AGING of Cerebral Functions

Advances in the prevention and treatment of organic memory disorders associated with aging

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The human brain is unique, individual and non-transferable.

Research on the functional brain is the search for transcendence and being in contact with the final reality, whatever that reality may be.
The brain ages and human genetics and genomes are involved in cellular aging.

Aging genetic expression is conditioned by the interaction with the environment.

Some genes have less expression after the age of 40: those with a major role in synaptic plasticity, vesicular transportation and mitochondrial function.

Genes that have damaged DNA resemble aging brains.

DNA damage can reduce gene expression in vulnerable genes which are involved in learning, memory, and neural survival—initiating an aging process in the brain early on in life.

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Loss of white matter increases after the sixth decade

- areas of fronto-polar, premotor and temporal association—12 and 15%
- hippocampus and parts of the amygdala—20-25%
- locus cerelus—20-40%
- black matter—50%

ALL OF THESE CHANGES REDUCE SYNAPTIC DENSITY

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Mesial temporal lobe which is essential to anterograde memory. Left: In Alzheimer’s Disease; Right: In a healthy elderly person.
Basal Ganglia are groups of neurons responsible for the initiation and integration of movement. With age, they begin to shine, due to an accumulation of iron. However, these changes do not appear to affect one’s health.
- Ratio between cerebral/cranial volume drops 20% (b/t sixth and seventh decade)
- Progressive neural loss in HIPPOCAMPUS
- Reduction in neural population in PUTAMEN and THALAMUS
- Gradual loss of CEREBRAL BLOOD FLOW

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Subarachnoid area is the region surrounding the brain. As the brain gets smaller, due to the gradual loss of neurons, this area increases in size to fill in the empty space.
Experience produces functional changes that can improve nervous system functioning.

However, cerebral self-regulation can deteriorate with age.

As we get older, we get wiser

• Other factors have adverse effects in the long-run:
  • uncontrolled hypertension
  • heart failure
  • smoking
According to different studies, the aforementioned conditions and aging can have a dual impact on the cerebral-vascular system.

Three of the most common neurological diagnoses in the elderly are Alzheimer’s, Parkinson’s and stroke.
5% of the over 65 population will be diagnosed as having a dementing disorder.

This percentage will increase to 10% in the over 80 population.

The most common diagnosis within the dementias is Alzheimer’s, affecting between 35% -- 50% of dementia cases; next is vascular dementia, which will be detected in 18% -- 13% of these cases.
- LINK BETWEEN AGING AND WEAKENING OF FUNCTIONAL ABILITY DUE TO NEUROLOGICAL CONDITIONS
  - Complex or instrumental activities are limited
  - Between ages of 65-69, 10% require assistance
  - In those aged 85+, 50% require assistance

- SOME SIMPLE ACTIVITIES OFTEN REMAIN INTACT
  - Daily life activities, like bathing, eating, walking, etc.
  - Intact in 89% of persons over 85

- THE BRAIN’S WEIGHT CHANGES WITH AGE
  - Decreases as of fifth decade
  - Loss of 2-3% of brain volume in following decades
  - 3 zones most affected by gyral atrophy
PERCENTAGE OF TRANSMISSION (T) OF DIFFERENT LIGHT WAVES BY HUMAN LENS AT DIFFERENT AGES, FROM 6 MONTHS TO AGE 82.
(DE LERMAN, S., J. GERONTOL., 38.295, 1983.)

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HEARING LOSS AT DIFFERENT AGES AT THE HIGHEST FREQUENCY –1 A 8 kHz. DATA FROM EIGHT SURVEYS PUBLISHED BY SPOOR AND CONVERTED TO ANSI 1969 BY LEBO AND REDDELL. (DE ORDY, J. M. AND BRISSEE, K.R., EDS., AGING, VOL 10, SENSORY SYSTEMS AND COMMUNICATIONS IN THE ELDERLY, RAVEN PRESS, NY, 1979, 156.)
WAIS FULL SCALE IQ MEAN SCORES FOR AGES 25-34 AND >75.

(DEKAUFMAN, A.S., ASSESSING ADOLESCENT AND ADULT INTELLIGENCE, ALLYN &BACON, BOSTON, 1990, 185.)
As we age, our vision deteriorates

More time is needed to identify complex visual stimuli

This decline could be due to the usual loss of visual discrimination

The elderly suffer a gradual deterioration of their sense of smell

The most significant decline is in identifying and remembering smells

Deterioration may be due to a decrease in the speed of cognitive processes
OTHER FACTORS AFFECTING MEMORY PROCESSES

Memory “Problems”

- Linked to neurological illness
  - Pathological Memory Disorders
- Linked to psychological and environmental factors
  - Functional problems due to depression / stress
- Linked to normal aging
  - “Normal” memory problems
CHANGES IN MEMORY ASSOCIATED WITH AGING

Causes are not clear

Physiological aging of the brain causes memory problems / affects memory processes

Genetic factors and lifestyle affect biological aging

Effects of aging differ among cognitive function

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WM is the volume of information available on the mental screen for information processing which reaches the senses simultaneously

- temporary activation of long-term memory network for a specific purpose

- if volume of available information is low, all other cognitive functions could be affected or delayed

- simultaneous storage, recovery and manipulation of processed information

- functional and long-term memory are part of the same system of cortical neural networks
IN THE ELDERLY, POOR PERFORMANCE IN DIFFERENT COGNITIVE TASKS HAS BEEN LINKED TO A RELATIVE DECREASE IN FUNCTIONAL MEMORY.

IN STUDIES ON PRIMARY MEMORY (short-term memory), THE CHANGES ARE LIMITED:

- STUDIES ON DIGIT AND WORD SPAN SHOWED INSIGNIFICANT DIFFERENCES ASSOCIATED WITH AGE

- ANNUAL STUDIES ON MEMORY AND OTHER COGNITIVE DOMAINS (USING NEUROPSYCHOLOGICA BATTERY) REVEALED DETERIORATION IN MEMORY FUNCTION OVER TIME, BUT NOT IN OTHER TASKS (SPEECH, VISUAL-SPATIAL ABILITY, ABSTRACT REASONING)

- DETERIORATION ASSOCIATED WITH AGING IS LIMITED TO SPECIFIC ASPECTS, LIKE ACQUISITION AND RECOVERY OF NEW INFORMATION
  - NOT RETENTION
SECONDARY MEMORY STORAGE AND AGING

SUBSTANTIAL CHANGES

TWO CAUSES DETERMINE LEVEL OF LOSS

TYPE OF MATERIAL TO RECALL

EVALUATION METHOD

GREATEST DECLINE IN FREE RECALL

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Prospective memory undergoes **general deterioration** during the aging process.

- Prospective abilities deteriorate with age.
- Problems **worsen due to an increase in memory load**, both in number of tasks and task content.
- Prospective memory functions within the context of continuous activities.
- The **level of commitment** required by the activity will determine what is remembered.
STUDIES REPORT THAT IMPLICIT MEMORY IS **MORE RESISTENT TO DETERIORATION** DURING NORMAL AGING

- IMPLICIT LEARNING ABILITIES **APPEAR BEFORE EXPLICIT MEMORY**

- THESE ABILITIES SHOW **LITTLE DETERIORATION IN ADULT LIFE**

- FUNCTION IN IMPLICIT PERCEPTION TASKS WAS **NORMAL IN OLDER ADULTS**

- IMPLICIT MEMORIES OCCUR **UNCONSCIOUSLY**

- **IN ACQUISITION, THIS DEFICIT APPEARS LIMITED WHEN CREATING NEW ASSOCIATIONS, WHICH REQUIRES CAPACITY**

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AUTHORS HAVE FOUND ASSOCIATION BETWEEN
- Physical Activity
- Age
- Cognitive/motor Functions

TO FIND WAYS TO
- Prevent
- Postpone
- Compensate

THE POSSIBLE DECLINE IN COGNITIVE FUNCTIONS DUE TO AGING
Thank you very much.

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