brain Systems and Brain Development - Pediatrics, Nov 1998; 102: 1225.

# 8 months\*

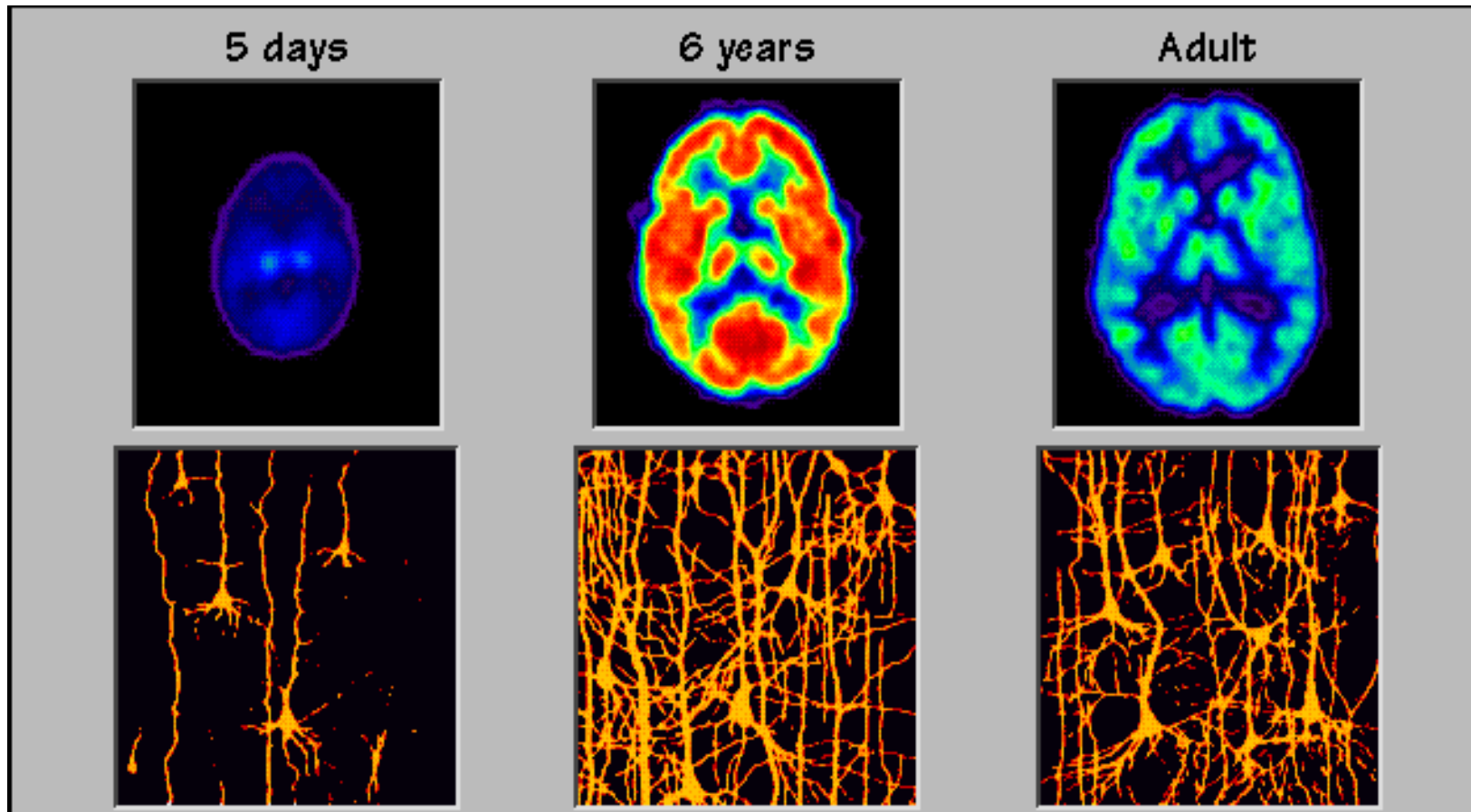


\* Harry T. Chugani - Biological Basis of Emotions: Brain Systems and Brain Development - Pediatrics, Nov 1998; 102: 1225.



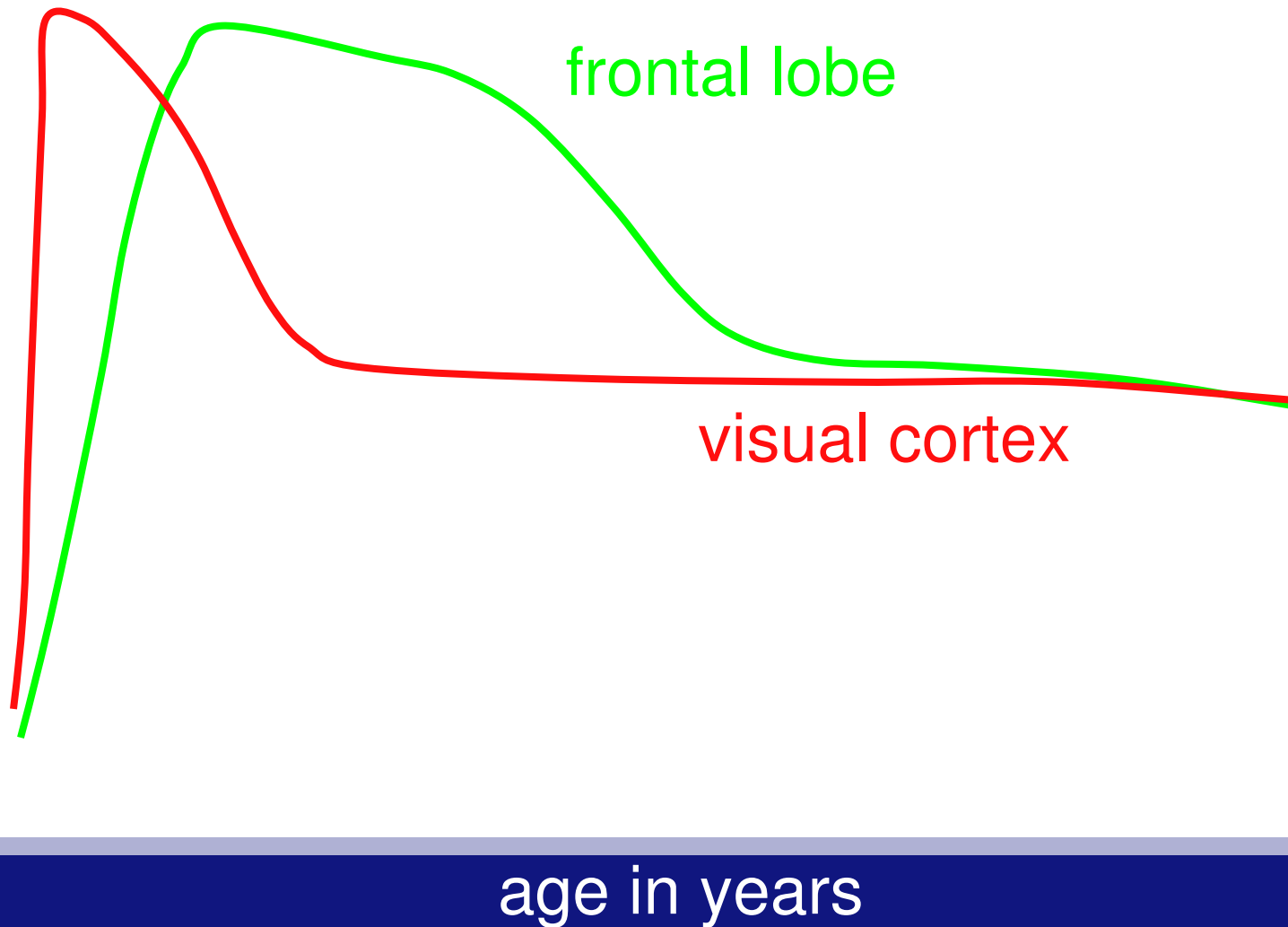
Scott Grafton, M.D. - Dept. of Neurology and Dept. of Radiology - University of Southern California

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# Synapse production & pruning



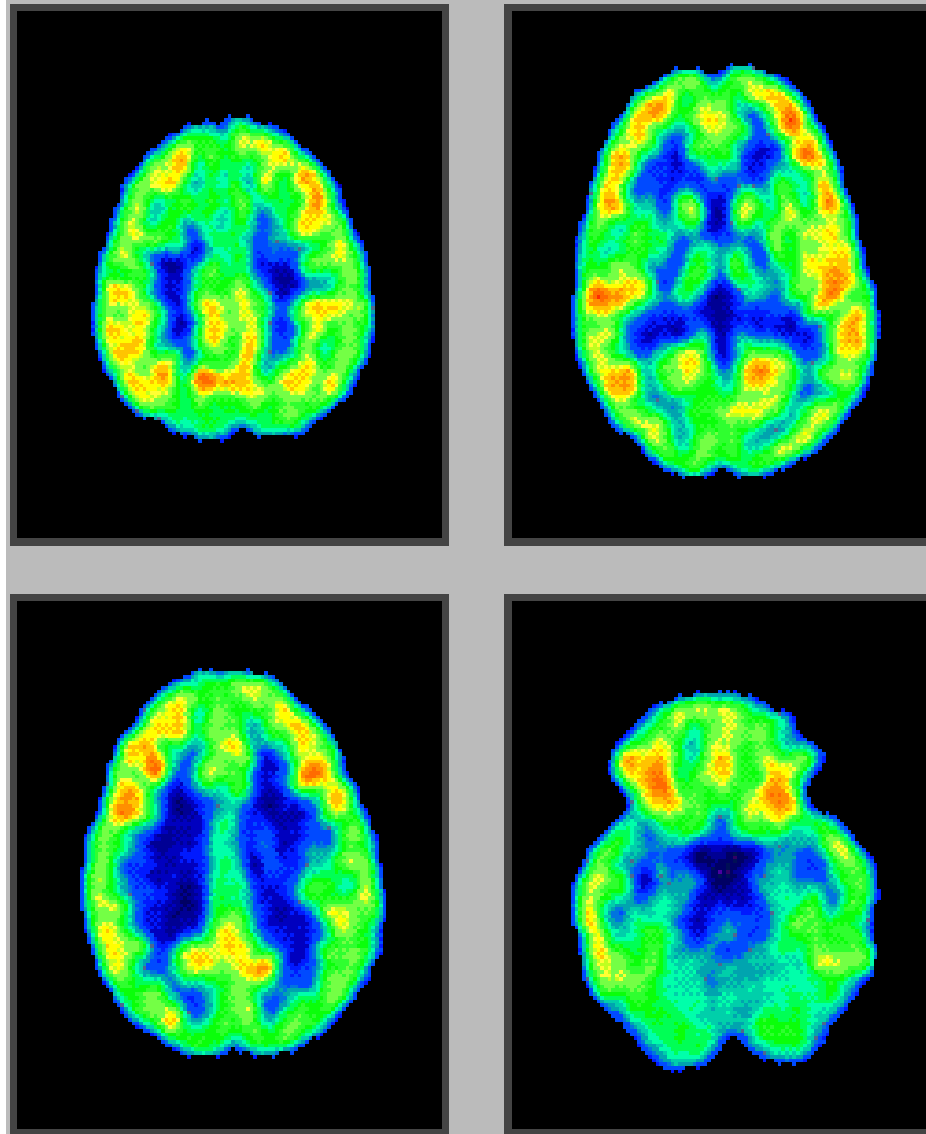
# Plasticity



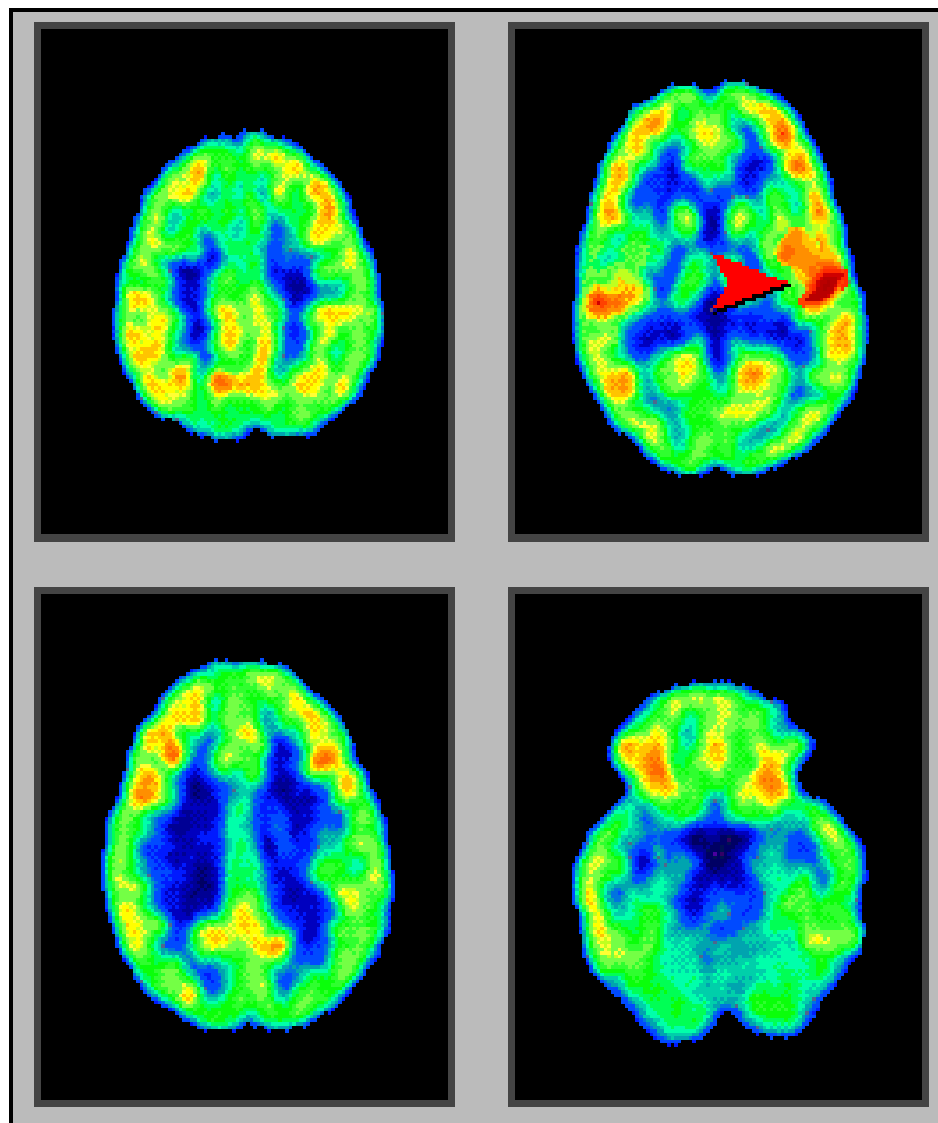
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Needed for Normal Brain Development	Detrimental or Toxic
Oxygen	Alcohol
Adequate protein and energy	Lead
Micronutrients, such as iron and zinc	Tobacco
Adequate gestation	Prenatal infections
Iodine	Polychlorinated biphenyls (PCBs)
Thyroid hormone	Ionizing radiation
Folic acid	Cocaine
Essential fatty acids	Metabolic abnormalities (excess phenylalanine, ammonia)
Sensory stimulation	Aluminum
Activity	Methyl mercury
Social interaction	Chronic stress
Note: The listed factors are not intended to be exhaustive.	

# Resting



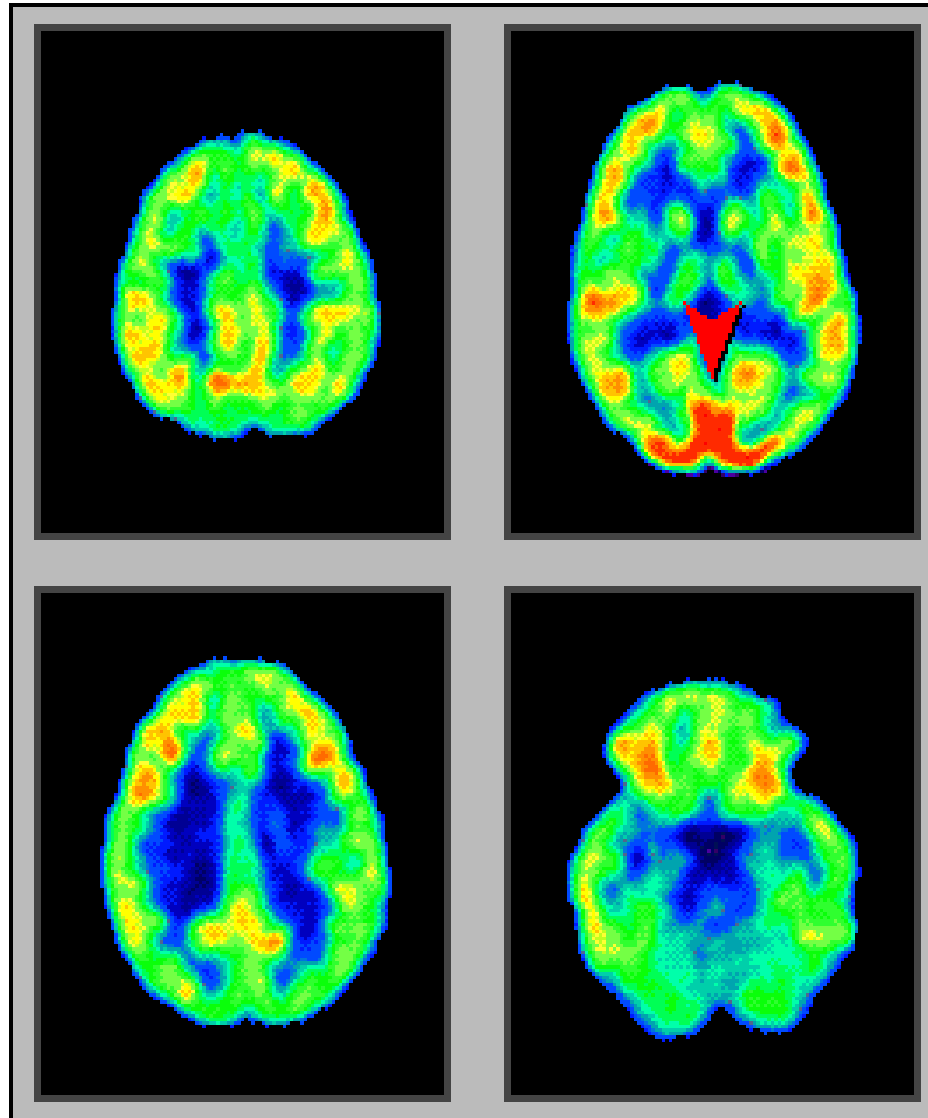
# Hearing



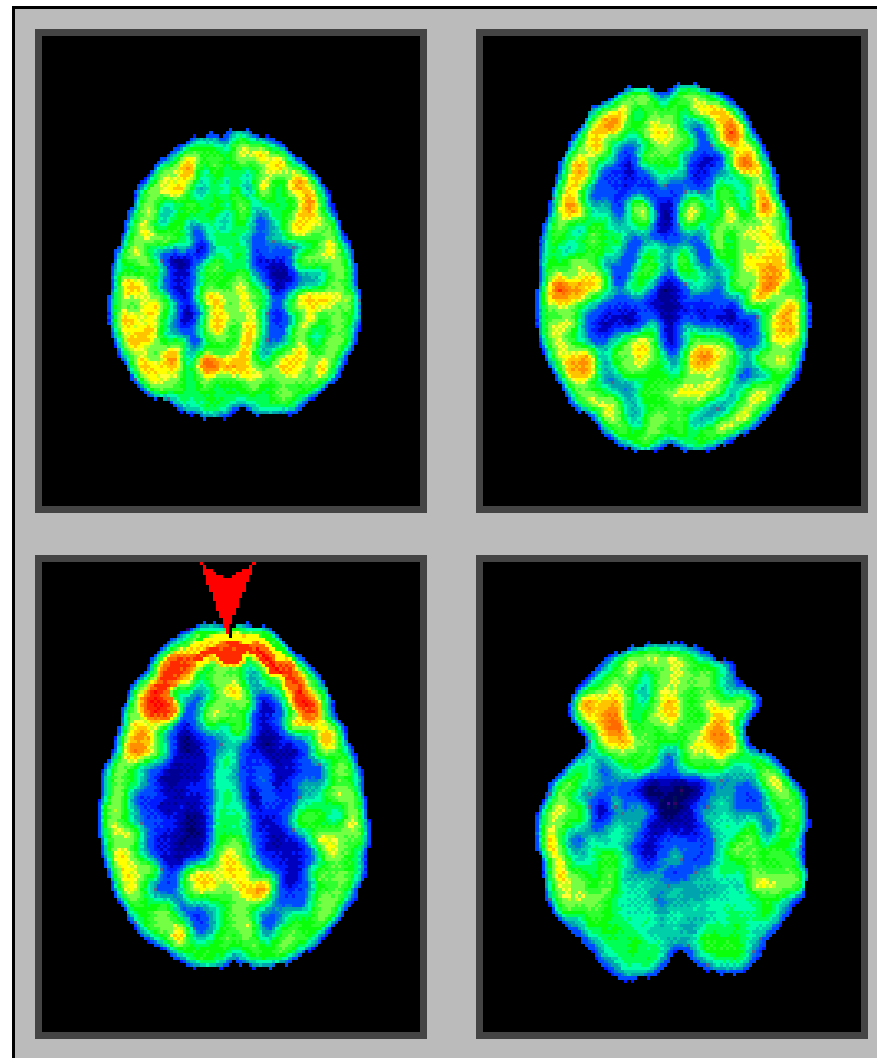
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# Visual

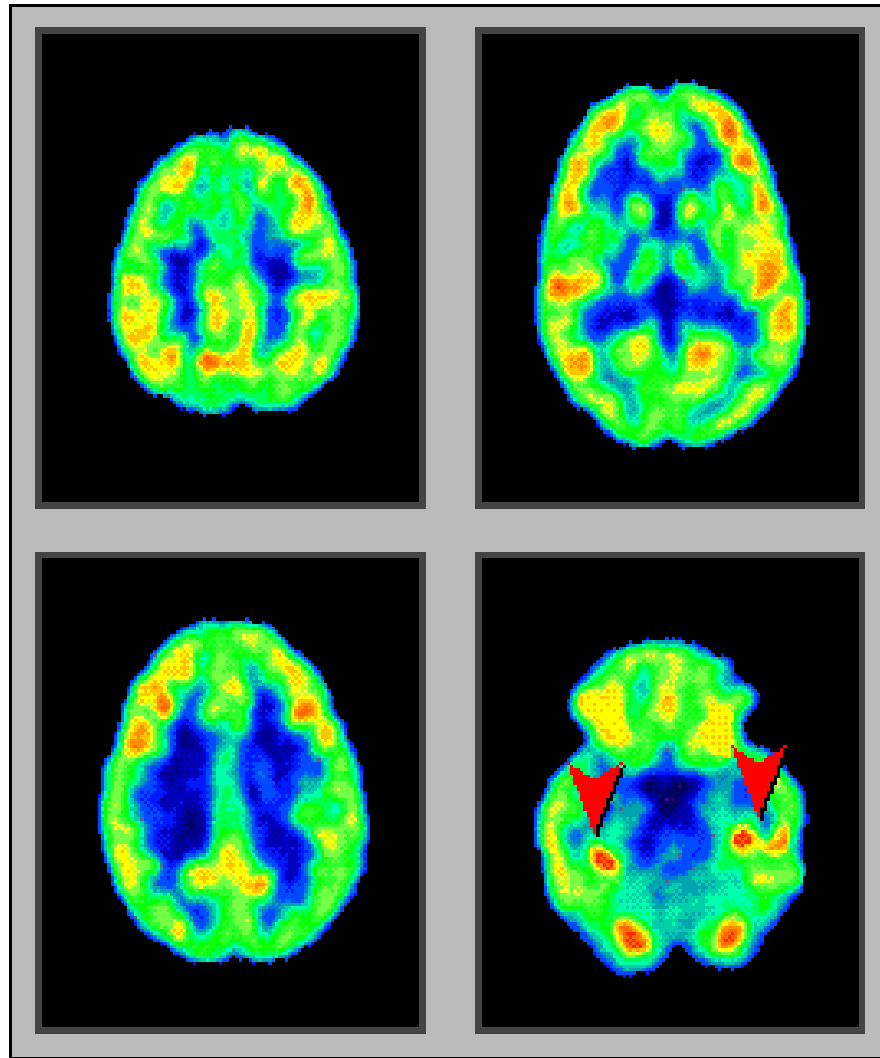


# Thinking task



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# Later Recall



## Foreign-language exposure



Live exposure

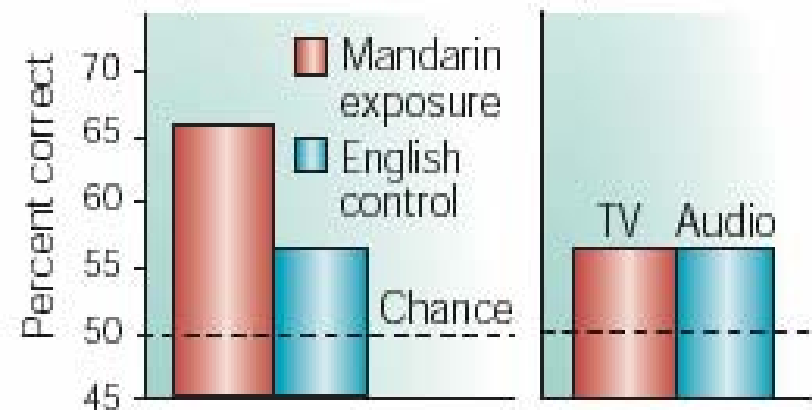


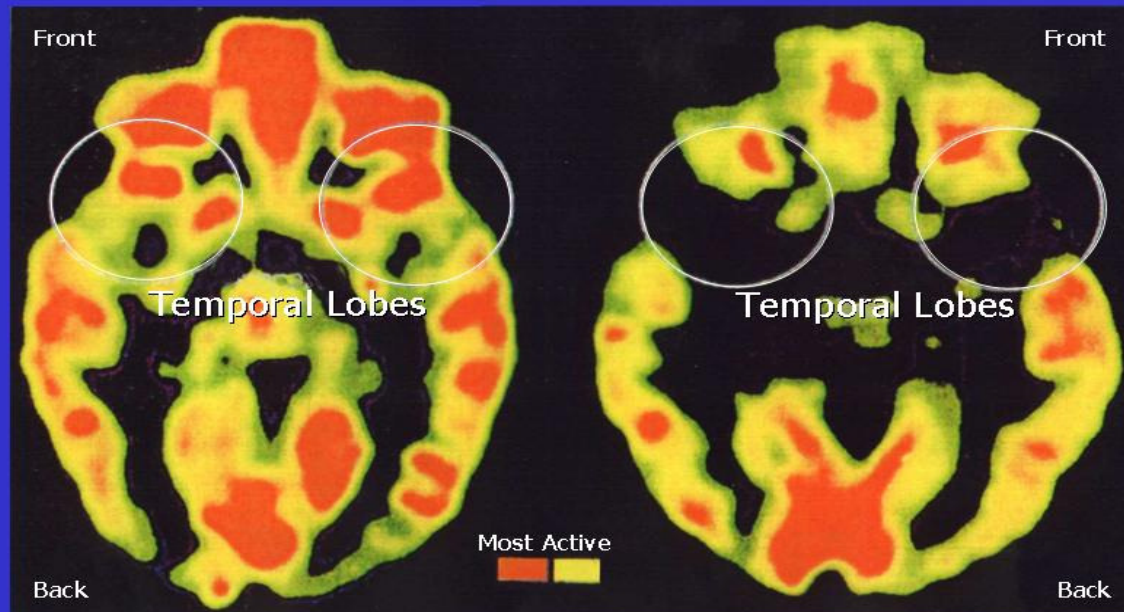
Auditory or audiovisual exposure

## Phonetic learning

Effects of live foreign-language exposure

Effects of non-live foreign-language exposure

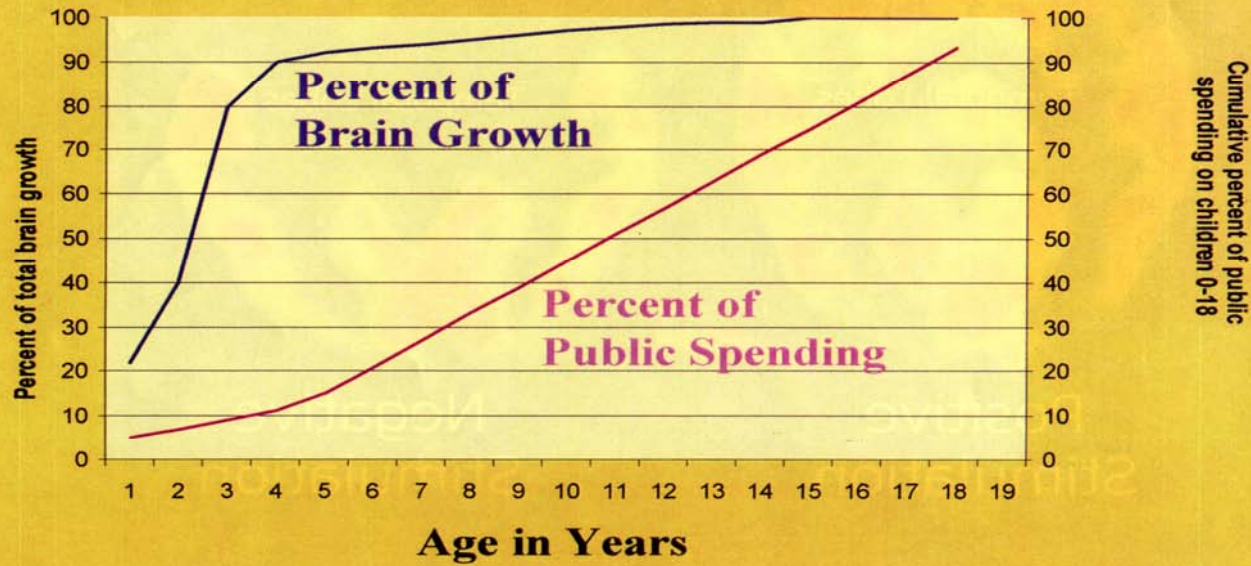




Positive Stimulation

Negative Stimulation

## Brain Growth versus Public Expenditures on Children Ages 0 - 18



The Child Development and Public Expenditures chart source is researchers at the RAND Corporation (see *Investing in our Children* in section 4).  
 Brain development curve Figure 2.4 in D. Purves, *Body and Brain*, Harvard University Press, 1988.  
 Public spending on children from Table 1 in R. Haverman and B. Wolfe, "Determinants of Children's Attainments: A Review of Methods and Findings," *Journal of Economic Literature*, Vol. 33, December 1995

# Conclusions



Window of Opportunity

Maximize our Human Capital

Nurture and Protect our Children

