**Title and Focus of Activity:** Personal Insights into Neurological Disorders

*Linking foundational and clinical sciences*

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**Course Information:**

Human Neurobiology; 3 semester credits; First year of program; either 2nd or 3rd semester.

This course is the first neuroscience course in the curriculum and is designed to introduce the students to the human nervous system at both cellular and systems levels, linking structure to function. The content focuses on the developmental anatomy and physiology of the human nervous system, with some pathology and neurology material integrated during the semester.

**Learning Experience Description:**

Over the last 20-25 years there have been a number of outstanding books written by individuals with a variety of neurological disorders about how their injury or disease affects their life. These books provide a unique insight to clinical conditions that are being introduced in foundational courses. This exercise helps the students make a connection between the classroom/lab and the clinic. Most importantly, it is a reminder to the students that the patients they will be working with are more than their diagnoses and that their patients will often have insights into nervous system function not necessarily covered in a textbook.

This activity breaks from the traditional lecture or lab experience by requiring the students to stand in front of the class and read short passages from carefully selected books. The students seem to take ownership of the discussions that follow the readings. It is not unusual for students to borrow one of the books and read more about a particular individual’s personal experience.

This exercise can be during either a lab or lecture period. Students volunteer to read short passages from 5-7 books that the instructor has pre-selected. Prior to the reading there is a 1-3 minute introduction to the specific neurological condition that is the subject of the book. Each reading takes about 3-6 minutes. Following the reading questions are solicited. For many students this is their introduction to these clinical conditions, so they do not have any questions. Occasionally one or two students comment on personal experiences with one of the clinical conditions (given the prevalence of bipolar disorder and autism spectrum disorder (ASD) they are usually the topics that students comment on). Examples of questions that have been asked by students (or by the instructor) during this period include:

1. What role do physical therapists have in the treatment of bipolar disorder (or autism or Tourette’s syndrome)?

The role of physical therapy in the treatment of these disorders is a great starting point to discuss the issue of comorbidities (e.g., someone diagnosed with ASD can tear their ACL and require physical therapy) and the evolving evidence for physical activity to ameliorate some of the signs and symptoms of brain disorders (not specifically bipolar disorder; but the evidence for physical activity as an effective intervention for clinical depression and Alzheimer’s disease continues to get stronger).

2. What part of the brain is affected by bipolar disorder (or autism or Tourette’s syndrome)?

This question can lead to discussions about the complexity of the connections and chemistry of the spinal cord and brain and that for many disorders the cause is not known but thought to be multifactorial. The students are directed to material presented in a previous lab that illustrates the complex neuronal wiring that occurs during CNS development (both the establishment and removal of synaptic connections) and that some disorders are thought to be secondary to “mis-wiring” of the brain. These questions also remind the students of the “diffuse modulatory systems” of the brain (topics covered in the previous week), and how problems with these systems can lead to a wide range of thought, mood and sleep disorders. One discussion point that is challenging for some students to grasp is the idea that there is not a specific physical lesion (secondary to trauma or a vascular problem) that causes the abnormal behaviors but some other biological factor that we do not understand (yet).

This activity is done during a foundational course to help the students put the foundational knowledge into a personal and patient-centered context. The exercise is also used to reinforce developmental, anatomical and physiological principles of CNS organization, but the main purpose is to establish a connection between basic science facts and the need for compassion and understanding in patient care.

Time for student to complete the activity:

1. preparation for activity outside of/before class: -
2. class time completion of the activity: 60 minutes ( or longer, depending on the number of book segments read).

Readings/other preparatory materials:

The instructor should be familiar with the books that are being used, including selecting appropriate passages prior to the learning experience. A list of some of the books that have been used for this exercise in the past follows.

1. *An Unquiet Mind, A Memoir of Moods and Madness* by Kay Redfield Jamison (1995). This is a first-person account of bipolar disorder from a world-renowned researcher/clinician. Given the social stigma of mental disorders and their prevalence in our society, the author’s insight into some of the challenges she has faced have proven useful as teaching tools for future PTs. The students read the 5 page *Prologue*.
2. *Thinking in Pictures, and Other Reports from My Life with Autism* by Temple Grandin (1995). This book provides a first person description of what it is like to have autism. The students read 3 pages from chapter 2, *Diagnosing Autism*.
3. *Moving Violations, A Memoir of War Zones, Wheelchairs and Declarations of Independence* by John Hockenberry (1995). The author, a writer and news correspondent for NPR and ABC, writes about many aspects of life following a spinal cord injury. His description of a situation where his loss of sensation resulted in a severe burn is not only an example of beautiful writing, but of anatomically correct beautiful writing. It is an effective example of how somatosensory information below the level of the injury may not be perceived, but still affects the CNS physiologically (this is a perfect lead in to autonomic dysreflexia). The students read 5 pages from chapter 4, *The Cutting Board*.
4. *An Anthropologist on Mars* by Oliver Sacks (1995). Dr. Sacks has written several books about interesting patients he has seen over the years, and in each case providing insight into brain function and the deficits that result following specific lesions or diseases. In this book he has a chapter about his friend/colleague who is a surgeon with Tourette’s syndrome. The students read 5 pages from the chapter titled *A Surgeon’s Life*. This description of the signs and symptoms of Tourette’s syndrome helps the students make the connection between brain physiology and human behavior.
5. *The Diving Bell and the Butterfly* by Jean-Dominique Bauby (1997). Bauby “wrote” this book one letter at a time after a brainstem CVA that resulted in locked-in syndrome. The students read the chapter titled *Bathtime* (3 pages). This story is an effective lead-in to different types of functional deficits that result from neurological disease and is an effective introduction to seeing the world from the patient’s point of view. This reading is a good starting point to get students thinking and talking about the functional losses they personally fear most.

Other books that have been used from over the years:

1. A Nearly Normal Life (1999), by Charles L. Mee (first person account of life after polio)
2. My Year Off (1998), by Robert McCrum (first person account of life after a CVA from the perspective of a literary editor)
3. My Stroke of Insight (2006), by Jill Bolte Taylor (first person account of life after a CVA from a neuroscientist’s perspective)
4. The Spirit Catches You and You Fall Down (1998), by Anne Fadiman (complicated cultural differences come to light when an infant is diagnosed with epilepsy; not a first person account but insightful nonetheless)
5. Phantoms in the Brain (1998), by V.S. Ramachandran (also not a first person account; neurological consequences of limb amputation and some clever therapeutic approaches; a great introduction to neuroplasticity)

Learning Objectives:

These will depend on the books that are selected, but here are examples from the books listed above:

1. Describe the symptoms of bipolar disorder and how they can interfere with a healthy life.
2. Contrast symptoms of bipolar disorder with symptoms of clinical depression.
3. Evaluate the advantages and disadvantages this condition confers upon individuals and explore the common problem of medication compliance.
4. Explain the signs and characteristic features of “autism”.
5. Summarize the difficulties that individuals with autism could encounter in school and work environments, and in their personal lives.
6. Describe the functional consequences of a complete spinal cord injury in the mid-thoracic region.
7. Summarize the potential secondary complications associated with a complete loss of sensation in a body area.
8. Provide a description of the typical overt signs and symptoms of Tourette’s syndrome.
9. Describe the pathology of Tourette’s syndrome and evaluate its effects on the life of a child of elementary school age.
10. Explain the location of the pathology that causes locked-in syndrome and discuss the resulting functional deficits.
11. Compare locked-in syndrome to coma in terms of the pathology and the subsequent functional deficits.

Methods of evaluation of student learning:

There are multiple choice questions on the corresponding exam taken from the objectives that have been written (as stated above, this will depend on which books are selected). Examples include:

1. Autism, or autism spectrum disorder, is best characterized as a disorder of:

a. mood and memory

b. movement and sensation

c. sleep and attention

d. social and language skills\*\*

2. Which of the following statements about bipolar disorder is true?

 a. there are no effective treatments for this diagnosis

 b. there are some desirable and pleasurable aspects to this condition\*\*

 c. the cause and the underlying pathology of this disorder is known

 d. the characteristic mood swings are predictable in frequency and intensity

3. Which of the following statements about sensory loss following complete spinal cord transection is false?

a. sensory information below level of the injury is accurately transmitted into dorsal horn of the spinal cord via fast (A delta) and slow (C) fibers

b. peripheral sensory receptors (free nerve endings, Meissner’s corpuscles, Pacinian corpuscles, etc.) are intact and function normally

c. conscious perception of sensory input below the injury is lost as a result of the lack of action potentials reaching the somatosensory cortex of the cerebrum

d. nociceptive information secondary to severe burns on the anterior thigh does not have a physiologic effect on the CNS of individuals with a mid-thoracic injury\*\*