Brain Research
What you need to know

Andrea McGuire, MD, MBA
Chief Medical Officer
American Republic Insurance Company

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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
NeuroAnatomy
NeuroAnatomy

Synapse

The synapse
Terminal button
Synaptic gap
Neurotransmitters
Dendrite
Positron Emission Tomography
Newborn Brain Pet Scans*

2-3 months*

8 months

Scott Grafton, M.D. - Dept. of Neurology and Dept. of Radiology - University of Southern California
John Mazziotta, M.D., Ph.D. - Dept. of Molecular and Medical Pharmacology and Dept. of Neurology - UCLA School of Medicine
Synapse production & pruning

age in years

frontal lobe

visual cortex
## Plasticity

<table>
<thead>
<tr>
<th>Needed for Normal Brain Development</th>
<th>Detrimental or Toxic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxygen</td>
<td>Alcohol</td>
</tr>
<tr>
<td>Adequate protein and energy</td>
<td>Lead</td>
</tr>
<tr>
<td>Micronutrients, such as iron and zinc</td>
<td>Tobacco</td>
</tr>
<tr>
<td>Adequate gestation</td>
<td>Prenatal infections</td>
</tr>
<tr>
<td>Iodine</td>
<td>Polychlorinated biphenyls (PCBs)</td>
</tr>
<tr>
<td>Thyroid hormone</td>
<td>Ionizing radiation</td>
</tr>
<tr>
<td>Folic acid</td>
<td>Cocaine</td>
</tr>
<tr>
<td>Essential fatty acids</td>
<td>Metabolic abnormalities (excess phenylalanine, ammonia)</td>
</tr>
<tr>
<td>Sensory stimulation</td>
<td>Aluminum</td>
</tr>
<tr>
<td>Activity</td>
<td>Methyl mercury</td>
</tr>
<tr>
<td>Social interaction</td>
<td>Chronic stress</td>
</tr>
</tbody>
</table>

Note: The listed factors are not intended to be exhaustive.
Resting
Hearing

Scott Grafton, M.D. - Dept. of Neurology and Dept. of Radiology - University of Southern California
John Mazziotta, M.D., Ph.D. - Dept. of Molecular and Medical Pharmacology and Dept. of Neurology - UCLA School of Medicine
Visual

Scott Grafton, M.D. - Dept. of Neurology and Dept. of Radiology - University of Southern California
John Mazziotta, M.D., Ph.D. - Dept. of Molecular and Medical Pharmacology and Dept. of Neurology - UCLA School of Medicine
Thinking task
Later Recall

Scott Grafton, M.D. - Dept. of Neurology and Dept. of Radiology - University of Southern California
John Mazziotta, M.D., Ph.D. - Dept. of Molecular and Medical Pharmacology and Dept. of Neurology - UCLA School of Medicine
Foreign-language exposure

Live exposure

Auditory or audiovisual exposure

Phonetic learning

Effects of live foreign-language exposure

- Mandarin exposure
- English control

Percent correct

50 55 60 65 70

Effects of non-live foreign-language exposure

- TV exposure
- Audio exposure

Chance

45
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.

Conclusions

Window of Opportunity

Maximize our Human Capital

Nurture and Protect our Children