NEUROPSYCHOLOGY AND COGNITIVE DISORDERS

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OUTLINE

I. What is Neuropsychology?

II. Cognitive Disorders and Neurobehavioral Syndromes

III. Normal Aging

IV. Neuropsychology Cases: DI, LTC, and Underwriting

I. CLINICAL NEUROPSYCHOLOGY

Neuropsychology:

The study of brain behavior relationships

Clinical Neuropsychology:

Administration of psychological tests to assess cognitive functioning in order to aid in differential diagnosis and treatment planning

I. CLINICAL NEUROPSYCHOLOGY

Cognitive Testing is conducted on patients with brain impairment due to:

Neurological Diseases:

Neurodegenerative disorders (Parkinson's, Alzheimer's, Lewy Body)

Multiple sclerosis, Epilepsy, Encephalitis, (e.g., Moya moya, Sturge Weber, genetic conditions like Huntington's disease, adrenoleukodstrophy)

Developmental Disorders:

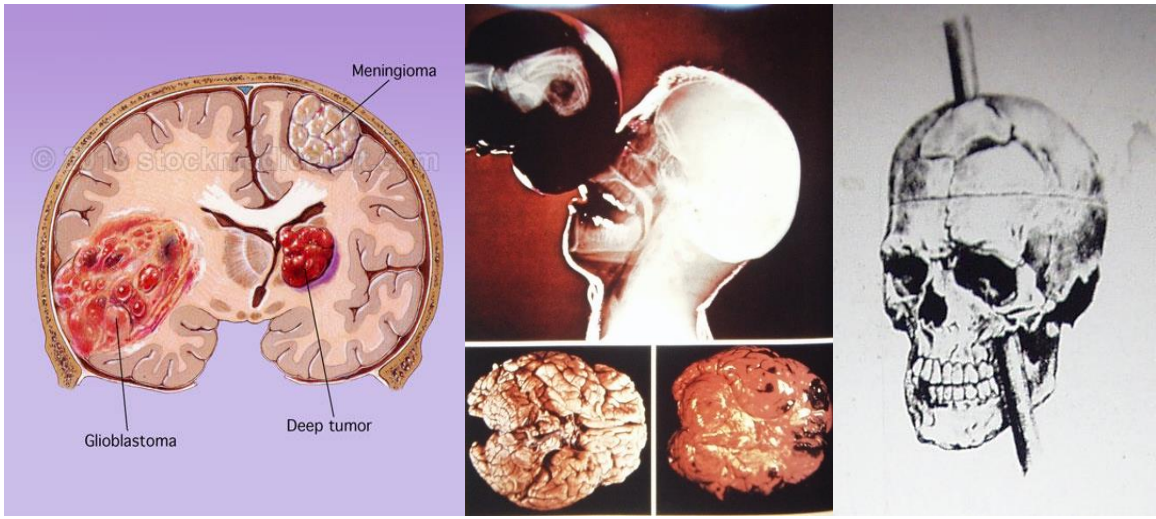
Intellectual Disability, ADHD, Learning Disabilities

Acquired Injuries:

Traumatic Brain Injuries, Strokes,

Brain tumors, penetrating

brain injuries



COGNITIVE DOMAINS TESTED

- Intelligence
- Memory
- Language
- Visual spatial
- Achievement
- Executive
- Sensory Perceptual
- Motor
- Personality
- Effort

INTELLIGENCE

Vocabulary

Bed

Tirade

Fund of Information

Where does the sun rise?

Who was president during the civil war?

What is the Koran?

Verbal Abstraction

How are a table and a chair alike?

How are air and water alike?

INTELLIGENCE

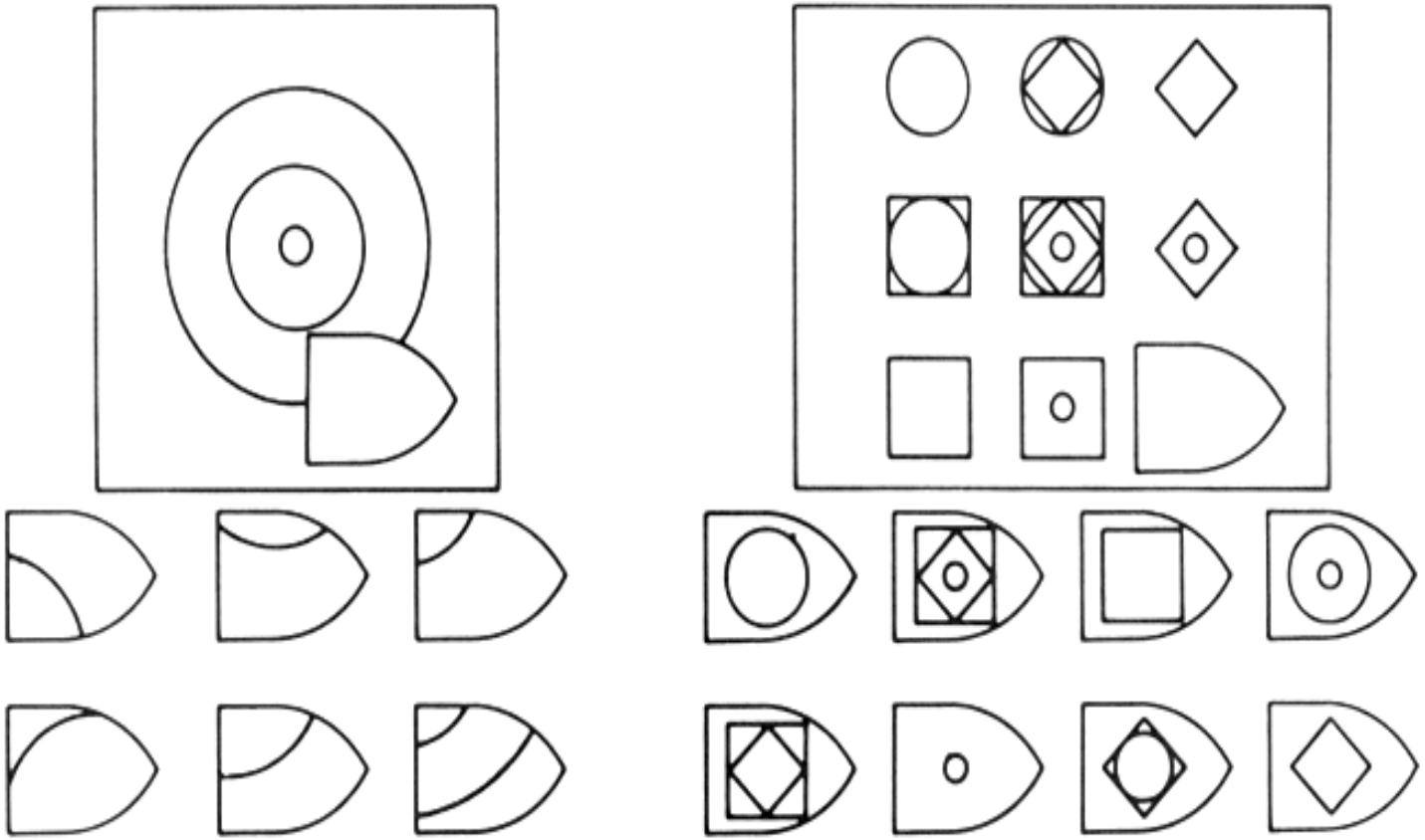
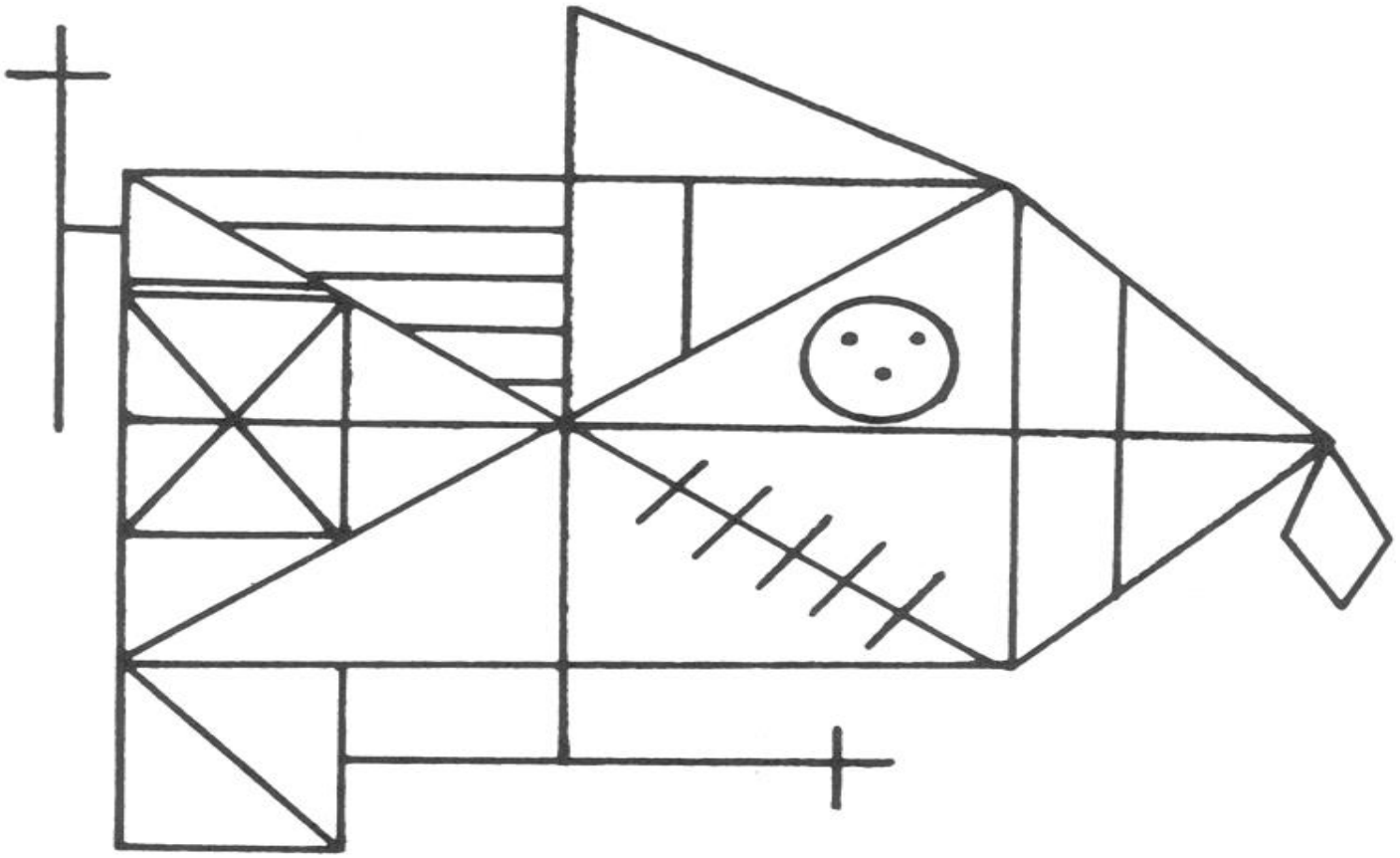


Fig. 15–3 Examples at two levels of difficulty of Progressive Matrices type items.

MEMORY



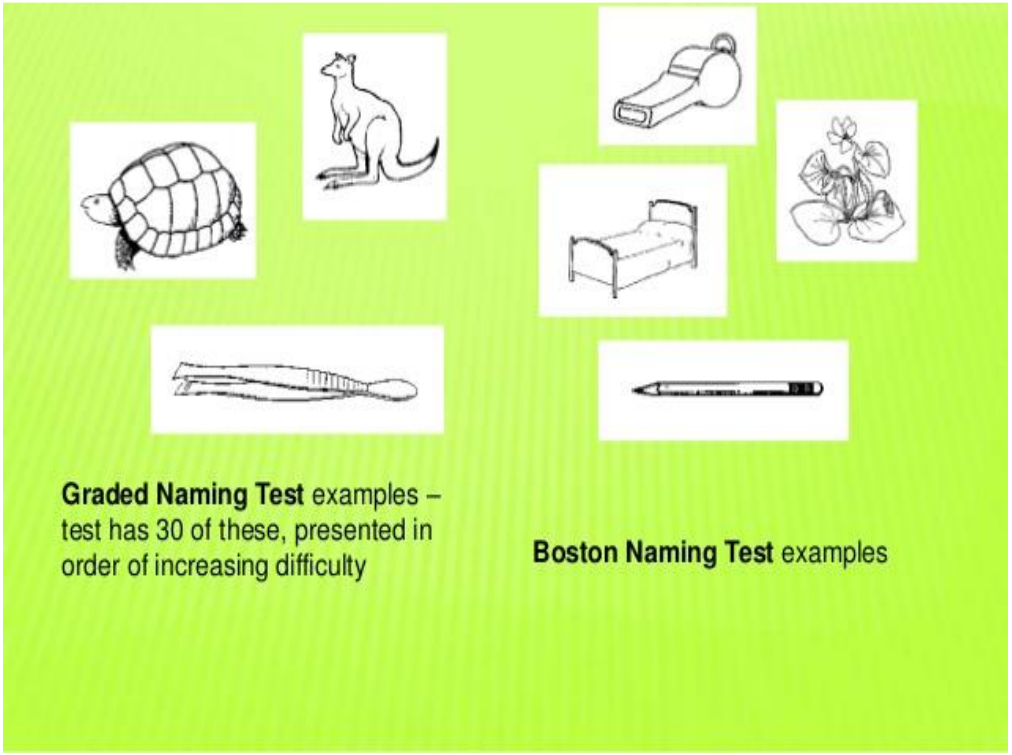
LANGUAGE

Naming

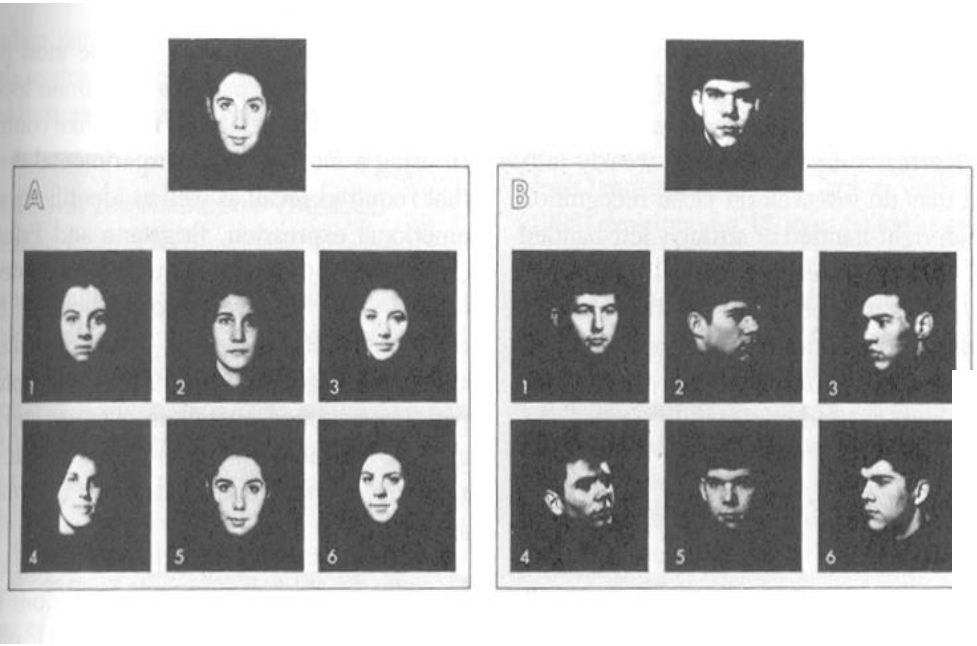
Comprehension

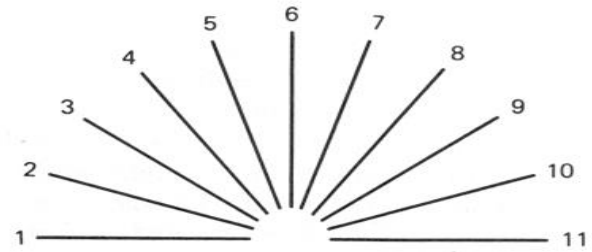
Repetition

Reading



VISUAL SPATIAL SKILLS





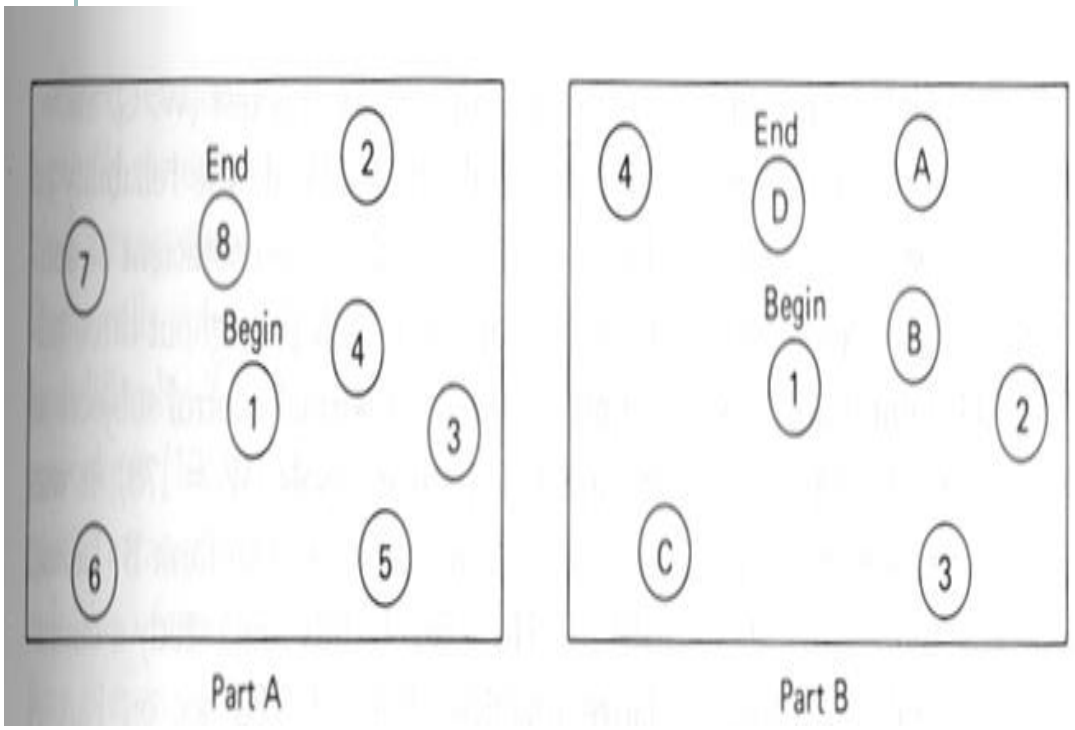
ACADEMIC ACHIEVEMENT

Reading (speed, accuracy, comprehension)

Arithmetic

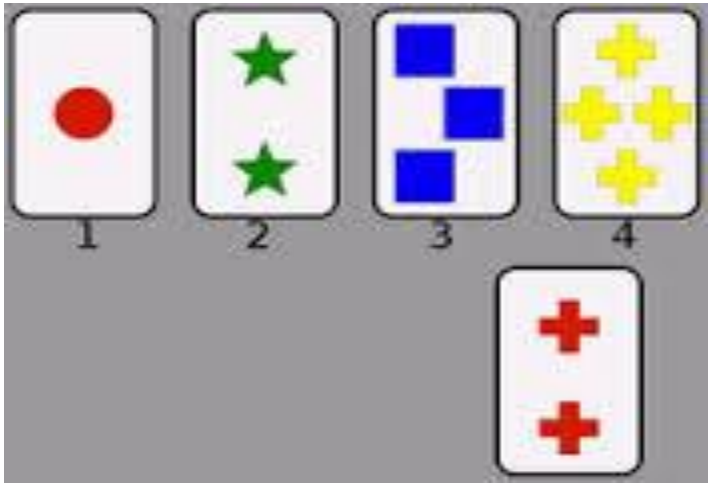
Spelling

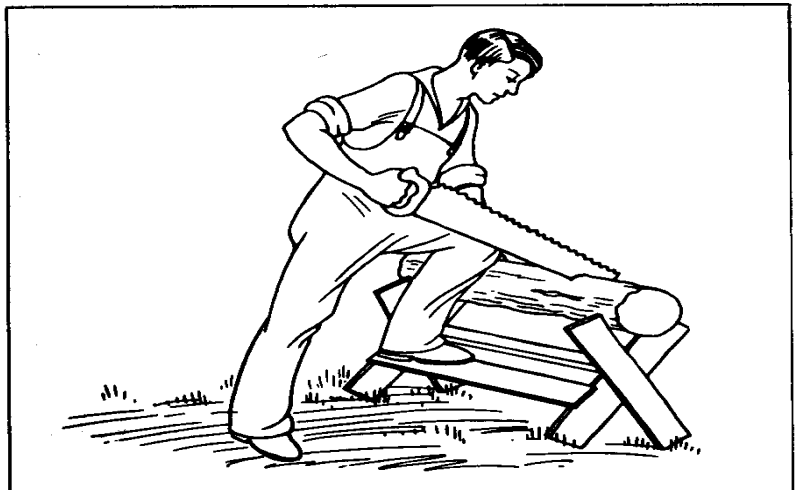
EXECUTIVE FUNCTIONS



Attention
Awareness
Reasoning
Mental Flexibility
Judgment
Self regulation

JUDGMENT/REASONING





MOTOR AND PROCESSING SPEED

1	2	3	4	5	6	7	8	9
#	+	X	=	^	*	%	>	@

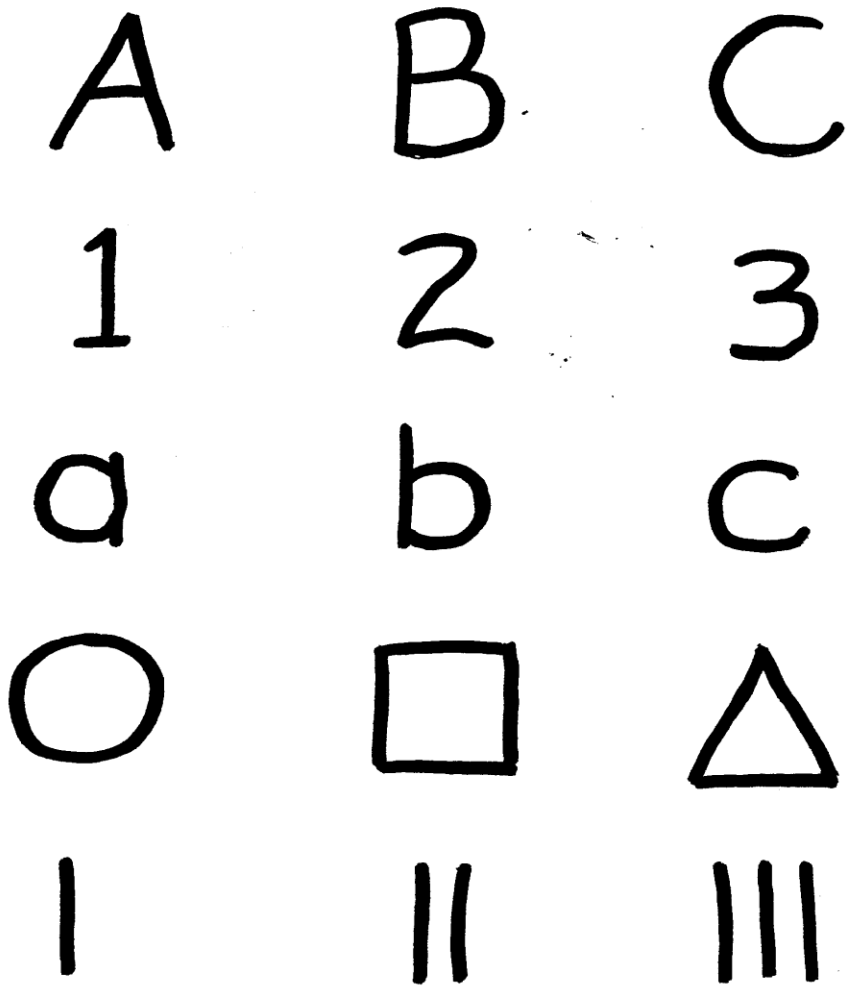
good job, keep going

1	9	7	1	5	8	7	5	6	9
#	@	%	#	^					

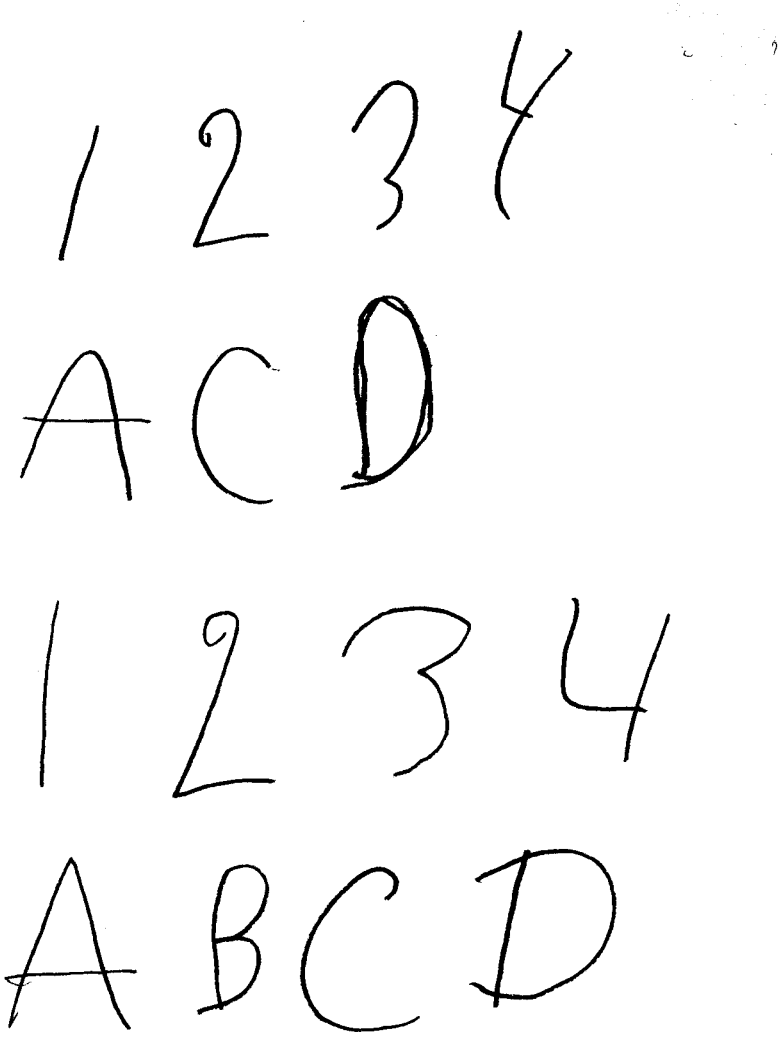
Personality

Effort

Fifteen Item Test



MALINGERING
SYMPTOM EMBELLISHMENT



PURPOSE OF NEUROPSYCHOLOGICAL ASSESSMENT

Differential Diagnosis

Description

For the purpose of rehabilitation or remediation

Prognosis or course

Forensic issues

INTERPRETATION

Level of Performance

- **normative**
- **individual**

Differential Score Approach (hold v. don't hold)

Pathognomonic Signs

Right-Left body Side Differences

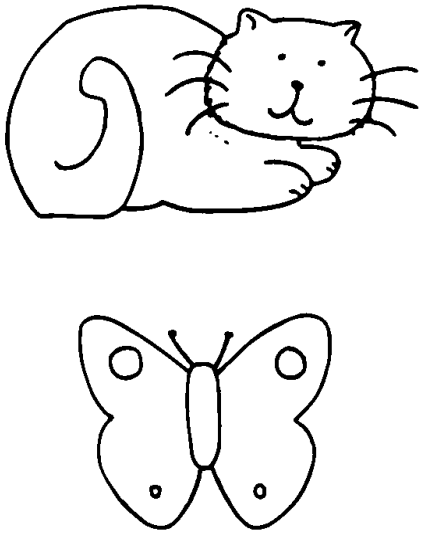
Dominant-Nondominant hemisphere differences

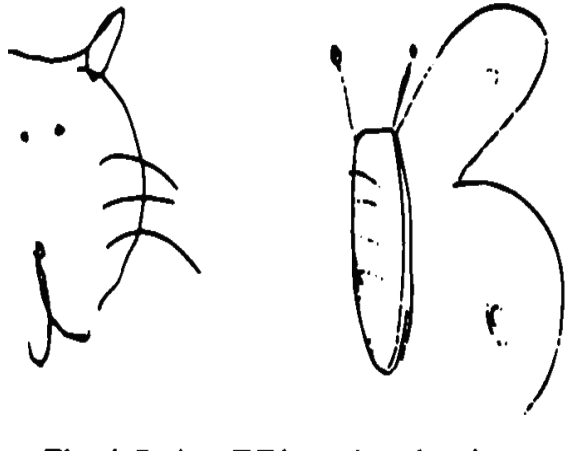
Pattern or syndrome analysis

DIFFERENTIAL SCORE APPROACH

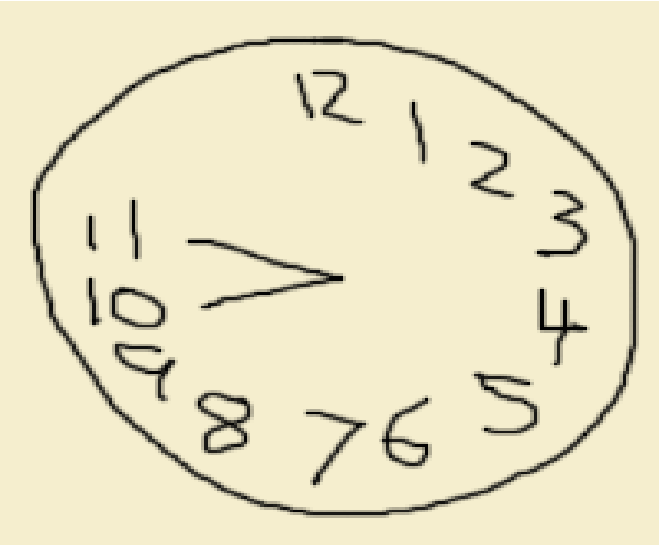
Hold	Don't Hold
Vocabulary	Similarities
Reading	Attention
Fund of Knowledge	Mental Processing Speed

PATHOGNOMONIC SIGNS HEMISPATIAL NEGLECT ON COPYING TASKS





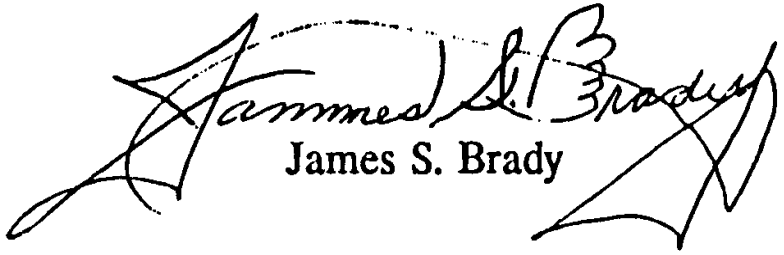
PATHOGNOMONIC SIGNS



PATHOGNOMONIC SIGNS
PERSEVERATION

Sincerely,

Sarah Brady
Chair



James S. Brady

c: Cosponsors of H.R. 467/S.1236
Membership of Handgun Control, Inc.

TEST PROFILE INTERPRETATION

Compare to known neurobehavioral syndromes

Look for consistency across tests and with the type of brain injury

One low score may not be significant

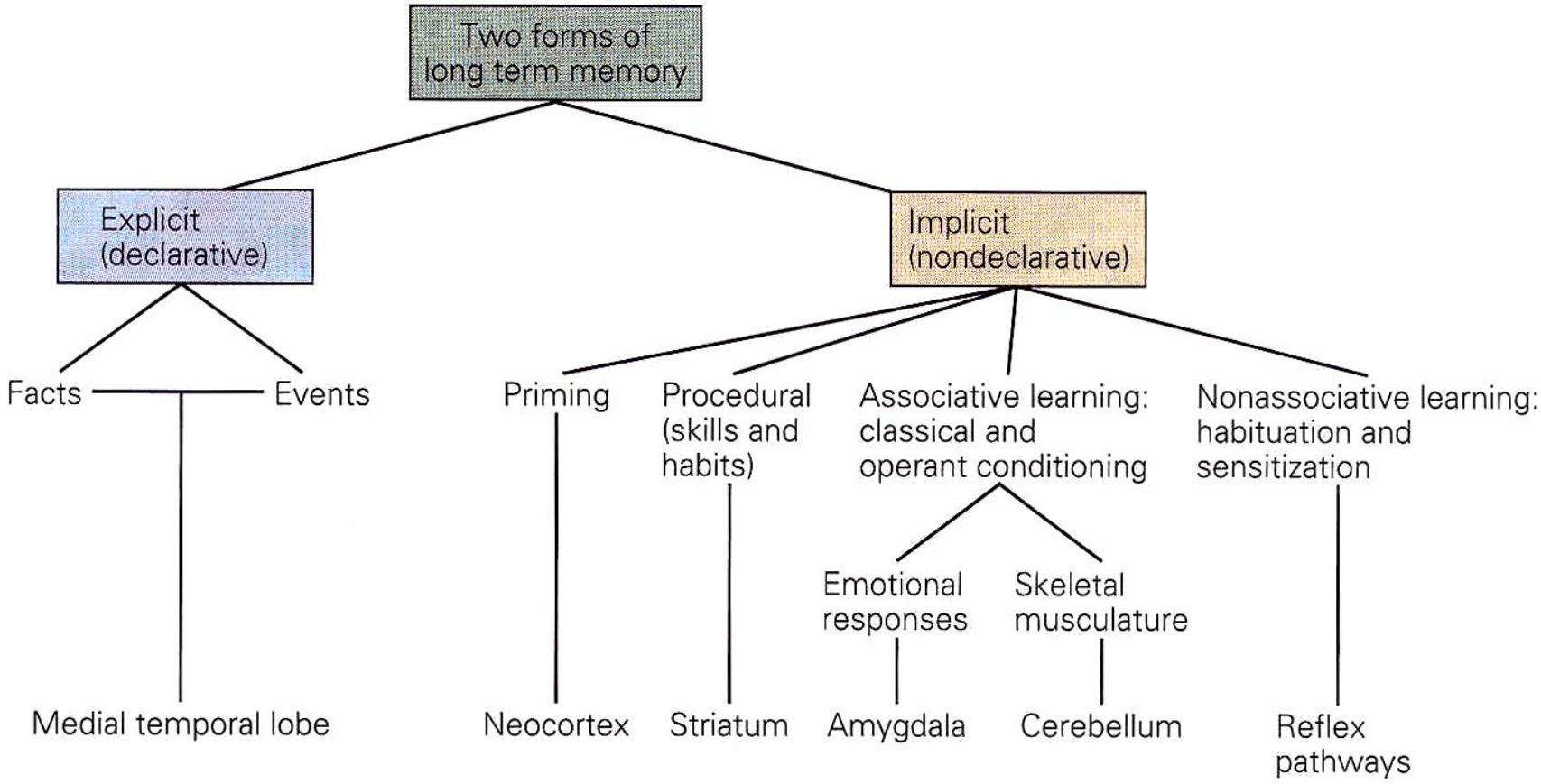
Normative studies show a very high proportion of individuals will have one low score on a battery of tests

II. COGNITIVE DISORDERS/NEUROBEHAVIORAL SYNDROMES

Major Neurobehavioral Syndromes

Rare Neurobehavioral Syndromes

MULTIPLE LONG TERM MEMORY SYSTEMS



DECLARATIVE MEMORY

Episodic Memory - explicit recollection of incidents that occurred at a particular time and place in one's personal past (e.g., remembering a specific visit to Chicago). Remember a story read 20 minutes ago.

Semantic Memory - general knowledge of facts and concepts that is not linked to any particular time and place (e.g., Chicago is the third largest city in US)

Immediate Memory: short attention span, holding a information in working memory (e.g., a phone number)

Recent Memory: What you had for dinner last night, memory of this lecture in an hour from now.

Remote Memory: Facts you have acquired (semantic memories), events from the past, remote autobiographical memories

FLASHBULB MEMORY: A SPECIAL TYPE OF EPISODIC MEMORY?

NOVEMBER 22, 1963

JULY 20, 1969

JULY 20, 1969

SEPTEMBER 11, 2001

NEUROBEHAVIORAL SYNDROMES

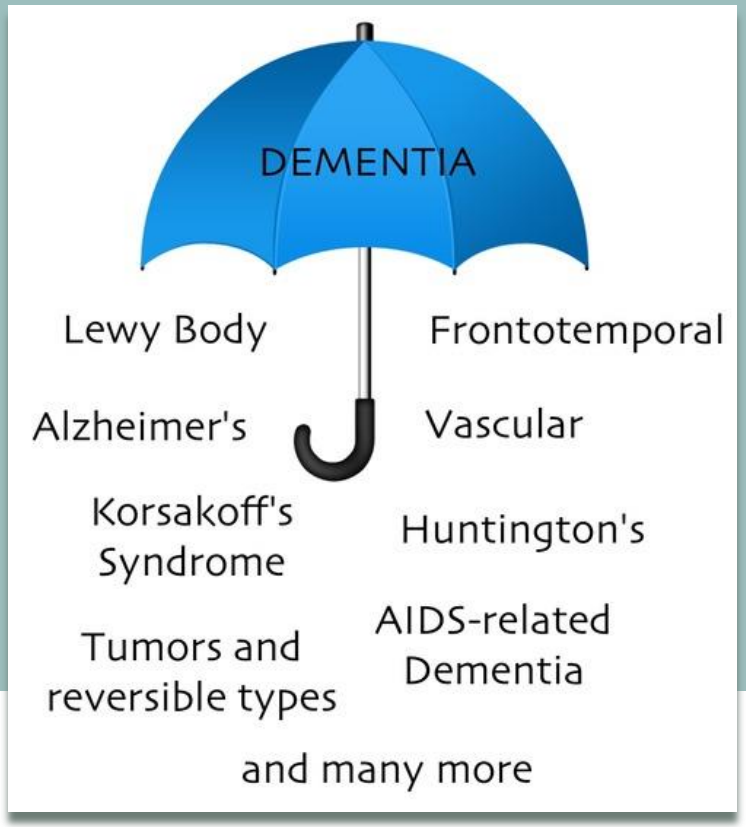
	Memory Functions		
	Immediate	Recent	Remote
Confusional States	-	-	+
Dementia	+	-	-
Dementia with confusion	-	-	-
Primary amnesia	+	-	+
Attentional disorder	-	+	+

Frontal Lobe Syndromes: disinhibited vs apathetic, disorders of abnormal awareness (Capgras)

Nondominant hemisphere syndromes: hemispatial neglect

Aphasic Syndromes- fluent (Wernicke's aphasia) and nonfluent (Broca's), Gerstmann's syndrome (R/L orientation, finger agnosia, agraphia, acalculia

Dementia Types

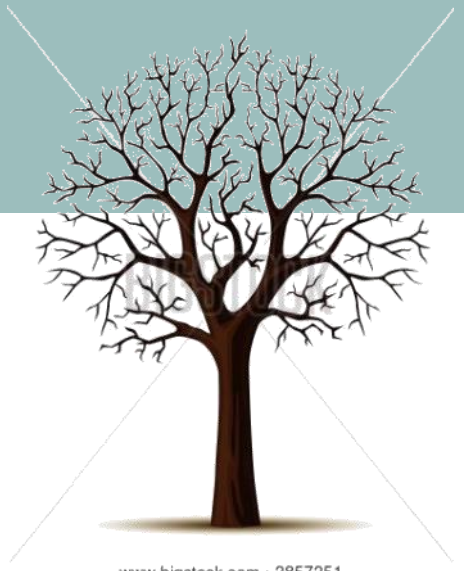


A compromise in two or more core mental functions resulting in significant everyday impairment

Vascular Dementia

Subcortical

- Difficulties with mental manipulation, personality/emotional changes, motor functions, attention



Cortical

- Disruption in "higher order" functions, such as memory, language, and semantic knowledge

Dementia subtypes

- **Cortical**
  - **Alzheimer's disease**
  - **Frontotemporal dementia**
    - **Behavioral Variant**
    - **Fluent Primary Progressive Aphasia**
    - **Nonfluent PPA**
  - **Vascular dementia**
- **Subcortical**
  - **Vascular (CADISIL, Binswangers)**
  - **Multiple Sclerosis**
  - **Huntington's disease**
  - **Parkinson's disease**
  - **Parkinson's Plus Syndromes**
    - **Multisystem atrophy**
    - **Progressive Supranuclear Palsy**
    - **Corticobasal Degeneration**
    - **Picks**
    - **Dementia with Lewy Bodies**

MILD NEUROCOGNITIVE DISORDER/ MILD COGNITIVE IMPAIRMENT

Subjective symptoms of memory loss

Abnormal memory on at least some neuropsychological tests

No Deficits in Activities of daily living

Considered an intermediate step between normal aging and dementia

Amnestic vs Nonamnestic MCI

- Single Domain
- Multiple Domains
- 4 subtypes:
  - Amnestic MCI, Single domain
  - Amnestic MCI, Multiple domains
  - Nonamnestic MCI, Single domain
  - Nonamnestic MCI, multiple domains

PROGRESSION FROM MCI TO DEMENTIA

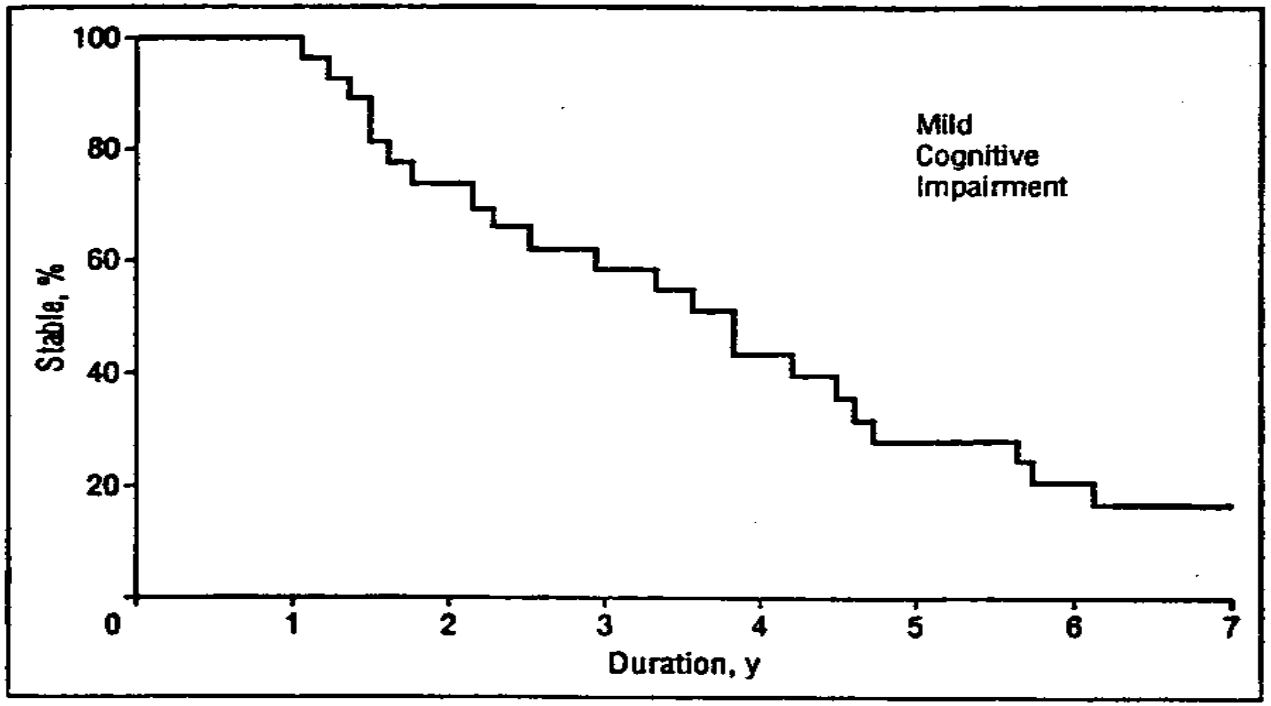


Figure 2. Survival curve of persons characterized as having a mild cognitive impairment for 6 years. Approximately 80% have converted to dementia during this time. Reprinted with permission from John Wiley & Sons, Inc.

Progression to dementia:

Healthy controls: **1-2% develop dementia per year**

MCI: **10-15% develop dementia per year**

80% of aMCI convert to dementia within 6 years

SOMATOFORM DISORDERS

The presence of physical symptoms that suggest a general medical condition but are not fully explained by a medical condition, the effects of a substance or by another mental disorder (e.g.., panic)

Physical symptoms reflect underlying emotional conflicts

Symptoms are not under voluntary control (unlike Factitious Disorder or Malingering)

Symptoms cause significant distress or impairment

III. NORMAL AGING

1. What is normal aging?
2. How does the brain change with age?
3. How does cognitive function change with age?

NORMAL AGING

Why not just use brain imaging? Who needs neuropsychological testing?

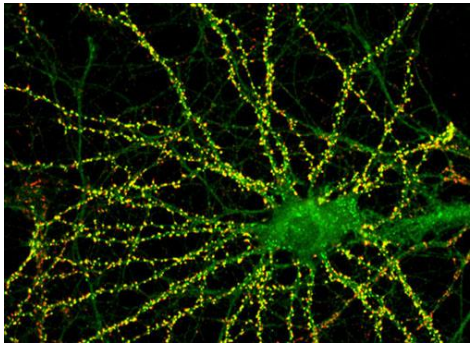
Brain Atrophy occurs with aging (next slide)

Brain Atrophy precedes clinical symptoms (low hippocampal volume)

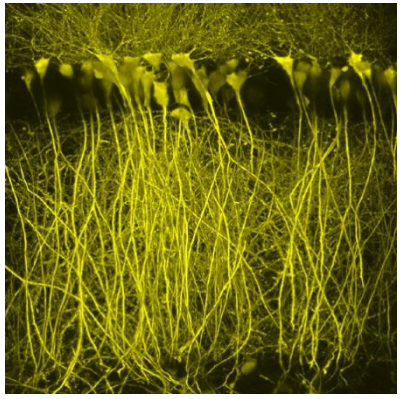
New research shows shrinkage in healthy older individuals who were followed for 3 years but remained free of MCI and AD

Individuals with dementia can have normal scans

Individuals with abnormal scans can have normal functioning

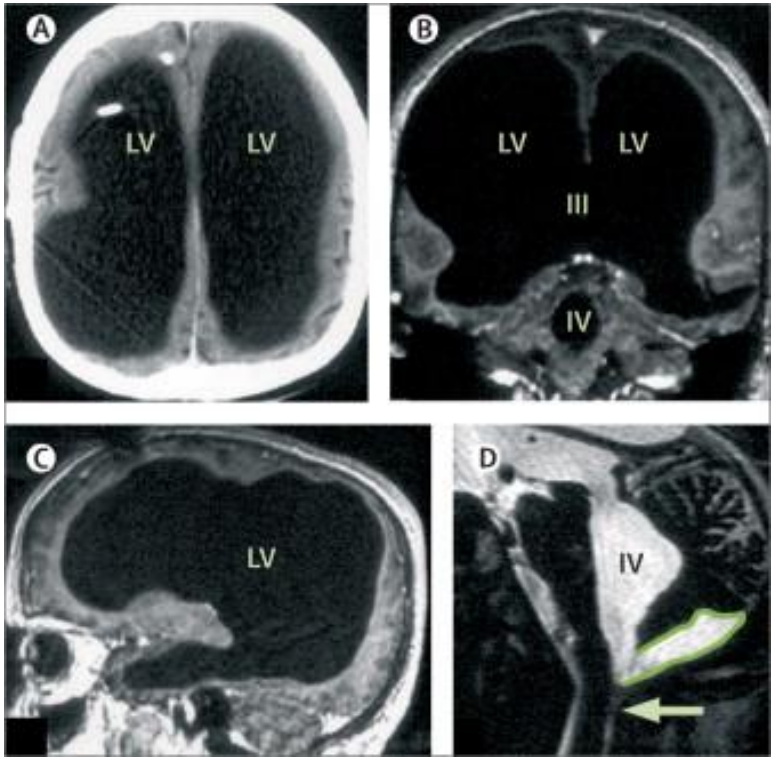


- **100 Billion neurons**
- **200,000 synapses per neuron**
- **Shrikage with age!**

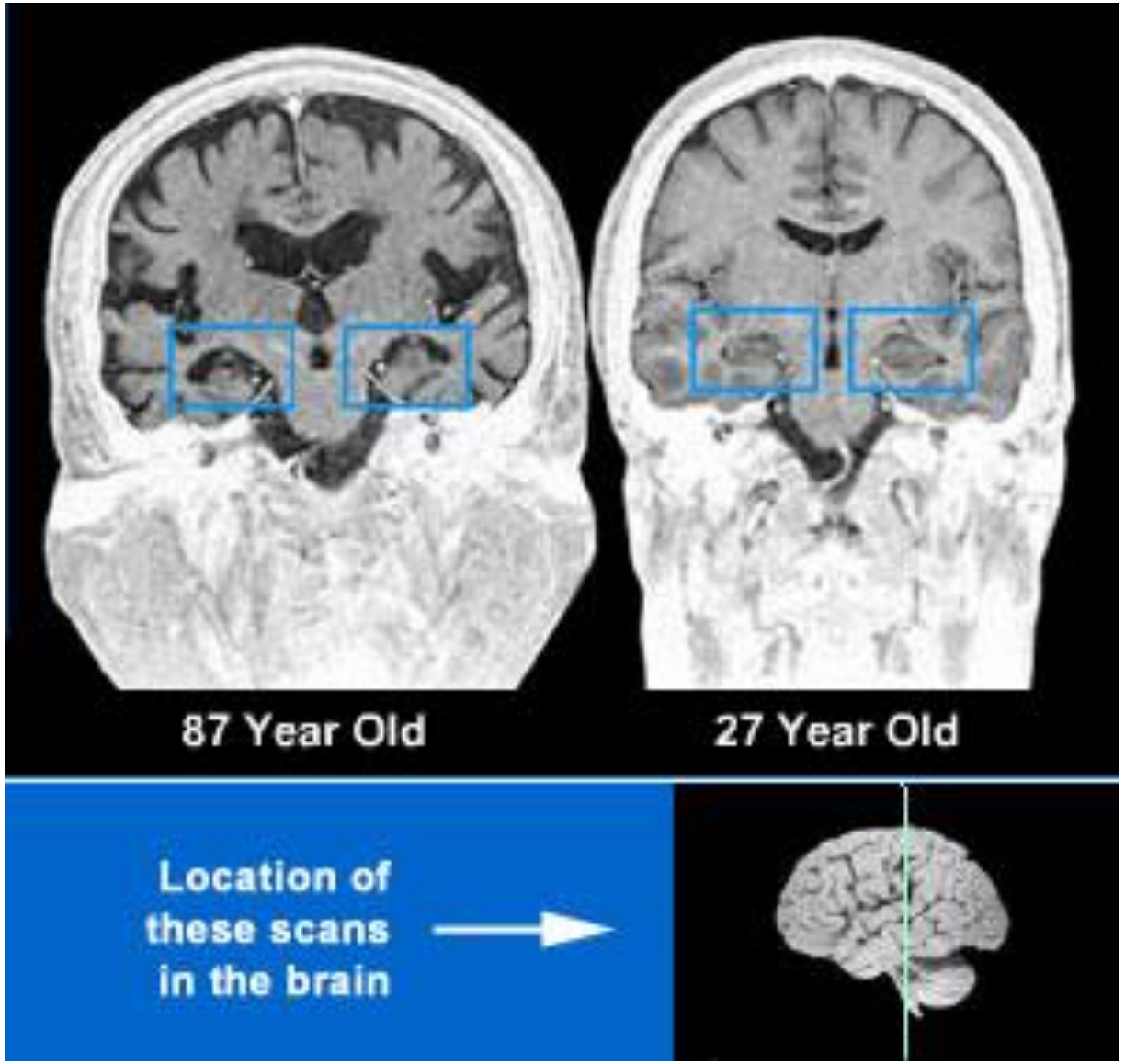


BRAIN OF A WHITE-COLLAR WORKER LANCET 2007; 370: 262

44 year old man presented with left leg weakness
VP shunt at 6 months of age for hydrocephalus
Ataxia at age 14 and paresis of left leg which resolved after shunt revision
Verbal IQ was 84, nonverbal IQ=70
Leg weakness and neuro exam normal after shunt revision
Married father of 2, employed as a civil servant



OREGON BRAIN AGING STUDY



BRAIN VOLUME AND FUNCTION

Brain volume decreases with age at a rate of ~2% per decade beginning in early adulthood

CSF volume increases with age

Age-related tissue volume ↓ appears primarily related to white matter loss (Guttmann et al 1998)

Blood flow (SPECT) Diminished perfusion in select cortical regions

Metabolic activity (PET) Diminished uptake in select cortical regions

fMRI Changes in task-related activation (c.f. HAROLD - Hemispheric Asymmetry Reduction in Old Adults)

LOOK FAMILIAR?

HTN

Hyperlipidemia

CAD

AODM

Osteoarthritis

GERD

s/p MI

Scattered T2 subcortical WM hyperintensities

HOW ABOUT THIS?

HCTZ

Lisinopril

Simvastatin

Zantac

Ibuprofen

Glyburide

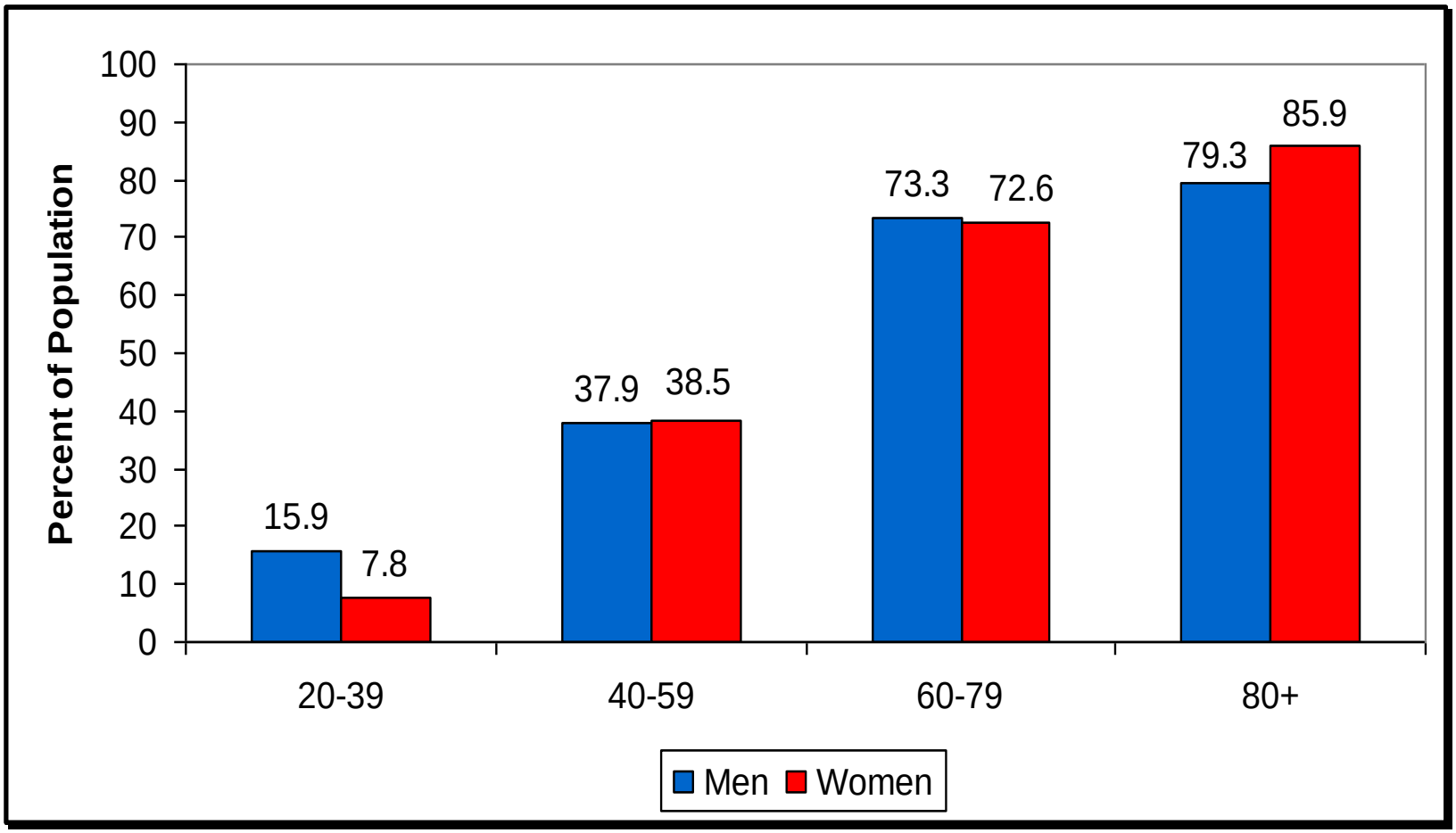
Albuterol

Proscar

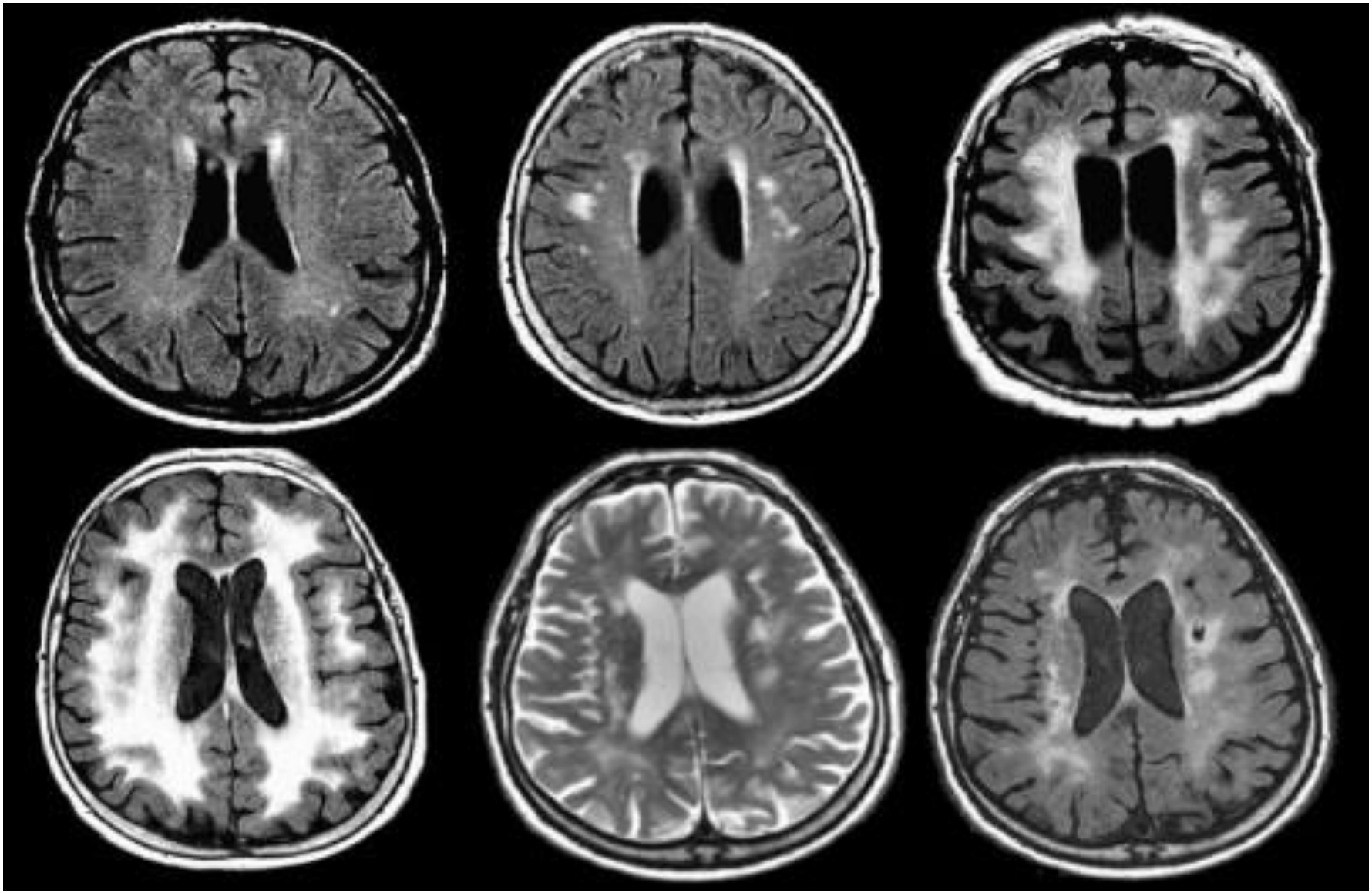
Viagra

Clonazepam

Celexa



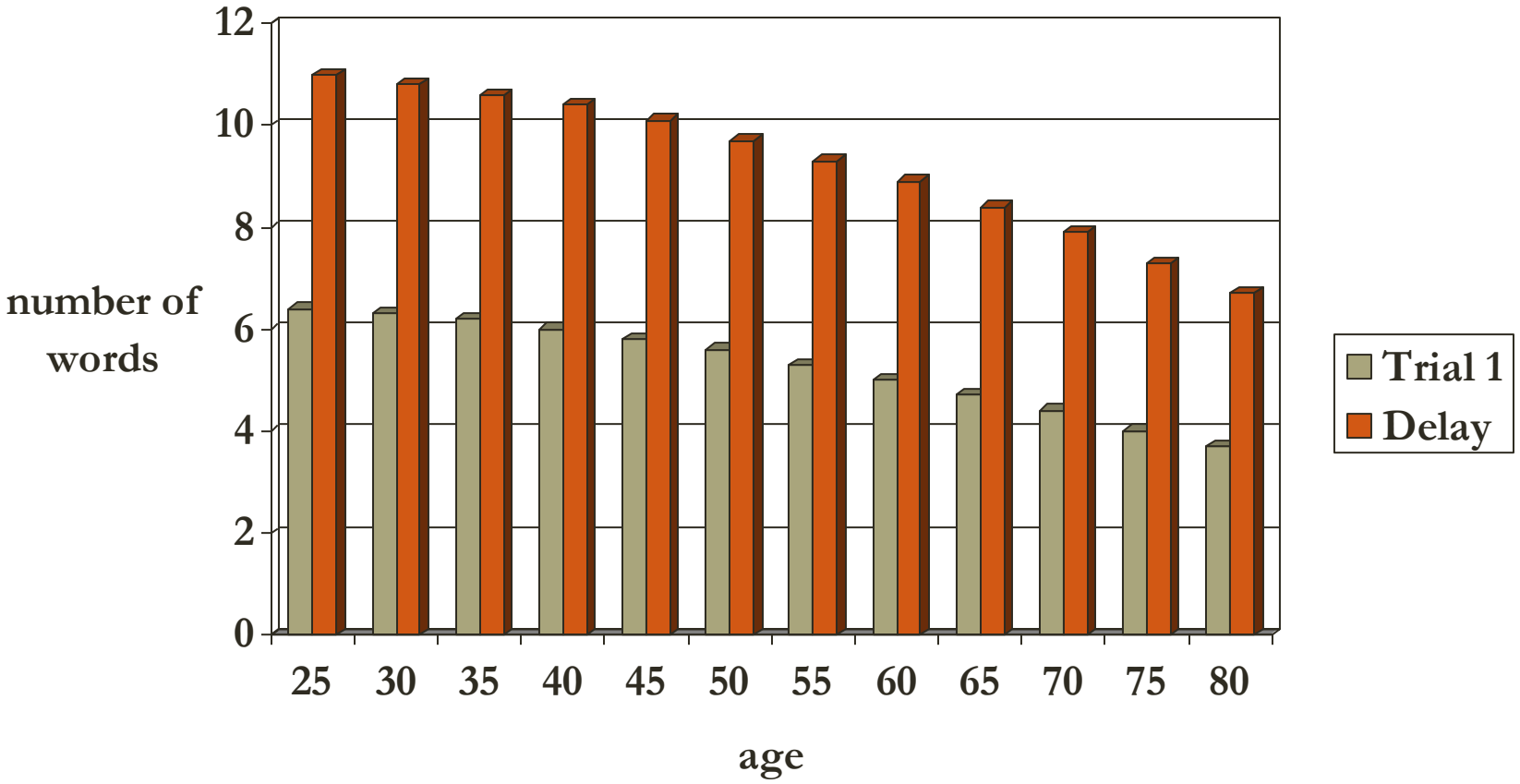
Prevalence of CVD in adults age 20 and older by age and sex (NHANES: 2005-2006). Source: NCHS and NHLBI. These data include coronary heart disease, heart failure, stroke, and hypertension.



The spectrum of small vessel disease–related brain changes in MRI: white matter lesions ranging from punctate foci (*upper left*) to extensive confluent abnormalities (*lower left*) and lacunar infarcts (*lower right*).

VERBAL MEMORY (RAVLT) NORMATIVE DATA

VAN DER ELST ET AL., JINS 2005

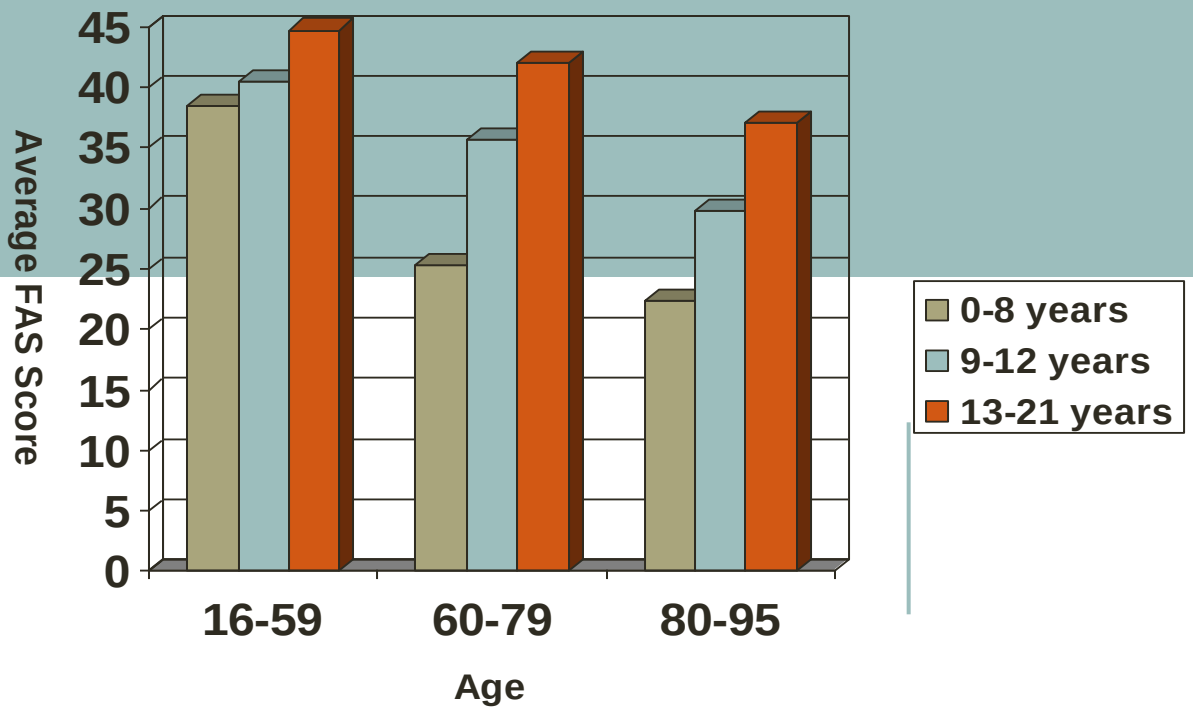


Males with average education

FAS-COWA

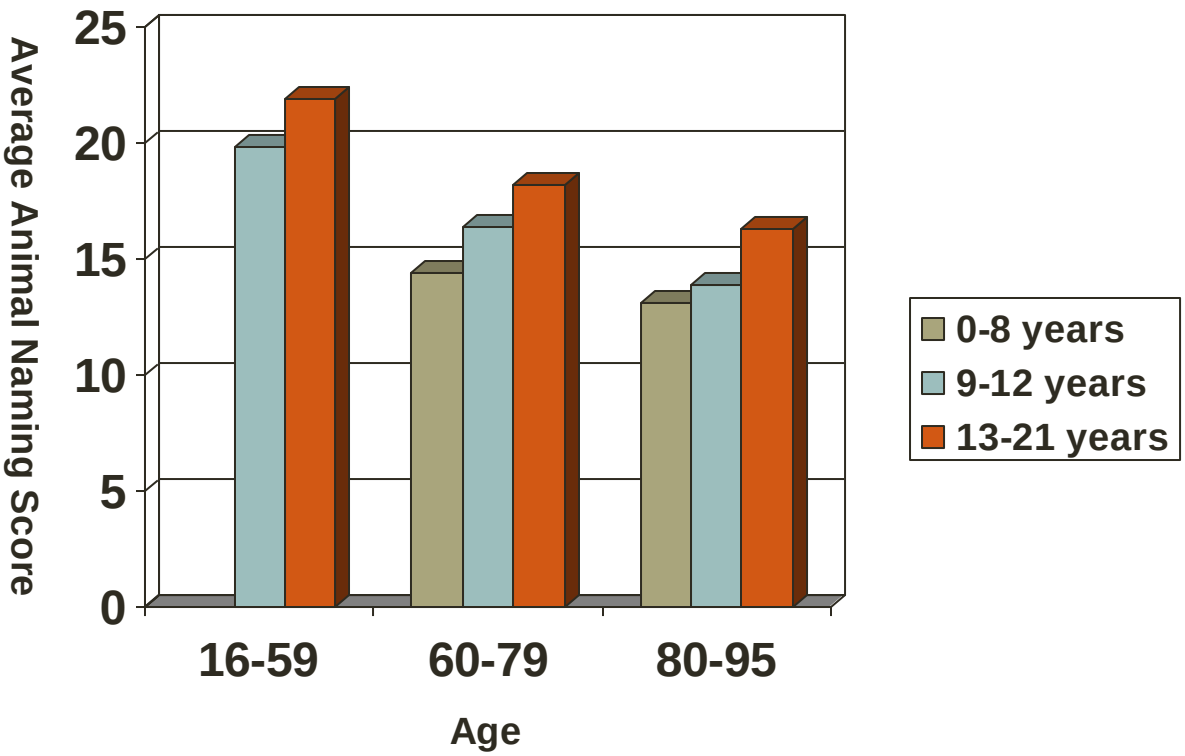
Normative data by age and education

Tombaugh, Kozak & Rees (1996)



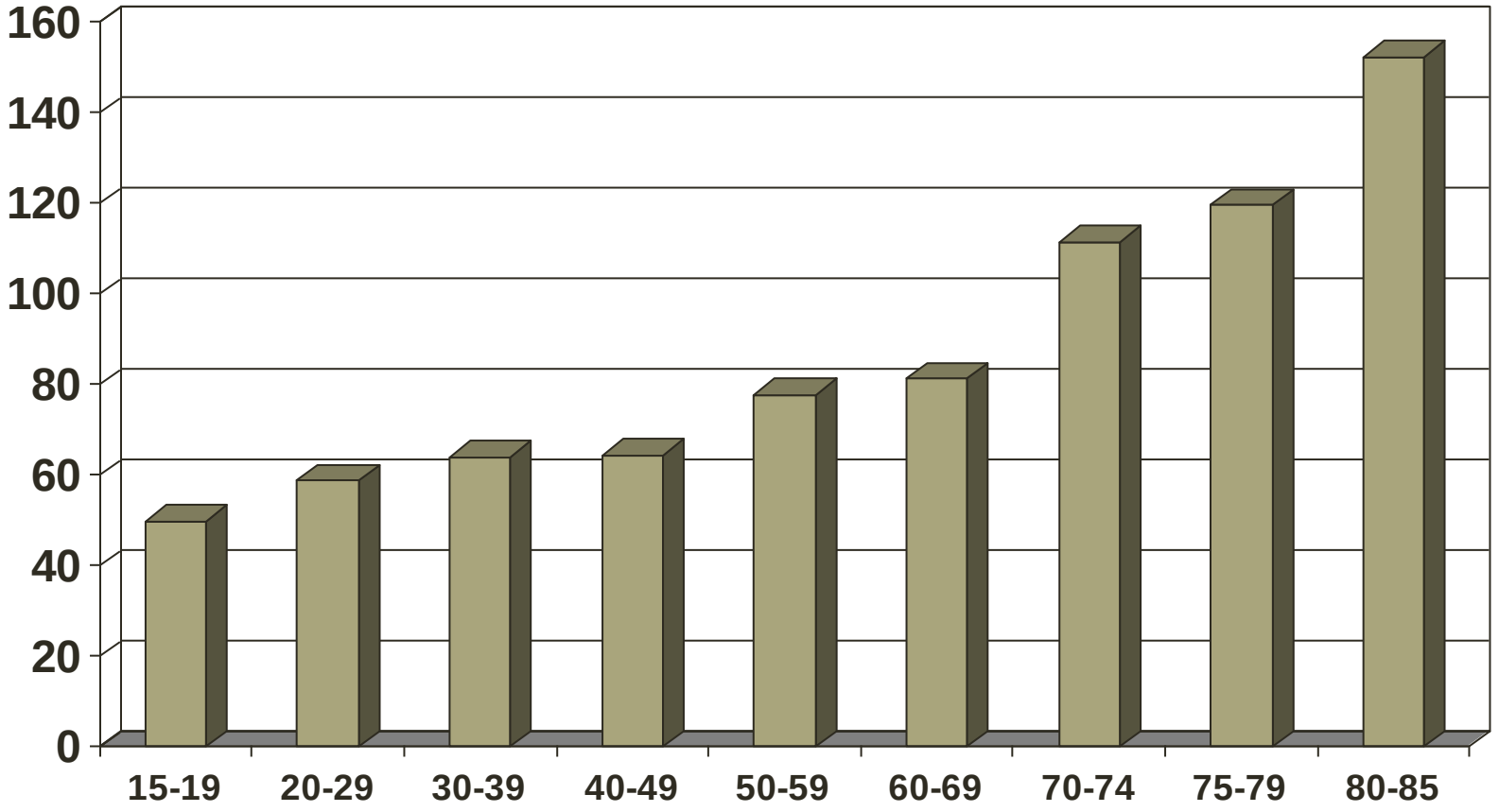
Animal Naming

Tombaugh, Kozak & Rees (1996)



Trail Making Test - B

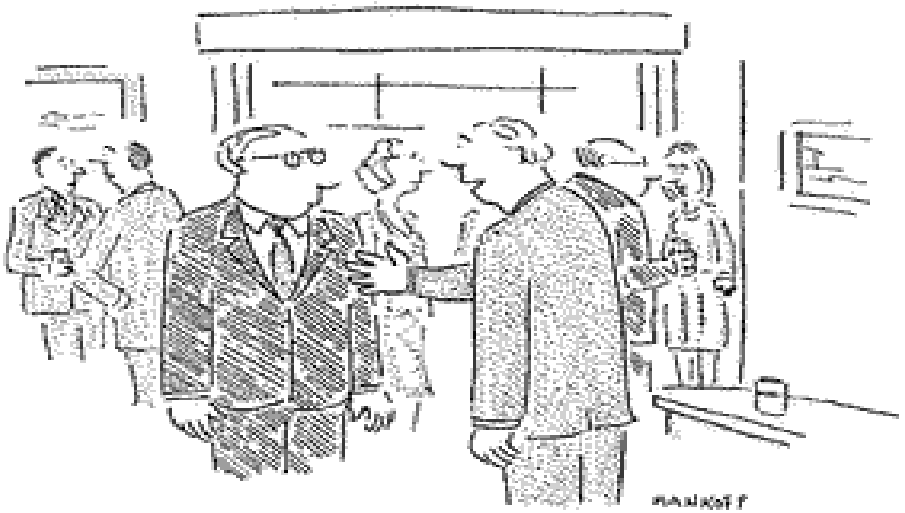
Tombaugh, Rees, & McIntyre (1996)



THE TOP COMPLAINTS

WHAT DO PATIENTS ACTUALLY COMPLAIN OF? *AND* IS THIS NORMAL?

NAMENESIA



Hi. I'm, I'm, I'm….. You'll have to forgive me.
I'm terrible with names.

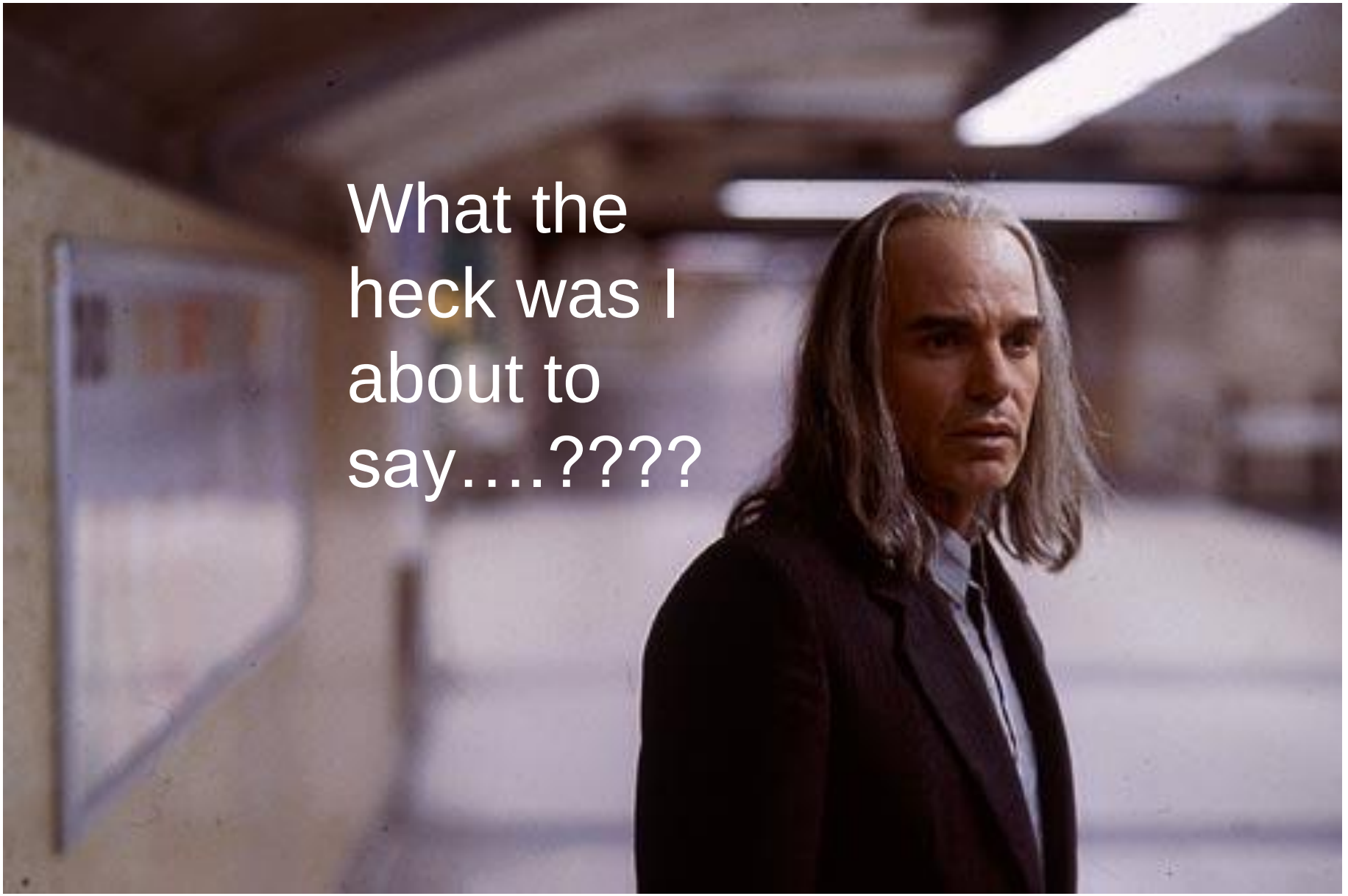
The case of the man who could not name that thing that climbers use.

WORDMNESIA


THIS MODERN WORLD by TOM TOMORROW
UH OH! LOOKS LIKE BILL'S BEEN FORGETTING TO TAKE HIS MEMORY ENHANCEMENT PILLS!
DRAT! WHAT WAS I GOING TO SAY?!
IT WAS RIGHT ON THE TIP OF MY...
MY...
YOU KNOW, THAT THING IN MY MOUTH...

ROOMNESIA

EPISODIC FLEETING THOUGHT SYNDROME



I'M ALWAYS LOSING THINGS

PARKINGMNESIA
(SHOPPING MALL TYPE)

I think it was in Section GG-17… or was it DD-71?

SENESCENT FORGETFULNESS (SF)
(KRAL 1962)

Benign SF: *"the inability...to recall relatively unimportant data and parts of an experience, like a name, a place, or a date, whereas the experience of which the forgotten data form a part can be recalled..."*

Malignant SF: *"inability to recall events of the recent past, whereby not only relatively unimportant data and parts of an experience but the experience as such cannot be recalled"*

In Clinical practice:

"I have trouble recalling why I went into a room, recalling names of people I have met recently." ***Worried Well***

"My husband asks 10 times in one hour the time for his upcoming appointment, forgets how many children he has" ***Pathologic***

AGING: VULNERABLE PROCESSES

Fluid intelligence (visual spatial skills)

Processing Speed (reaction time, speed of sensori-motor output)

Working memory

Executive Function: multi-tasking/divided attention

Long-term memory

- Episodic memory
- Source recall

Complex visual processing

NEUROGENESIS AND PLASTICITY

THEN: The brain is equipped with a finite complement of neurons. Once a neuron dies, it is never replaced. Therefore aging entails a relentless, subtractive process.

NOW: New neurons sprout in the hippocampus throughout the lifespan. The change in the absolute number of neurons is not significant.

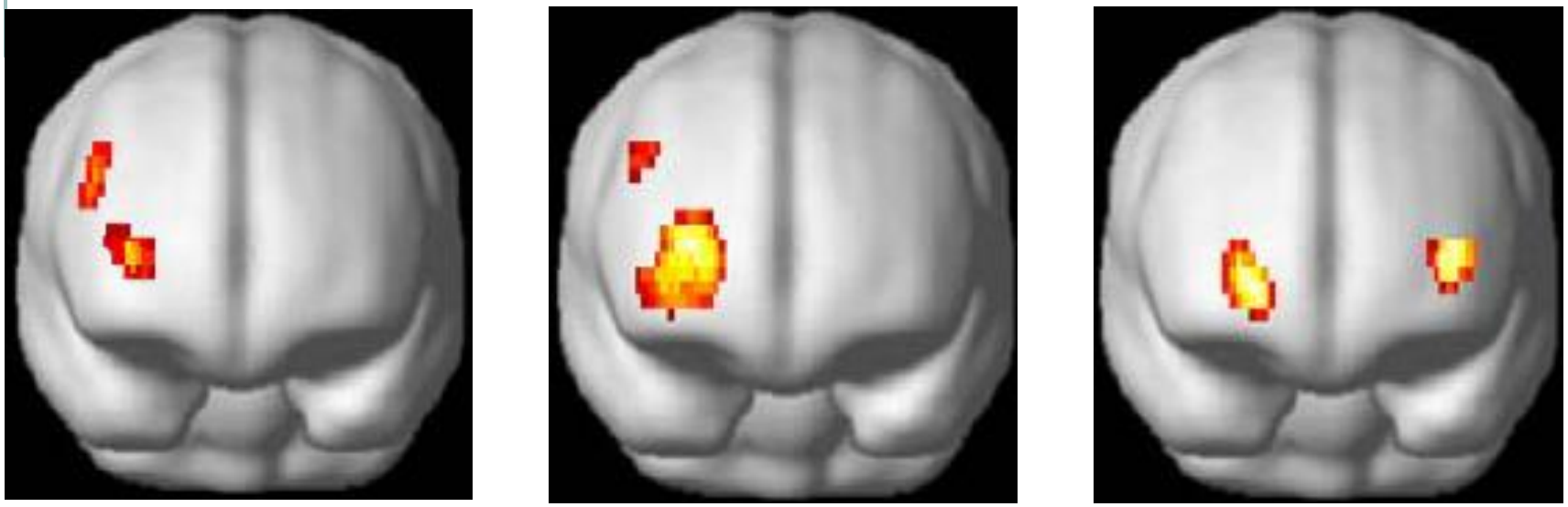
CAVEAT: Old outgoing neurons do not transmit their experience to new replacements.

Peter Eriksson & Fred Gage, *Neurogenesis in the adult human hippocampus.*

Nature Medicine 1998

PET BRAIN ACTIVITY DURING SOURCE MEMORY TASK

Young **Old-Low** **Old-High**



Cabeza et al. (2002, *Neuroimage*)

Old-Low performing subjects recruited similar PFC regions as young adults but used them inefficiently

Old-High performing subjects compensated for age-related memory decline by reorganizing the episodic retrieval network

→SUPPORTS COMPENSATION VIEW OF **HAROLD**

Hemispheric Asymmetry Reduction in Old Adults

THE GOOD NEWS

Social Involvement

- social support ↑ cognitive function

Effects of exercise

- ↑ Lung function
- ↑ Cerebral blood flow
- ↓CVD risk factors (HTN, hypercholesterolemia, obesity)
- CV health augments brain plasticity
- ↑ Capillary growth around neurons
- ↑ Synaptic density

Vascular risk factors are controllable:

- Cigarette smoking
- Obesity
- HTN
- Hypercholesterolemia
- Diabetes

YOUR BRAIN: USE IT OR LOSE IT

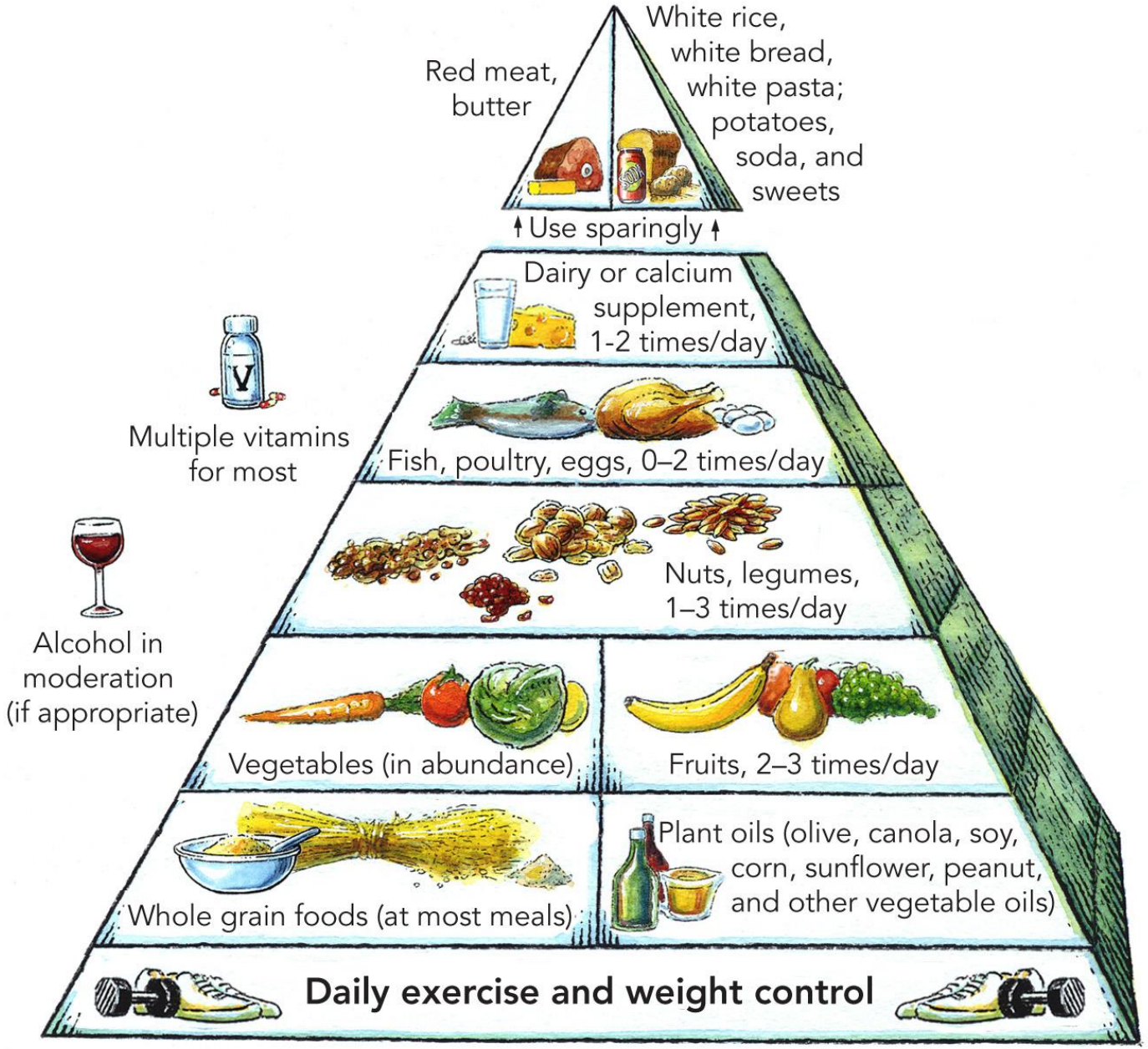
MacArthur Foundation study

- Years of education correlates most robustly with cognitive outcome in aging

High levels of education convey neuroprotective effect in withstanding AD pathology

Rush U study: frequency of engagement in intellectually stimulating activity better predicts dementia diagnosis than years of education

Importance of Lifelong Learning


Red meat, butter
White rice, white bread, white pasta; potatoes, soda, and sweets
Use sparingly
Dairy or calcium supplement, 1-2 times/day
Multiple vitamins for most
Fish, poultry, eggs, 0–2 times/day
Nuts, legumes, 1–3 times/day
Alcohol in moderation (if appropriate)
Vegetables (in abundance)
Fruits, 2–3 times/day
Plant oils (olive, canola, soy, corn, sunflower, peanut, and other vegetable oils)
Whole grain foods (at most meals)
Daily exercise and weight control

NORMAL AGING REDEFINED

There's nothing normal about aging

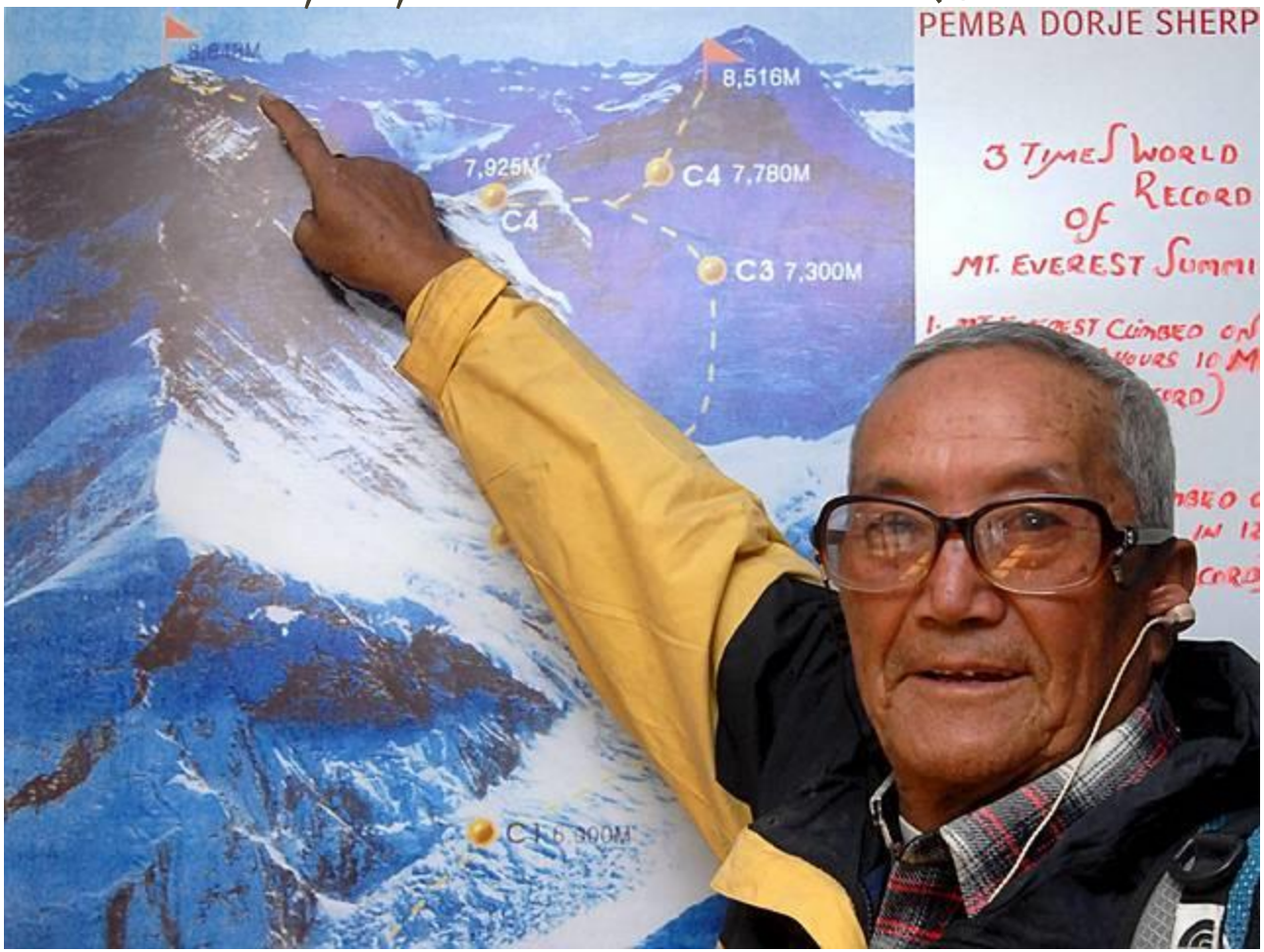
Typical or average or usual aging

Optimal aging

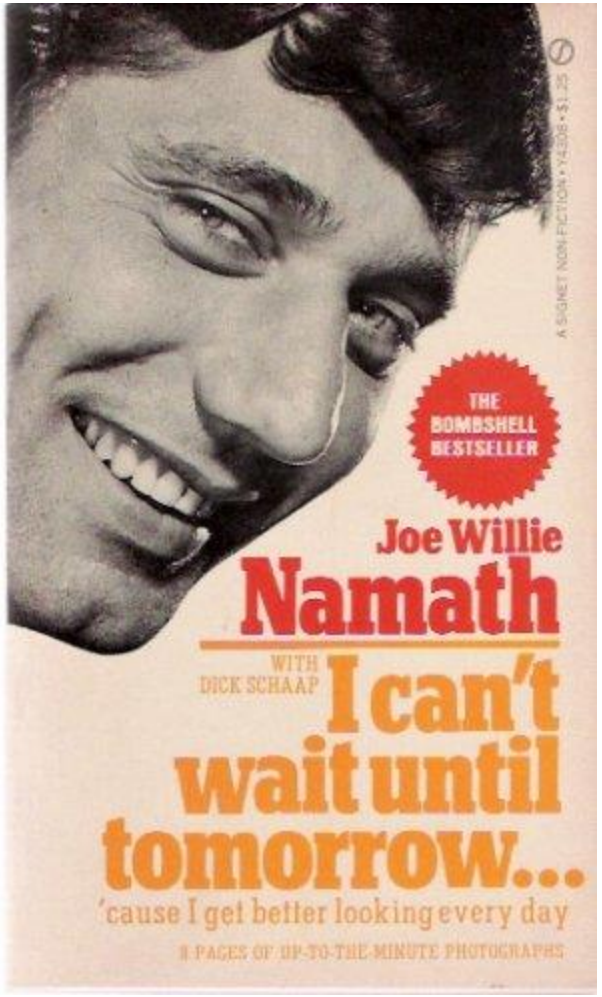
Super aging


HEALTHY
AGING
Picture by
Karen Kasmauski

MIN BAHADUR SHERCHAN,
NEPALESE CLIMBER, 76, OLDEST MAN TO CONQUER EVEREST

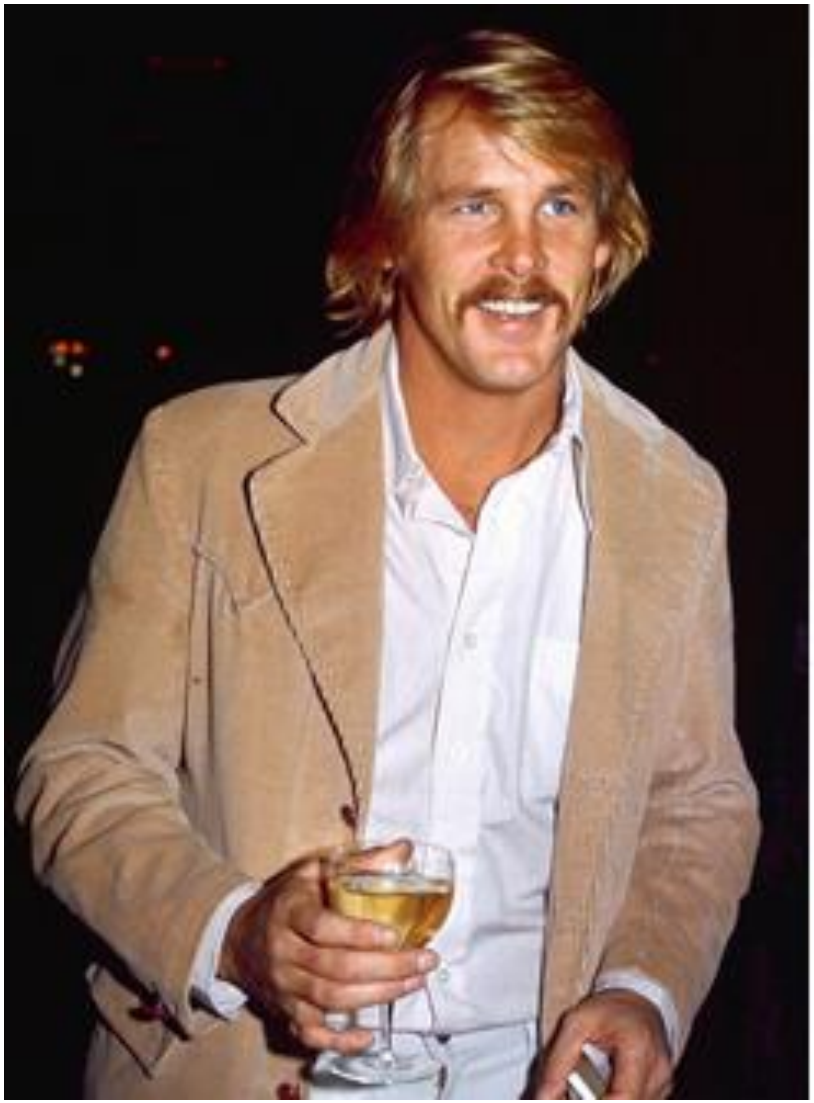


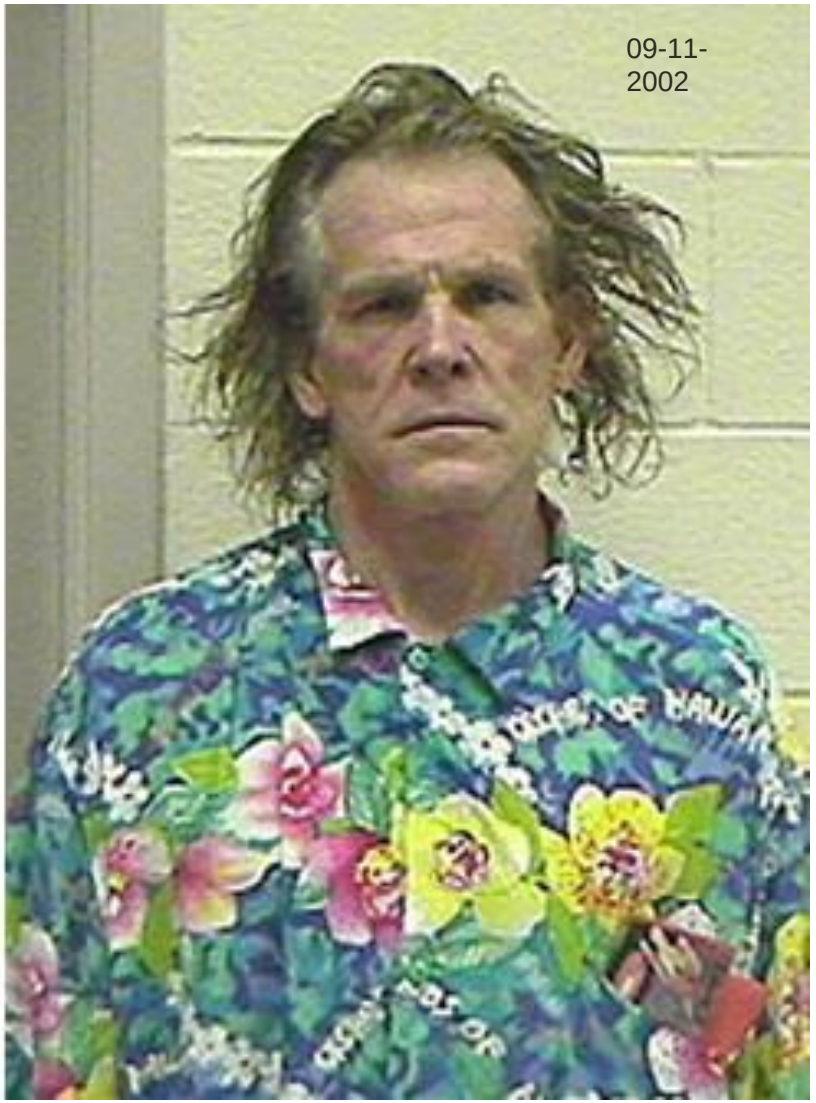
May 2008


A SIGNET NON-FICTION • Y4306 • $1.25
THE BOMBSHELL BESTSELLER
Joe Willie
Namath
WITH DICK SCHAAP
I can't wait until tomorrow...
'cause I get better looking every day
8 PAGES OF UP-TO-THE-MINUTE PHOTOGRAPHS

NICK NOLTE

2/8/1941





SISTER MADONNA BUDER
82 YEARS OLD

Roman Catholic nun

Completed her first triathlon at age 52

Oldest person (man or woman) to complete an Ironman

2.4 mile swim, 112 mile bike, 26.2 mile run

IV. CASES

- DI
- LTC
- Underwriting

DI CASE

56 year old attorney claiming limitations due to speech problems

His firm has asked him to leave the law practice

Insured's wife reports a 9 month history of reduced fluency of speech

Insured is under stress at work and has lost several large clients

Insured believes he is still capable of working

Graduated from an Ivy league law school

Neuropsychological testing:

- Reading: Superior
- Intellectual skills: 98 Verbal Index, 126 Perceptual Reasoning Index
- Boston Naming Test: 43/60 (Impaired)
- Verbal phonemic fluency (impaired)
- Ability to judge line angles: High Average
- Memory scores: Normal (high average)
- Beck Depression Inventory: Mild

DIAGNOSIS? LIMITATIONS?

Primary Progressive Aphasia

Total

DI CASE

41 year old woman involved in a motor vehicle accident 2 years ago

No loss of consciousness or period of amnesia, briefly dazed

Claims headaches, dizziness, light sensitivity, inattention, and poor memory preclude her from working as a business consultant

Involved in litigation against the driver of the vehicle

Broken femur

Neuropsychological testing:

Average intelligence

Average delayed recall but borderline impaired recognition memory

Normal effort testing

Variable scores on attention measures

Personality Testing showed: elevations on somatization and conversion

Beck Depression Inventory: Moderate Depression

DI CASES

Common DI Cases:

1. Traumatic brain injury (mild to severe)

2. Dementia (early onset Frontotemporal dementias, later onset garden variety AD)

3. Psychiatric condition presenting with cognitive concerns (depression, anxiety, and co-morbid cognitive concerns)

4. Somatic Symptom Disorders

- Mild Concussion and now multiple unrelenting somatic physical and cognitive concerns not explained by the concussion but explained by underlying psychosocial stressors, misattribution of normal symptoms to TBI, or misattribution of depressive symptoms to brain injury residuals
- Severe pervasive belief that an individual has a medical condition (e.g., the case of Morgellons--delusional belief that they have been infested by a disease causing agent like insects, parasites, hairs or fibers, sometimes claiming to pull hairs or fibers out of their skin) Delusional infestation

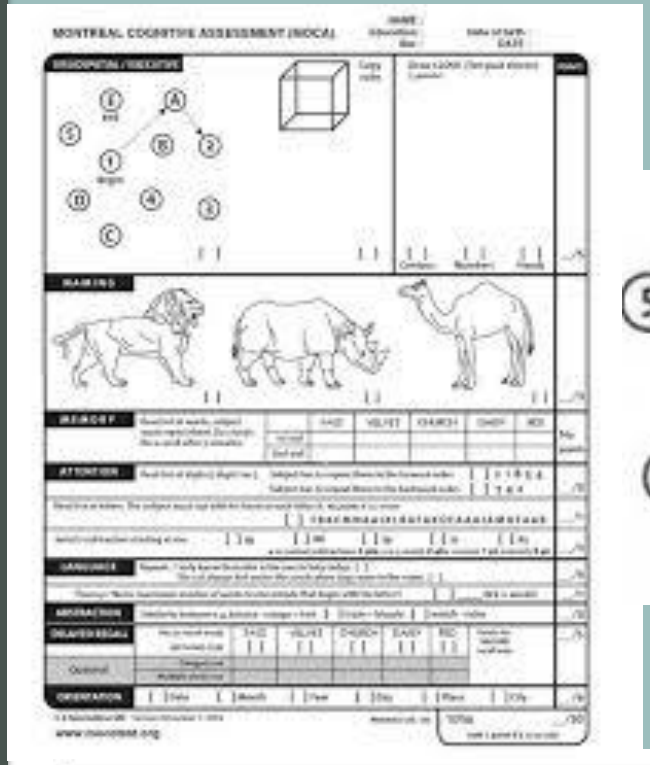
LONG TERM CARE

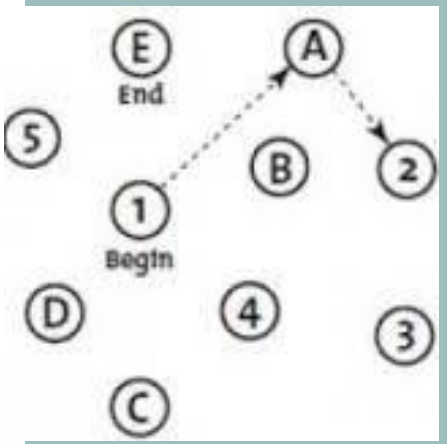
81 year old woman former teacher

- Osteoarthritis
- Diabetes
- History of alcohol use
- Living independently with some intervention from family
- Losing weight
- Family believes she needs supervision in the home due to memory problems
- No diagnosis of dementia in her medical records
- MMSE 26/30 (normal score for her age)
  - Missed all words after a delay and misstated the date
- Neuropsychological Testing (often unavailable)
- IQ: High Average
- Immediate memory: high average
- Delayed recall and recognition: impaired
- Diagnosis?
- Need for LTC?

MOCA VS MMSE

Montreal Cognitive Assessment (MOCA)





- Sample of Trail Making Test
- Three Dimensional Cube
- Clock Drawing
- Picture Naming
- Receptive and Expressive Screen
- Orientation

Sensitivity and Specificity (%) MoCA©			
Cut-off	≥ 26	< 26	< 26
Group (n)	Normal controls (90)	Mild Cognitive Impairment (94)	Alzheimer Disease (93)
MoCA©	87	90	100

Screening Test– 24 to 26 cutoff

LTC UNDERWRITING

57 yr old female MD worked night shift in ER

Saw her physician after she got lost driving home

Is she at risk for Dementia? Yes?

Neuropsychological Testing was normal

Applied for LTC 2 years later

Issue policy?

Another Neuropsychological evaluation was requested and there was no decline in her scores over time.

Neuropsychological testing after a 2 year interval with baseline testing for comparison is the strongest evidence that there is *not* a dementing condition.

Found to have Circadian Rhythm Sleep-Wake disorder related to shift work in ED

LTC

57 year old woman with memory concerns

Works as a seamstress

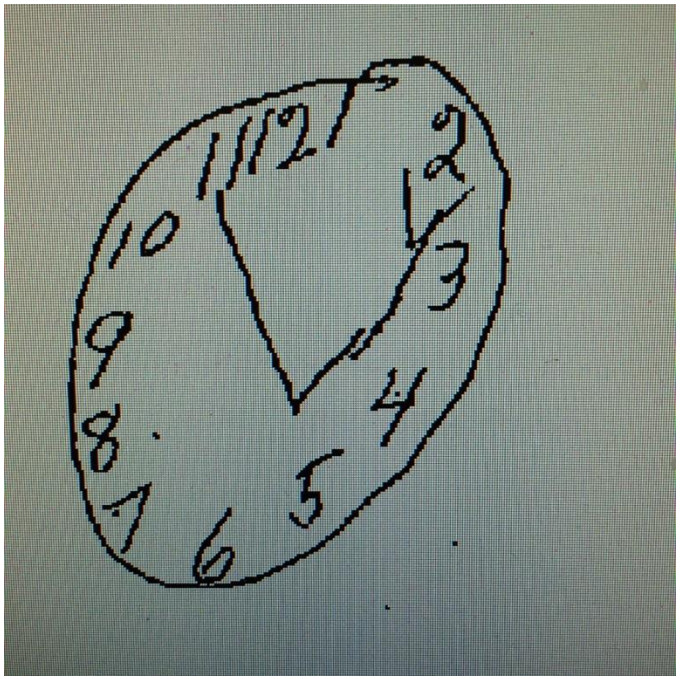
23/30 on the MMSE

2/3 for delayed recall

Missed the sentence, spelling WORLD or serial 7s

Neuropsychological testing in

	2010	2016
IQ	82	86
Memory I	low ave	low ave
Object Naming	low ave	low ave
Trails	average	average
Reading	2nd grade level	



- Neuropsychological testing is an objective way to evaluate cognitive and psychological functioning (brain structure does not equal function)
- Neurobehavioral syndromes are defined by the results of cognitive testing (memory in particular)
- Forgetting and word finding problems are common
- Neuropsychological testing is useful for differentiating normal from abnormal aging or neurodegeneration
- Provides information that can be useful for evaluating claims and underwriting

SUMMARY

Questions?

LTC UNDERWRITING

MCAS phone screening tool is validated for differentiating individuals who are normal from those who have mild to moderate cognitive impairment.

More studies are needed to assess ability to differentiate MCI from normal aging or developmental disorders (ADHD) from degenerative disorders.

Applicants can “cheat” by writing information down or looking at their phone or watch for the date

Some items will be failed by individuals with attentional problems or learning disabilities who struggle to perform math in their heads or repeat digit strings

If questions persist, ask for a neuropsychological evaluation

Presenting with adult onset ADHD symptoms can be a red flag and some will have a cognitive disorder but more will have a psychiatric condition.