Understanding the Brain

COURSE DESCRIPTION

Everything that goes on inside your body and every interaction you have with the outside world is controlled by your brain. It allows you to cope masterfully with your everyday environment. It is capable of producing breathtaking athletic feats, sublime works of art, and profound scientific insights. It also produces the enormous range of emotional responses that can take us from the depths of depression to the heights of euphoria.

Considering everything the brain does, how can this relatively small mass of tissue possibly be the source of our personalities, dreams, thoughts, sensations, utterances, and movements?

Understanding the Brain, a 36-lecture course by award-winning Professor Jeanette Norden of Vanderbilt University School of Medicine, takes you inside this astonishingly complex organ and shows you how it works, from the gross level of its organization to the molecular level of how cells in the brain communicate. With its combination of neurology, biology, and psychology, this course will help you understand how we perceive the world through our senses, how we move, how we learn and remember, and how emotions affect our thoughts and actions.

Solving the Mystery of the Brain

The ancient Egyptians discarded the brain during mummification while carefully preserving other organs; to them, the brain was of no importance. Starting with the Greek physician Hippocrates, however, observers began tracing more and more of our sensory, nervous, and intellectual activities to the brain—and eventually to specific regions of the brain.

The brain is still a mystery in many respects—for example, we still are unsure as to how consciousness is generated—but recent decades have seen unparalleled advances in understanding how the brain does what it does. In the last 50 years, an explosion of knowledge about the brain's structure and function has occurred. Scientists have performed amazing research by using tools such as MRIs and PET scanning to get a better grasp on deciphering the mysteries of how this important organ works.

Due to these technological advances, we can now pinpoint:

- where light that enters the eye is converted into the subjective experience of sight
- where pressure waves that reach the ear are processed into sound
- where fear is generated
- which areas of the brain are involved in spoken and written language
- where the deep chemistry of love is kindled

What You Will Learn

Understanding the Brain provides you with an in-depth view of the inner workings of your brain. Your tour starts with the organization of the central nervous system at the gross, cellular, and molecular levels, then investigates in detail how the brain accomplishes a host of tasks—from seeing and sleeping to performing music and constructing a personal identity.

- **The Structure of the Brain:** Lectures 1–11 cover the cellular structure and the overall layout of this intricate organ. You learn how the brain develops during gestation, and are introduced to the technical vocabulary that you will use throughout the course.
- **Brain and Mind:** Lectures 12–19 explore how the brain and mind are thought to be related by examining the sensory functions of sight, hearing, and bodily sensation. You analyze the motor system, which governs how movement is initiated and coordinated, and explore Parkinson's disease and its progressive impairment of movement.
- **Higher-Order Cognitive Functions:** Lectures 20–29 discuss the areas of the brain thought to be responsible for language, emotion, executive function, and cognition—abilities that, in large part, define us as humans. You look at the underlying neurological mechanisms and explore their role in various phenomena like depression, musical ability and appreciation, and drug use.
- **Special Topics:** Lectures 30–36 look at several subjects of universal interest. Are the brains of males and females different? How does the brain regulate sleep and dreaming? What is consciousness? And how can you understand the signs and symptoms of Alzheimer's disease?

Our insights into the functioning of the brain often come from cases where something has gone wrong, such as strokes, tumors, injuries, neurological diseases, and mental illnesses—pathologies that vividly demonstrate the distinct roles played by the various affected regions. An expert neuroscientist, Dr. Norden provides a fascinating presentation of these cases.

Know Your Mind

We now know that something important is always going on inside our brain and, as **Understanding the Brain** illustrates, if you know what to look for, you can observe specific aspects of your own brain in action:

- **Vision:** The "now you see it, now you don't" feeling you get when you see an illusion is your brain trying to interpret raw data from the eyes. Far from taking a picture of the world and sending it to the brain, the eyes actually transmit very little information; "seeing" is a creation of the brain.
- **Thought:** Sometimes, you can have trouble thinking after taking an antihistamine. This is because antihistamines do not just combat the effects of an allergy, they also block histamine as a neurotransmitter in the brain, altering your ability to think and process information.
- **Motor skills:** When you learn how to walk, ride a bicycle, knit, dance, or perform some other motor skill, you reach a point where all of a sudden you are able to coordinate the new movement. That is because specialized neurons in your brain's cerebellum are now firing in sequence.
- **Emotion and memory:** Think about doing your taxes. Does that thought elicit a particular emotion? We do not just remember something; our memories are colored with emotion. All of our experiences are influenced by previous experiences through complex loops in the brain's limbic system.
- **Social bonding:** Your feeling of well-being with your spouse or friends has a neurochemical basis. The neurotransmitter oxytocin is found in very high concentrations in the limbic systems of animals that bond socially.
- **Consciousness:** Sometimes, you can arrive at work with very little memory of the details of your journey; obviously you were not unconscious, but you were not fully aware either. This occurs when your brain is in "autopilot" mode—where it was in control without your being conscious of all that was happening around you.

Appreciate the Wonder of the Brain

As a researcher, Dr. Norden has participated in an ongoing scientific revolution. She is also a nationally recognized educator, singled out as one of the most effective teachers in America in *What the Best College Teachers Do*. Among Dr. Norden's special qualities cited in the book is this simple, but highly effective, approach to teaching: "Before she begins the first class in any semester, she thinks about the awe and excitement she felt the first time anyone explained the brain to her, and she considers how she can help her students achieve that same feeling."

You can share her consuming passion for the intricacies of the brain in this lively and engaging course, which Dr. Norden has designed specifically for those without a background in science. "All you need to bring is your own brain and a desire to learn," she says.

Thus equipped, you will explore a broad range of exciting topics in neuroscience. Above all, you will come away from **Understanding the Brain** with a deeper knowledge of how the brain is organized—and a feeling of wonder and appreciation for all that it accomplishes.

36 Lectures

Disk 1

1. Historical Underpinnings of Neuroscience
2. Central Nervous System—Gross Organization
3. Central Nervous System—Internal Organization
4. Central Nervous System—Subdivisions
5. Cortex—Lobes and Areas
6. Cortex—Sensory, Motor, and Association Areas

Disk 2

7. Central Nervous System—Development
8. Central Nervous System—Cellular Organization

9. Pathways and Synapses
10. Neurotransmitters
11. Stroke
12. The Visual System—The Eye

Disk 3

13. The Visual System—The Cortex
14. The Auditory System
15. The Somatosensory System
16. Agnosias
17. The Motor System—Voluntary Movement
18. The Motor System—Coordinated Movement

Disk 4

19. Parkinson's Disease
20. Language
21. The Limbic System—Anatomy

22. The Limbic System—Biochemistry
23. Depression
24. The Reward System—Anatomy

Disk 5

25. The Reward System—Drugs
26. Brain Plasticity
27. Emotion and Executive Function
28. Processing of Negative Emotions—Fear
29. Music and the Brain
30. Sexual Dimorphism of the Brain

Disk 6

31. Sleep and Dreaming
32. Consciousness and the Self
33. Alzheimer's Disease
34. Risk Factors for Alzheimer's Disease

35. Wellness and the Brain—Effects of Stress

36. Neuroscience—Looking Back and Looking Ahead

ABOUT THE PROFESSOR

Dr. Jeanette Norden is a neuroscientist, Professor of Cell and Developmental Biology in the School of Medicine, and Professor of Neurosciences in the College of Arts and Sciences at Vanderbilt University.

She earned her Ph.D. in Psychology, with training in Neurobiology and Clinical Neurology, from Vanderbilt University. She completed postdoctoral training at Duke University, the National Institute for Medical Research in London, and Vanderbilt School of Medicine.

Professor Norden is also the Director of Medical Education in the Department of Cell and Developmental Biology at Vanderbilt School of Medicine. Her innovative approach in integrating “humanity” into basic science courses has been recognized at Vanderbilt and nationally.

Dr. Norden has twice won the Shovel Award, given by the graduating class to the faculty member who has had the most positive influence on them in their four

years of medical school. She has received several other teaching awards, including the Jack Davies Award for teaching excellence in the basic sciences, the Outstanding Teacher of the Year Award, and the Robert J. Glaser Distinguished Teacher Award from the Alpha Omega Alpha Medical Honor Society and the Association of American Medical Colleges. She was the first recipient of both the Teaching Excellence Award given by the Vanderbilt University School of Medicine and the University Chair of Teaching Excellence at Vanderbilt.