Neurodevelopmental Aspects of School Readiness

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What is Readiness to Learn?

- Also called “readiness for school”
- A set of competencies that allow children to take advantage of opportunities and challenges offered at school and in their environment.
- Measured in Ontario by the Early Development Instrument (EDI).
- Five Scales:
  - Language & Cognitive, Social, Emotional, Physical health and well-being and Communication skills in English

Readiness to Learn: Brain Bases

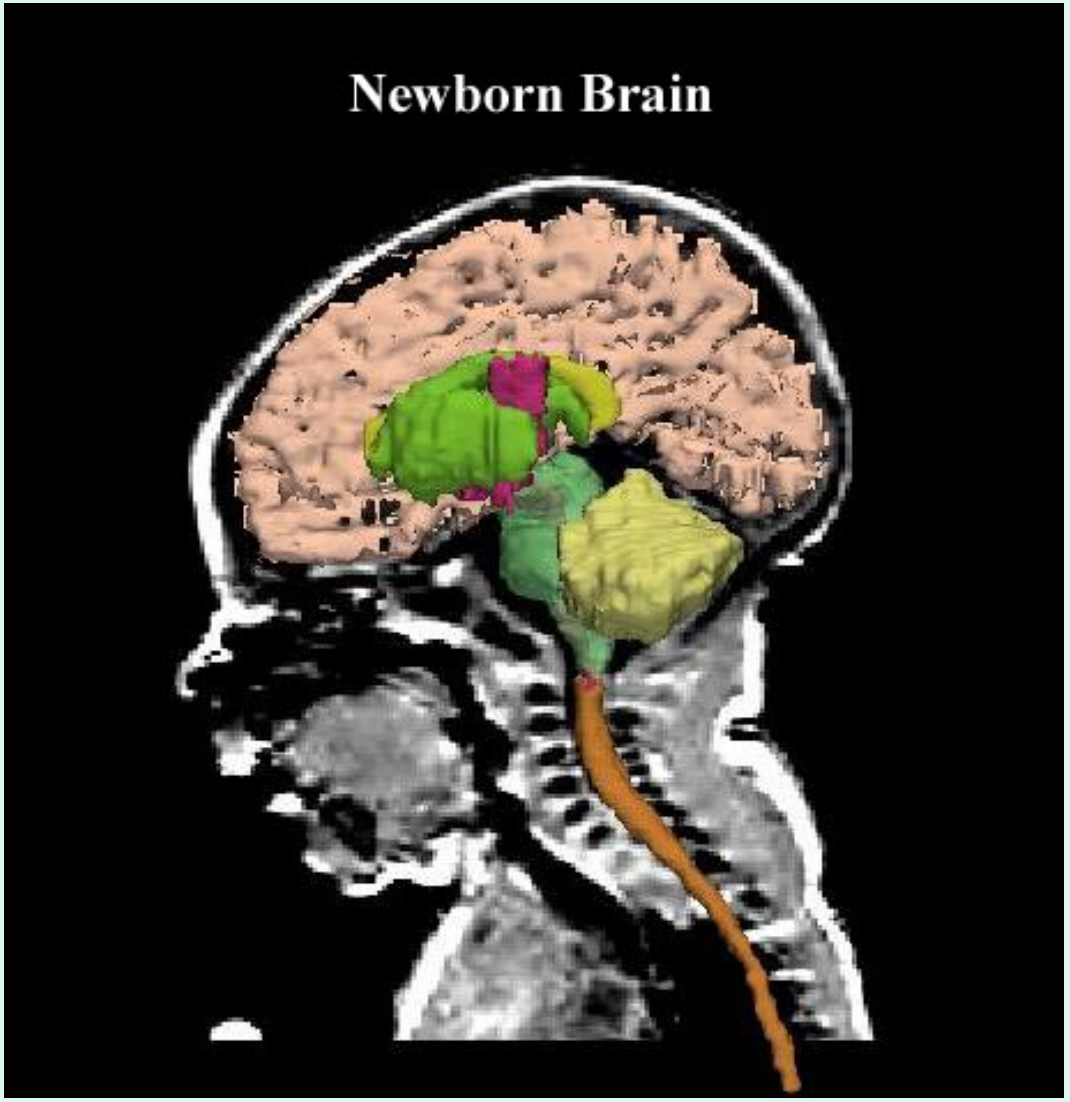
- Readiness to learn can be operationalized as connectivity of brain systems (white matter) and availability of viable neuronal pathways.
- Determinants: Biological, psychological, social
- Increasingly rests on the development of Executive Functions (Frontal Lobe)
- Transforms into “Life-long learning”

Developmental Timeline

- 0-3: massive organization of somatosensory cortex and motor areas
- 3-5: language areas and attention/working memory areas
- 5-10: Continued maturation in all regions: Hemispheric Lateralization of functions
- 10-25: Continued maturation of all areas PLUS major developments in the frontal lobe

Everything you wanted to know about brain development…

- Newborn has greatest number of neurons it will ever have in its life
- Brain development proceeds by two main mechanisms: white matter growth and pruning.
- Neurons and dendrites are selectively “pruned”: Some connections are strengthened and others are lost.
- Pruning periods are critical periods, especially for children in marginalized settings.
- Some parts of our brain replace cells continually, if stimulated by the environment (e.g., hippocampus)



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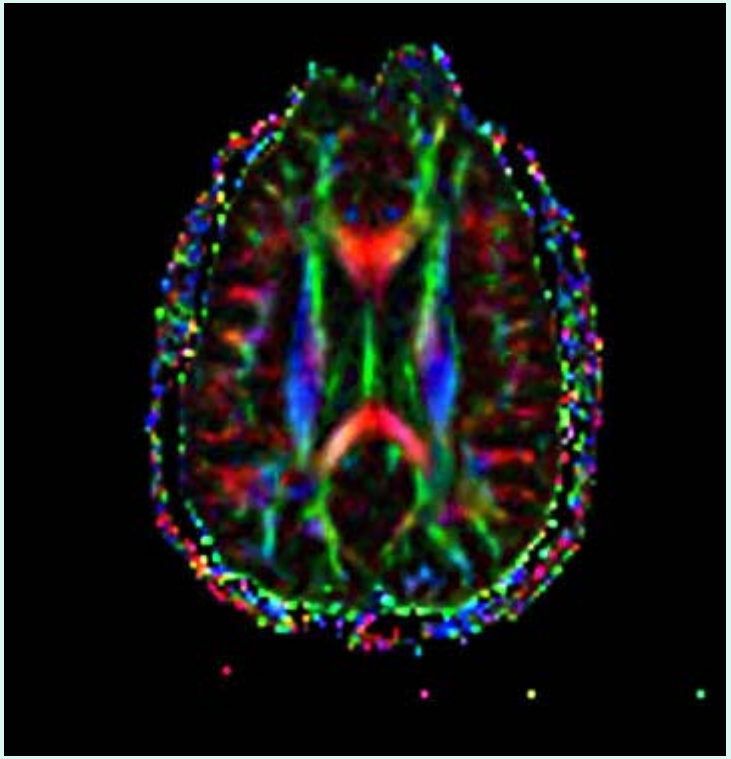
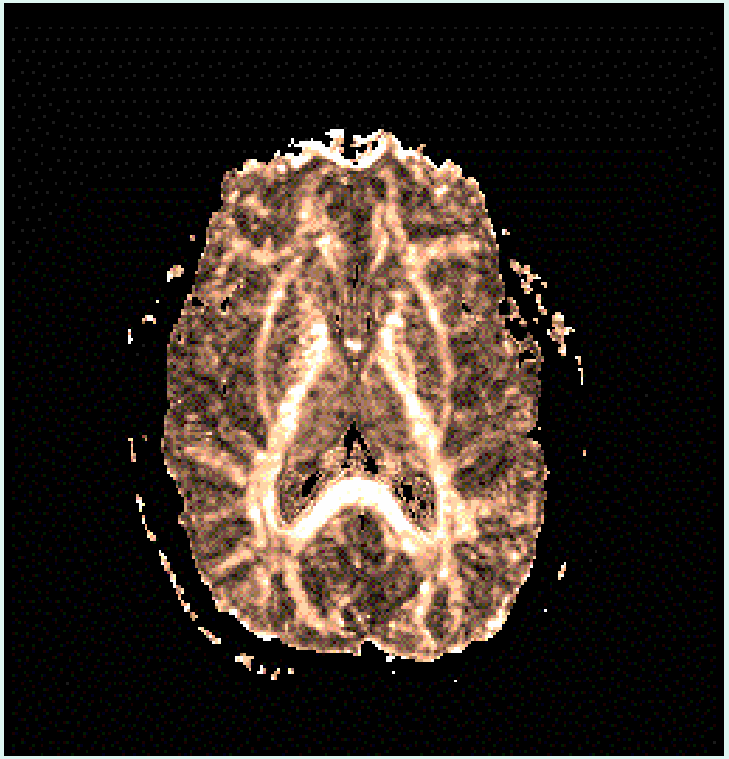
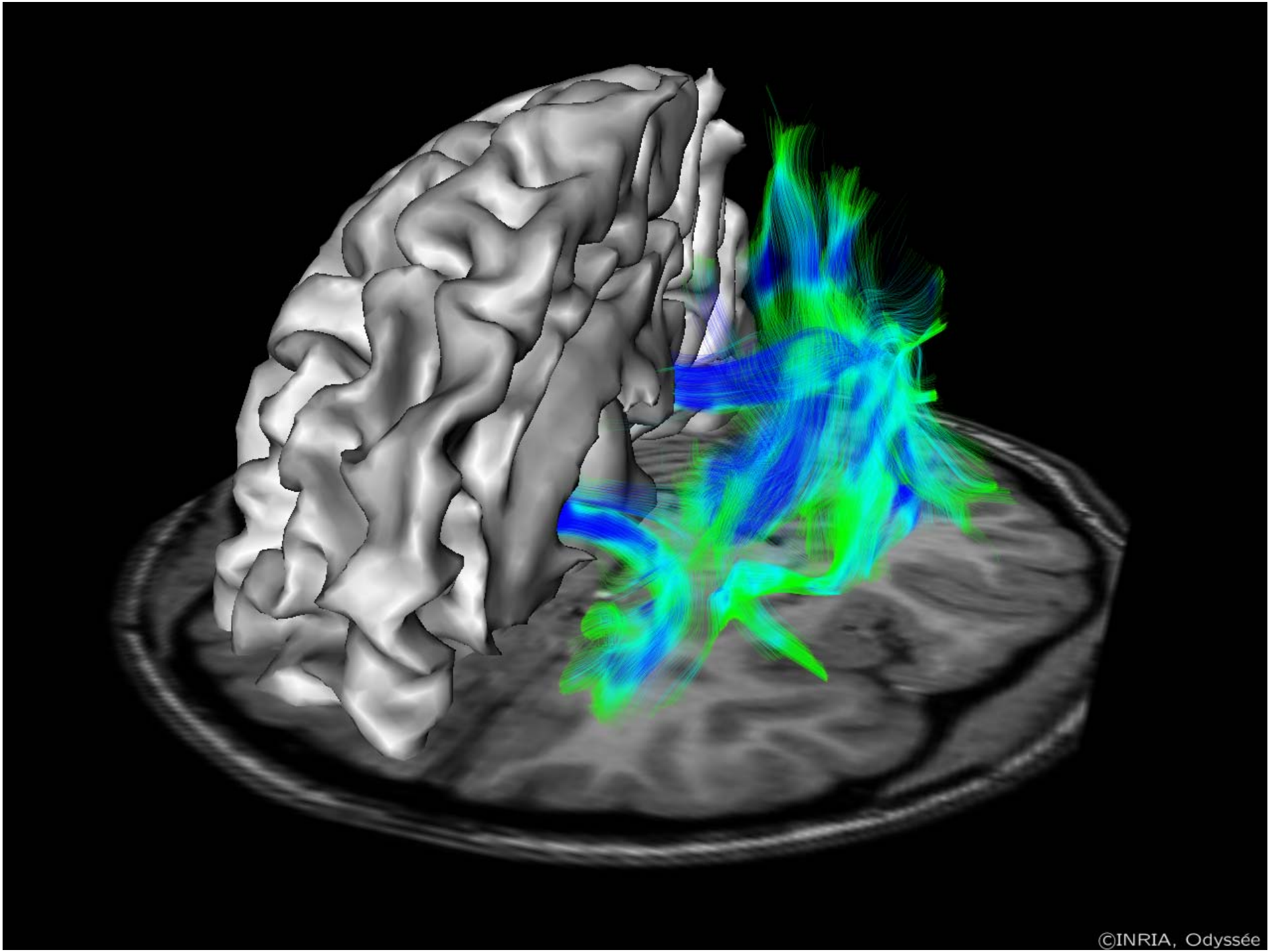
White Matter



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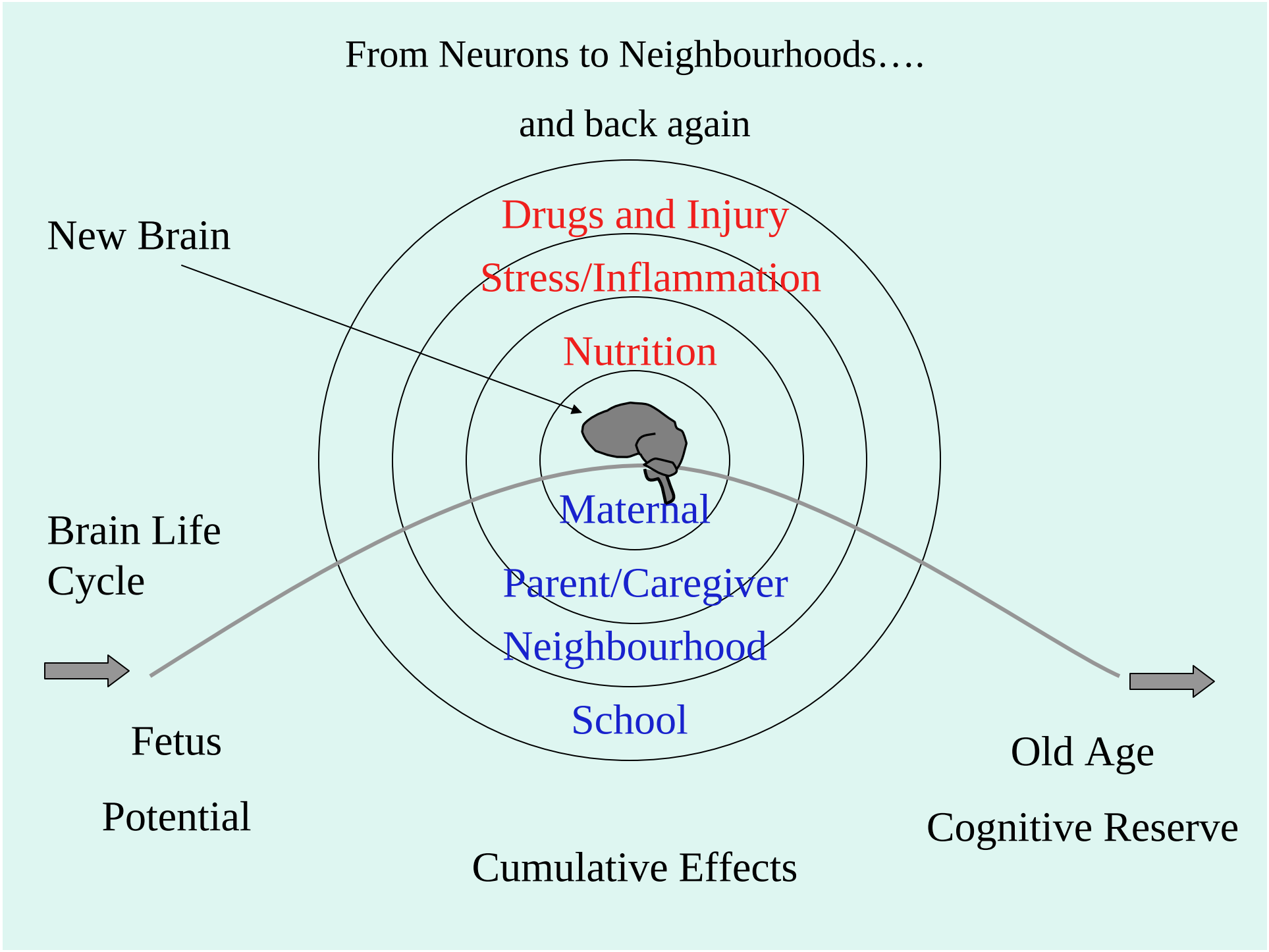
From Neurons to Neighbourhoods….
and back again
New Brain
Drugs and Injury
Stress/Inflammation
Nutrition
Maternal
Brain Life Cycle
Parent/Caregiver
Neighbourhood
School
Fetus
Potential
Old Age
Cognitive Reserve
Cumulative Effects

How Does Outside Get Inside?:

- Early events interface with critical neural periods-or they don’t.
- Stress chemicals interfere with gene expression during development and cause neuroinflammation which compromises white matter and neurons.
- Cell expression and growth compromised by stress.
- Mediated by Parents and Neighbourhood

Brain Development and Health Outcome

- Early global factors (e.g., nutrition, stimulation and attachment) can have a profound effect on later health:
  - Poor frontal development-risky behaviour
  - Poor early nutrition-increased rate of dementia
  - Poor education-increased rate of dementia
  - Premature-Poor behaviour outcomes
  - Neglected-Poor behaviour regulation
  - Early deprivations-increased risk later in life due to reduced “cognitive reserve”

Models of Risk for Poor Outcome

“Poker Hand” Genetic model:

A lot depends on the “hand” that you are dealt when you are born (e.g., born premature)

“Dye is Cast” Latency Model:

Early experiences have a marked effect on the child by shaping their basic responses to the world, which are independent of later experiences or intervention.

“**Fork in the road**” or **pathways model**:

Several consecutive negative life events can lead to deviations in developmental trajectory.

“Snowball Effect”: Risks and protections accumulate

Social Reproduction of Poor Brain Development

- Poor environments affect language and social development of a generation.
- Subsequently, as adults, they understimulate their children, or engage in less than optimal parenting practice.
- This produces poor brain development and so on…..

Community Response: Build *Social Capital*

- Monkey studies: Monkeys bred for high stress may not express the gene for high stress reactivity when reared with nurturing parents.
- Louisiana: Poor children perform significantly worse than better-off children.
- Sweden: Poor children and well-off children do not differ in terms of cognitive outcomes

Neighbourhood Effects: "Social Capital"

Jane Jacobs:

"*Underlying any float of population must be a continuity of people who have forged neighbourhood networks. These are a City's irreplaceable Social Capital"*

What is Social Capital?

(Putnam, *Bowling Alone*)
Citizens exhibit:

- ✓ Community networks
- ✓ Civic engagement
- ✓ Sense of belonging, solidarity, identity
- ✓ Reciprocity and norms of cooperation
- ✓ Trust in Community

- ➢ Social capital is measured in terms of individual attitudes, but has an effect at the neighbourhood level (so even if you are paranoid, but live in a trusting, open community, you benefit from that social capital).

- ➢ Closely related to socioeconomic status (wealth)

Wealth and Place: *It is not just how rich your Daddy is…*

Neighborhood levels of socioeconomic prosperity have an effect on child development above and beyond the contribution of the parent's level of income.

Socioeconomic status and brain development

- SES connects up to broad neighbourhood effects: overall health, parental factors, immediate environment, quality of child care, nutrition, exposure to toxins (lead), iron deficiency
- SES has been linked to lowered readiness to learn
- SES at the parental level has been linked to differences in specific neurocognitive systems (Farah, 2005)

So What Can be Done?

- By the time the child reaches remediation-is it too late (“catch up to the other kids by learning more slowly”)
- In many cases, the better off kids benefit more from the intervention than the needy kids (*Mathew Effect*)
- Studying the underlying mechanisms of readiness to learn links EDI with other important developmental mechanisms.
- Creating the resources for better neighbourhoods and better early years experiences.

What Makes a Brain Development-Friendly Neighbourhood?

Risk

- Poor nutrition
- Low stimulation
- Poor access to health care
- Parental stress
- Lack of parental support services
- Lack of knowledge about child development
- Poor childcare resources
- Stressful neighbourhood conditions
- Lack of community-level resources

Protection

- Parental support
- Quality childcare
- Nutrition programs
- Parenting skills classes
- Income support
- Building community social cohesion
- Community wide resources for adults
- Violence reduction
- Play-centered learning

Preschool Characteristics

- Better match between challenges and child's level of ability or learning style
- Play based learning
- Secure, un-stressful environment
- Lower child to staff ratio
- Social inclusion
- Parental inclusion
- Identification of early signs of falling behind
- Greater ECE staff awareness of neurodevelopment and signs of early risks.