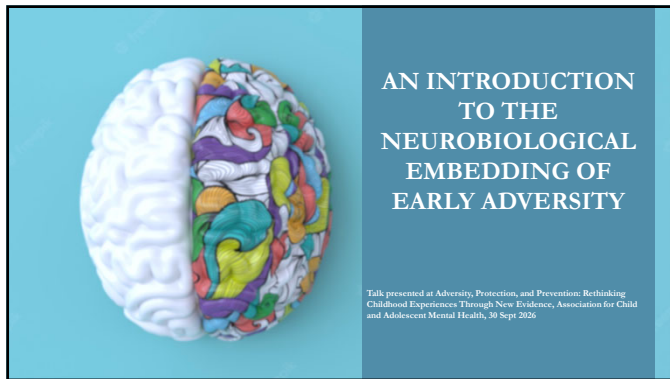
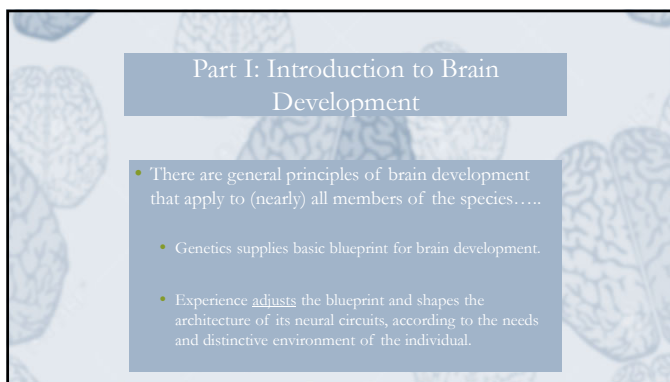




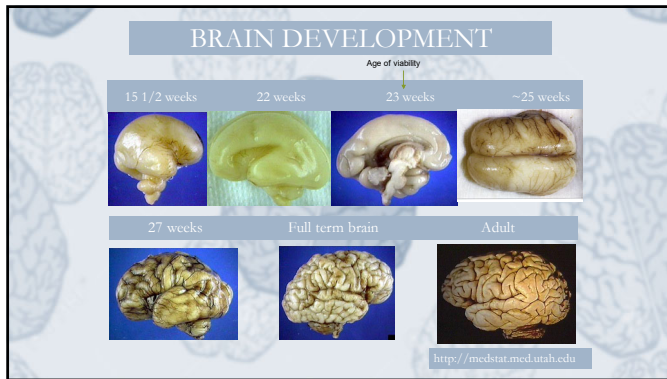
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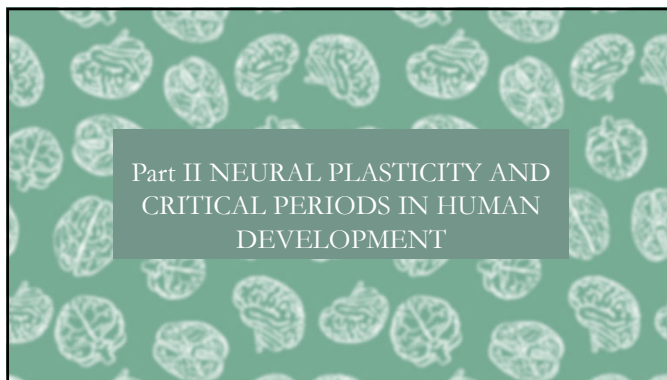
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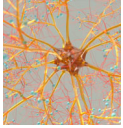


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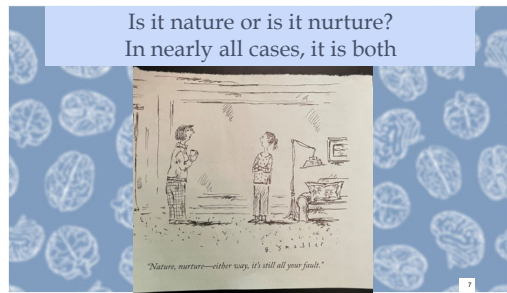
Individuality is the product of both personal experience and biological inheritance



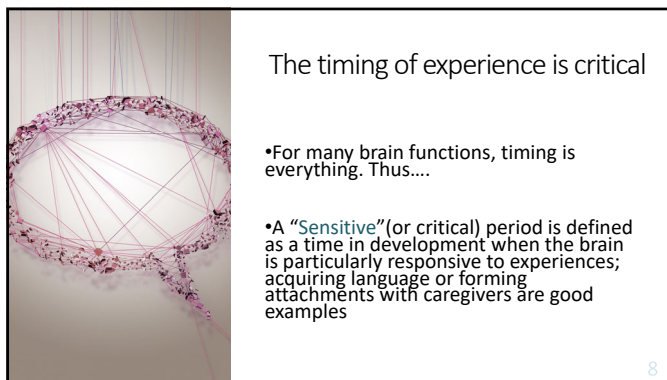
- Our genes specify the properties of neurons and neural connections to different degrees in different pathways and at different levels of processing.
- But, because many aspects of an individual's world are not predictable, brain circuitry relies on experience to customize connections to serve the needs of the individual.
- Experience shapes these neural connections and interactions *but always within the constraints imposed by genetics.*

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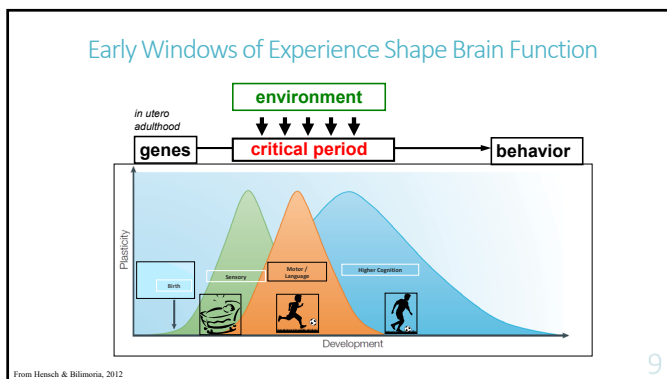
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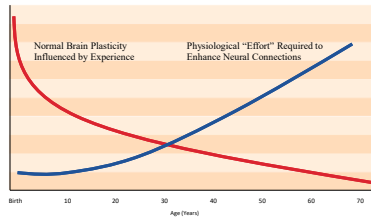


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Finally, the ability to change the brain decreases over time

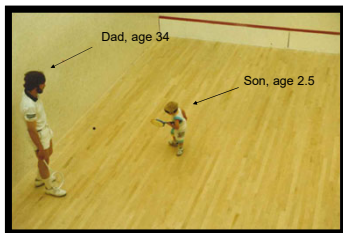


Source: Levitt (2009)

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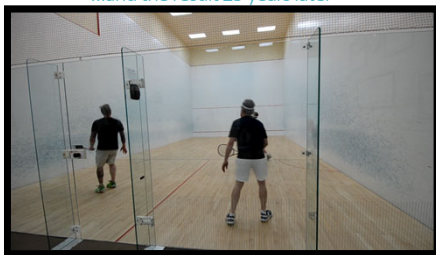
...which is why acquiring skills early in life is easier
than acquiring them later in life
Example: learning squash at age 2.5 years



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...and the result 25 years later



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Summary



Many elements of postnatal brain development adhere to the principle of critical periods.

Most critical periods occur during a time of rapid brain development – the first years of life. After a critical period has passed, the effort involved in altering brain development becomes greater.

Two big questions:

1. Can we figure out ways to “rescue” critical periods in adulthood?
2. Are critical periods limited to the first years of life (e.g., might there elements of the transition to puberty that reflect a second major “critical period”?)

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Part II: Effects of Early Adversity

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Some experiences can be healthy and adaptive

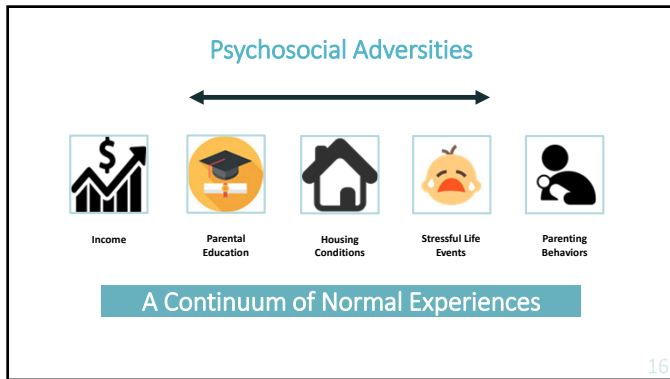


Others can be “toxic” and negatively impact development



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Worldwide Prevalence of Early Adversity

The Centers for Disease Control (US) estimates 1/3rd of the world's children <18 years old experience physical or harsh punishment or abuse.

The United Nations (UN) estimates that at least 133–275 million children globally witness violence between primary caregivers

223 million children are victims of sex trafficking each year.

Between March 2020 and May 2022, ~10 million children have been orphaned because of Covid-19; and the mental health of countless others has also suffered greatly.

Between 2011 and 2021, >330,000 children in the US lost a parent to a drug overdose.

Finally, if we consider caregiver mental health, the World Health Organization (WHO) argues that depression represents the leading cause of disease-related disability globally per



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Effects of Early Adversity Are Long Lasting

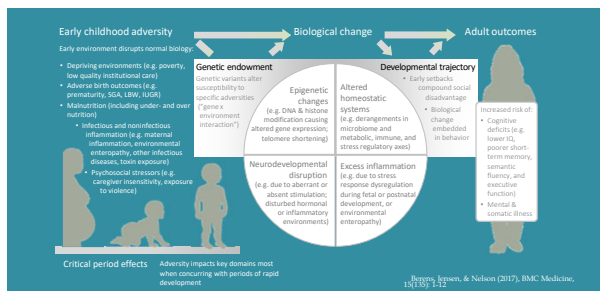
Increased risk of mental (e.g., anxiety and depression) and physical health (e.g., cardiovascular disease; diabetes) disorders

It is theoretically possible for effects to biologically cascade from one generation to the next (epigenetic effect)

The financial and human capital costs to society are enormous; as economists say ***"Pay now or pay more later"***

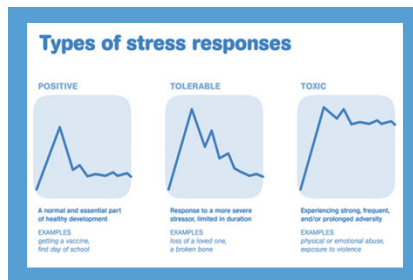
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How to model the biological embedding of adversity



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Case Study #1: Toxic Stress



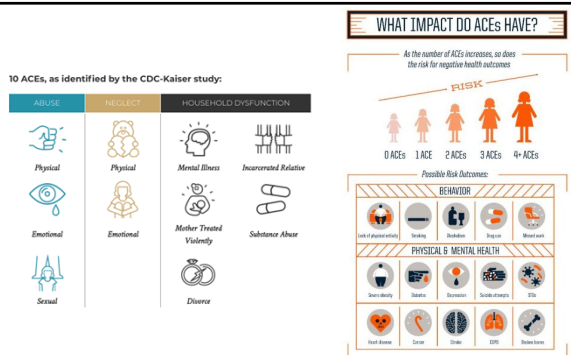
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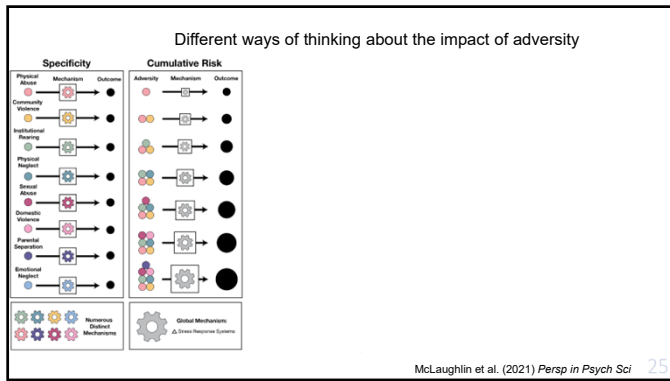
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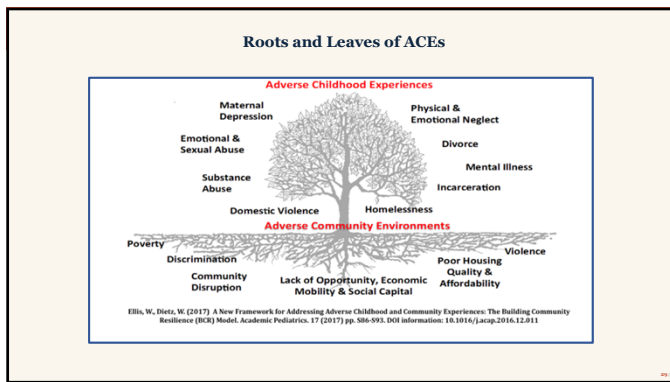


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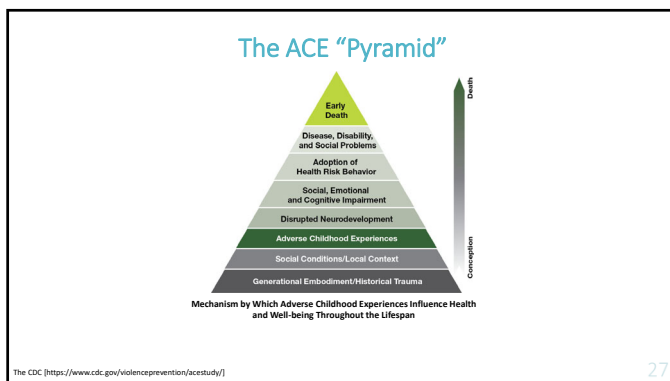
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Summary

- There is a dose-response curve to the developmental sequelae of early adversity, with higher ACE scores associated with more severe outcomes
- But it likely is not as simple as “more” adversity equals “worse” outcomes; *timing* is very important (when adversity occurs) as is *type* (e.g., child sexual abuse is likely far worse on children than parental divorce)

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