



Introduction

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The human brain is a remarkable contraption, capable of decoding complex information about the world around us and organizing that information into plans and dreams. This seminar reviewed the overall structure of the brain and its subdivision into regions that are responsible for different tasks, such as vision, hearing, control of movement, and decision-making. The function of the brain was related to the activity of cells within the brain, particularly neurons, which are capable of collecting, integrating, and relaying information. The seminar also described common diseases of the brain, such as Parkinson's disease, Alzheimer's disease, epilepsy, and stroke, and related the causes and consequences of these diseases to properties of cells and groups of cells in the brain. Because the biology of the brain has many levels of complexity, it is a suitable substrate for lesson plans at a variety of grade levels, encompassing aspects of mathematics, biology, chemistry, philosophy, and social studies.

Specifically, the seminar covered the following topics:

1. Cellular structure of the brain
2. Organization of the brain
3. Neurotransmission and the synapse
4. The body manager (major senses and body regulation)
5. Nutrition and the brain
6. Parkinson's disease and other neurodegenerative disorders
7. Positron Emission Tomography (PET) imaging of the brain
8. Emotions and social function
9. Learning, thinking, remembering
10. Epilepsy

The discussions were enhanced by our reading from three books: *The Dana Guide to Brain Health: A Practical Family Reference from Medical Experts*, Bloom, Beal, and Kupfer (eds.), Dana Press (2006); *Think Smart*, Richard Restak, Riverhead Books (2009); and *The Brain that Changes Itself*, Norman Doidge, Penguin (2007).

The Fellows prepared curriculum units that covered a breadth of information on the brain and the senses. The material presented in the units assembled in this volume span an impressive range and are designed for use in classrooms from first grade through high school.

Two of the units focused on material that is most appropriate for high school students. Eric Laurensen prepared a unit called "The Brain Desynchronized," which is designed for use in high school physics classrooms. In this unit, students are asked to use their knowledge of electrical circuits to understand signal

transmission in the brain and to develop mathematical models of electrical activity. These concepts are illustrated by describing the changes that occur in seizures. Connie Scercy Wood prepared a unit called "Neurobiology Using Both Sides of the Brain," which was designed for International Baccalaureate or Advanced Placement classes. Her unit uses information on the cellular mechanisms of neurobiology to give students practice with the scientific method and testing of hypotheses.

Several of the units were addressed to middle school classrooms. Chanh Quach prepared a unit called "Brain Structure and Function," which relates function of the brain to its organization into distinct anatomical regions. The function of each region is further explored by looking at differences in organization among species. Shelley Freedman-Bailey prepared a unit called "Memory Boot Camp," which uses classroom activities to explore mechanisms of memory and to provide students with tools to enhance memory. Kimberly K. Turner prepared a unit titled "Art Is Not Just in the Eye of the Beholder but in the Brain," which explores the function of the visual system and relates the way that the brain processes images to illustrate how artists achieve effects - such as perspective and optical illusions - in their work. Sharon M. Mott prepared a unit called "Our Brain's Fat and Carbohydrate Connection," which discusses the important role of diet in the function of the healthy brain, focusing on the impact of carbohydrate and fat composition of the diet on brain health. Karen L. Brinkley prepared a unit called "Mathematics and the Brain: Easy as 1-2-3, Simple as A-B-C," which describes differences in learning styles for mathematics, and provides teachers with approaches to enhance their students' ability to solve multistep word problems.

Many of the units were addressed to elementary school classrooms. Vivienne Bartman prepared a unit called "An Investigative Approach to the Brain: the 5 Senses and the 5 W's and an H," which introduces students to the techniques of investigative journalism and applies these techniques to study of the special senses. Kathleen Gormley wrote a unit called "An Investigation into Learning Using the Regions of the Brain," which encourages students to find connections between the way their brains work and the ways that they learn. Sharyn F. Gray prepared a unit titled "This Is Your Brain. This Is Your Brain on Fire...Any Questions?" In this unit, students are introduced to the learning styles and new research on brain function, in order to provide them with personal strategies to enhance their learning potential. Carol Boynton prepared a unit called "Sensing Our Five Senses," which provides a collection of hands-on activities to introduce young students to the power of observation through the five senses.

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