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The Use of Nuclear Medicine in Detecting and Treating Mental Health Diseases

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Nuclear Medicine

Nuclear Medicine is a functional imaging modality used on many organs within the body. It utilizes radiopharmaceuticals, which are injected into the body and then imaged with a gamma camera.

(Johns Hopkins, n.d.)

Mental Health Disorders

- Mental Health Disorders affect nearly 53 million people in the United States.
- Common mental health disorders include: Alzheimer's Disease (AD), depression, Attention Deficit Hyperactive Disorder (ADHD), Post Traumatic Stress Disorder (PTSD), Obsessive Compulsive Disorder (OCD), and schizophrenia.

(Henderson, Lieropm, McLean, Et al., 2020)

Nuclear Medicine Studies Used in Detection

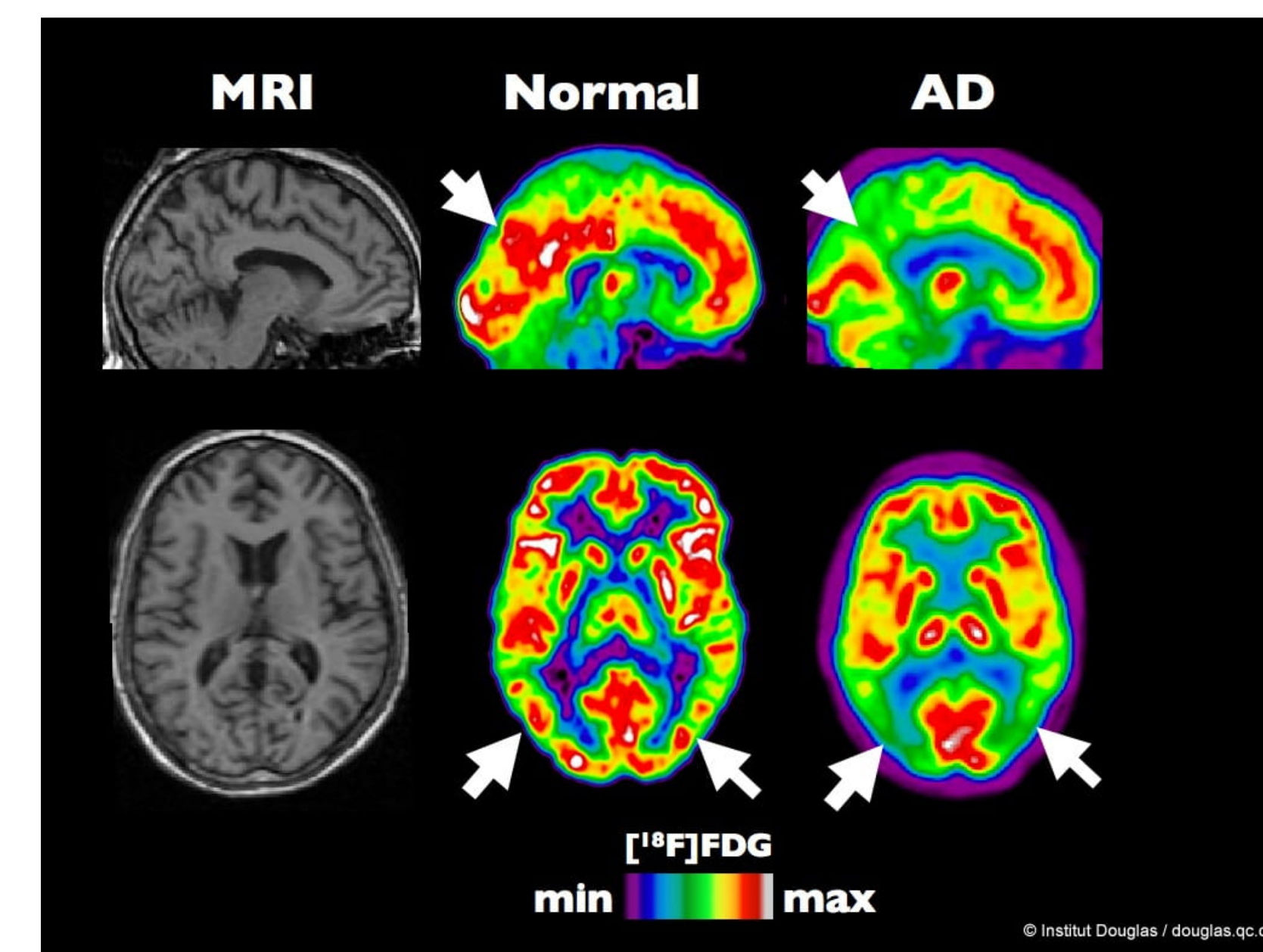
PET/CT Scan of Brain

- Uses ^{18}F -FDG Amyvid, Vizamyl, or NeuraCeq as the common radiopharmaceuticals.
- Radiopharmaceuticals injected intravenously, which are required to circulate anywhere from 30 to 130 minutes.
- Patient is imaged with a gamma camera for approximately 20 minutes. Body Mass Index (BMI) impacts the scan time.
- Positron Emission Therapy (PET) images will be fused with Computed Tomography (CT) images for a detailed evaluation.

Brain SPECT

- Brain SPECT scans use Ceretec and Neurolite as radiopharmaceuticals.
- Patients must sit or lay down in a dim room without any stimulation.
- The radiopharmaceuticals circulate in the system for 90 minutes, and imaged in the same way as PET/CT.

(Shackett, 2020)

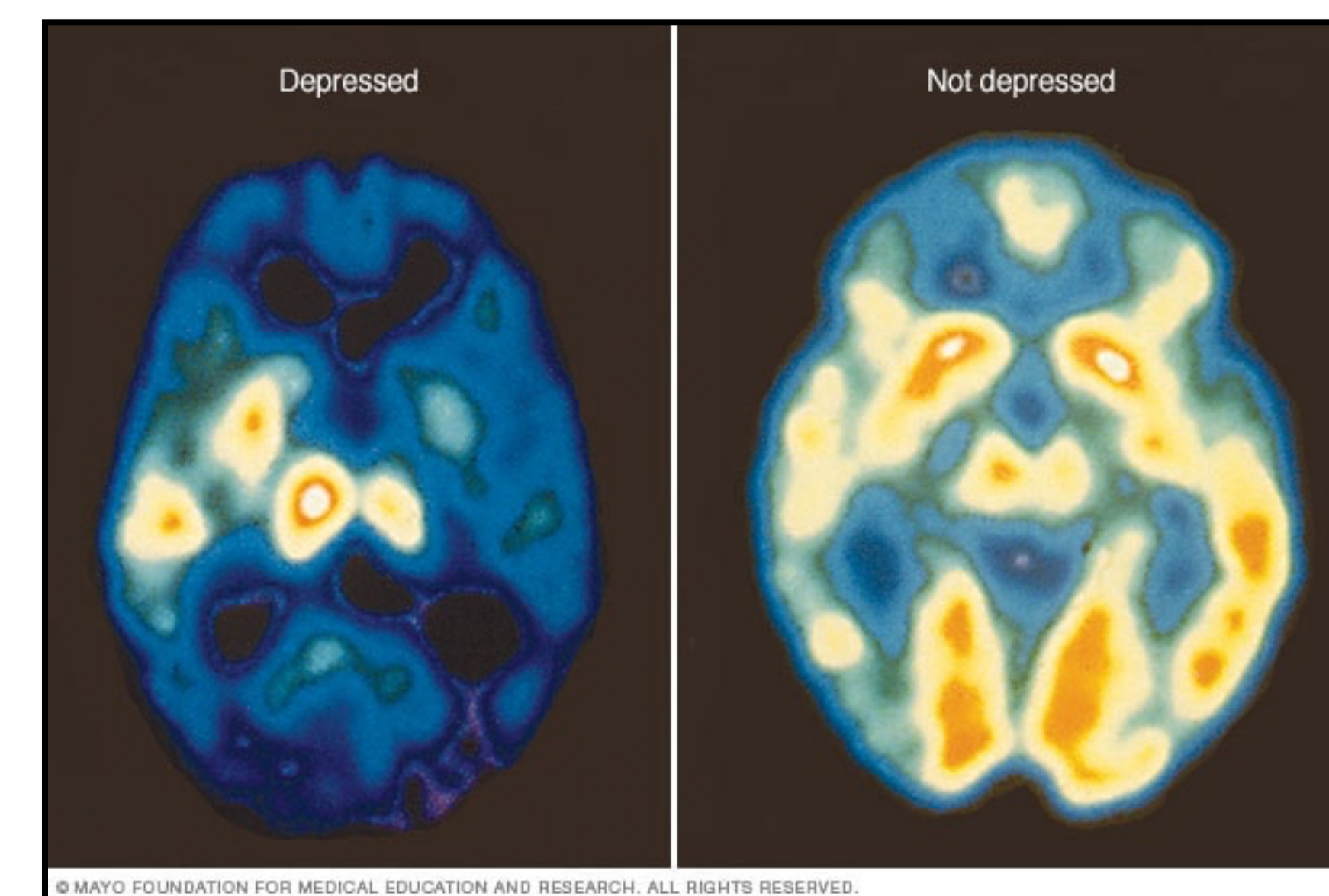


(IU Blooming, 2022)

Studies

- PET scans are being utilized for Neuroimaging, for the purpose of categorizing ADHD.
- Research has confirmed the effectiveness of PET in targeting the proper medication for mental health disorders.

(Henderson, 2020)



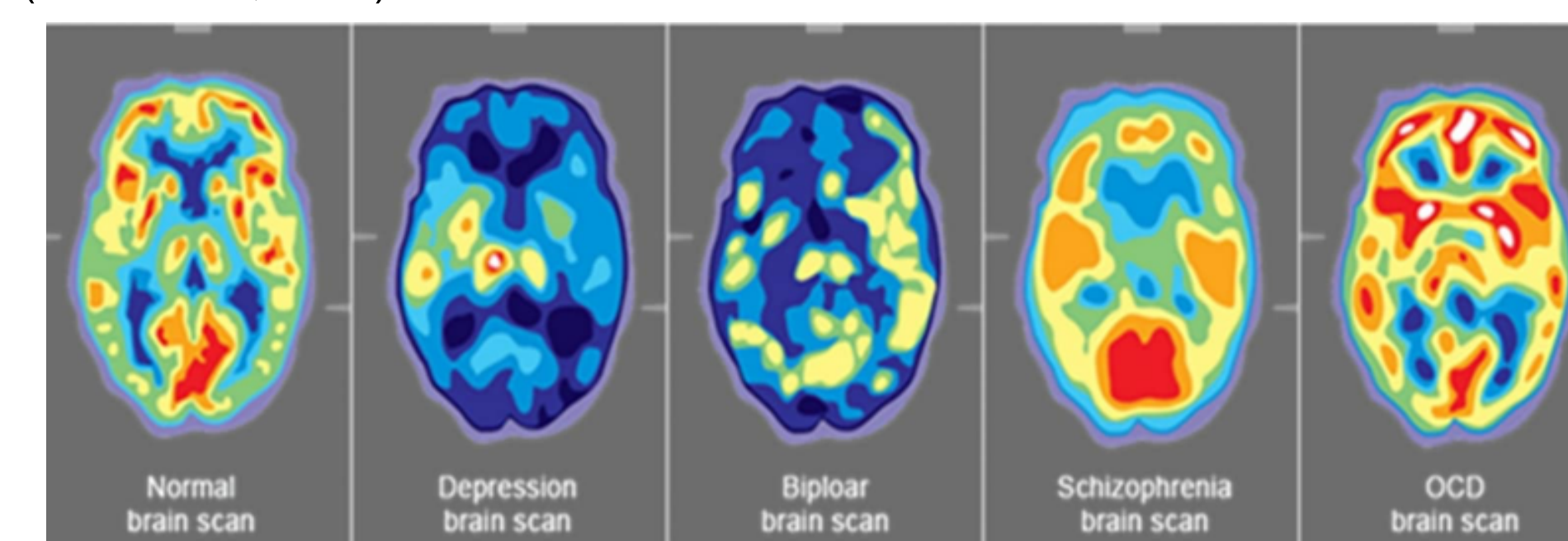
(Mayo Clinic, n.d.)

- Inflammation in the brain caused by schizophrenia can be evaluated by a brain SPECT. Results concluded positive results when using for evaluation of treatment and tracking of progress.

(Fond, 2021)

- SPECT Neuroimaging is displaying 60% positive outcomes for finding treatments to ADHD.

(Henderson, 2020)



(Soul- Alliance. 2021)

Recent Radionuclide Research

- Monoacylglycerol lipase (MAGL) is being paired with ^{18}F -T-401, and a PET scan is used to evaluate neuropsychiatric disorders.

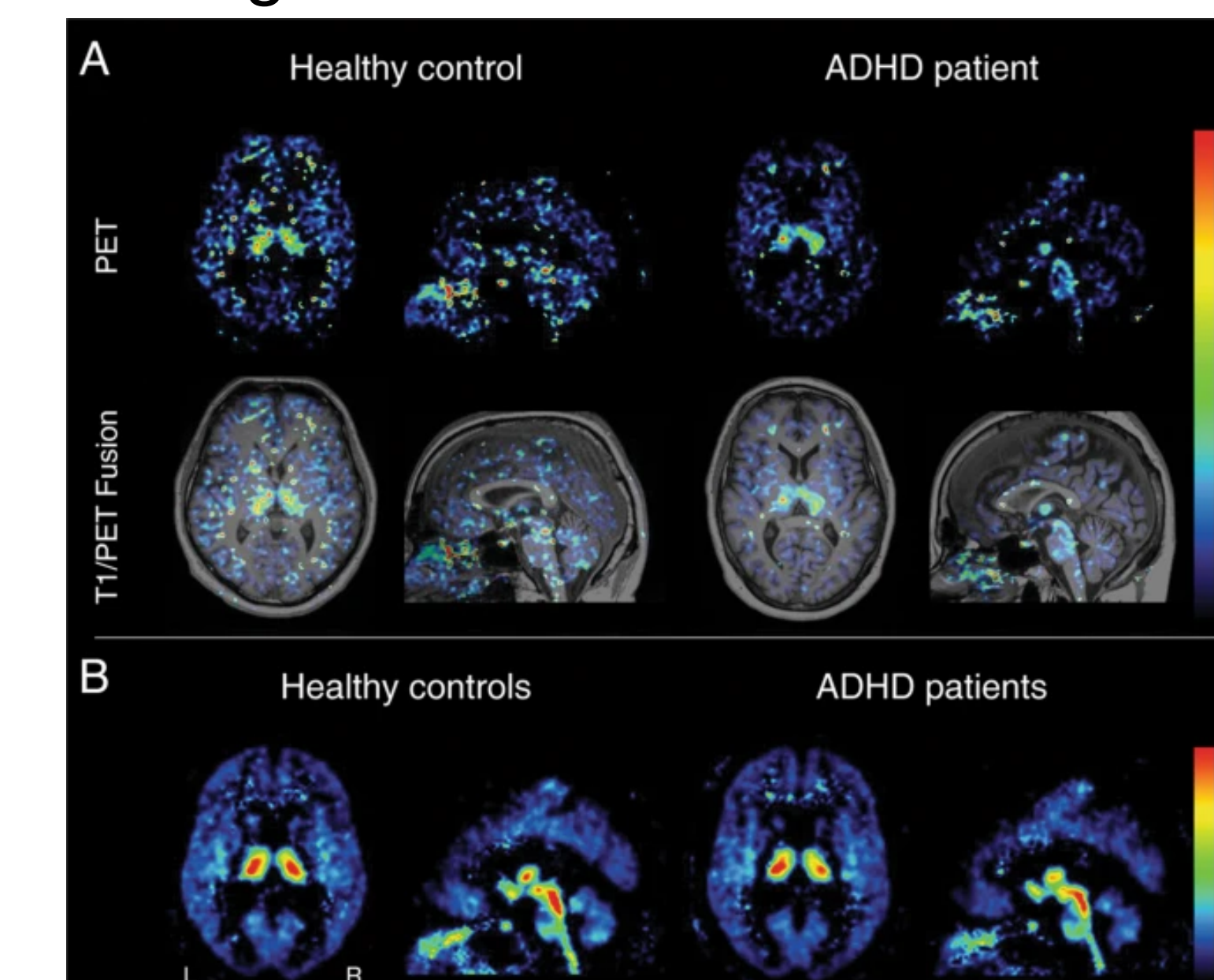
(Takhata, 2022)

- As of 2018, there have been advancements with Tau (neuroimaging brain scan) with the use of ^{18}F -AV-1451, ^{18}F -MK-6240 and ^{18}F -THK showing the highest promise for results. Tau imaging uses PET for evaluation of AD.

(McCluskey, 2020)

- SV²A is currently in clinical trials for determining the state of disease in AD and addiction.
- For evaluation of Parkinson's Disease (PD) VACHT for PET, and ^{18}F FE0BV is allowing for more detailed imaging on the smaller regions of the brain affected.

- Depression and PD can be seen through imaging using ^{11}C -ITMM & ^{18}F FIMX, which are two PET tracers that focus on brain signal.



(Transitional Psychiatry, 2019)

- Bipolar disorder & schizophrenia can be evaluated with ^{18}F -MNI-444, and this drug is showing promising sights to be superior for imaging of the Central Nervous System (CNS).
- With the development of more drugs, it allows for more advances focusing to specific areas of the brain.

(McCluskey, 2020)

Advantages & Disadvantages

Advantages

- Research allows for advancements in medicine providing a map of where certain disorders affect the brain, and more definitive answers as to what progress, if any, is being made.
- Treatment: The use of radiopharmaceuticals are showing positive outcomes for PTSD, and other therapies.

(Pagani, 2019)

- The use of nuclear medicine is being broadened to PET/ Magnetic Resonance Imaging (MRI), which would allow for better evaluation of the brain.

(Mayo Clinic, n.d.)

- fMRI is most often utilized for therapeutic imaging. It is a branch of PET that will allow better visualization of the brain muscle and activity levels.

(Falkai, 2018)

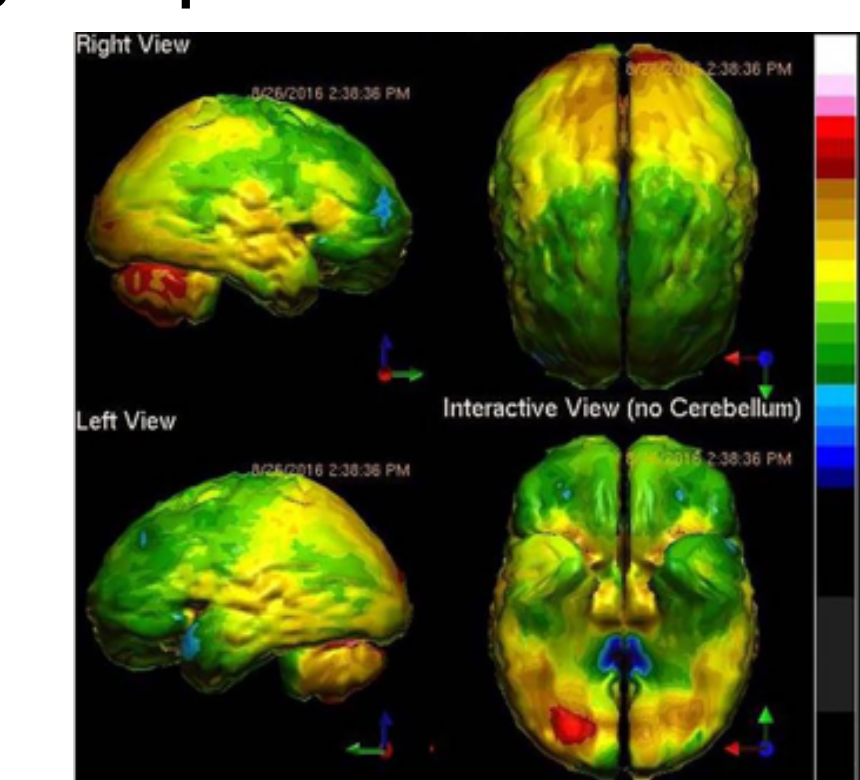
Disadvantages

- It can be expensive for many patients, and long scan times are not ideal.
- Psychiatric evaluation is more commonly performed.
- Some patients may not be able to remain still.
- As of 2018, the use of Nuclear Medicine to evaluate for AD has gradually decreased.

(Mayo Clinic, n.d.)

Conclusion

In conclusion, Nuclear Medicine has the ability to aid in diagnosis of mental health disorders. Despite the slow process determining which radiopharmaceuticals are best, the future use is promising for patients.



(Henderson, 2020)