AGING AND CHANGES IN THE BRAIN

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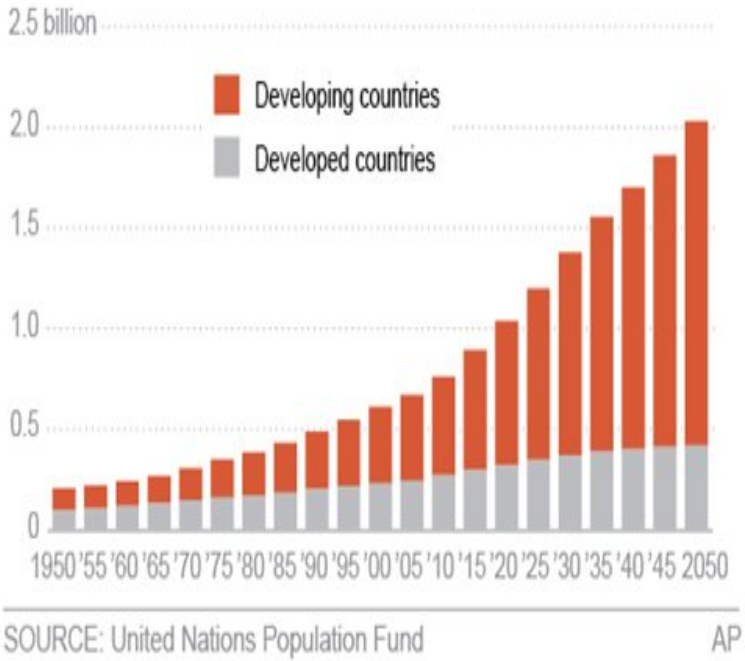
World not ready for aging population

The number of people in the world aged 60 and older is expected to grow past 2 billion by the year 2050.

Total population of people aged 60 and older



SOURCE: United Nations Population Fund AP

Objectives

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

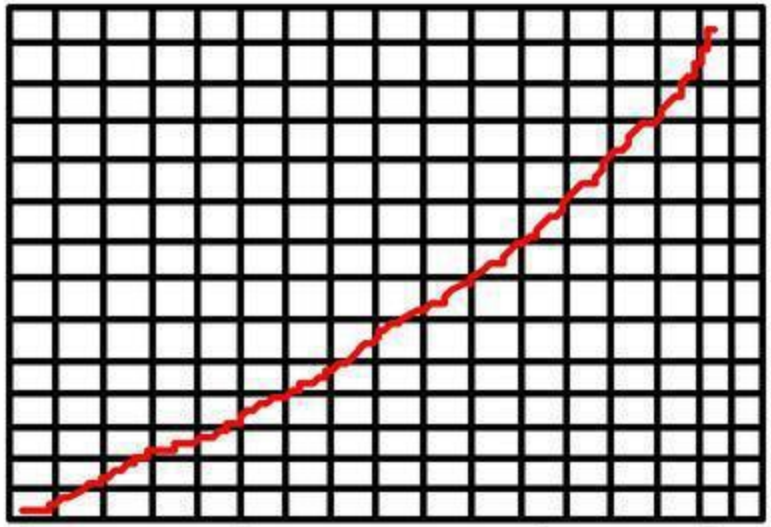
Aging is not a disease; however, the risk of developing disease is increased, often dramatically, as a function of age.

AGEING IN THE DEVELOPMENT AGENDA

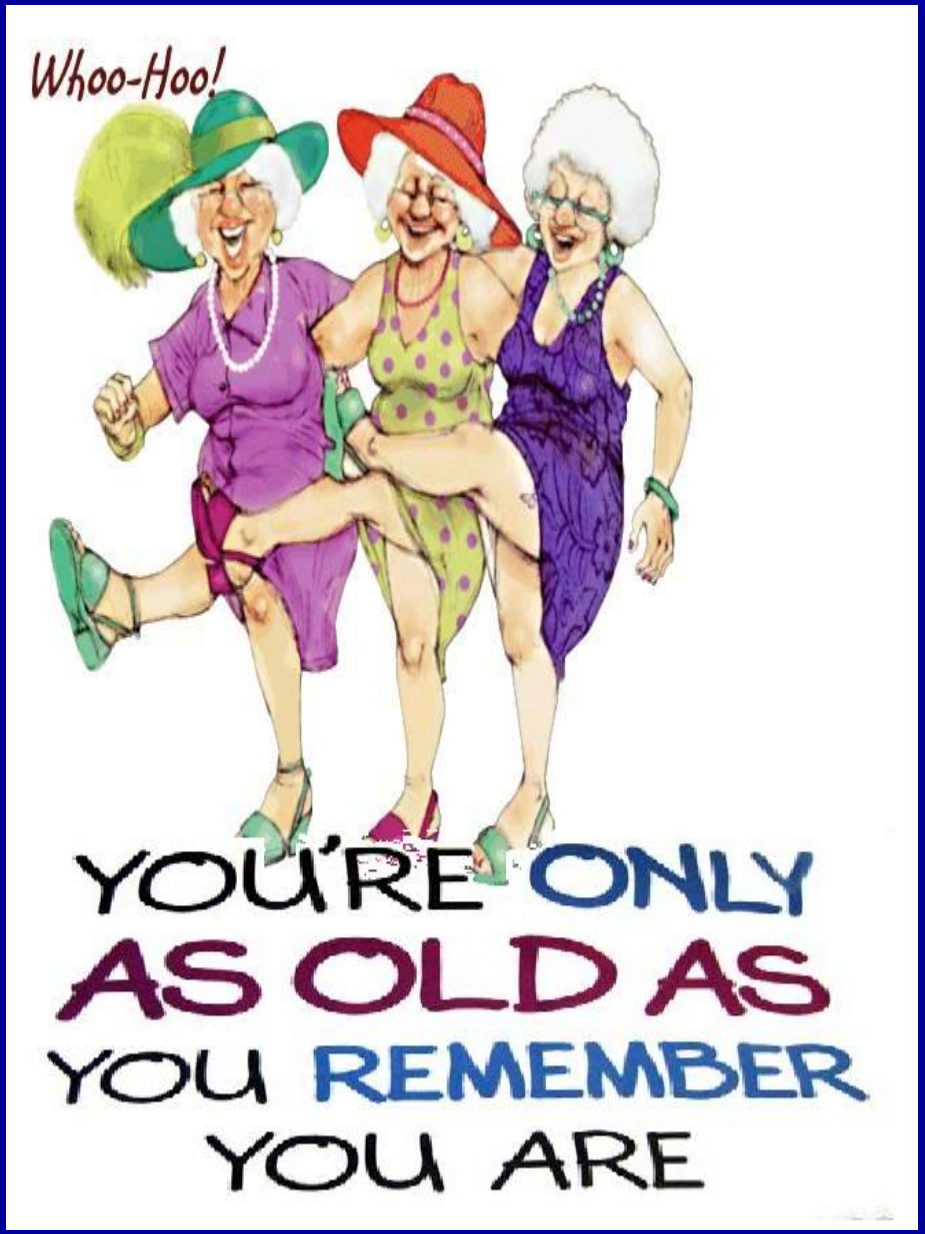
"Ageing is a development issue. Healthy older persons are a resource for their families, their communities and the economy."

WHO Brasilia Declaration on Ageing, July, 1996

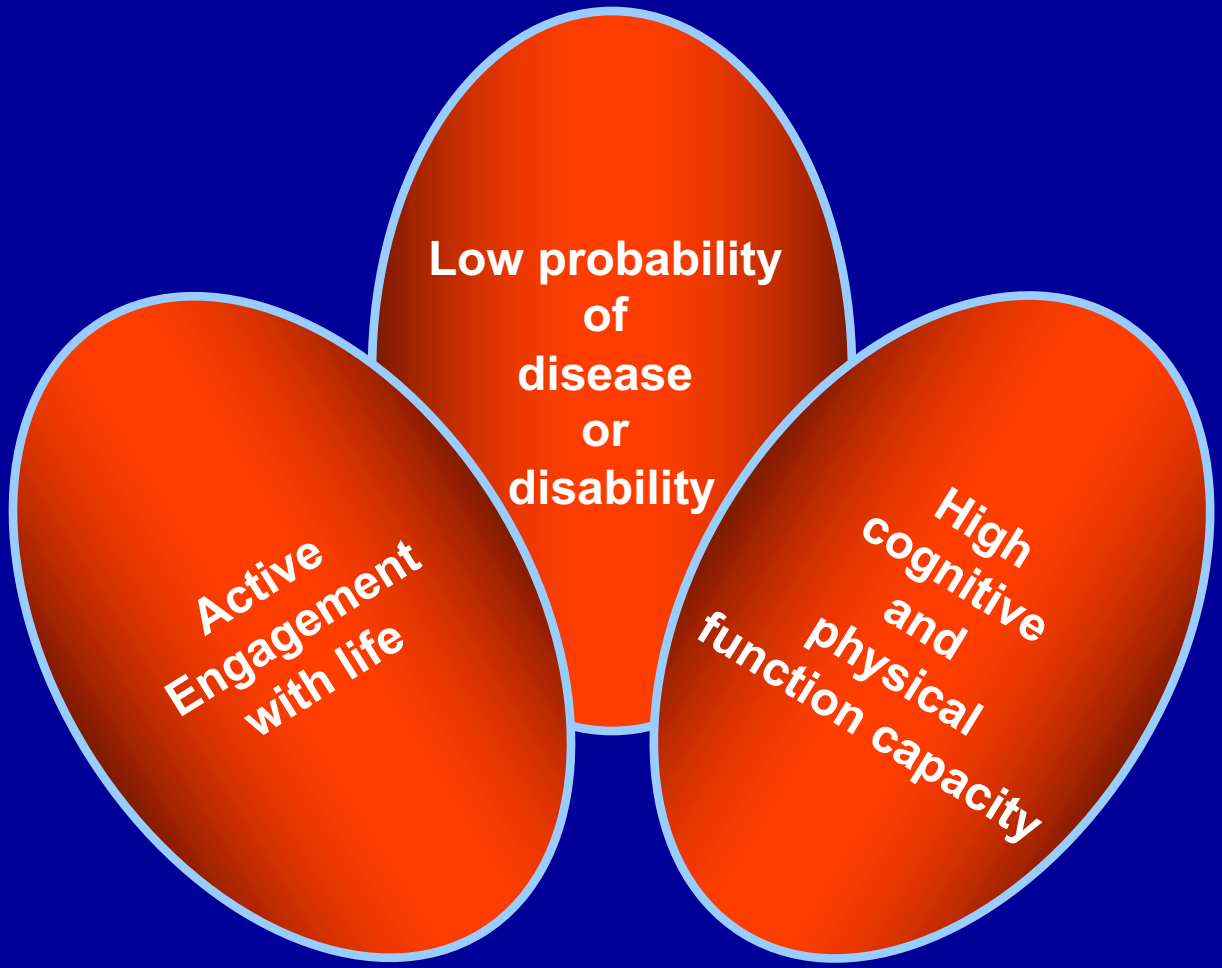
I am Not Aging,



I am Increasing In Value.



SUCCESSFUL AGEING



THE TERM AGEING

- **UNIVERSAL AGEING**: age changes that all people share)
- **PROBABILISTIC AGEING**: age changes that may happen to some (eg type two diabetes).
- **CHRONOLOGICAL AGEING**: referring to how old a person is
- **SOCIAL AGEING**:society's expectations of how people should act as they grow older
- **BIOLOGICAL AGEING**: an organism's physical state as it ages

Some Theories of 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	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

Some Theories of Aging

Hypothesis	How It May Work
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 the immune system to respond to infectious agents and the overactivity of natural immunity create vulnerability to Inf..
Accumulation of senescent cells	Renewing tissues become dysfunctional through loss of ability to renew

OXYGEN - free radicals (FR) and reactive oxygen species (ROS)

Cell metabolism

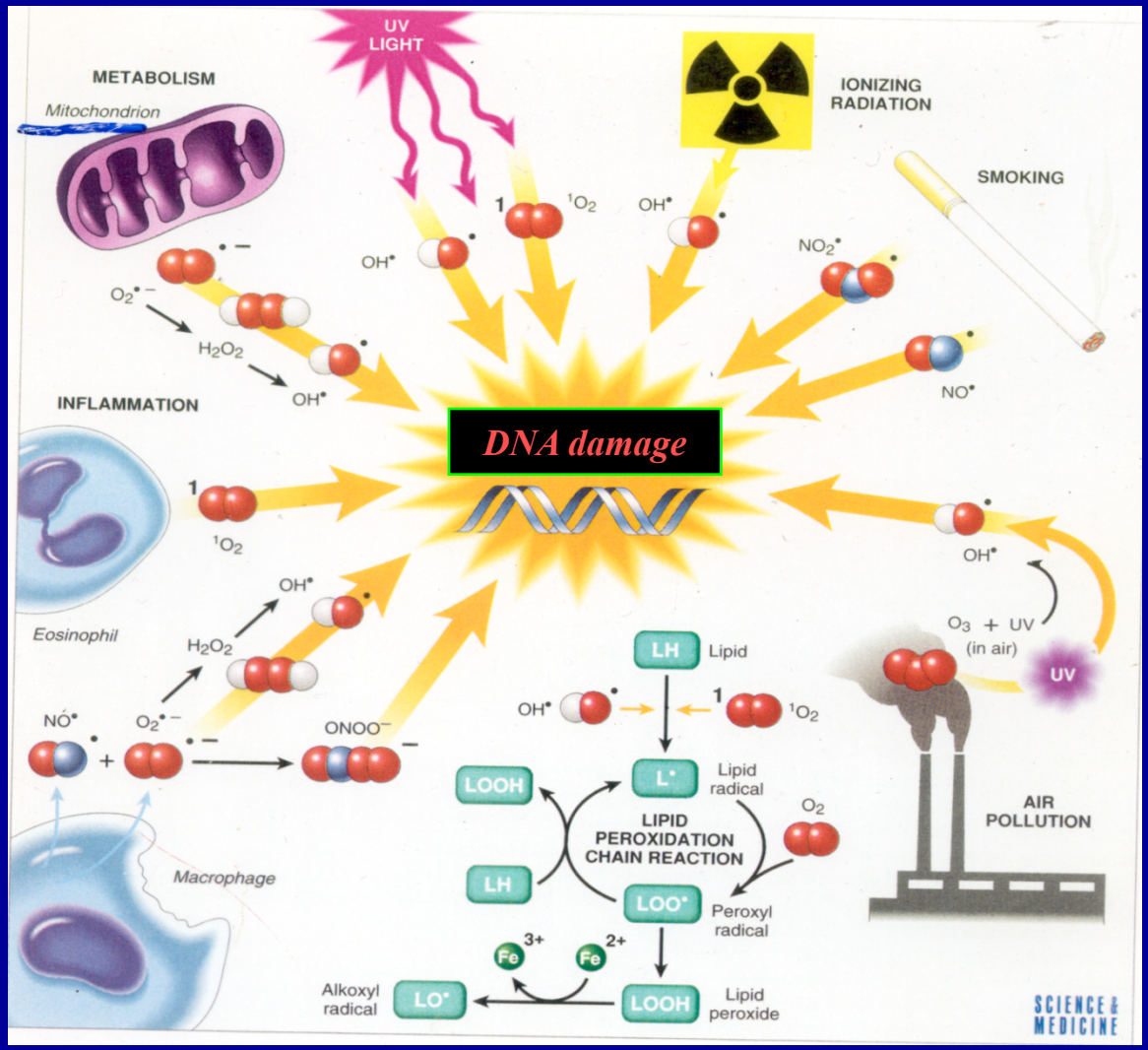
environment

Infection

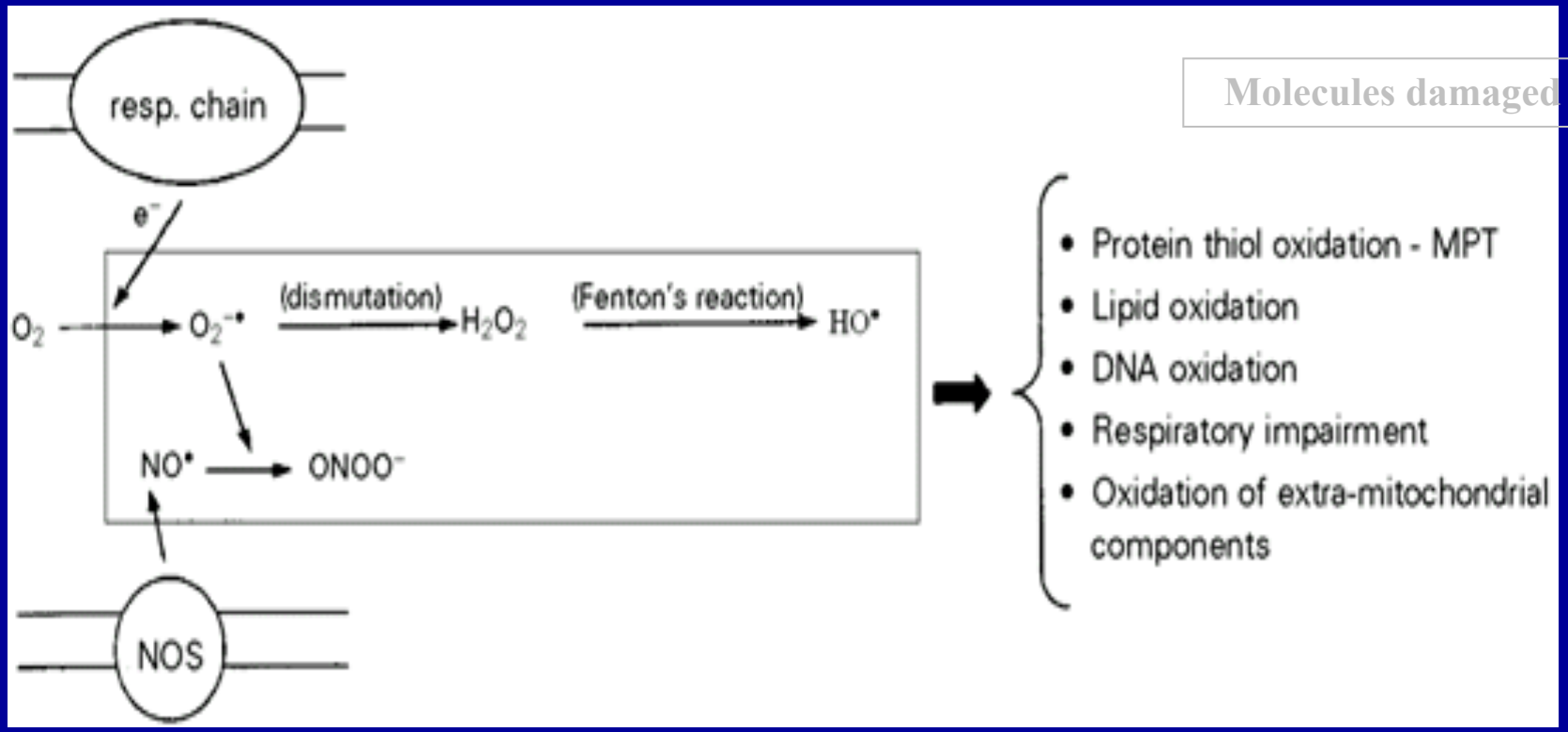
diet

lifestyle

pollution



Mitochondria produce ROS:



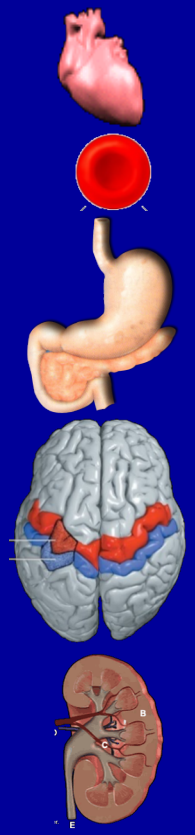
The respiratory chain (resp. chain) produces superoxide radicals ($O_2^{-\cdot}$), which generate hydrogen peroxide (H_2O_2) and hydroxyl radicals ($HO^{\cdot}$). Mitochondrial nitric oxide synthase (NOS) produces nitric oxide ($NO^{\cdot}$), which combines with $O_2^{-\cdot}$ to generate peroxinitrite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

Kowaltowski 2002


The older
we get...
the less
we care!

Leading Causes of Death Age 65+ "Medical Diagnoses"

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



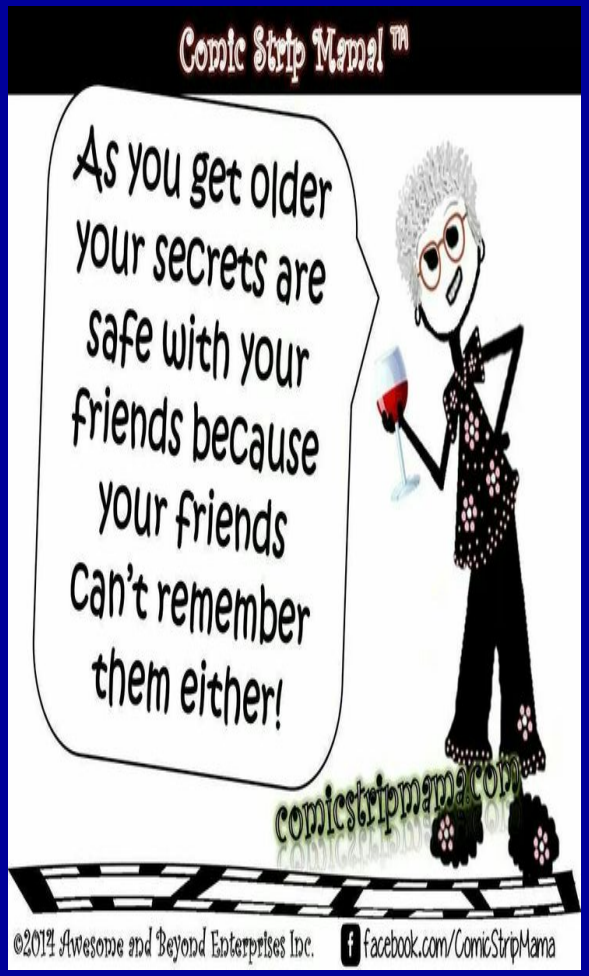
State of Aging and Health CDC/NCHS Health US, 2002

Age Related Changes

- Decreased height, lean body mass and body water
- Increased body fat
- Consequence Changes in pharmacokinetics

Cont…**Age Related Changes**

- 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

Aging nervous system

Changes

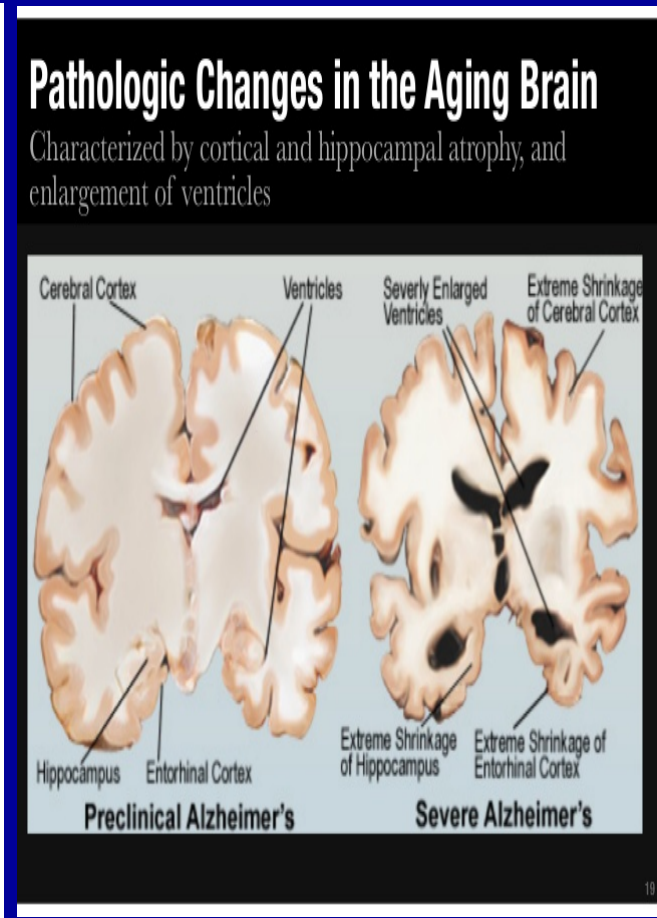
- ↓Decreased brain weight
- ↓Cerebral blood flow
- memory
- Alteration in CNS neurotransmitters
- Decreased vibratory sense

Consequences

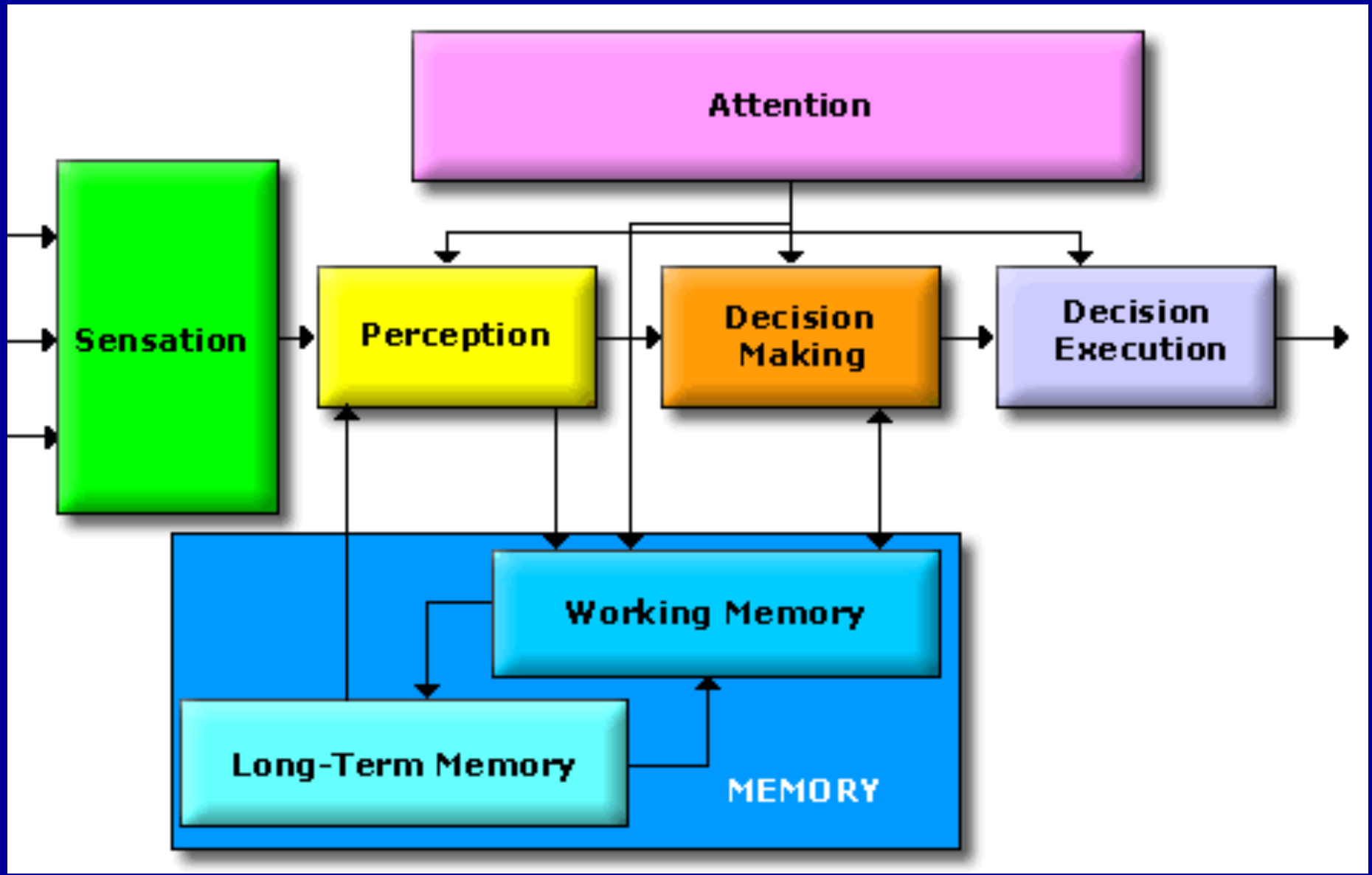
- Drug toxicities
- delirium
- Altered mood
- Decreased IQ scores
- “Benign senile forgetfulness”
- Increased postural instability
- Altered gait
- Falls, accidents

Aging nervous system

Structure	Regional function
Basal ganglia	Becomes bright in appearance due to iron accumulation
Subarachnoid space	Increase in size due to brain shrinkage
Hippocampus	Reduction in size due to cell loss in the structure.
Ventricles	Increase in size due brain shrinkage.
White Matter	Reduction in size due to neuronal atrophy in the deep brain.



CONGITIVE CHANGES IN AGING: MENTAL PROCESSING



Nervous System changes

- **Aging leads to increased cerebral amyloid**
- **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.**
- **Loss of RNA (messenger and transcription) but not DNA**
- **Loss of lipids, and lipid turnover rate, and a decrease in catabolism and synthesis.**

Cont…Nervous System changes

- Neuronal loss is normal in the aging brain but the ability to learn remains generally unchanged
- There is loss of dendritic arborization
- Recall memory is affected more than cognitive function in normal aging
- Cerebral atrophy shows up on CTs and MRI scans
- Reduced Sympathetic nervous system activity
- Reduced Neurotransmitter levels
- Changes in sleep patterns
- Abnormalities in EEG tracings
- Increased risk of stroke

Geriatric Syndromes

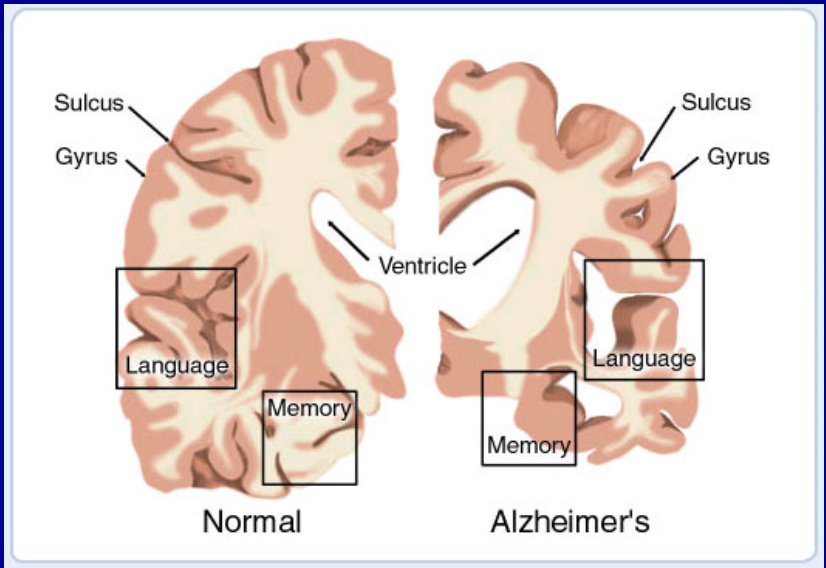
- *Dementia and Delirium*
- *Falls*
- *Urinary Incontinence*
- *Pressure Ulcers*
- *Functional Decline*

Dementia and 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

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

Alzheimer's Disease



- Alzheimer's disease is defined as 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.

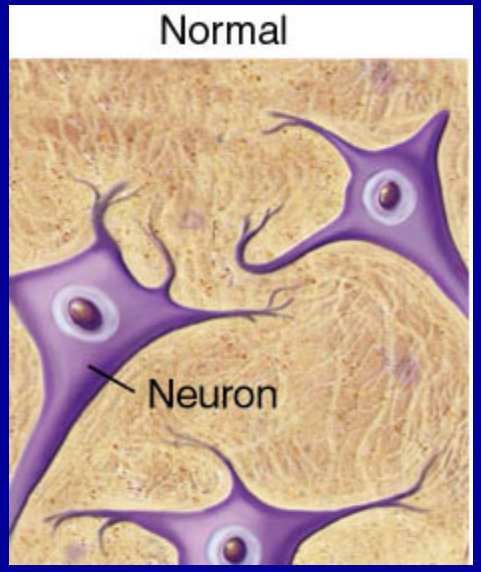
Alzheimer's Disease (Features)

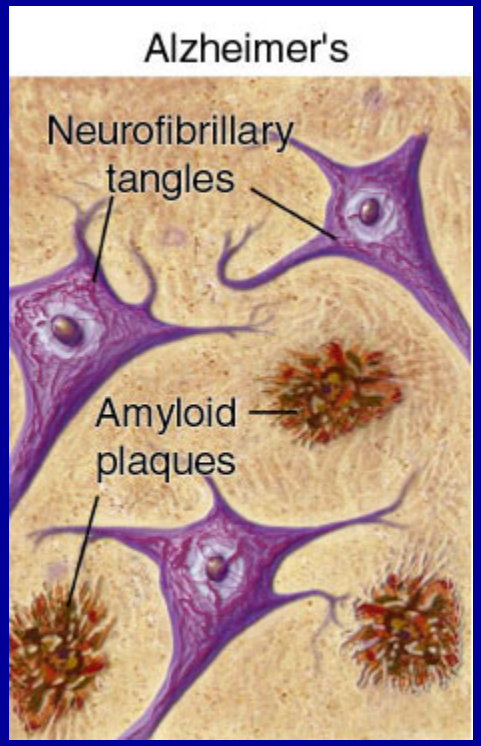
(1) an amnesic type of memory impairment

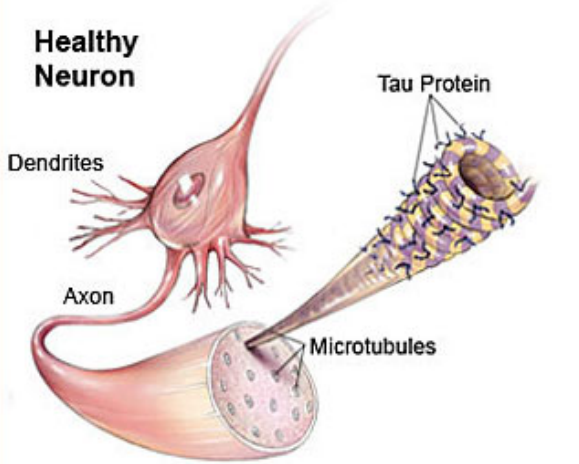
(2) deterioration of language

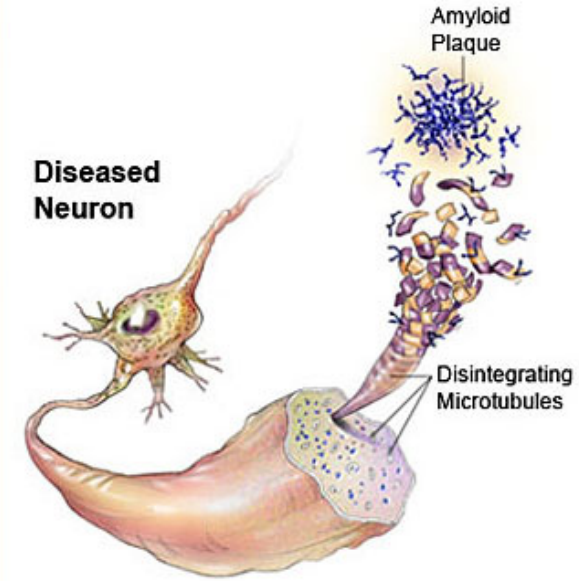
(3) visuospatial deficits.

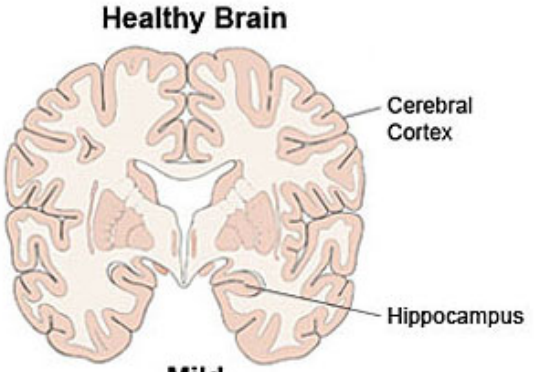
Motor and sensory abnormalities, gait disturbances, and seizures are uncommon until the late phases of the disease.

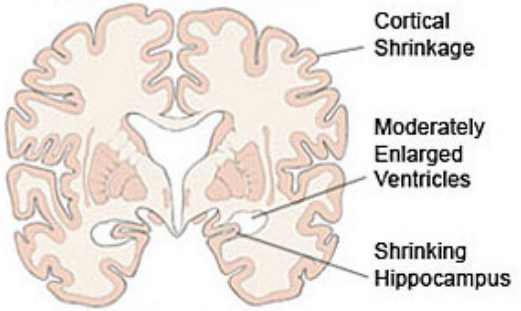

Normal
Neuron

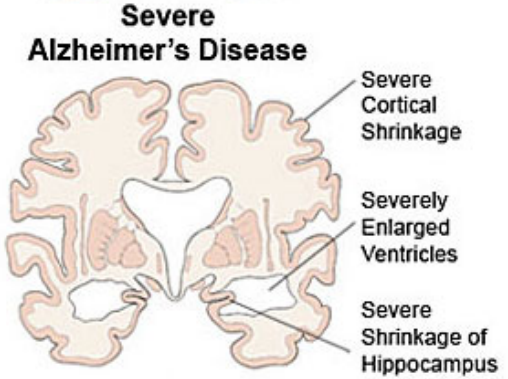

Alzheimer's
Neurofibrillary tangles
Amyloid plaques


Healthy Neuron
Tau Protein
Dendrites
Axon
Microtubules


Amyloid Plaque
Diseased Neuron
Disintegrating Microtubules


Healthy Brain
Cerebral Cortex
Hippocampus


Mild Alzheimer's Disease
Cortical Shrinkage
Moderately Enlarged Ventricles
Shrinking Hippocampus


Severe Alzheimer's Disease
Severe Cortical Shrinkage
Severely Enlarged Ventricles
Severe Shrinkage of Hippocampus

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.

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.

Baroreceptor Reflex

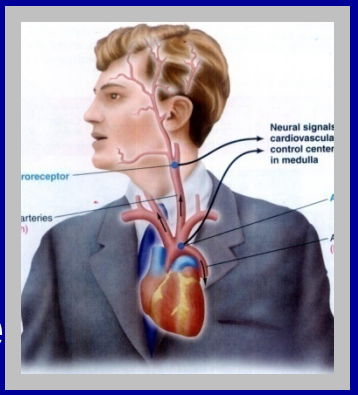
Quick operation (within few seconds)

Mediated through autonomic nerves

Adjusts CO &TPR to restore BP to normal

Influences heart & blood vessels

Carotid sinus hypersensitivity

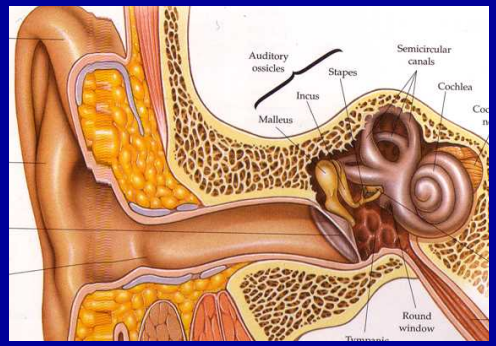


- Carotid sinus syncope occurs when there is an exaggerated vagal response to carotid sinus stimulation,
- Provoked by wearing a tight collar, looking upwards or turning the head
- Carotid sinus syndrome occurs in the elderly and mainly results in bradycardia.
- Most common etiologies of atrioventricular block
- Do not massage both carotids simultaneously.

Vision

- 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

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 (see above), Ménière's disease, and 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; a vast number of drugs, particularly those that interfere with cell turnover such as antithyroid and antineoplastic agents; radiation therapy to the oral cavity and pharynx; viral infections; endocrine disorders; neoplasms; and aging

Pain and Sense of Touch

With age, skin is not as sensitive as in youth due to:

1. Loss of elasticity
2. Loss of pigments
3. Reduced fat layer

Safety Implications:

1. Decreased ability to recognize dangerous levels of heat
2. Decreased ability to maintain temperature
3. Tendency to develop bruises, skin tears.

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%

Brief Geriatric Assessment Instruments

Domain	Instrument	Comments
Cognition		
Dementia	MMSE (mini-mental state examination)	Widely studied and accepted
	Time and change (T&C) test	Sensitive and quick
Delirium	CAM (confusion assessment method)	Sensitive and easy to apply
Affective disorders	GDS 5-question form (Geriatric depression scale)	Rapid screen
Visual impairment	Snellen chart	Universally used
Hearing impairment	Whispered voice	No special equipment needed
	Pure tone audiometry	Can be performed by trained office staff
Dental health	DENTAL	
Nutritional status	Weight loss of >4.5 kg (>10 lb) in 6 months or weight <45 kg (<100 lb)	
Gait and balance	"Timed Get Up and Go" test	Requires no special equipment

THANKS