

# Science of Lifelong Learning

Neuropsychological Perspectives

**Professor SH Annabel Chen, PhD**  
**Director, CRADLE**



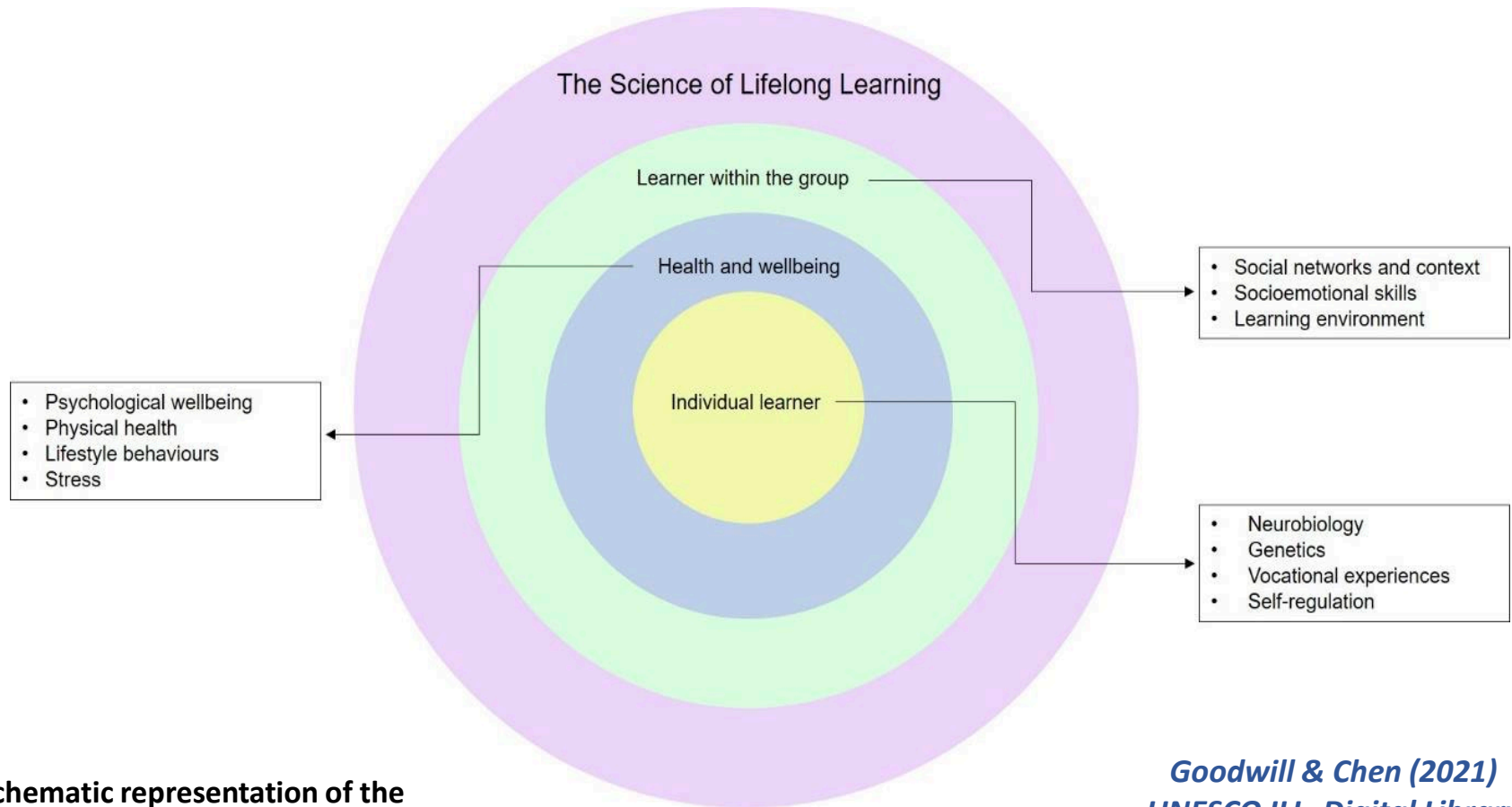
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# The Science of Lifelong Learning



Schematic representation of the

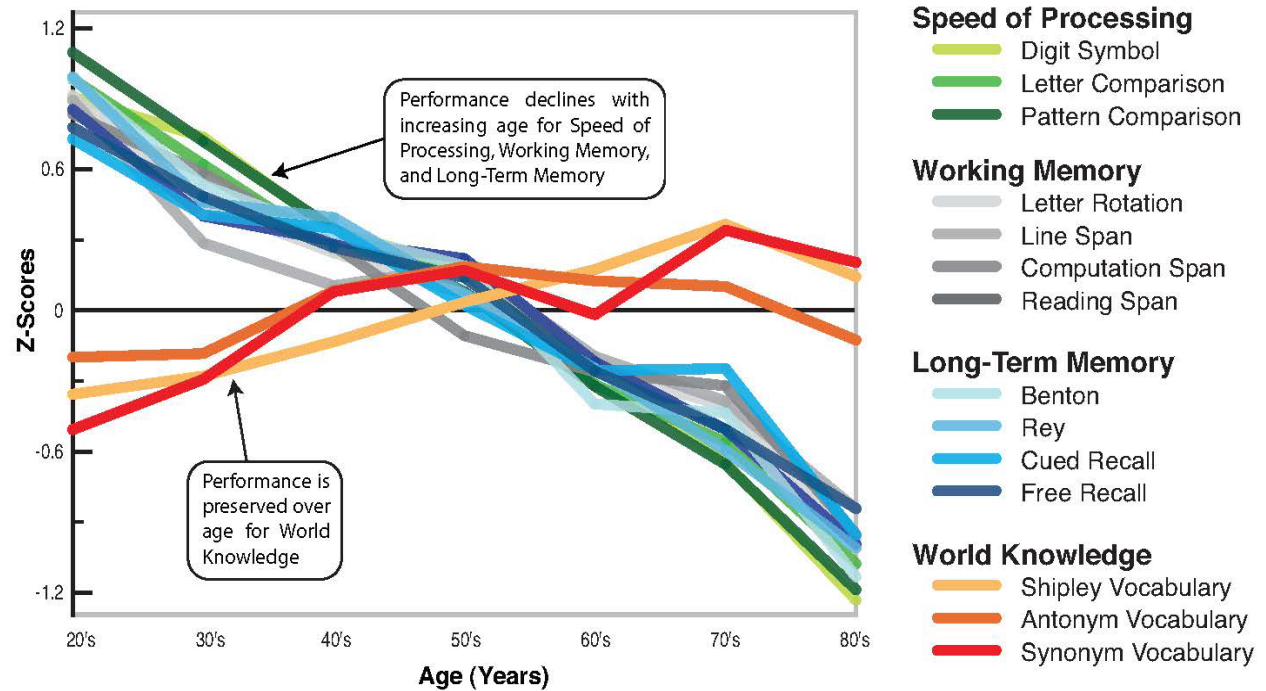
- biological (individual learner),
- lifestyle (health and wellbeing) and
- psycho-socio-emotional and environmental (learner within the group) factors that interact with cognitive processes and learning across the lifespan

# Neuropsychology of Aging: Cognition

What Changes as we Age?

Cognitive Performance

Fluid Intelligence  
Crystallized Intelligence



Park & Reuter-Lorenz,  
*Annu Rev Psychol*,  
2009

Figure 1

Cross-sectional aging data adapted from Park et al. (2002) showing behavioral performance on measures of speed of processing, working memory, long-term memory, and world knowledge. Almost all measures of cognitive function show decline with age, except world knowledge, which may even show some improvement.

# Neuropsychological of Aging: Brain Structure

What Changes as we Age?

Structural Brain Volume

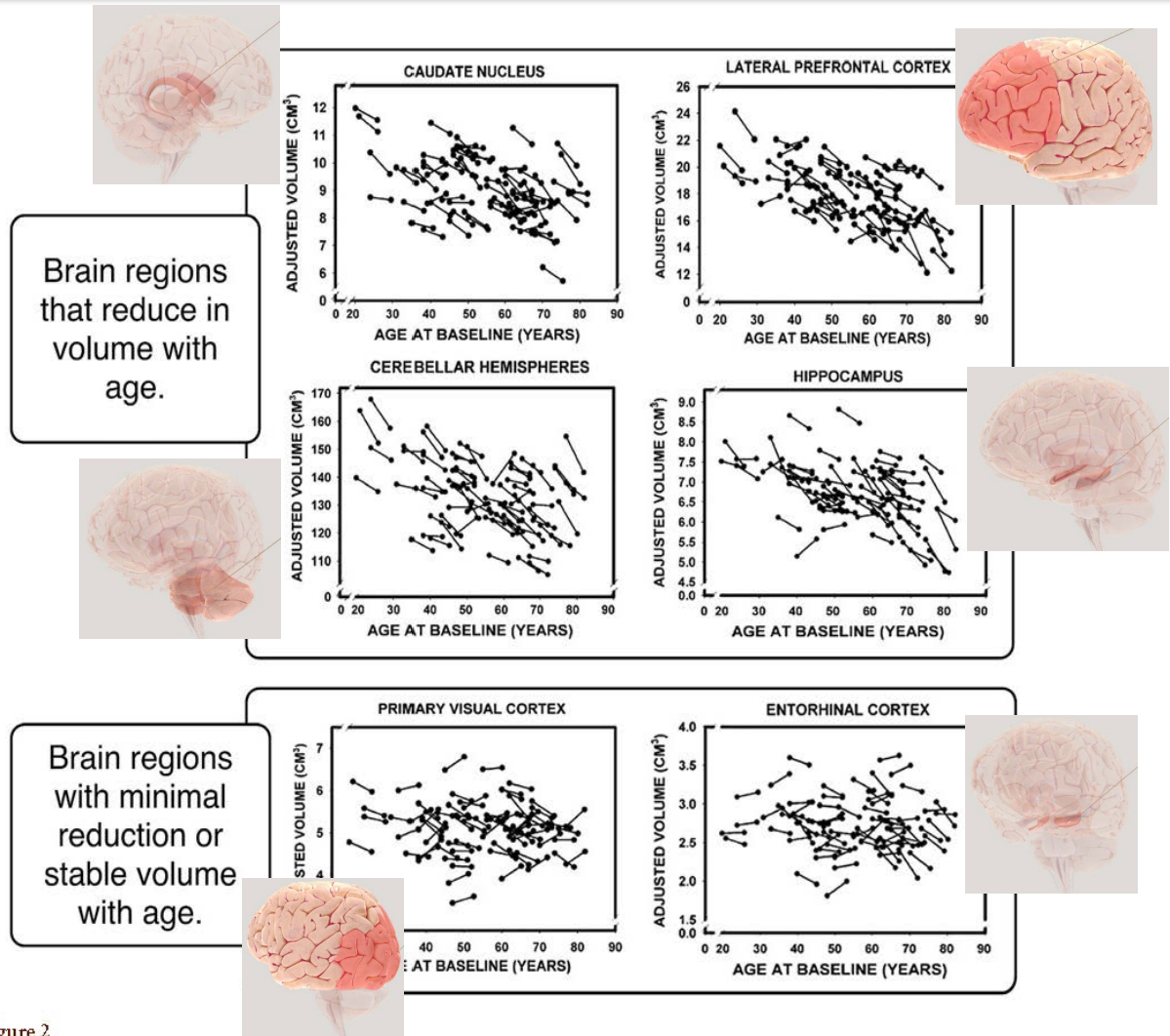
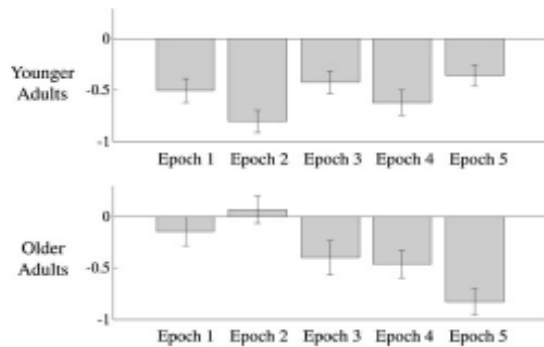
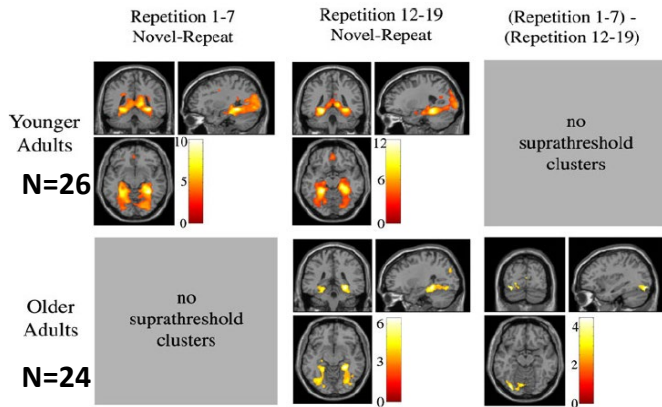


Figure 2

Cross-sectional and longitudinal aging brain volumes across various brain regions (adapted from Raz et al. 2005). Each pair of line-connected dots represents an individual subject's first and second measurement. The caudate, hippocampal, cerebellar, and frontal regions all show both cross-sectional and longitudinal reduction in volume with age. The entorhinal, parietal, temporal, and occipital regions are relatively preserved with age.

# Neuropsychological of Aging: Brain Function

## Memory

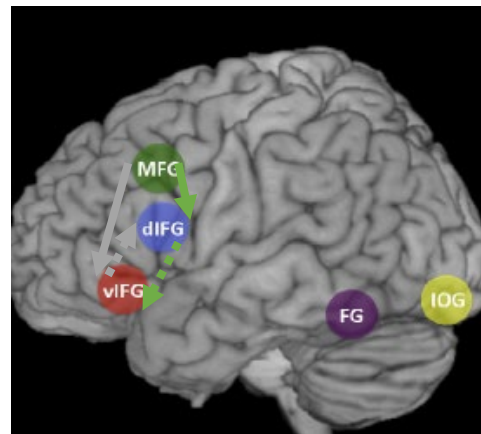


Miyakoshi, Chen et al (2012)  
Brain Imaging and Behavior

## Language

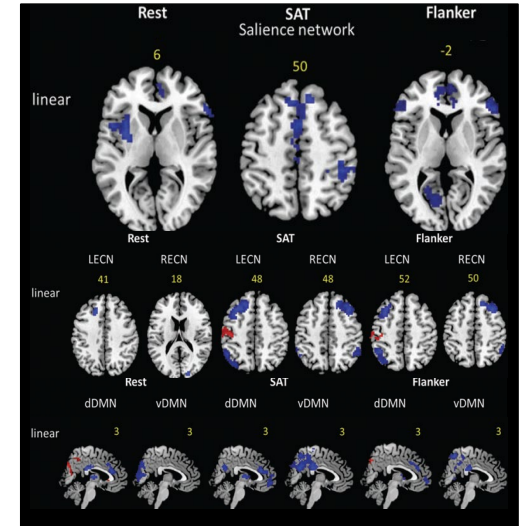
Wu et al. (2014) Brain & Language

- Older adults (orange) preferred a direct connection from orthographic inputs (MFG) to phonological lexicons (dIFG) prior to the activation of semantic (vIFG) representations
- The shift in reading pathways accompanied by slowed reaction time for the older adults → age-related decline in the efficiency of network connectivity.



## Brain at Rest

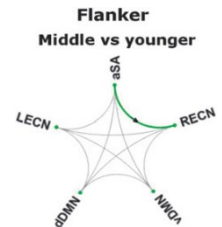
Archer et al (2016) Brain Connectivity



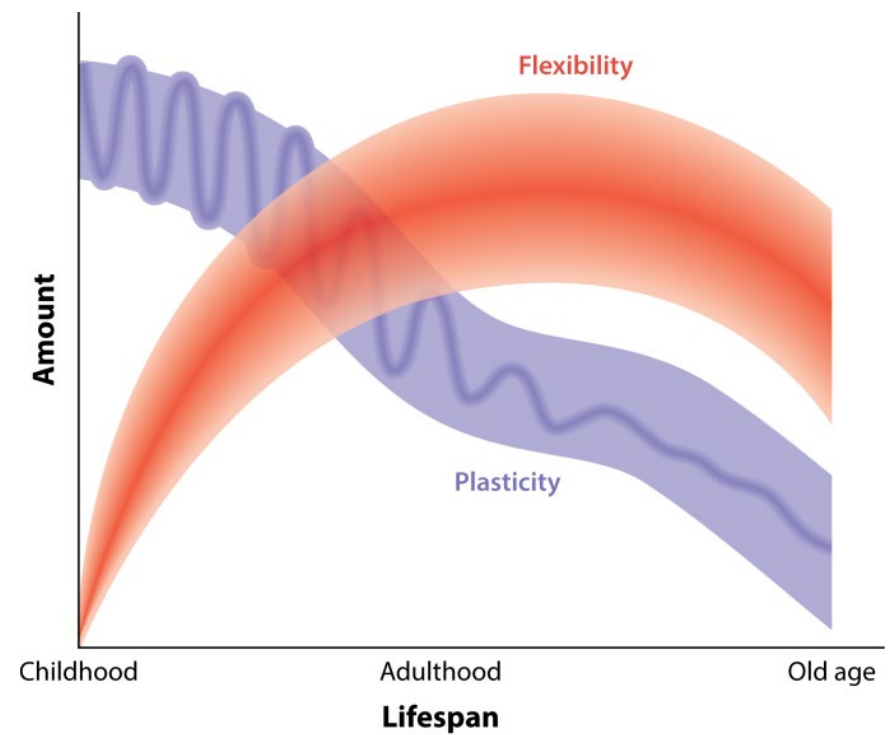
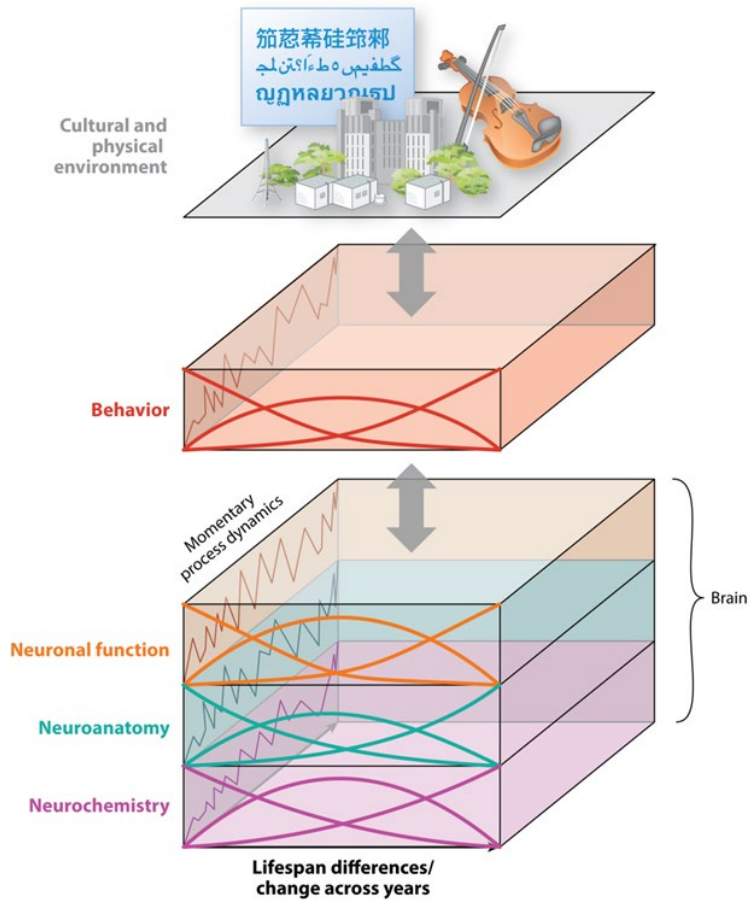
Red: greater connectivity with age  
Blue: less connectivity with age

(n=210; 21-80yrs)

The influence from the anterior salience network to the right ECN increased in middle adults compared to younger adults



# Neuropsychological of Aging: Neuroplasticity



AR Lindenberger U, Lövdén M. 2019. *Annu. Rev. Dev. Psychol.* 1:197–222

AR Lindenberger U, Lövdén M. 2019. *Annu. Rev. Dev. Psychol.* 1:197–222



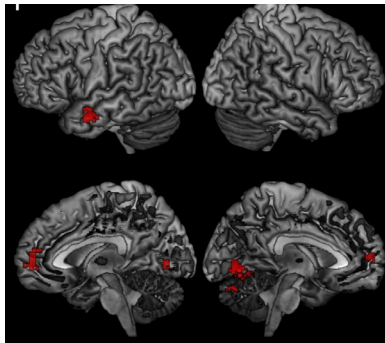
# Benefits of Lifelong Learning: Cognition and Well-Being

## Cognition

- Cognitive reserve
- Education

Protective against

- Cognitive Decline



**Education** is associated with **greater neural recruitment, thus greater task activation and better task performance** even in the face of neural deterioration (*Archer et al., 2018*).

## Well-Being

- Stress reduction
- Non-formal learning

Protective against

- Depression and Anxiety

**Education** has an enduring, consistent, and growing effect on **health** (*Mirowsky & Roth, 2003*).

**Education** is a powerful determinant of **health and longevity** (*Baker et al., 2011*)

# Lifelong Learning

“

To grow gracefully with success in  
age, we need to learn for life  
- And that is Lifelong Learning!

SH Annabel Chen

CONFINTEA VII 2022



# Thank you / Merci!

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<https://www.uil.unesco.org/en/seventh-international-conference-adult-education>

<https://www.ntu.edu.sg/cradle>

annabelchen@ntu.edu.sg



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