

What's Happening in the Brain?

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The human brain is important for many reasons. It is responsible for every thought, emotion, breath, and movement experienced by an individual. To better understand the function of the brain of an individual with dementia, it is helpful to understand some brain basics.

Made up of networks comprised of approximately 100 billion individual cells called neurons, the three-pound organ known as the brain is the epicenter of communication to the body. Information is transferred from neuron to neuron through connections at more than 100 trillion points in the brain, allowing a person to perform a task, make a decision, or store a memory.

The largest portion of the brain—the cortex—is in charge of higher cognitive operations, such as thinking and problem solving. This region is segmented into four quadrants, each of which is responsible for different forms of cognitive functioning.

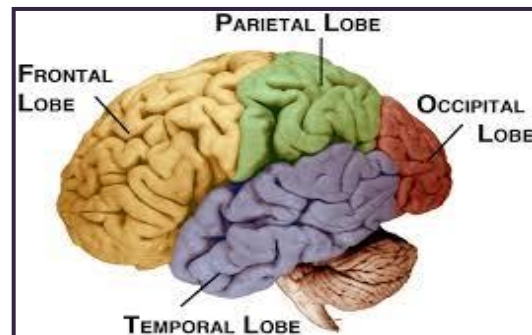
The **frontal lobe** is known as the “control panel” of one’s personality and is involved in motor function, problem solving, logic and reasoning, judgement, emotional expression, and social behavior.

The **parietal lobe** is responsible for language interpretation, and sensory perception. It is this part of the brain that is responsible for recognizing senses that come from the body, such as the feeling of heat from a fire.

The **occipital lobe** is the visual processing center of the brain. This area is involved in spatial organization. When the eyes receive visual information, the stimuli is sent to this part of the brain where it is organized into images the brain can understand.

The **temporal lobe** controls the ability to recognize faces, as well as word and number recognition. The function of this lobe enables us to comprehend meaningful speech. It houses the primary auditory cortex, which is responsible for processing sound stimuli from the ears.

An individual may experience memory loss, difficulty performing familiar tasks, confusion,



or changes in mood and personality. These symptoms, defined as dementia, may be traced back to some cause or specific neurological disease. Progressive dementia is an irreversible disease producing symptoms that may be mild at first, but become more severe over time.

Following are the four most common types of dementia with an explanation of how the quadrants of the brain are affected.

Alzheimer’s Disease (AD) and the Brain

In a neurodegenerative disease such as Alzheimer’s, neuronal death and tissue loss are responsible for symptoms associated with the disease. As the disease progresses, the brain shrinks in size, damaging the cortex and affecting all of its functions. AD is the product of an excess of beta-amyloid protein, called **plaques**. This protein build-up creates a chronic state of inflammation in the affected areas. While the tissue is inflamed, **tau**, a substance that supports cell structure in a healthy brain, diminishes. This corrosion of tau forms web-like structures called **neurofibrillary tangles**. Plaques and tangles tend to spread throughout the brain in a fairly predictable manner. Deterioration from AD begins in the temporal lobe in the hippocampus, the portion of the brain in charge of memory formation. This is why problems with memory are one of the first notable signs of the disease. Neuronal damage next occurs in the frontal and parietal lobes, gradually affecting thinking, judgement, speech, and social behavior. The deterioration continues to spread to the occipital lobes, where increasing difficulties with spatial awareness and hallucinations may occur. As an Alzheimer’s patient enters the late stages, basic functions such as communication, swallowing,

alzheimer's association®

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Santa Barbara County
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Ventura County
2580 E. Main St Suite 201
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Tel: 805.494.5200

24-Hour Helpline:
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alz.org/CaCentral



Tips

- Understand that the behaviors your loved one is exhibiting are caused by physical changes in the brain—they are not doing this on purpose
- Learning more about your loved one's specific diagnosis can help you better understand their behaviors and treatment options
- June is Alzheimer's Brain and Awareness Month—help us spread awareness by wearing purple



Tools

Visit alz.org to:

- Learn more about the symptoms and brain changes associated with each type of dementia
- Take the Interactive Brain Tour to see how a healthy brain is affected by Alzheimer's Disease
- Visit the Alzheimer's Association's Research Center to follow all dementia related research progress
- Sign up for TrialMatch to participate in research trails, for both healthy brains and those affected with dementia

and breathing will become affected.

Parkinson's Disease, Dementia with Lewy Bodies (LBD) and the Brain

Lewy Bodies Dementia (LBD) is symptomatically very similar to AD, but there are physical differences that occur in the brain. Although plaques and tangles are also found in patients with Parkinson's disease and LBD, Lewy bodies—a different type of build-up from alpha-synuclein proteins—materialize and result in abnormal brain functioning.

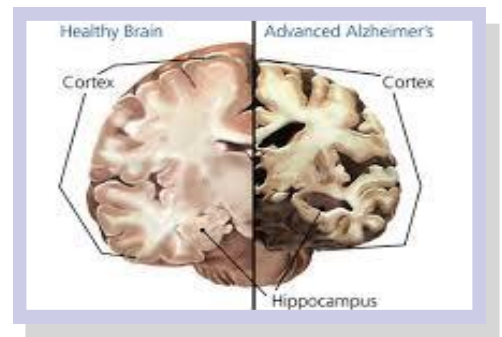
Lewy bodies are small, spherical structures that consist of protein deposits. They are responsible for neuronal death in this type of dementia. Lewy bodies are first found in an area called the substantia nigra, where the neurotransmitter dopamine is produced. With Lewy body structures present, dopamine levels decrease, causing problems with motor function among those with Parkinson's, eventually resulting in LBD. Especially affected in LBD is the visual cortex, which explains why hallucinations are often present with this type of dementia. A diagnosis of LBD is made when the numbers of Lewy bodies increase to other areas of the brain and mental functioning becomes affected.

Vascular Dementia (VD) and the Brain

This type of dementia stems from problems in the cardiovascular system. Because the brain is fueled by oxygen in the blood, vascular dementia occurs when the blood supply to the brain is disturbed. When a stroke (or multiple strokes) occur, the brain is damaged because of interrupted blood flow to the brain, causing surrounding neurons to die and resulting in loss of cognitive abilities. Like those with AD, individuals with VD experience memory loss, language difficulties, and disturbances in cognitive abilities. However, symptoms often vary widely in VD, depending on where the damage occurred and how severe it may have been. Individuals with VD may show sudden loss in cognitive and motor skills after experiencing a major stroke, or may exhibit a more gradual progression of decline following multiple, smaller strokes.

Fronto-temporal Dementia (FTD) and the Brain

Rather than a steady decline in memory functioning, fronto-temporal dementia occurs because of nerve cell loss specifically in the frontal and temporal lobes of the brain. There



are no amyloid protein deposits or arterial damages observed in the brain of an individual with FTD, but obvious atrophy exists in the frontal and temporal lobes, affecting the functions controlled by these areas. These two regions of the brain often show incidence of tau and TDP43, but these proteins are not necessarily present in every case. The exclusive injury to these areas explains why individuals with FTD often experience distinct personality changes, problems with judgment and motor functioning, and lack of inhibition or social appropriateness.

As you can see, there are variances in symptoms resulting from different diseases that cause dementia. As a result of the disease, physical changes occurring in the brain are likely to create behavior changes. A medical diagnosis may help a caregiver understand that difficult behavior is not intentional.

Resources

- Halgin, R. P., & Whitbourne, S. K. *Abnormal psychology: Clinical perspectives on psychological disorders*. McGraw-Hill.
- Hooley JM, Butcher J, Mineka J. (2010). *Abnormal Psychology (14th Edn.)*. Boston: Allyn & Bacon.
- Pinel, J. P. J. (2014). *Biopsychology*. Harlow, Essex: Pearson Education Limited.