

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

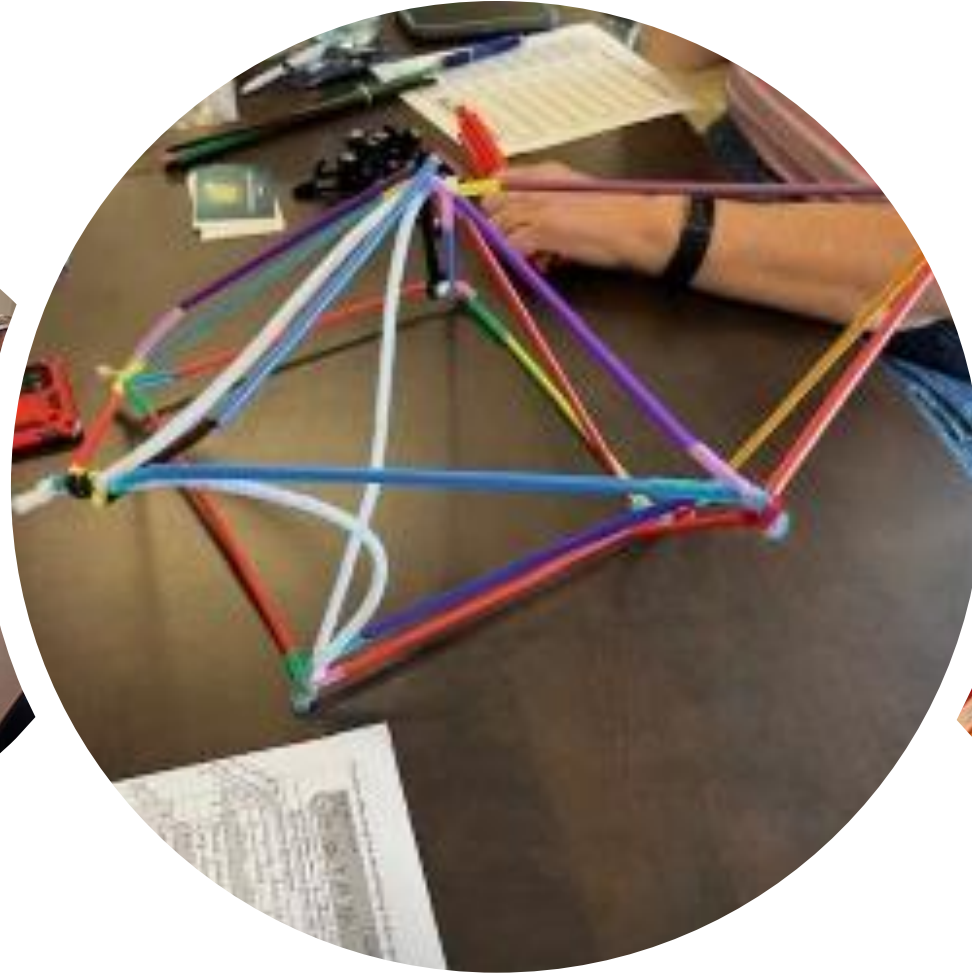
LEFT BRAIN SPECIALISTS?

- 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,

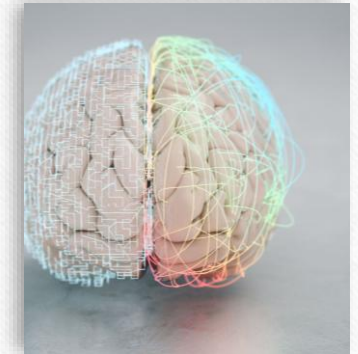
“How well a brain develops depends on many factors in addition to genes, such as:

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. ”



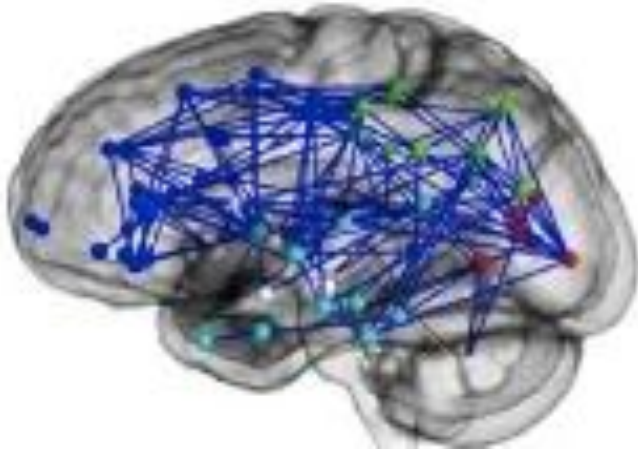
<https://www.cdc.gov/ncbddd/childdevelopment/early-brain-development.html>

The Science of Early Childhood & The Brain Architecture Game Video

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

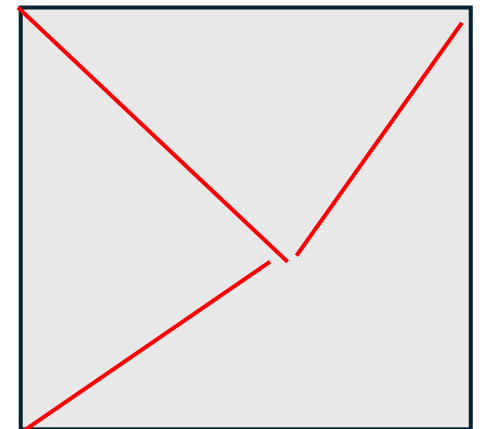
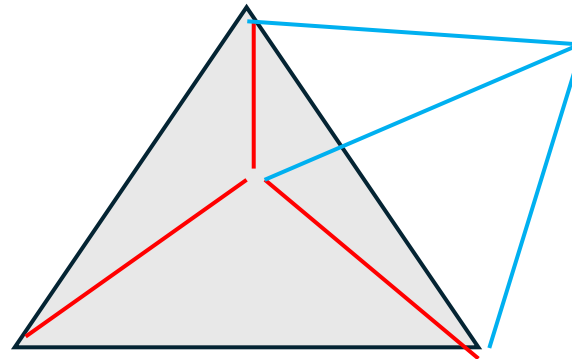
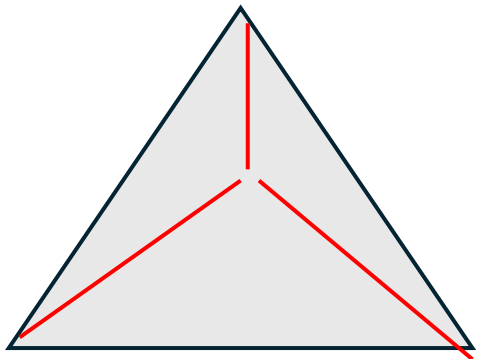
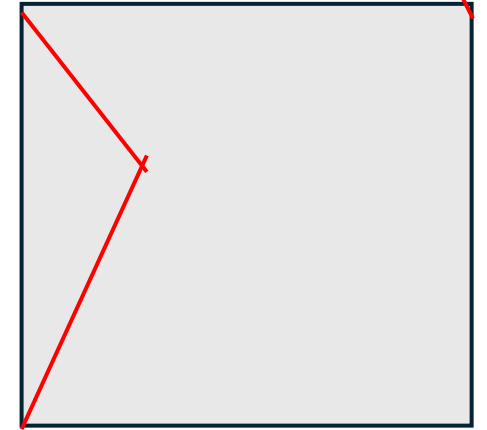
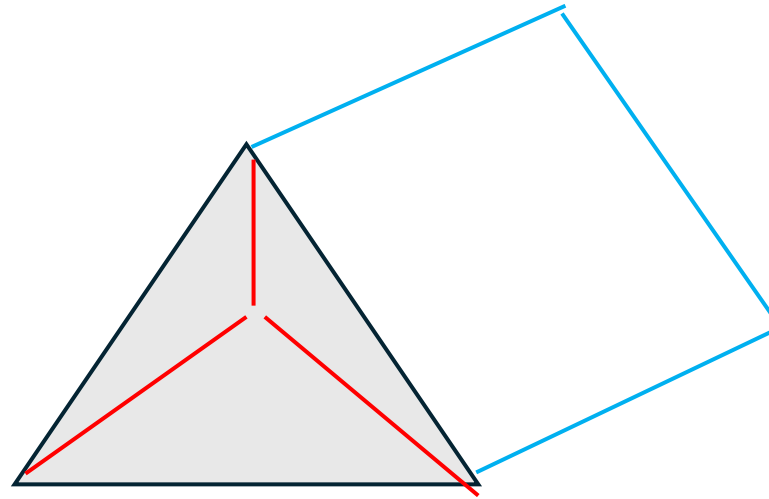
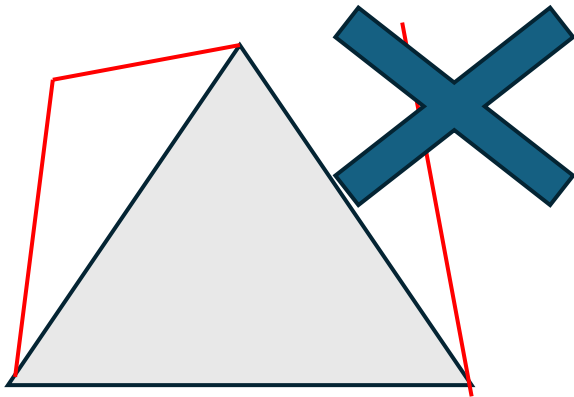
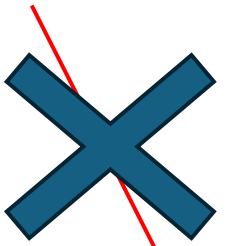
You'll get a **WEIGHT** for a **Tolerable** card IF

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



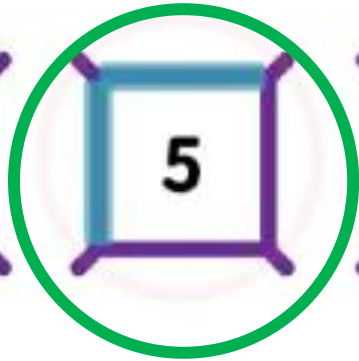
4 Base Pipe Cleaners



2 Base Straw(s)

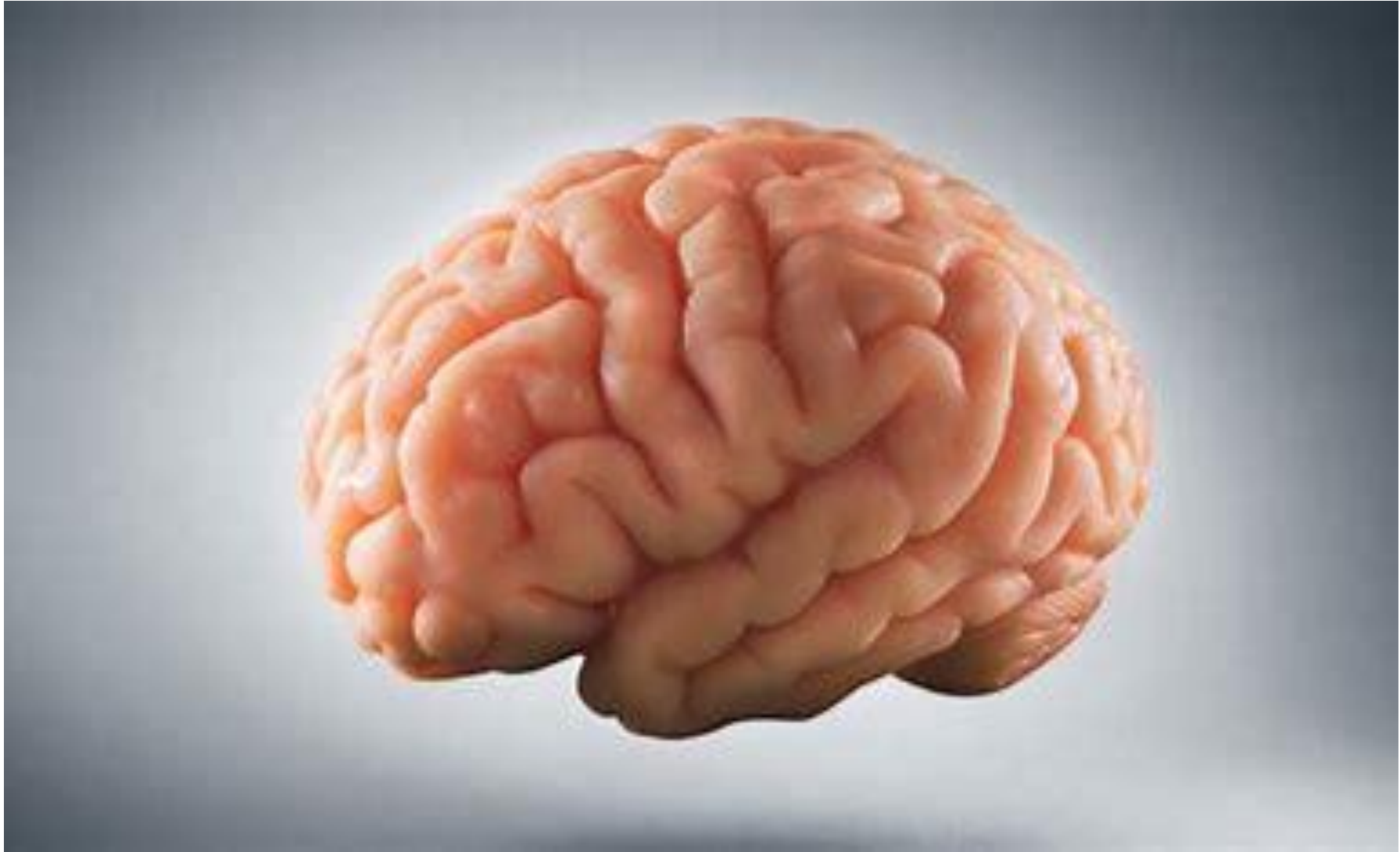


What is your genetic starting point?



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

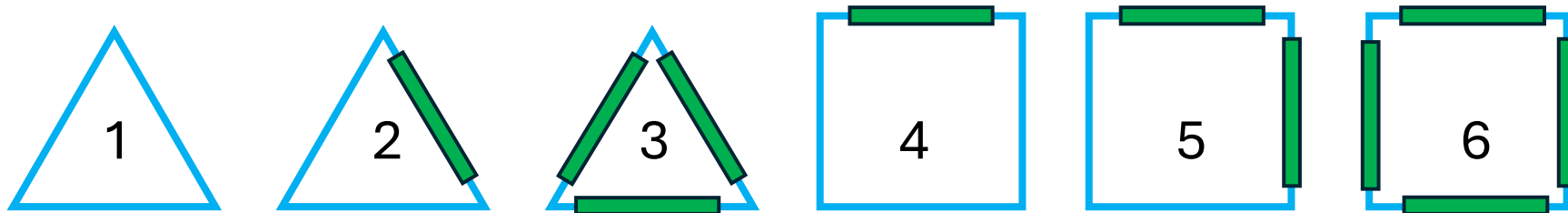
YEAR	YEARS 1-5	POSITIVE	TOLERABLE	TOXIC	LIFE EXPERIENCE	Genes	Social Support
1-5	PIPE CLEANER	STRAW					
1	X	x	x		Childhood illness		
	X	x	x		Frequent changes in caregivers		
	X	x	X		Caregiver depression diminishes serve and return interaction		
2	X	x	x		Frequent changes in caregivers		
	X	x			Language 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?



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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

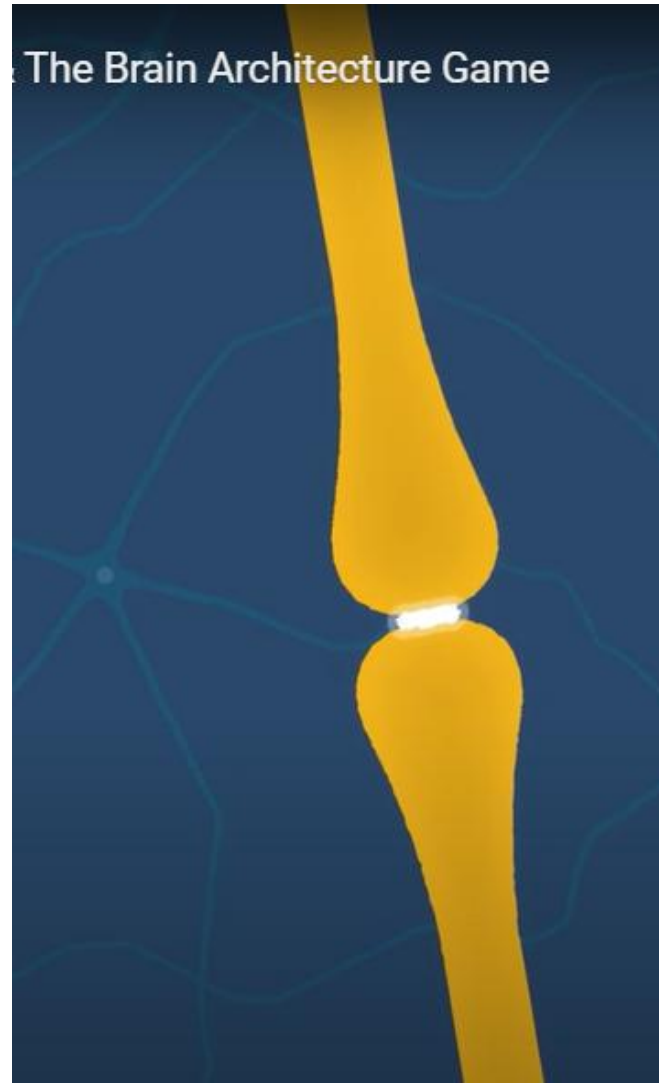
• YEAR 1
possibilities

Severe neglect

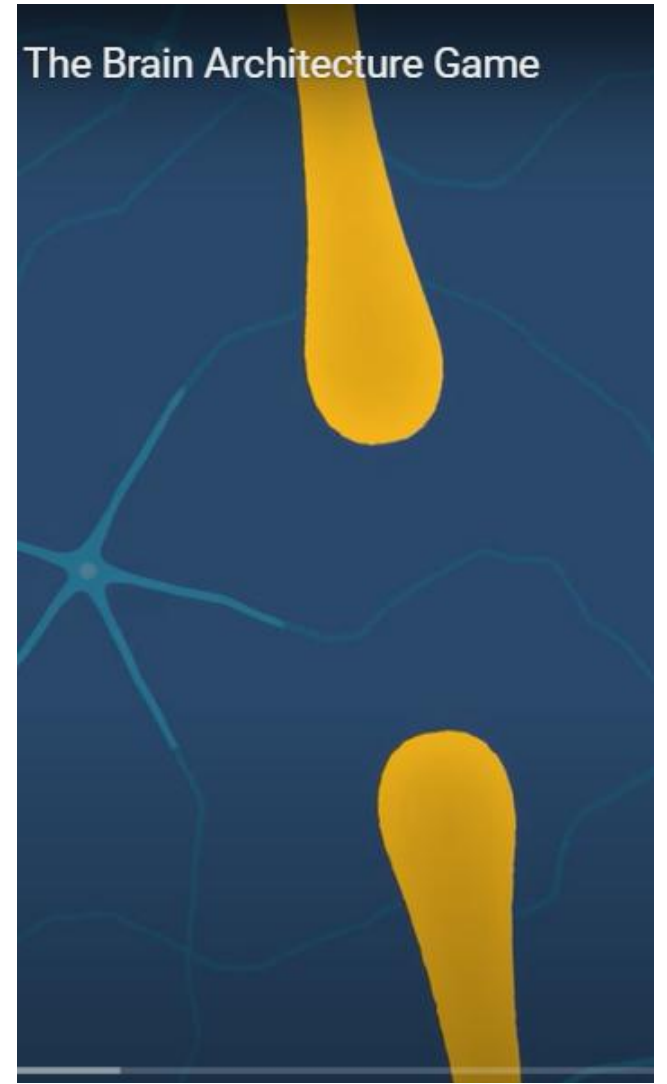
Malnutrition



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

1ST YEAR
(0-1)

Child care with highly
skilled caregivers



Language-rich
environments

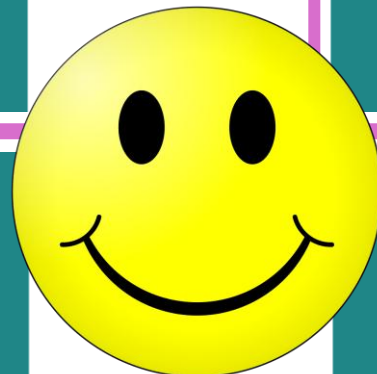
2ND YEAR
(1-2)

Job flexibility so
parent can spend
more time with child

Encouragement while
learning a skill

3RD YEAR
(2-3)

Fresh fruits and
vegetables replace
fast food



Access to
high-quality
medical care

4TH YEAR
(3-4)

HEADSTART

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

Substantial long-term benefits in experimental group, apparent **when in 3rd 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:

- 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”

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

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

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

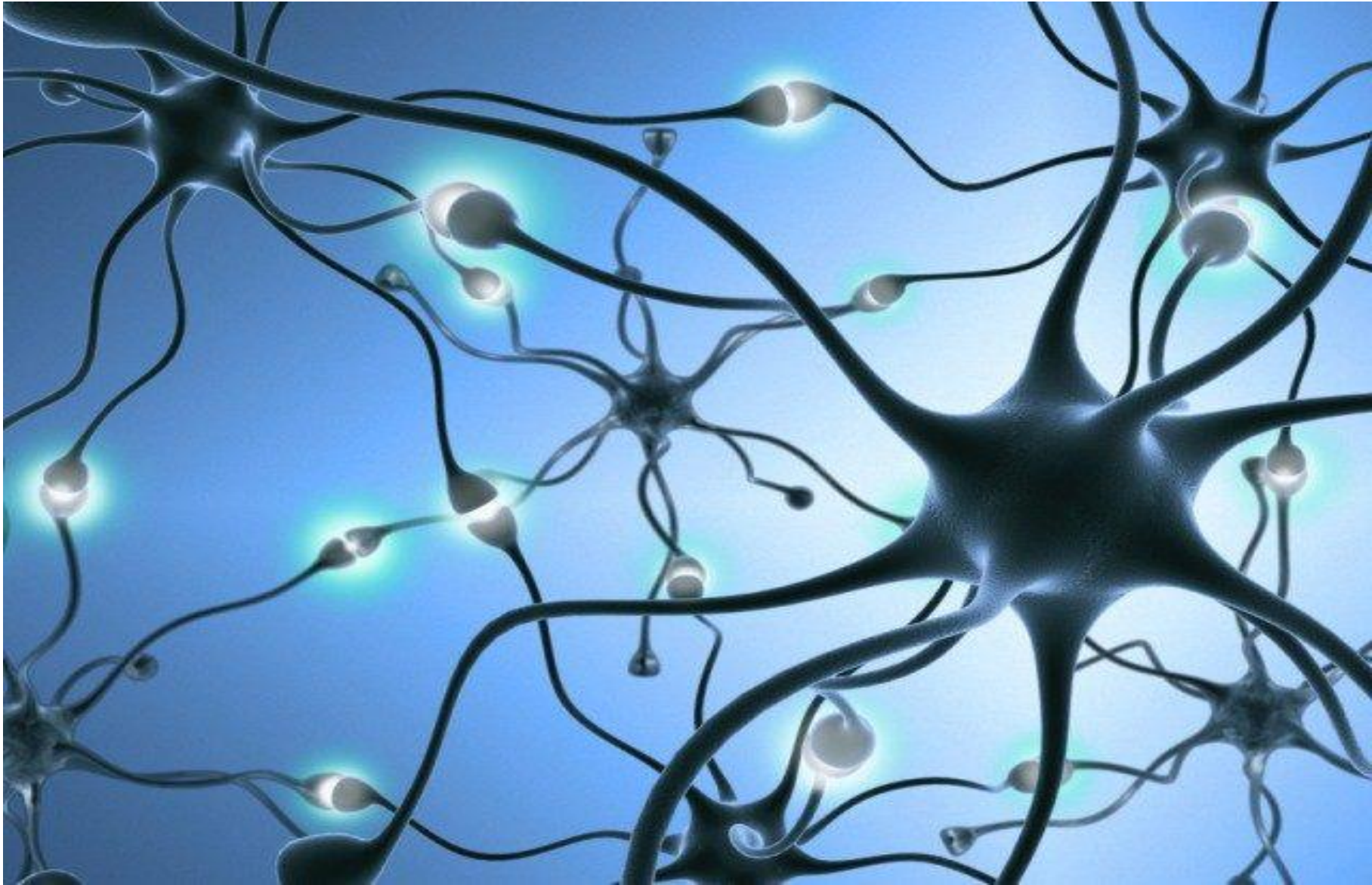




Need a Break?

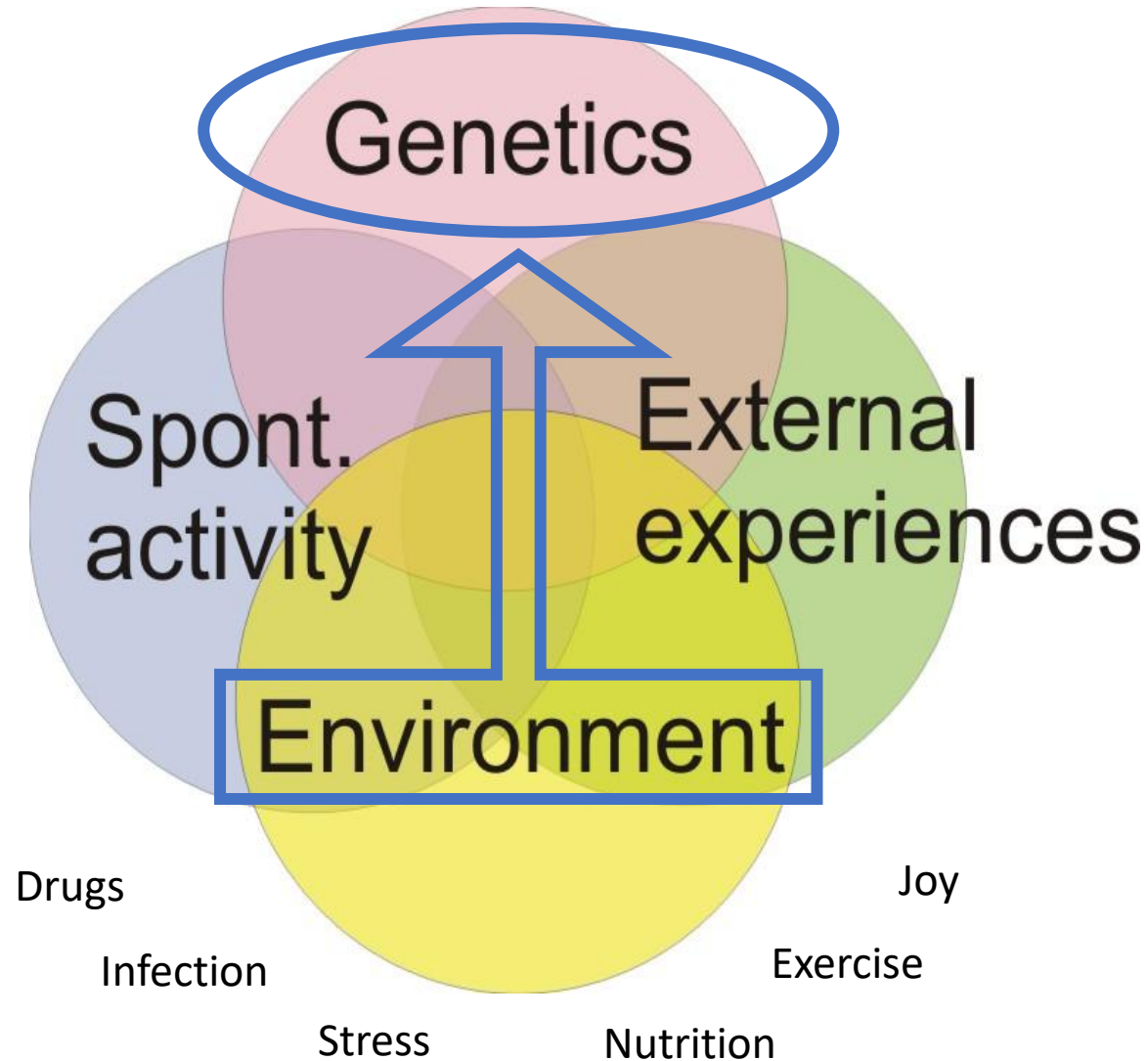
If so,
please return in 5
minutes for our closer
look at early brain
neuroscience.





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

In the beginning

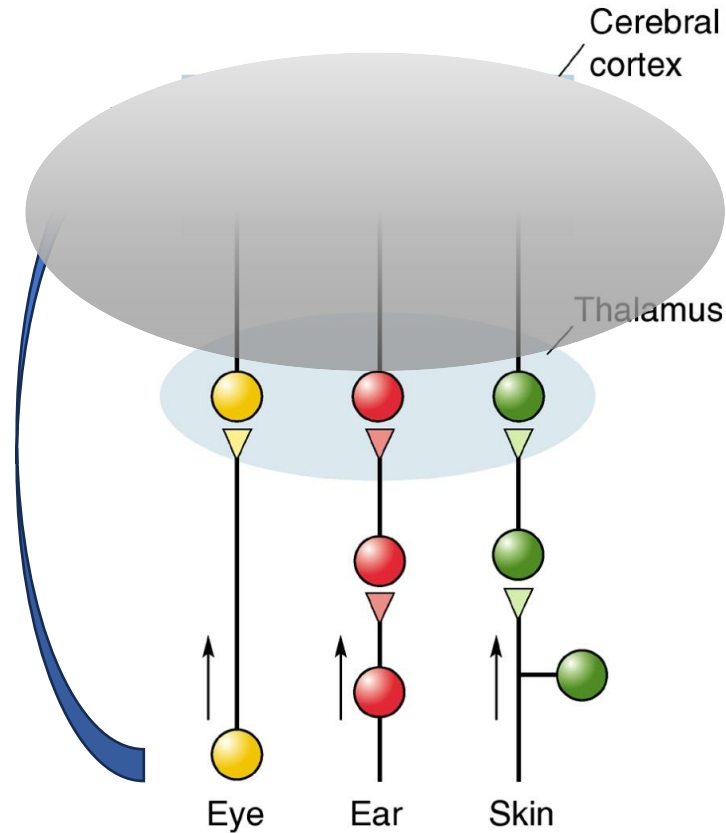


What factors govern development of brain structure and function in the embryo and fetus?

- From the beginning brain at 2 weeks post conception through the 6th 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.

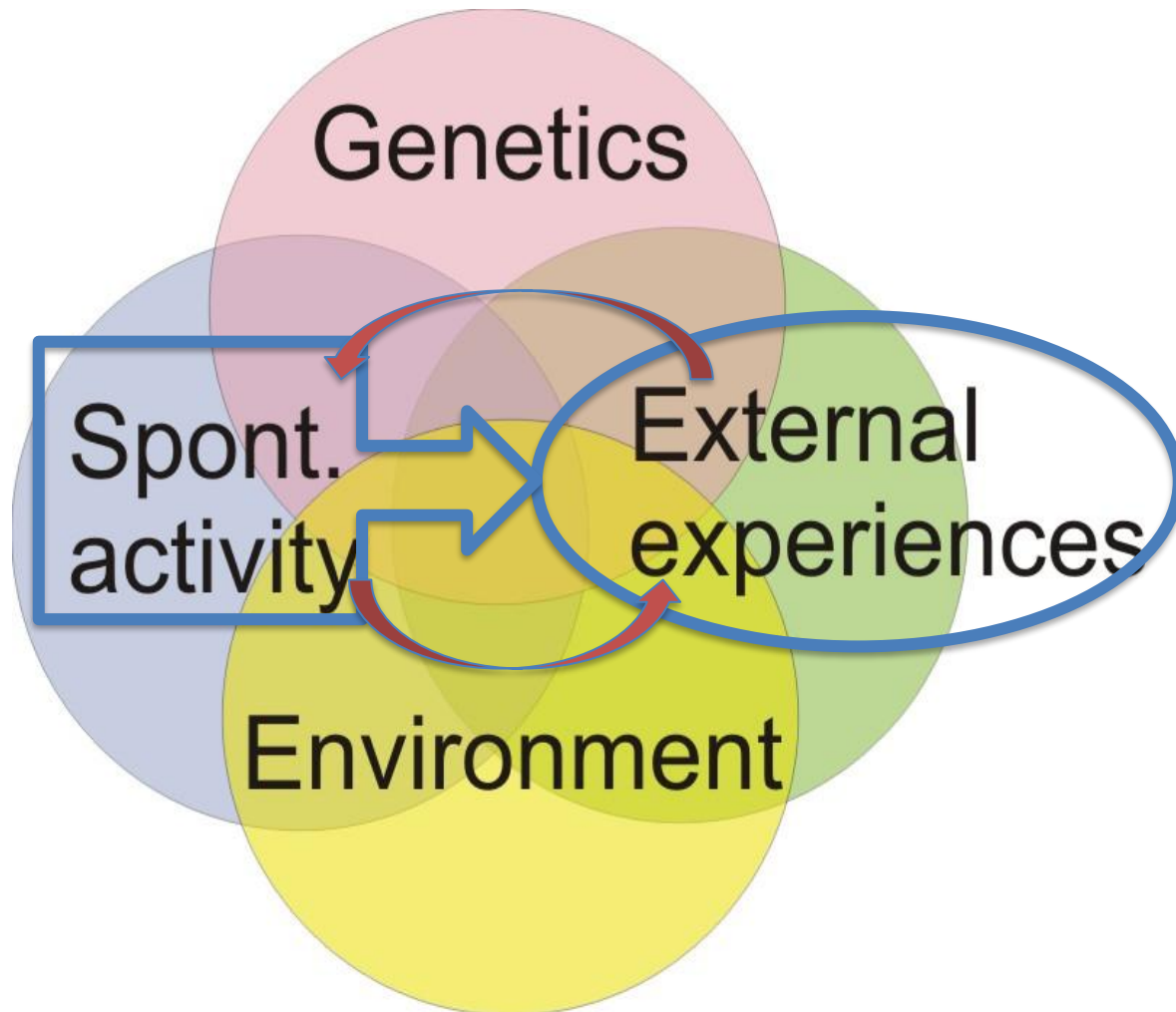
Sensory **perception** is a higher-order process that requires complex circuitry, including at minimum connections of parietal, temporal, cognitive & emotional centers.

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



https://ehp.niehs.nih.gov/cms/asset/66ff7182-ed28-4bfc-98bd-d56f33c49907/ehp2268_f1.jpg

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

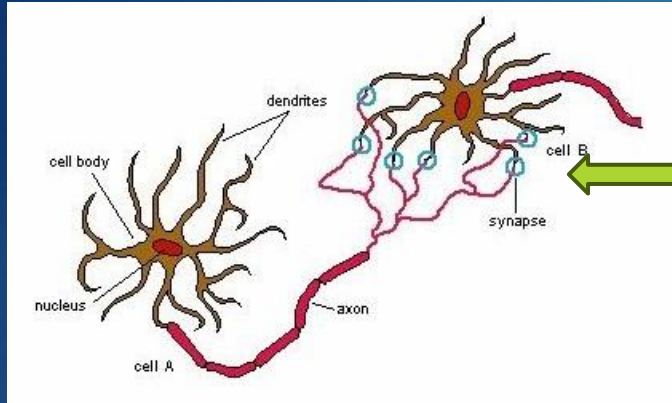


The individual's own spontaneous and intentional **activities** that interact with external experiences are equally important to neural development.

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

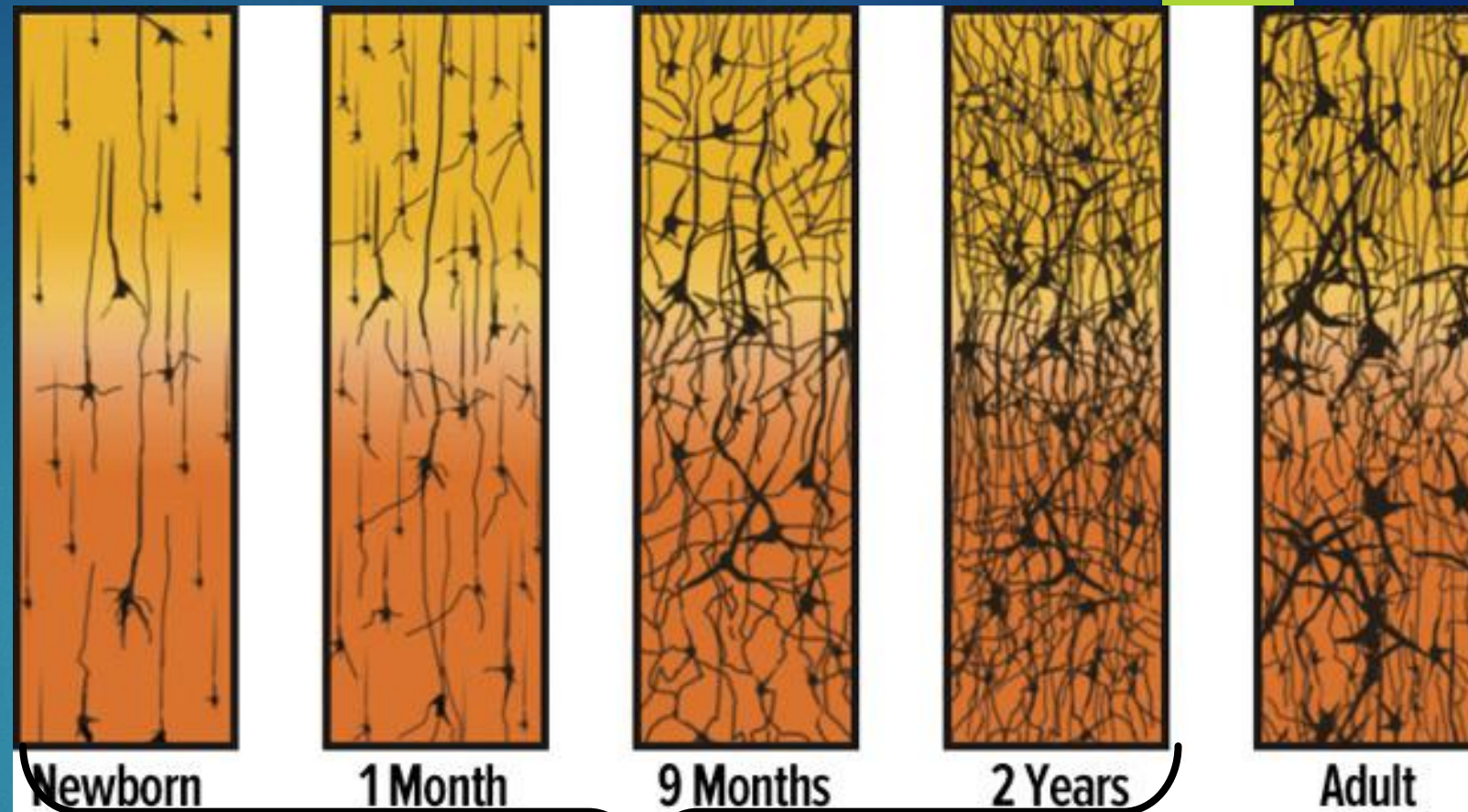
This is the critical nurturing loop known as **Serve and Return**.

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”.

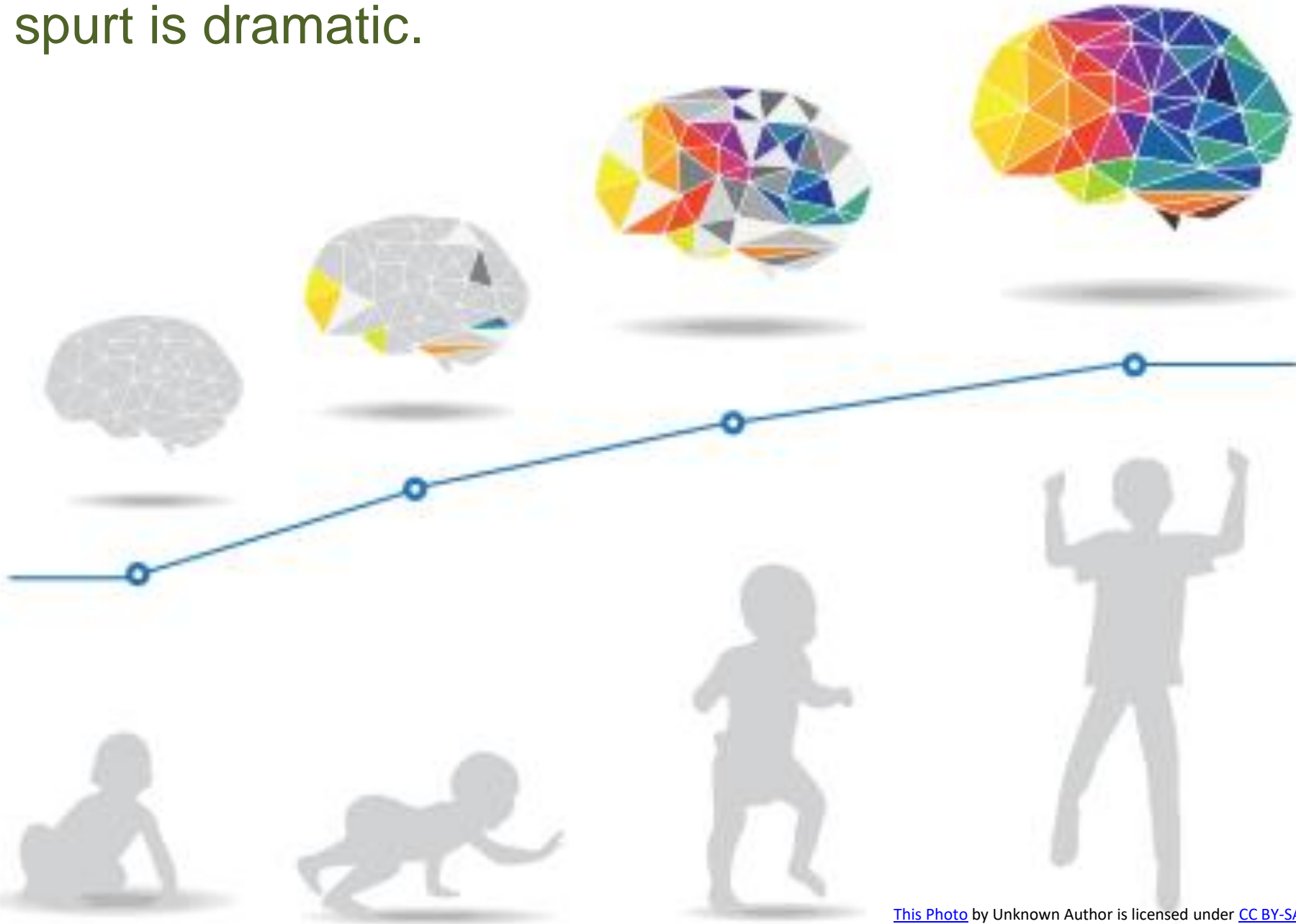


In the brain in the first year of life 700 new interconnections are made every second. No new cells. The increasing density seen over the first 2 years is just from the rapidly developing networks of axons and dendrites. You can see the result of pruning in the more specialized brain of an adult.

Early childhood

Brain growth spurt is dramatic.

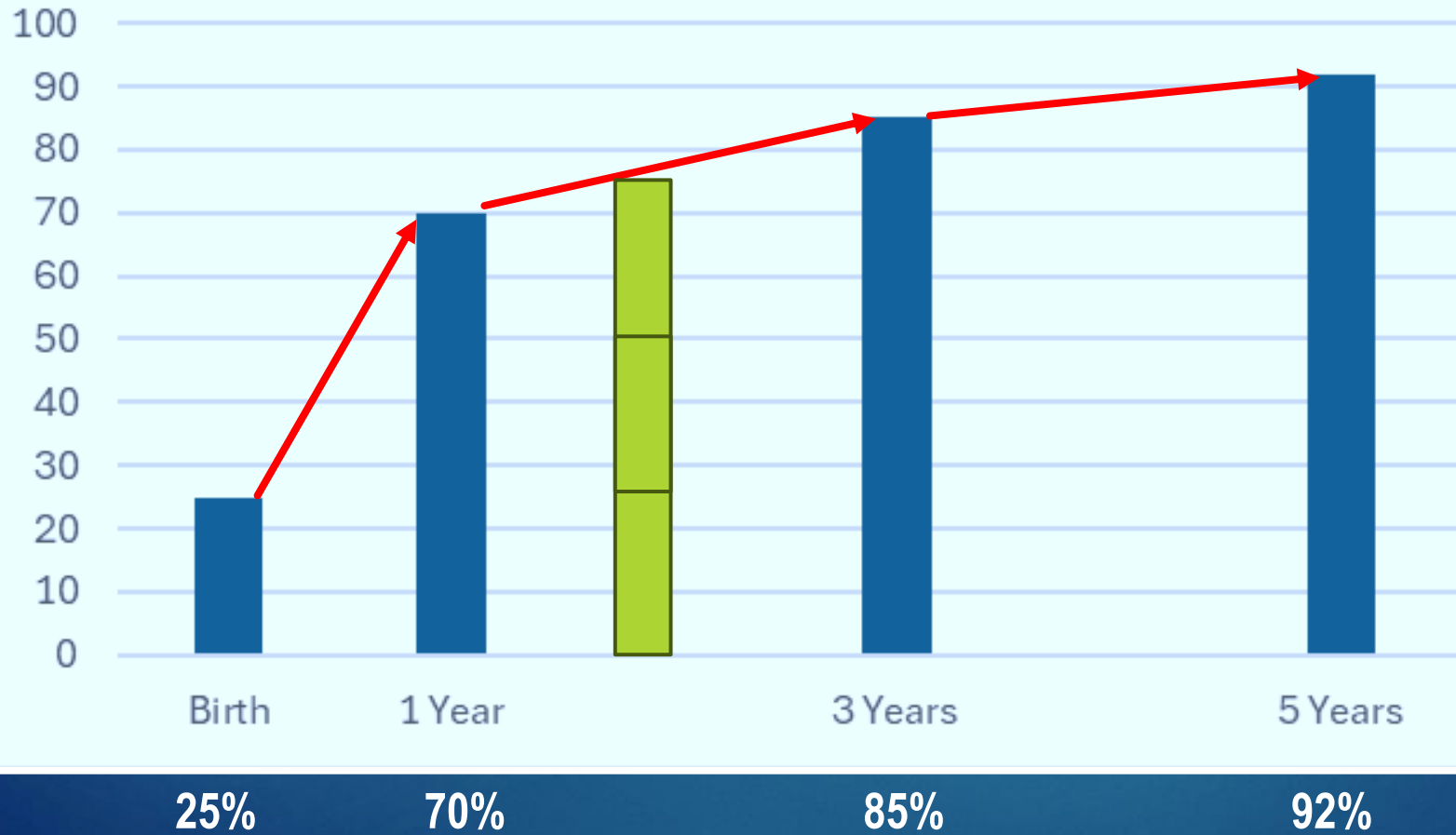
Brain at
birth
25% of its
adult weight



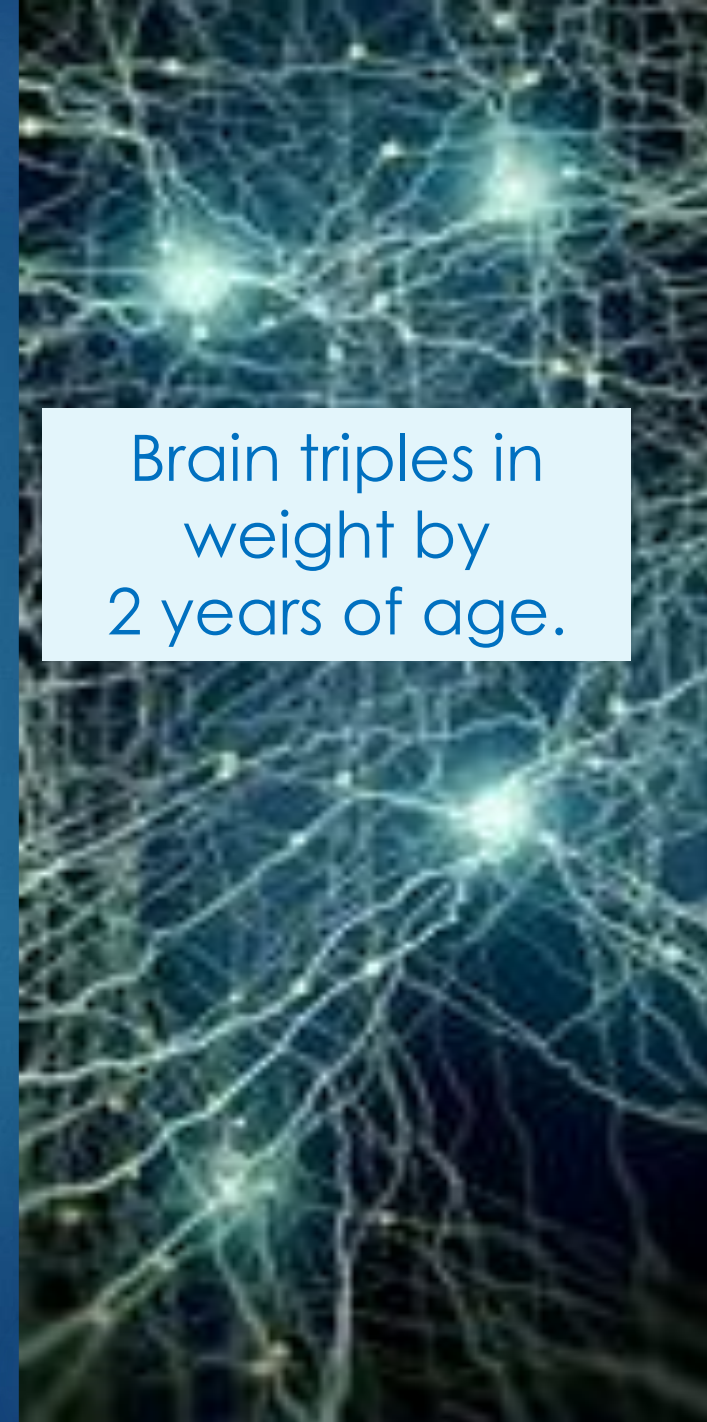
Brain at
2 years
75% of its
adult weight

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



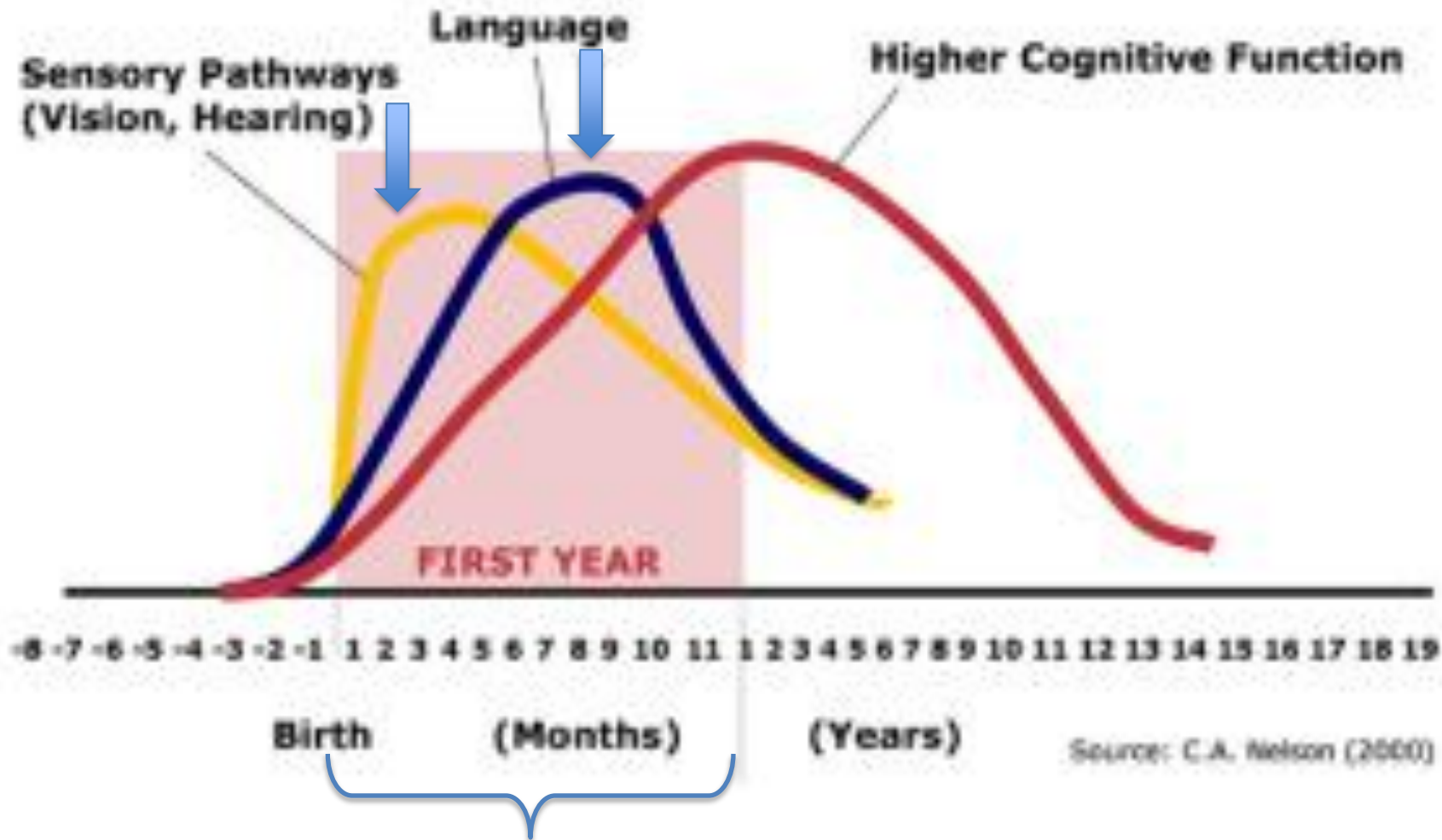
ALL HUMAN BRAINS REQUIRE:

- 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.

Source: C.A. Nelson (2000)

*Most brain
development after
birth is
Experience-
Dependent*

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

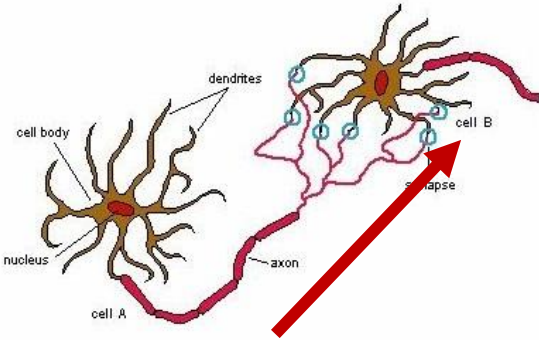
If the parents speak Mandarin, the brain must be able to process those sounds.

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 locked.

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!

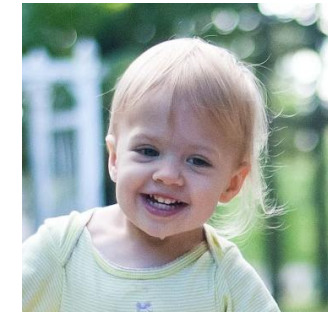


Sensitive Periods for Experience-*Dependent* development

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

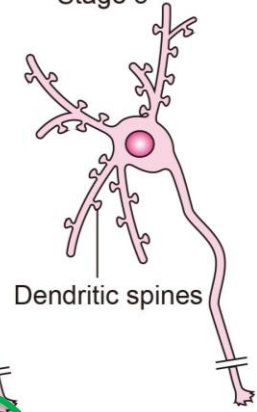
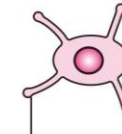
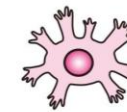
Stage 1

Stage 2

Stage 3

Stage 4

Stage 5



Minor neurites

Axon

Dendrites

Dendritic spines



Newborn



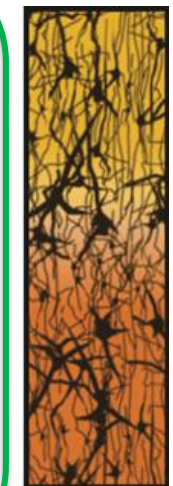
1 Month



9 Months



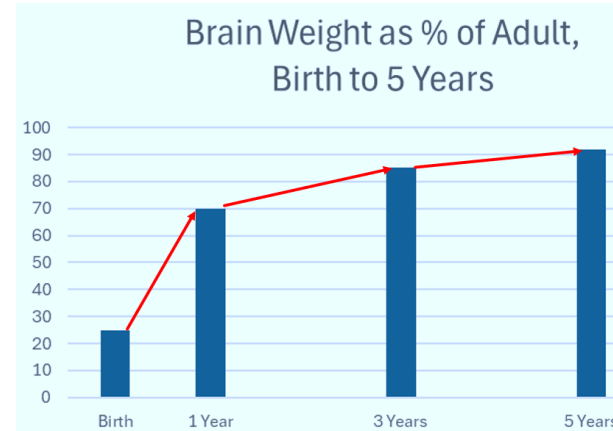
2 Years



Adult

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

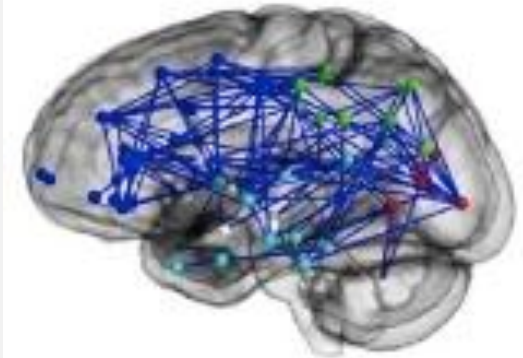
- Motor development – before birth to roughly age 4
- Emotional control – 0 to 2-3 yrs
- Vision – 0 to 2-3 yrs
- Social attachment – 0 to 2-3 yrs
- Math/logic – 1 to 4-5 yrs
- Music – 3 to 10 yrs
- Language – 0 to 7 yrs



- 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

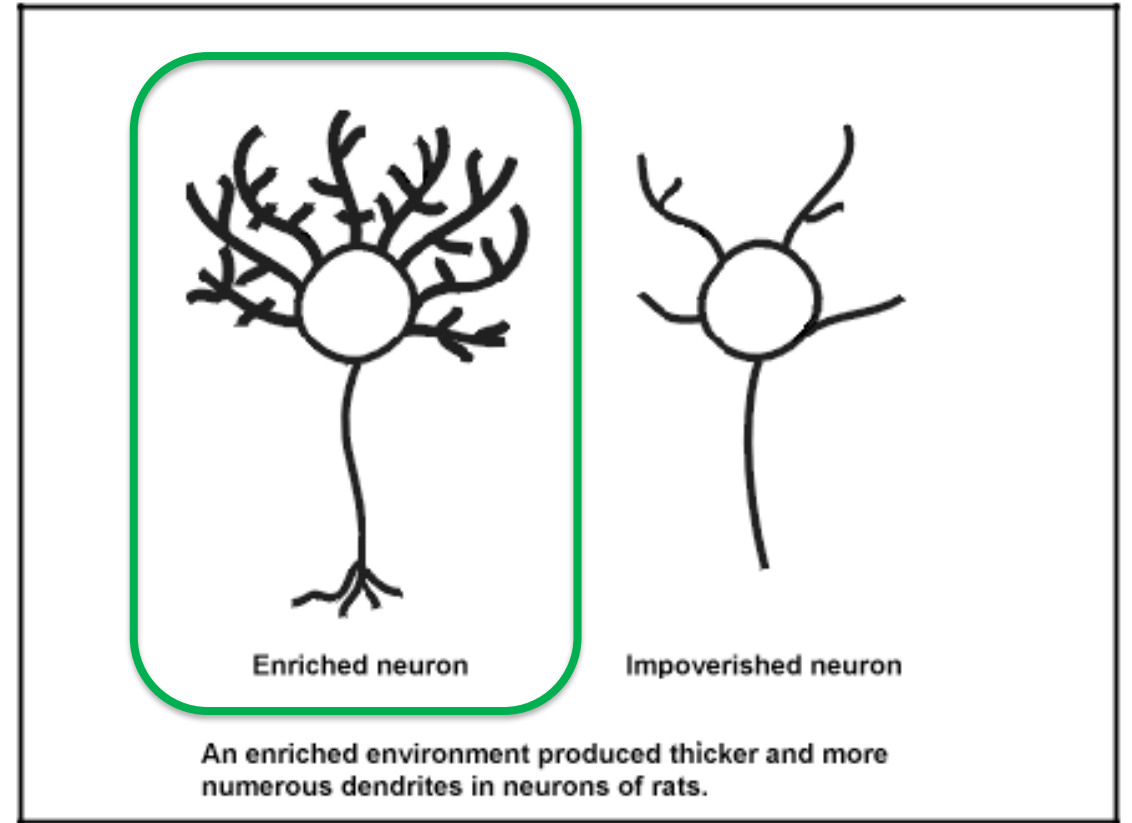
Enrichment

OPPORTUNITIES to EXPLORE & SOCIALIZE



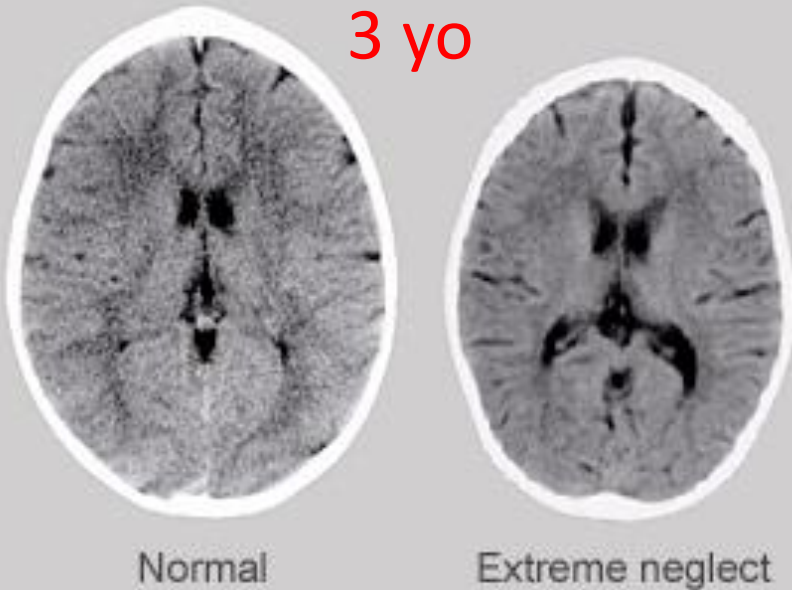
“standard cage”

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

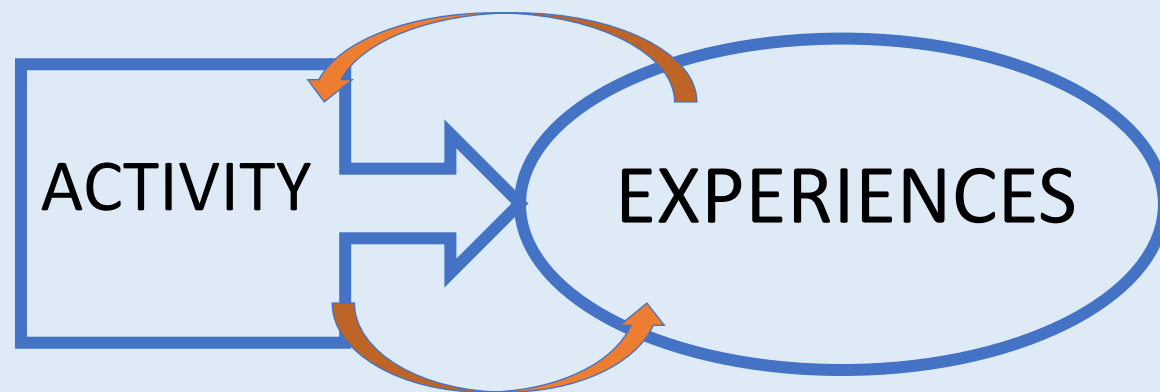
behavior:

- conduct disorders
- depression



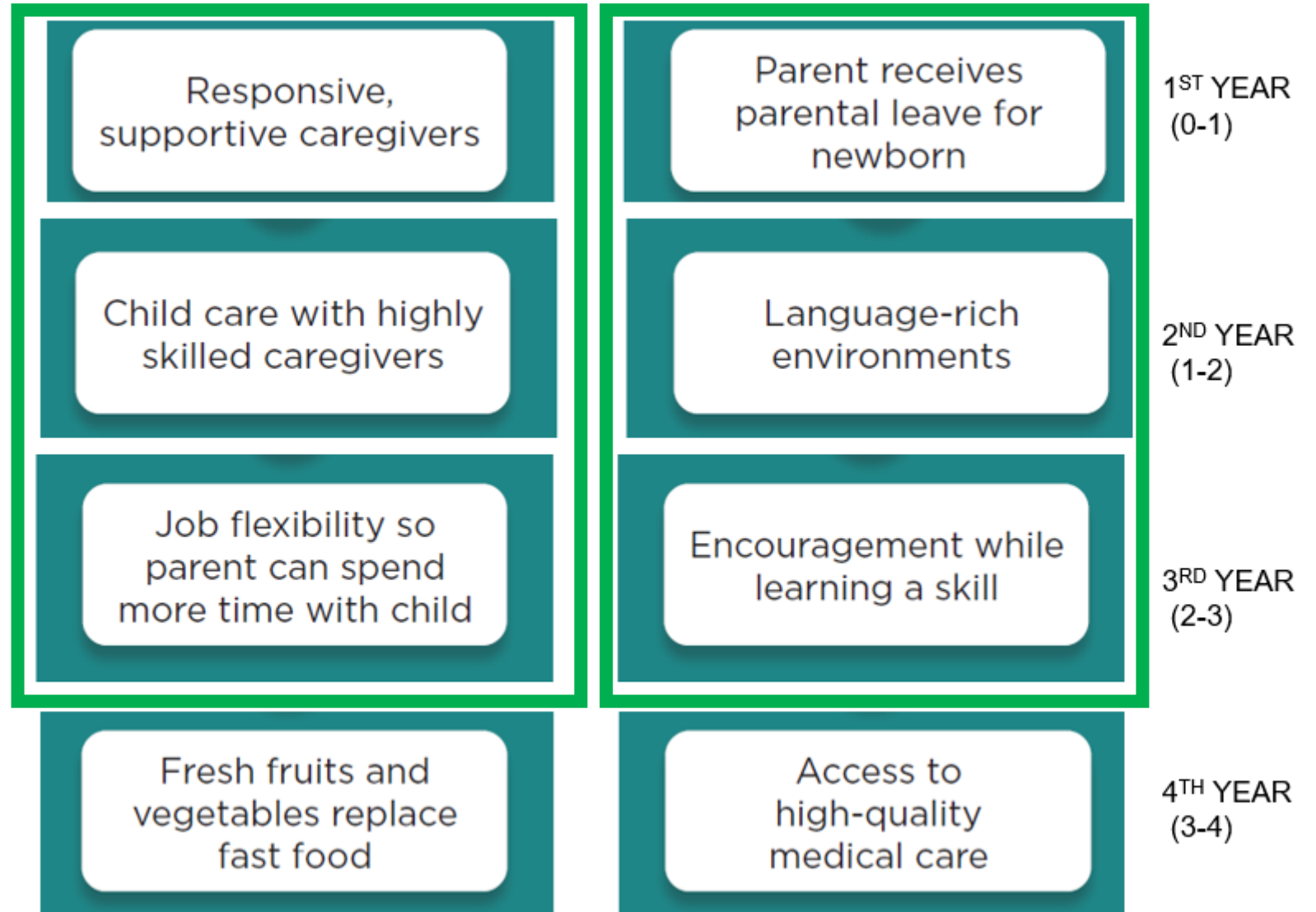
KEY INGREDIENT:
Social Interaction

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.

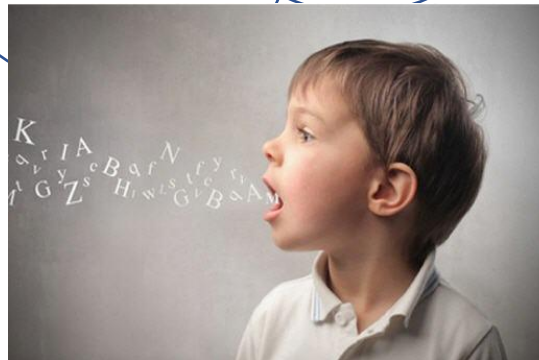


Serve and Return is critical for language development.



Imagine ---

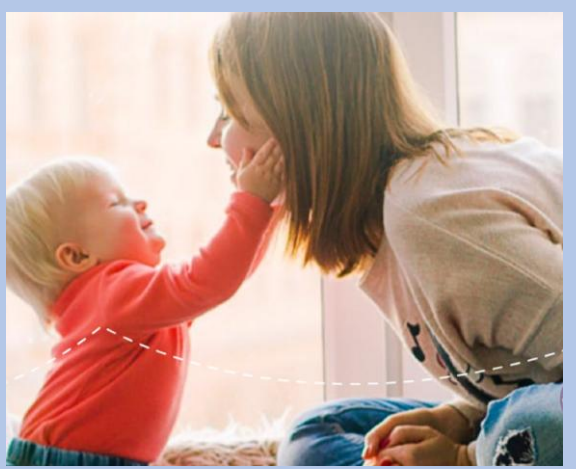
How do they get from here to there?



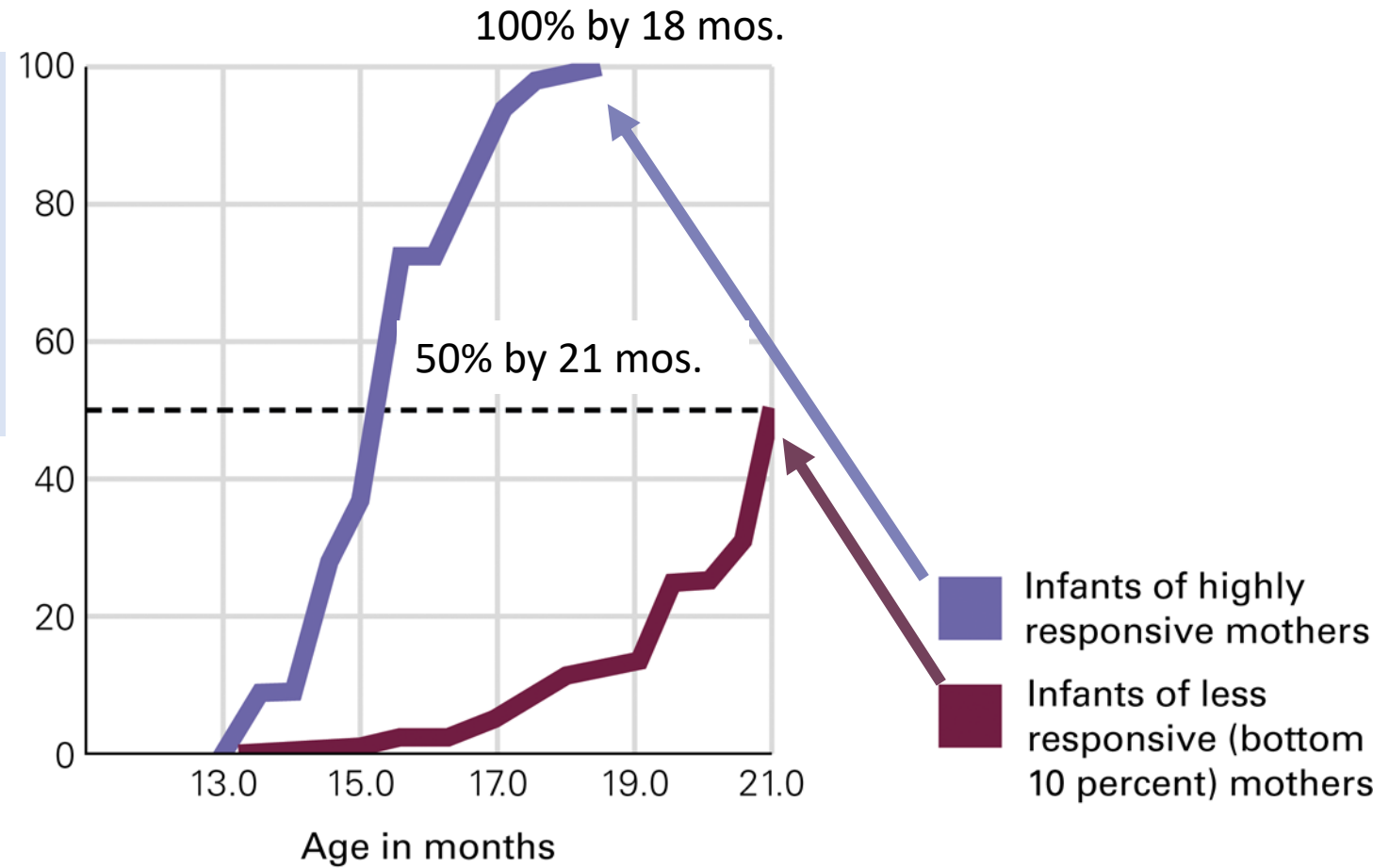
Language learning is enhanced with “responsive mothers”



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.



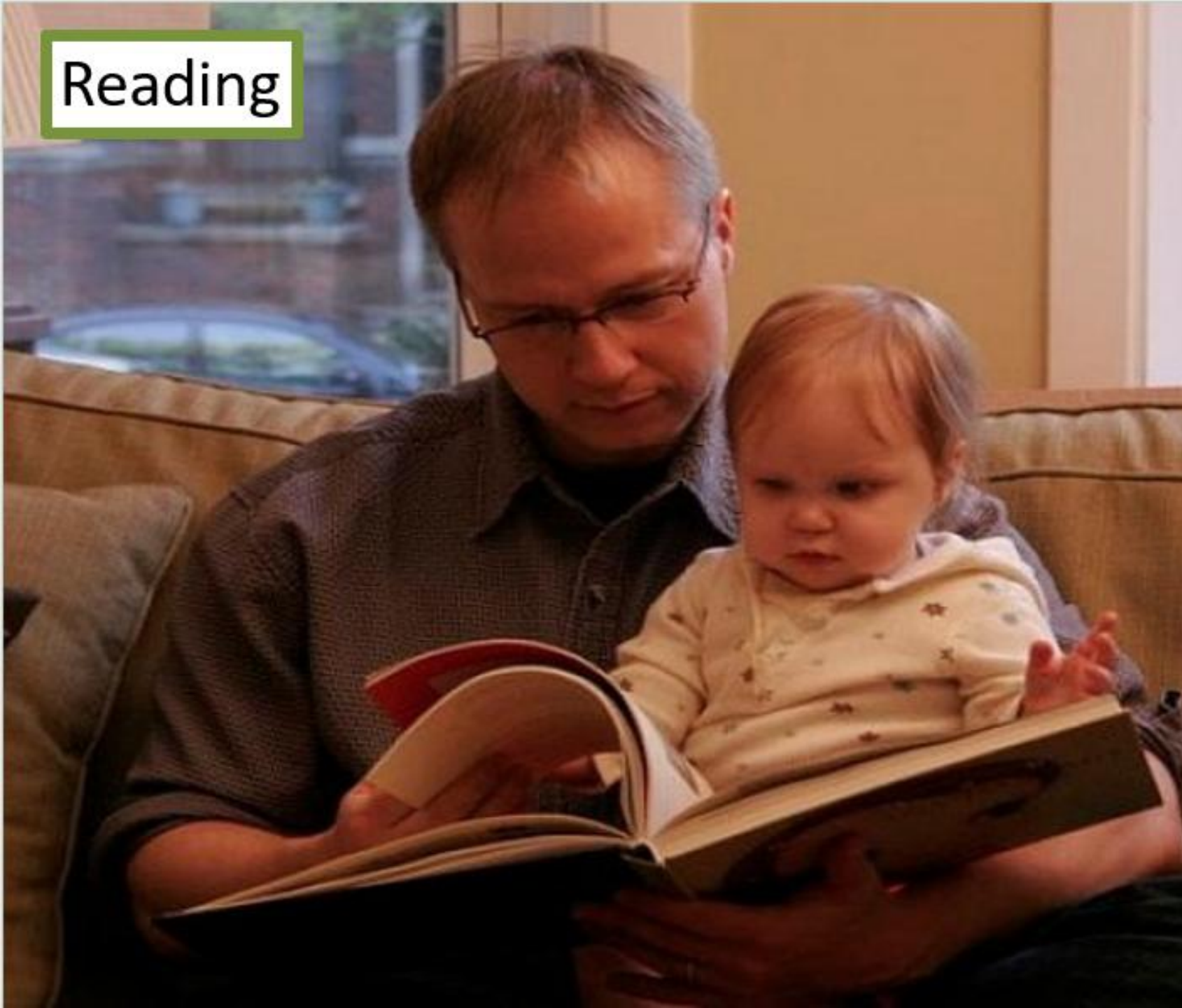
<https://youtu.be/ErPPXfsY6a8?si=iRXBYUuTrY3J4nmK>



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, 4th 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

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

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

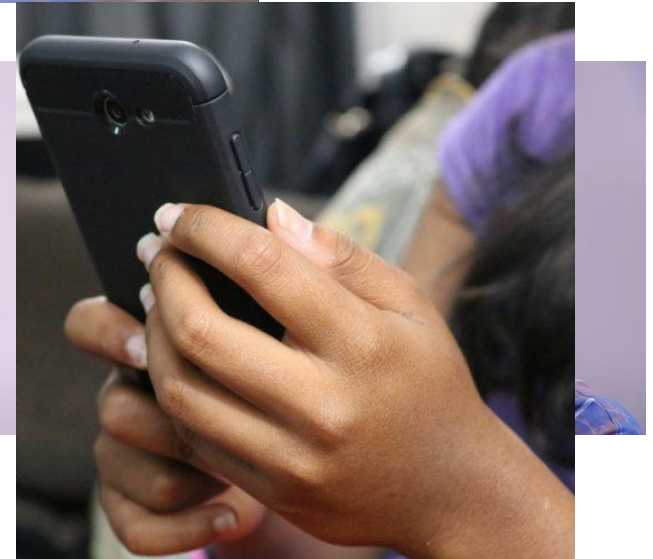
For **Reach Out & Read So Az** specify this *Program* at

<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.

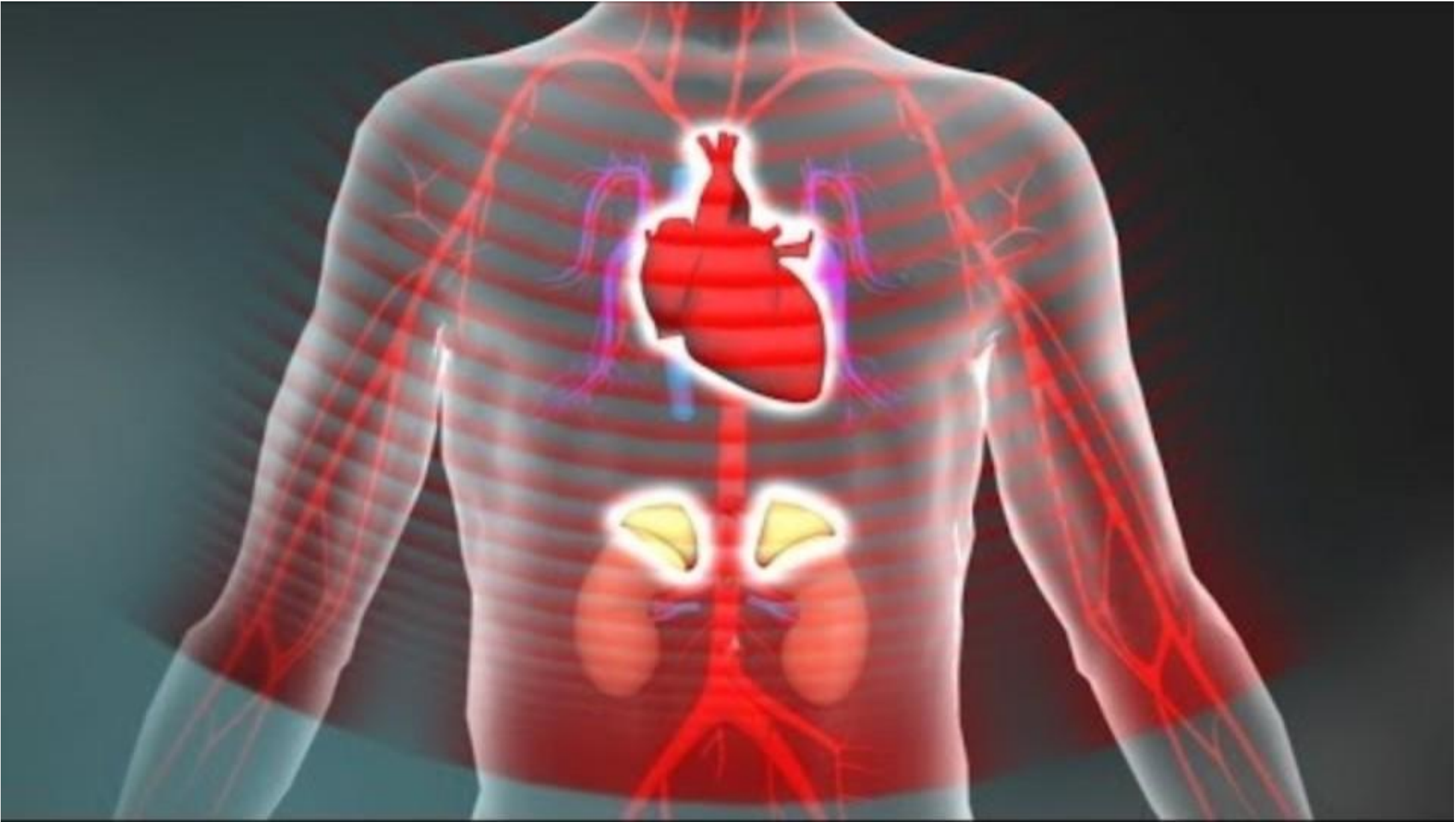
Good touch

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?

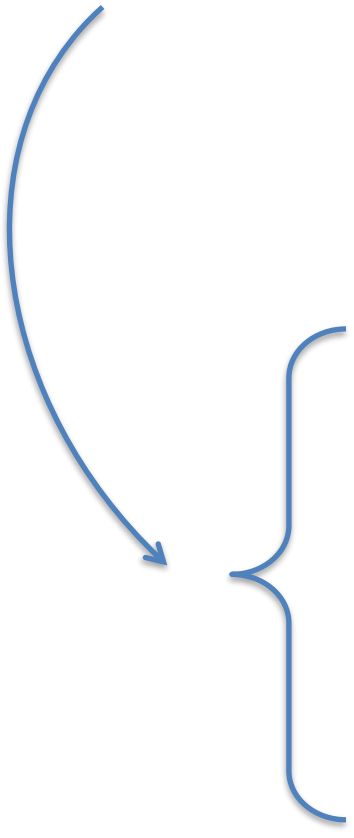
Effects of chronic stress on development

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

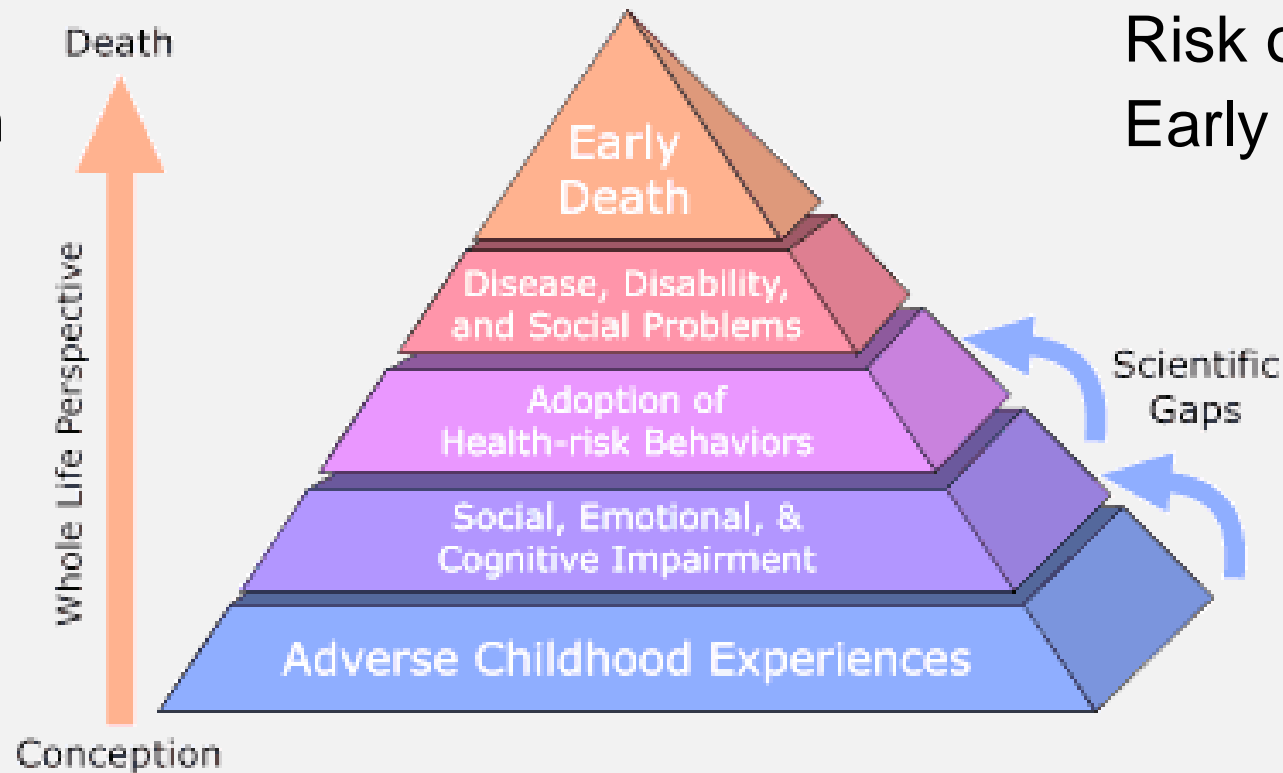
Chronic childhood stress → later problems

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
(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

0-5 Hotline, 8 – 8 M – F 877-705-5437

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

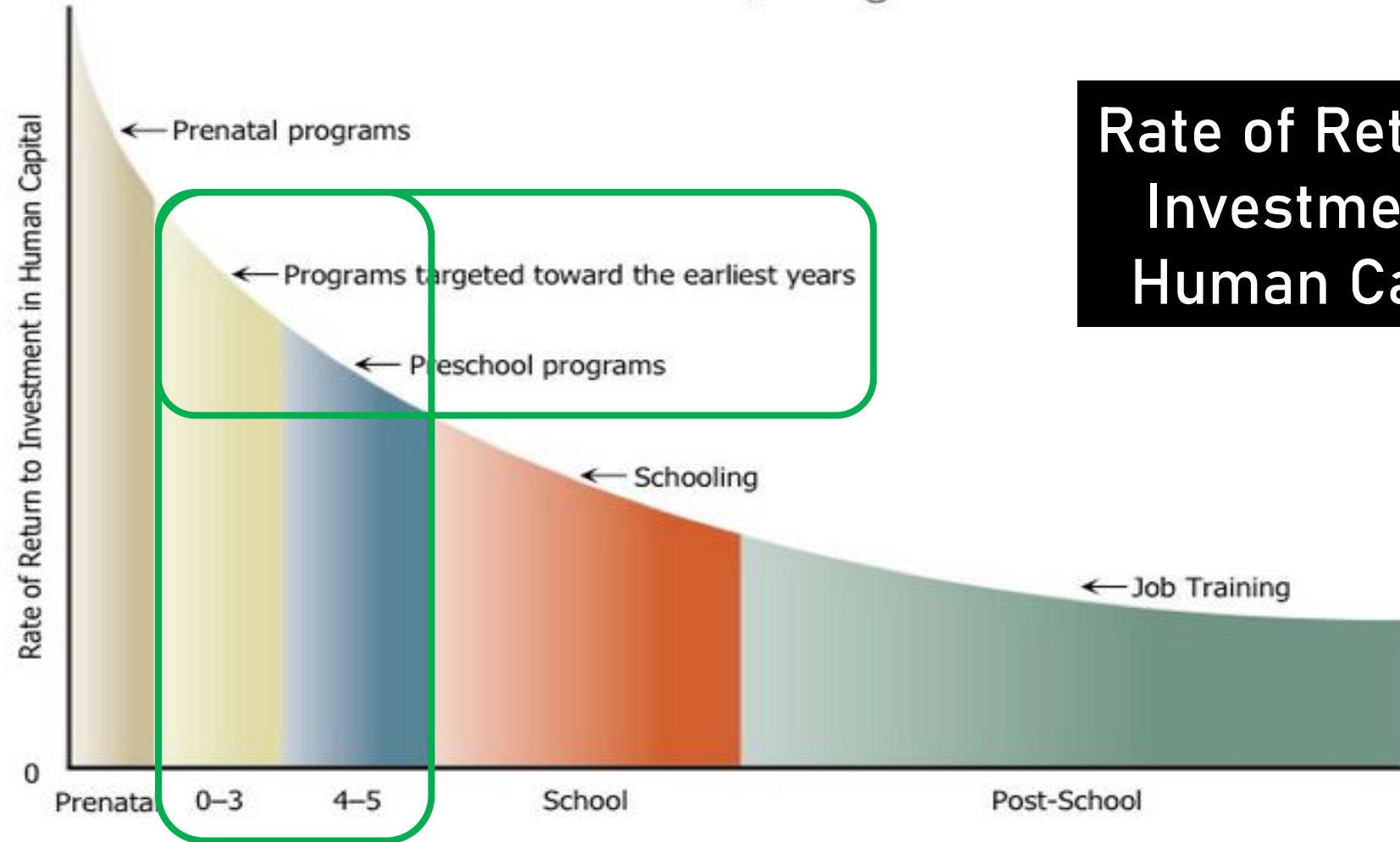
[2025 FTF Pima County Family Resource Guide](https://www.firstthingsfirst.org/wp-content/uploads/2024/11/2025-Pima-County-Family-Resource-Guide.pdf) – <https://www.firstthingsfirst.org/wp-content/uploads/2024/11/2025-Pima-County-Family-Resource-Guide.pdf>

- 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 2nd 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

RESOURCES for Optimizing Early Brain Development 2-2025 D Johnson, MD, FAAP



In-Home Family Support (home visitors).
<https://unitedwaytucson.org/family-support-alliance/>
FamilySupport@UnitedWayTucson.org
 (520) 903-3921

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- Parents as Teachers
- Healthy Families America

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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

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
 For questions or to use RMD, contact Monica Brinkerhoff, 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



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