



Cognitive Impairment and the Brain

Brain Damage: the Facts

Brain damage causes cognitive impairment.

Cognitive impairment may include impairment in a person's ability to:

- Think
- Understand what s/he sees or hears
- Figure out how to do things
- Remember

Some cognitive impairment, like an irreversible dementia, keeps getting worse over time.

A person with an irreversible dementia goes through stages that occur as the brain damage gets worse and spreads over the surface of the brain.

Each part of the brain controls specific cognitive functions or skills. As the damage affects each part, the person starts to lose the functions that part of the brain controls.

Dementia illustrates the cognitive functions controlled by each part of the brain, since dementia involves so many parts of the brain.

There are more than 80 different disorders that can cause dementia. The most common cause is Alzheimer's Disease. Other causes include:

- Dementia with Lewy Bodies (where there are tiny abnormalities within the brain cells called Lewy Bodies).
- Vascular Dementia (where there are mini-strokes over the surface of the brain).

In each disorder that causes an irreversible dementia, the brain damage affects the parts of the brain in a different order.

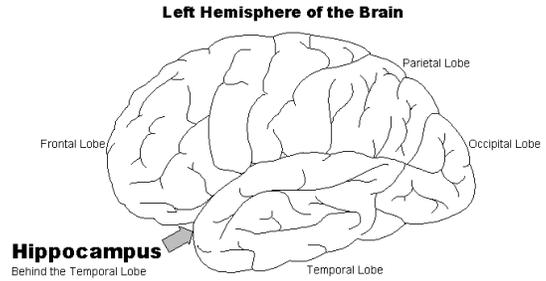
The brain has two halves or sides called the (left and right) hemispheres that are almost mirror images of each other. Each side has 4 parts called lobes. For each lobe on the right side there is a similar lobe with the same name on the left side. The right side of the brain controls the left side of the body, and the left side of the brain controls the right side of the body.

In some disorders, like dementia, the lobes on both sides of the brain are damaged.

Regardless of the disorder causing the damage, when a particular part of the brain is affected, the same cognitive functions are impaired.

Hippocampus

In Alzheimer's Disease, brain damage occurs in the hippocampus, which is a structure tucked up inside the brain behind the temporal lobes:



The hippocampus helps you:

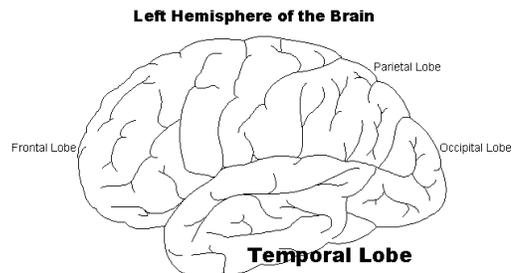
- Know what to remember and what to forget; remember what just happened.
- For example, it lets you know what you just said, what you had for lunch, or that your daughter just visited.

When the hippocampus becomes damaged, you may:

- Repeat a question or concern.
- Forget something someone just said.
- Forget that a daughter just visited.
- Be surprised and angry when a caregiver begins to take off your clothes, because you forgot you just agreed to take a shower.

Temporal Lobes

In Alzheimer's Disease, the brain damage also occurs in the temporal lobes, which are located on the side of your head:



The left temporal lobe helps you:

- Understand language.
- Speak.

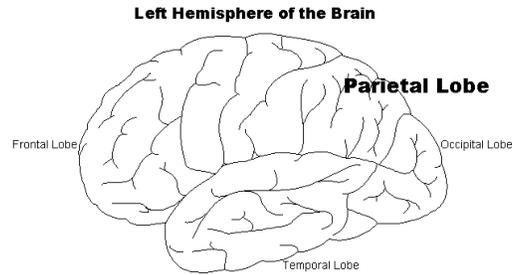
When the left temporal lobe becomes damaged, you may:

- Make nonsense sounds.
- Use the wrong words.

- Substitute a similar word (e.g. “pip” for “pen”).
- Use fewer words because you can’t think of the words to use.
- Say “Yes” when you mean “No”.
- Not understand what someone tells you or asks you to do.
- Use swear words without realizing it.

Parietal Lobes

In Alzheimer’s Disease, brain damage also occurs in the parietal lobes, which are located above and behind the temporal lobes:



The right parietal lobe helps you:

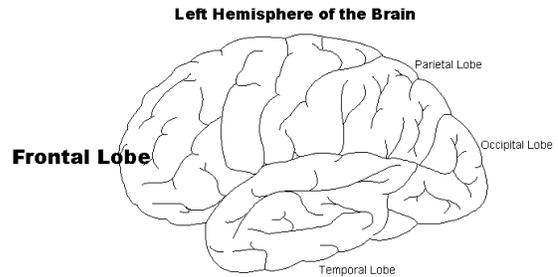
- Locate and arrange objects in space relative to yourself and to each other.
- Pay attention to everything in your visual field or space.

When the right parietal lobe becomes damaged, you may:

- Work hard to put an arm into an armhole of a shirt. (This is not obvious to yourself or others.)
- Put a glass down on the top edge of a plate, instead of beyond it, and spill what’s in it.
- Have difficulty responding to stimuli in the left part of the visual field.
- Have difficulty tolerating clutter, many objects, and movement in the environment.
- Feel angry, frustrated, stressed, or fatigued from all the confusing stimuli in the environment.
- Respond better when a caregiver approaches from the front.
- Resist stepping into tub or shower because you can’t easily see:
 - How high the side of the tub or edge of the shower is.
 - Where your feet or hands should go.
 - How deep the water is.

Frontal Lobe

In typical Alzheimer's Disease, brain damage occurs in the frontal lobe. All the other lobes get more and more impaired. The frontal lobe is located at the front of the brain:



The frontal lobe helps you:

- Handle more than one thing at a time.
- Know what to focus on.
- Sense how much time is passing.
- Switch attention from one idea or task to another.
- Know when a task is done.
- Keep focused on a task until it's done.
- Control impulsive responses to thoughts and desires.
- Identify the order of steps for a task.

When the frontal lobe becomes damaged, you may:

- Have difficulty focusing on a task and paying attention to what is going on.
- Be overwhelmed when a caregiver talks and touches at the same time.
- Have difficulty following the logic of an argument.
- Need the most important words said first in a sentence.
- Need short, simple words and sentences.
- Refuse a bath because you can't think of how to do it.
- Leave a shower before you're done because you think you've been there long enough.
- Be unable to stop from striking or grabbing someone because you can't control impulses or switch gears quickly.

More about the Brain and its Functions

Caring Sheets

You can find more detail about the information in this handout on the websites cited at the end of this handout. Posted on the websites is a series of handouts called Caring Sheets (CS). CS #1 describes the organization of a healthy brain. CS #2 describes the effects of brain damage on specific cognitive functions and behaviors, and in particular changes to the brain and cognitive functions in dementia. Other caring sheets suggest intervention strategies, and others describe various dementing disorders in detail. Portions of caring sheets #1 and #2 are modified and included below.

Intervention

An important concept to note about the brain is that when parts of the brain become damaged, the cognitive functions those parts mediate become impaired, often resulting in emotional distress and behavioral changes. Learning how to adapt or compensate for the impaired cognitive functions, can help a person perform tasks more easily and successfully and to feel more competent and comfortable.

Since changes in cognitive functions can sometimes be subtle, it is usually very helpful to know where the brain damage is, so that the cognitive functions likely impaired can be identified more easily. Interventions can then be developed to address the impaired cognitive functions that are related to the affected parts of the brain. Focusing on specific cognitive functions can increase the efficiency of developing effective interventions and can avoid the trial and error method of choosing interventions to try.

Brain Organization and the Individual

The left and right hemisphere of the brain is divided into four regions called lobes. Three of the lobes were addressed in this handout: the frontal, temporal, and parietal lobes. The fourth lobe is called the occipital lobe and is crucial to vision. It allows the person to recognize or know what objects are, to recognize faces, and to see more than one object at a time, as well as other functions. Two additional major structures of the brain are not addressed in this caring sheet. They are the cerebellum and the brain stem. Other important structures are buried deep within the brain.

The cortex (from the Latin word for bark of a tree) is the surface of the brain. It looks a little like noodles stuck together. This is where the most sophisticated cognition (i.e. higher intellectual thought processes) takes place. In general, the amount of surface area of the cortex correlates with the individual's quality of intellectual functioning. In this handout, we focused on the functions of the cortex.

Each lobe and hemisphere plays a major role in its own set of cognitive functions. We listed only a few of these cognitive functions in this handout. (More are listed in the caring sheets.) Other areas of the brain play a role in all of these functions as well. There is a complex overlap and interaction of these functions among lobes and between hemispheres that varies from one person to the next. In addition, each lobe

and hemisphere communicates with each other in complex ways, which also vary from one person to the next. This outline of the general location of various cognitive functions in the cortex, within each lobe and hemisphere, therefore, is oversimplified and generalized.

The organization of functions also depends upon a person's structural dominance, as is partially evidenced by her/his hand dominance. In this handout, the person described is assumed to be right handed. Left handed persons are usually similar to right handed persons. Some left handed persons, however may have functions controlled by both hemispheres or more rarely by the hemisphere opposite of what is listed here. For most right handed persons, major damage to the left hemisphere causes the right side of the body to be weaker and altered in its ability to feel, notice, or recognize stimuli on the right side; and major damage to the right hemisphere of the brain causes similar effects on the left side of the body.

The amount of brain damage required in each lobe to create cognitive and behavioral changes depends upon the individual brain, person (including for example, age and general health), and circumstances.

As a person ages from birth to old age, each lobe and hemisphere becomes increasingly specialized in the cognitive functions it performs. When part of the brain is damaged, the rest of the brain tries to take over the functions the damaged part had been mediating. The older the brain is, the more specialized each lobe and hemisphere is, and the more difficult it is for other parts of the brain to recover the affected functions.

In dementing disorders such as Alzheimer's Disease, while repair mechanisms may be at work, the pathological changes appear to spread more quickly than the ability of the other parts of the brain to recover the lost functions. In less progressive disorders, such as major strokes, even brains that are quite advanced in age, seem to recover functions more easily than they do in dementia.

Websites for Caring Sheets

1. The Michigan Dementia Coalition: <http://www.dementiacoalition.org>
2. The Michigan Mental Health and Aging Project in Lansing, Michigan: <http://www.lcc.edu/mhap>