



# C10 DIAGNOSTIC IMAGING IN ALZHEIMER'S

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# OBJECTIVES

- ❖ Understand the background of Alzheimer's disease
- ❖ Outline how Alzheimer's disease is diagnosed
- ❖ Explore how magnetic resonance imaging (MRI), positron emission tomography (PET), and computed tomography (CT) can each aid in the diagnosis of Alzheimer's
- ❖ Advancements in Alzheimer's diagnosis with AI and diagnostic imaging



Dr. Alois Alzheimer

[HTTPS://WWW.ALZINT.ORG/ABOUT/DEMENTIA-FACTS-FIGURES/TYPES-OF-DEMENTIA/ALZHEIMERS-DISEASE/ALOIS-ALZHEIMER/](https://www.alzint.org/about/dementia-facts-figures/types-of-dementia/alzheimers-disease/alois-alzheimer/)

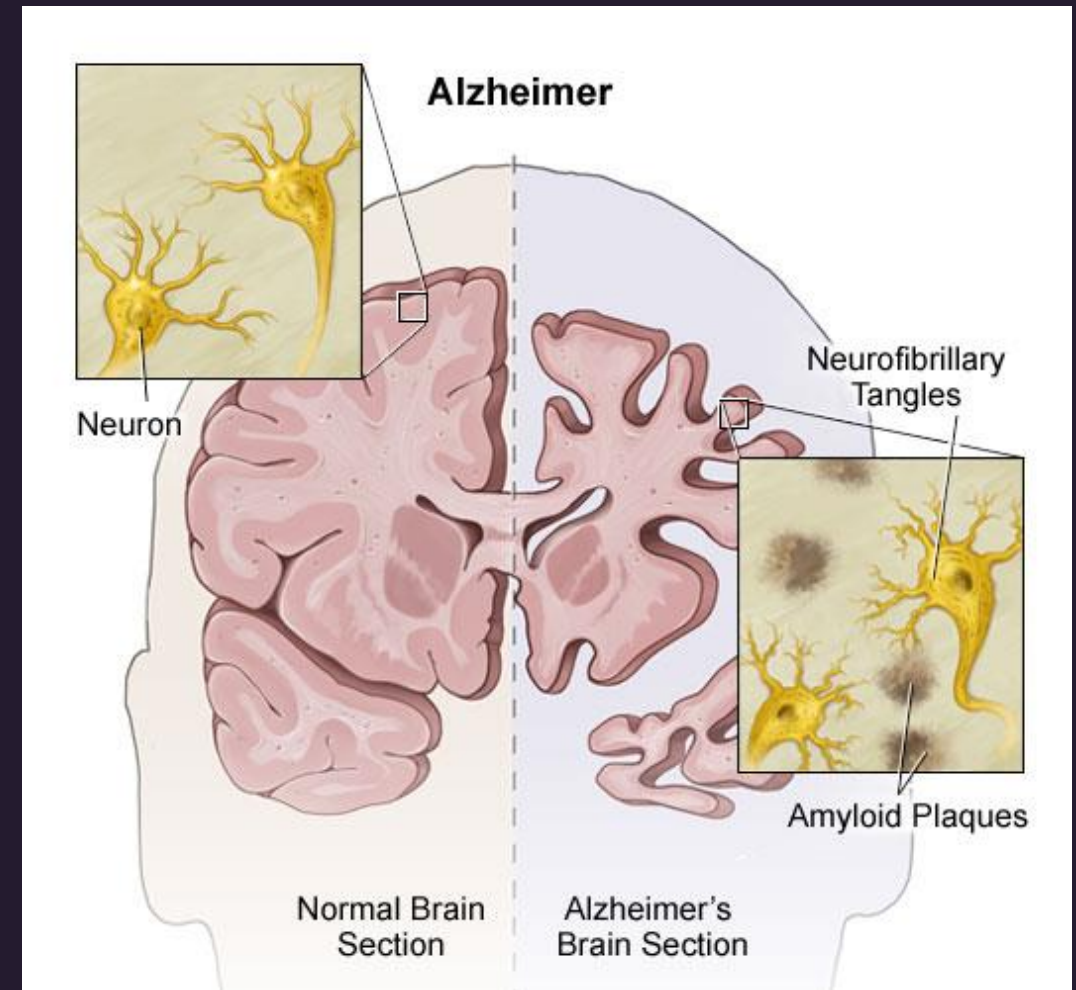
## BACKGROUND ON ALZHEIMER'S DISEASE

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- ❖ Named after Dr. Alois Alzheimer, Alzheimer's is a type of dementia that starts with memory loss. It sabotages the neurons and their connections in the part of the brain that pertains to memory. Eventually, it impacts areas responsible for language, reasoning, and social behavior. In the worst cases, Alzheimer's disease leads someone to lose their ability to function and communicate normally day-to-day.

# BACKGROUND ON ALZHEIMER'S DISEASE CONT.

- ❖ As of now, there is not a complete understanding of the disease or what causes it, but there are factors thought to increase a person's risk of developing it, such as age or genetics.
- ❖ Although there is no cure for Alzheimer's disease, the earlier it is caught, the earlier a treatment plan can be put in place.



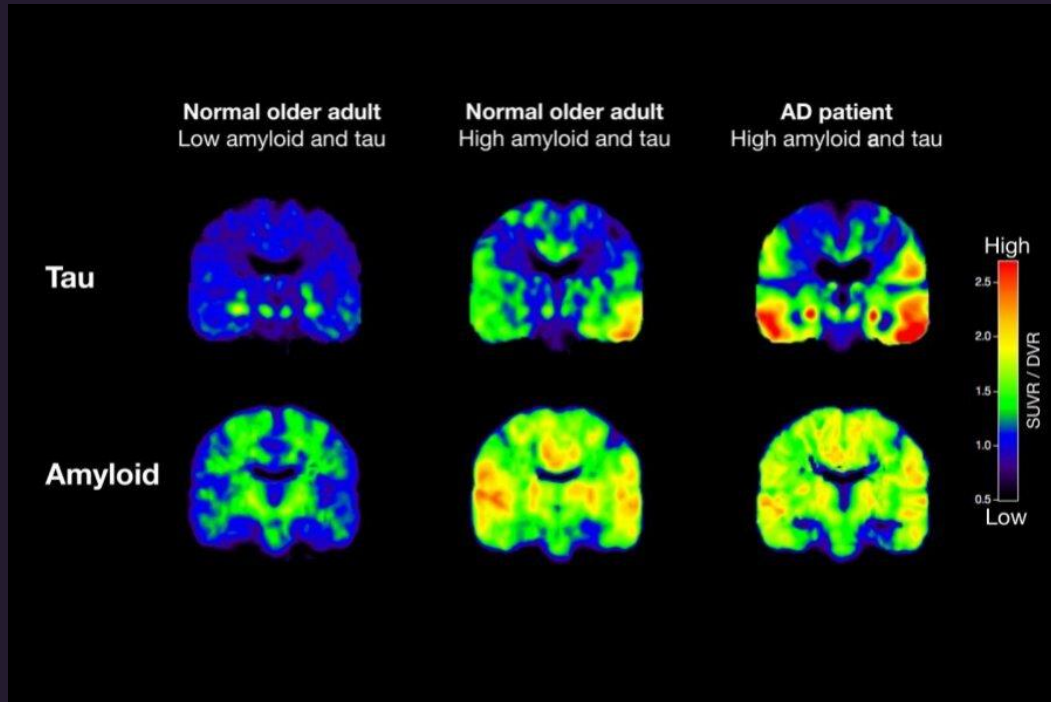


# HOW IS ALZHEIMER'S DIAGNOSED?



- ❖ Doctors will first evaluate patient's symptoms and learn about their behaviors from a family member. Before any testing, the doctor will check for impaired memory and cognitive abilities, as well as change in mood or personality.
  - It is important to check the degree of cognitive impairment to determine how far a patient's symptoms have progressed.
- ❖ Lab test can be done to check for vitamin deficiencies or amyloid or tau proteins in their spinal fluid.
- ❖ Imaging such as MRI, PET, and CT can help give doctors an idea of what is going on in a patient's brain.

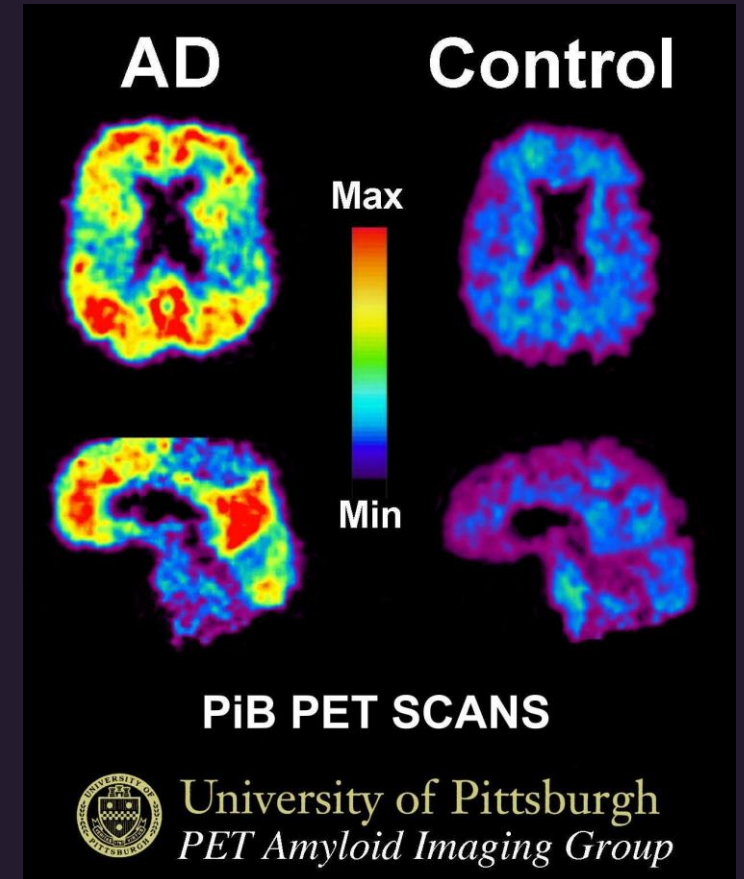
# POSITRON EMISSION TOMOGRAPHY



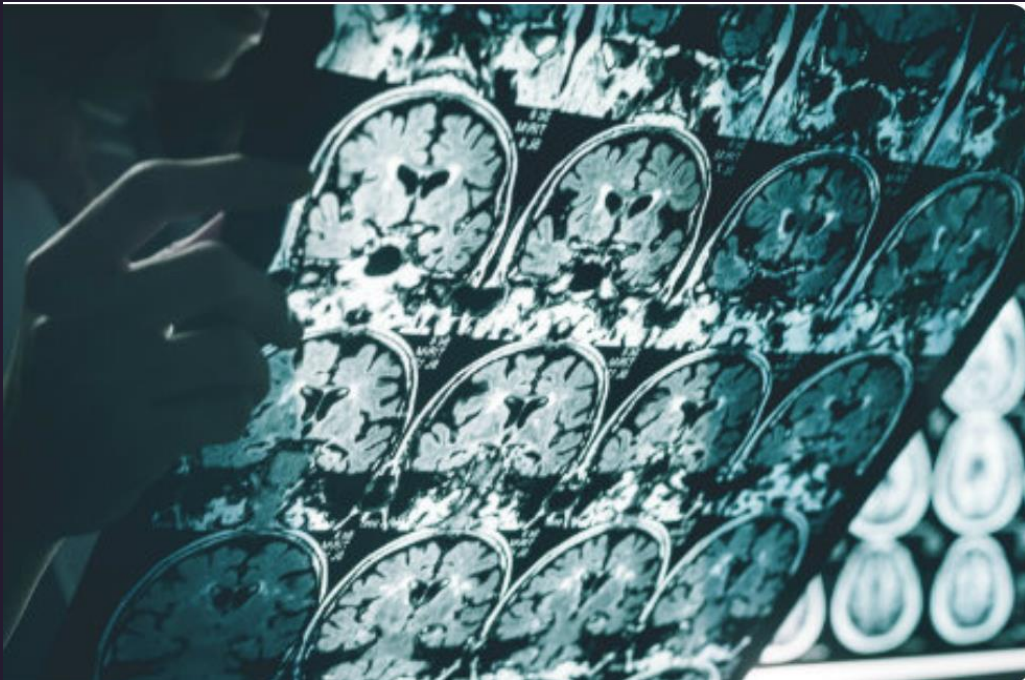
- ❖ Positron emission tomography (PET) provides doctors with information about the brain on a cellular level and determines if there have been changes in any areas of the brain.
- ❖ PET uses radioactive tracers to be able to see any substances and activity in a patient's brain.
- ❖ **Types of PET scans for Alzheimer's disease:**
  - Fluorodeoxyglucose (FDG) PET scan
  - Amyloid PET scan
  - Tau Protein PET scan

# PET AND ALZHEIMER'S DIAGNOSIS

- ❖ PET is primarily used in research settings, but they can often be a good indicator of Alzheimer's disease before symptoms begin to show.
- ❖ FDG PET scans can be used as a biomarker for neurodegeneration.
- ❖ In those with Alzheimer's disease, Amyloid plaques often buildup in the hippocampus of the brain.
  - This could previously only be determined from autopsy but can now be seen with Amyloid PET scans.
- ❖ Tau proteins in those with Alzheimer's can become altered and cause tangles in this system that lead to memory loss.
  - A radioactive tracer for tau proteins was approved in 2020 which is a big step as memory loss is often the first sign of Alzheimer's.



# COMPUTED TOMOGRAPHY

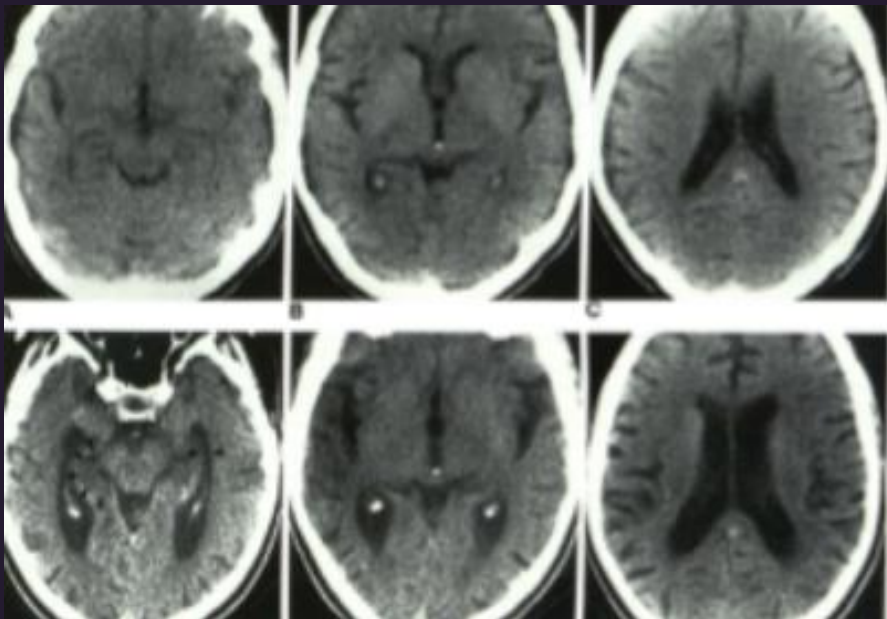


[HTTPS://AMERICANHEALTHIMAGING.COM/HEAD-CT-IDENTIFY-ALZHEIMERS-DISEASE/](https://americanhealthimaging.com/head-ct-identify-alzheimers-disease/)

- ❖ CT shows parts of the body from three different planes, much like MRI, but quicker. This may be easier for patients with Alzheimer's to sit still for a shorter amount of time.
- ❖ Brain CT provides detailed information about brain tissue and structures. This can tell us injuries or diseases of the brain.
- ❖ A CT of the head is commonly performed as a non-contrast exam, especially if the exam indication is for dementia (Carpenter & Jones, 2010).
  - This is because contrast exams look at the blood-brain barrier, which is not needed for Alzheimer's patients.
- ❖ These exams could potentially rule out other issues a patient could be experiencing, as well as determining if other tests are needed.



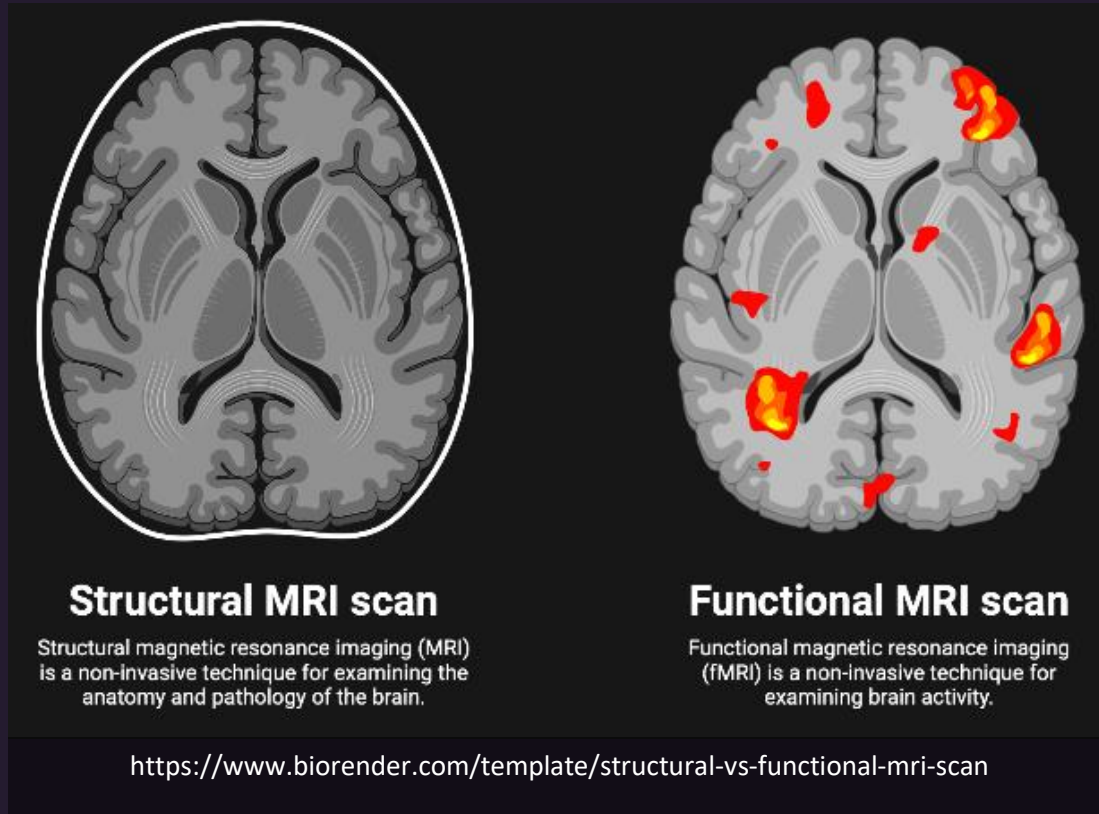
# CT AND ALZHEIMER'S DIAGNOSIS



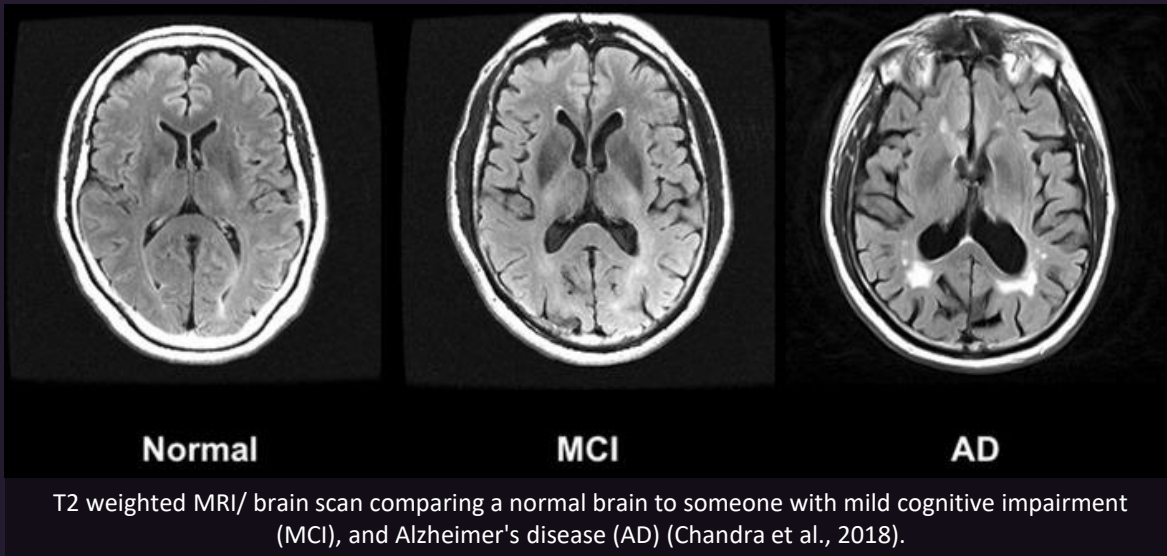
- ❖ The primary purpose of CT scans in patients potentially having Alzheimer's is to rule out other conditions that could lead to cognitive symptoms like a tumor or stroke.
- ❖ CT can help target an effective treatment plan for suspected Alzheimer's
- ❖ Detection of structural changes in the temporal lobe of the brain and the hippocampus on CT, supports a diagnosis of Alzheimer's disease.
- ❖ Brain atrophy can also be seen on a CT scan which is a common sign of Alzheimer's

# MAGNETIC RESONANCE IMAGING

- ❖ MRI is used to image the brain and spinal cord. It can show anything from tumors to neurodegeneration that could contribute to memory loss.
- ❖ There are two types of MRIs that could be done when looking for Alzheimer's disease:
  - **Structural MRI** looks at the anatomy and pathology of the brain, is painless for Alzheimer's patients, and provide the doctors with clear images of the anatomy.
  - **Functional MRI** is a scan that looks at the activity of brain in different areas. It can detect changes in cognition and memory over time. The functional changes in the brain can be detected by the fMRIs before any structural changes are seen.



# MRI AND ALZHEIMER'S DIAGNOSIS



- ❖ MRIs can show patterns of brain damage that distinguish Alzheimer's disease from other brain illnesses and abnormalities from mild cognitive impairment and other behavioral outcomes.
- ❖ Disruption of the gray matter networks, which can be seen on a structural MRI, can be associated with the progression of Alzheimer's as it can result in the decline of cognitive abilities like memory and language. For a doctor to see what is happening in the brain at any given moment, a functional MRI scan is performed.

# ADVANCEMENTS IN ALZHEIMER'S DIAGNOSIS

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- ❖ Researchers are in the midst of creating an AI that can read brain scans and diagnose Alzheimer's with more than 90 percent accuracy.
- ❖ Combining genomics and brain imaging in a database teaches the AI what to look for when diagnosing.
- ❖ More research needs to be done before the AI can be approved for medical use.



AI CAN PREDICT ALZHEIMER'S DISEASE UP TO SEVEN YEARS BEFORE SYMPTOMS APPEAR, STUDY FINDS (PSYPOST.ORG)



## CONCLUSION

- ❖ Alzheimer's disease is not yet fully understood and does not have a simple diagnosis, so a series of tests can be done along with imaging to learn as much about it as possible.
- ❖ Diagnostic imaging like magnetic resonance imaging (MRI), positron emission tomography (PET), and computed tomography (CT) each aid in the diagnosis of Alzheimer's disease in their own unique ways.
- ❖ Imaging alone cannot diagnose Alzheimer's disease; however, new research advancements involving AI may one day be approved for medical use.

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