



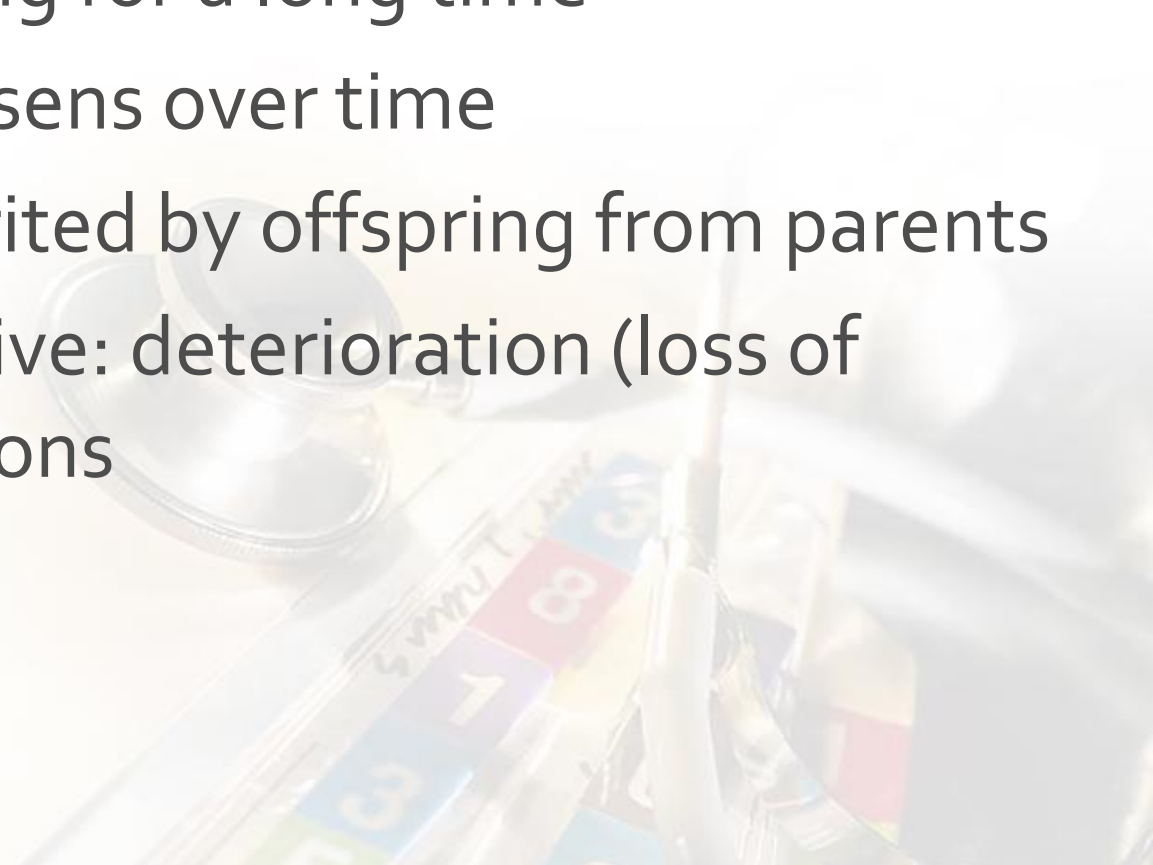
# Neurological Disorders

Huntington's Disease  
Parkinson's Disease  
Alzheimer's Disease  
Multiple Sclerosis  
Epilepsy






# Terms used to describe medical disorders

- Fatal: lethal, deadly
  - Chronic: persisting for a long time
  - Progressive: worsens over time
  - Hereditary: inherited by offspring from parents
  - Neurodegenerative: deterioration (loss of function) of neurons
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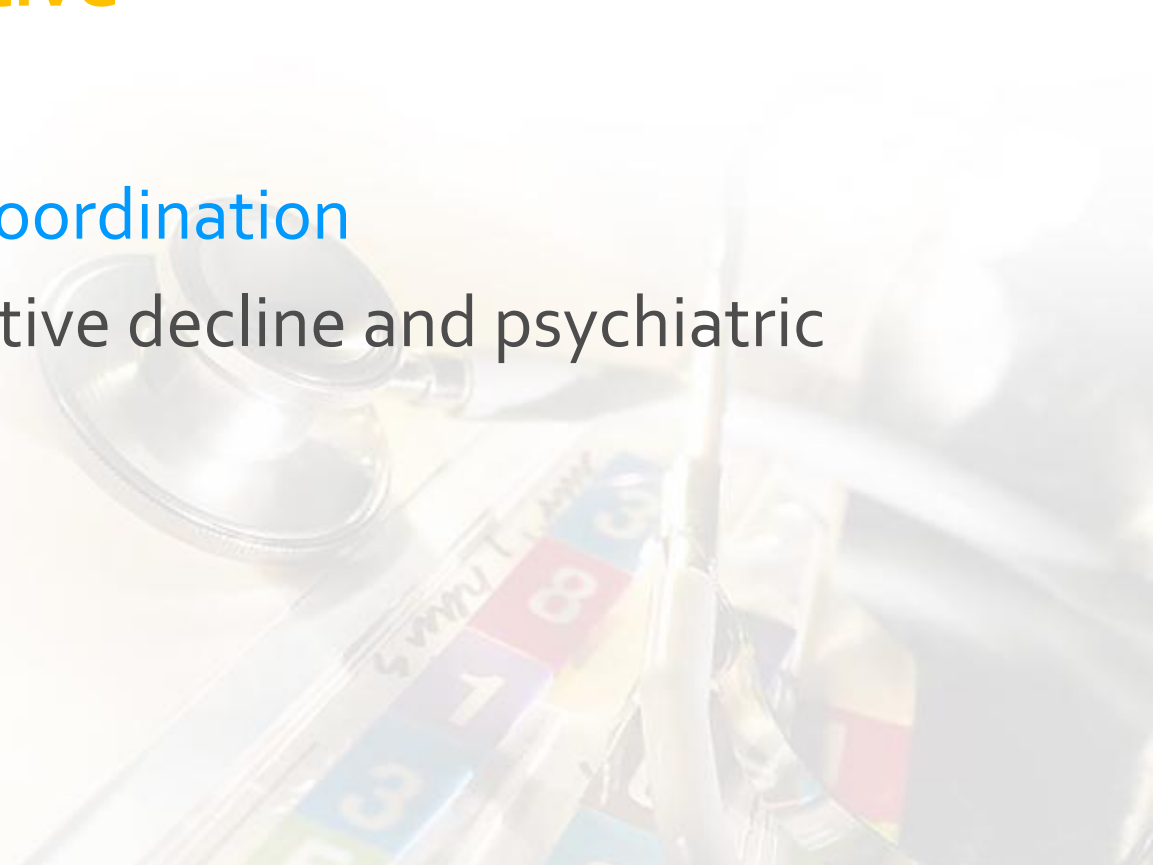
# Neurological Disorders Chart

Disorder	Definitions	Cause	Symptom	Treatment
Huntington's				
Parkinson's				
Alzheimer's				
Multiple Sclerosis				
Epilepsy				





# What is Huntington's Disease?

- A **fatal hereditary** disorder
  - **Neurodegenerative**
  - Recognized by:
    - Lack of **muscle coordination**
    - **Dementia**: cognitive decline and psychiatric problems
- 

# Causes of HD

- **Autosomal dominant** disorder
  - Defect on chromosome 4
- Abnormal HD gene has extra repeats
  - **CAG repeats** normally 10-28 times
  - With Huntington's, the repeat is 36-120 times
- Normal protein called **Huntingtin**
  - Abnormal protein product is larger
  - Toxic to brain cells but don't know why (mechanism unknown)

Repeats	Disease
< 27	-
27 - 35	-
36 - 39	+ / -
> 39	+

# Manifestation of HD

- The greater the number of repeats, the earlier the age of onset
- More common in Western Europeans
- 70 times to 100 time greater chance for Caucasian
- Death within 10-20 years of first symptoms

Repeat Size	Median Age at onset* (years)
39	66 (72-59)
40	59 (61-56)
41	54 (56-52)
42	49 (50-48)
43	44 (45-42)
44	42 (43-40)
45	37 (39-36)
46	36 (37-35)
47	33 (35-31)
48	32 (34-30)
49	28 (32-25)
50	27 (30-24)

\*Age by which 50% of individuals will be affected

Specific numbers of CAG repeat correlates to disease. Walker FO (2007). "Huntington's disease". *Lancet* 369 (9557): 218–28. Normal HD gene CAG repeats range from 10 - 27 repeats. A few normal individuals have intermediate HD gene CAG repeats of 27-35 repeats. A current review of 1,049 persons (the majority of whom were symptomatic) has provided a determination of the likelihood of an age-of-onset for a given CAG repeat size for repeats between 39 50 repeats (Brinkman et al., 1997; *Am. J. Hum. Genet.* 60:1202-1210).




# Symptoms of HD

- Behavior changes may occur before movement problems
  - Hallucinations, moodiness, irritability, paranoia
- Abnormal / unusual movement:
  - Jerking, uncontrollable movements
  - Facial movements, including grimaces
- Dementia progresses:
  - Speech problems
  - Personality changes



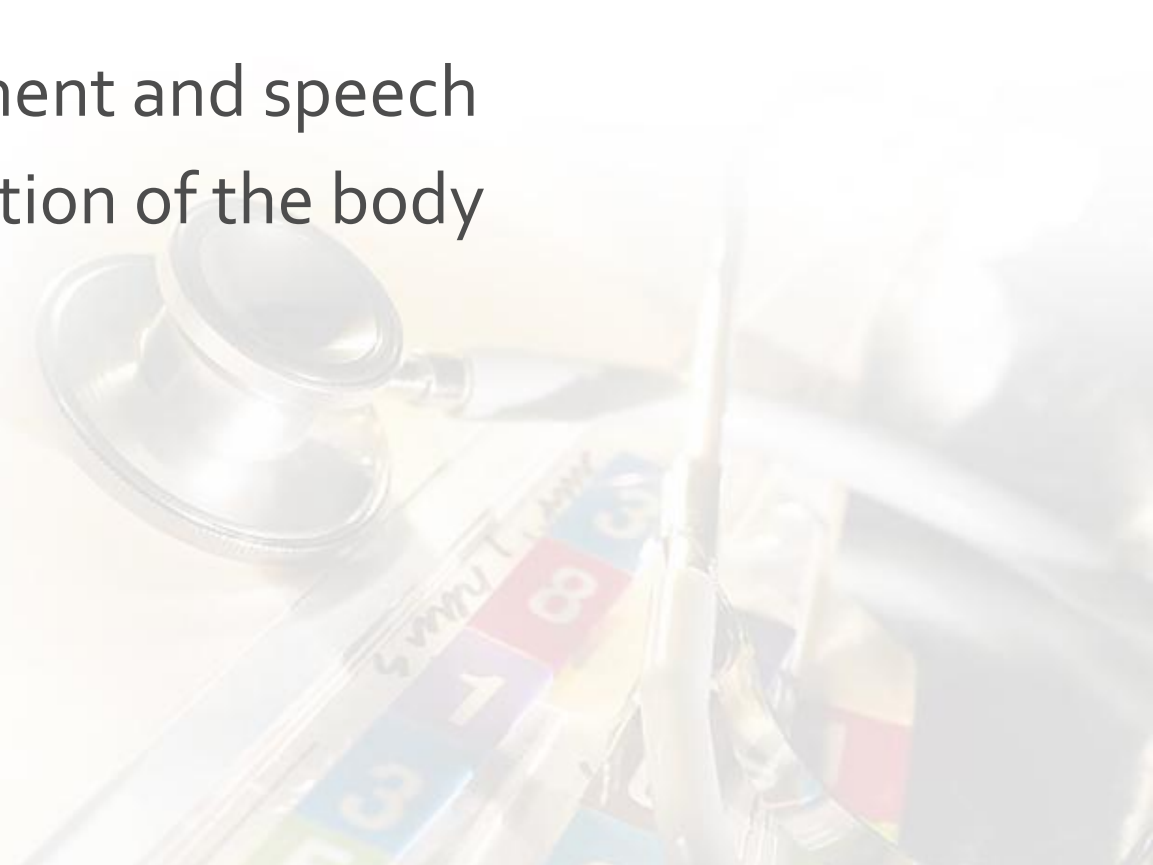
# Treatments for HD

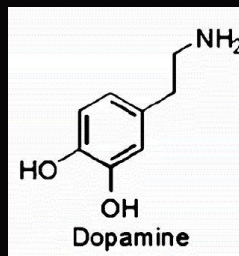
- No cure
  - No way to stop the degeneration
  - Treatment: to lessen severity of symptoms
- 





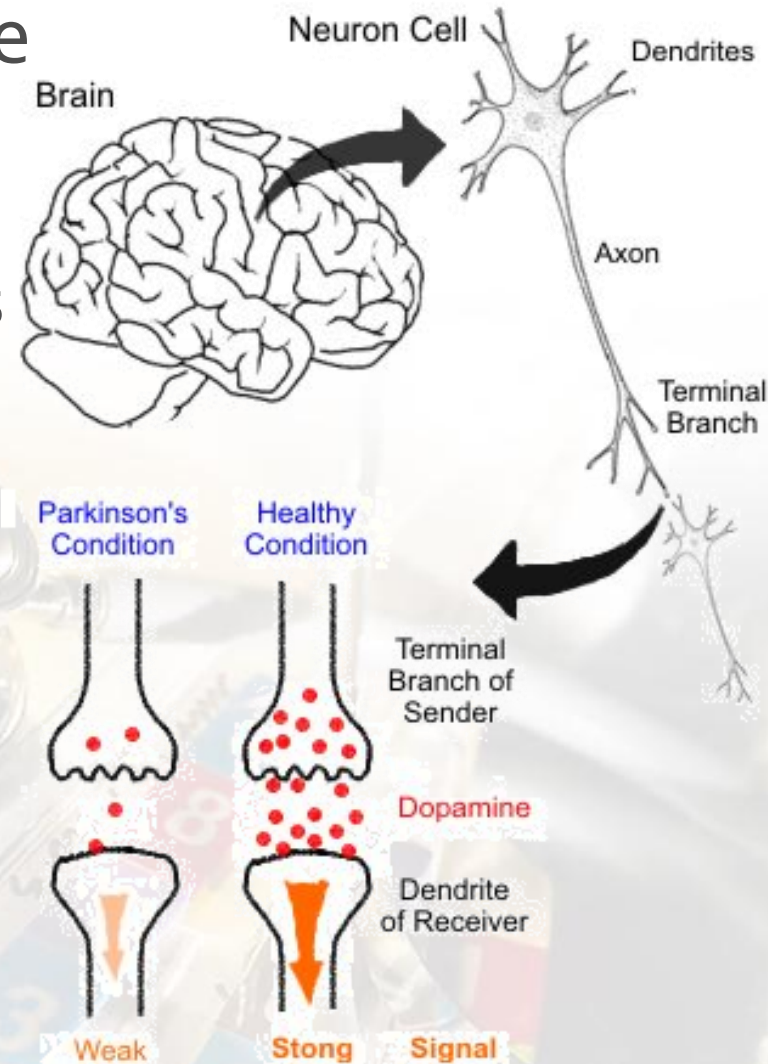
# What is Parkinson's Disease?

- **Chronic progressive degenerative** disorder
  - Recognized by:
    - Impaired movement and speech
    - Lack of coordination of the body
- 



# Cause of PD

- Unable to produce dopamine
  - Degeneration of the basal ganglia (brainstem) where dopamine-producing neurons are normally found
- **Dopamine:**
  - neurotransmitter
  - needed for voluntary movement, attention, learning, cognition, sleep and mood





# Manifestation of PD

- Age of onset: 60 years
  - Prevalence: 1 in every 100 persons over 60
- 



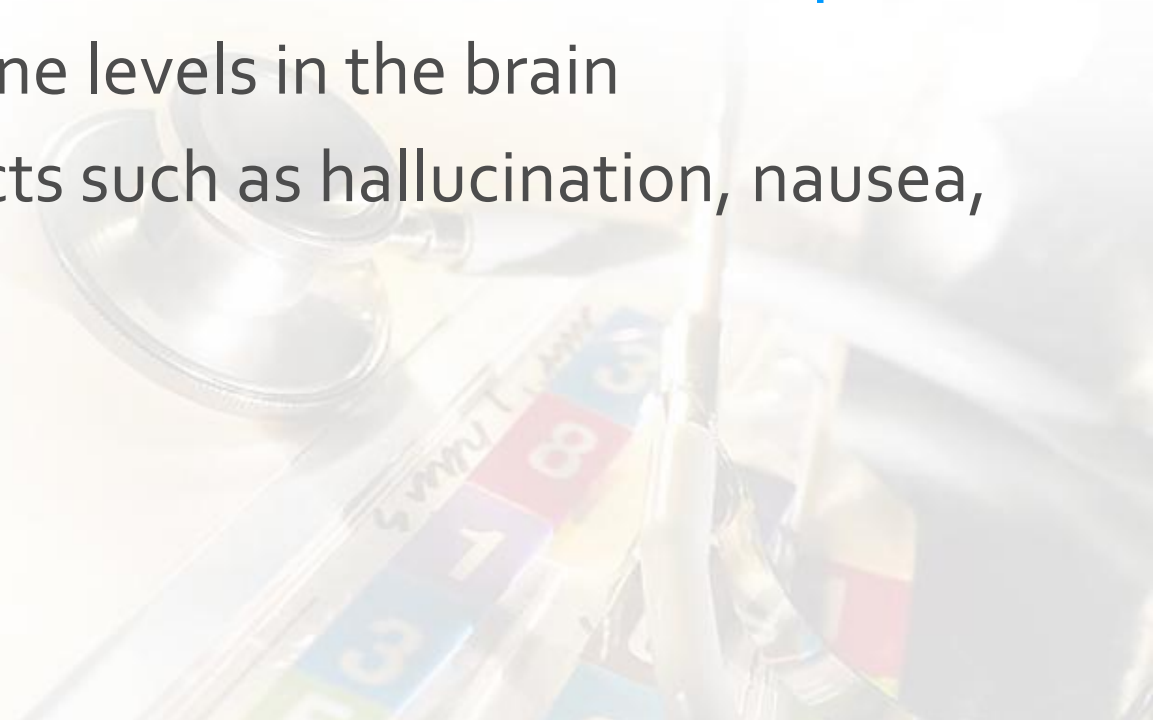
# Symptoms of PD

- Low levels of dopamine leads to the inhibition of the neural pathways that are responsible for movement
  - Tremor
  - Muscle rigidity / stiffness, slow movements
  - Poor balance and coordination
  - Stooped posture






# Treatment for PD

- No cure
  - Treatments: to control symptoms
  - Temporary relief from medication: **L-Dopa**
    - increase dopamine levels in the brain
    - Severe side effects such as hallucination, nausea, vomiting
- 

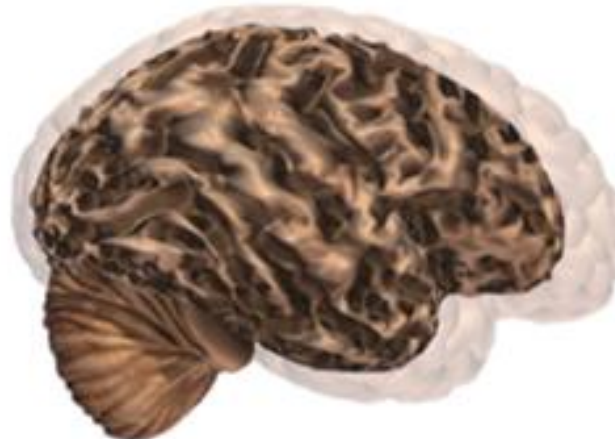
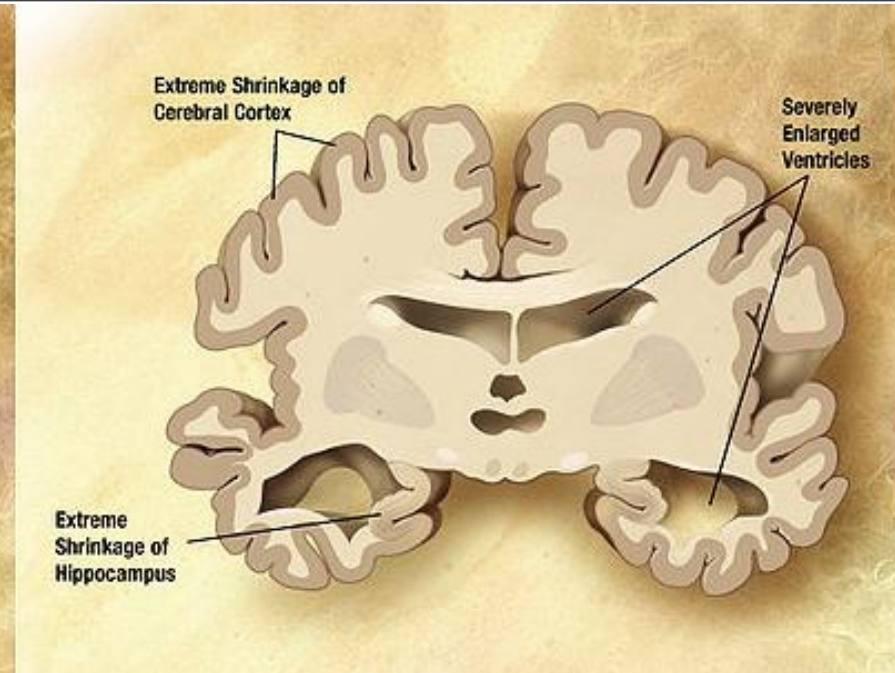
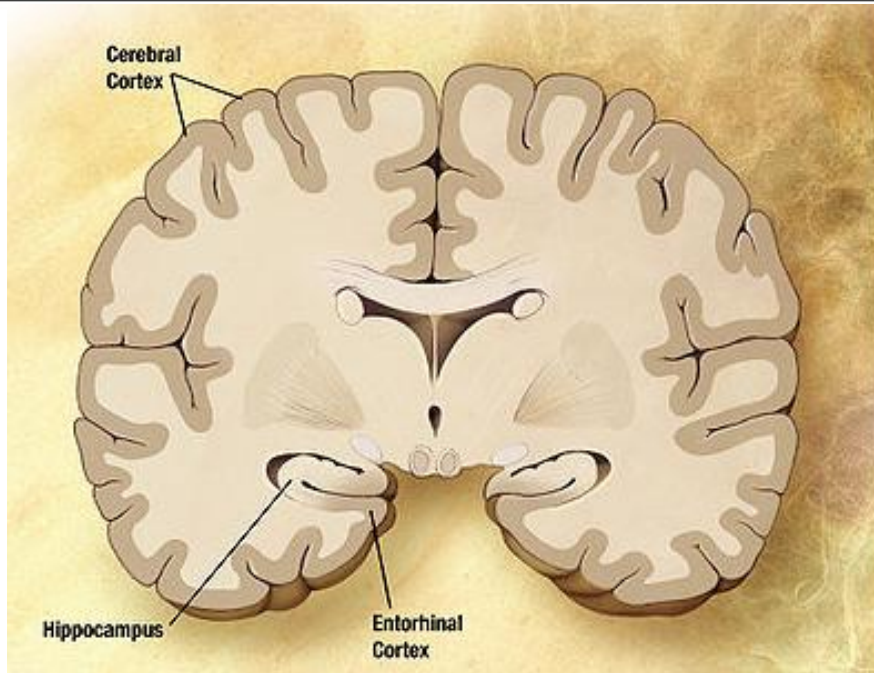


# What is Alzheimer's Disease?

- **Progressive** disorder of the brain
  - **Neurodegenerative**
  - Recognized by:
    - Profound memory loss
    - Loss of cognitive ability
    - Mood and behaviour changes
- 

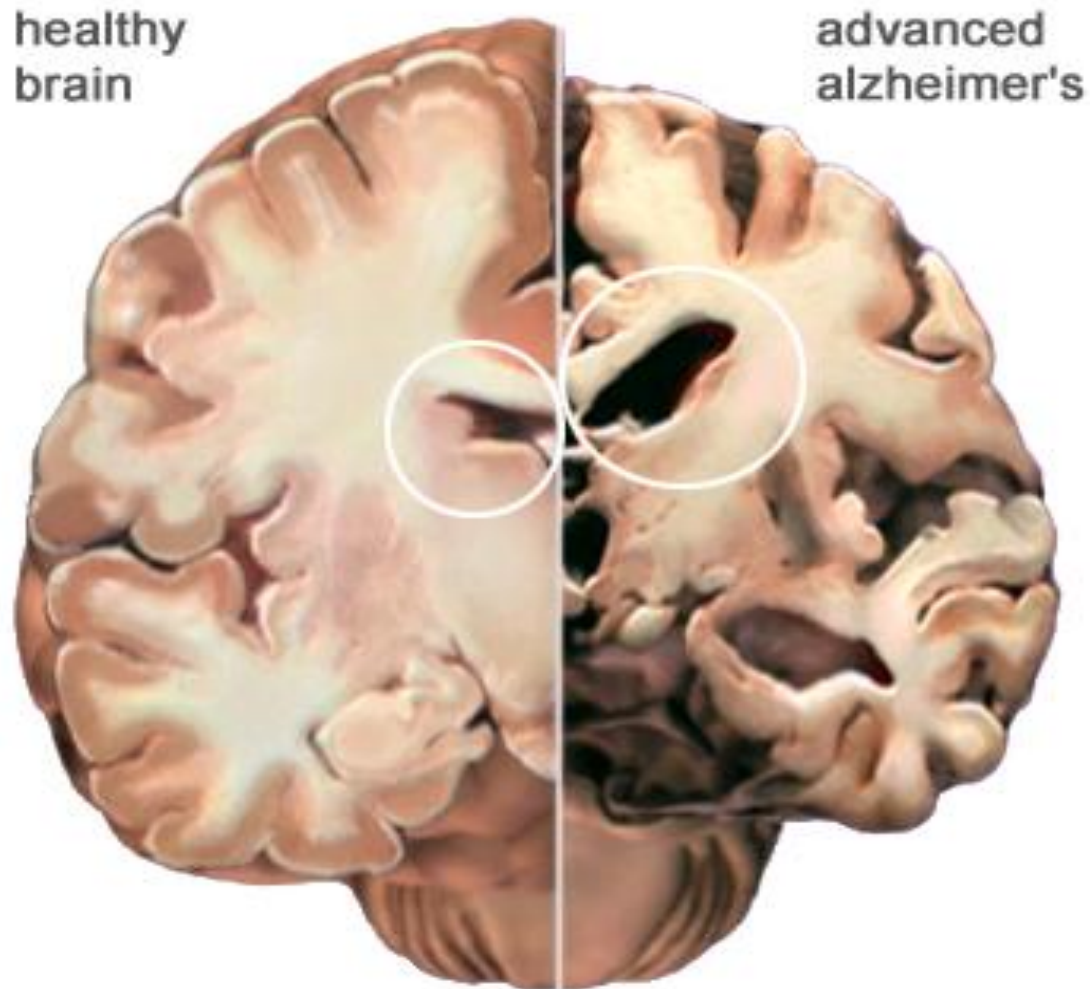


# Brain Atrophy: Loss of Mass





# Ventricles



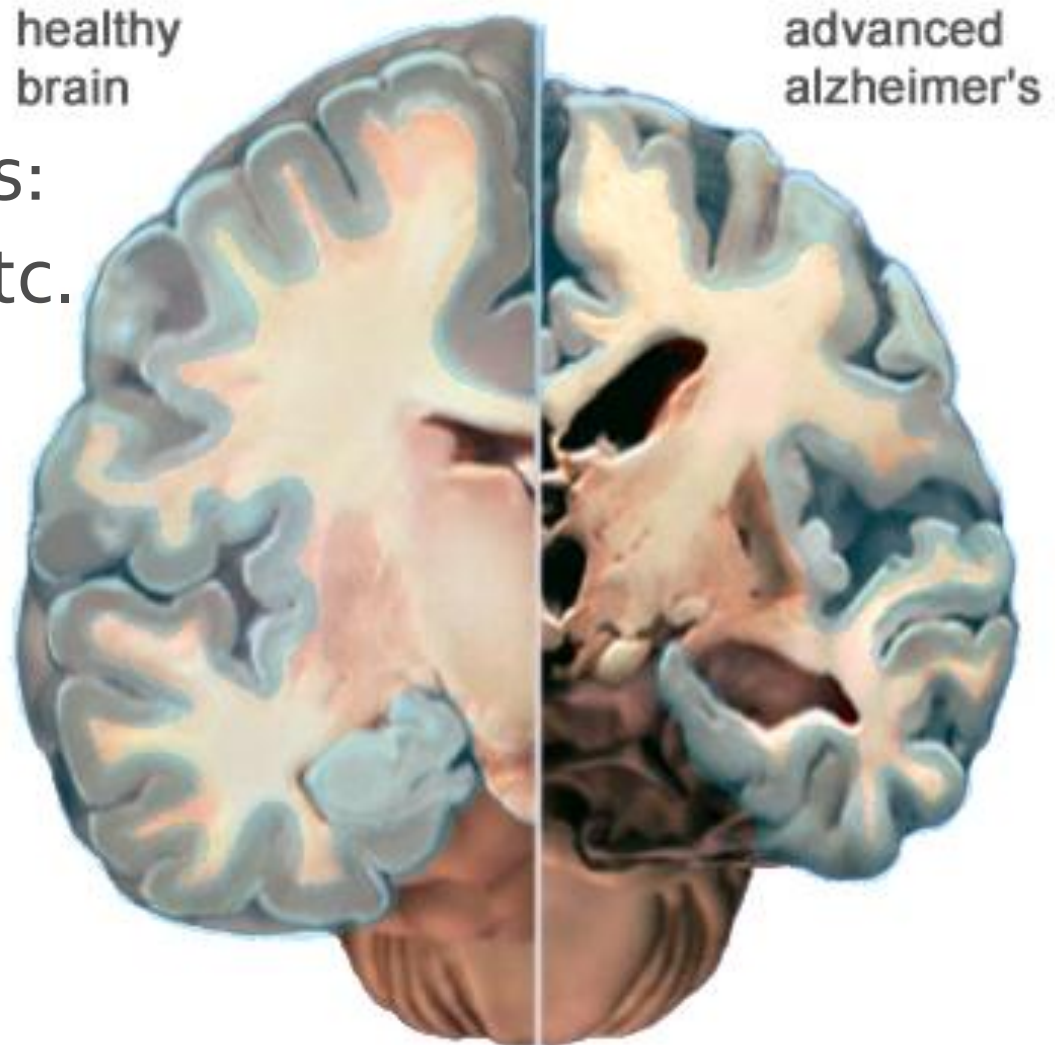
Due to large number of brain cell death, ventricles grow





# Cerebral Cortex

- higher brain functions: thought, reasoning etc.
- Motor skills
- Ability to control the five senses
- Ability to retain information & solve problems



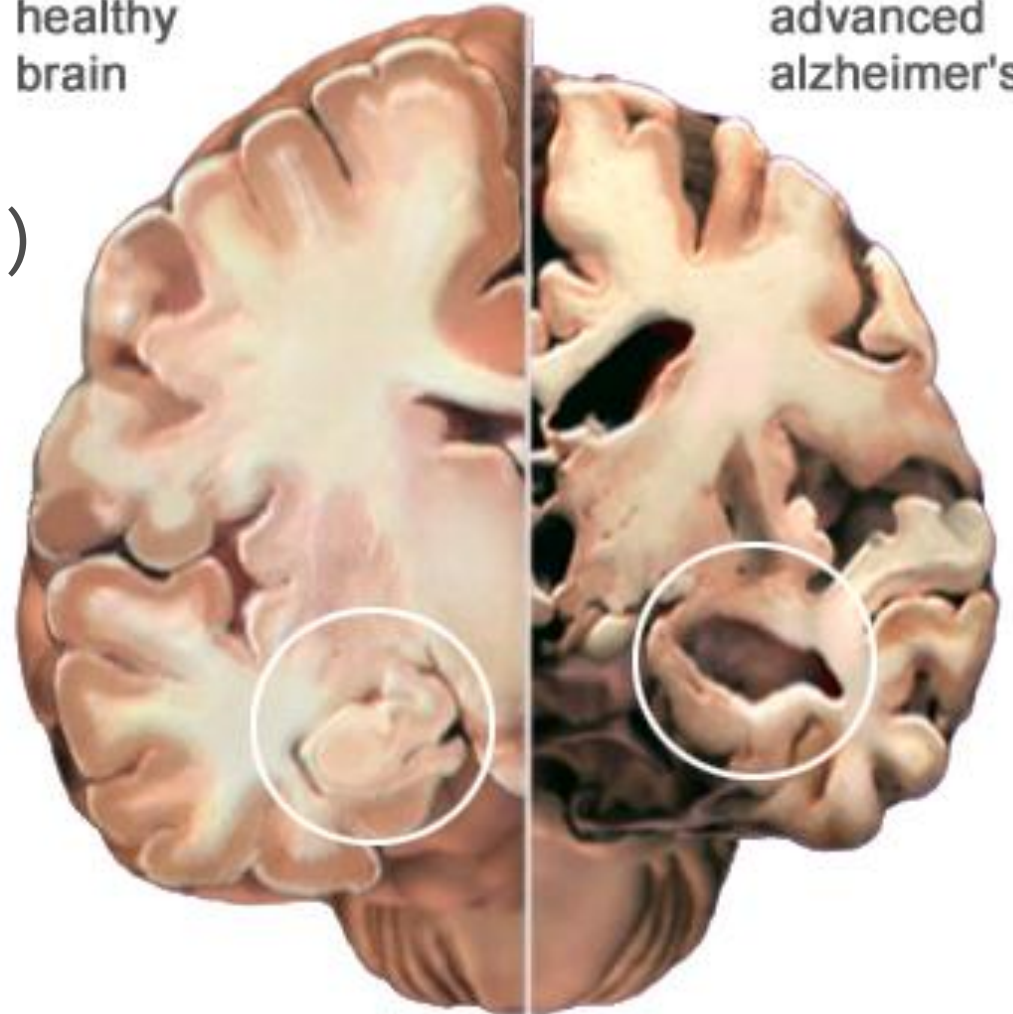


# Hippocampus

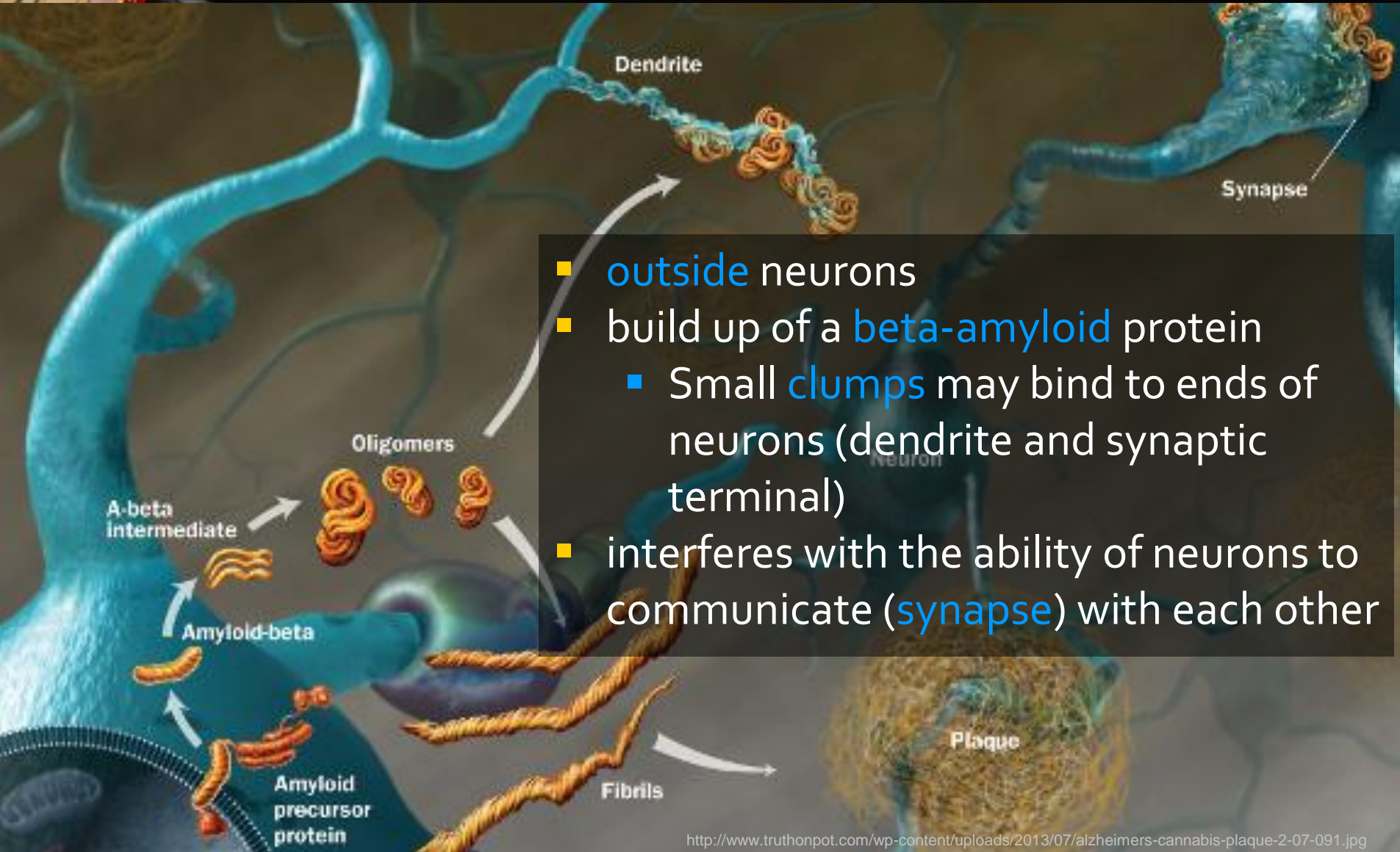
- formation of new memories (amnesia)

healthy brain

advanced alzheimer's



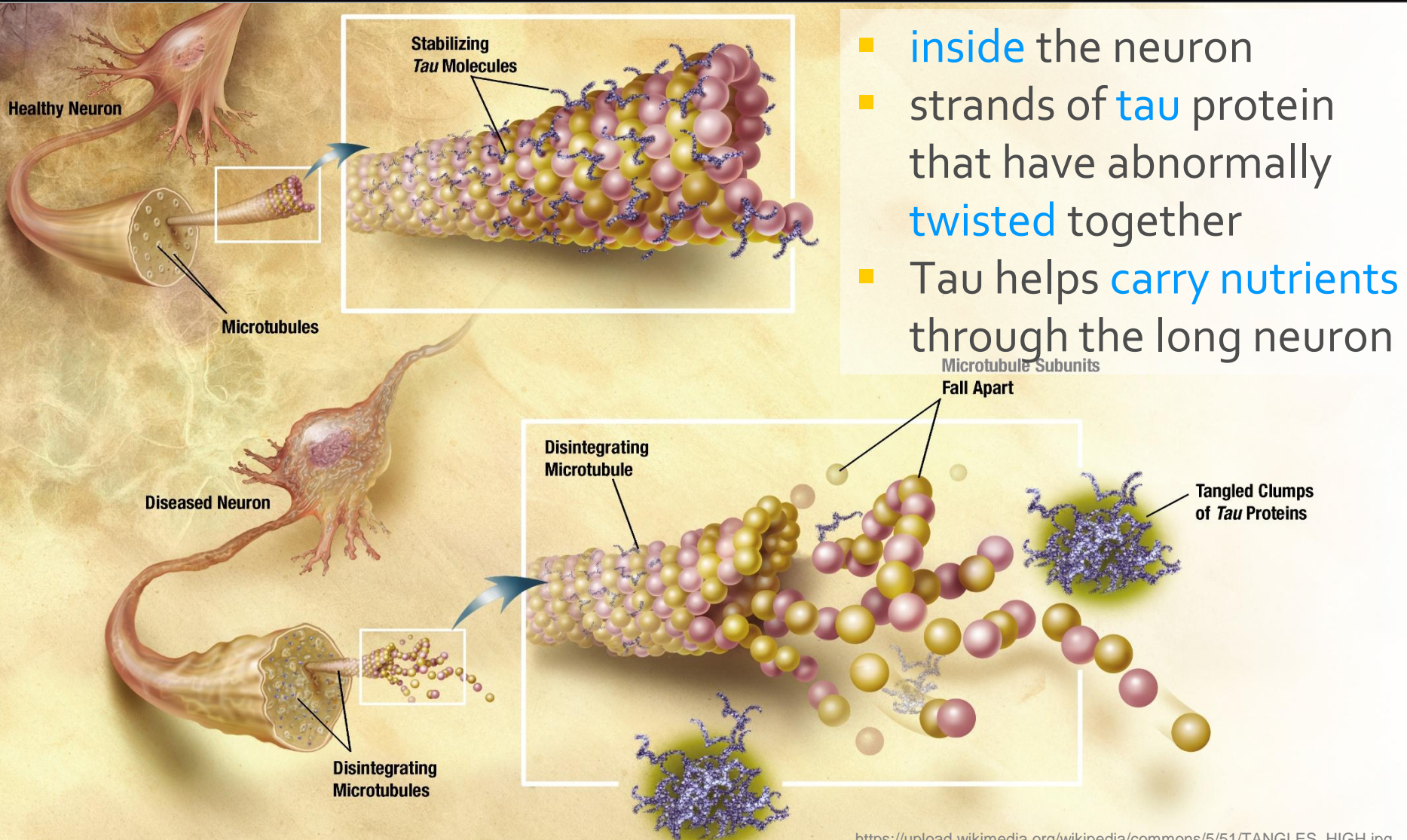
# Cause of AD: Plaques



- outside neurons
- build up of a **beta-amyloid** protein
  - Small **clumps** may bind to ends of neurons (dendrite and synaptic terminal)
- interferes with the ability of neurons to communicate (**synapse**) with each other

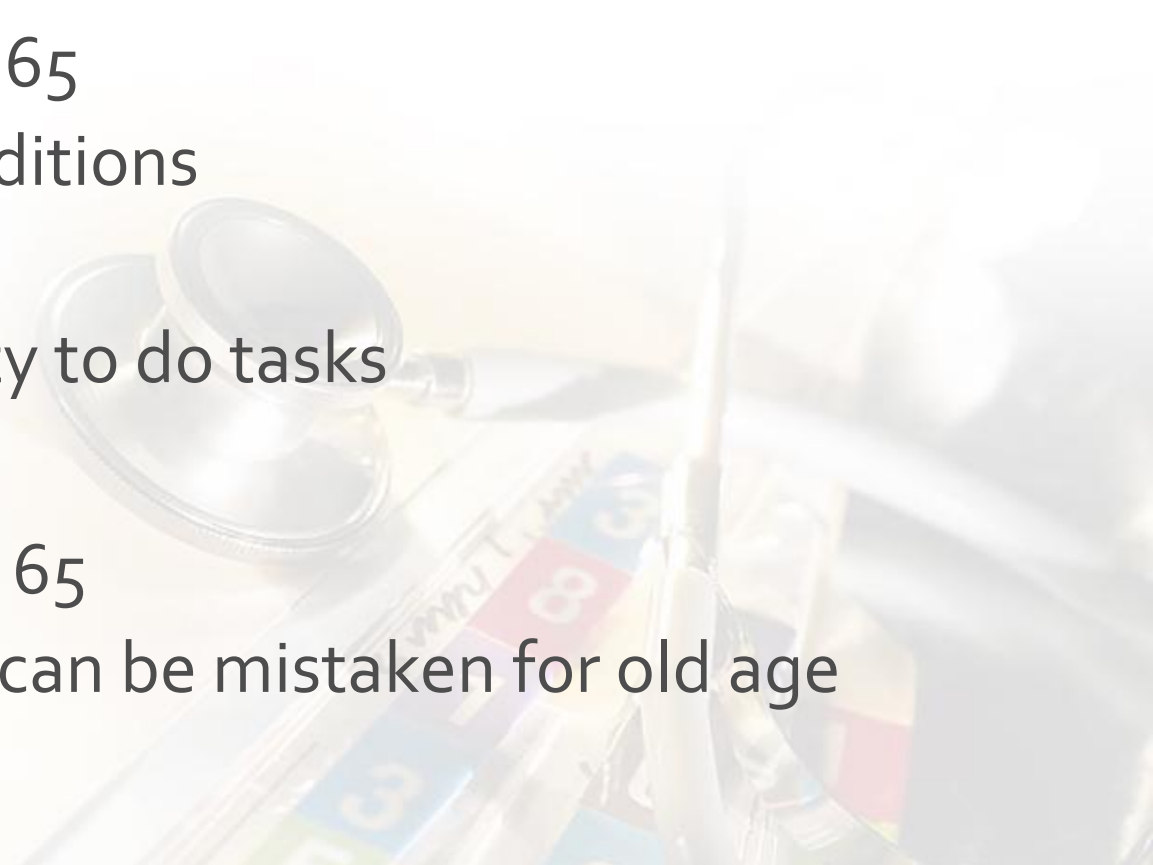


# Cause of AD: Tangles





# Manifestation of AD

- 75% are mostly women
  - Early-Onset Alzheimer's
    - under the age of 65
    - Usually mild conditions
    - Forgetfulness
    - Retains the ability to do tasks
  - Alzheimer's
    - above the age of 65
    - Early symptoms can be mistaken for old age
- 




# Symptoms of AD

- Progression of memory loss:
  - Forgetfulness
  - Difficulty forming new memories
  - Disorientation
  - Deepening confusion about events, time and place
- Mood and behavior changes
  - Mood swings, erratic behaviour
  - Unfounded suspicions about family, friends and professional caregivers

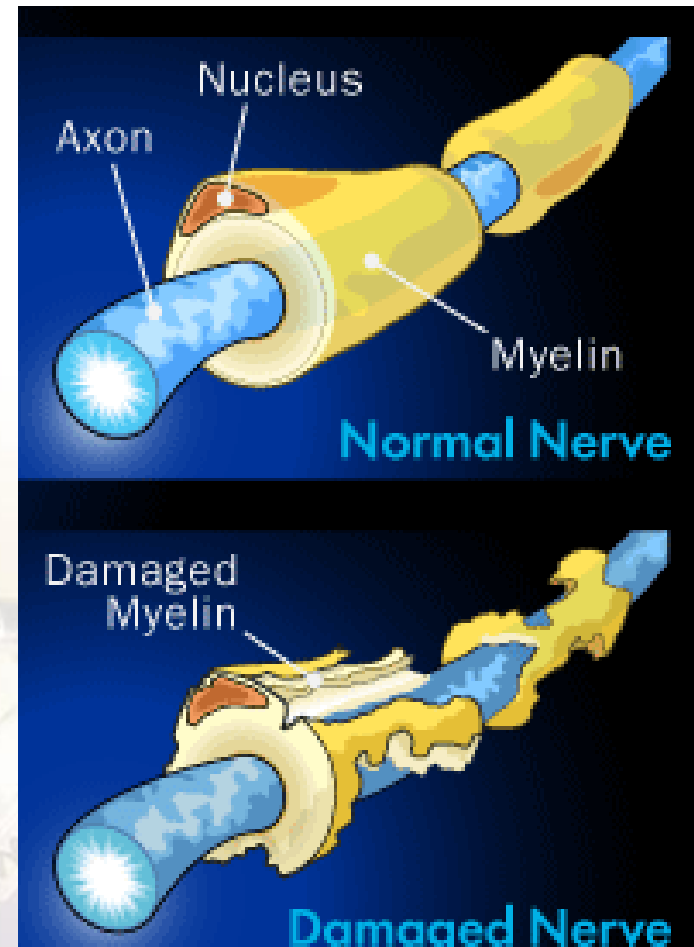


# Treatment for AD

- No cure
  - Treatment: to lessens symptoms of memory loss and confusion
- 

# What is Multiple Sclerosis?

- Sclerosis
  - From Greek meaning hard
  - Myelin is destroyed and replaced by scars of hardened patches of tissue called plaques
- Multiple
  - many different areas of the nervous system that may have damaged myelin
- Suspected to be an **autoimmune** disease








# Cause of MS

- Immune system views myelin sheath as foreign and attacks.
  - Myelin sheath becomes inflamed and damaged
  - axons are withered, demyelinated
  - no transmission of electrical impulse
  - compared to a loss of insulating material around an electrical wire, interferes with the transmission of signals
- Replaced with hardened scar tissue:
  - block formation of new myelin
  - slows down electrical impulse




# Cause of MS

- Other suspected theories resulting in demyelination and scarring:
    - triggered by virus or bacteria
    - genetic (although MS gene has not yet been found)
- 



# Manifestation of MS

- Women are 2-3 times more likely to get MS than men.
  - Affects Caucasians more than other races.
- 

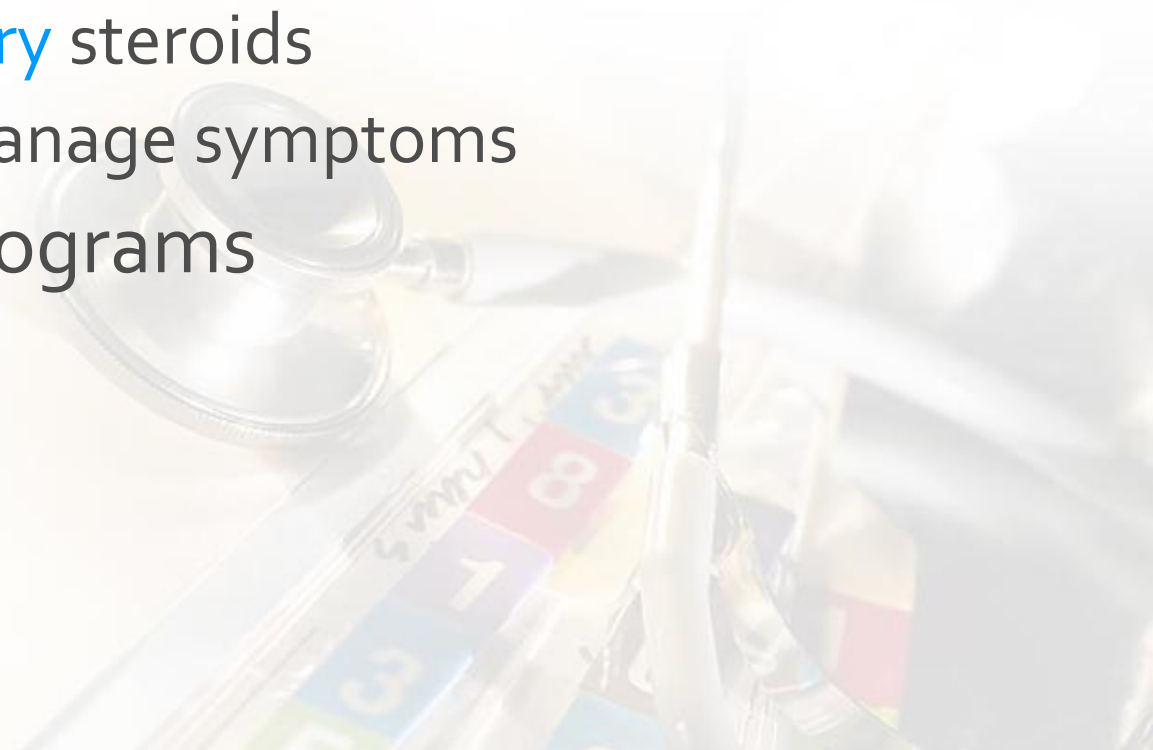


# Symptoms of MS

- Unpredictable, affects each person in different ways
  - Different symptoms
  - Varying severities
  - Depends on location of damage
- Body functions:
  - Bladder & bowel problems
  - Difficulty with swallowing
  - Slurred speech
  - Hearing / vision loss
  - Dizziness, headaches
- Muscular:
  - stiffness / spasms
  - Numbness / weakness / fatigue
  - Awkward gait / difficulty walking
  - Loss of coordination
  - Uncontrollable tremors
  - Paralysis
- Cognitive:
  - Mental health problems / depression
  - Memory problems
- Pain, seizures

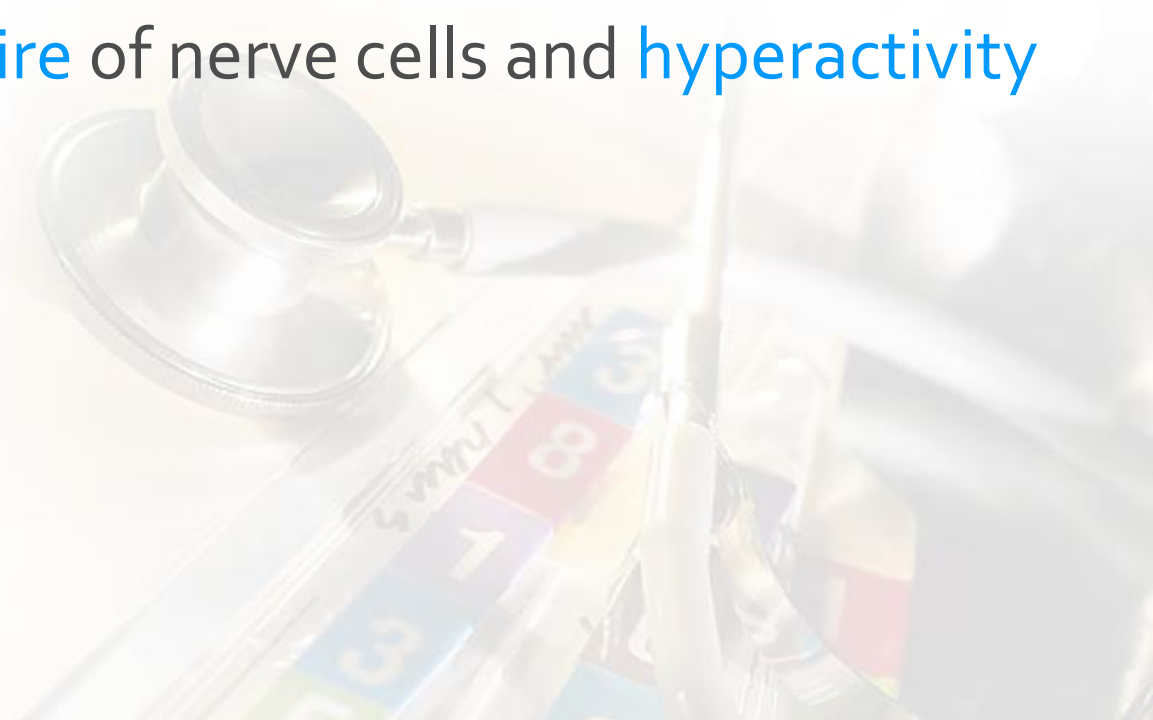


# Treatment for MS

- Treatment: reduce number and severity of relapses
  - Medication:
    - anti-inflammatory steroids
    - Other ones to manage symptoms
  - Rehabilitation programs
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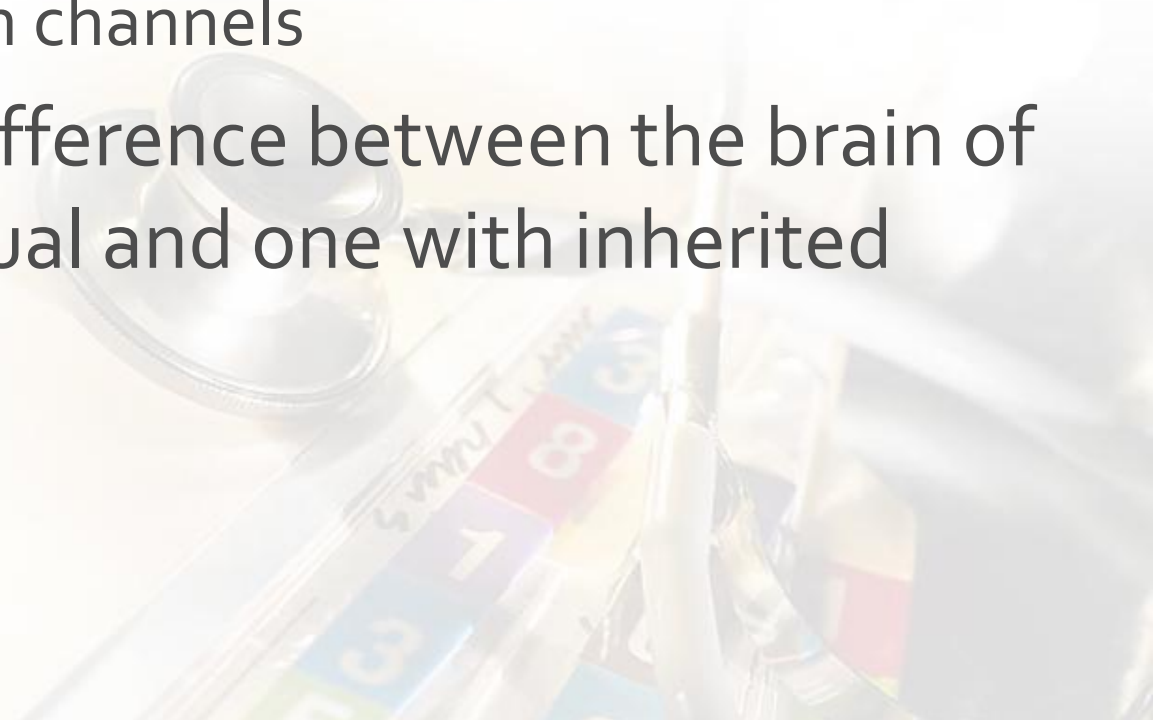


# What is Epilepsy?

- **Recurring unprovoked seizures**
    - Seizure: sudden surge of brain activity
  - Imbalance in the brain's electrical signals
    - caused by a **misfire** of nerve cells and **hyperactivity** within the brain
- 



# Cause of Epilepsy

- can be genetically inherited
    - however exact pathology is uncertain
    - possible explanations include mutations which affect protein ion channels
  - no discernable difference between the brain of a healthy individual and one with inherited epilepsy
- 

# Epilepsy Diagnosis



- Several tests need to be performed to confirm illness is epilepsy
  - Electroencephalography (EEG)
  - Brain imaging (CT, MRI, PET)
  - Blood tests
  - Developmental, neurological, and behavioral tests





# Manifestation of Epilepsy

- Can occur at any age
- More likely to occur in children and seniors
- Elderly that have diseases have increased risk of epilepsy
- Epilepsy in adults generally result from brain lesions or brain tumours
- Seizures **can be triggered by certain stimulants** such as alcohol, flashing lights, hormone changes




# Symptoms of Epilepsy

- **Convulsions:** sudden, violent, irregular, **involuntary** movement of the body
- **Muscle spasms:** **involuntary** contraction of muscles often causing **pain**
- **Twitches:** sudden, **short**, **involuntary** movement (a jerk)
- **Tics:** **habitual**, **repetitive** movement that can be suppressed for a brief period
  - triggered or increased by stress, lack of sleep etc.
- **Tremors:** **involuntary** trembling, **shaking** movement



# Treatment for Epilepsy

- No cure
  - Treatment: To reduce the severity and frequency of seizures
- 



# Treatment for Epilepsy

- Anticonvulsant medications
- **Corpus callosotomy**
  - Surgical procedure to sever the corpus callosum
  - Corpus callosum: tissue that connects and transmit messages between the two hemispheres of the brain
- **Vagus Nerve Stimulation:**
  - implanting a device that generates pulses of electricity
  - Sends regular pulses of electricity to the brain through the vagus nerve (autonomic nervous system)
  - Likens to a pacemaker for the brain
  - currently no explanation for why it reduces seizures



# Neurological Disorders Chart

Disorder	Definitions	Cause	Symptom	Treatment
Huntington's	Fatal Hereditary Degenerative	Autosomal dominant CAG repeats	Lack of muscle coordination Dementia	NA
Parkinson's	Chronic Progressive Degenerative	Lack of dopamine	Tremors	L-Dopa
Alzheimer's	Progressive Degenerative	Plaques & Tangles	Brain atrophy Memory loss	NA
Multiple Sclerosis	Autoimmune	Inflammation of myelin sheath replaced with scar tissue	Stiffness Spasms Numbness Fatigue	Anti-inflammatory
Epilepsy	Recurring	Imbalance in brain electrical signal	Seizures	Corpus callosotomy Vagus nerve stimulation