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FOR ALZHEIMER'S RESEARCH
& TREATMENT

“USE IT OR LOSE IT”

The Role of Brain Exercises

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DISCLOSURES

- Nothing to disclose
- Proprietary names used in this presentation are for the purpose of examples and are not intended to serve as a product or company endorsement



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LEARNING OBJECTIVES

1. Define neuroplasticity and cognitive reserve
2. Identify and describe three classes of cognitive interventions
3. Describe the benefits of cognitive stimulation
4. Delineate the types of activities for brain exercises



COGNITION

Cognition – the mental activities and processes involved in receiving, comprehending, storing, retrieving, and using information.



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COGNITIVE DOMAINS

memory

attention

executive functions

language

calculation



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COGNITIVE DOMAINS

reasoning

processing speed

visual-spatial skill



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CONCEPTUAL BASIS

Neuroplasticity

Cognitive resilience

Cognitive reserve



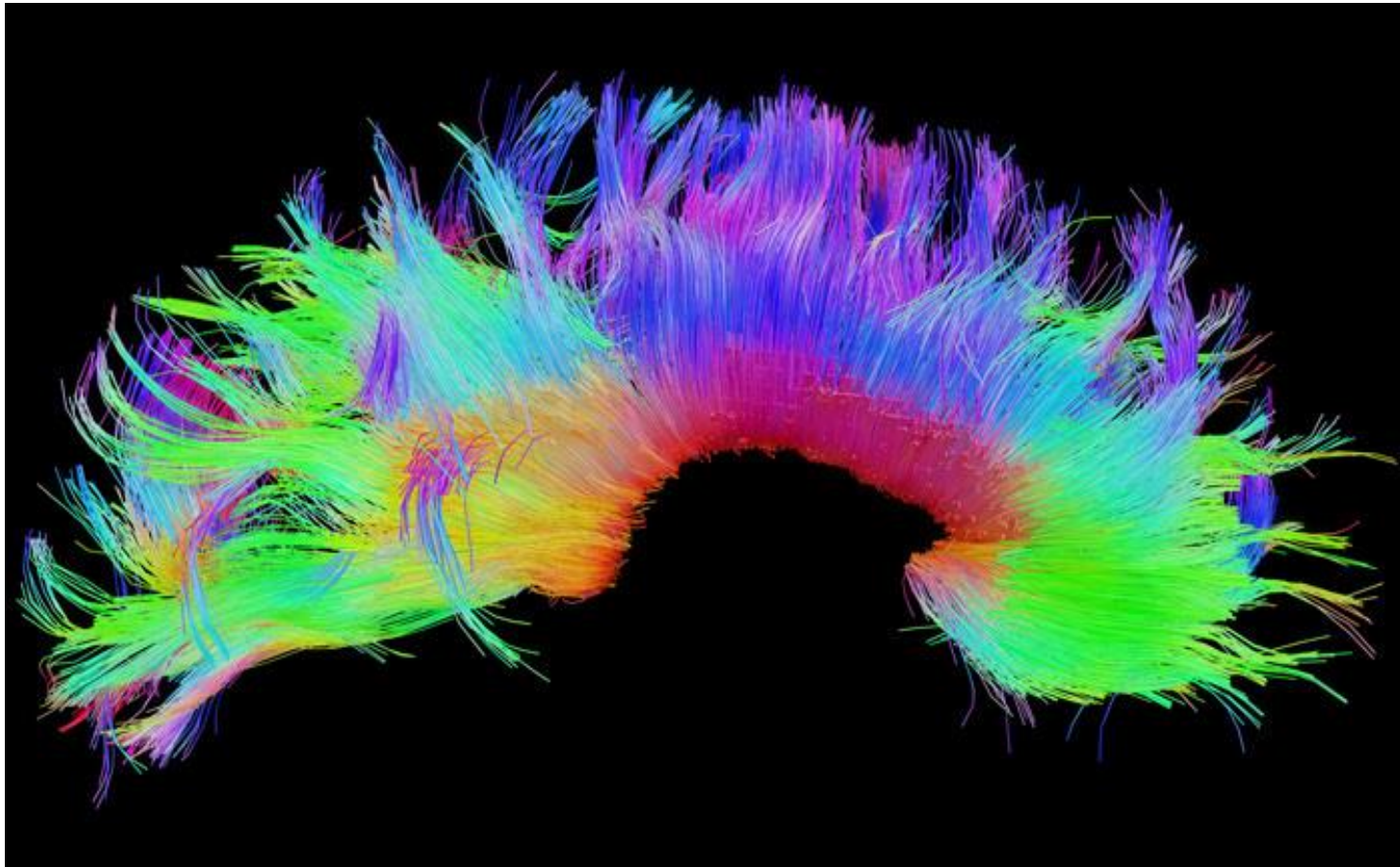
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NEUROPLASTICITY

- ability of the brain to modify, change, and adapt structure and function in response to experience across the life span
- essential for healthy brain function

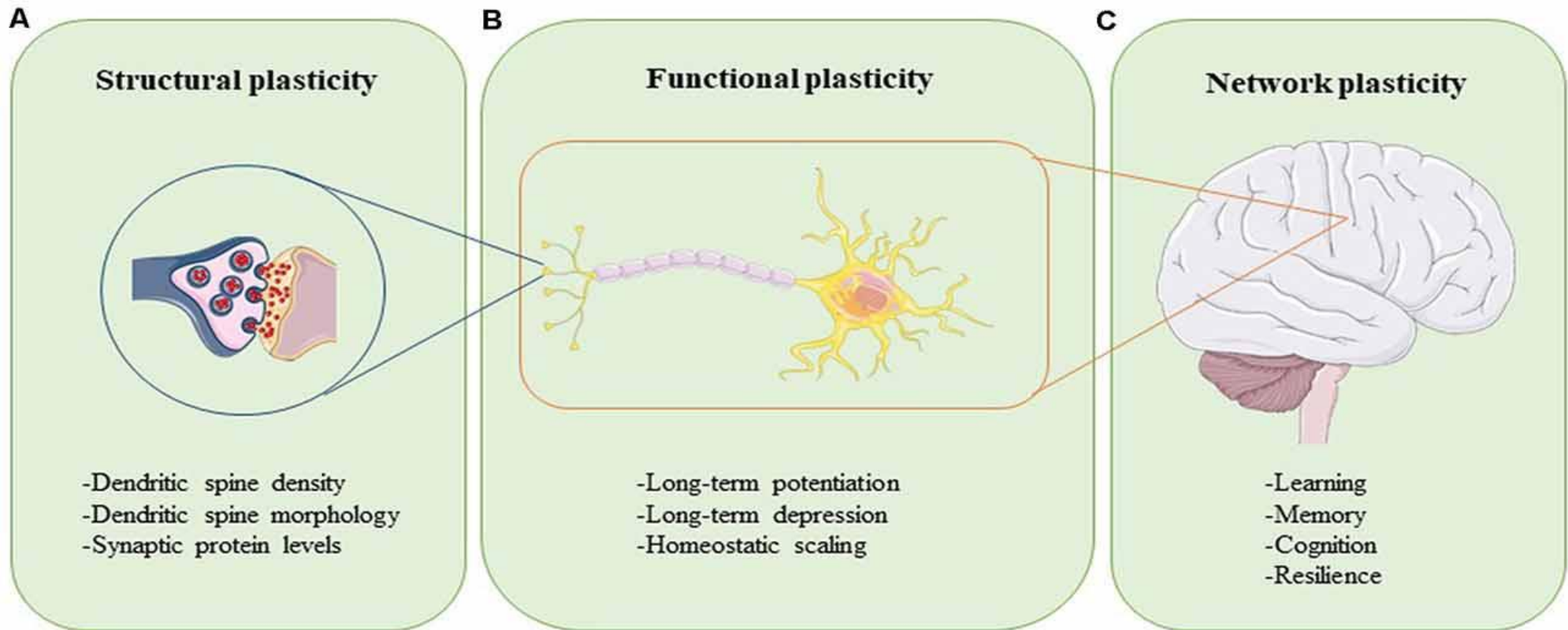
(Nelson, Jester, Petkus, & Andel, 2021; Arenaza-Urquijo et al., 2020, Voss et al., 2017)

NEUROPLASTICITY



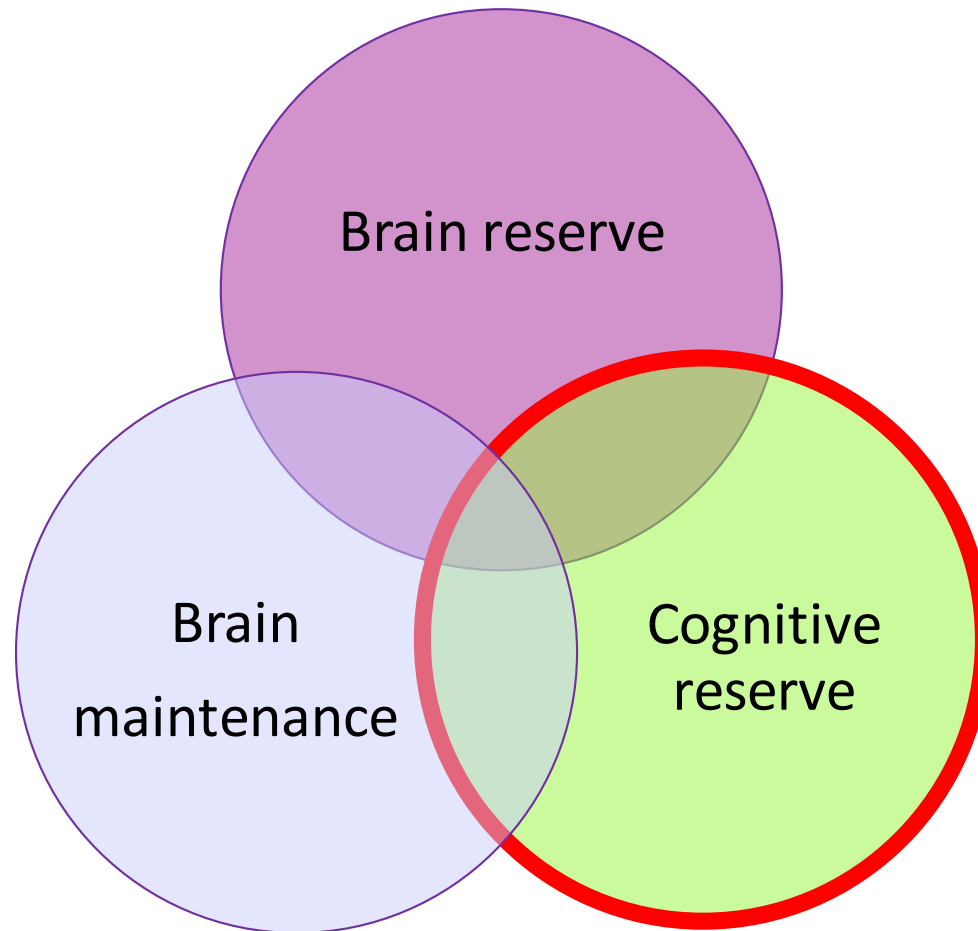
(University of Southern California, Human Connectome Project, 2022)

LEVELS OF NEUROPLASTICITY



(Koller & Chakrabarty, 2020)

COGNITIVE RESILIENCE



COGNITIVE RESILIENCE

- Brain reserve – greater neurobiological capital (more neurons, more synapse)
- Cognitive reserve - neuronal network adaptability (efficiency, capacity, flexibility)
- Brain maintenance – reduced development of age-related brain changes & pathology (genetics and/or lifestyle)

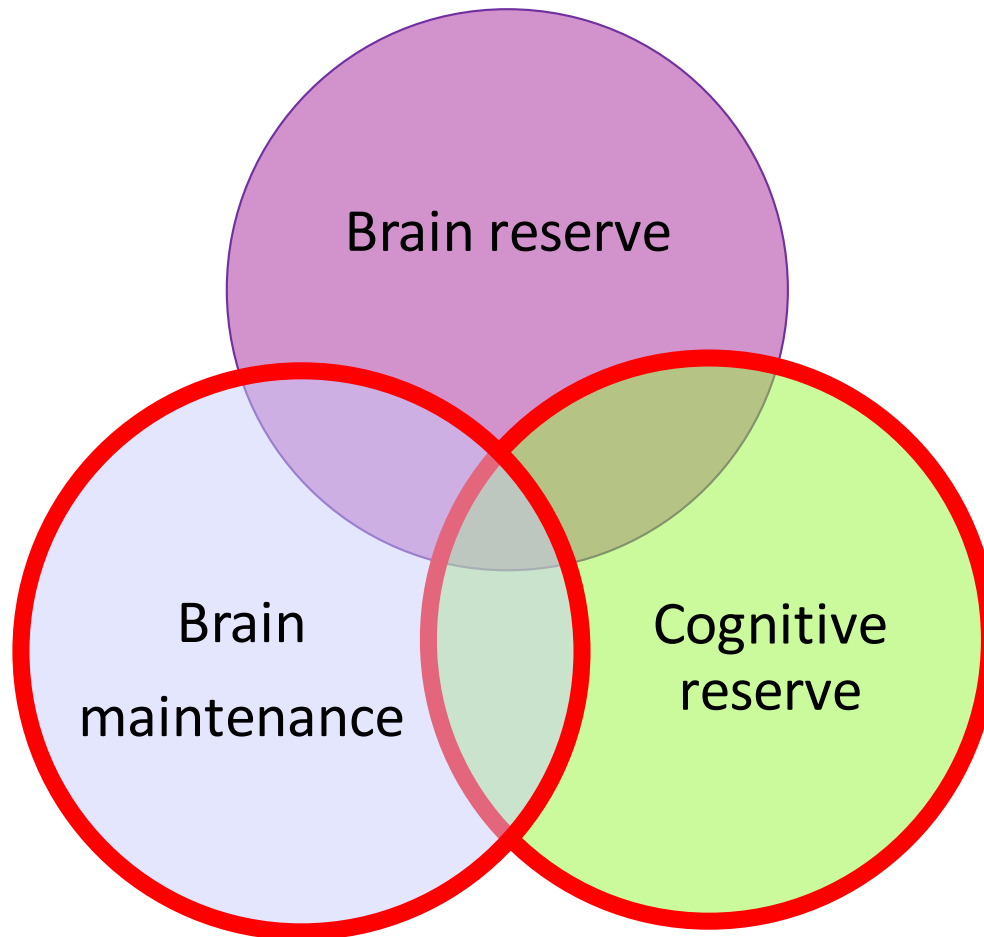
(Stern, 2021; Arenaza-Urquijo et al., 2020; Stern & Barulli, 2019)



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COGNITIVE RESILIENCE

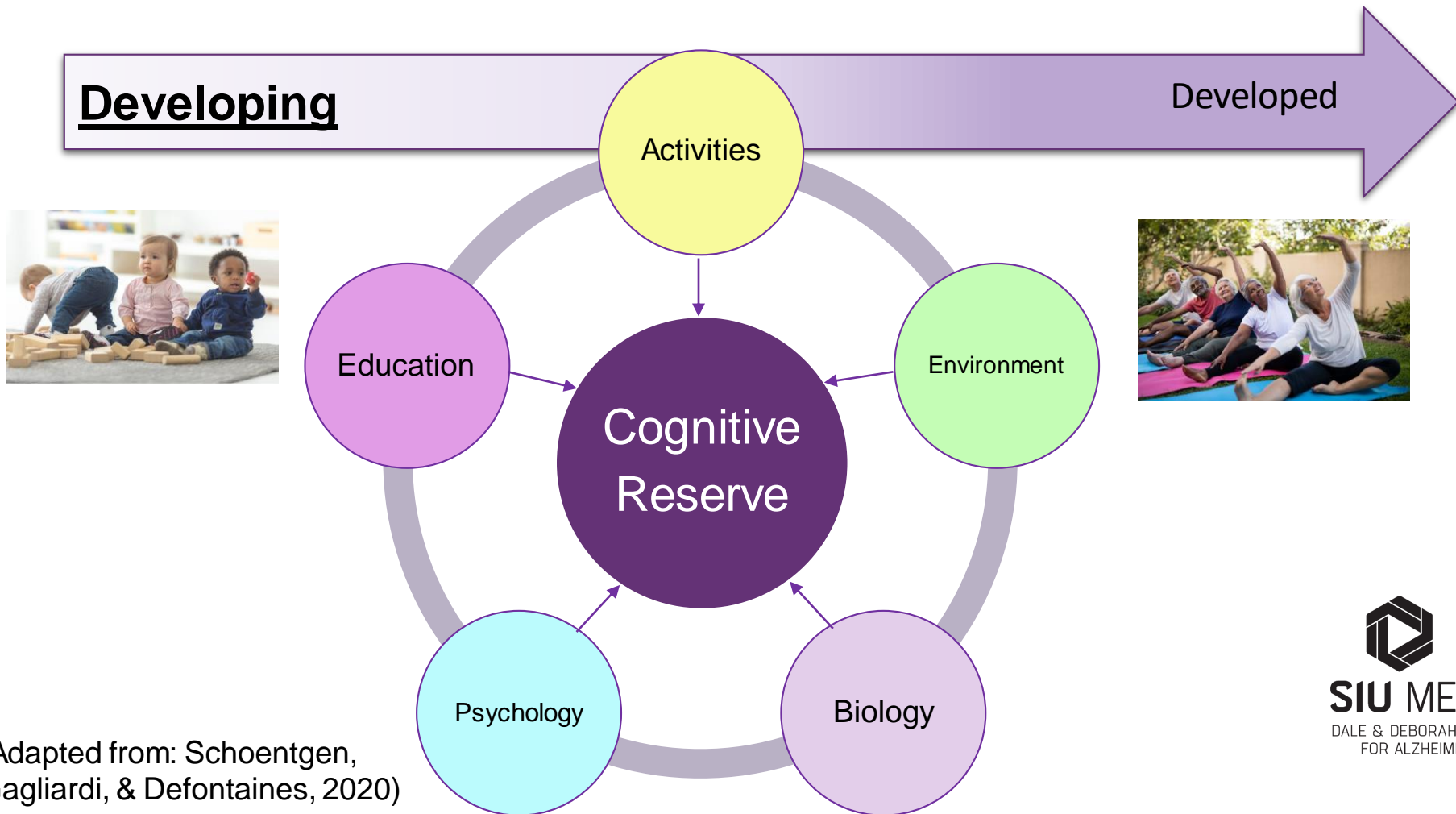


COGNITIVE RESERVE

- neuronal network adaptability (efficiency, capacity, flexibility)
- individual differences in cognitive or functional brain processes determine cognitive reserve

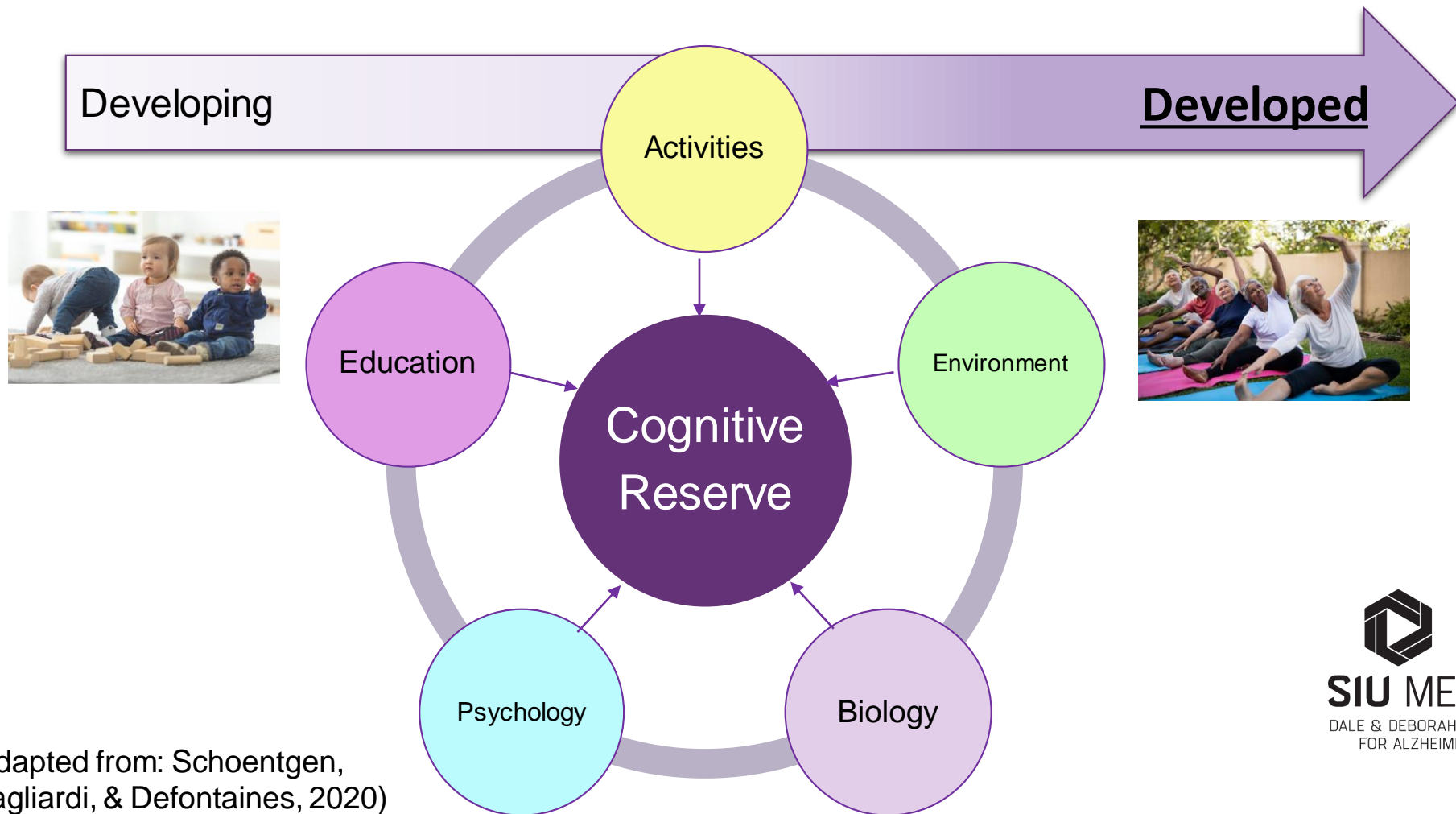
(Nelson, Jester, Petkus, & Andel, 2021; Arenaza-Urquijo et al., 2020,; Stern & Barulli, 2019; Voss et al., 2017)

COGNITIVE RESERVE



(Adapted from: Schoentgen, Gagliardi, & Defontaines, 2020)

COGNITIVE RESERVE



(Adapted from: Schoentgen, Gagliardi, & Defontaines, 2020)

COGNITIVE EXERCISE

COGNITIVE STIMULATION

COGNITIVE TRAINING

COGNITIVE REHABILITATION

(Clare et al., 2018; Bahar-Fuchs, Clare, & Woods, 2013)



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COGNITIVE EXERCISE

COGNITIVE STIMULATION

- non-specific engagement in a range of activities and discussions either individually or in a group setting i.e. reality orientation, reminiscence activities

(Clare et al., 2018; Bahar-Fuchs, Clare, & Woods, 2013)

COGNITIVE EXERCISE

COGNITIVE TRAINING

- guided approach involving practice of standardized tasks targeting a particular cognitive function such as attention, memory, or problem solving
- computerized cognitive training (CCT)

(Clare et al., 2018; Bahar-Fuchs, Clare, & Woods, 2013)

COGNITIVE EXERCISE

COGNITIVE REHABILITATION

- individualized approach with functional goals, creates compensatory strategies

(Clare et al., 2018; Bahar-Fuchs, Clare, & Woods, 2013)

COGNITIVE EXERCISE

COGNITIVE STIMULATION (CS)

COGNITIVE TRAINING (CT, CCT)

COGNITIVE REHABILITATION (CR)

(Clare et al., 2018; Bahar-Fuchs, Clare, & Woods, 2013)



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ACTIVITIES – COGNITIVE STIMULATION

Discussion of past and/or present events

Word games

Puzzles – crossword, word search, sudoku, jigsaw

Music

Board games



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ACTIVITIES – COGNITIVE STIMULATION

Indoor gardening

Creative activities – baking, crafting, sewing

Socialization



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ACTIVITIES – COGNITIVE TRAINING

Memory card games

Memorizing information/lists

Pattern detection games

Use of touch screen games to increase thinking speed



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ACTIVITIES – COGNITIVE TRAINING

Board games

Dance

Art

Music



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ACTIVITIES – COMPUTERIZED CT (CCT)

BrainHQ – Healthy older adults, ADHD, bipolar disease, depression, MCI, dementia, PD, MS, stroke, TBI

CogniFit – Healthy older adults, ADHD, depression, PD, stroke, PD, dyslexia, dyscalculia, insomnia, fibromyalgia

CogniPlus – Brain damage, ADHD, MCI

(Irazoki et al., 2020; O’Shea et al., 2019)



ACTIVITIES – CCT

Cogmed – ADD, TBI, stroke, learning disorders,
cognitive impairment

Luminosity – Healthy older adults

(Irazoki et al., 2020; O’Shea et al., 2019)

CCT - COGNITIVE DOMAINS

BrainHQ – Visual spatial working memory, memory

CogniFit – Attention, executive function, working memory, memory, reasoning, visual-spatial perception, processing speed

CogniPlus – Attention, executive function, memory, spatial processing, visuomotor skills, processing speed



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(Bahar-Fuchs et al., 2020; Aksayli et al., 2019; 'Shea et al., 2019; Yang et al., 2019; Hardy et al., 2015))

CCT - COGNITIVE DOMAINS

Cogmed – Working memory

Luminosity – Visual sustained attention, processing speed,
memory, problem solving



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(Bahar-Fuchs et al., 2020; Aksayli et al., 2019; 'Shea et al., 2019; Yang et al., 2019; Hardy et al., 2015))

EVIDENCE SUMMARY

1. CS, CT, or CCT does not prevent dementia
2. The evidence is mixed as to the effectiveness of CS, CT, or CCT in improving global and specific cognitive domains.
3. CS, CT, and CCT may offer some improvements in certain cognitive functions

EVIDENCE SUMMARY

4. CS, CT, and CCT may offer some improvement in quality of life and ability to perform Activities of daily living for some individuals
5. Combining CS, CT, or CCT with aerobic exercise may offer a synergistic effect for improving certain cognitive functions



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EVIDENCE SUMMARY

6. There is no evidence to date for significant harm from CS, CT, CCT other than the cost of commercially available programs



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RECOMMENDATIONS

RESEARCH

1. There is a significant need for further research in this area:
 - a. higher quality studies
 - b. leveraging newer technologies i.e. virtual reality, artificial intelligence/machine learning

RECOMMENDATIONS

CLINICAL

1. Healthy older people should be encouraged to participate in CS and CT activities despite the modest benefits
2. Those with subjective cognitive complaints and MCI should be encouraged to use CS and CT

RECOMMENDATIONS

CLINICAL

3. Those with dementia should be encouraged to participate in CS programs
4. Brain health should be incorporated into the public health paradigm from a life span perspective beginning in childhood

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PUZZLE ANSWERS

IALOSC MGGEATEENN

S O C I A L E N G A G E M E N T
7 55 37 73 58 26 46

RAPIEMID NUFNOITC

I M P A I R E D F U N C T I O N
44 65 72 21 49 23 8

LOCTLHEEROS

C H O L E S T E R O L
53 6 61 60 32 40 11

NALCITTULLEE VATTYICI

I N T E L L E C T U A L A C T I V I T Y
39 22 57 68 17 4

COORDT

D O C T O R
59 14 19

GODO DETI

G O O D D I E T
63 34 18 15

CETMDINOIA DSEI-CESTEFF

M E D I C A T I O N S I D E - E F F E C T S
20 38 43 47 69 1 71 24 36 28 54

VAURSACL HETAHL

V A S C U L A R H E A L T H
25 67 35 29 30 10 33 31 12 2

RIEEXSEC

E X E R C I S E
41 9 16 27

DUETEAQA SELPE

A D E Q U A T E S L E E P
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LODBO PESRUERS

B L O O D P R E S S U R E
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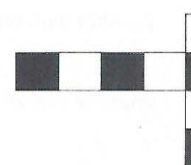
S T A Y P H Y S I C A L L Y A C T I V E , R E D U C E
1 2 3 4 5 6 4 7 8 9 10 11 12 4 13 14 15 16 17 18 19 20 21 22 23 24

V A S C U L A R R I S K F A C T O R S , T A L K T O
25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47

Y O U R D O C T O R , A N D K E E P Y O U R B R A I N
4 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 4 63 64 65 66 33 67 68 69

L I V E L Y !
70 71 17 72 73 4

Dana.org



PUZZLE ANSWERS

ICESTAAO

A S S O C I A T E

XEARL

R E L A X

RENNECATCTO

C O N C E N T R A T E

COSFU

F O C U S

LSWONOWD

S L O W D O W N

NAOZIGRE

O R G A N I Z E

WITRE

W R I T E

PETREA

R E P E A T

IUZAVISLE

V I S U A L I Z E

“Why do reptiles have such good memories?”

“ B E C A U S E T H E Y H A V E
T U R T L E R E C A L L ”



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PUZZLE ANSWERS

We're Not in Kansas Anymore

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
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A N D M Y H E A D I ' D B E S C R A T C H I N G
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W H I L E M Y T H O U G H T S W E R E B U S Y
 14 19 12 25 13 7 9 1 19 2 10 18 19 1 5 14 13 6 13 15 10 5 9

H A T C H I N G I F I O N L Y H A D A B R A I N
 19 4 1 17 19 12 8 18 12 22 12 2 8 25 9 19 4 3 4 15 6 4 12 8

T H E S C A R E C R O W
 1 19 13 5 17 4 6 13 17 6 2 14

The Sci-Fi Brain

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
		7			10		9	22				8								1	20	19			

T H E H U M A N B R A I N , T H E N , I S T H E
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M O S T C O M P L I C A T E D O R G A N I Z A T I O N
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O F M A T T E R T H A T W E K N O W
 23 10 8 3 17 17 16 21 17 9 3 17 19 16 4 12 23 19

I S A A C A S I M O V
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