Cognitive Decline in Older Adults

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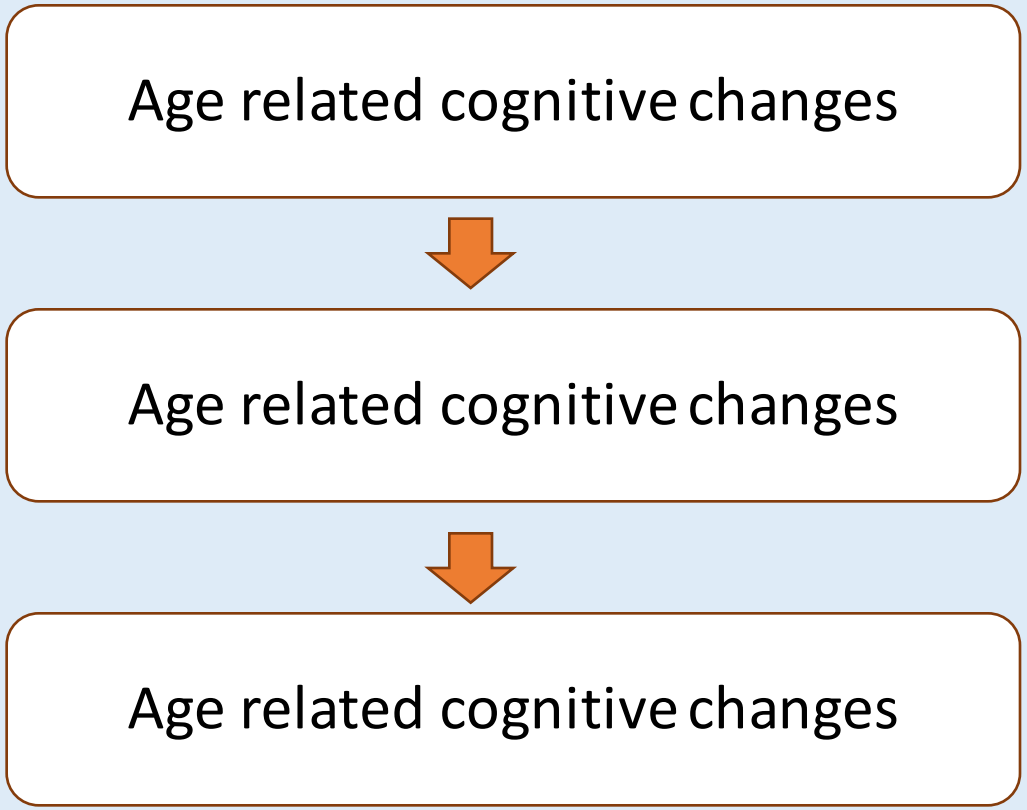
Learning objectives

After the class, the students would be able to explain the normal cognitive changes, cognitive reserve and how to preserve of normal cognition and prevention of cognitive disease in older adults.

Continuum of Cognitive Change



Not all elders follow this continuum

Pathological changes

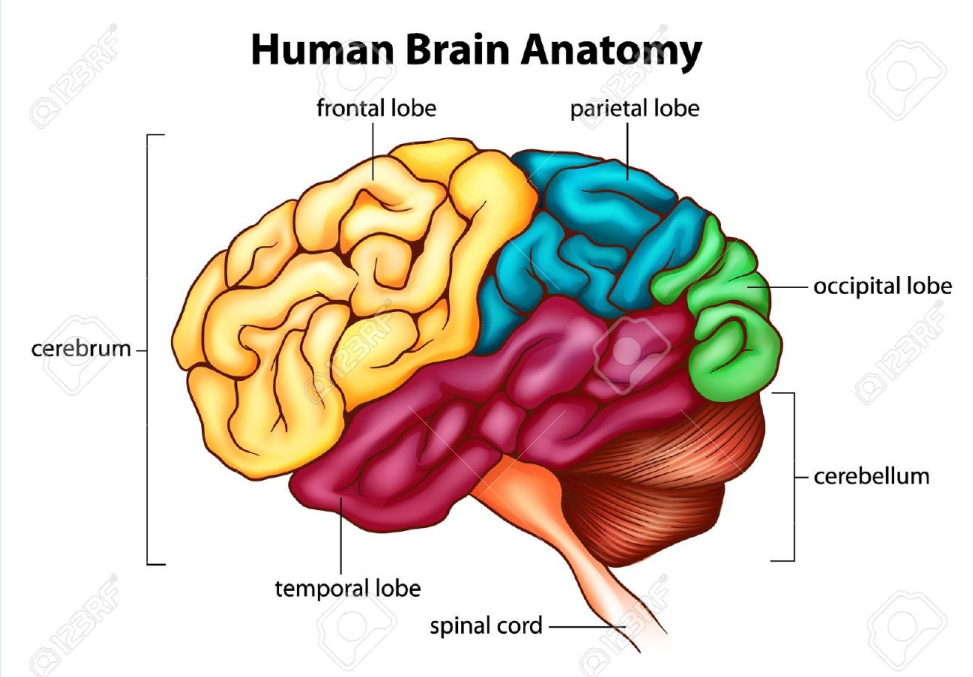
Normal Cognitive Aging

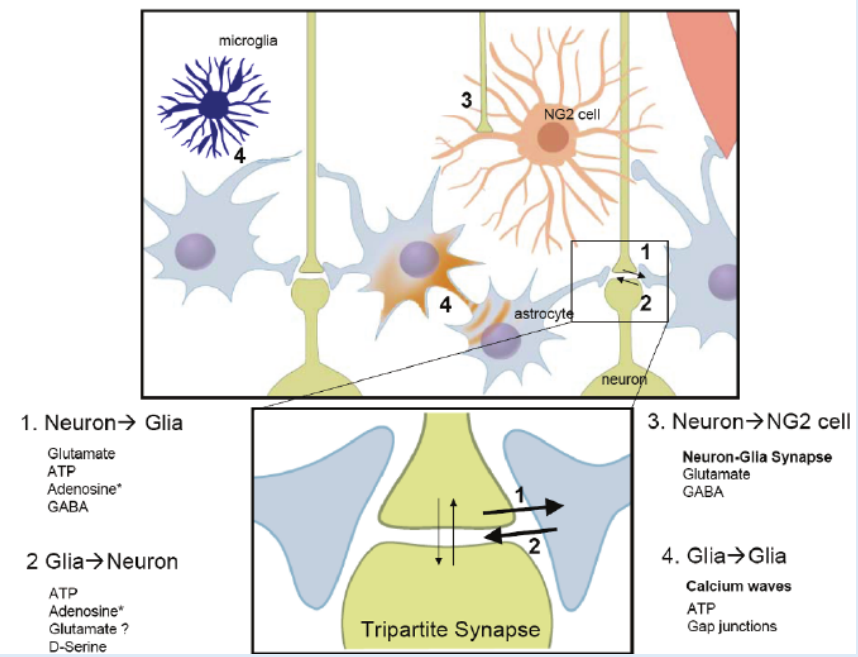
No clear line between a completely healthy brain and a diseased brain.

Cognitive changes becoming more noticeable after the age of 50 years.

Usually mild & affect

- Visual and verbal memory
- Visuospatial abilities
- Immediate memory
- Ability to name objects.





1400 g weigh
2 billions neurons with synaptic connections

Neurons cannot generate after birth
Synaptic connection can remodel throughout life

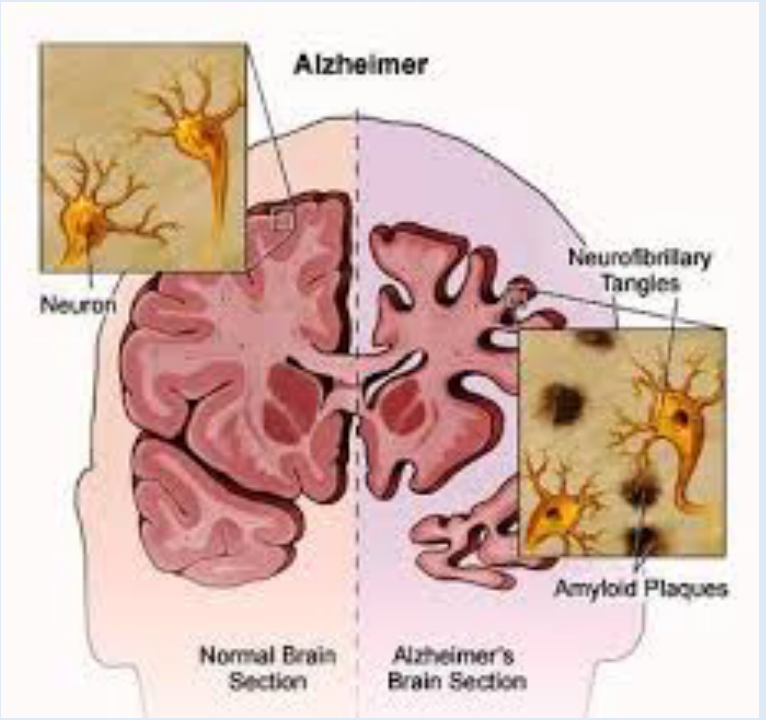
Synaptic connections -Crucial messaging exchange center between neurons

Pathologic loss of these synaptic connections is the basis of dementia.

Neurotrophins are important signaling molecules that regulate the synapse and lead to learning and memory.

Neuropathology can seen;

- ❖ In both healthy & cognitive impaired elders
- ❖ More extensive in individuals with dementia



Senile neuritic plaques are -no pathologic significance until the plaque matures and is filled with neurofibrillary tangles and other abnormal proteins

Nuropathology changes:

- Cortical atrophy
- Cell loss
- Senile neuritic plaques
  Neurofibrillary tangles

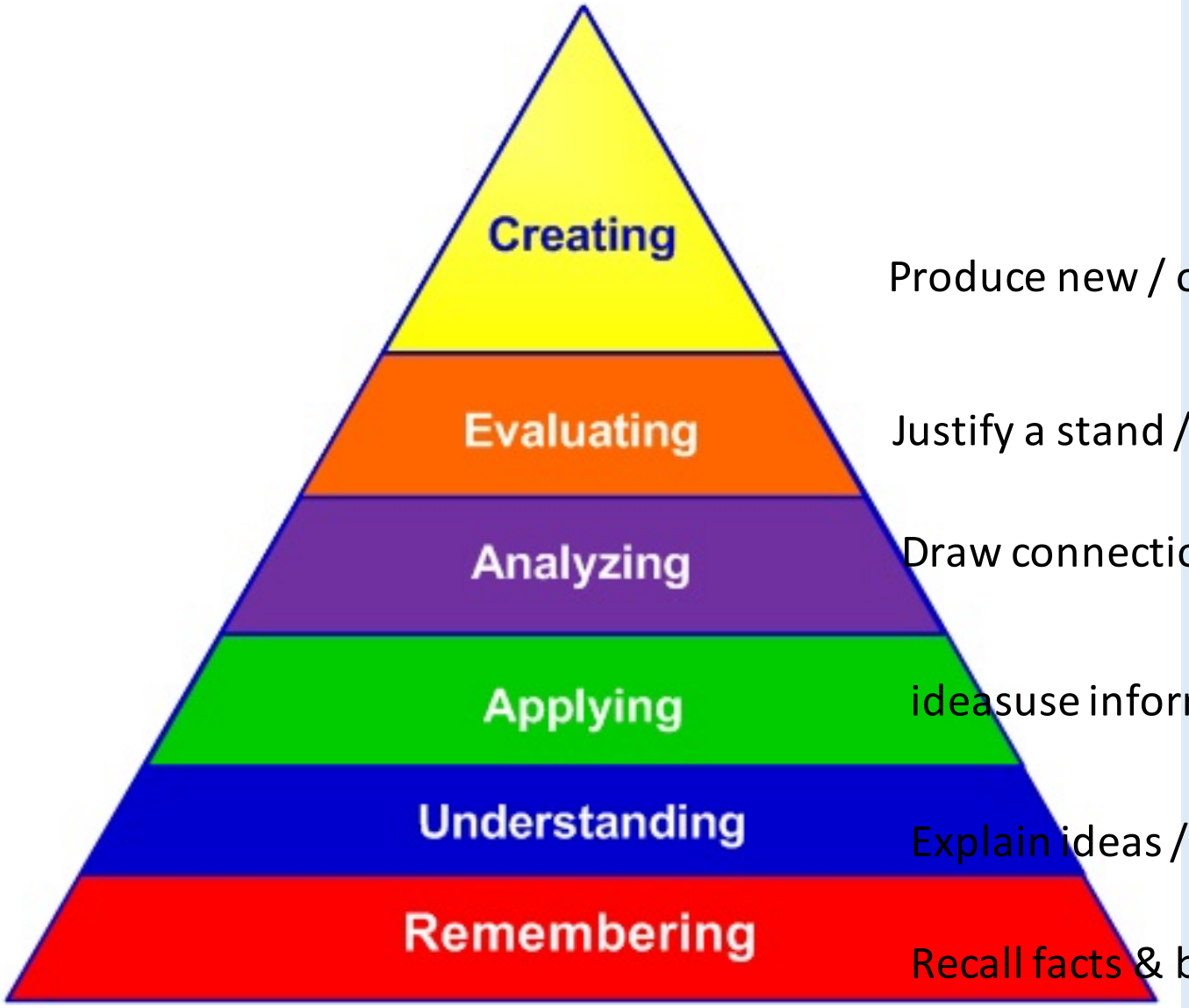
Normal Cognition

Cognitive abilities:

- ✓ Memory
- ✓ Language
- ✓ Perception
- ✓ Reasoning
- ✓ Perceptual speed
- ✓ Spatial manipulation
- ✓ Executive skills

These abilities collectively form the concept of intelligence.

Cognitive Domain



Produce new / original work

Justify a stand / decision

Draw connections among ideas

ideasuse information in new situations

Explain ideas / concepts

Recall facts & basic concepts

Anderson et al. 2001,Bloom B. (1956)

Intelligence

Fluid

- Increase childhood –adolescence
- Peak during adolescence
- Decline rapidly adulthood (affected by neurologic insult, genetics, and biological aging processes)

Crystalized

- Increase childhood –adolescence
- Continues to increase gradually throughout adulthood- 9th decade

Intelligence

Generally measured by IQ tests

Include expertise, creativity, & wisdom

Broadened view recognizes the importance of culture and acquired knowledge rather than only genetic intelligence

Although expertise, creativity, and wisdom can be found at any age when extensive experience with the hypothetical situation is present, wisdom is most frequently associated with age.

Executive Functioning (EF)

Complex behavior - (memory + intellectual capacity + cognitive planning)

Activities of executive functioning:

- Planning
- Active problem solving
- Working memory
- Anticipating possible consequences of an intended course of action
- Initiating an activity
- Inhibiting irrelevant behavior
- Being able to monitor the effectiveness of one's behavior

These behaviors are often at the core of rehabilitative effort

Working memory is the center of EF and incorporates complex attention, strategy formation, and interference control.

Cognitive decline

Mild in normal aging

Greater in neurologic disorders such as CVA or dementia

Characteristics of EF decline;

- Decrease in planning ability
- Decrease in working memory
- Decrease in inductive reasoning
- Decrease ability to modify and update working memory

The interesting aspect of EF is its relationship to motor function.

EF is an important factor for self-reported & observed performance of complex, independent ADLs (managing money & medications).

Intact EF serve as a fall prevention measure by minimizing behavior that jeopardizes safety despite motor or sensory impairment.

Executive dysfunction should trigger the therapist's awareness of the risk for falls.

Memory

- Memory loss is the most common cognitive component associated with aging.
- When the process of remembering is slowed but still intact, this is considered normal aging
- In healthy individuals, memory loss usually does not interfere with social or personal activities.

Four types of memory:

- Working memory
- Episodic memory
- Semantic memory
- Remote memory

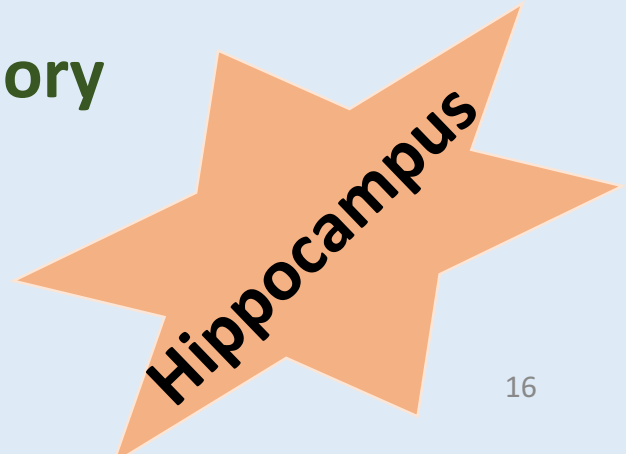
Working memory allows us to “hold on” to bits of information

Limited Working memory

Allowing to only hold onto a few bits of information at a time

To remember these bits of information

Information must be encoded into **Episodic memory**



Semantic memory

- strongly language-based and describes memory for facts and words.

Remote memory

- memory for remote or past events.

Semantic memory and remote memory can become independent of the hippocampus and thus may not always be impaired in pathologic cognitive dysfunction.

Other health issues can also affect memory;

- ❑ Medication side effects (vitamin B^{12} deficiency)
- ❑ Chronic alcoholism
- ❑ Brain tumors, infections, or blood clots
- ❑ Some thyroid, kidney, or liver disorders

} Lead to memory loss

Emotional problems

Stress, anxiety, or depression → more forgetful & mistaken for dementia

Personality

Personality types remain fairly stable throughout life.

Therefore, younger individuals who are characterized by an internal locus of control or who believe they have the ability to control the events in their lives will continue to react accordingly as they age.

Plasticity

Ability of the brain to change and keep itself vital.

When a person is challenged, either by environmental conditions or by activities, neurons form new dendritic branches creating more synapses that enhance the brain and provide better capacities to resist insults from neurologic conditions such as delirium and dementia.

When the mind is challenged, the brain responds positively, in physical and chemical ways, regardless of age.

Cognitive Reserve

Cognitive impairments become apparent only when cognitive or neurologic resources become depleted *beyond a certain threshold*

Low cognitive reserve

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Fewer resources to sustain normal & disease-related changes

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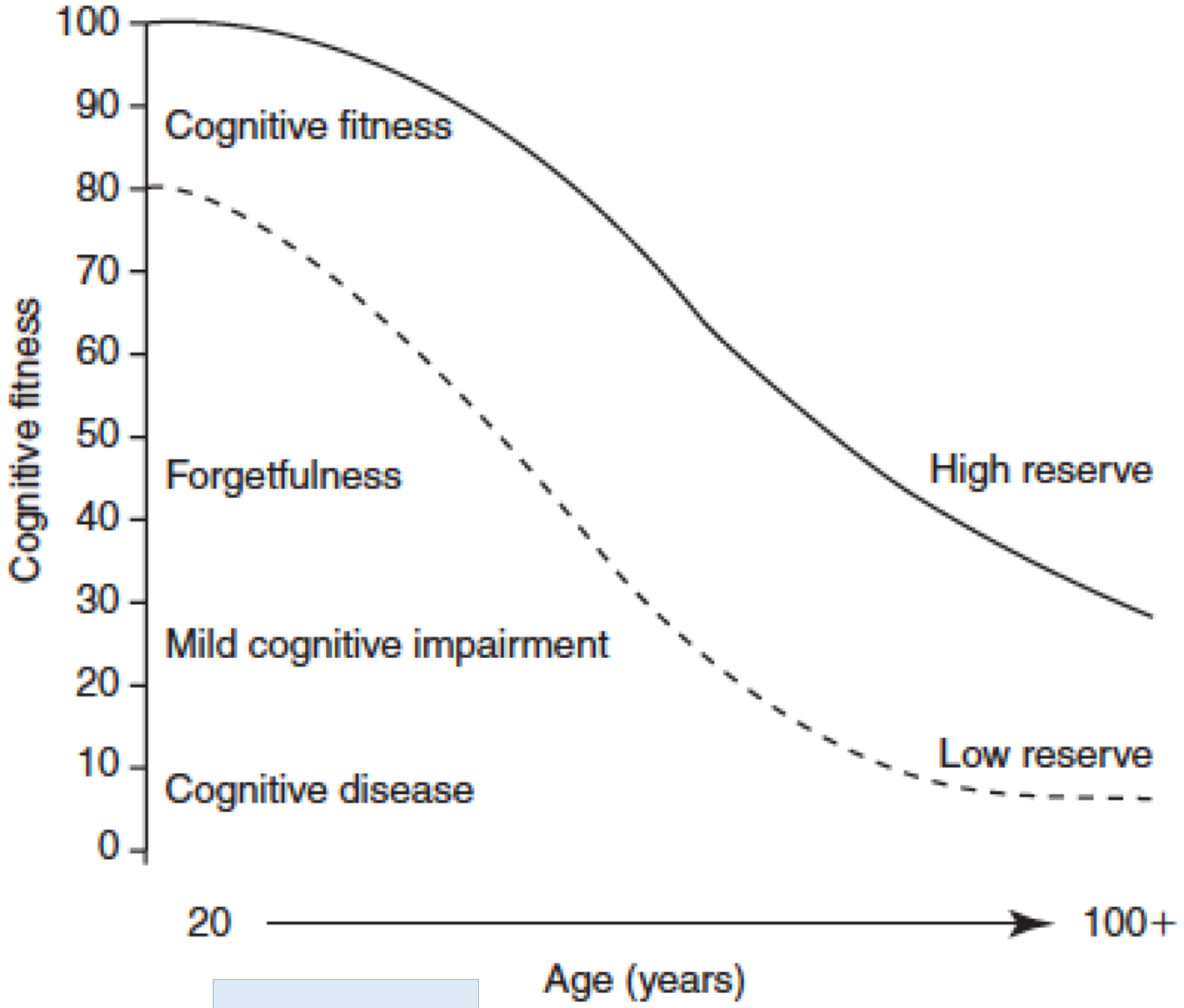
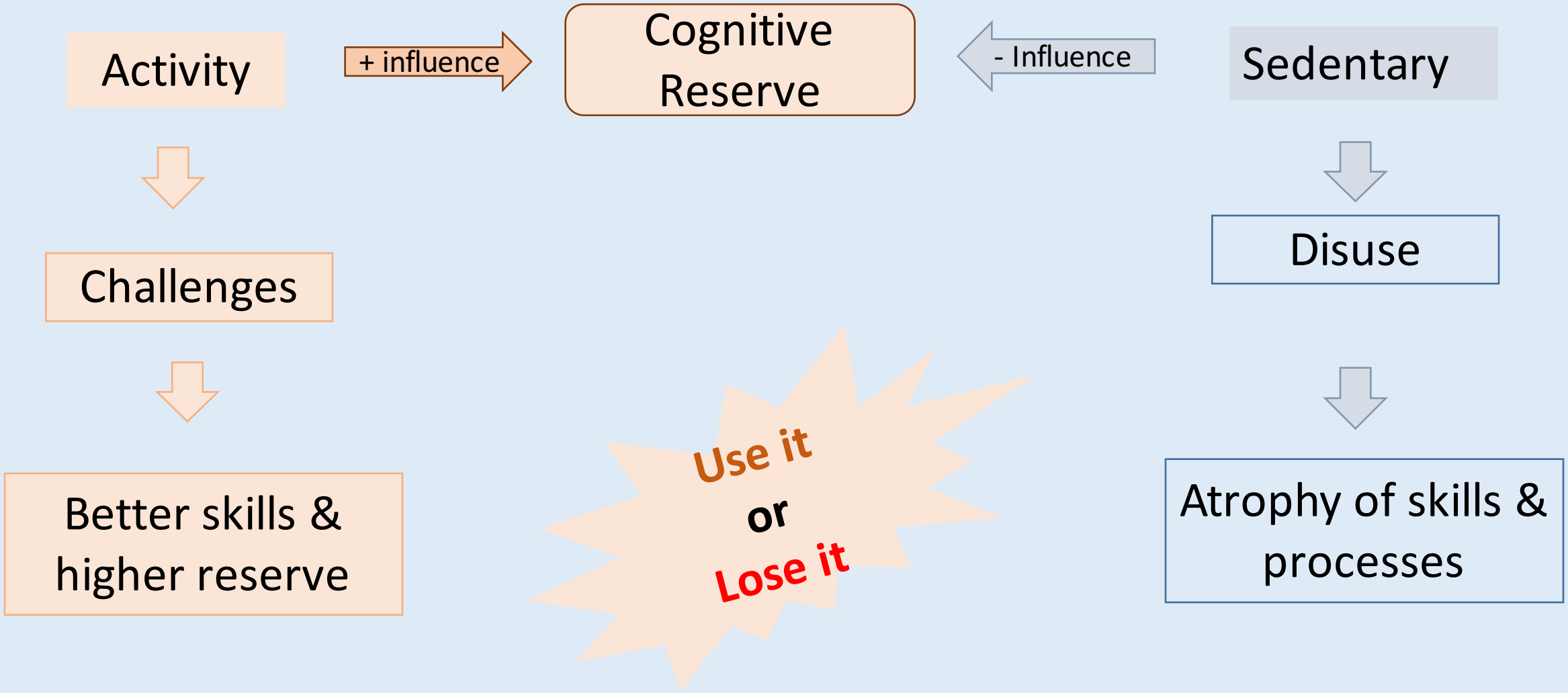
More likely to demonstrate clinical signs of cognitive disease



Slippery slope of cognition.

Influencing factors of cognitive reserve

- Genetics
- Learning
- Education
- Experience
- Stimulation
- Social engagement, etc.


Activity
+ influence
Cognitive Reserve
- Influence
Sedentary
Challenges
Disuse
Better skills & higher reserve
Use it
or
Lose it
Atrophy of skills & processes

Factors contribute to higher cognitive reserve

- ✓ Physically & Cognitively active
- ✓ Less stress & peaceful minded
- ✓ High education level
- ✓ Higher Income
- ✓ Lifelong learning
- ✓ Can speak ≥2 languages fluently (excluding native language)
- ✓ Increased daily social & intellectual activity hours
- ✓ Being female

Preservation of Normal Cognition and Prevention of Cognitive Disease

The more engaged cognitive & mentally stimulated, the less likely cognitive decline.

- Plaques and tangles associated with AD *occur over many years*, prior to any indication of cognitive decline.
- Intervention of cognitive stimulation prior to disease may delay the onset of significant symptoms.
- Cognitive disease, chronic diseases, is not curable but is modifiable at some point in the continuum of the disease.

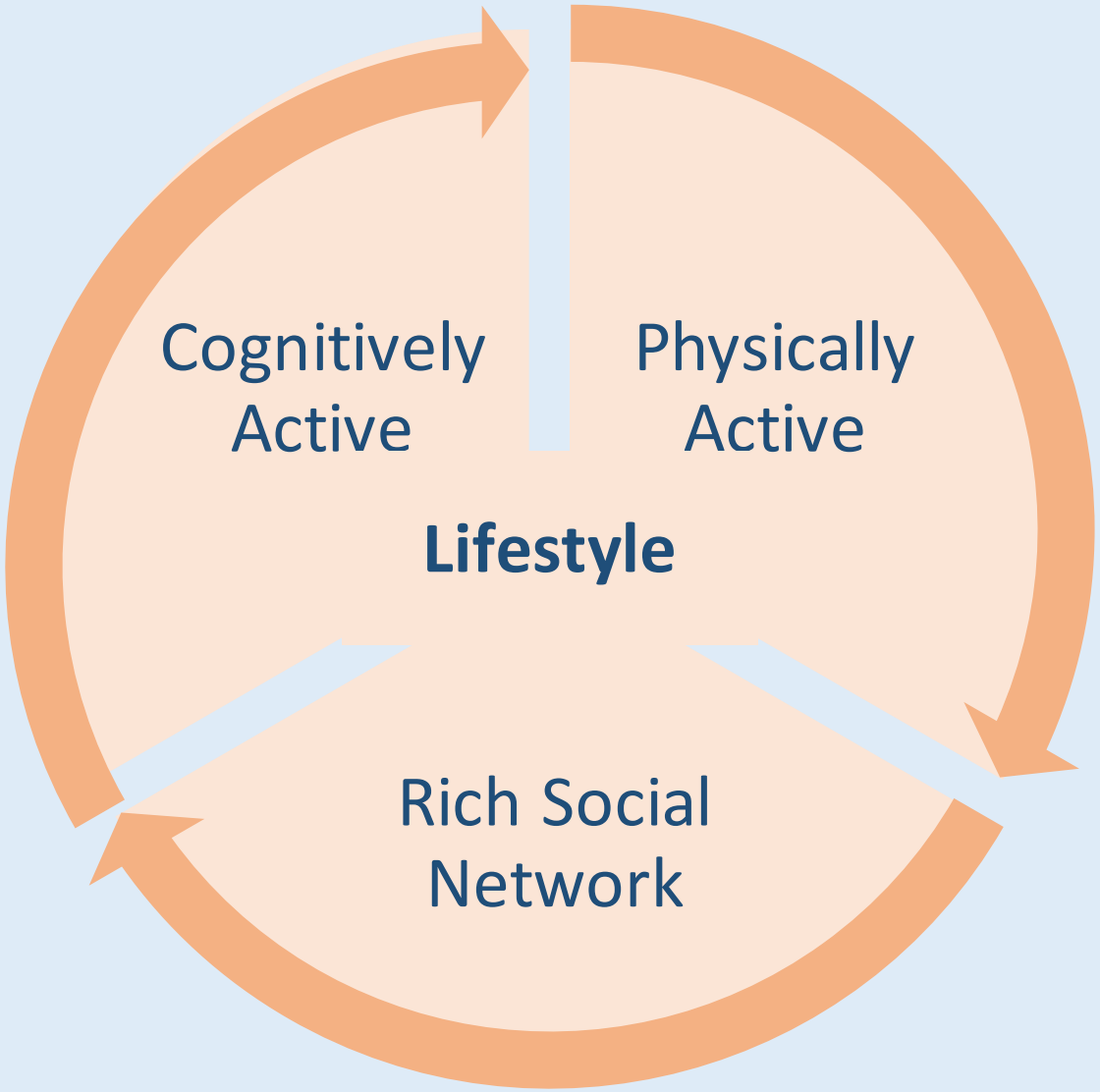
★ *Cognitively inactive lifestyles had the greatest risk for developing AD.*

★ *Physically active lifestyle s generally regarded as an important in the prevention of cognitive decline.*

Physical Exercises

✓ **I**mproved cerebral blood flow in the dentate gyrus and also enhance performance on memory tasks.

✓ Alter brain chemistries and favor neural stem cell proliferation, survival, & maturation.



Best Cognitive Function in later age

Recommendations for a Cognitively Active Lifestyle

Recommendation	Rationale
Be physically active.	**Regular *activity***, not necessarily planned exercise, seems to relate to brain fitness. Activities like gardening, dancing, and even cleaning, among others, could increase and maintain brain health
Make time for cognitively stimulating activities that have always been enjoyed.	Continuing favorite activities can ensure sustainability of cognitive stimulation. Long-term exposure to cognitive stimulation may be needed for practical functional benefits.

Recommendation	Rationale
Add some new cognitive challenges, as time and enjoyment permit.	**Trying new activities** may enhance brain plasticity by requiring new learning or development of new cognitive strategies. **Calculate**. Perform word-search games and crossword puzzles. Attend lectures, concerts, and museums. May benefit from performing mental gymnastics and mind challenges.
Aim to engage in cognitively stimulating activities several times/week or more; generate some mental sweat.	Current knowledge does not permit a prescription for how often or how long individuals should engage in cognitively stimulating activities. However, epidemiologic studies suggest that more is better, within clinically reasonable limits.

Recommendation	Rationale
Be aware that there is no one cognitive activity or combination of activities that is uniquely good for decreasing AD risk.	Many different kinds of cognitively stimulating activities have been associated with preserved cognitive skill.
Social interactions can be a great way to stimulate the mind.	Group training of cognitive skills has been shown to be effective in sharpening specific cognitive skills, and broader social networks have been associated with reduced AD risk.

Summary

Although neuroanatomic changes are present in nearly all aging brains, the degree in which they occur and subsequently affect cognition is quite variable, representing the continuum of normal cognition to disease.

Some mild memory loss and cognitive slowing is expected with age, but no functional loss should be apparent.

References

1. *Avers, D and Williams, A.K. (2012)* Cognition in the aging adult. In *Geriatric physical therapy,* ed. AA Guccione, RA Wong and D Avers; p. 121-152. Elsevier.
2. Anderson, L.W., Krathwohl, D.R., Airasian, P.W., Cruikshank, K.A., Richard, M., Pintrinch, P.R. and Wittrock, M.C. (2001) A Taxonomy for leraning, teaching, and assessing: A revision of Blooms Taxonomy of Educational Objectives.