Johns Hopkins Engineering

Methods in Neurobiology

The Aging Brain

JOHNS HOPKINS
WHITING SCHOOL
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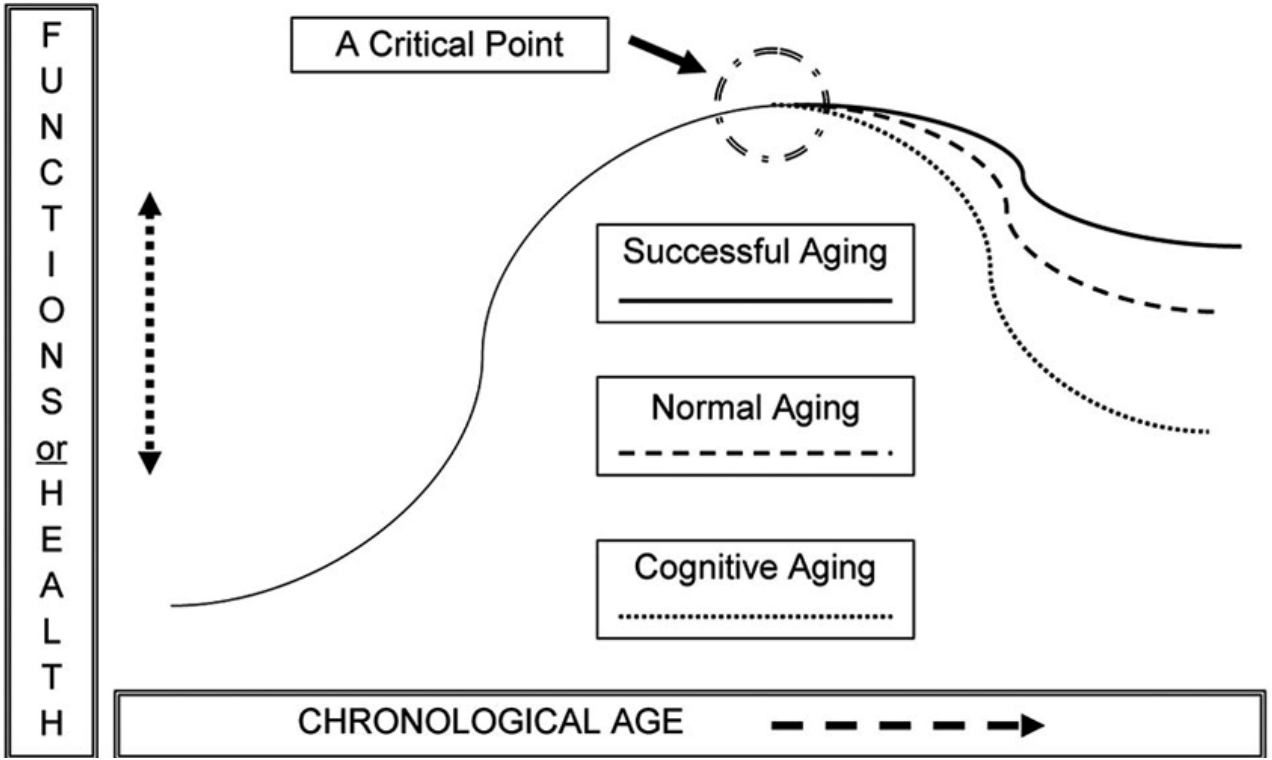
Aging Brain


FUNCTIONS or HEALTH
A Critical Point
Successful Aging
Normal Aging
Cognitive Aging
CHRONOLOGICAL AGE

Functional and Structural Changes in the Aging Brain-Normal Aging

Physical Characteristics

- 30% reduction neurons dorsolateral cortex
- Reduction of dendritic branching in superficial cortical layers
- Reduction in overall brain mass, specifically hippocampus and PFC

Physiology

- Disruption in calcium receptor densities
- Increased amplitude of AHP
- Decrease in neuronal firing

Genetic Changes

- Reduction of gene expression responsible for LTP
- Alterations in area CA1 of the hippocampus
- Reduced expression of genes responsible for synaptic plasticity

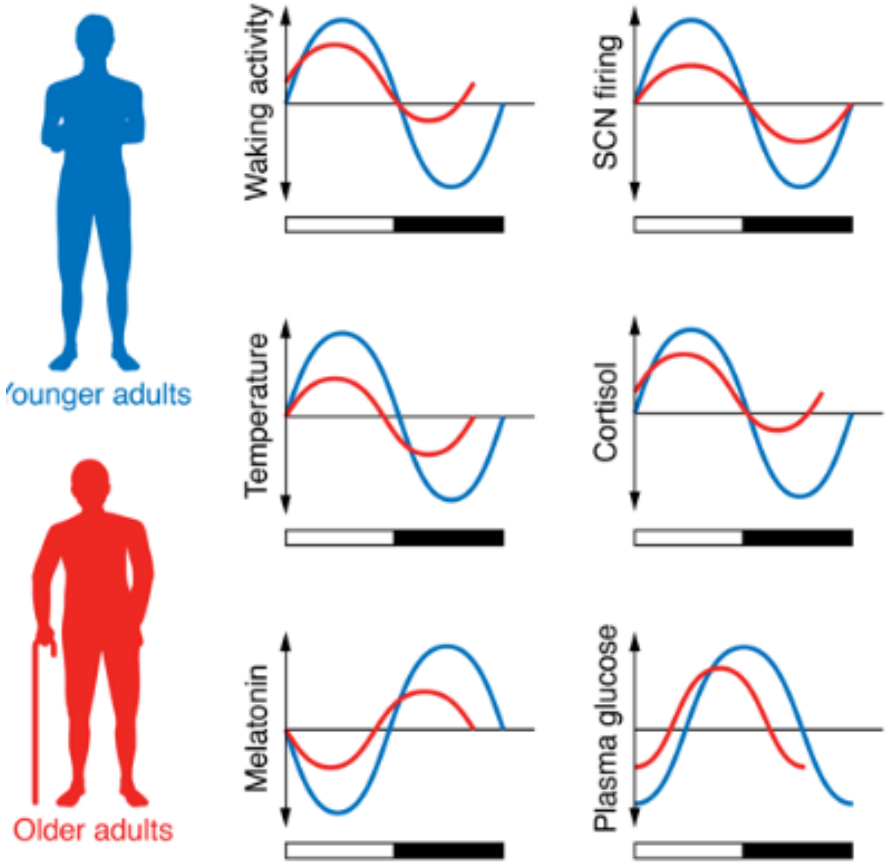
Cell to Cell Interaction

- Loss of synapse connections in the hippocampal dentate gyrus
- Dysregulation of genes responsible for synapse protein synthesis
- Reduction of EPSPs and neuron cooperation

Cognition

- Deterioration in spatial and associative memory
- Reduction in working memory and executive function
- Reduction in LTP and associated memory processes

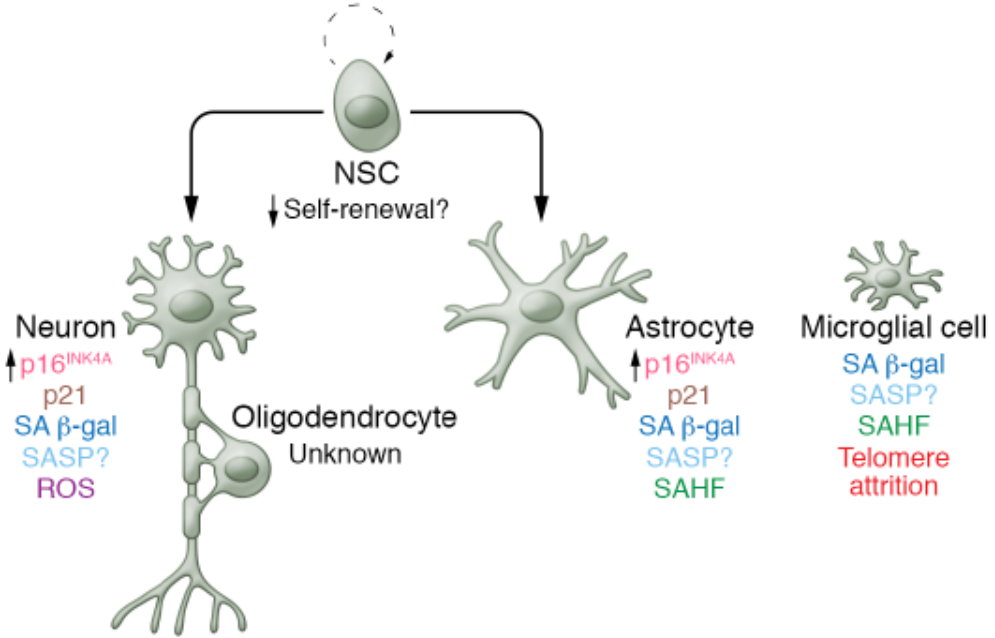
Circadian Clock and Aging



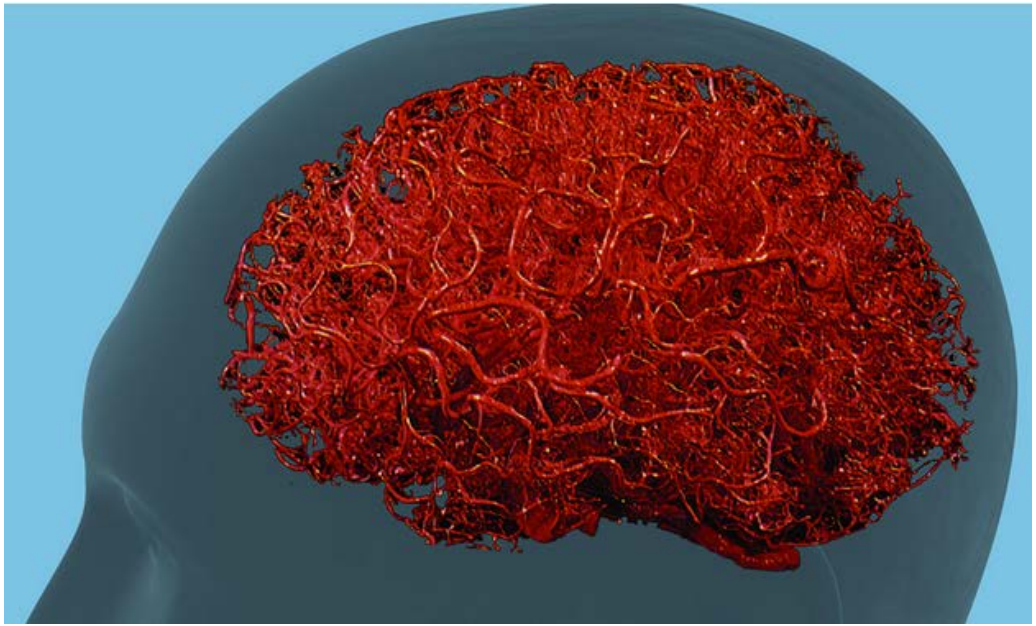
Aging brain: Cellular Aging

Cellular changes:

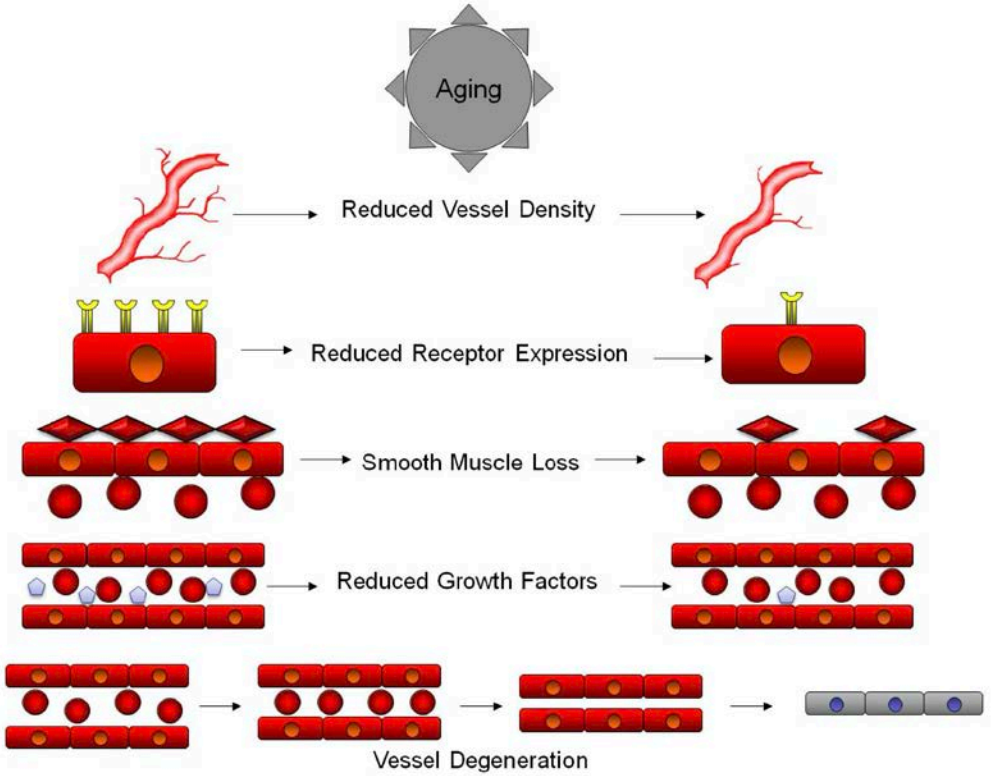
- Drastic reduction of neurogenesis;
- Accumulation of pigment: lipofuscin
- Senile plaques: Tau or Aβ
- Hirano bodies
- SAPS ➔NEUROINFLAMM-AGING



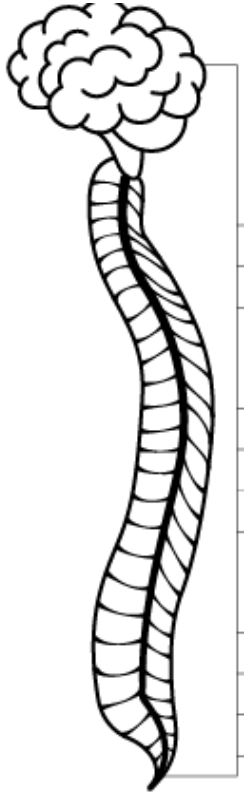
Vascular Aging and the Brain



Cellular Damage in Blood Vessels During Aging

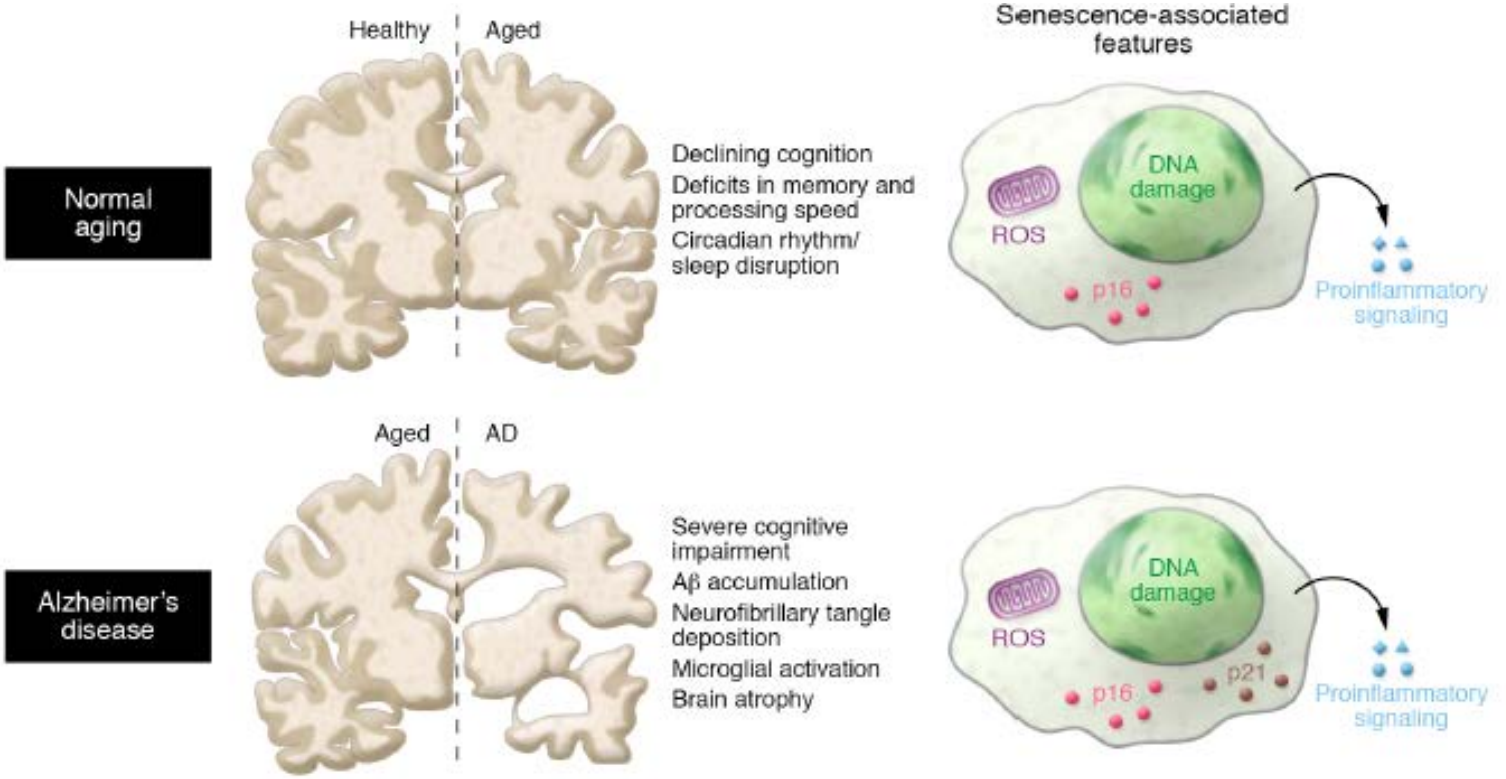


Aging vs CNS Disorders



- **Vascular disorders**: stroke, transient ischemic attack (TIA), subarachnoid hemorrhage, subdural hemorrhage and hematoma, extradural hemorrhage
- **Infections**: meningitis, encephalitis, polio, and epidural abscess
- **Structural disorders**: SN injury, tumors, Bell's palsy, cervical spondylosis, peripheral neuropathy, Guillain-Barré syndrome
- **Functional disorders**: headache, epilepsy, dizziness, and neuralgia
- **Degeneration**: Parkinson disease, multiple sclerosis, amyotrophic lateral sclerosis (ALS), Huntington chorea, and Alzheimer disease

Healthy Aging vs Dementia (AD)



Healthy Aging vs Dementia (AD)

AGING

- Change in cognition: deficits in executive function and reduce in processing speed> episodic memory loss. Preserved semantic and verbal.
- Changes in structure: grey matter loss ≈ white matter volume. Anterior-posterior decline.
- Functional changes: PFC- executive dysfunctions
- Dopaminergic dysfunction

AD

- Change in cognition: Accentuated memory deficits>deficit in executive functions. Impairment in semantic and verbal memory
- Changes in structure: grey matter loss >> white matter volume. Posterior-anterior decline.
- Functional changes: mediotemporal brain regions -memory deficits
- Cholinergic dysfunction

References

Slide	Reference
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6	Promising Treatment for Alzheimer's Moves Toward Clinical Trials. Research @MSU. Michigan State University https://research.msu.edu/promising-treatment-for-alzheimers-moves-toward-clinical-trials/
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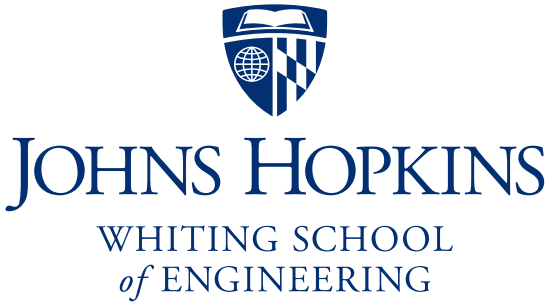

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