Wisdom and Wit:
Intellectual Abilities of Older Adults

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Outline

I. Wisdom and Wit
II. Normal Aging and Cognitive Change – The “Game”
III. Neurological Structure and Function – “Chemistry” (Biology and Physics, too)
IV. Cognitive Structure and Function – “Psychology”
V. Cognitive Reserve – A Work Around
VI. Improving Intellectual Competence – “What’s Happening all over?”

Wit and Wisdom

Dromio: "There's no time for a man to recover his hair that grows baldly by nature. … it is a blessing that he [Time] bestows on beasts, and what he hath scanted men in hair, he that given them in wit.

Antipholus: Why, but there's many a man hath more hair than wit.

Dromio: Not a man of those but he hath the wit to lose his hair.

(Shakespeare, A Comedy of Errors, Act 2, Scene 2)

As we age …

More knowledge (wisdom), less ability to use it (wit)

An increase in experience, knowledge, and perspective,

but a decrease in attention and speed using these **resources**.

True, but these deficits do not **necessarily** affect everyday life of older adults

Chronological age **alone** does not explain intellectual competence

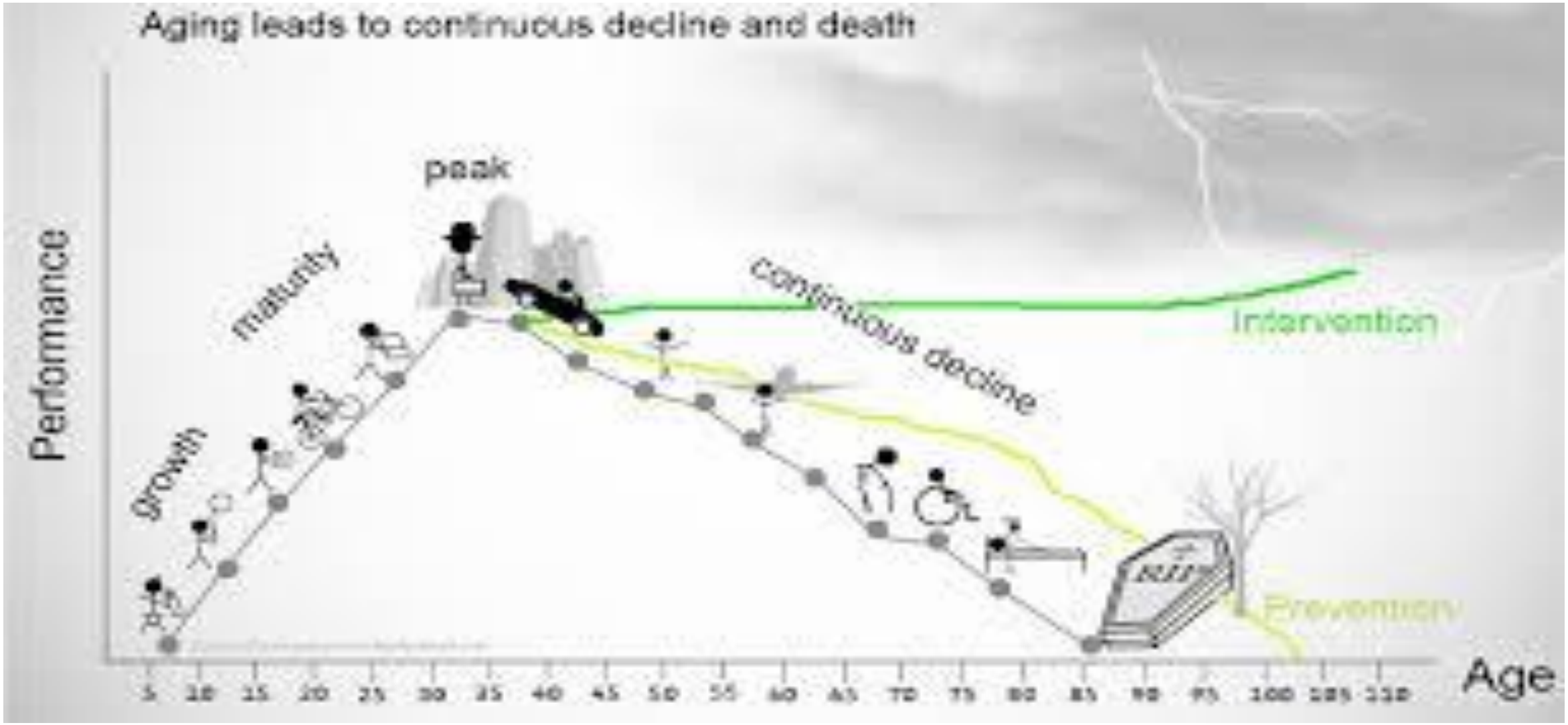
Our focus …

Factors affecting the **normal** changes in intellectual competence as we get older, particularly after we leave our occupations and responsibilities of mid life …

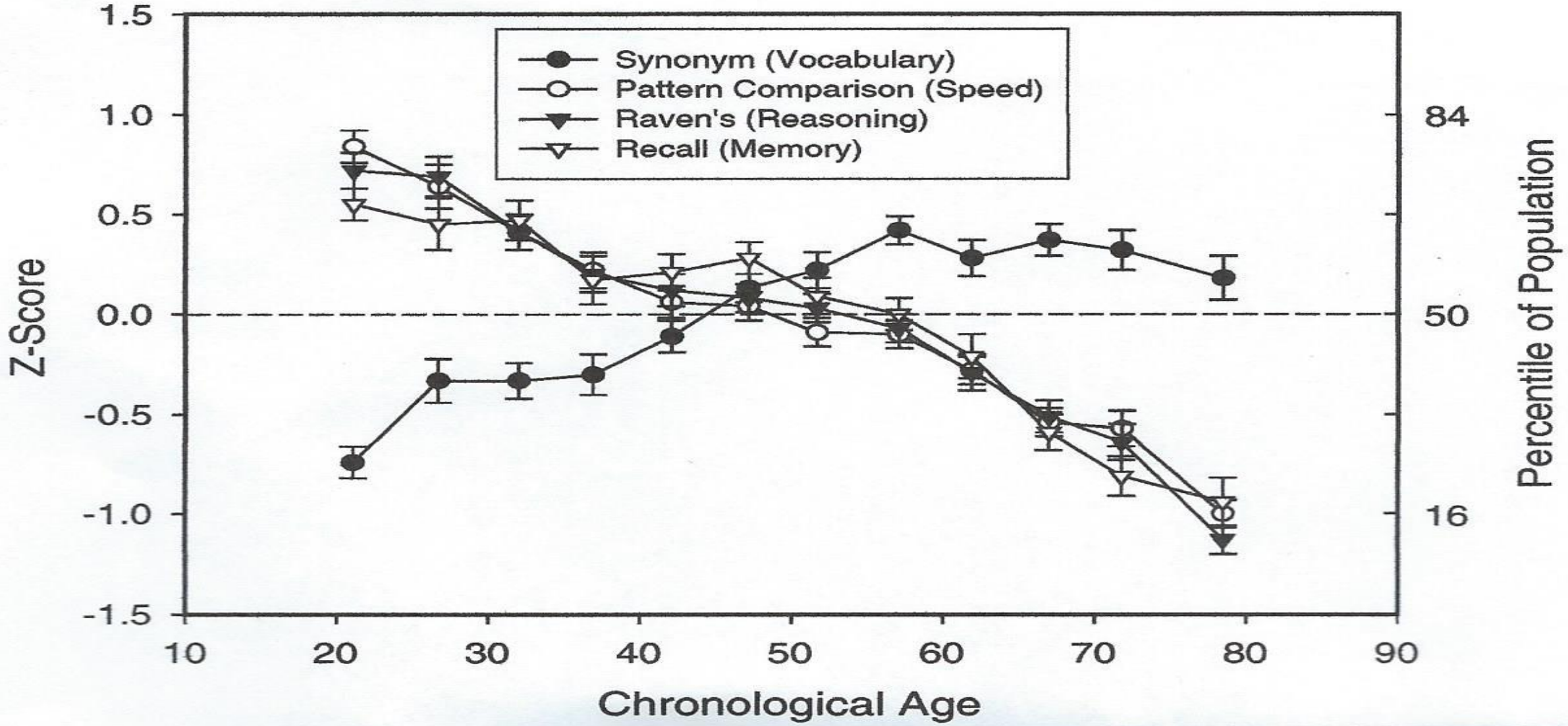
… and how the **abilities** to learn and use our learnings, past and present can be maintained and even improved in through out our lives.

Normal Aging and Cognitive Change

Senescence – the inevitability of aging



Classical Aging Curve – Wisdom preserved, wit declines



As we age …

More **distractible** – the ability to concentrate despite what's going on

- Sustained attention
- Dividing attention and switching between sounds
- Filtering out irrelevant information

More **confused** – the ability to hold information in memory for a brief time to perform a task.

- Sustained attention
- Filtering out irrelevant information
- Visuospatial tasks, e.g. three-dimensional drawing and construction

More **forgetful** – the ability to recall details, such as names, locations, and episodes.

- Unaided recall, less so for recognition
- Word finding,, naming, and rapid listing of words
- Cognitive flexibility, ability to integrate unfamiliar information and novel strategies, though comprehension not affected

More **slow** – the ability to perceive, think, and act quickly

- Information processing speed, sensory input and motor responses that affect cognitive function and performance

More **resourceful** – the ability to use sounds, words, and concepts and principles and strategies learned from experience.

- Vocabulary and narrative style often increases

Concomitant Changes With Age

Decrease **sensory acuity**, for all senses

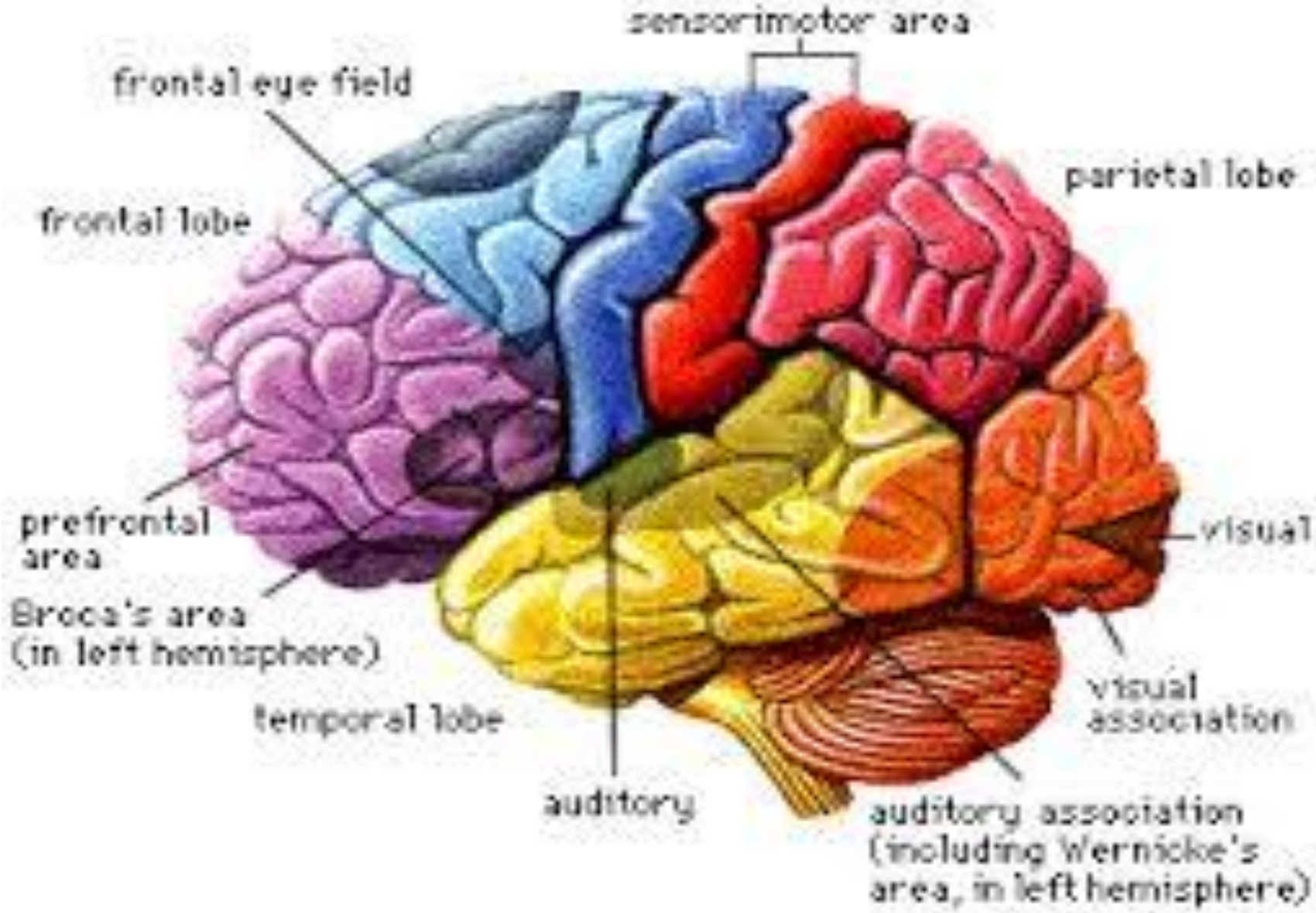
Life style changes, such as more fragmented (REM) sleep

Physical disabilities, including a general decline in strength and flexibility

Decreased task **engagement**, **risk taking**, and **goal orientation**. More convention, cautious, and routine bound approach to tasks. Decreased flexibility and tolerance for change

Neurological Structure and Function

… the hardware


sensorimotor area
frontal eye field
parietal lobe
frontal lobe
prefrontal area
visual
Broca's area (in left hemisphere)
visual association
temporal lobe
auditory
auditory association (including Wernicke's area, in left hemisphere)

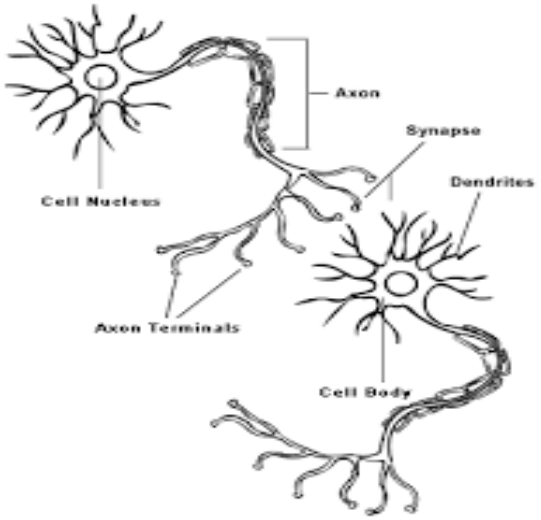
Frontal Lobe Hypothesis of Aging

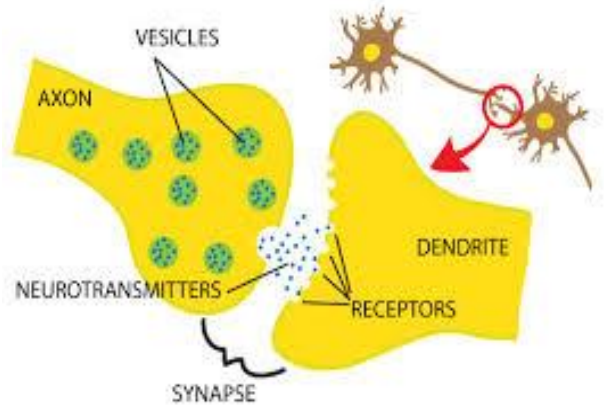
Normal aging affects some brain areas more than others. Hippocampus, temporal regions, and prefrontal cortex affect memory and executive functions.

Prefrontal cortex, in particular, has broad influence via reciprocal connection with other regions.

Decline in brain size with aging, and loose correlation between brain size and “intelligence”

Neurological Structure and Function





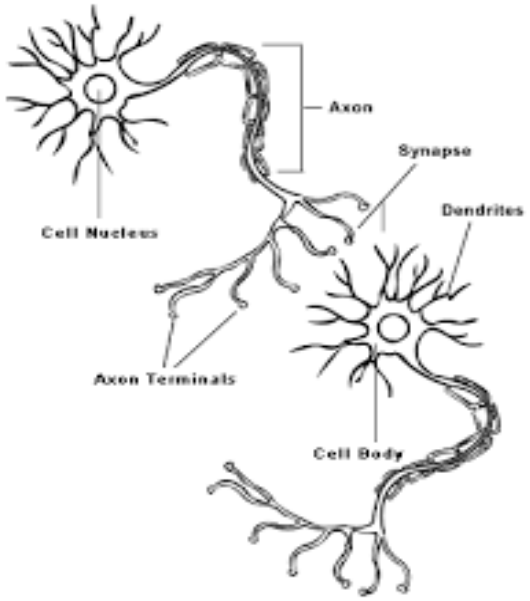
Neurological and mitochondrial membrane **deterioration** or **chemical changes** in the neuron and/or the connections between neurons affects neurotransmission

Decline or loss of neurons and synapses, the “shrinking brain,” caused by either a **loss of neurons** or a **degradation of the neurons and their connectors.**

Peaks in the teens or twenties, then declines gradually, two-percent every two years, but does not accelerate in old age.

The key is the integrity of the connections between neurons and the condition of the cell bodies,

Neurological Structure and Function



Wit must grow like fingers – John Selden

Cognitive Structure and Function
… the software

Intellectual Processes

Perception and Attention

Memory

Higher Level Cognitive Functions

Cognitive Structure and Function

Intellectual Processes

- Perception and Attention
- Memory and Executive Functions
- Reasoning

- Speed
- Resources

- Motivation

Perception

Reduced in older adults, due to senescence, but can be reduced or compensated. Once corrected, differences diminish.

Attention

Significant decline in tasks requiring the dividing or switching of attention between stimuli or tasks, particularly when demands are high or asked to vary task priority.

Not attention “deficit” but slower processing in situations that require faster processing. And maybe not “speed” but processing **resources** insufficient to the task.

Flexible control of attention can be improved by training, making task more automatic and reducing processing resources … and possibly simply by improving cardiovascular fitness, thus improving efficiency of neural processes and metabolic resources.

Working Memory (Short-term Memory)

Limited capacity **system** involving maintenance and manipulation of information in attention for short periods of time

Maintenance of information (7+/- bits) requires simple rehearsal, and shows minimal or no deficits with age.

Active reorganization or manipulation of information (e.g., repeating numbers backwards), requires executive control of how information is encoded, stored, and retrieved. This ability declines with age if not practiced.

Three theories … insufficient attention resources (as tasks demand more manipulation over long periods of time), reduced speed of manipulation (thus, requiring more resources), or failure of attention control (thus, crowding out needed information from the “work” space).

Long-term Memory (Storage Memory)

Information no longer present or being maintained in an active state

Aging affects episodic memory for specific events or experience in the past. Older memories (the things we "know") become more semantic, retaining the core but not the details. Remembering context or source (or whether something really happened or was simply thought about) becomes more difficult.

Executive deficits … encoding, storage, and retrieval … requiring attentional resources or external aids.

Saliency or emotionality affects effort put into encoding and storage and maybe retrieval. Though excess emotion or stress can reduce recall.

Task Characteristics and Demands

- Saliency and emotionality of information affects effort put into encoding, storage, and retrieval.
- Physical and mental context of the information to be memorized, e.g. sleep, fatigue, anxiety, stress, illness, and disability.
- Alertness, relevance of information, novelty and relationship of information to existing organization and detail of information in memory.

Long-term Memory

Episodic (Personal Knowledge)

Personally experience events or a particular place and time (and maybe other features such as emotion). Allows “thinking back.”

Most advanced form of memory, came later in human evolution, and likely distinctly human.

Peaks in mid-teens or 20’s

Most effected by injury, disease, and aging.

Changes with age, must actively recall information and be aware of it, required efficient encoding, storage, and recall.

Long-term Memory

Semantic (General Knowledge)

Store of general knowledge not tied to time and place of learning

No general decline with age, organization does not change (without re-learning), though maybe become more difficult to retrieve. Can continue to grow and become more complex.

Might get in the way of working memory, as familiar gets in the way of processing the new and unfamiliar.

Long-term Memory

Procedural (Skills and Procedures)

Acquired more slowly, through practice, but then persists, “automatically,” and usually not able to describe how to do it or how learned

Fewer changes with age, because recall is implicit and does not require awareness

Long-term Memory

Autobiographical

Memories of personal past, engaging episodic and semantic memories

Specific episodes might decline, except highly emotional episodes, but semantics (gist) remain stable. Recent episodes are easiest at all ages, except between 15 and 25, the “reminiscence bump,” due to saliency or emotionality of episodes.

Long-term Memory

Prospective (vs. Retrospective)

Remembering to do things in the future.

Engages episodic and semantic (and maybe procedural memories.

Older do well, except where tasks may high demands on attention and on encoding, storage, and retrieval.

Responds to memory aids, such as salient reminders or cues in the environment, though self-initiation might be more difficult for older aduts

Fluid and Crystallized Intelligence

Fluid Intelligence (Wit)

Attention and working memory, not based on experience

Peaks in 20's, though some features can improve with age

Change explained by genetic and neurological structure and function, though improved through training that requires increasing reaction time, switching mental gears and processing information in new ways

Crystallized Intelligence (Wisdom)

Acquired through education and experience, affected by personality, motivation, opportunities, and culture

Verbal ability (vocabulary); inductive reasoning (particularly related to people, emotion and ethical issues); problem-solving, decision-making and judgment.

Stable through the life-span.

Many “intelligences” – *Thank the Lord!*

Different tasks require different kinds of intelligence

Primary Mental Abilities (Thurstone) IQ

Perceptual Speed (F) Associative Memory (F), Spatial Reasoning (F), Numerical Ability (F), Verbal Fluency (C), Verbal Comprehension (C), Inductive Reasoning (C)

Age affects different kinds of intelligence differently

Deficit in one kind of intelligence might be compensated by another

Cognitive Structure and Function

Higher Level Cognitive Functions

Speech and Language

Largely in tact, but can be slower. Deficits occur under difficult processing conditions due to sensory loss or working memory limitations

Vocabulary more extensive with age, depending on education and continued learning, though word-finding might show aging affect

Comprehension stable, except as affected by senory, attention, and executive deficits, though can be compensated, particularly if task is important and motivating.

Discourse skills can increase, narratives well structured, elaborate, and interesting … unless heard over again!

Higher Level Cognitive Functions

Decision-making (Problem-solving, judgment, and planning

- Affected by attention and working memory (executive controls) and long-term memory
- And relevance, prior knowledge, motivation, emotional investment
- Decision-making makes processing demands, but is reduced by relevant knowledge and experience in the domain.
- Age differences in decision making, older adults rely on prior knowledge and less on new information, while younger persons sample and evaluate more current information and consider more alternatives.

Cognitive Reserve

Late 90's study of persons with post-mortem evidence of Alzheimer's Disease but who had shown few symptoms prior to their death. Those with the fewest symptoms had greater brain weight and more neurons. Thus, these persons had greater brain weight to begin with or somehow avoided a loss of neurons, despite having brain disease. This capacity has been called "cognitive reserve."

Subsequent studies suggest that the brain maintains a plasticity and compensates for structures and functions that have deteriorated through injury or disease.

Cognitive Reserve

Interest then focused on the mechanisms responsible for this maintenance of intellectual abilities and for the factors that support it.

Mechanisms include **neural efficiency**, **neural capacity**, and **use of other brain regions,** from imaging studies, and executive functions, from behavioral studies. Tasks performed effectively, though more slowly.

Factors including education (**childhood cognition** and **educational attainment**) and **occupation** contribute to cognitive reserve. CR established earl, and though dynamic, is relatively stable until near the end of life. **Activities that engage cognitive processes**, including **physical activity**, and **social relationships** that mitigate stress also contribute to CR.

Cognitive Reserve

The upside … Persons with significant CR, who have led mentally stimulating lives, through education, occupation, and/or leisure activities have 35-40% less risk Alheimer's disease **symptoms.** For each additional activity, add eight percent.

The downside … The greater the CR, the higher the threshold for symptoms of AD, the faster the decline when symptoms commence, due to eventual failure of compensatory mechanisms. CR does not protect from AD, the disease. CR "masks" or helps avoid the symptoms.

As with cognitive deficits of any cause, normal aging or disease or injury, the manifestations and effects in one's life, impairments of social functions and independent living are the real issues.

Improving Intellectual Competence

Education

Some evidence that is slows intellectual decline by a decade – a new twist on the cost/benefit of a college education

Learning

New tasks, information, and strategies, complicated enough to engage executive processes, but not so demanding that they add stress

Health

Same verse, different tune … optimal BMI, hypertension, and cardiovascular function maintain and improve intellectual performance, as does good mental health

Improving Intellectual Competence

Diet and Lifestyle

Eat a diet of proteins, vegetables, and moderate alcohol – a "Mediterranean" diet. B-vitamins, antioxidants, and omega-3 won't hurt.

Exercise

Moderate to vigorous, weekly, increases brain volume, muscle flexibility, strength, and mood, through increased oxygen, blood flow and vessel growth, and chemical production important in neurotransmission.

Sociability

Actively seek challenge **and** support.

Improving Intellectual Competence

Technology

Use technical aids and strategies to mitigate sensory lossand difficulties in executive control

Tasks

Consider motivation, persistence, personality, and other not-age related factors are equally, if not more, important. Intellectual abilities are not the only factors in intellectual performance.

Consider the difficulty of tasks. We tend to choose tasks that reduce physical and cognitive demands, that is, we are “lazy.”. Adapt to age-related changes by altering the nature and pattern of activities.

Use your strengths, greater experience and knowledge, sometimes taking the “easier,” yet successful approach to intellectual and life challenges.

“Wit without wisdom is like a song without sense;
it does not please long”

Josh Billings