22 Physiology of aging

CNS

Sources:
Female slides

Objective :

1) Definition of Aging

2) Theories and terms Used

3) Body Changes in Aging

4) Brain Changes in Aging

5) Memory Changes in Aging

6) Carotid Hypersensitivity

Aging

- Aging is the progressive, universal decline first in **functional reserve** and then in **function** that occurs in organisms over time
- ***Aging is not a disease;*** *however, the* ***risk*** *of developing disease is increased, often dramatically, as a function of age.*

Characterized by

- Changes in appearance **(**gradual reduction in height and weight loss due to loss of muscle & bone mass**)**.
- A lower metabolic rate.
- Longer reaction times.
- Declines in certain memory functions.
- Declines in sexual activity and in women menopause.
- A functional decline in audition, olfaction, and vision.
- Declines in kidney, pulmonary, and immune functions, declines in exercise performance, and multiple endocrine changes.

(Craik and Salthouse, 1992; Hayflick, 1994, pp. 137-186; Spence, 1995

Terms of aging

The term **"ageing"** is somewhat ambiguous.

- UNIVERSAL AGEING:

age changes that all people share.

- PROBABILISTIC AGEING:

age changes that may happen to some, but not all people as they grow older,

such as the onset of type two diabetes.

- CHRONOLOGICAL AGEING:

referring to how old a person. chronological age does not correlate perfectly with functional age, **i.e.** two people may be of the same age, but differ in their mental and physical capacities.

- SOCIAL AGEING:

society's expectations of how people should act as they grow older.

- BIOLOGICAL AGEING:

an organism's physical state as it ages.

There is also a distinction between:

- proximal ageing:

age-based effects that come about because of factors in the recent past.

- distal ageing:

age-based differences that can be traced back to a cause early in person's life, **such as** childhood poliomyelitis.

Some theories of aging

Hypothesis	How it may work
Genetic	Is a genetic program activated in post-reproductive life, when individual's evolutionary mission is accomplished.
Oxidative stress	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 of mitochondrial DNA with age compromises function and alters 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 shortening	Aging is related to a decline in the ability of cells to replicate.
Defective host defenses	The failure of immune system to responds to infectious agents, create vulnerability to infections.
Accumulation of senescent cells	Renewing tissues become dysfunctional through loss of ability to renew.

SUCCESSFUL AGEING

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

Medical diagnosis - leading causes of death age +65:

- **Heart Disease 32% .**
- Cancer
- Stroke
- Chronic respiratory Flu/Pneumonia
- Diabetes
- Alzheimer's

State of Aging and Health CDC/NCHS Health US, 2002

Age related changes

-Decreased height, lean body mass and body water

-Increased body fat

→ Consequence Changes in pharmacokinetics

Aging nervous system

Changes	consequences
-Decreased brain weight.	Drug toxicities
-Decreased Cerebral blood flow.	delirium
-Decreased memory.	Altered mood
-Alteration in CNS neurotransmitters.	Decreased IQ scores
-Decreased vibratory sense.	Benign senile forgetfulness
	Increased postural instability
	Altered gait
	Falls, accidents

Extra information

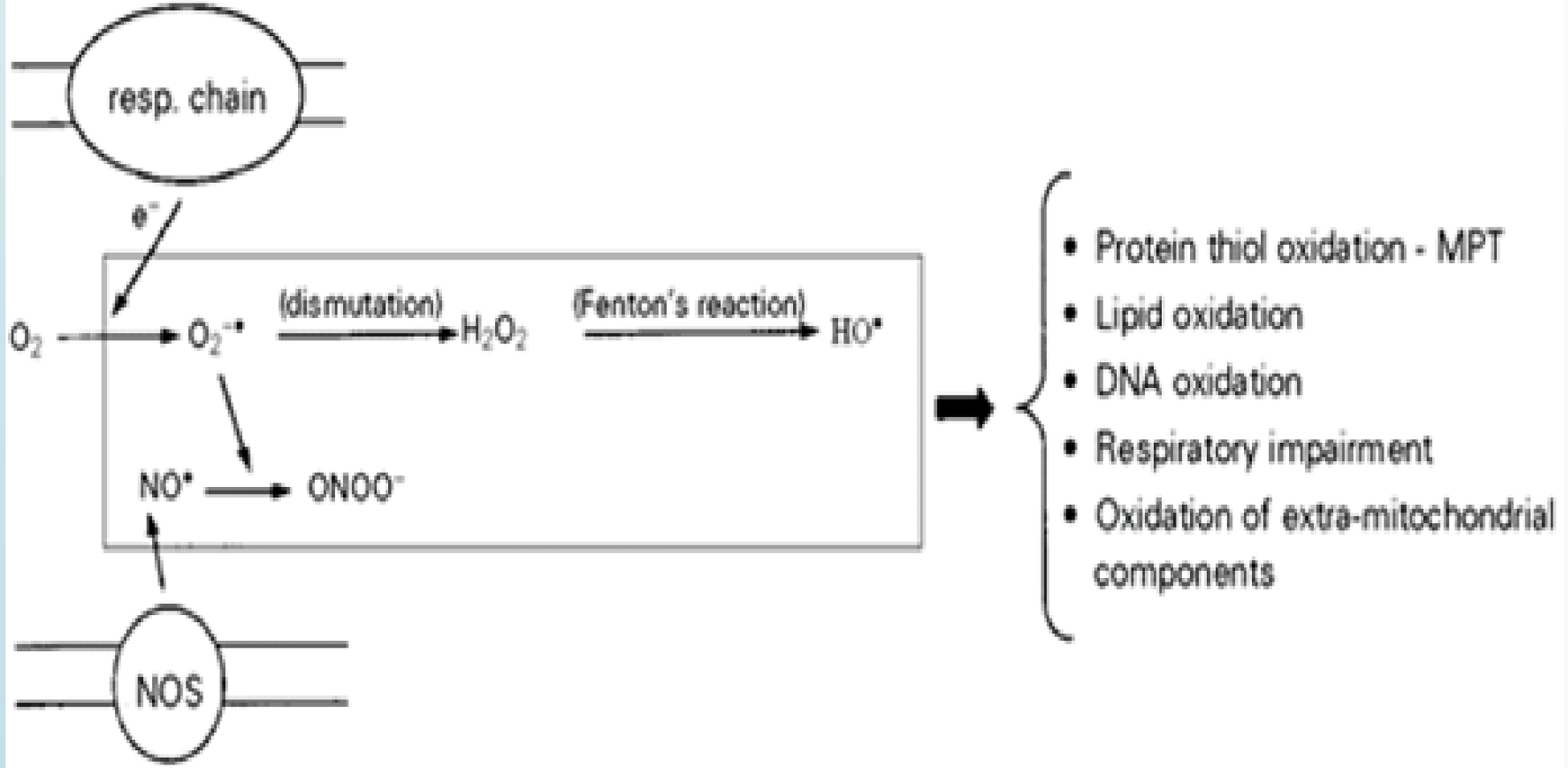
Oxygen free radicals and reactive oxygen species

They come from many sources:
- Cell metabolism.
- environment.
- Lifestyle.
- infections.
- diet.
- pollution.

The respiratory chain (resp. chain) produces **superoxide radicals ($O_2^{-\cdot}$),** which generate **hydrogen peroxide (H_2O_2)** and **hydroxyl radicals ($HO^{\cdot}$)**. Mitochondrial **nitric oxide synthase (NOS)** produces **nitric oxide ($NO^{\cdot}$)**, which combines with $O_2^{-\cdot}$ to generate **peroxinitrite ($ONOO^-$)**. All these ROS may cause mitochondrial and cellular damage if present in excess. MPT, Mitochondrial permeability transition.

(Kowaltowski 2002).

-**hydroxyl radical** and **peroxinitrite** are highly toxic.



Nervous System

1*Aging leads to increased cerebral amyloid

2*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).

3* Average amount of brain protein is reduced with a marked loss in multiple enzymes (carbonic anhydrase and the dehydrogenases) but with a relative *increase in abnormal proteins such as amyloid in tangles and plaques.

4* Loss of RNA (messenger and transcription) but not DNA.

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

**Note: amyloid :(accumulate in brain tissue of older people with normal aging in normal way but in young people amyloid protein when it is produce in the body is not accumulate because their body Get rid of it by one way or another).

Neurological System

1*Neuronal loss is normal in the aging brain but the ability to learn remains generally unchanged.
(because cognitive function still)

2*There is loss of dendritic arborization
(means decrease of communication between dendrites lead of many integration and coordination affected)

3*Recall memory is affected more than cognitive function in normal aging
(difficulties in remember but the still know how choose, understanding and take decision)

4*Cerebral atrophy shows up on CTs and MRI scans
(the brain of aging person smaller then adult person)

5*Lowered seizure threshold
(risk for aging person high for convulsion)

6*Reduced Sympathetic nervous system activity

7*Reduced Neurotransmitter levels

8*Changes in sleep patterns
(for some aging people the may have anosmia in night or they so sleepy in morning)

9*abnormalities in EEG tracings

10*Increased risk of stroke

Carotid sinus hypersensitivity

(may happen with aging)

1) Carotid sinus syncope occurs when there is an exaggerated vagal response to carotid sinus stimulation,*1

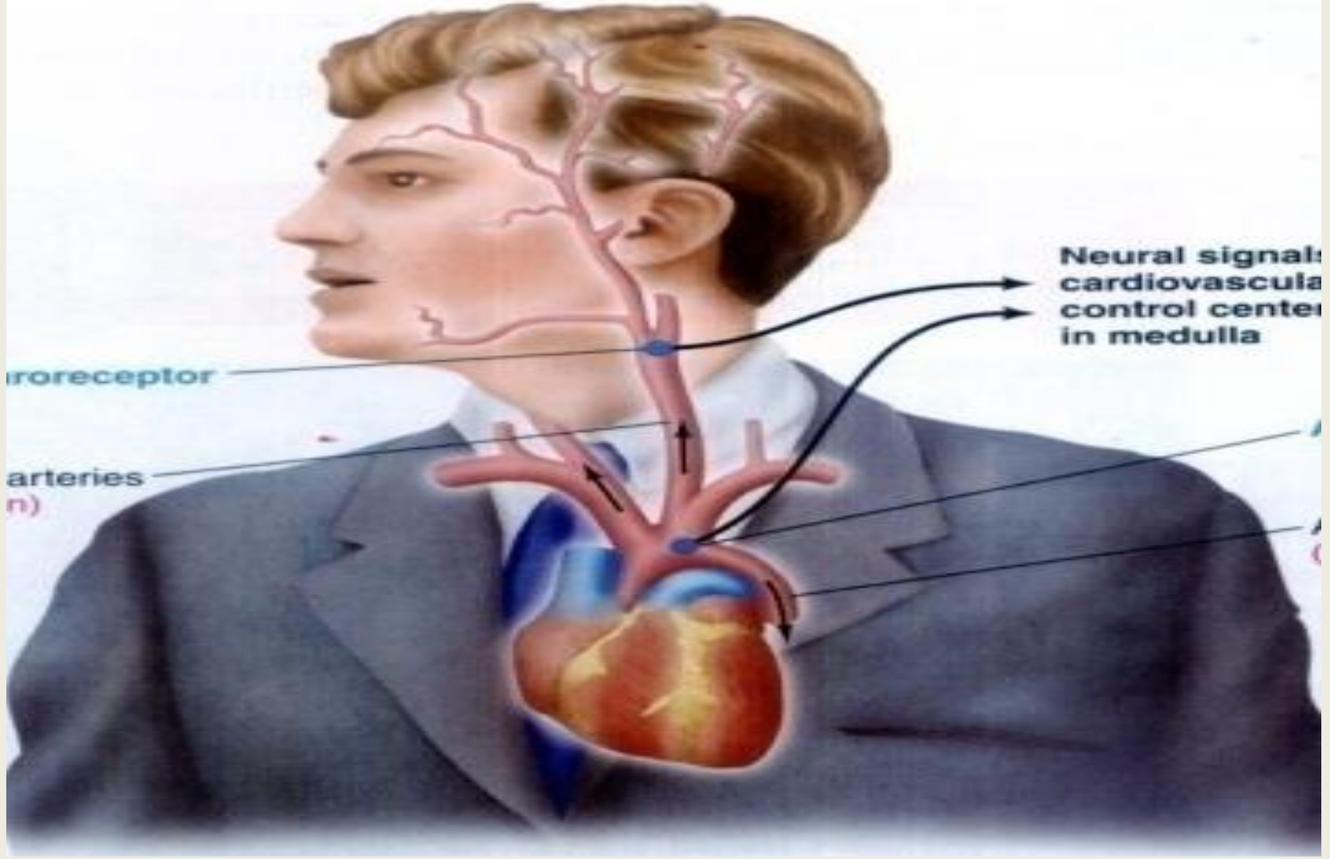
2)Provoked by wearing a tight collar, looking upwards or turning the head

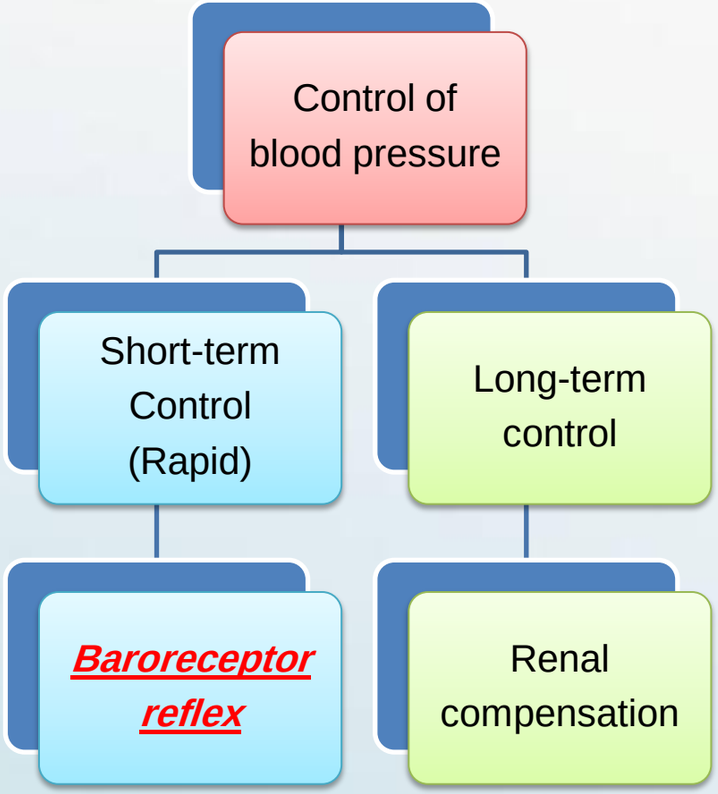
3) Carotid sinus syndrome occurs in the elderly and mainly results in bradycardia and hypotension .

4) Most common etiologies of atrioventricular block

5) Do not massage both carotids simultaneously.

1) (there are main receptors ((baroreceptor and chemoreceptor))to receive the sensation of stimulus on carotid sinus).





Baroreceptor Reflex

Quick operation (within few Seconds (correction any change in BP)	Mediated through autonomic nerves	Influences heart & blood vessels	Adjusts CO &TPR to restore BP to normal

Baroreceptor Reflex Arc

Receptors	• Baroreceptors in carotid sinuses, aorta
Afferents	• Vagus Nerve
Center	• Vasomotor Center in medulla oblongata
Efferents	• Sympathetic & parasympathetic nerves
Effectors	• Heart and blood vessels

Pressure on the carotid sinus, produced by the tight collar or carotid massage

Can cause :

vasodilatation

marked bradycardia	Fainting or syncope

Sensory neural 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 (see above), Ménière's disease, and aging.

Disorders of the Sense of Taste:

Disorders of the sense of taste are caused by

****sensory loss(degeneration of test buds).***

• transport loss.

**** neural loss.***

Sensory gustatory losses are caused by inflammatory and degenerative diseases in the oral cavity; a vast number of drugs, particularly those that interfere with cell turnover such as anti -thyroid and anti-neoplastic agents; radiation therapy to the oral cavity and pharynx; viral infections; endocrine disorders; neoplasms; and aging

Vision: Extra information

- Loss of ability to see items that are close up begins in the 40's (Presbyopia)
- Size of pupil grows smaller with age: focusing becomes less accurate
- Lens of eye yellows making it more difficult to see red and green colors
- Sensitivity to glare increases
- Night vision not as acute

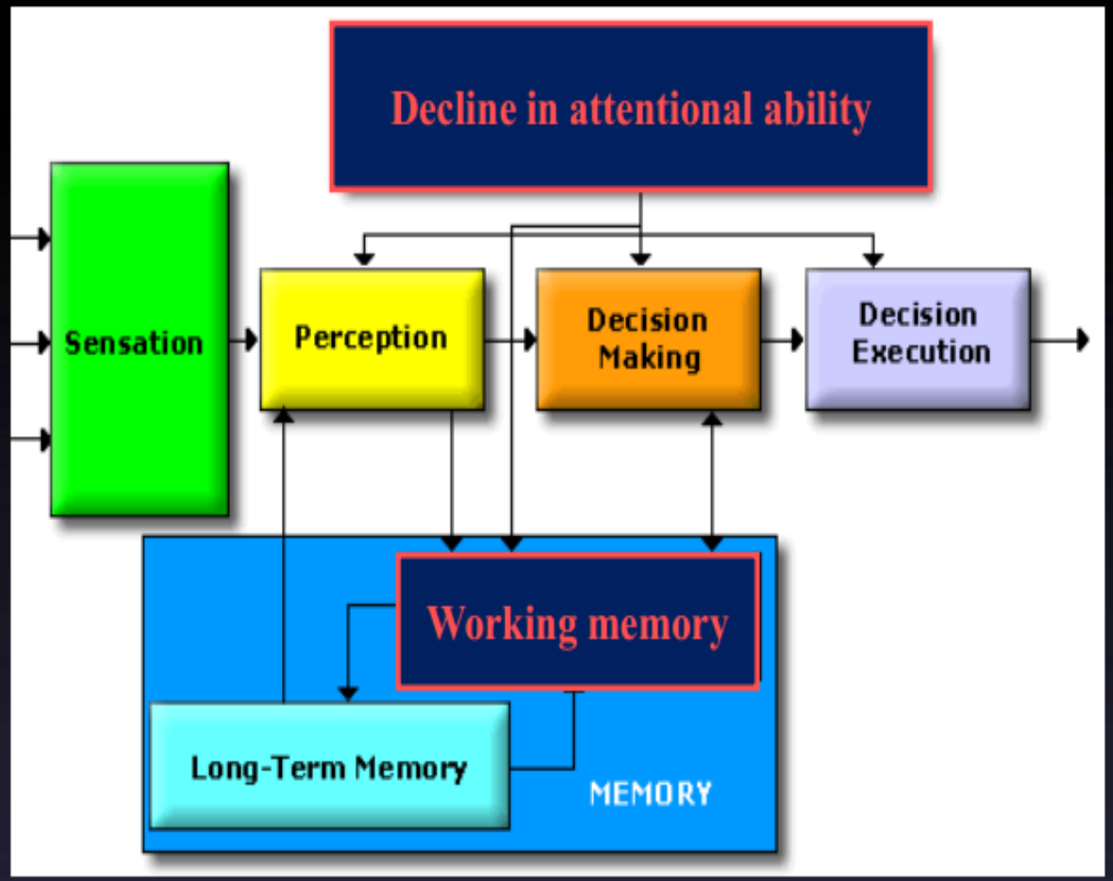
Pain and Sense of Touch: Extra information

With age, skin is not as sensitive as in youth
– Contributing factors include:
1. Loss of elasticity
2. Loss of pigment
3. Reduced fat layer

- Safety Implications:

1. Lessened ability to recognize dangerous levels of heat
2. Lessened ability of body to maintain temperature
3. Tendency to develop bruises, skin tears more easily

CONGITIVE CHANGES IN AGING: MENTAL PROCESSING



There is decline in mental processing via reduction of attentional ability and decline in ability in forming working memory (mainly includes short term memory)
There is decline in explicit memory that involves hippocampus (surroudings & Skills)

Geriatric Syndromes:

* *Dementia and Delirium.*
* *Falls.*
* *Urinary Incontinence.*
* *Pressure Ulcers.*
* *Functional Decline.*

Dementia and Delirium

Dementia : (irreversible)is a syndrome of progressive decline in which multiple intellectual abilities deteriorate, causing both (cognitive and functional impairment*1).

1)Problem in save information and interpretation and use it. also All mental function are loss or decrease so he or she can not take decision and Judgment.

Delirium : is an acute state (reversible)of confusion

Delirium may be the only manifestation of a life-threatening *1 illness in the older adult.

1) Life threatening because it is one of manifestation if blood flow is affected by thrombosis or any thing ales (lead to infraction and stroke)

Alzheimer's Disease

Alzheimer's disease is defined as premature aging of the brain, usually beginning in mid-adult (40-50 years old)life and progressing rapidly to extreme loss of mental powers
similar to that seen in very, very old age.

Alzheimer's Disease (Features):

(1) an amnesic type of memory impairment

(2) deterioration of language

(3) visuospatial deficits.

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

1) Amyloid Plaques:

It is hallmark of Alzheimer's disease

There is accumulation of amyloid plaques between nerve cells (neurons) in the brain.

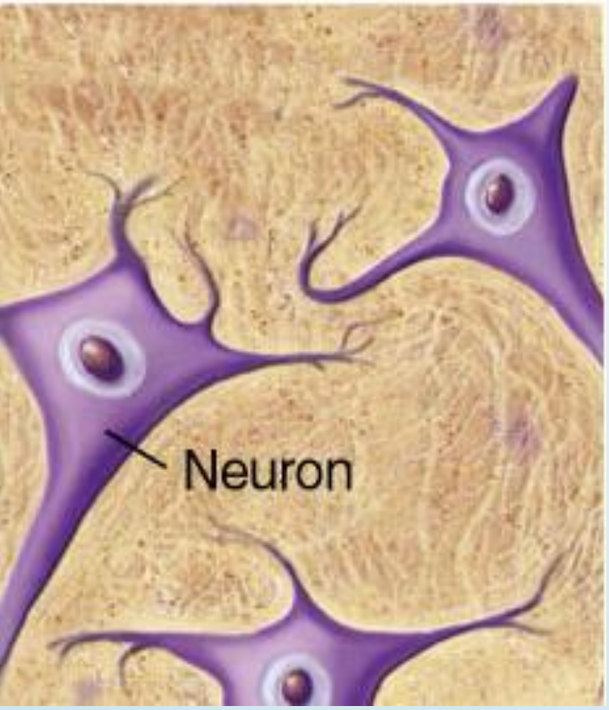
In a healthy brain, these protein fragments are broken down and eliminated. In Alzheimer's disease, the fragments accumulate to form hard, insoluble plaques.

2) Neurofibrillary Tangles:

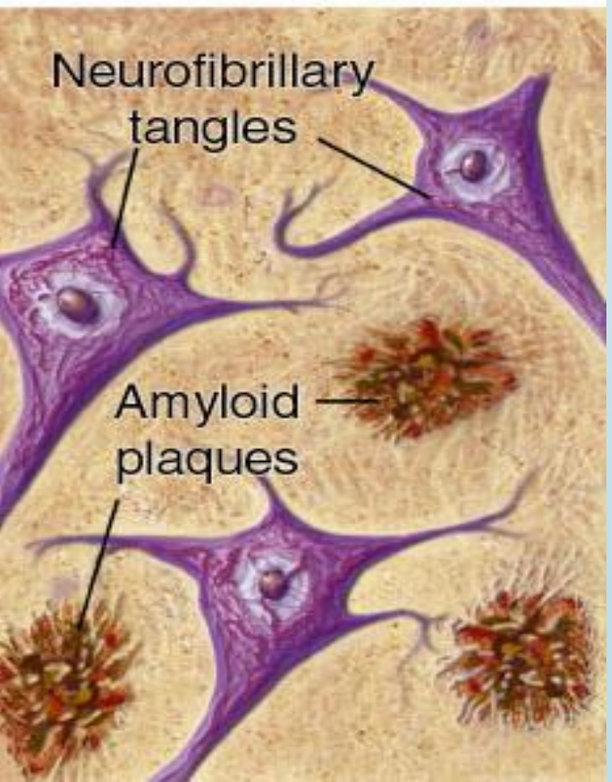
These are insoluble twisted fibers found inside the brain's cells. Consist primarily of a protein called tau, which forms part of a structure called a microtubule. The microtubule helps transport nutrients and other important substances from one part of the nerve cell to another.

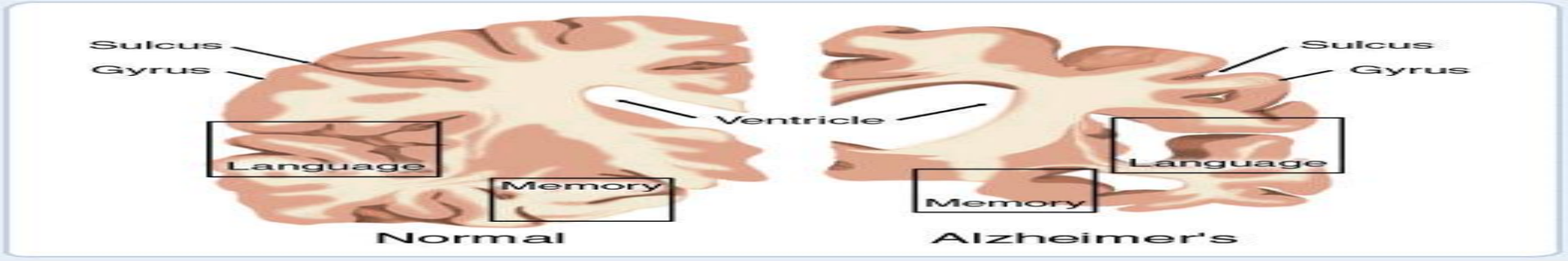
In Alzheimer's disease, however, the tau protein is abnormal and the microtubule structures collapse.

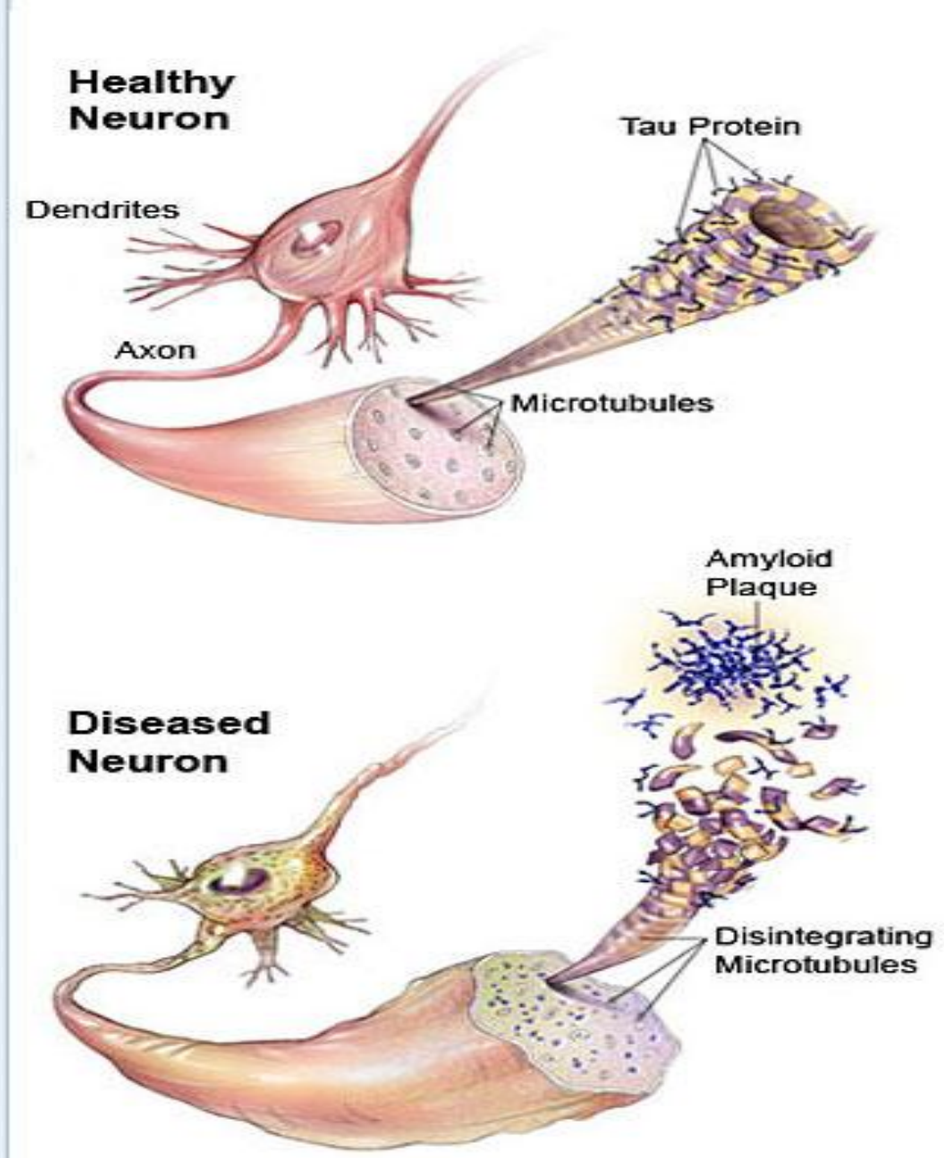
Normal

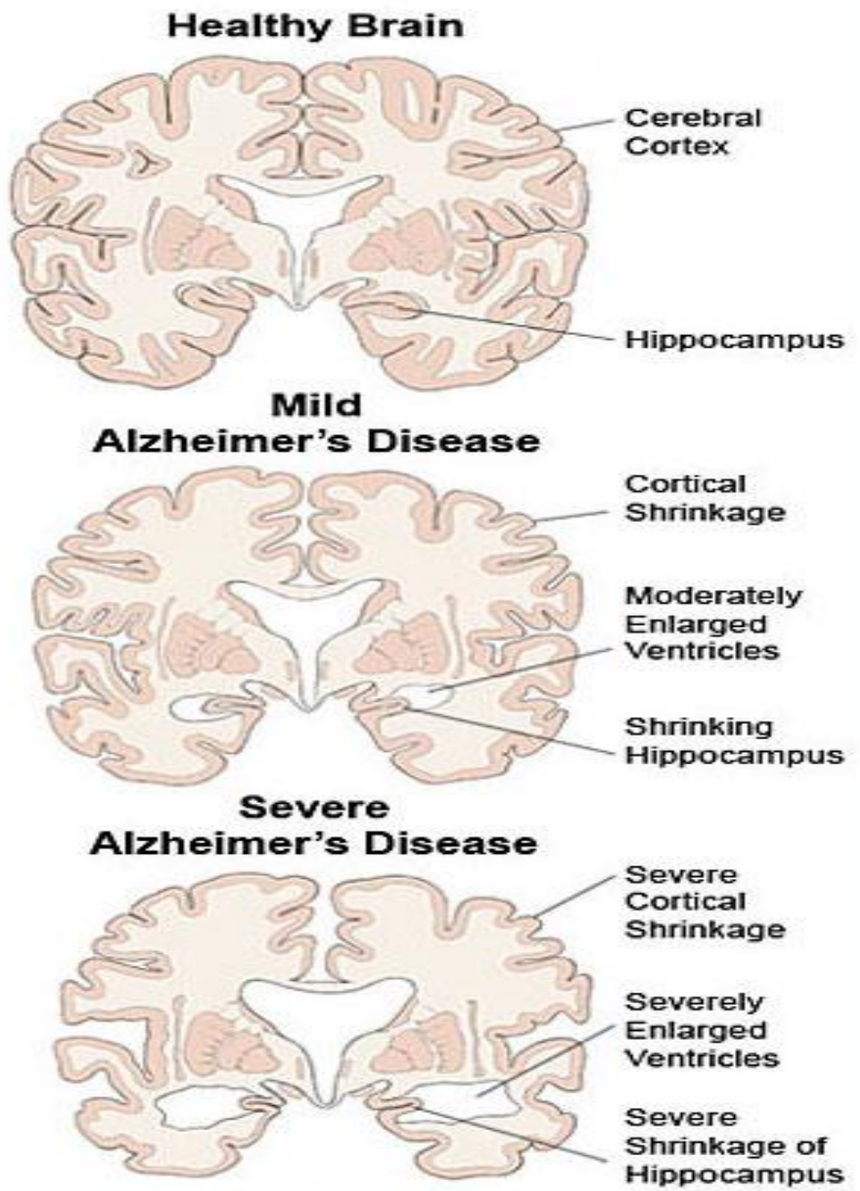


Alzheimer's









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%

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