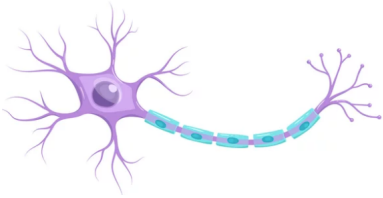


BRAIN HEALTH REFERENCE GUIDE

GENERAL

Neuron – A neuron is a specialized cell in the nervous system that transmits information through electrical and chemical signals. Neurons are the functional units of the brain and the nervous system. Your brain contains roughly 86 billion neurons, each capable of forming thousands of connections with other neurons, creating the networks that support everything we think, feel, and do.



Neuroplasticity – A term used to describe adaptive changes in the function and/or structure of nerve cells or groups of nerve cells in response to changes in the patterns of their use. Your brain has the ability to form new neural connections throughout life.

Senses – The senses are your body's systems for detecting and responding to information from the environment and from within your body. This is how your brain receives data about the world around you.

The **traditional five senses** are:

- **Sight** - detecting light through photoreceptors in your eyes
- **Hearing** - detecting sound waves through receptors in your ears
- **Smell** - detecting airborne chemicals through receptors in your nose
- **Taste** - detecting chemicals in food and drink through taste buds on your tongue
- **Touch** – detecting pressure, touch and vibration through receptors in your skin

Acute – An acute event is a sudden onset and often a short duration—something that happens quickly and typically resolves relatively soon (days to weeks).

Long-term (or chronic) – A long-term event is one lasting for an extended period—months, years, or permanently.

- An acute event (like a stroke or severe infection) can cause sudden cognitive changes, while long-term conditions (like uncontrolled high blood pressure) can cause gradual changes and damage over time.

DISORDERS OF THE BRAIN

Mild Cognitive Impairment – (MCI) MCI is a condition where a person experiences noticeable cognitive decline that goes beyond normal age-related changes, but not severe enough to significantly interfere with daily life and independence.

Key characteristics of MCI:

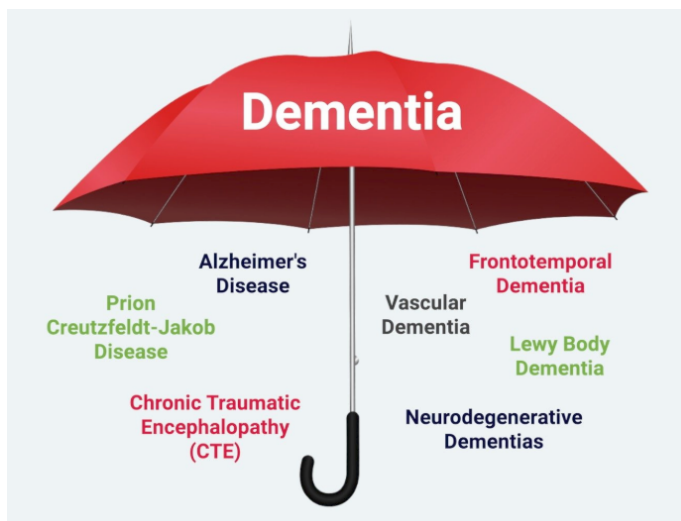
- Some noticeable problems with memory, thinking, or judgment that are greater than expected for someone's age
- The individual and/or family members often recognize the changes
- Daily activities and independence are largely maintained (this is the key difference from dementia)
- Some of the problems are measurable on cognitive testing

MCI is ***not a guaranteed progression to dementia***. While some people with MCI can develop dementia (about 10-15% per year), others remain stable or even improve, especially with lifestyle interventions.

This is a critical "window of opportunity" MCI is when brain-healthy lifestyle changes may have the greatest impact. It's a call to action!

Dementia – Dementia is a *general term used to describe a decline in cognitive abilities*—such as memory, thinking, reasoning, and communication – severe enough to interfere with daily life.

Dementia is not a single disease but rather an umbrella term for a collection of symptoms that can be caused by various conditions. Dementia is progressive, meaning symptoms typically progress over time. Dementia is not a normal part of aging, though age is the greatest risk factor.



What are the different types of dementia?

Alzheimer's Disease (AD) – Alzheimer's is the most common cause of dementia, accounting for 60-80% of dementia cases. The disease is caused by abnormal buildups of proteins in the brain that damage brain cells, particularly in areas involved in memory and cognition.

Alzheimer's typically begins with mild memory loss and progresses over years to severe cognitive and functional impairment. While age is the greatest risk factor, Alzheimer's is not a normal part of aging – it's a disease.

Dementia with Lewy Bodies – Dementia with Lewy Bodies (DLB) is a type of progressive dementia caused by abnormal deposits of a protein called alpha-synuclein that form inside brain cells. These deposits are called Lewy bodies. DLB is the 3rd most common cause of dementia, after Alzheimer's disease and vascular dementia.

Unlike Alzheimer's, which primarily affects memory first, DLB often affects attention, visual-spatial abilities, and executive function early on. Memory problems may come later in the disease progression.

Vascular Dementia – Vascular dementia is cognitive decline caused by reduced blood flow to areas of the brain. These changes in blood flow can damage or kill brain cells due to lack of oxygen and nutrients. Vascular dementia is the 2nd most common type of dementia after Alzheimer's disease.

Common causes include:

- **Stroke** – a single major stroke or multiple small strokes
- **Small vessel disease** – damage to tiny blood vessels deep in the brain
- **Conditions that damage blood vessels** – like high blood pressure, diabetes, high cholesterol, or heart disease

Symptoms depend on which areas of the brain are affected by reduced blood flow. Common symptoms include problems with planning, judgment, decision-making, and slowed thinking.

Frontotemporal Dementia – (FTD) is a group of disorders caused by progressive changes to the frontal and/or temporal lobes of the brain – the areas responsible for personality, behavior, and language. Memory typically remains relatively intact in the early stages, which distinguishes FTD from Alzheimer's disease.

Key characteristics that set FTD apart:

- **Younger onset:** Typically affects people between ages 45-65, though it can occur in older adults too
- **Personality and behavior changes often come first**, not memory problems (unlike Alzheimer's)
- **Language difficulties** may be the primary early symptom in some types

FTD accounts for about 10-20% of dementia cases and has a stronger genetic component than some other dementias—roughly 40% of people with FTD have a family history of the disease.

OTHER TERMS

Magnetic Resonance Imaging – (MRI) MRI scans will show structural changes that can occur in neurodegenerative diseases. MRI scans are performed to identify changes in certain areas of the brain known to be associated with different types of dementia and will also show if structural abnormalities are present, like a brain tumor, or if there are changes associated with a stroke or altered blood supply.

Positron Emission Tomography – (PET) There are three types of PET brain scans: scans performed to look at the brain's metabolic function using a radioactive sugar to measure glucose metabolism; scans performed with a radioactive amyloid agent, looking at amyloid accumulation and distribution; and scans performed with a radioactive tau agent, looking at tau accumulation and distribution.

Tau Tangles – The tau protein plays a vital role in maintaining the health of nerve cells. In Alzheimer's disease, tau tends to accumulate into harmful structures called neurofibrillary tangles. These tangles cause the death of the nerve cell.

Amyloid Plaques – Also referred to as beta-amyloid; these protein fragments are found naturally in the brain, but when they clump together into amyloid plaques, they block nerve cells from signaling. Beta amyloid plaques are a characteristic feature of AD pathology. Beta-amyloid plaques are also found in the brains of individuals without Alzheimer's disease.

Biomarkers – The term biomarker is short for "biological marker". Biomarkers are measurable indicators of a biological condition, disease, or process in the body.

Think of a biomarker as a "clue" or "signal" that:

- Can detect the presence of a disease
- Can track disease progression
- Can predict future risk
- Can monitor response to treatment

Your blood pressure, blood glucose level and cholesterol level are all biomarkers.

Common biomarkers for dementia / Alzheimer's disease:

- Beta-amyloid plaques (detected in brain scans or spinal fluid)
- Tau protein tangles (detected in brain scans or spinal fluid)
- Brain volume changes (visible on MRI scans)
- Blood tests detecting specific proteins
- APOE-e4 genetic variant

APOE – APOE (Apolipoprotein E) is a gene that provides instructions for making a protein involved in transporting cholesterol and other fats in the bloodstream and brain.

Everyone inherits two copies of the APOE gene—one from each parent. There are three common variants (alleles):

- **APOE-e2** (thought to be protective)
- **APOE-e3** (thought to be neutral)
- **APOE-e4** (risk-increasing)
 - APOE-e4 is present in ~14% of population
 - **This variant can increase** Alzheimer's risk:
 - One copy (e4/e3 or e4/e2): 3-4 times higher risk
 - Two copies (e4/e4): 8-12 times higher risk
 - This variant is also associated with earlier age of onset

APOE-e4 is NOT destiny. Many people with one or even two e4 alleles never develop Alzheimer's, while many people without any e4 alleles do develop it.

Research shows that people with APOE-e4 may actually benefit *more* from lifestyle interventions, making brain-healthy habits even more crucial.

Cognitive Test – A cognitive test is an assessment tool that measures various mental abilities—such as memory, attention, language, problem-solving, and reasoning. These tests help identify cognitive strengths and weaknesses and can detect changes over time.

Purpose:

- Screen for cognitive impairment or dementia
- Establish a baseline for tracking changes
- Distinguish between normal aging and concerning decline
- Help guide diagnosis and treatment planning

Cognitive Reserve – Cognitive reserve is the brain's ability to improvise and find alternate ways of completing tasks, even when there is damage or aging-related changes occurring in the brain.

Think of it as your brain's **resilience or "backup system"** – the mental resources you've built up over your lifetime that help your brain compensate when some neurons or connections are lost.

A helpful analogy – Imagine two people driving to the same destination:

- Person A only knows one route – if that road is blocked, they're stuck
- Person B knows multiple routes – if one is blocked, they can take another path and still reach their destination

Cognitive reserve is like knowing multiple routes. When brain pathways are damaged by aging, stroke, or a dementia pathology, people with higher cognitive reserve can "reroute" and maintain function longer.

How cognitive reserve is built:

- **Education** - Years of formal learning
- **Occupational complexity** - Mentally demanding work
- **Lifelong learning** - Taking classes, learning new skills or a new language
- **Social engagement** - Rich social networks and interactions
- **Cognitive activities** - Puzzles, games, musical instruments
- **Physical exercise** - Promotes brain plasticity and new neural connections
- **Novel experiences** - Travel, new hobbies, varied activities

Cognitive reserve can be built **at any age**. This is neuroplasticity in action!