

**Healthy Heart, Healthy Brain:  
The association between cardiovascular  
disease and Alzheimer's disease**

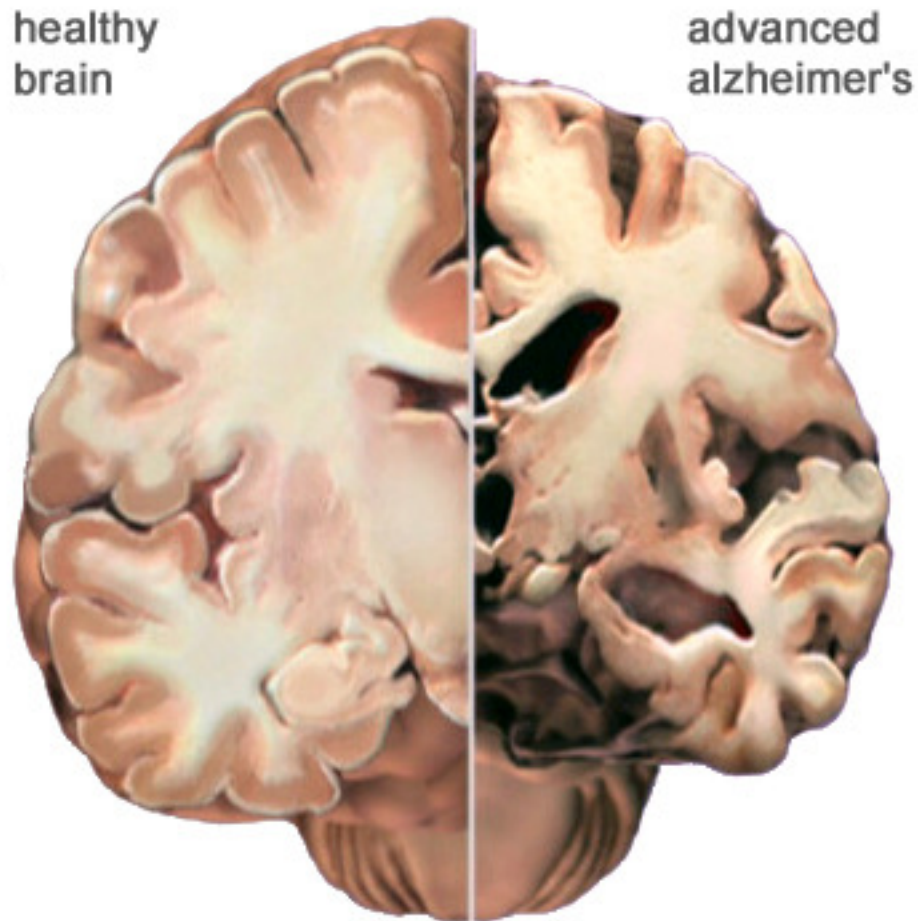
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# A brief introduction about Alzheimer's disease

# The “first” face of Alzheimer’s disease: Auguste D.

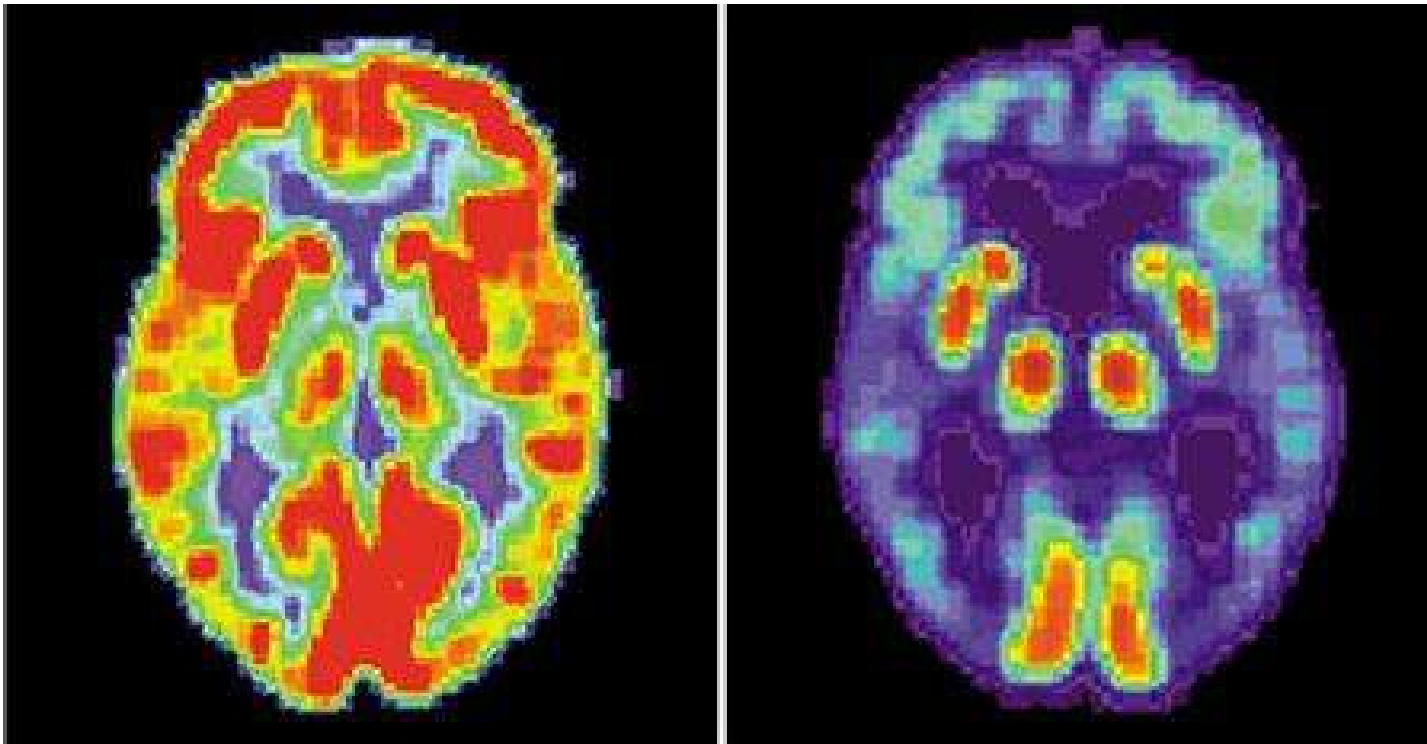


# Alzheimer's disease (AD) – a neurodegenerative disease



Taken from: <http://hubpages.com/hub/My-Simple-Theory-on-Alzheimers>

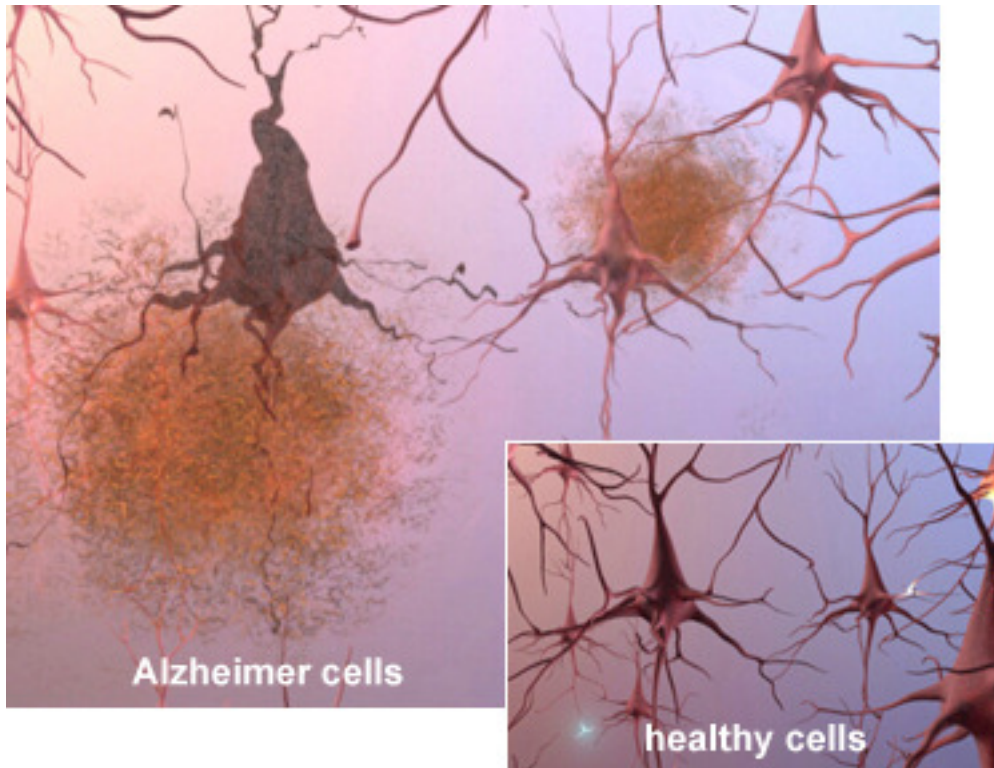
# The AD brain is functionally impaired



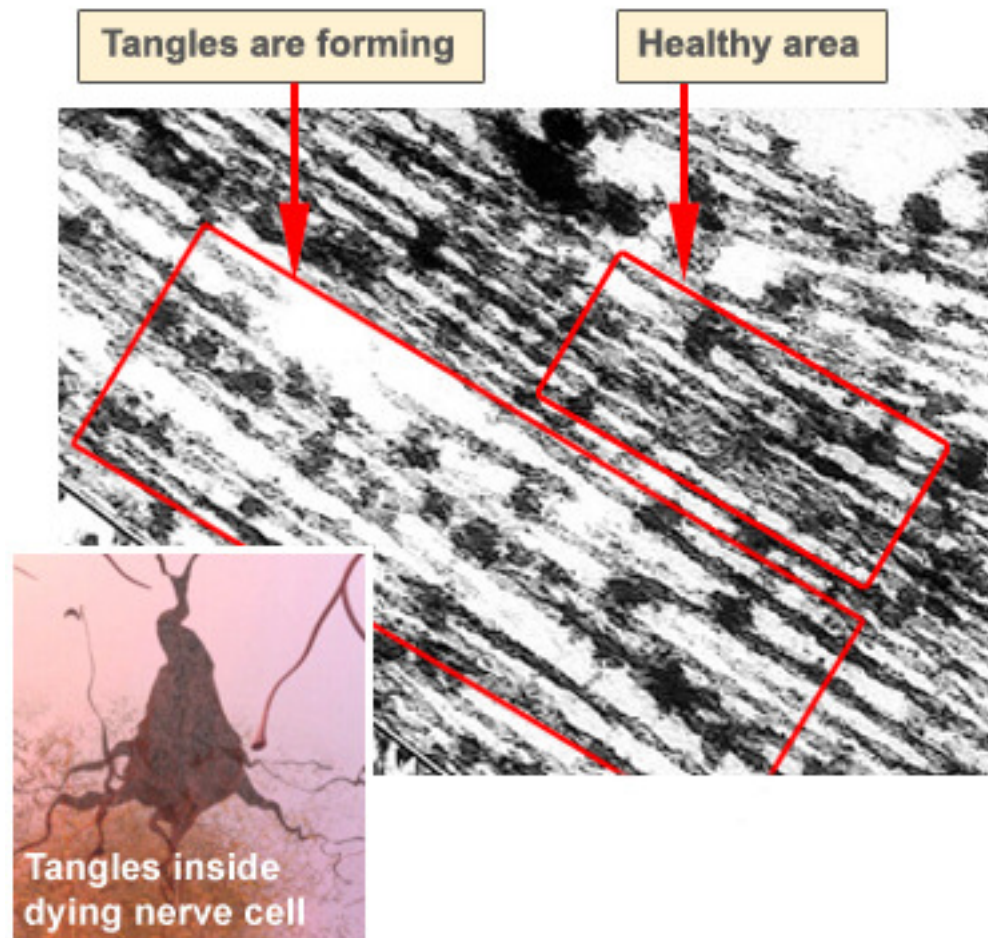
NORMAL

Alzheimer's disease

# Hallmarks of Alzheimer's brains?



# Hallmarks of AD: Neurofibrillary tangles



# Exploring the link between heart disease and Alzheimer's disease



# The brain is very sensitive to changes in blood/oxygen supply

- The brain receives approximately 15% of cardiac output
  - Implies that compromised cardiovascular function would reduce supply of blood (and thus oxygen) to the brain
- The brain is responsible for 20% of the body's total oxygen consumption
  - The brain is very sensitive to loss of oxygen
- The brain is responsible for about 25% of total body glucose utilization

# Common risk factors for heart disease and Alzheimer's disease

- Advancing age
- Hypertension
- ApoE4 allele
- Elevated cholesterol (LDL)
- Diabetes
- Elevated homocysteine

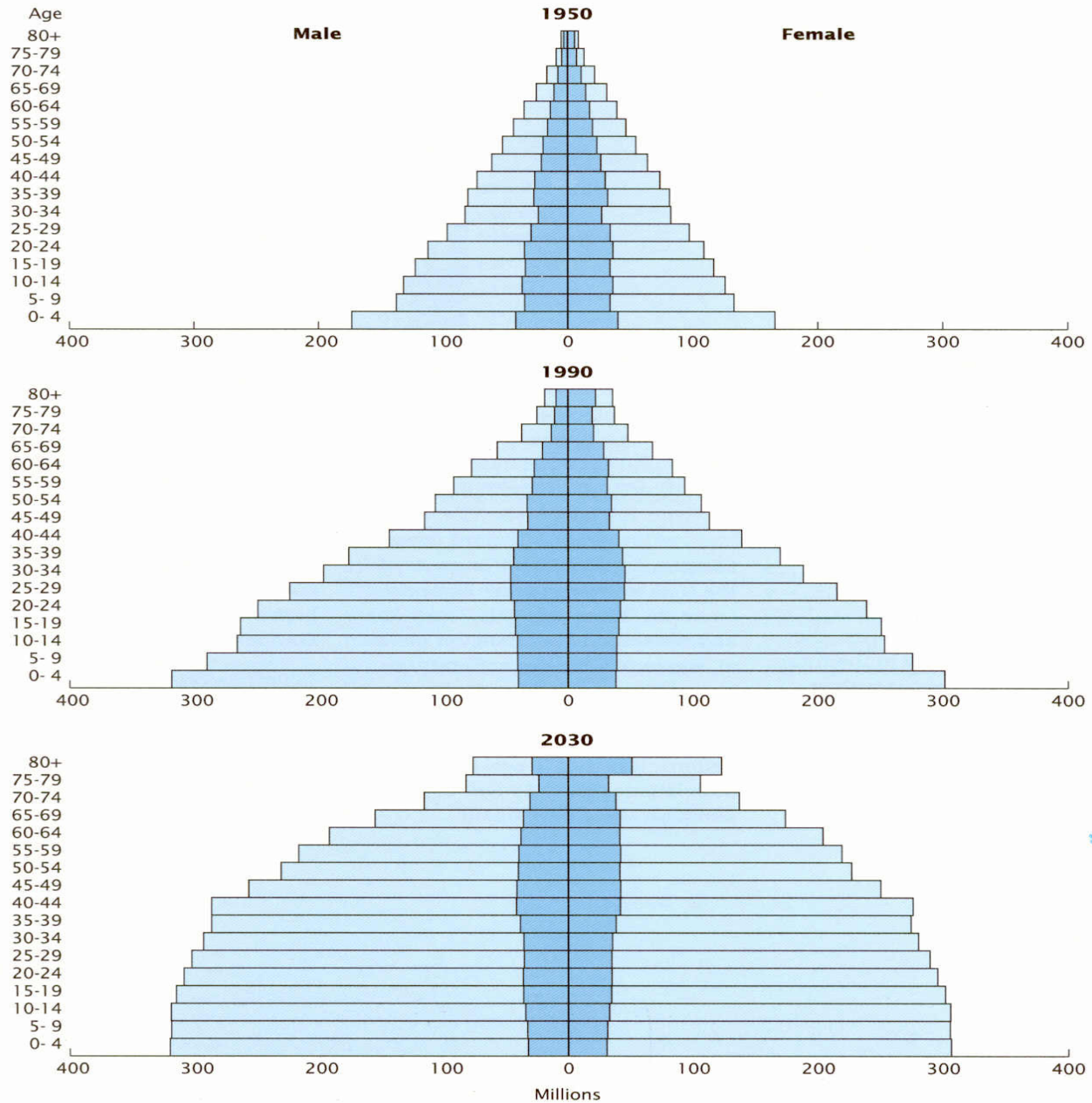
# Age is the greatest risk factor in Alzheimer's disease

- About 5 million Americans currently have Alzheimer's disease. The risk of getting Alzheimer's disease goes up with age after 65.
- By 2050, it is estimated that in the US alone 13.5 million people will have Alzheimer's Disease

# The Graying of America

Population by Age and Sex: 1950, 1990, and 2030

Developing countries  
 Developed countries



Sources: United Nations, 1999 and U.S. Census Bureau, 2000a.

# Hypertension and Alzheimer's disease

- Kaiser Permanente study – those with hypertension at mid-life had a 24% greater risk for Alzheimer's disease (Whitmer et al., 2005)
- Honolulu-Asia Aging study – those with borderline high blood pressure had more than three-fold increase in risk for Alzheimer's disease (Launer et al., 2000)

# Cholesterol and Alzheimer's disease

- Higher cholesterol and higher LDL levels are associated with increased risk for cognitive dysfunction (Yaffe et al., 2002)
- The French Three-City Study of 9294 subjects, higher total cholesterol levels was associated with increased risk for dementia (Dufouil, et al., 2005, Whitmer et al., 2005; Kivipelto et al., 2002)
  - Note, however, that not all studies that have examined this relationship show a convincing effect of increased cholesterol and Alzheimer's disease. May be due to parameter being measured

# ApoE4 allele and Alzheimer's disease

- ApoE4 regulates lipid transport
- Increases the risk for not only cardiovascular disease but also Alzheimer's disease.
- Subjects with an e4 allele had impaired cognitive function (Kang et al., 2005).
- In a meta-analysis of caucasians, one e4 allele conferred a nearly 3-fold increase risk for Alzheimer's disease, while having both e4 alleles increased risk by 14.9 fold (Farrer et al., 1997)

# Diabetes/obesity and Alzheimer's disease

- Diabetes/obesity predisposes people to heart disease
- Type 2 diabetes is associated with increased risk of cognitive impairment (Cukierman et al., 2005; Coker and Shumaker, 2003)



# Patients who have had a stroke are at increased risk for dementia

- Epidemiological data describing the incidence of dementia following a stroke:
  - Cross sectional analysis:
    - 1 yr: 6.7% demented
    - 3 yrs: 21.3% demented
    - 4 yrs: 21.5 to 23.2% demented
    - 5 yrs: 32% demented
  - Longitudinal studies:
    - Kokmen et al: retrospective review of 971 stroke patients
      - 7, 10, 15, and 23% at 1, 3, 5, and 10 yrs, respectively.
    - Samuelsson et al: 81 lacunar infarction patients
      - 4.9 and 9.9% demented at 1 and 3, respectively.
    - Desmond et al: 334 ischemic stroke and 241 stroke-free control
      - Incidence rate: 8.94 per 100 person-yr for stroke patients  
1.37 per 100 person-yr for control

Treatments for heart disease have been proposed/shown to be of potential benefit in the treatment/prevention of Alzheimer's disease

- Statins
  - Lower cholesterol
- IDE (Insulin degrading enzyme)
  - Can degrade amyloid-beta
- Anti-hypertensives
  - Can reduce the risk for Alzheimer's disease

# Strategies to prevent the occurrence of brain aging and Alzheimer's disease?

- **Choose Good Parents (genetics)**
- **Physical Exercise**
- **Mental Exercise**
- **Cardiovascular fitness**
- **Dietary lowering of cholesterol**
- **Protect the brain from injury and inflammation**
- **Use Antioxidants**

The moral of the story.....

Keep your heart healthy and you  
will reduce your risk for Alzheimer's  
disease and other dementia

# Alzheimer's disease is 6<sup>th</sup> leading cause of death in the United States

## Percentage Changes in Selected Causes of Death, 2000 and 2006

Cause	2000	2006	Percentage Change
Heart disease	710,760 <sup>a</sup>	629,191 <sup>c</sup>	-11.5
Breast cancer	41,200 <sup>b</sup>	40,970 <sup>d</sup>	-0.6
Prostate cancer	31,900 <sup>b</sup>	27,350 <sup>d</sup>	-14.3
Stroke	167,661 <sup>a</sup>	137,265 <sup>c</sup>	-18.1
<b>Alzheimer's disease</b>	<b>49,558<sup>a</sup></b>	<b>72,914<sup>c</sup></b>	<b>+47.1</b>

a National Center for Health Statistics. *Deaths: Final Data for 2000*.<sup>30</sup>

b American Cancer Society. *Cancer Facts and Figures 2000*.<sup>31</sup>

c Heron et al.<sup>23</sup>

d American Cancer Society. *Cancer Facts and Figures 2006*.<sup>32</sup>

# Alzheimer's disease is multi-faceted

We must understand all the risk factors

We must work together to enable more work to be done and subsequently ensure the dissemination of the resulting information.