



## DEMENTIA CARE SERIES

Michigan Department of Health and Human Services

THOUGHTS & SUGGESTIONS FOR CARING

# Caring Sheet #1: The Healthy Brain and Cognition

By Shelly E. Weaverdyck, PhD

## Introduction

This caring sheet outlines the organization of the healthy brain and its cognitive functions.

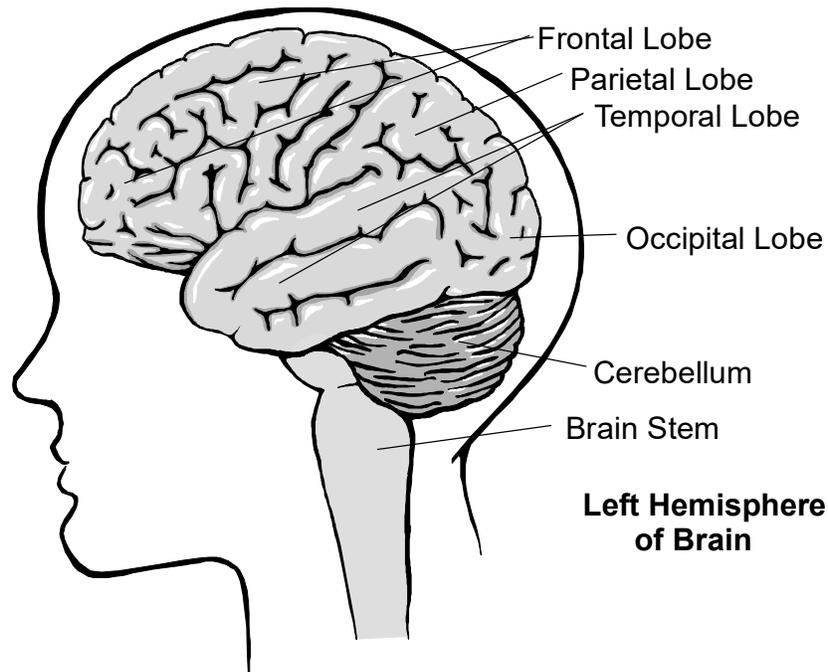
Caring sheet #2 describes the brain changes in dementia and the impact these changes have on cognition. The resulting changes in cognition (i.e., the way in which a person thinks and processes information) lead to changes in behavior and the ability to perform tasks.

These two caring sheets (#1 and #2) are written as companion pieces with corresponding lists of intact and impaired cognitive functions. Other caring sheets discuss intervention strategies to address these cognitive changes.

## Brain Organization

The brain is organized primarily into two halves called cerebral hemispheres. They are the **left hemisphere** and the **right hemisphere**. Each hemisphere is divided into four regions called lobes, three of which will be addressed here: 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.) (See Figure 1.)

The **cortex** (from the Latin word for bark of a tree) is the surface of the brain as seen in Figure 1. 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.



**Figure 1: Schematic drawing of the brain, including the left cerebral hemisphere, cerebellum and brain stem. *Size and position of the brain with respect to the outline of the head is not to scale. The right side of the brain is essentially a mirror image of the left. The right cerebral hemisphere has the same four lobes.***

## **Cognitive Functions and Localization in the Brain**

Some of the complex cognitive functions affected in dementia which are most noticeable to caregivers occur in the frontal, temporal, and parietal lobes of the left and right cerebral hemispheres. Those are the cognitive functions and brain structures addressed in this caring sheet.

Each lobe and hemisphere mediates or plays a major role in its own set of cognitive functions. Some of these cognitive functions are listed below.

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. Here 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.)

### **Left Hemisphere** (for most right handed people)

- controls sensory and motor functions of the right side of the body.
- helps the person recognize and use analytical or linear thinking, including language.
- When a person's left hemisphere is damaged the right side of the body tends to be weaker and altered in its ability to feel, notice, or recognize stimuli. The person may also have slurred speech or difficulty finding words she wants to use.

### **Right Hemisphere** (for most right handed people)

- controls the sensory and motor functions of the left side of the body.
- helps the person recognize and use spatial aspects of information received from the environment.
- When the right hemisphere is damaged the left side of the body tends to be weaker and altered in its ability to feel, notice, or recognize stimuli. The person may also have difficulty locating objects in space or judging distances.



## **Frontal Lobe**

The frontal lobe plays a major role in many cognitive functions, some of which are listed here. In general, the frontal lobe allows a person to:

- plan and organize
- make use of a pool of information or ideas, by sorting through and choosing from among them
- know when a task is done
- get started on a task
- recognize mistakes and correct them
- know how much time has passed
- recognize chronology of events in the past and put them in temporal perspective (e.g., I played as a child with my sister long before I cooked supper for my own children.)
- recognize and monitor her own thoughts and feelings
- discern triggers or causes of thoughts and feelings
- control impulsive responses to thoughts and feelings, by censoring, delaying, or pacing the responses
- adapt to new conditions
- switch from one idea or action to another
- imagine something not visible or tangible (i.e., abstract)
- recognize or know the order of task steps or items
- think about or do more than one thing at a time

## **Temporal Lobe**

The temporal lobe, among other functions, allows a person to:

- comprehend language (in the left hemisphere)
- express language (in the left hemisphere)
- remember very recent events or information (in cooperation with the hippocampus, a structure tucked behind the temporal lobe) (e.g., it prevents a person from repeating the same story in a single conversation or forgetting that a visitor had just been there)



## **Parietal Lobe**

The parietal lobe, among other functions, allows a person to:

- recognize spatial information (in the right hemisphere) (e.g., it allows a person to recognize where people or objects in a room are in relation to each other and to the person's own body)
- organize spatial information (in the right hemisphere) (e.g., it allows a person to draw and to set the table in a spatially correct way)
- integrate and organize sensory information (particularly visual)
- write and to perform arithmetic (in the left hemisphere)
- recognize her own body and its left/right orientation

Other areas of the brain play a role in all of these functions, and many cognitive functions are not listed here. These are some of the most complex cognitive functions frequently impaired in brain damage or in dementia. Impairment of these functions can create or contribute to some of the behavioral changes evident to caregivers.

© Copyright 1997 by S. Weaverdyck (Page 5 and Header Revised 2018).

Citation: Weaverdyck, S. (1997). #1 - The Healthy Brain & Cognition. *Dementia Care Series Caring Sheets: Thoughts & Suggestions for Caring*. Lansing, Michigan: Michigan Department of Health and Human Services.

Edited and produced by Eastern Michigan University (EMU) Alzheimer's Education and Research Program for the Michigan Department of Health and Human Services (MDHHS), with gratitude to the Huron Woods Residential Dementia Unit at St. Joseph Mercy Hospital, Ann Arbor, Michigan.

The author, Shelly Weaverdyck was Director of the EMU Alzheimer's Education and Research Program.

We gratefully acknowledge Peter J. Whitehouse, MD, Ph.D., Case Western Reserve Univ., and Sara Holmes, MPH, Education Core, Michigan Alzheimer's Disease Research Center (MADRC), for their careful review and comments.

Editor: Shelly Weaverdyck, PhD, Former Director EMU Alzheimer's Education and Research Program; Email: [sweaverd@umich.edu](mailto:sweaverd@umich.edu)

All Caring Sheets are available online at the following websites:

[http://www.michigan.gov/mdhhs/0,5885,7-339-71550\\_2941\\_4868\\_38495\\_38498---,00.html](http://www.michigan.gov/mdhhs/0,5885,7-339-71550_2941_4868_38495_38498---,00.html) (Michigan Department of Health and Human Services MDHHS), at <http://www.lcc.edu/mhap> (Mental Health and Aging Project (MHAP) of Michigan at Lansing Community College in Lansing, Michigan), and at <https://www.improvingmipractices.org/populations/older-adults> (Improving MI Practices website by MDHHS)

The Caring Sheets were originally produced as part of the in-kind funding for the Michigan Alzheimer's Demonstration Project. Funded by the Public Health Service, Health Resources and Services Administration (1992-1998) and the Administration on Aging (1998-2001) 55% federal funding and 45% in-kind match. Federal Community Mental Health Block Grant funding supported revisions to Caring Sheets (2002-2018).