

Thanks for  
coming!!!

# Architecture of the Brain Game and the Neuroscience of Early Development



**EACH BRAIN MATTERS**  
THE CENTER FOR NEUROSCIENCES FOUNDATION

1. An exploration using Harvard's Brain Architecture Game
2. Early brain neuroscience - or *"What Matters?"*

Game and videos produced by  
Harvard University's  
Center on the Developing Child



Dorothy Johnson, MD, FAAP  
Lynne Oland, PhD  
Susan Hopkinson, Director  
The Center for Neurosciences Foundation

February 4, 2025 for OLLI

# Whooo are you?



## RIGHT BRAIN SPECIALISTS?

- artist, dentist, architect, structural engineer, designer, photographer – YOU NAME IT

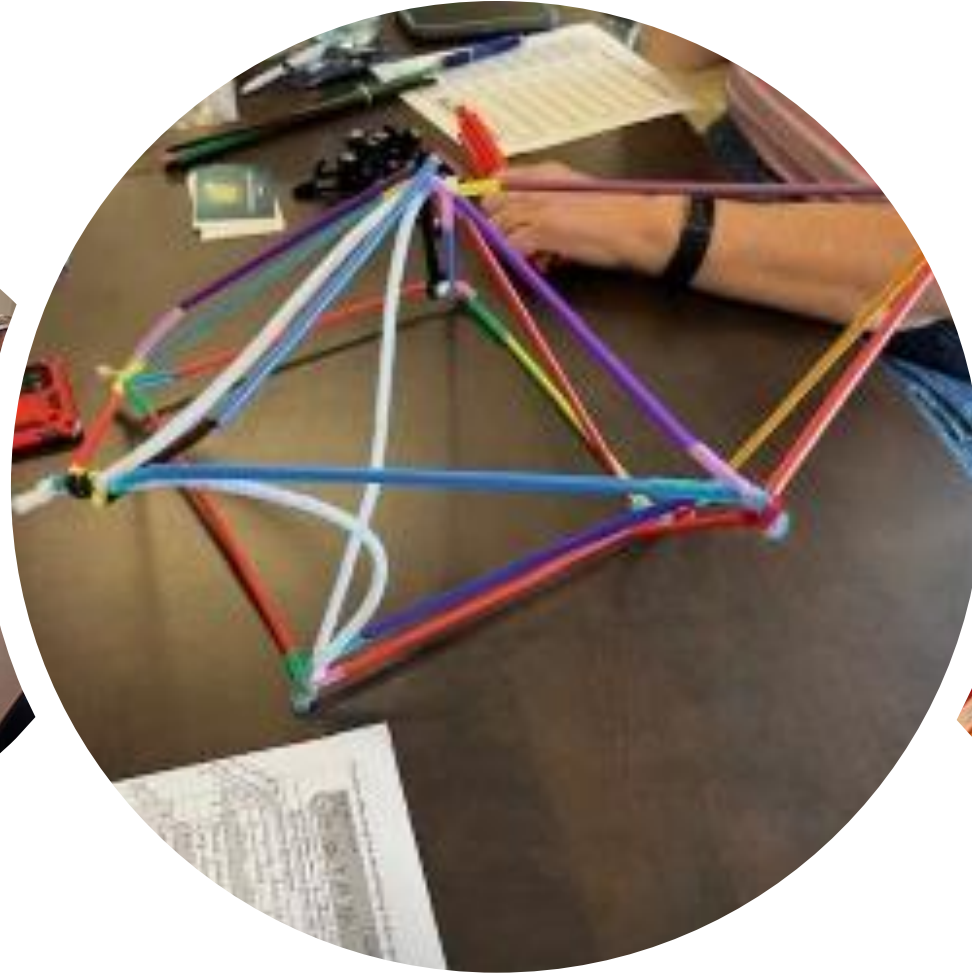
## LEFT BRAIN SPECIALISTS?

- writer, lawyer, planner, coder, list-maker, Excel-user, accountant - - YOU NAME IT

## CARE-GIVERS?

- teacher, nurse, doctor, pastor, social worker, psychologist, trainer, therapist, coach, partner, husband, wife, parent, child - - YOU NAME IT

# Part 1: The Brain Architecture Game



**This is a Multimodal Exploration of  
the Impact of Genes, Social Support and Life Experience  
on Early Brain Development**

# According to the CDC,

“How well a brain develops depends on many factors in addition to genes, such as:

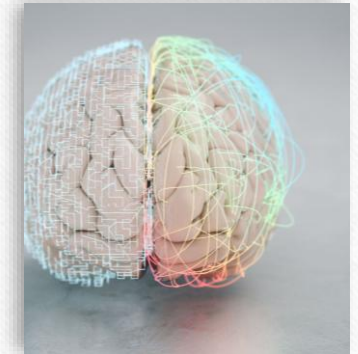
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Proper nutrition starting in pregnancy

Exposure to toxins or infections

The child’s experiences with other people and the world

Positive or negative experiences can add up to shape a child’s development and can have lifelong effects. ”



<https://www.cdc.gov/ncbddd/childdevelopment/early-brain-development.html>

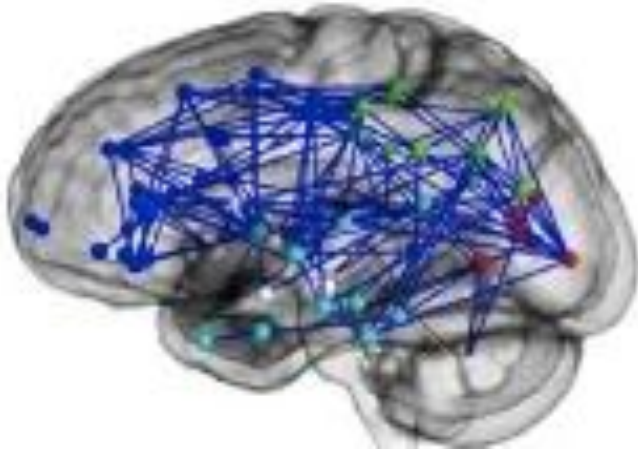
## The Science of Early Childhood & The Brain Architecture Game Video

<https://youtu.be/y2-DMvcrTIk?si=tX8Ri27NN13BmjzH>

Note: You'll work in small teams each building parts of one brain instead of large groups building separate brains.



We're going to make one big brain composed of neural networks made by teams of 2 (or 3) people.



**NEEDED: 4 Volunteers**

## **2 Building Coaches – Right Brain Experts**

(artist, dentist, architect, structural engineer, designer, photographer )

**Circulate to help teams with construction**

## **2 Experiencing Volunteers - Sensory System**

### **1. Roll Die for**

- “Genetic Lottery”
- “Social Supports”
- To determine impact of some “Tolerable” events

### **2. Hold and Pick Life Experience Cards**

**Everyone else**, working in teams of 2 (or 3)

## **NEURAL NETWORK BUILDERS**

Building our brain's neural networks with Pipe Cleaners, Straws & Weights

### **Years 1 – 5**

- **Three pipe cleaners** for each year,
- One **straw** for any **Positive**

### **Years 6 – 8**

- **EITHER** one **pipe cleaner** for any **Positive**
- **OR** one **weight** for any **Toxic**.

# Brain Architecture Game Reference Page



You get a **STRAW** for each **SOCIAL SUPPORT** point you rolled at the beginning. Keep these separate, but you can use them at any time.

**EVERY YEAR 1 – 5** you get **3 PIPE CLEANERS**.

**STRAWs** Years 1 – 5 depend:

You'll get a **STRAW** for each **Positive** circumstance. That's strength!

You'll get a **STRAW** for a **Tolerable** card IF

The **Total Positive** Life Experiences are **more than Total Toxic** OR

You roll **2, 4 or 6** when Total **Positives** = Total **Toxic** OR

You roll **2, 4 or 6** when **Tolerable** is the **very first** card

## BUILDING RULES – AIMING FOR TALL AND STRONG

Each year use **all the materials earned that year**, enclosing all spaces, before going on.

**Years 1 – 5** fasten only at **ends of pipe cleaners**.

**No reconstruction** is permitted, but reinforcement of a prior pipe cleaner with new one is ok.

**Years 6-8** may fasten pipe cleaners **anywhere**.

Years 6 – 8 **weights** are to be secured to the **“highest” point**.

**Years 6 – 8** **Either** PIPE-CLEANER **or** WEIGHT depending:

You'll get a **WEIGHT** for each **Toxic** experience

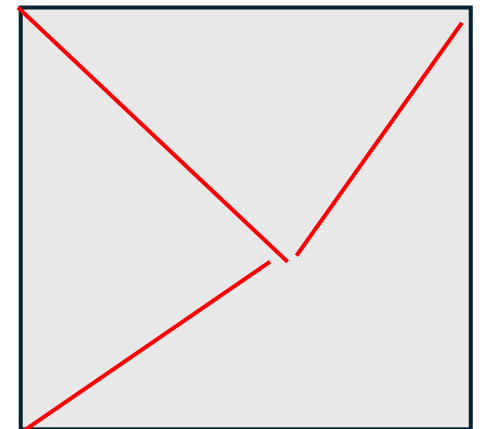
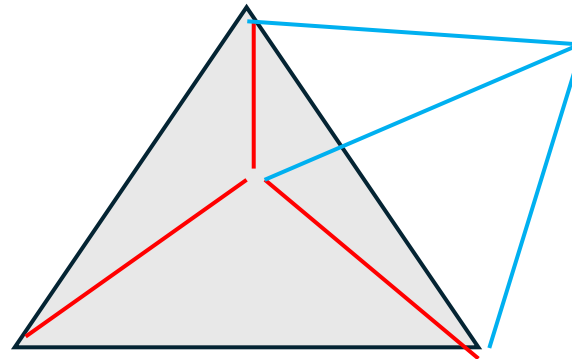
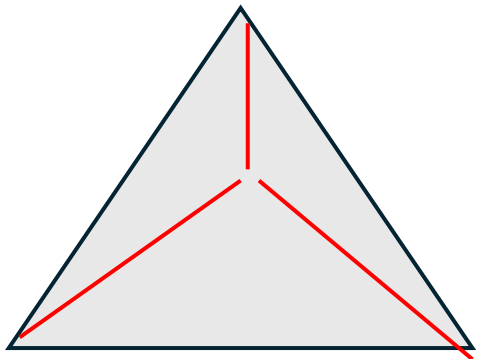
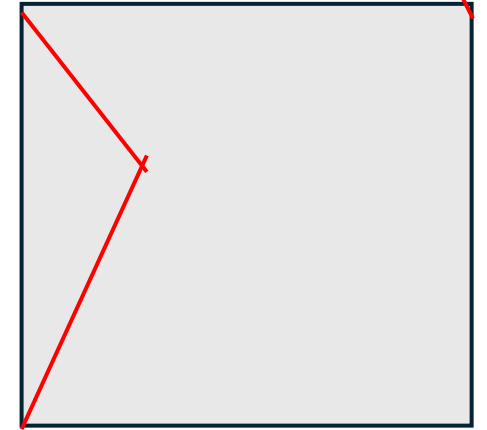
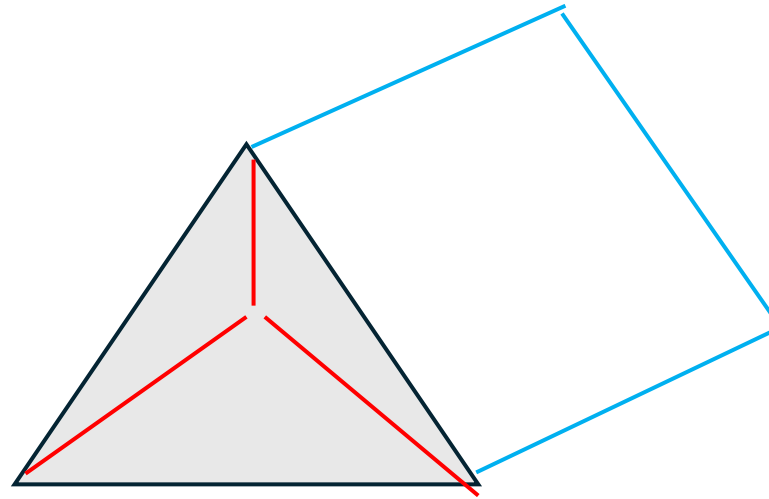
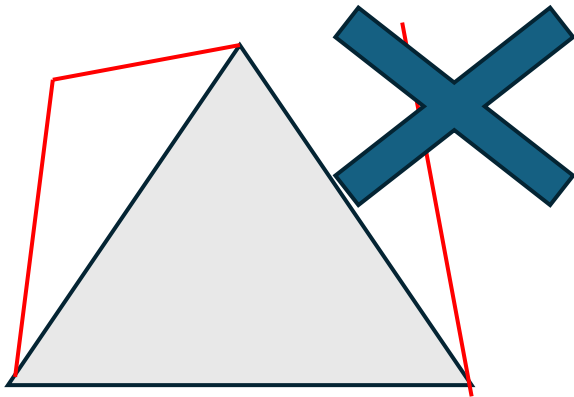
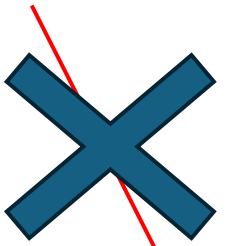
You'll get a **WEIGHT** for a **Tolerable** card IF

The **Total Toxic** Life Experiences are **more than Total Positive** OR

You roll **1, 3 or 5** when Total **Positives** = Total **Toxic**

# SOME BUILDING TIPS

At end of each year, must have attached **both ends of each pipe cleaner**, and used **all** that year's pipe cleaners and straws or weights.







Experiencing Volunteer, please roll die for



The “Genetic Lottery”

## ➔ Social Supports

**3 Support Straws**

Supports

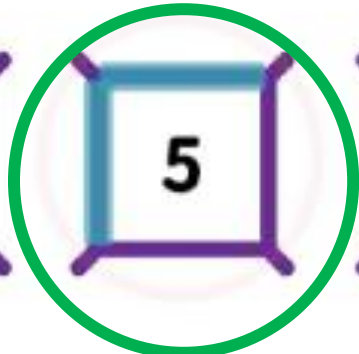


**4 Base Pipe Cleaners**



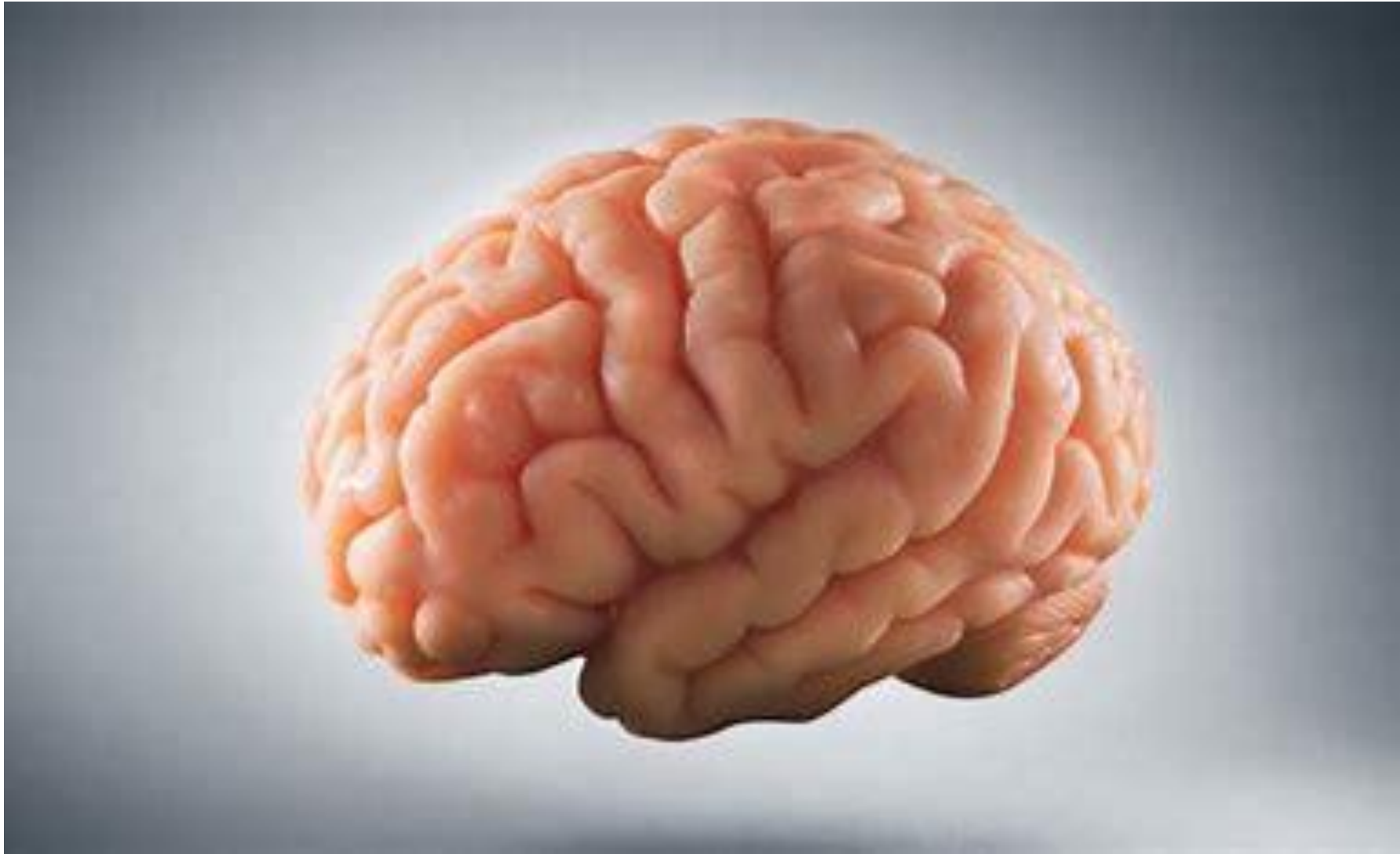
**2 Base Straw(s)**

**What is your genetic starting point?**



Keep these straws **separate** from your general supply. Add them to pipe cleaners when needed.

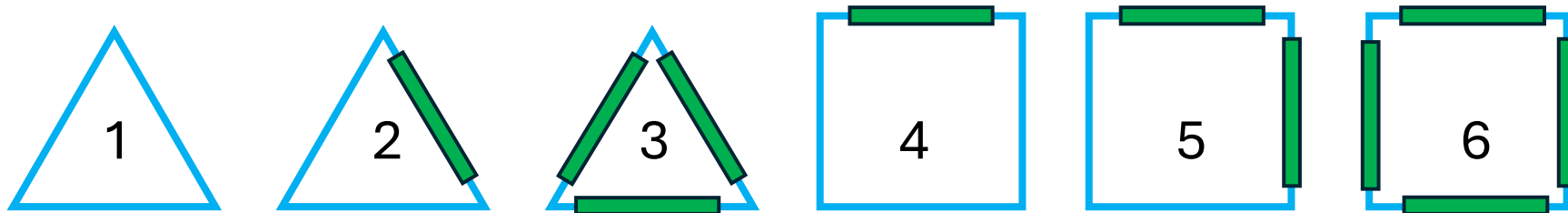
YEAR	YEARS 1-5	POSITIVE	TOLERABLE	TOXIC	LIFE EXPERIENCE	Genes	Social Support
1-5	PIPE CLEANER	STRAW					
1	X	x	x		Childhood illness		
	X	x	x		Frequent changes in caregivers		
	X	x	X		Caregiver depression diminishes serve and return interaction		
2	X	x	x		Frequent changes in caregivers		
	X	x			Language rich environment		
	X	x	x		Parent loses job		
3	X			X	Emotional abuse from one parent		
	X	x	x		Frequent changes in care givers		
	X			X	Exposure to hazardous chemical		
4	X	x	x		Parents divorce		
	X	x			Access to high-quality medical care		
	X			X	Chaotic dangerous child care facility		
5	X	x			Supportive caregiver helps overcome disagreement with friend		
	X	x	x		Conflict with peer		
	X			X	Removed from home by child protection services		
6-8	PIPE CLEANER	STRAW		WEIGHT			
6	x				Encouragement while learning a skill		
	x				Clean and safe playground nearby		
			x	X	Frequently exposed to rug and alcohol abuse		
7	x				Safe home provided while rebuilding from natural disaster		
	x		x		Excluded by a group of youth at school		
				X	Sexual abuse		
8	x		x		Bullied by agang at school		
				X	Witness domestic violence		
				X	Frequent crimes and gang activity in neighborhood		



How did your *brain-building fare*?

# Let's Think About It

- What's meant by the “genetic lottery” in the game?
- How much difference did the “**genetic lottery**” die roll make in the strength of our *brain*?
- Would a high roll necessarily be better?



# Let's Think About It

How much difference did our amount of “**social supports**” make in building this *brain*?

Do you think that matches real life?  
What comes to mind?



designed by freepik

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# What is the difference between “TOLERABLE” & “TOXIC” stress?

Responsive,  
supportive caregivers

Caregiver depression  
diminishes “serve &  
return” interaction

Premature birth

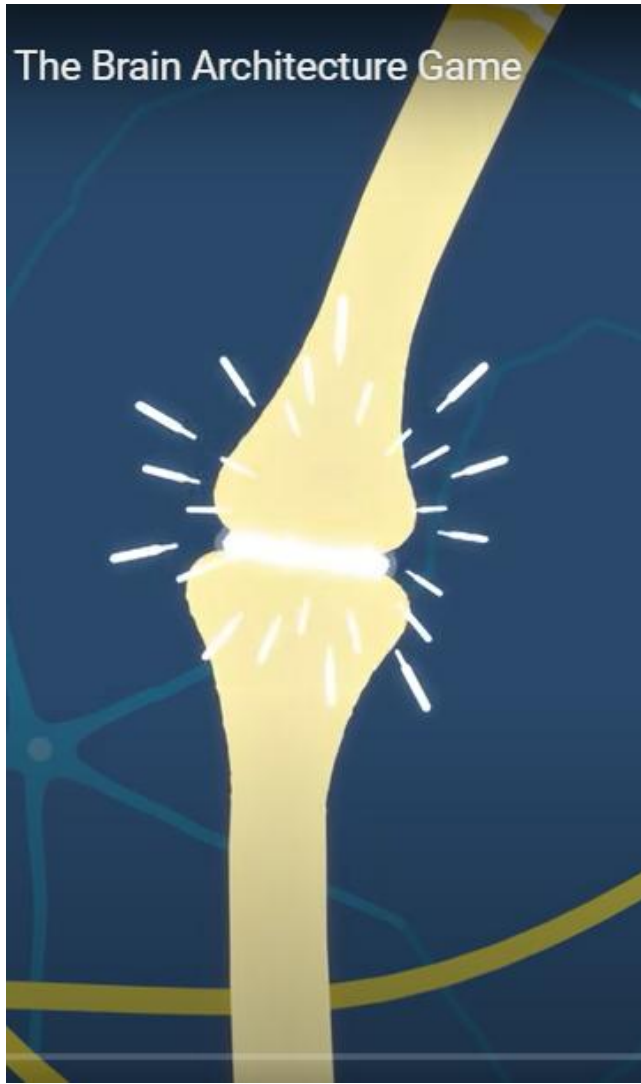
Childhood illness

Parent receives  
parental leave for  
newborn

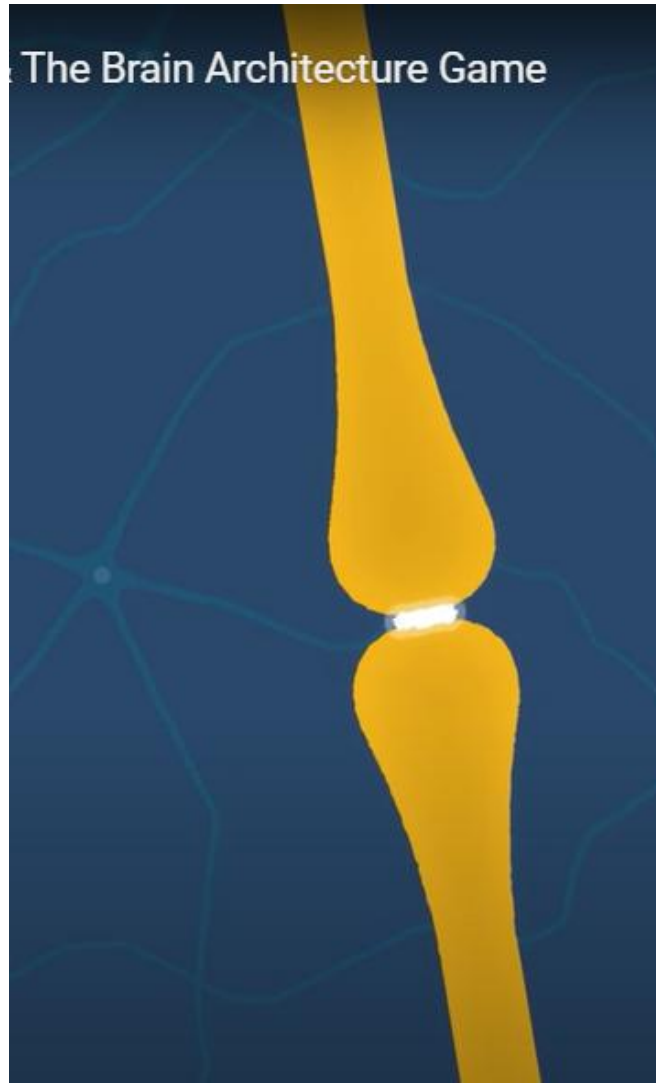
• YEAR 1  
possibilities

Severe neglect

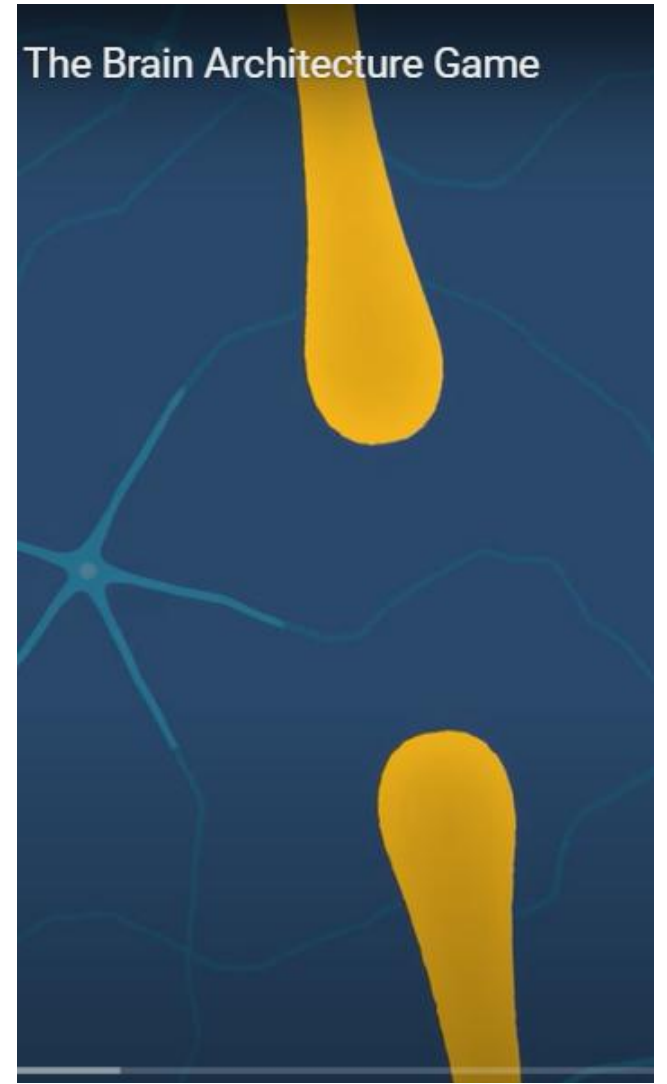
Malnutrition



**Positive**



**Tolerable**



**Toxic**

## Let's Think About It (continued)

- How can the presence of positives (“POSITIVE”) decrease the chance of “TOLERABLE” becoming “TOXIC”?
- How can access to high quality early childcare and preschool contribute to healthy brain development?



Responsive,  
supportive caregivers



Parent receives  
parental leave for  
newborn

1<sup>ST</sup> YEAR  
(0-1)

Child care with highly  
skilled caregivers



Language-rich  
environments

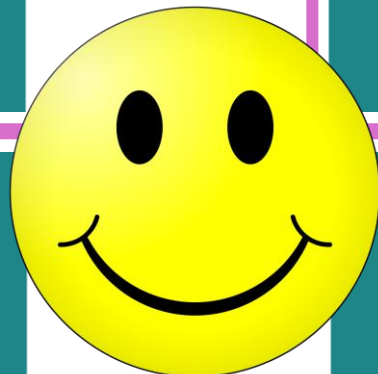
2<sup>ND</sup> YEAR  
(1-2)

Job flexibility so  
parent can spend  
more time with child

Encouragement while  
learning a skill

3<sup>RD</sup> YEAR  
(2-3)

Fresh fruits and  
vegetables replace  
fast food



Access to  
high-quality  
medical care

4<sup>TH</sup> YEAR  
(3-4)

HEADSTART

# CONCLUSIONS FROM EXPERIMENTAL EARLY CHILD PROGRAMS (ALL INCLUDED PARENT ENGAGEMENT)

Substantial long-term benefits in experimental group, apparent **when in 3<sup>rd</sup> grade or later**

- Less special education
- Higher math and reading scores by age 10
- Less likely to repeat a year of school
- Higher goals as adolescents
- Less likely to be mistreated in adolescence
- More likely to attend college
- Less likely to go to jail
- Lower unemployment

Water Cooler talk by James Heckman  
“Human Development is Economic Development”

“Children from low-income families **who did not attend preschool** have higher rates of -

- Special education  
(**4x cost** of regular)
- Unemployment (no taxes)
- **Imprisonment**  
(**\$25,000-36,000/year**)”

Vs **Preschool** program cost of  
\$5,000 - \$15,000/year/child

# Strong early brain development leads to lifelong effects in the individual such as:

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- Greater educational achievement
- Higher job levels
- Richer adult cognitive capacity and ability to regulate emotions
- Lower incidence of divorce, mental illness, incarceration
- Greater resilience to stress (more strategies to reduce stress and more ways to counteract the effects of stress)
- Greater cognitive reserve in old age, which leads to slower/late onset of cognitive decline

# THE FAMILY AND THE “VILLAGE”

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The needed team for a  
healthy brain foundation.



# Early Childcare & Education in Pima County



Donating to  
PEEPS  
and  
Early reading  
programs

**FINDING CHILDCARE/ PRESCHOOLS** Including PEEPs, Early Head Start and Quality First infant care, childcare and early education programs:  
**Arizona Childcare Resource & Referral (CCRR)**  
<https://azccrr.com/>  
**520-325-5778** [childcareinfo@cfraz.org](mailto:childcareinfo@cfraz.org)

**PEEPS: Pima-Early-Education-Program Scholarships** for preschoolers 3 – 4, and pre-k 5-year-olds in families earning  $\leq$  300% of Federal Poverty Level (\$93,600 for family of 4).  
<https://www.pima.gov/975/Pima-Early-Education-Program-Scholarship>

## \$\$\$ Donations

For PEEPs & Family Support Alliance go to United Way of Tucson & Southern AZ,

<https://give.unitedwaytucson.org/>

DONATE: "Designate where needed most" v Educational Success. In Memo specify PEEPS = Accelerate Quality and/or Family Support Alliance

For questions or to use RMD, contact Monica Brinkerhoff, [mbrinkerhoff@unitedwaytucson.org](mailto:mbrinkerhoff@unitedwaytucson.org)

For **Make Way for Books** use *Ways to Give* at <https://makewayforbooks.org/> for RMD

For **Reach Out & Read So Az** specify this Program at <https://literacyconnects.org/> DONATE NOW

Funding sources supporting kids in high quality preschools in Pima County.

**Pima Early Education Program Scholarships**  
Provides funding for low-income families (at or below the 300% FPL)

**First Things First Quality First**  
funding for low-income families (at or below 300% FPL) County & State Programs

**Head Start**  
funding for very low-income families (at or below 100% FPL)  
\*does not include tribal Head Start. Federal Program

**Arizona Department of Education High Quality Early Learning Grant**  
grants to early childhood programs in high-need communities State Program

**Arizona Department of Economic Security Child-Care Subsidies**  
funding for low-income working families (at or below 165% FPL) State Program



Funding Sources Currently Supporting Children in High Quality PRESCHOOL in Pima County

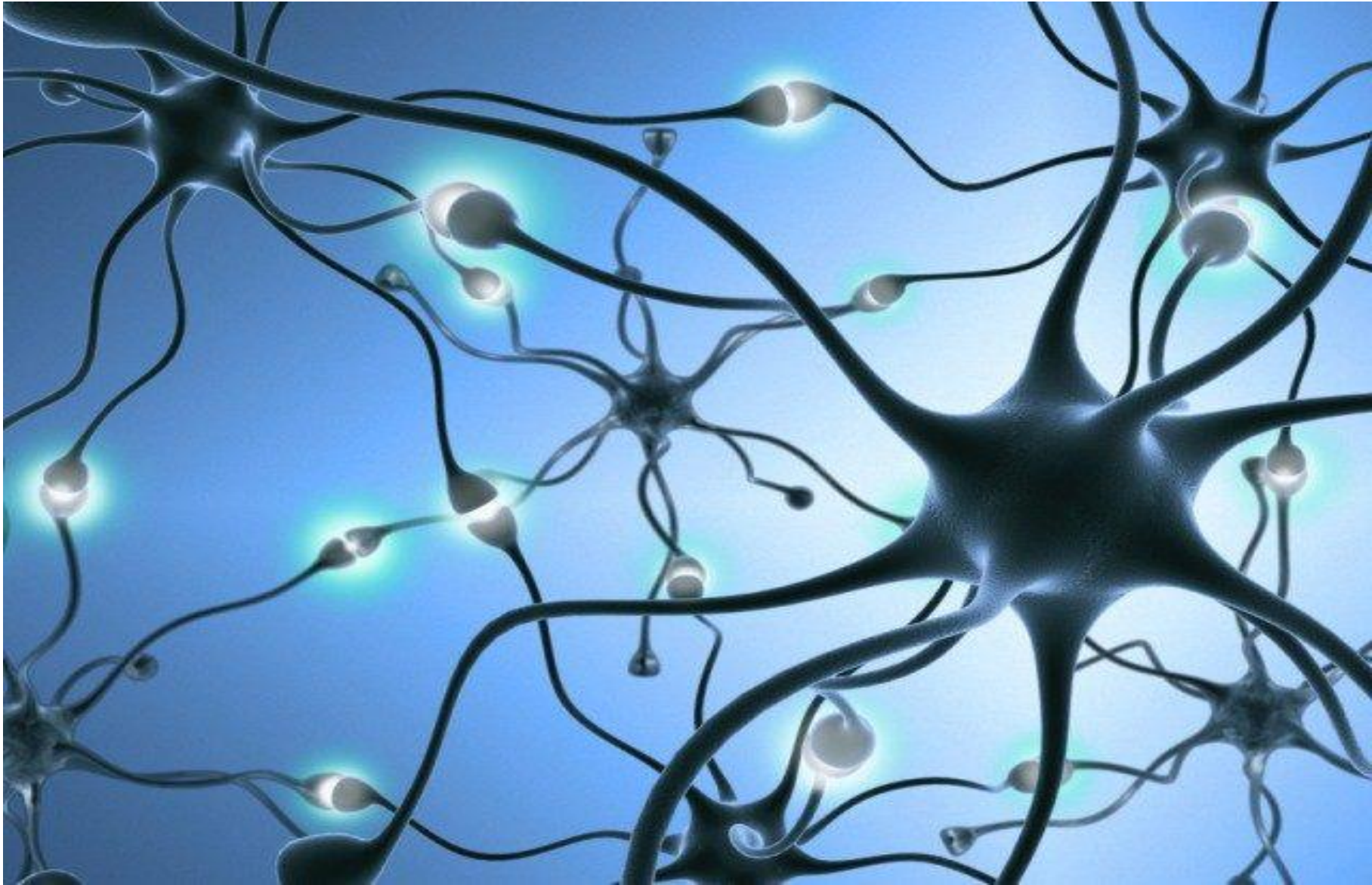




# Need a Break?

If so,  
please return in 5  
minutes for our closer  
look at early brain  
neuroscience.

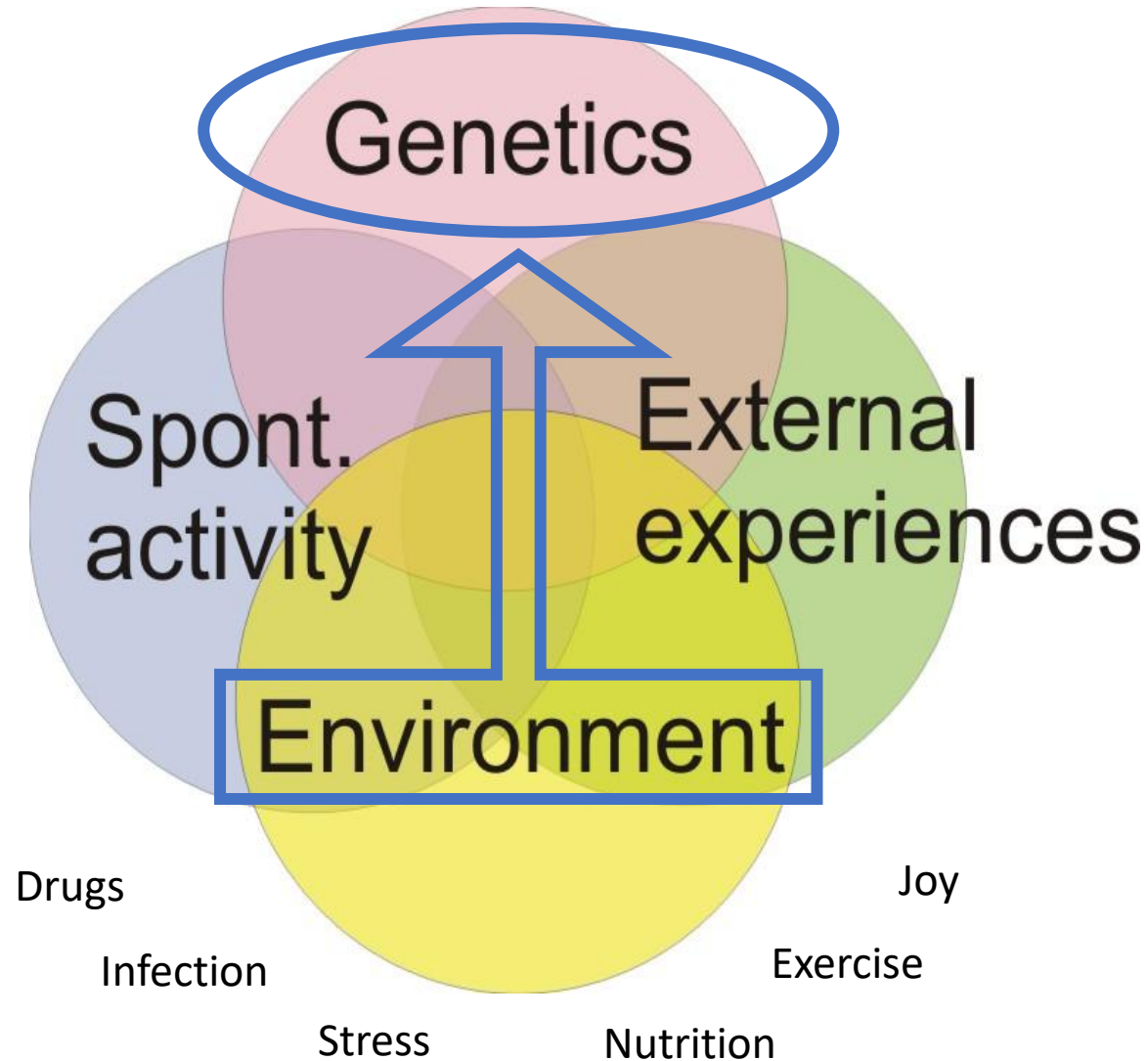




**Part 2. What's going on in there? & What matters?**



# In the beginning

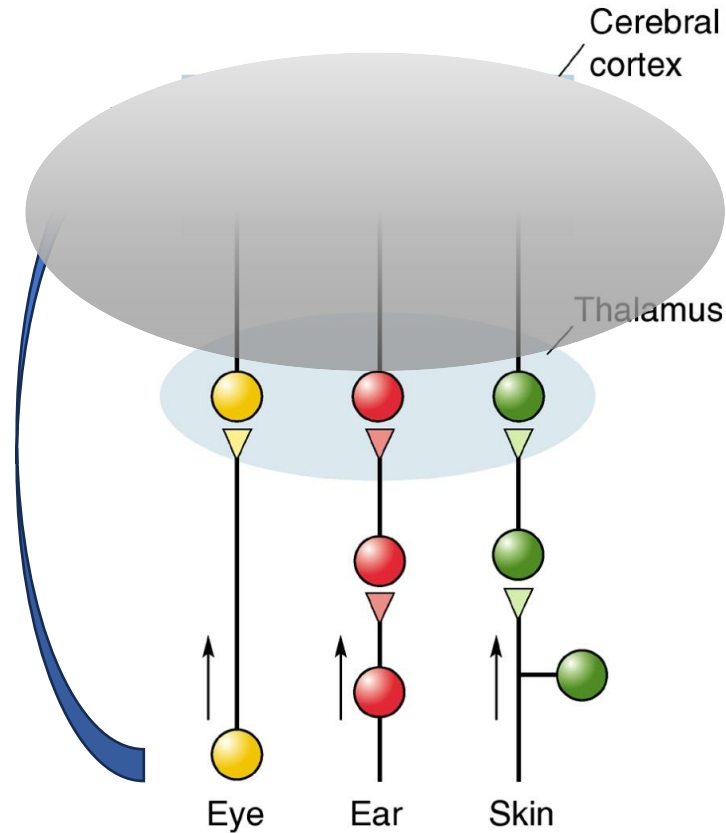


## What factors govern development of brain structure and function in the embryo and fetus?

- From the beginning brain at 2 weeks post conception through the 6<sup>th</sup> month, all of the brain building is directed by **genetics**.
- However, the expression or effect of a gene is often changed by the **environment**, including toxins, stressors and outside stimulation.

# EXPERIENCE

Fetal brain development is not impacted by sensory EXPERIENCE until there is a connection between sensory input & the cortex.



Neuroscience: Exploring the Brain, 3rd Ed. Bear, Connors, and Paradiso Copyright © 2007 Lippincott Williams & Wilkins

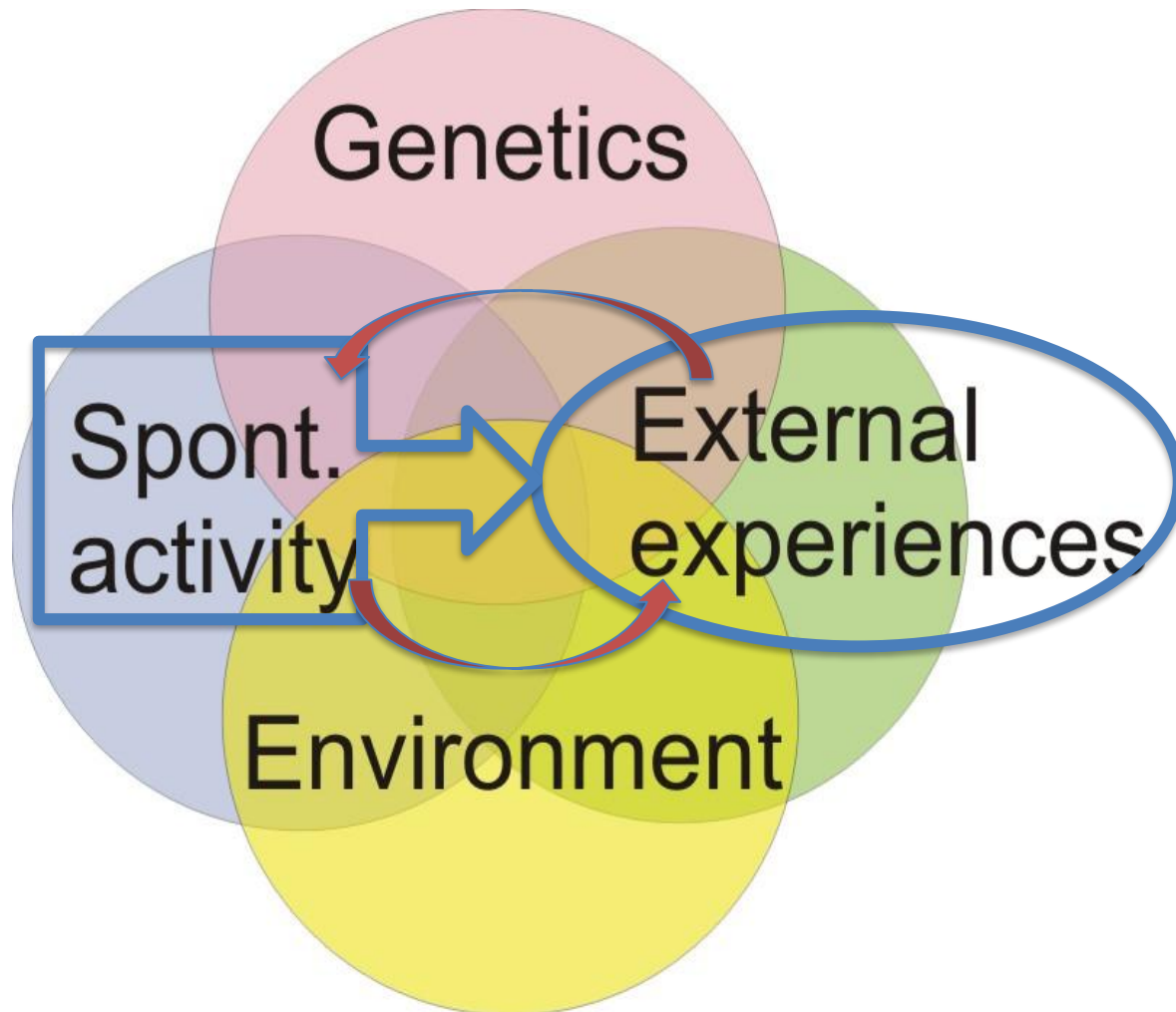
Not even the most basic pathways from the periphery all the way to the cortex are present before 5-6 months. Until then the fetus is **not perceiving** sight, sound, touch, smell or taste.

Sensory **perception** is a higher-order process that requires complex circuitry, including at minimum connections of parietal, temporal, cognitive & emotional centers.

*Beginning ~ 5-6 months, with new cortical connections, brain development begins to be influenced by Experience.*



# BY BIRTH AT 9 MONTHS, SENSED EXPERIENCES ARE KEY TO BRAIN DEVELOPMENT

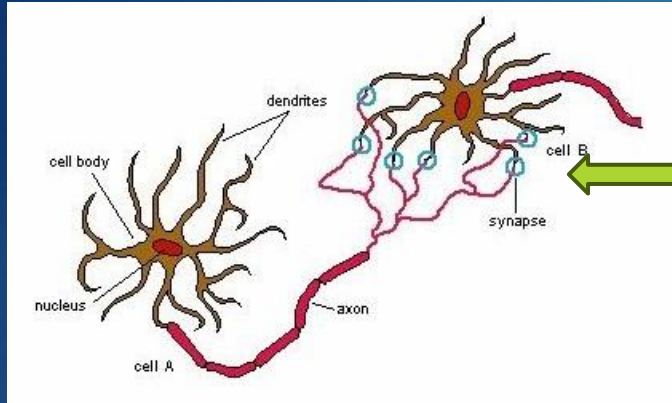


The individual's own spontaneous and intentional **activities** that interact with external experiences are equally important to neural development.

External input generates activity which in turn elicits new external input.

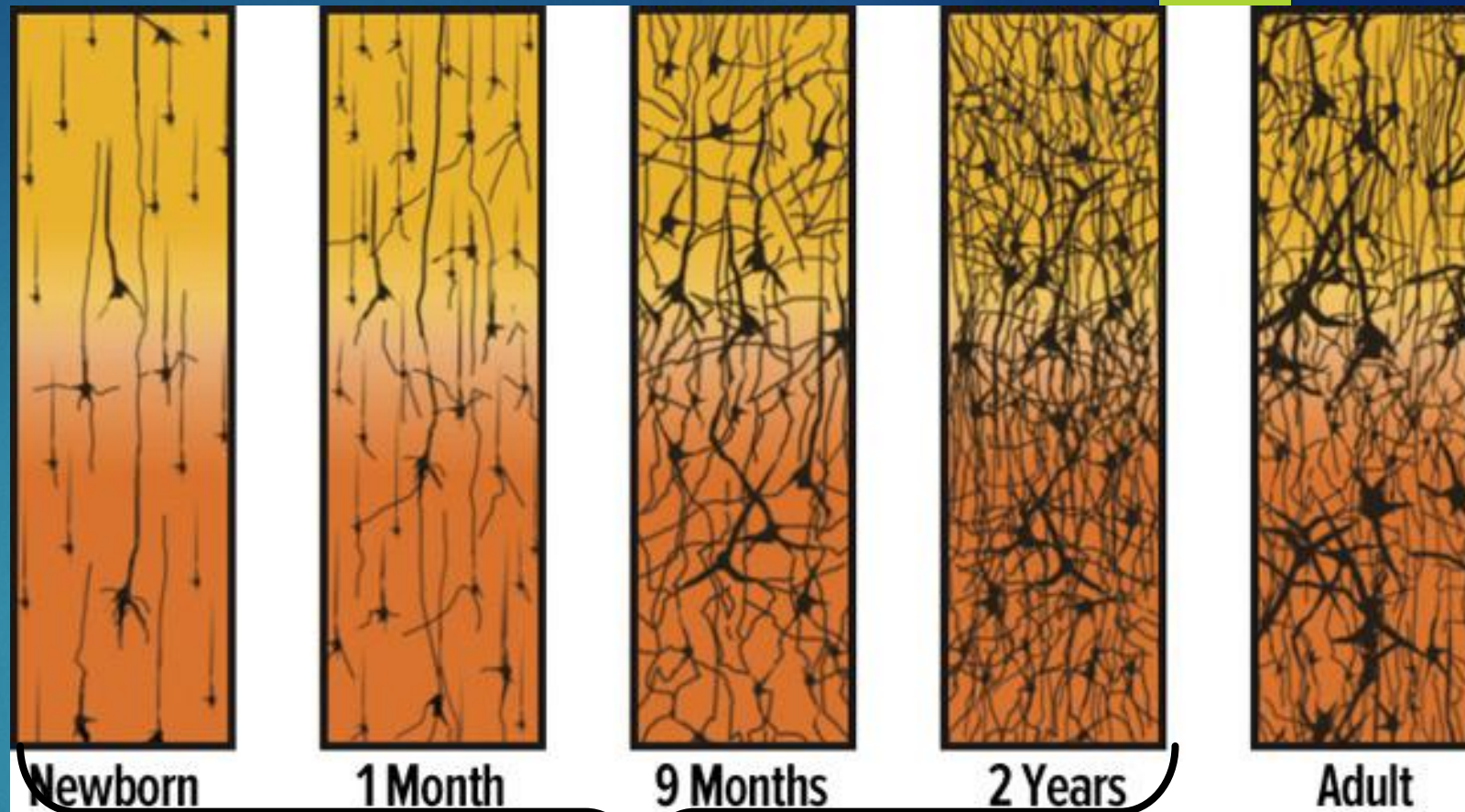
This is the critical nurturing loop known as **Serve and Return**.

**SYNAPTOGENESIS** is stimulated and supported by motor and sensory **EXPERIENCES**, including touch & talk.



This is the essence of learning.

Not used? The synapse is removed – “pruned”.

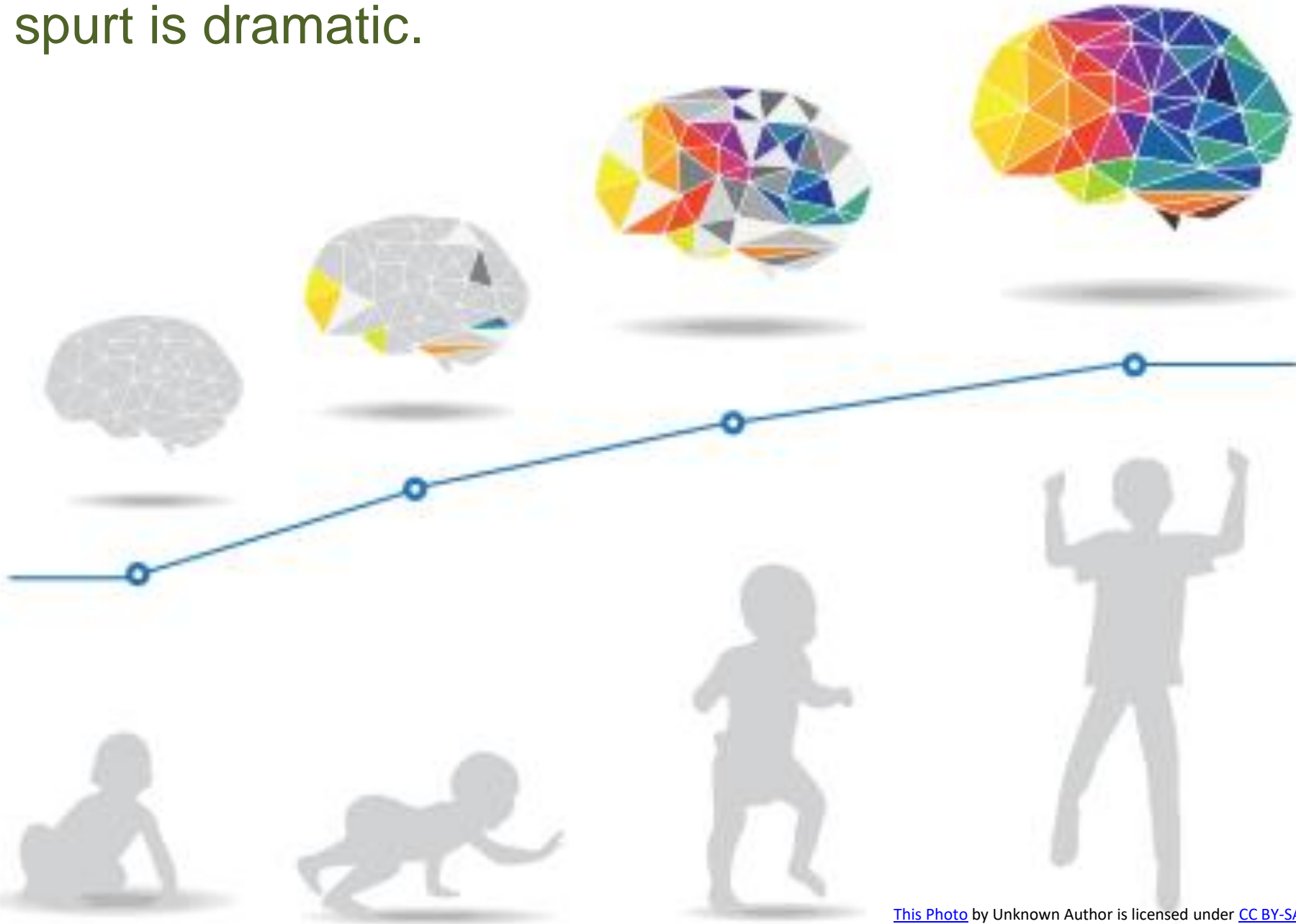


In the brain in the first year of life **700 new interconnections are made every second. No new cells.** The increasing density seen over the first 2 years is just from the rapidly developing networks of axons and dendrites. You can see the result of pruning in the more specialized brain of an adult.

# Early childhood

Brain growth spurt is dramatic.

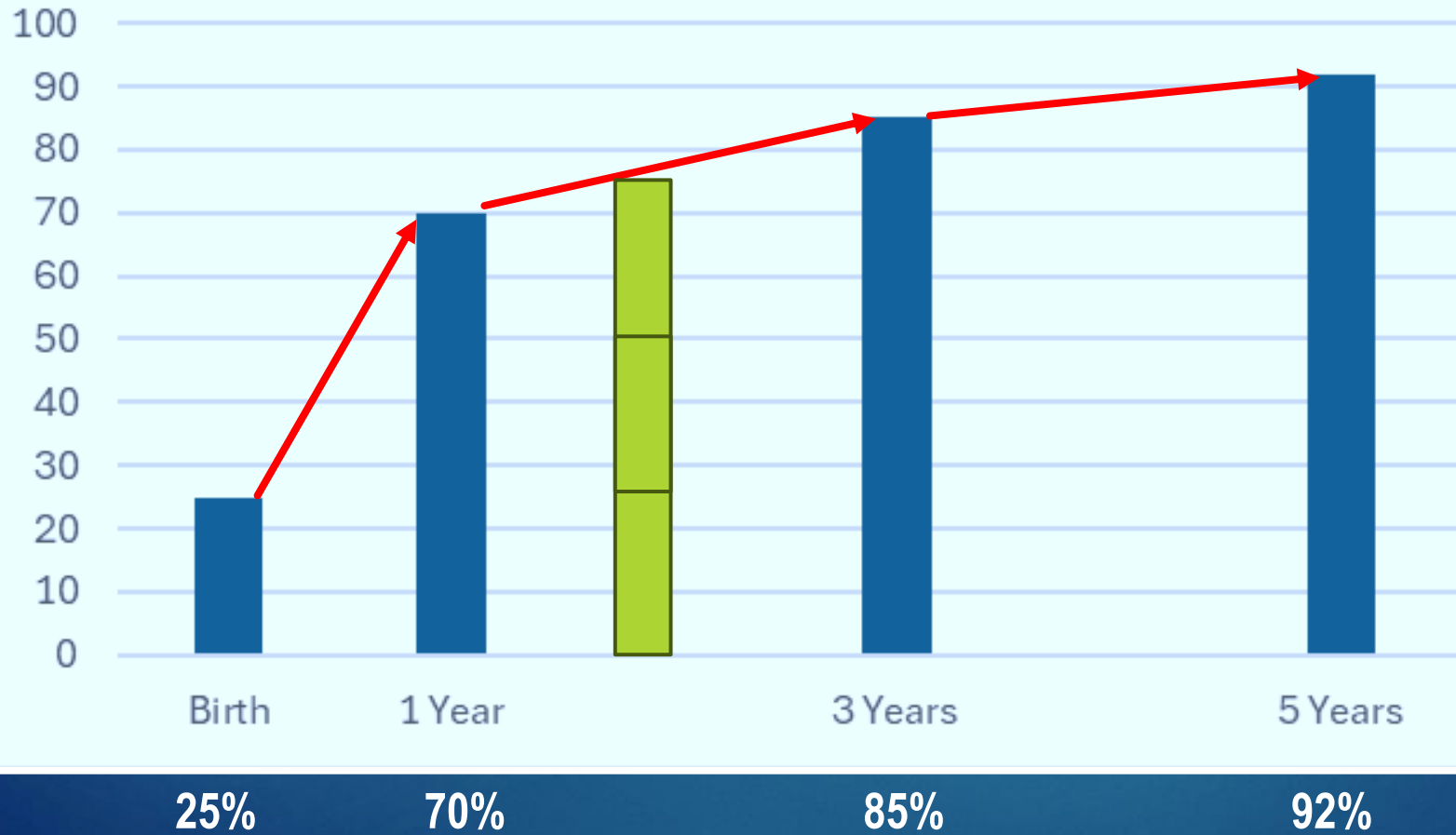
Brain at  
**birth**  
**25%** of its  
adult weight



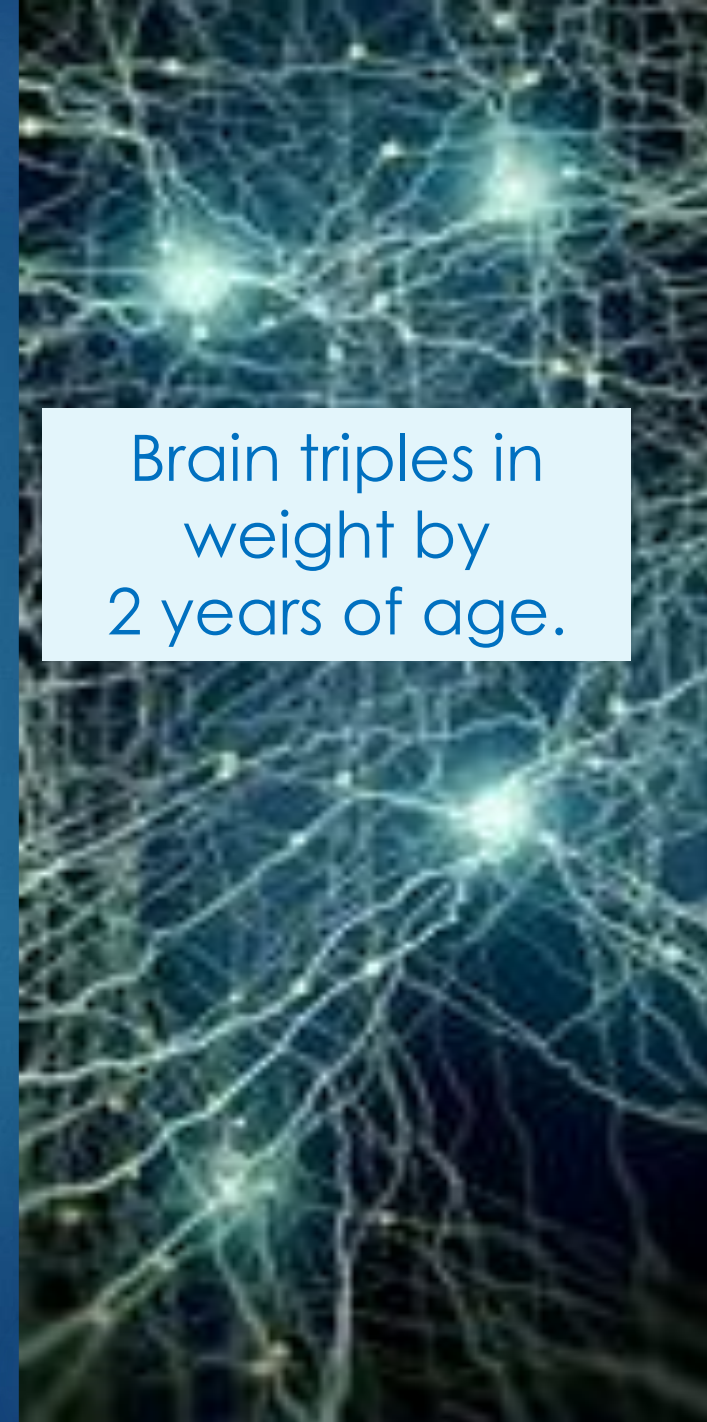
Brain at  
**2 years**  
**75%** of its  
adult weight

# Earlier enrichment → bigger impact

Brain Weight as % of Adult,  
Birth to 5 Years



Brain triples in weight by 2 years of age.



# EXPERIENCE-**EXPECTANT** brain development

## *Necessities for Foundational Brain Development*

### **Every developing brain EXPECTS**

certain things and usually experiences them:

- Faces to see
- Words to hear
- Touching bodies
- Nourishment to taste and swallow
- Objects to explore
- Opportunity for movement



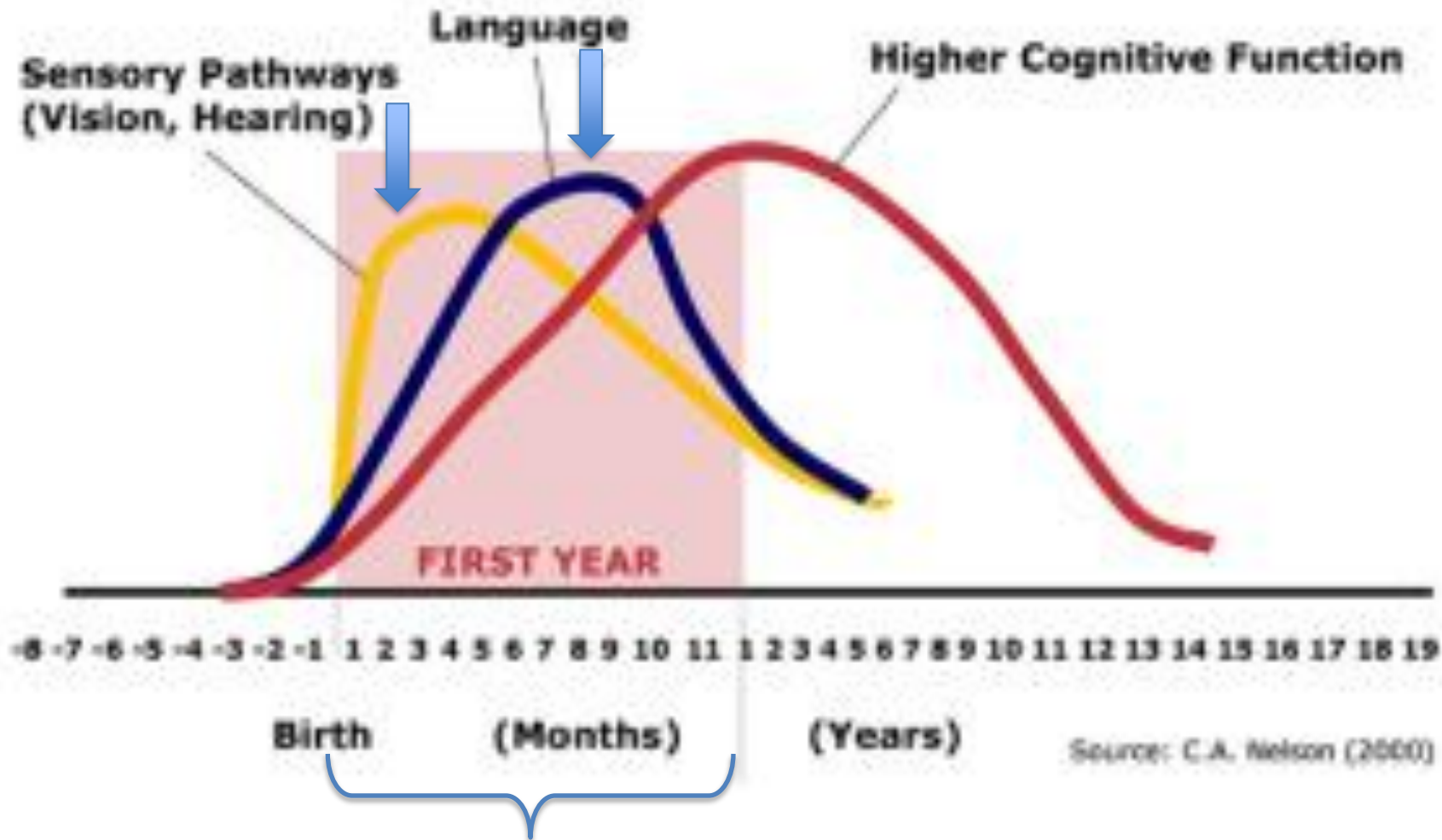
### **ALL HUMAN BRAINS REQUIRE:**

- Holding, caressing
- Eyes and ears that work properly
- Nutrition
- Serve and Return:  
in-person  
interaction,  
conversation

# Experience-*expectant* development

## Human Brain Development

Neural Connections for Different Functions Develop Sequentially



This shows the rate of making **new synapses** that form **REQUIRED** neural structures.

You can see that the peak of this work occurs in the **first year** for the critical framework for **seeing & hearing**, and for **discriminating the sounds** of language.

If there is no opportunity for sight or sound during this critical period, the foundation to process vision or hearing would be minimal.



*Most brain  
development after  
birth is  
Experience-  
Dependent*

Experience shapes the brain to meet the needs of the child's specific circumstances.

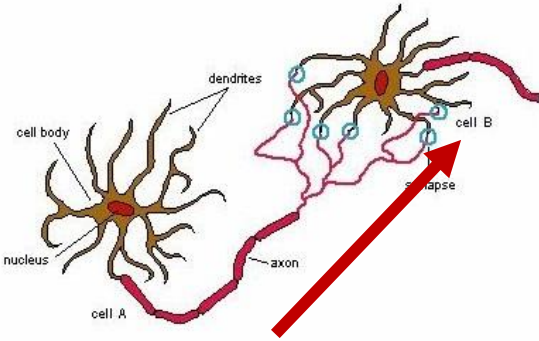
If the parents speak Mandarin, the brain must be able to process those sounds.

If the child lives in a rural area or a huge urban center, it needs to develop skills appropriate to those environments.

If reading matters, a vast network of connections must be developed.



# Each brain's unique development is dependent on experiences.



Kopec, C. and Malinow, R. 2006. Science. 314: 1554-1555

## Connections depend on use.

Remember the initial video? It showed how synapses that are used repeatedly get stronger. Synapses that are not used go away.

A normal **6-month-old** has a “**universal language processor**”, which is sensitive to and ready to learn the sounds of **any** language. But later, by just **1 year** of age, he mainly just responds to sounds of his **family's** language.

- In infancy, the **repetition of particular sounds** increases the strength, stability and number of synapses that are responsive to those sounds.



for sounds that aren't heard atrophy & are “**pruned**” starting around 6 months. By 12 months the “universal processor” for speech sounds is largely gone.

Researcher Patricia Kuhl found that just a dozen 20 minute **in person** interactions in the **foreign** language between **9 & 10 ½ months** of age

is enough to preserve the processor for the sounds of that language!

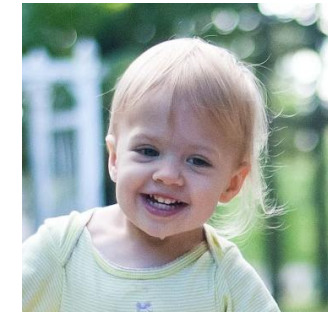


# Sensitive Periods for Experience-*Dependent* development

Times when the young brain is especially receptive to *specific types of input* because it is “GO TIME” for neurons to grow and connect.

Learning is rapid and efficient

After this “window” closes, learning is possible but is significantly harder.



A Cultured hippocampal neurons

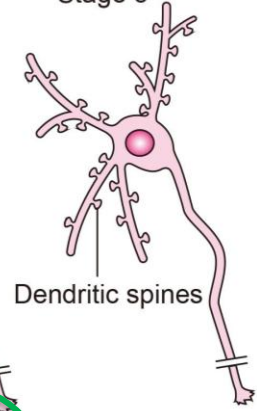
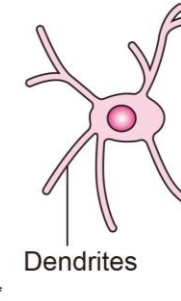
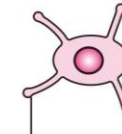
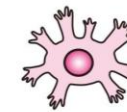
Stage 1

Stage 2

Stage 3

Stage 4

Stage 5



Minor neurites

Axon

Dendrites

Dendritic spines



Newborn



1 Month



9 Months



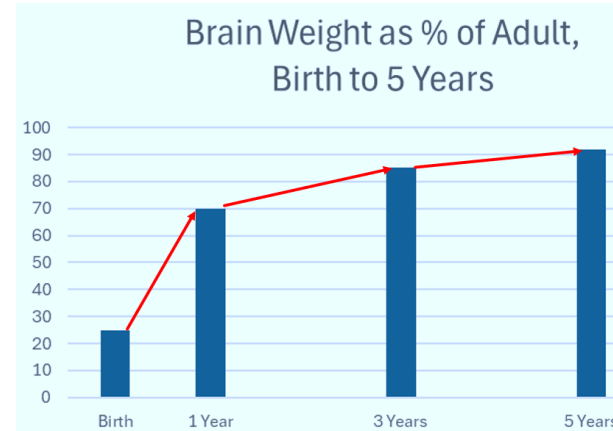
2 Years



Adult

# Sensitive periods are mostly during the first 3-5 years of life.

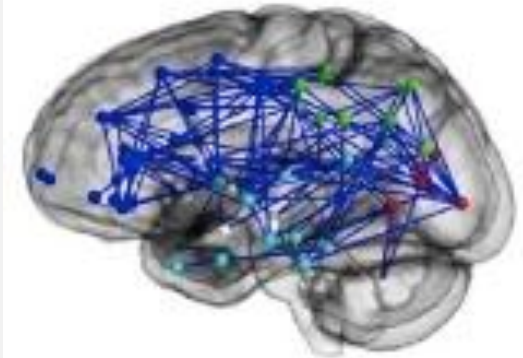
- Motor development – before birth to roughly age 4
- Emotional control – 0 to 2-3 yrs
- Vision – 0 to 2-3 yrs
- Social attachment – 0 to 2-3 yrs
- Math/logic – 1 to 4-5 yrs
- Music – 3 to 10 yrs
- Language – 0 to 7 yrs



- During sensitive periods, synapses multiply rapidly and become stronger.
- Using the major pathways determined prenatally by genetics, the highly plastic brain of early childhood **rapidly grows the elaborate dendritic arbors and additional synapses as experience dictates that they are needed.**
- **But this growth does not occur if there is deprivation or toxic stress.**

# Experience-dependent development

- General principle: the young brain thrives with rich **sensory** and **social** stimulation, building robust connections to match the experiences.
- Enriched environments are associated with “good” brain development:
  - formation of efficient connections
  - increase in synapses and branching
- **Impoverished environments can be disastrous, especially during the sensitive periods of early childhood.**



This Photo by Unknown Author is licensed under [CC BY](#)

During sensitive periods, experience & activity will increase & strengthen synapses, **but deprivation can produce lasting impairments.**

*This is the main take-home message!*

# Sensory Enrichment

## TOUCH



*Infant “massage” is associated with better physical growth & synaptogenesis*

## SOUND



*Zhao & Kuhl, Proceedings of the National Academy of Sciences, 2016*

*Interacting with waltz music 12 sessions at 9 – 10 months improves auditory processing and detection of sound patterns*

# Enrichment

## OPPORTUNITIES to EXPLORE & SOCIALIZE

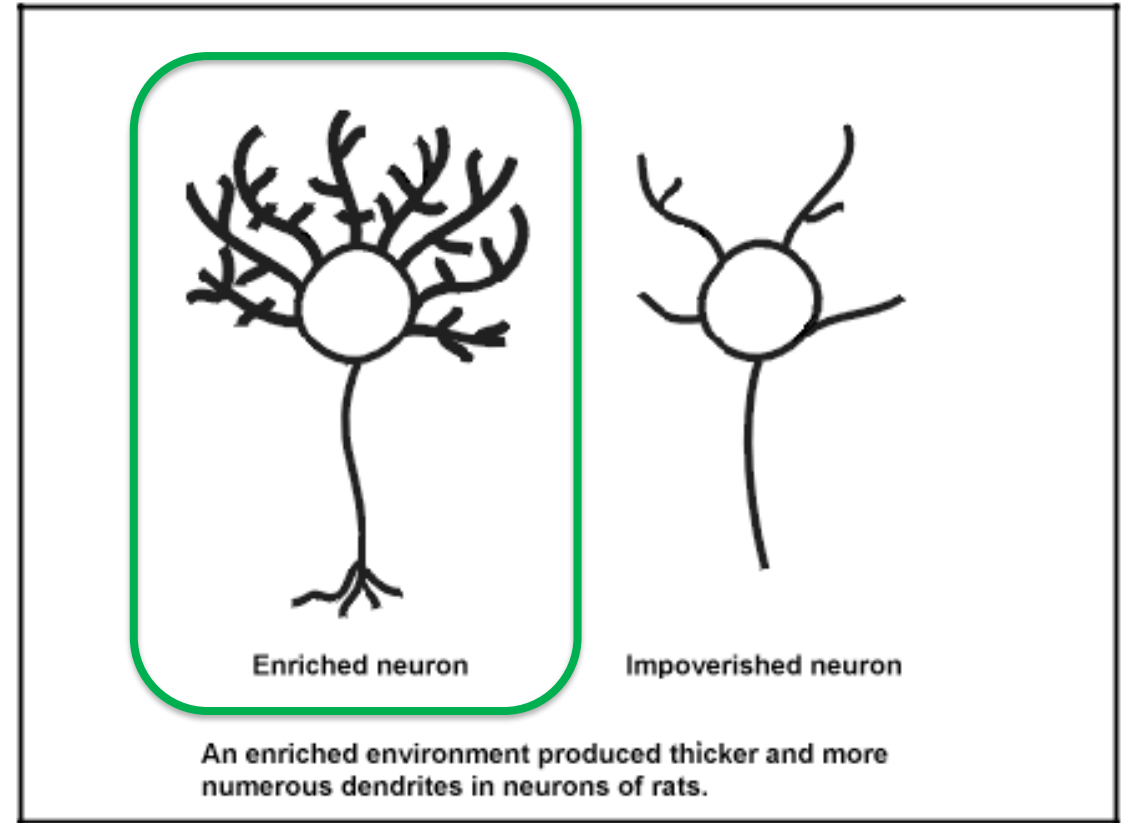


(c) Enriched condition



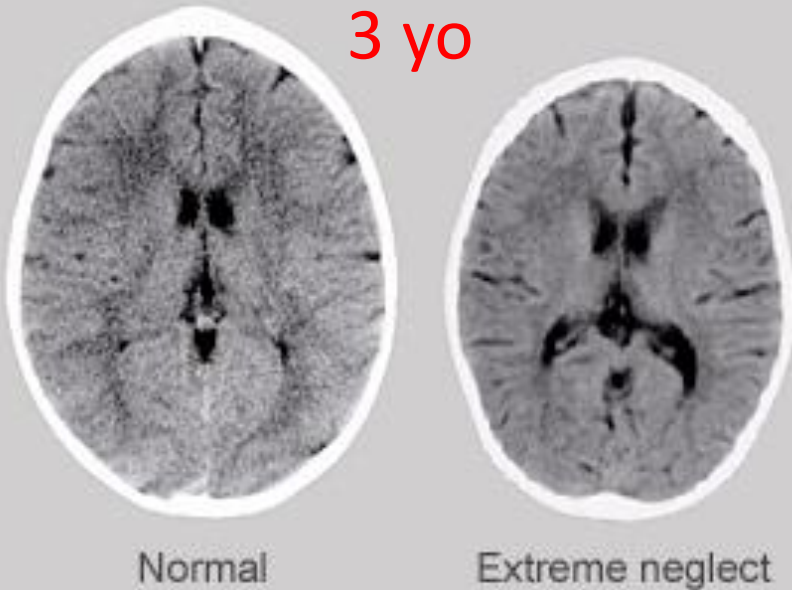
“standard cage”

Versus



*Early enrichment is associated with much better neuron & brain development*

# Impoverished environment: early deprivation in Romania



Lack of personal connection or brain development  
→ primitive reactivity.

- Conduct disorders.
- Aggressive behavior, such as cruelty to animals, fighting and bullying.
- Destructive behavior, such as arson and vandalism.
- Deceitful behavior, such as shoplifting and lying.
- Violation of rules, which may include truancy and running away from home.

## brain:

- reduction in white matter
- reduction in grey matter

## behavior:

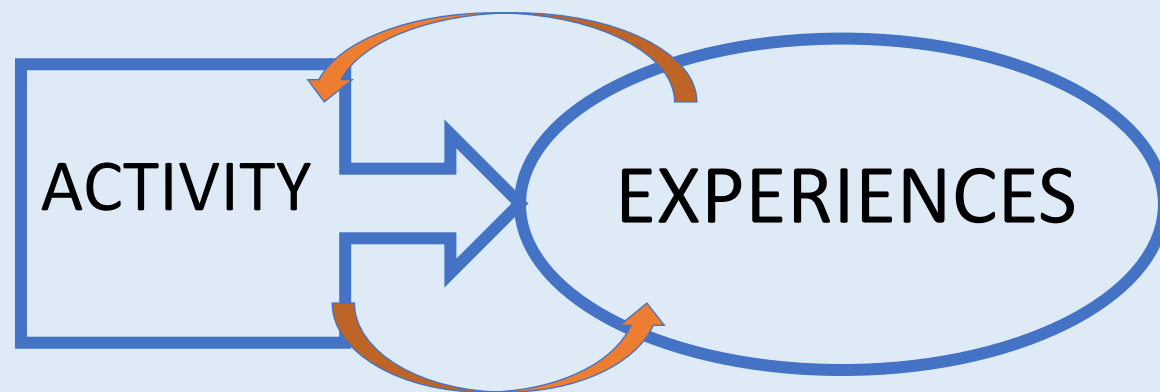
- conduct disorders
- depression





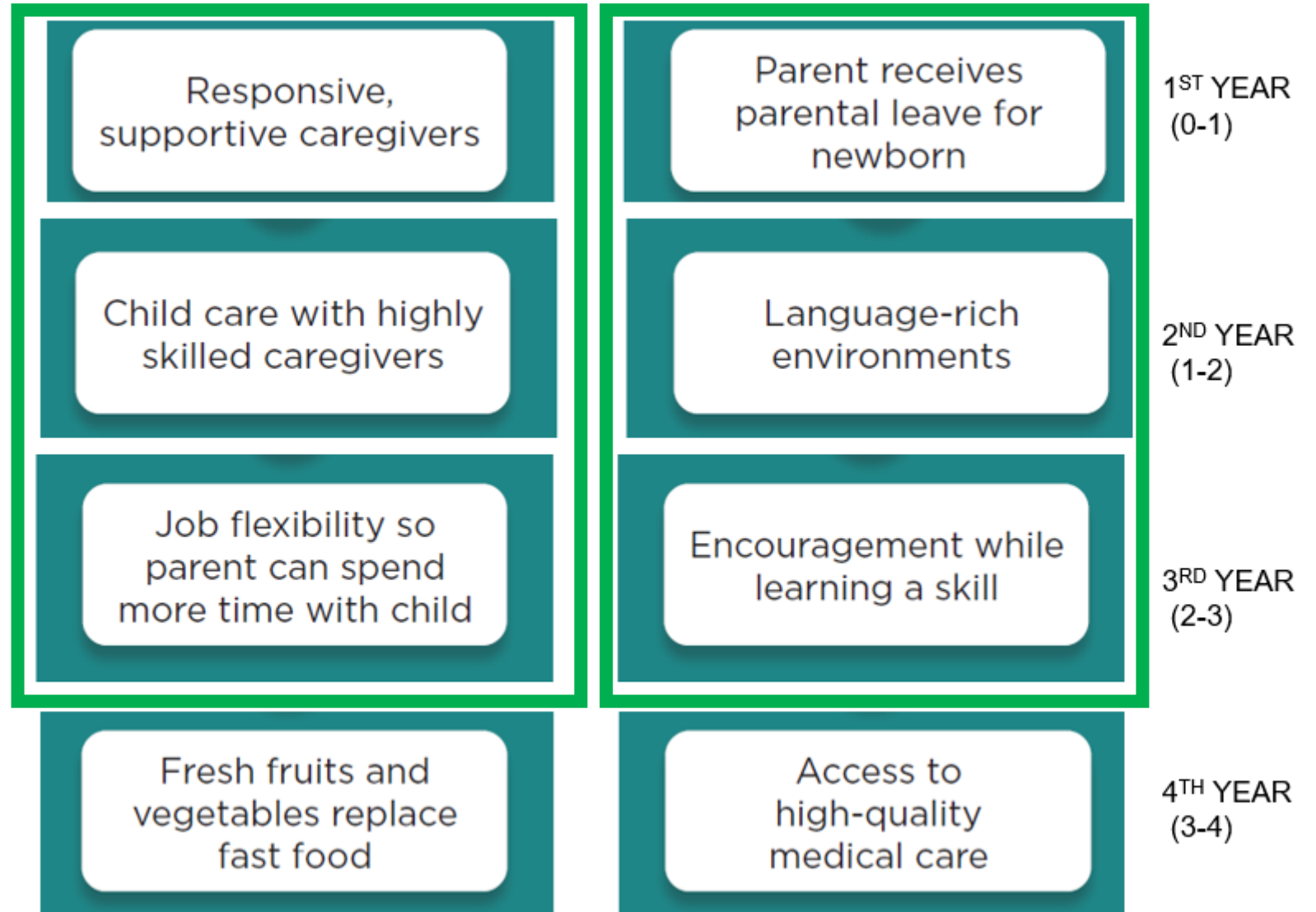
KEY INGREDIENT:  
Social Interaction

*Serve & Return:*  
Prompt returns to the  
infant's and child's serves



Necessary both for  
Expectant basic functions &  
Dependent brain specialization

The opportunity for ample  
**Serve and Return**  
interaction is key to healthy  
brain development.

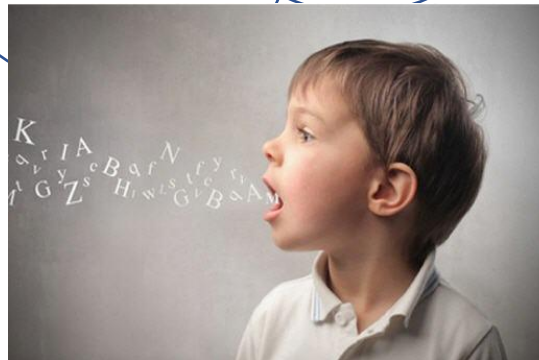


# Serve and Return is critical for language development.



*Imagine ---*

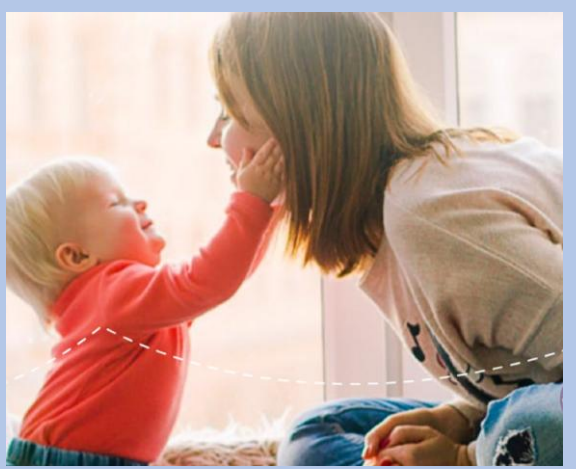
How do they get from here to there?



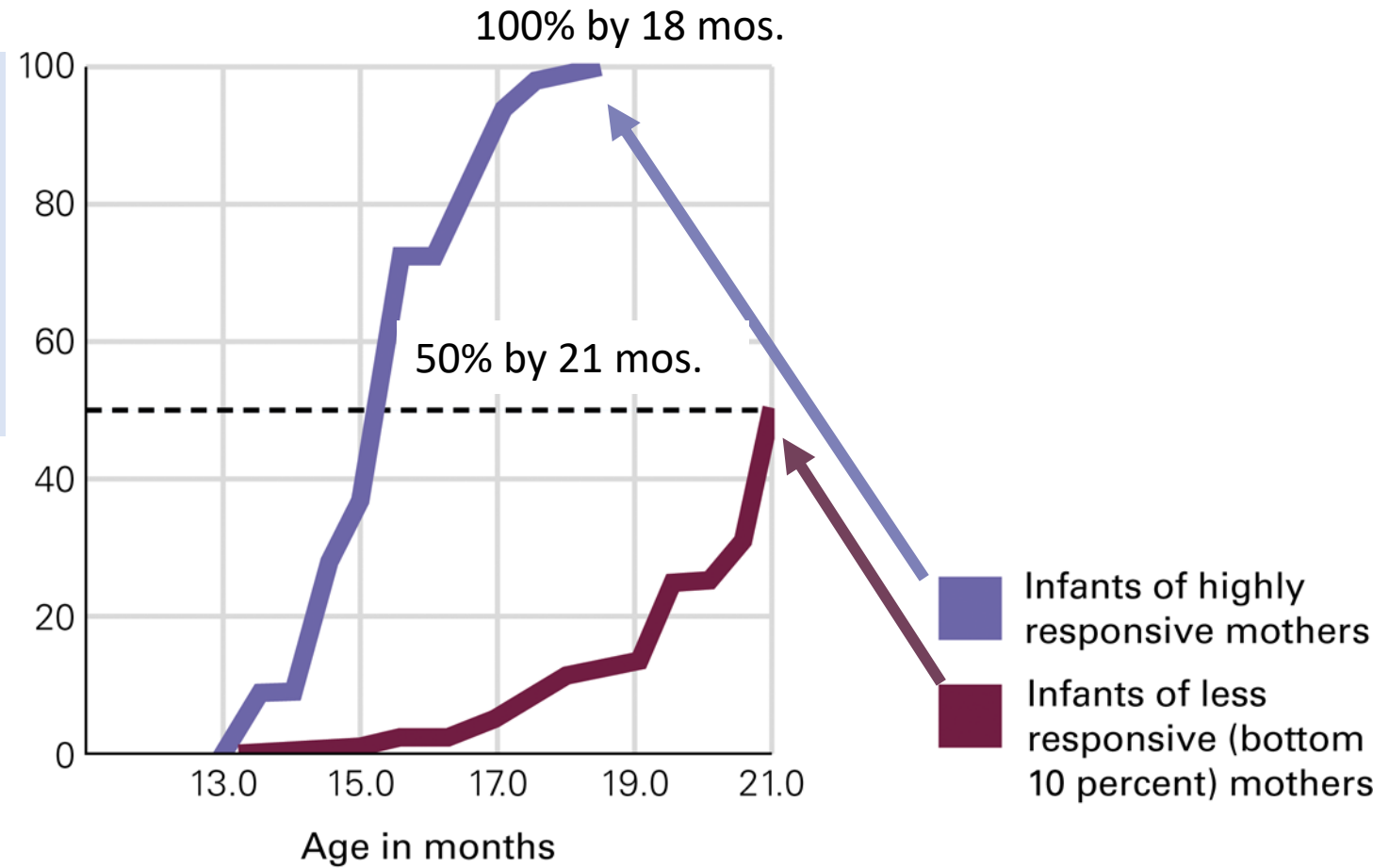
# Language learning is enhanced with “responsive mothers”



shutterstock · 491857810



Percent of infants knowing at least 50 words.



[This Photo](#) by Unknown Author is licensed under [CC BY-NC-ND](#)

Source: Adapted from Tamis-LeMonda et al., 2001, p. 761.

**Figure 6.1** Maternal Responsiveness and Infants’ Language Acquisition  
Berger: The Developing Person Through the Life Span, Seventh Edition  
Copyright © 2008 by Worth Publishers

12 sessions between 9 and 10.5 months of age



# Talking and reading in person grows language.

Patricia Kuhl, The Baby Brain.  
Brain Mind Summit

NO LEARNING when same lessons  
given by audiovisual video.



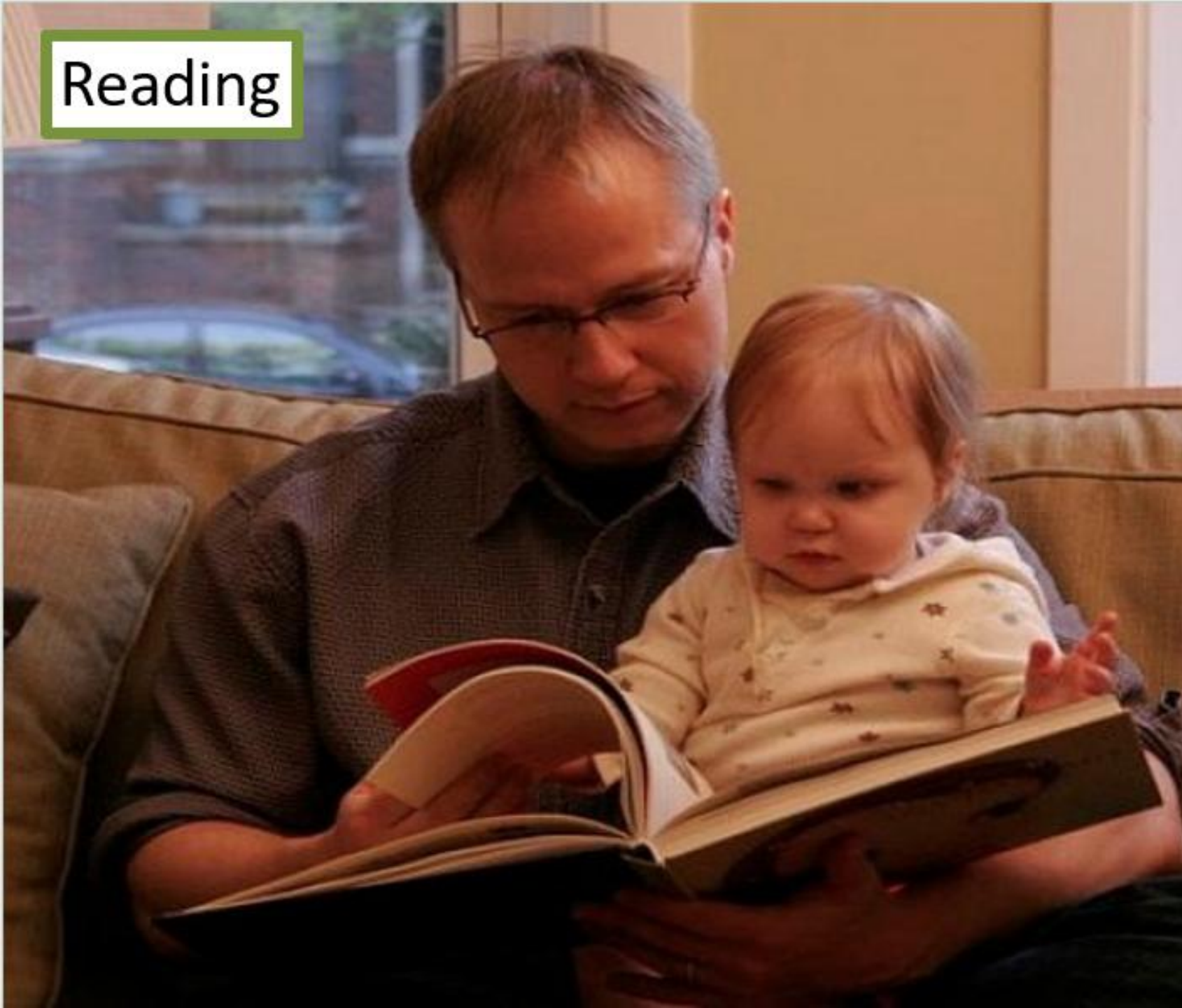
<https://youtu.be/ErPPXfsY6a8?si=iRXBYUuTrY3J4nmK>



Multiple studies document that turn-taking conversations with the child have the greatest impact on the number of words that a child understands and a child's speaking vocabulary.

Reading together enhances turn-taking conversation with expanded topics & vocabulary as well as pictures.

# Reading



- Early exposure to print in the home is the strongest predictor of school success, including reading proficiency.
- Educators talk about the 10-book child versus the 1000-book child.



**Make Way** for **Books**

# Reach Out and Read



**Pediatric providers** give an age-appropriate book at **each well exam** visit from **6 months to 5 years**, modelling interactive reading and explaining its importance.

Recent study of [100,000 survey responses](#) found that parents with exposure to Reach Out and Read were:

- 27 percent more likely to report reading or looking at books with their child every day
- more likely to engage in positive shared reading behaviors that support parent engagement and bonding ----
  - letting the child turn pages,
  - making up stories about the pictures,
  - asking the child about the pictures,
  - helping identify things in the pictures, and
  - reading for at least 30 minutes every day.



# MAKE WAY for BOOKS

Free App, fully bilingual, no ads.

- ✓ Read stories on the app.
- ✓ Tips to enhance reading with little ones.
- ✓ Related fun activities.
- ✓ Best books for each age, 0- 5yrs,
- ✓ Where the books are in Pima County Libraries with the distance from you.

In Person Programs:

- Family Education and Literacy
- The Story Project: School-Based Literacy
- Cuéntame Collaborative for home-based care providers

# Make Way for Books

App for families with babies, toddlers, and preschoolers



## Parenting can be tough.

Finding great books shouldn't be.



Read books on the app.

Build skills with your child.

Find books at the library.

Scan now for  
free books:



# One's future in schooling and beyond is profoundly impacted by one's kindergarten vocabulary.

This is a graph of data from a table in an extensively researched textbook on human development. It depicts a huge variation in the total number of words a child would **understand** by kindergarten.

We know where we'd like every child's vocabulary to be.

Sooo ---

20,000				20,000
19,000				
18,000				
17,000				
16,000				
15,000				
14,000				
13,000				
12,000				
11,000				
10,000			10,000	
9,000				
8,000				
7,000				
6,000				
5,000		5000		5000
4,000				
3,000			3000	
2,000	2000			
1,000	100	1000		
	2 years	3 years	4 years	5 years

(Data in Berger, K. Invitation to the Life Span, 4<sup>th</sup> ed, Worth Publishers, 2019, p 175.)

On the handout:

Supporting  
Serve & Return,  
language and  
reading.

### **\$\$\$ Donations**

**For PEEPs & Family Support Alliance** go to

United Way of Tucson & Southern AZ,

**<https://give.unitedwaytucson.org/>**

DONATE: “Designate where needed most” v  
Educational Success. In Memo specify

PEEPS = Accelerate Quality and/or  
Family Support Alliance

For questions **or to use RMD**, contact

Monica Brinkerhoff, [mbrinkerhoff@unitedwaytucson.org](mailto:mbrinkerhoff@unitedwaytucson.org)

For **Make Way for Books** use Ways to Give at

<https://makewayforbooks.org/> for **RMD**

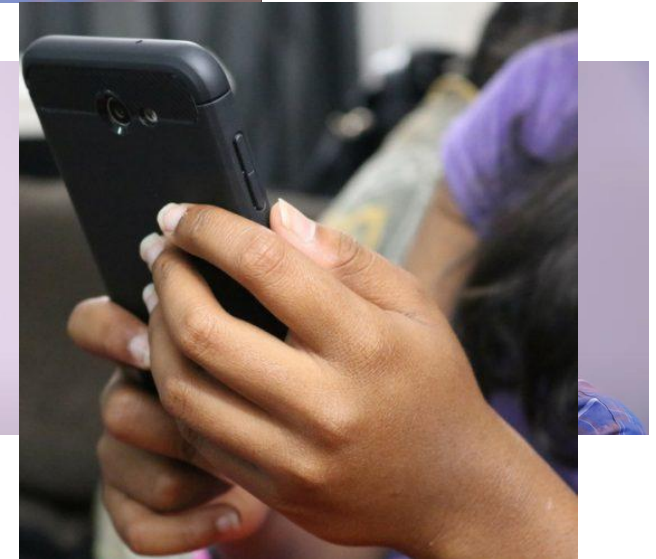
For **Reach Out & Read So Az** specify this *Program* at

<https://literacyconnects.org/> **DONATE NOW**

# No "S & R" = DEVELOPMENT IMPAIRED

## Neglect & Still Face Experiment:

- All babies require immediate returns to their serves.
- It is **experience-expectant**, and they are wired to work to get it.
- Its persistent absence is **NEGLECT**.



- <https://youtu.be/7Pcr1Rmr1rM> Still Face with Dads, Richard Cohen, PhD

Original  
• Still Face

Experiment with  
Dr. Ed Tronick, Ph.D.

The lack of  
interaction from a  
parent or other  
important care  
provider who is  
physically present,  
is highly stressful.

<https://youtu.be/YTTSXc6sARg>



The holding caring presence of a trusted (trustworthy) adult can mitigate the damaging effects of transient stress.

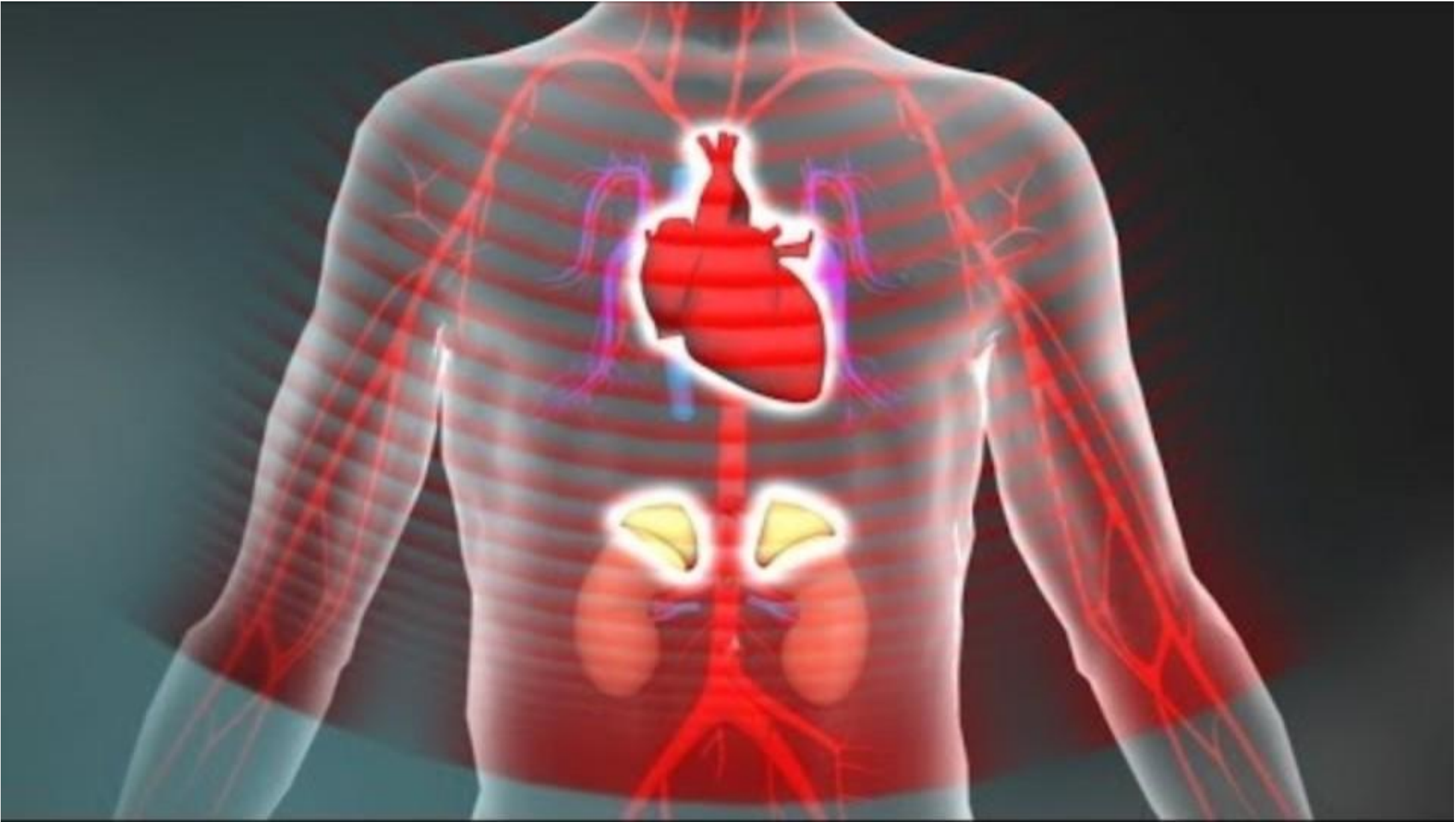
### **Good touch**

turns on **serotonin** production which decreases production of cortisol, the stress hormone  
→ an increase in felt **comfort**, and facilitated **synaptogenesis**.



**TOXIC  
STRESS!**

Toxic  
Stress





Severe neglect

Emotional abuse  
from one parent

Malnutrition

Witness domestic  
violence

Removed from home  
by child protection  
services

Caregiver  
substance abuse

Chaotic, dangerous  
child care facility

Persistent  
neighbourhood  
violence

Exposure to  
hazardous chemical

Caregiver depression  
diminishes “serve &  
return” interaction

Child care with  
poorly trained child  
care providers

Frequent changes  
in caregivers

Disorganized,  
unskilled child care

Addictive screen use  
by parents ~ **still face**

Parents divorce

Parent loses job,  
affecting family  
resources

Natural disaster  
(earthquake, hurricane, flood)

Earthquake  
damages home and  
neighbourhood

\$ stress of Inflation  
& housing scarcity

Premature birth

Childhood illness

Injury, illness  
hospitalization

Conflict with peer

Less opportunity for  
outdoor play

Toxic Stress Derails Healthy Development



## HEALTHY NURTURE

What is the difference between  
“TOLERABLE” stress and  
“TOXIC” stress?

Why would a history of  
Toxic circumstances  
affect the impact of a  
new “Tolerable stress”?

## TOXIC STRESS

Toxic Stress Derails Healthy Development



# Thinking again --

When would the impacts of  
toxic and tolerable stresses  
be the most harmful –  
Birth to 2 years or  
3 to 5 years?

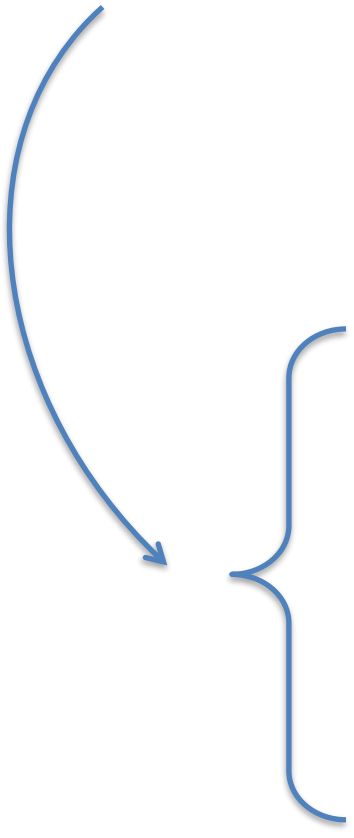
# Effects of chronic stress on development

ACEs

Early life stress or Adverse Childhood Experience

physical neglect, and emotional neglect

sexual abuse, physical abuse, emotional abuse,

- 
- Poor cognitive growth
  - Reduced emotional control
  - Poor growth
  - Poor development of resilience
  - Increased vulnerability to mental illness
  - Disrupts the architecture of the developing brain

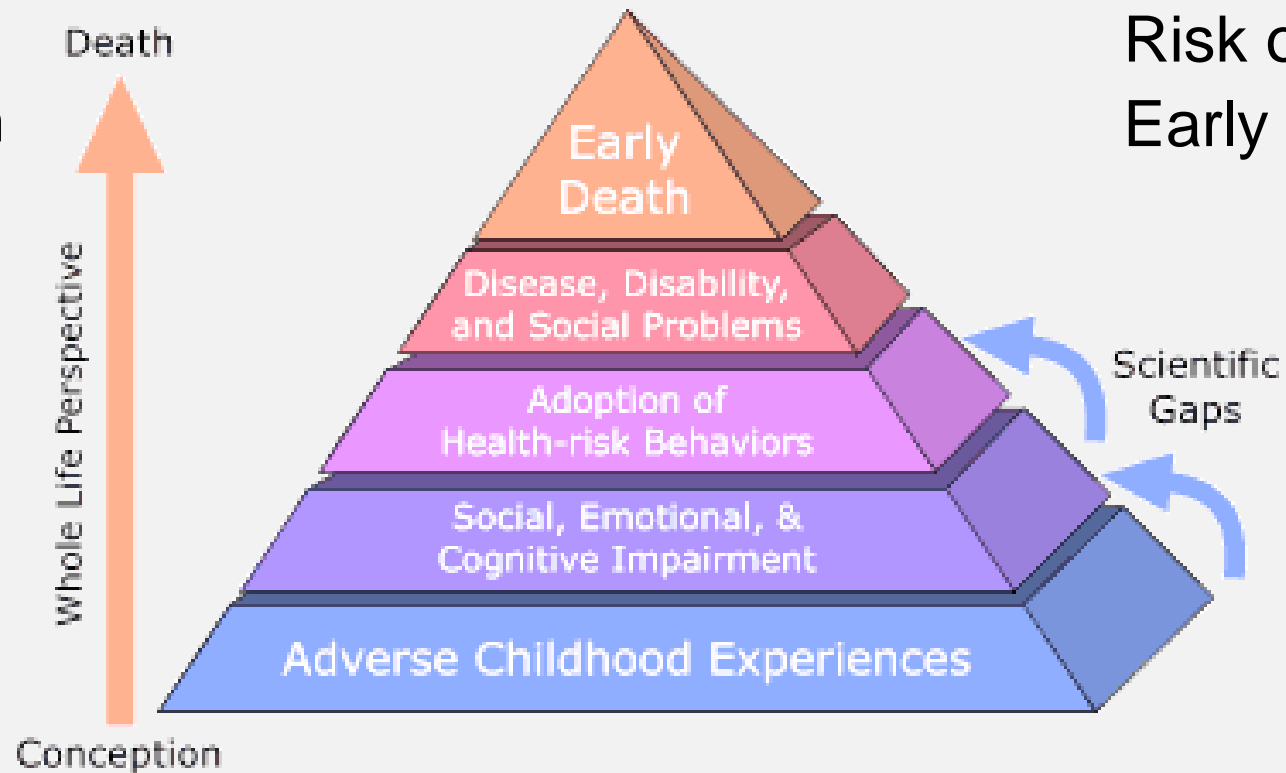
# Chronic childhood stress → later problems

## Adolescence:

Substance abuse  
Mental health problems  
Early pregnancy  
Risk of victimization

## Adulthood:

Heart, lung & liver disease  
Depression, suicide risk  
Risk of HIV infection  
Early death



# When parents are unable to engage:

Neglect and Toxic Stress  
Derail Healthy Development

If a parent isn't able/available (as depressed,  
addicted, ill/exhausted and/or WORKING)

it is

critical for someone to reliably provide

**Serve & Return:**

Other parent,  
Grandparent, aunt, uncle  
Even older sibling—  
Other caring adults,  
**Early childhood professionals**

The “village” can help the  
parents obtain mental  
health intervention as  
well as parenting support  
& child care.



A Caring  
Community  
for Early  
Childhood

**Neglect  
High risk**

**Family Support Alliance**

**Child Care  
Preschool.**

*Az Child Care Resource &  
Referral (CCRR)*

**Parenting Support:  
Health Services,  
Accurate Information,  
Language, Reading**

Health Centers  
PCDPH, WIC

**0-5 Hotline 877-705-5437**  
**First Things First**  
AAP's HealthyChildren.org  
Zero to Three

**Make Way for Books**  
**Reach Out & Read**



# VILLAGE HELP FOR PARENTING



**EACH BRAIN MATTERS**  
THE CENTER FOR NEUROSCIENCES FOUNDATION



**In-Home Family Support** (home visitors).  
<https://unitedwaytucson.org/family-support-alliance/>

**[FamilySupport@UnitedWayTucson.org](mailto:FamilySupport@UnitedWayTucson.org)**  
**(520) 903-3921**

**Home Visiting** with

- Nurse-Family Partnership
- Early Head Start
- Parents as Teachers
- Healthy Families America

**Reliable information for parents  
of infants & young children**

<https://www.firstthingsfirst.org/>  
<https://www.healthychildren.org/>  
[www.zerotothree.org](http://www.zerotothree.org)

**0-5 Hotline, 8 – 8 M – F 877-705-5437**

**Comprehensive Guide to Community Resources for 0 – 5-year-olds**

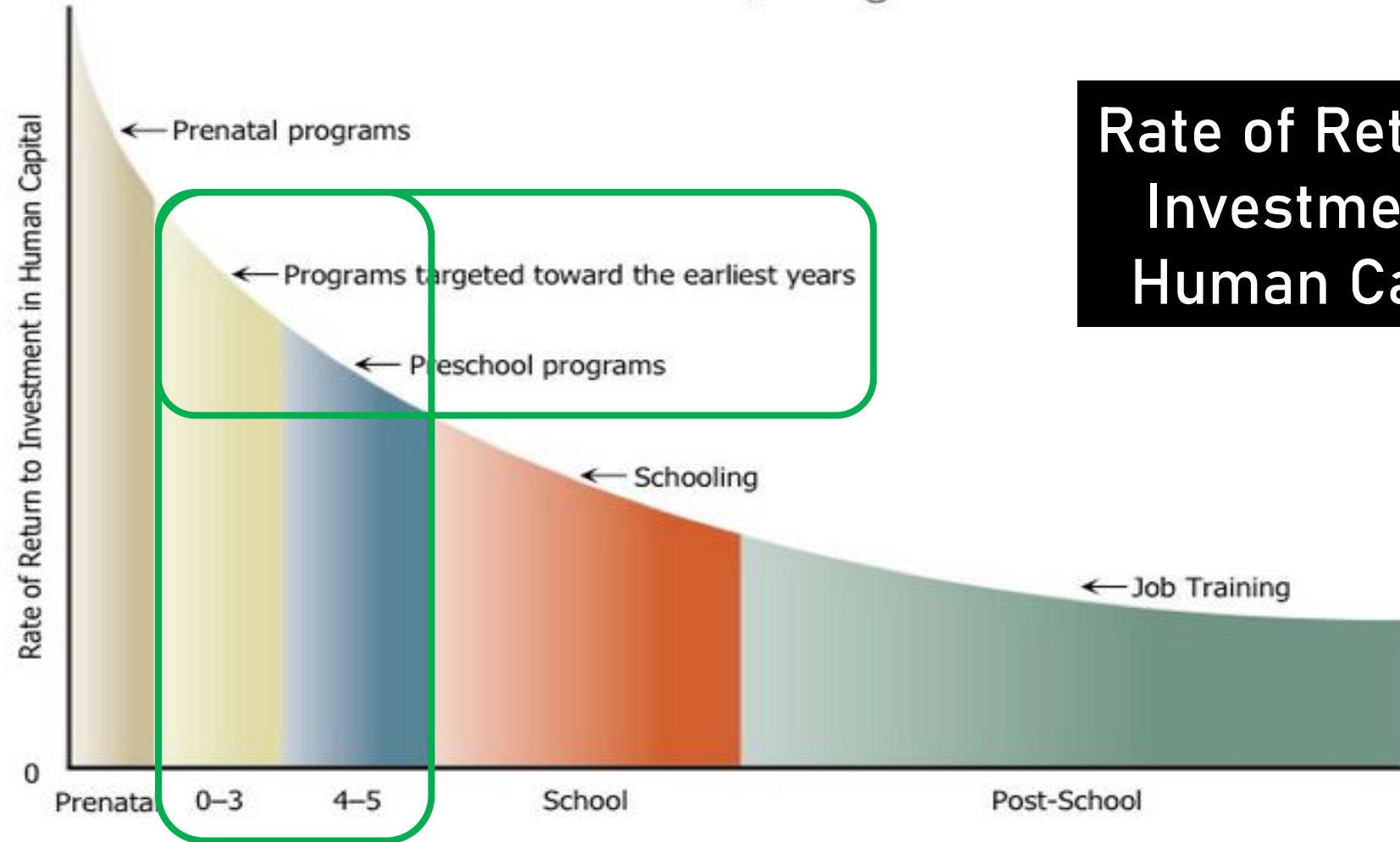
**[2025 FTF Pima County Family Resource Guide](https://www.firstthingsfirst.org/wp-content/uploads/2024/11/2025-Pima-County-Family-Resource-Guide.pdf)** – <https://www.firstthingsfirst.org/wp-content/uploads/2024/11/2025-Pima-County-Family-Resource-Guide.pdf>

- After birth, as the brain is being actively shaped by **experience**, it is the **responsibility** of the parents, the families, the teachers, the caregivers and society to **ensure a rich and complex experience to grow that brain to its fullest potential.**



# EARLY CHILDHOOD DEVELOPMENT IS A SMART INVESTMENT

The earlier the investment, the greater the return



**Rate of Return to Investment in Human Capital**

Source: James Heckman, Nobel Laureate in Economics

# Which is the priority investment? \$\$\$

For a building,  
The foundation



Or the 2<sup>nd</sup> floor?



For our children,  
Reading to & together,  
child care & preschool



Or college?



## PEEPS

Pima Early Education  
Program Scholarships

MonicaBrinkehoff

Accelerate Quality

United Way of Tucson &  
Southern Arizona

MonicaBrinkehoff@united  
waytucson.org

## MAKE WAY FOR BOOKS

<https://makewayforbooks.org/>

*Ways to Give*

## REACH OUT & READ

<https://literacyconnects.org/>

# Healthy Brain Needs:

## Physical Care

Protected pregnancy

Healthcare

Sleep

Good food

Protection/Safety



**We Seniors  
are Central**

## Experiences

At least one person who touches you, responds to you and talks with you -

Lots of direct conversation

Serve & Return

Exposure to books

Free play to explore



# Impact of Genes, Social Support and Life Experiences on Early Brain Development



**EACH BRAIN MATTERS**  
THE CENTER FOR NEUROSCIENCES FOUNDATION

Dr. Dorothy Johnson  
Dr. Lynne Oland  
Susan Hopkinson, Director

OLLI members,  
thanks for coming!



We value your evaluations.



See separate  
handout.

# “Village” Resources for 0 – 5-year-olds in Pima County

Home Visits

Information,  
Resources

Reading

Care

Preschool

Donating



**In-Home Family Support** (home visitors).  
<https://unitedwaytucson.org/family-support-alliance/>  
**FamilySupport@UnitedWayTucson.org**  
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**Comprehensive Guide to Community Resources for 0 – 5-year-olds**  
 2025 *FTF Pima County Family Resource Guide* – <https://www.firstthingsfirst.org/wp-content/uploads/2024/11/2025-Pima-County-Family-Resource-Guide.pdf>

**Make Way for Books** - get App for phone <https://makewayforbooks.org/>  
**Reach Out and Read of S AZ** Well Child visit books <https://literacyconnects.org/> Programs

**Early Child Care and Education**  
**FINDING CHILDCARE/ PRESCHOOLS** Including PEEPs, Early Head Start and Quality First infant care, childcare and early education programs:  
**Arizona Childcare Resource & Referral (CCRR)**  
<https://azccrr.com/>  
 520-325-5778 [childcareinfo@cfraz.org](mailto:childcareinfo@cfraz.org)

Funding sources supporting kids in high quality preschools in Pima County.

**Pima Early Education Program Scholarships**  
 Provides funding for low-income families (at or below the 300% FPL)

**First Things First Quality First**  
 funding for low-income families (at or below 300% FPL) County & State Programs

**Head Start**  
 funding for very low-income families (at or below 100% FPL)  
 \*does not include tribal Head Start. Federal Program

**Arizona Department of Education High Quality Early Learning Grant**  
 grants to early childhood programs in high-need communities State Program

**Arizona Department of Economic Security Child-Care Subsidies**  
 funding for low-income working families (at or below 165% FPL) State Program

**PEEPS: Pima-Early-Education-Program Scholarships** for preschoolers 3 – 4, and pre-k 5-year-olds in families earning <= 300% of Federal Poverty Level (\$93,600 for family of 4).  
<https://www.pima.gov/975/Pima-Early-Education-Program-Scholarship>

**\$\$\$ Donations**  
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<https://give.unitedwaytucson.org/>  
 DONATE: “Designate where needed most” v Educational Success. In Memo specify PEEPS = Accelerate Quality and/or Family Support Alliance  
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**For Reach Out & Read So Az** specify this Program at <https://literacyconnects.org/> DONATE NOW



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