Physiology of Aging & Changes in Brain

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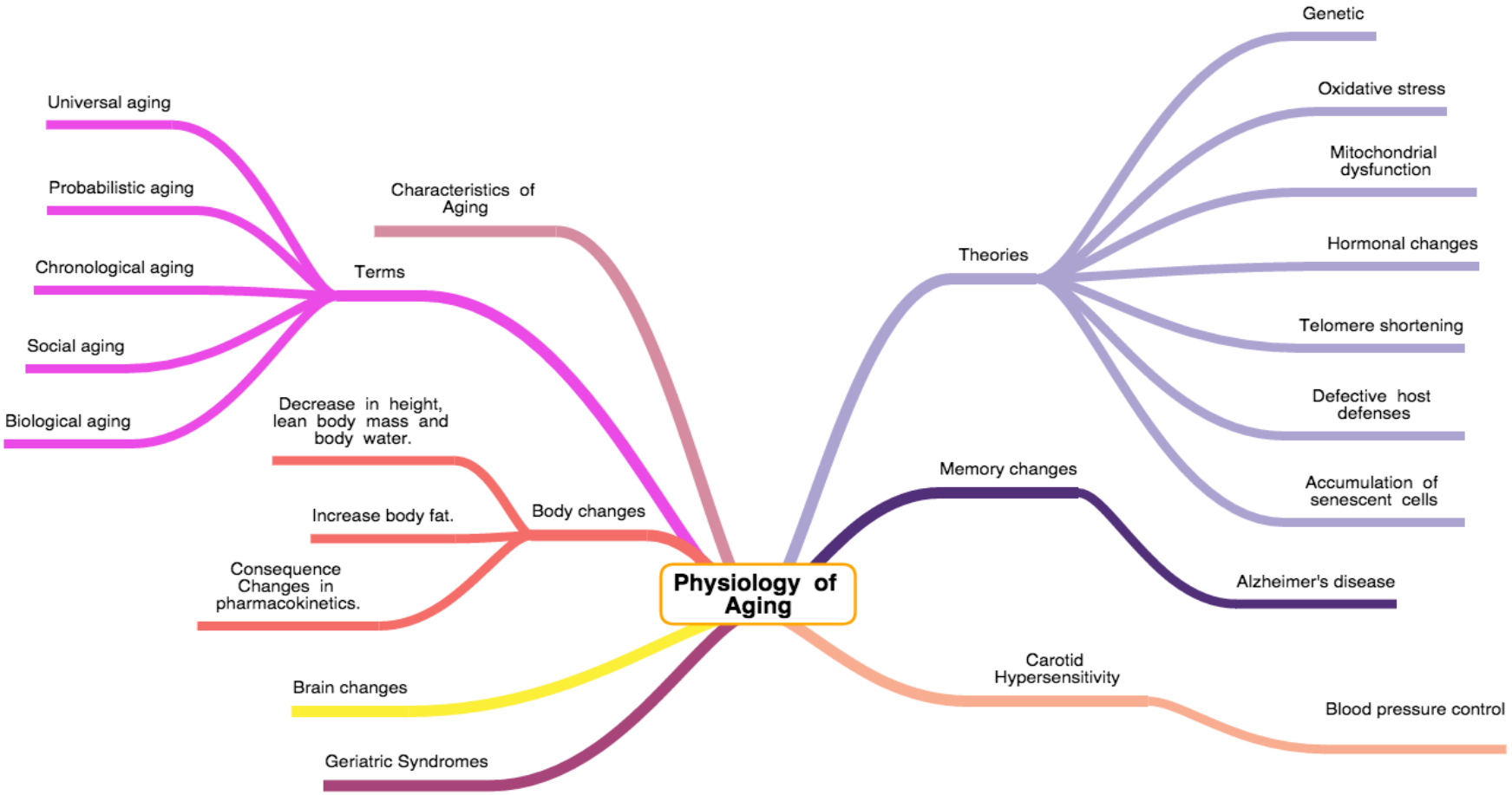
Please check out this link before viewing the file to know if there are any additions/changes or corrections. The same link will be used for all of our work Physiology Edit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What is Aging?

Aging is the progressive, universal decline first in functional reserve and then in function that occurs in organisms over time

A part of an organs function is being used.

e.g. Kidneys.

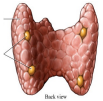
The whole function is lost.

- ✧ Aging is Not a disease.
- ✓ The Risk of developing diseases when aging is increased.

Characteristics of Aging

Changes in appearance
(Loss of muscle tone & bone mass = gradual reduction in height & weight)

↓ Exercise performance, & multiple endocrine changes.



↓ Metabolic rate

↑ Reaction time

↓ Audition, olfaction, & vision.

↓ Kidney, pulmonary, & immune functions

↓ In certain memory functions

↓ Sexual activity & menopausal woman.

Aging Terms:

Universal Aging:
Changes everybody shares.

e.g. Grey hair and wrinkles

Probabilistic Aging:
Changes that may happen to some.

e.g. Having type two diabetes.

Chronological Aging:
Degrees of aging
(how old a person is).

Social Aging:

society's expectations of a persons behavior when they grow older

مثل في بعض المجتماعات الحرمة إذا صارت جدّة بغض النظر عن عمرها خلاص تعتبر كبيرة ويفترض تتصرف مثل العجايز.

Biological Aging:

Physical state of a person when he ages.

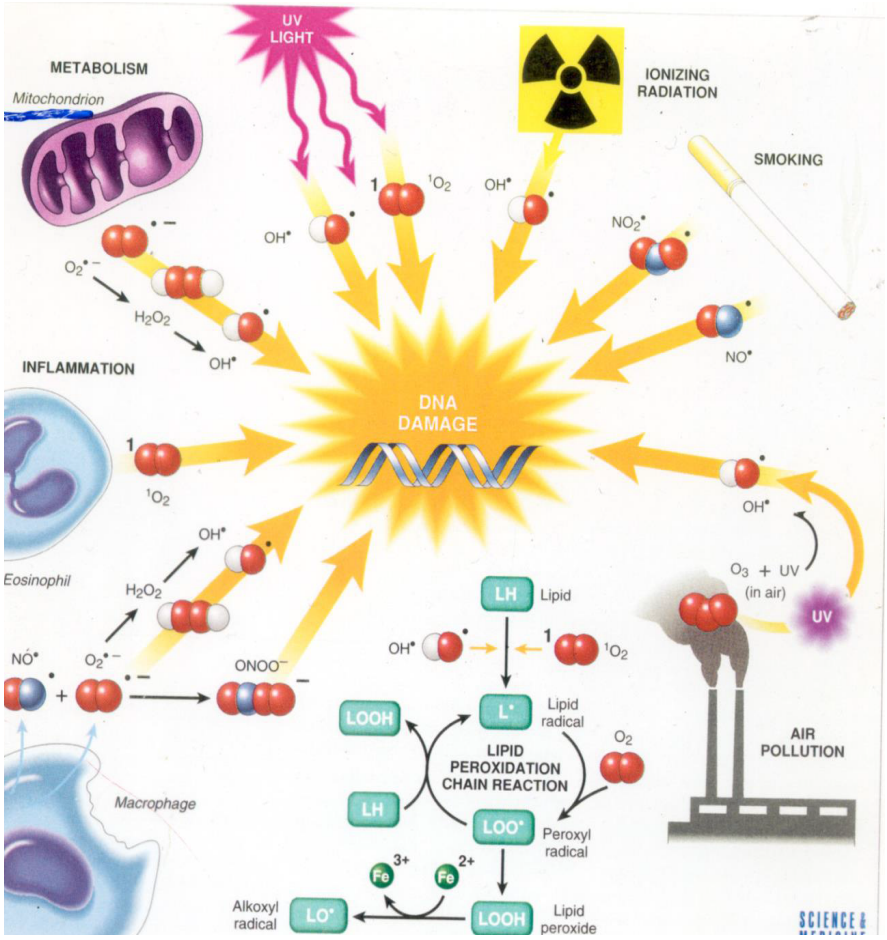
Aging Theories No facts about aging

Hypothesis	How It May Work
Genetic	Aging is a genetic program activated in post-reproductive life when an individual's evolutionary mission is accomplished
Oxidative Stress Most Famous Theory	Accumulation of oxidative damage to DNA, proteins, and lipids interferes with normal function and produces a decrease in stress responses
Mitochondrial Dysfunction	A common deletion in mitochondrial DNA with age compromises function and alters cell metabolic processes and adaptability to environmental change.
Hormonal Changes	The decline and loss of circadian rhythm in secretion of some hormones produces a functional hormone deficiency state
Telomere[1] Shortening	Aging is related to a decline in the ability of cells to replicate.
Defective Host Defenses	The failure of the immune system to respond to infectious agents create vulnerability to Infection.
Accumulation of Senescent Cells	Renewing tissues become dysfunctional through loss of ability to renew.

1: is a region of repetitive nucleotide sequences at each end of a chromatid, which protects the end of the chromosome from deterioration or from fusion with neighboring chromosomes.

OXYGEN -free radicals (FR) and reactive oxygen species (ROS) resources which cause DNA Damage:

1) Cell metabolism.
2) Environment. (Radiation)
3) Lifestyle. (Smoking)
4) Pollution. (Air pollution)
5) Diet. (Fast food)
6) Infection.

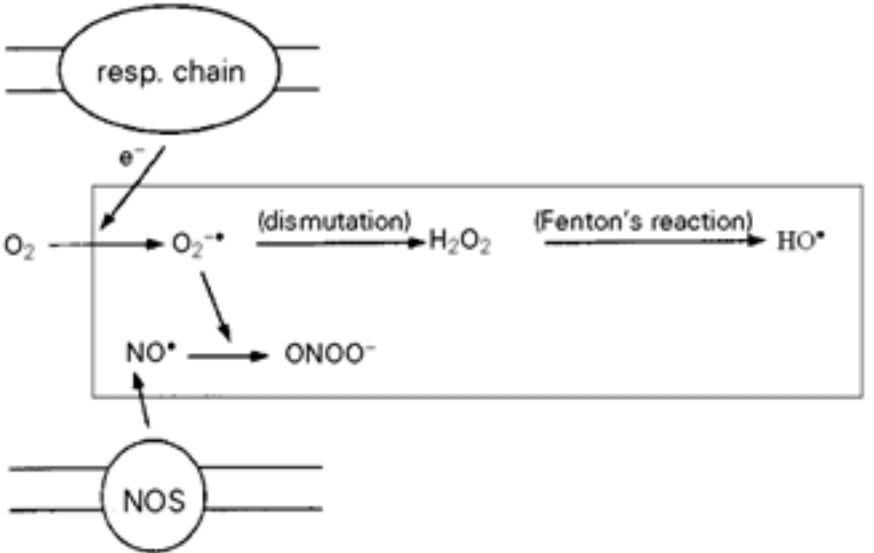


Mitochondria produce ROS:

#The Respiratory chain → produce → **Superoxide radical (O_2^-)** → To generates → **Hydrogen peroxide (H_2O_2) & Hydroxyl radicals (OH^-)**

#Nitric oxide synthesis (NOS) → produce → **Nitric oxide (NO^-)** → Combines with → **Superoxide radical (O_2^-)** → To generates → **peroxinitrite (ONOO-).**

All these ROS may cause mitochondrial and cellular damage if present in excess.



Molecules damaged

- Protein thiol oxidation - MPT
- Lipid oxidation
- DNA oxidation
- Respiratory impairment
- Oxidation of extra-mitochondrial components

Mitochondrial permeability transition.

Nobody now is saying How to prevent aging we just want it to be successful.. على الأقل الواحد يكبر ويستمتع بحياته

Successful Ageing:

Happens if their was:

- ✓ Active engagement with life.
- ✓ Low probability of a disease or disability.
- ✓ High cognitive & physical function capacity.

Age related changes:

1- ↓ Height, lean body mass and body water.

2- ↑ Body fat.

3-Consequence Changes in pharmacokinetics.
(The dose of drug has a special measure for old people).

Leading causes of death age 65+ "Medical diagnosis":

Heart diseases	**32%**
Cancer	22%
Stroke	8%
Chronic respiratory	6%
Flu/Pneumonia	3%
Diabetes	3%
Alzheimer's	3%

Aging Nervous System

Changes

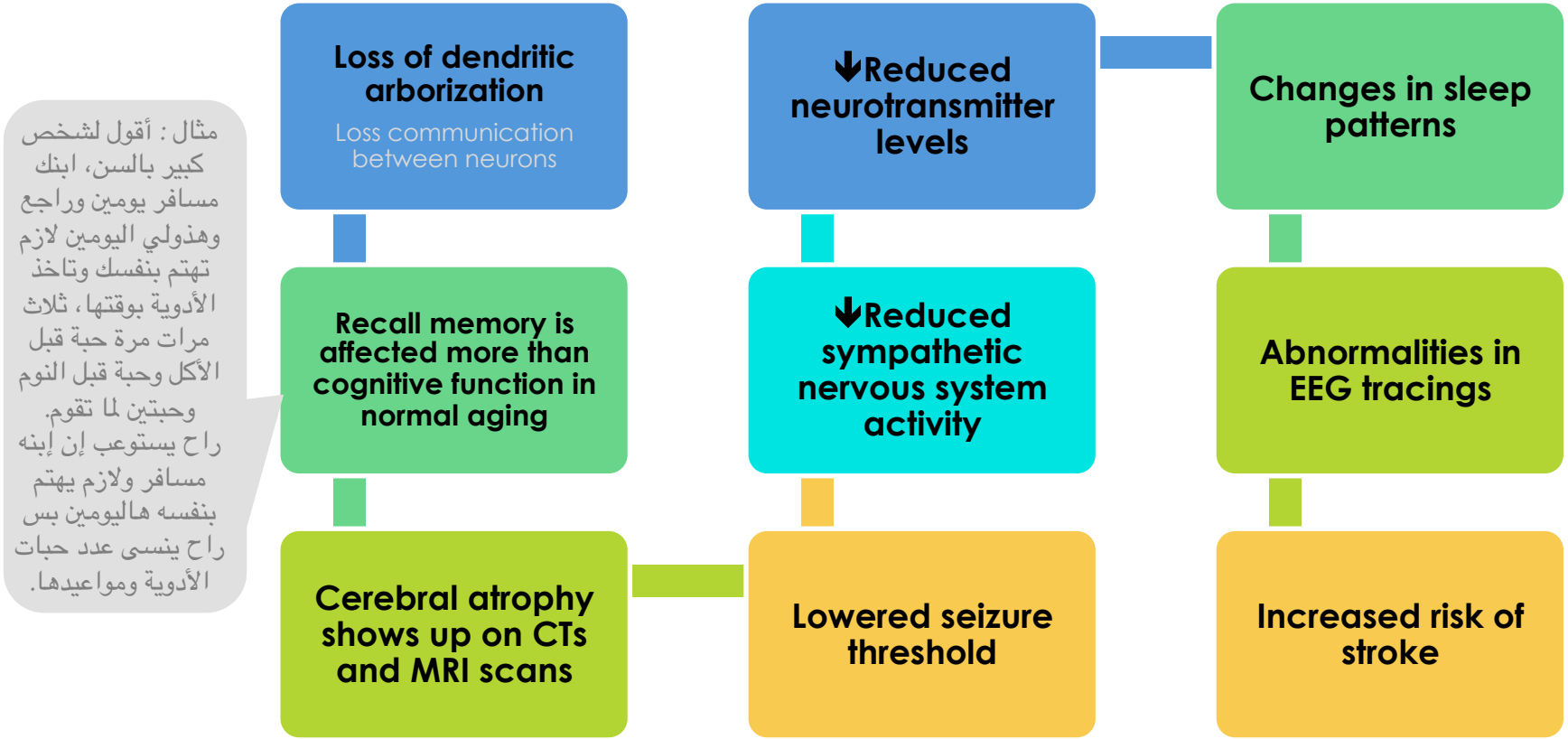
- Decreased brain weight
- ⬇Cerebral blood flow
- ⬇Memory
- Alteration in CNS neurotransmitters
- Decreased vibratory sense

Consequences

- Drug toxicities
- delirium
- Altered mood
- Decreased IQ scores
- "Benign senile forgetfulness" (memory loss due to old age not illness)
- Increased postural instability
- Altered gait
- Falls, accidents

Neurological System in Old Age

Neuronal loss is normal in the aging brain but the ability to learn remains generally unchanged (أطلبوا العلم من المهد إلى اللحد)



Nervous System in Old Age

Increased cerebral amyloid (an a abnormal proteins) in tangles and plaques

Average amount of brain protein is reduced with a marked loss in multiple enzymes (carbonic anhydrase and the dehydrogenases)

Aging leads to :

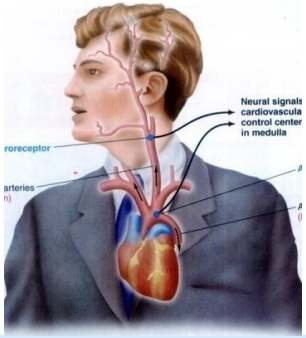
Loss of RNA (messenger and transcription) but not DNA

Loss of lipids, and lipid turnover rate, and a decrease in catabolism and synthesis.

Carotid Sinus Hypersensitivity **also called** Carotid sinus syndrome

an exaggerated vagal response to carotid sinus stimulation

- ✧ **Occurs in the elderly and mainly results in bradycardia.**
- ✧ **Most common etiologies of atrioventricular block .**
- ✧ **Provoked by 1) Wearing a tight collar 2) Looking upwards 3) Turning the head**
- ✧ **Do not massage both carotids simultaneously.**



Pressure on the carotid sinus

Produced by the tight collar or carotid massage

Marked bradycardia

Vasodilatation

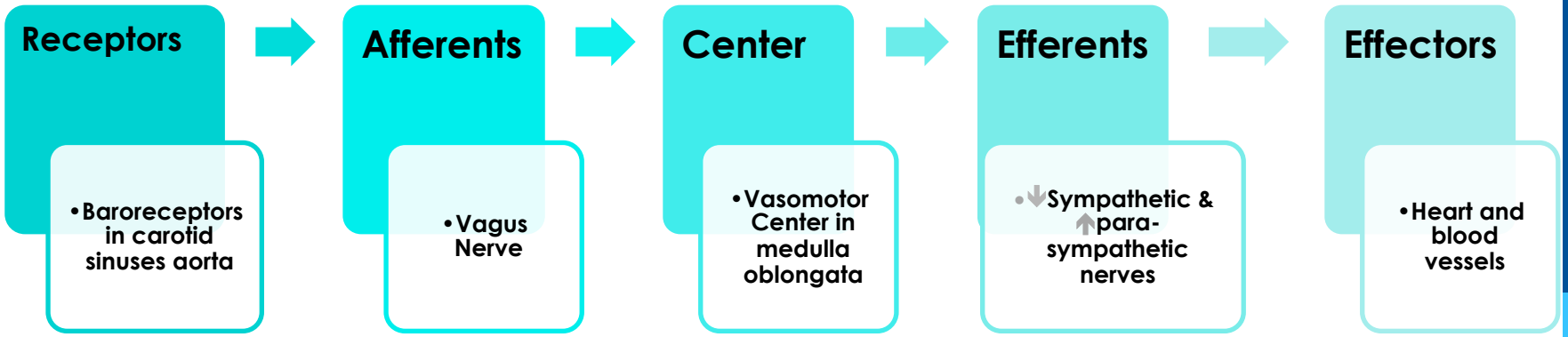
Fainting or syncope can be caused

Control of Blood Pressure

A) Short-term Control (Rapid) by Baroreceptor reflex.
B) Long-term Control by Renal compensation.

- **Baroreceptor reflex:**

1) Quick operation (within few seconds) 2) Mediated through autonomic nerves
3) Adjusts CO & TRP to restore BP to normal 4) Influences heart & blood vessels



Sensorineural Hearing Loss

✧ **Damage to the hair cells of the organ of Corti**

✧ May be caused by:

✓ Intense noise.
✓ Viral infections.
✓ Ototoxic drugs (e.g., salicylates, quinine and its synthetic analogues, aminoglycoside antibiotics, loop diuretics such as furosemide and ethacrynic acid, and cancer chemotherapeutic agents such as cisplatin).
✓ Fractures of the temporal bone
✓ Meningitis
✓ Cochlear otosclerosis
✓ Ménière's disease a disorder of the inner ear that causes spontaneous episodes of vertigo
✓ **Aging**

Disorders of the Sense of Taste

✧ Disorders of the sense of taste are caused by:

✓ Transport loss
✓ Sensory loss
✓ Neural loss

✧ Sensory gustatory losses are caused by:

✓ Inflammatory and degenerative diseases in The oral cavity
✓ Drugs particularly those that interfere with cell turnover (e.g., antithyroid and antineoplastic agents)
✓ Radiation therapy to the oral cavity and pharynx
✓ Viral infections
✓ Endocrine disorders
✓ Neoplasms
✓ **Aging**

Geriatric الشيخوخة Syndromes:

- Dementia and Delirium
- Falls
- Urinary Incontinence
- Pressure Ulcers
- Functional Decline

Dementia & Delirium

- **Dementia** is a syndrome of progressive decline in which multiple intellectual abilities deteriorate, causing both cognitive and functional impairment.
- **Delirium** is an acute state of confusion, may be the only manifestation of a life-threatening illness in the older adult.

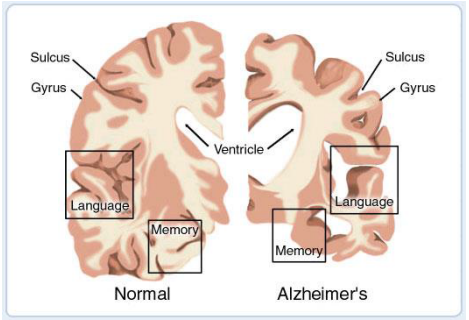
Sexual Dysfunction

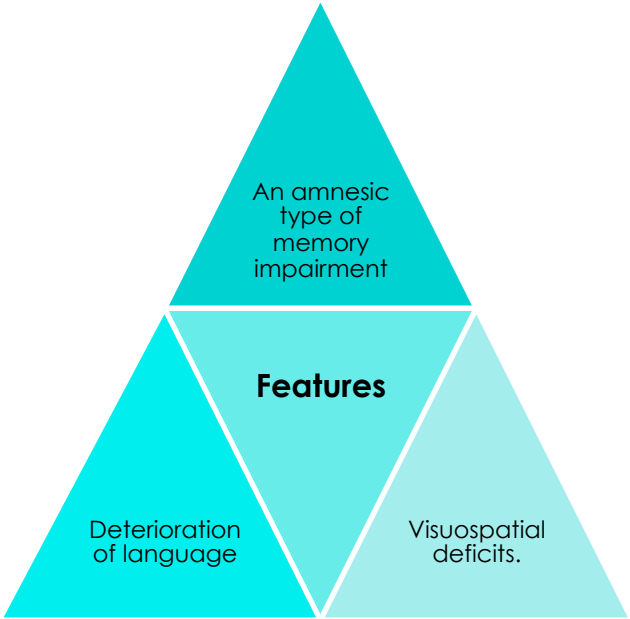
Erectile dysfunction (ED) is not considered a normal part of the aging process. Nonetheless, it is associated with certain physiologic and psychological changes related to age.

In the Massachusetts Male Aging Study (MMAS), a community-based survey of men between the ages of 40 and 70, 52% of responders reported some degree of ED. Complete ED occurred in 10% of respondents, moderate ED occurred in 25%, and minimal ED in 17%

Alzheimer's Disease

Premature aging of the brain, usually beginning in mid-adult life and progressing rapidly to extreme loss of mental powers similar to that seen in very, very old age.



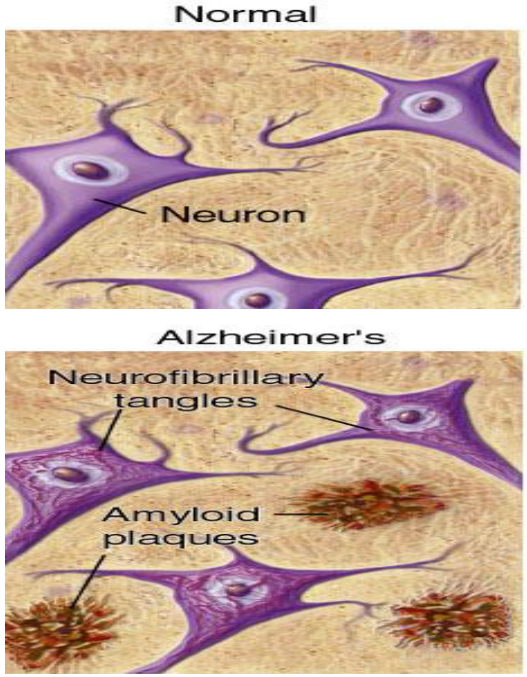


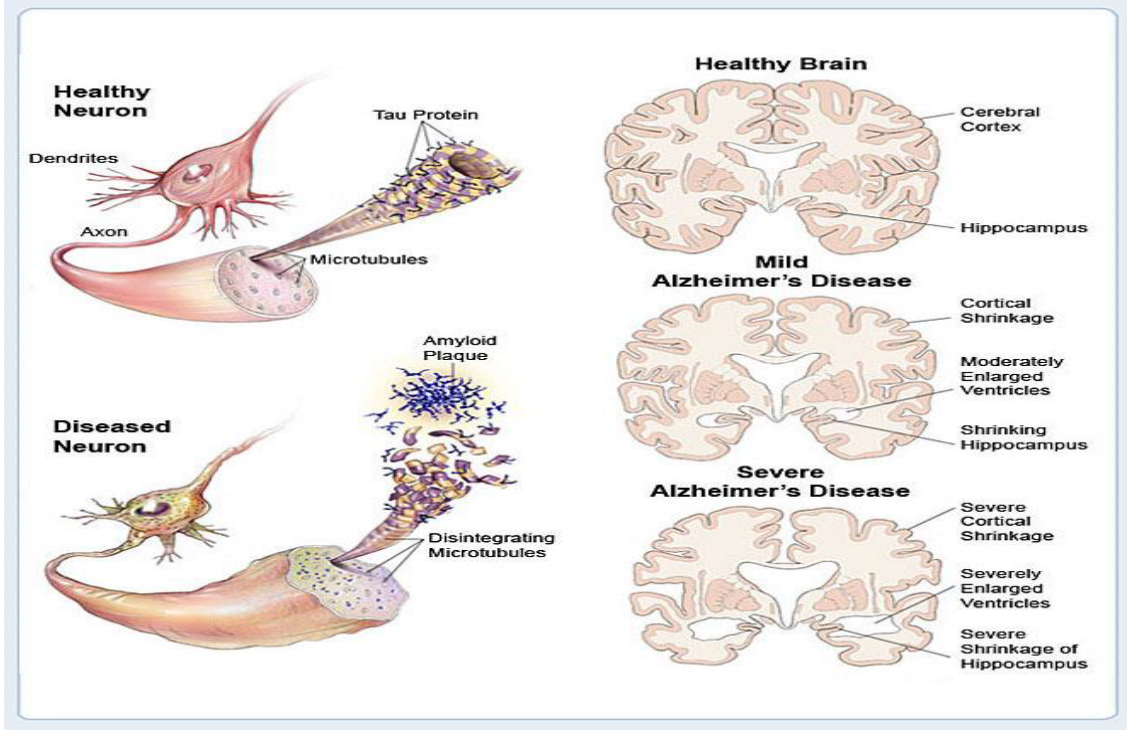
Neurofibrillary Tangles

These are insoluble twisted fibers found inside the brain's cells. • Consist primarily of a protein called tau, which forms part of a structure called a microtubule. The microtubule helps transport nutrients and other important substances from one part of the nerve cell to another.

In Alzheimer's disease, however, the tau protein is abnormal and the microtubule structures collapse.

Motor and sensory abnormalities, gait disturbances, and seizures are uncommon until the late phases of the disease.





Amyloid Plaques

It is hallmark of Alzheimer's disease

- There is accumulation of amyloid plaques between nerve cells (neurons) in the brain.
- Amyloid is a general term for protein fragments that the body produces normally.
- Beta amyloid is a protein fragment snipped from an amyloid precursor protein (APP).
- In a healthy brain, these protein fragments are broken down and eliminated. In Alzheimer's disease, the fragments accumulate to form hard, insoluble plaques.

1-Which one of the following is Not a characteristic of Aging?

A. Decrease in reaction time.
B. Changes in appearance.
C. Decrease in metabolism rate.
D. Decline in certain memory functions.

2- Type two diabetes is related to which term of aging?

A. Social aging.
B. Universal aging.
C. Probabilistic aging.
D. Biological aging.

3-One of the leading causes of death in aging is?

A. Cancer.
B. Stroke.
C. Alzheimer's.
D. Heart diseases.

4-Aging in lead to loss of all the following EXCEPT?

A. increased cerebral amyloid in tangles and plaques.
B. Loss of DNA.
C. marked loss in multiple enzymes.
D. Loss of lipids, and lipid turnover rate

5-"Benign senile forgetfulness" is a result of which of the following:

A. Alzheimer's
B. Dementia
C. Old age
D. None of the above

6-which one of the following is a hallmark for Alzheimer's ?

A. Amyloid plaques
B. Dementia
C. Delirium
D. Neurofibrillary Tangles

1.A
2.C
3.D
4.B
5.C
6.A

MCQs

1-Successeful aging occurs by having what?

1) Active engagement with life. 2) Low probability of a disease or disability. 3) High cognitive & physical function capacity.

2-What are the Body changes that happen when a person age?

1)Decrease height, lean body mass and body water. 2)Increase body fat. 3) Consequence Changes in pharmacokinetics.

3- Two enzymes that are markedly lost in the nervous system due to aging are?

Carbonic anhydrase and the dehydrogenases

4- name three of the changes in the nervous system that happens with aging?

1) loss of memory 2) Decreased cerebral blood flow 3) Decreased brain weight

5- Carotid sinus hypersensitivity can be produced by?

The tight collar or carotid massage causing pressure on the carotid sinuses.

6- what's the difference between beta-amyloid protein in a healthy brain and in an Alzheimer's patient ?

In a healthy brain, these protein fragments are broken down and eliminated. In Alzheimer's disease, the fragments accumulate to form hard, insoluble plaques.

THANK YOU FOR CHECKING OUR WORK!

BEST OF LUCK

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