

ARTICLE

Narratives and Neurons: Stories of Damaged Brains

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Stories register in human memory in special ways, and stories about neurological cases can entertain and move a reader while simultaneously being an important part of any neuroscience curriculum. Here we describe a course taught in the context of the liberal arts curriculum of Baldwin-Wallace College. Students from a variety of disciplines learned basic neuroanatomy, neurophysiology and neurochemistry and then used this information to help them understand published neurological case studies, which were analyzed for their literary as well as scientific qualities. Later in the course, students were paired with a person with a neurological disorder and they investigated their cases in some depth. The capstone experience was a monograph that aimed to be both good science and good story telling. *Narratives and Neurons* was team taught by

faculty from the Neuroscience and English departments. However, the case studies were shaped and improved by all the class participants using writing workshop methods common to creative writing classes. Assessments of this course were very favorable, suggesting that students find that the work enhanced their resourcefulness and challenged their abilities to critically evaluate and problem solve. Some of the cases have found their way into the peer-reviewed literature. Moreover, the interaction between students and individuals with neurological disorders provided a diversity of experiences that enriched the lives of all the participants.

Key words: neurological case studies; stories; teaching methods; narratives; undergraduate neuroscience courses; inter-disciplinary courses; neuroscience education

This course began over a beer. During a campus-wide retreat in January of 2005, somehow we started talking about Phineas Gage at the hotel bar, which led to a discussion of neurological case studies and their appeal. Later, as we began to consider the possibility of building a course around case studies, we talked about stories, their value, their role in the humanities, and their role in the sciences. I had a vision of one of my former English professors. He taught a rigorous and excellent class on John Milton, but I remembered him telling a story: He had a cousin, an adult ne'er do well who lived with his elderly mother. Each day, the elderly mother would walk down to the corner store to buy the ne'er do well a six-pack of beer. The beer kept him home and kept him out of trouble. To be honest, more than 15 years after the class, I don't remember that much about John Milton, but I remember that story: I can picture that cousin sitting on the porch and drinking beer all day. I can envision Phineas Gage in the same way and Oliver Sacks' "last hippie" too. The stories made them come alive in my head. They were more than cases. They were people. (DAH)¹

THE VALUE OF CASE STUDIES IN NEUROSCIENCE

For hundreds of years neurological and psychological case studies have helped shed light on how the brain functions. Introductory psychology students continue to learn how Sigmund Freud's detailed descriptions of his patients opened doors to the study of the unconscious (Freud, 1996). Paul Broca's descriptions of "Tan" provided insights

into the localization of language in the brain (Broca, 1861). And Phineas Gage's unfortunate accident helped point the direction for untold studies of prefrontal cortex functionality (Macmillan, 2000).

Modern-day interest in the individual case shows no signs of waning. Henry Molaison (H.M.) has been described as "the most studied human being in the history of psychology" (Miller, 2009) and the post-mortem study of his brain may offer additional insights about the role of the temporal lobes in memory. V. S. Ramachandran's investigations of individuals have prompted his insights into such diverse topics as neural plasticity, humor, and vision (Ramachandran and Blakeslee, 1998). The case of A.J., who cannot forget anything that has happened to her over a 25-year period, has inspired James McGaugh and colleagues to look at memory in a different way (Parker et al., 2006; Robbins, 2006).

When insights about the brain are combined with the native interest students seem to show in narratives about individuals with brain damage, students are highly motivated to learn. Students report stories are more interesting, easier to comprehend, and easier to remember than other means of exposition (Bower and Clark, 1969; for review of this literature, see Willingham, 2004). Recent fMRI data suggest that reading stories activates neural representations of visual and motor experiences in the brain (Speer et al., 2009). These data support the view that readers understand a story by simulating the events in the story. For example, brain regions involved in motor function are active when a person views, or reads about, another person who is executing an action (Rizzolatti and Craighero, 2004). All things considered, the study of psychological and neurological cases can enhance the

¹ Throughout this article we provide several narratives that are aimed at illustrating the kind of writing we tried to promote in this course.

learning experience and play a very important role in the neuroscience curriculum (Meil, 2007).

COURSE OVERVIEW

Narratives and Neurons: Stories of Damaged Brains was an interdisciplinary, team-taught special topics seminar at Baldwin-Wallace College during the fall semester of 2007. The course was taught by the authors of this article who brought to the experience very different skill sets from neuroscience/psychology and English/journalism. The course had no prerequisites and was open to students (sophomore or above) in our honors program and those from any discipline who had achieved a GPA of 3.5 or higher. The course explored clinical and cognitive neuroscience through the reading, interpreting, and writing of clinical case studies. Readings were selected from a growing literature (see, for example, Meil, 2007) that documents details about individuals with brains damaged by developmental defects, disease, or trauma. This semester-long course was divided into three phases and started with three weeks of studying basic neuroanatomy, neurophysiology, and neurochemistry. Students learned about resting potentials, action potentials, basic synaptic functions, and how electrical and chemical signals work together to allow information processing to occur in the brain. The neuroanatomy was taught at a basic level aimed at providing the student with structure-function relationships that would help them later in the course. With this information to draw on, students then began reading published clinical case studies and evaluated them in regard to what they said about brain functioning but also as literary and journalistic texts. During this period of time students were also identifying (or being assigned) individuals with neurological problems. In the second half of the course, students interviewed their subjects and the people close to them, wrote extensive case studies, and “workshopped” these monographs, meaning the cases were discussed and examined by the entire class in order to improve their technical accuracy as well as their literary appeal.

COURSE OBJECTIVES

The objectives of the course (as stated in the syllabus) were:

1. Gaining factual knowledge by learning the basics of neurophysiology, neuroanatomy and neurochemistry.
2. Developing skills in expressing oneself orally and in writing.
3. Learning to apply course material (to improve thinking, problem solving, and decisions).
4. Learning to analyze and critically evaluate ideas, arguments, and points of view.
5. Learning how to find and use resources for answering questions or solving problems.

Taking this class also provided unquantifiable “real-life” benefits for students. Many students will one day face neurological challenges in themselves or within their families. A course such as *Narratives and Neurons* gives students a head start in terms of understanding

neurological and psycho-social aspects of dementias, autism, stroke and other diseases affecting sensory, motor and cognitive systems of the brain.

PRELIMINARY DISCUSSIONS WITH STUDENTS

The summer before the course began we emailed the students enrolled in this class and provided a general outline of the course along with a draft list of the books and case studies we were considering asking them to read. It was important to us to explain that this course was new to us just like it was new to the students and that they could have a real say in how we structured it.

In response to this survey, some students shared their anxiety about the fact that they had little or no background in neuroscience, while others suggested course formats (e.g., a final report at the end of the class). Others volunteered that they had already begun to look for “their case.”

Throughout the process, we acknowledged that the course brought an element of risk for everyone involved. During the semester, we had a few class-wide conversations that allowed students to discuss problems and successes and even gripe a bit. These discussions allowed us to consider overall adjustments or give individual advice and feedback.

PUBLISHED CASE STUDIES

The neurological case studies that comprised the readings for this course were selected based on the insights that they revealed about brain functioning and disease, the diversity of disorders discussed, the quality of the writing, and the different voices of the authors. We also wanted to expose the students to modern neurological “classics” (e.g., Oliver Sacks’ “*The Man Who Mistook His Wife for a Hat*”) as well as more-journalistic writings about contemporary celebrities they may know about (e.g., Muhammad Ali and Michael J. Fox). Examples of these readings:

- “Background to fame” (Chapter 2), “The wonderful journey” (Chapter 5) and “Damage to Gage’s psyche” (Chapter 6) from *An Odd Kind of Fame* [detailed history of Phineas Gage]
- “The Lost Mariner” (Chapter 2), “Eyes Right” (Chapter 8), “Witty Ticky Ray” (Chapter 10), “Reminiscence” (Chapter 15), “The Twins” (Chapter 23), and “The Autist Artist” (Chapter 24), from *The Man Who Mistook His Wife for a Hat*
- “The last hippie” from *An Anthropologist on Mars*
- “My mother’s best friend” (Chapter 1), “Still smiling” (Chapter 2), “A trip to paradise” (Chapter 4), “The lizard” (Chapter 5), “Morbid obesity” (Chapter 20) from *Newton’s Madness: Further Tales of Clinical Neurology*
- “The man who would save the world” (Chapter 4), “Spontaneous generation” (Chapter 7), “Legacy” (Chapter 8), “Broca’s amusia” (Chapter 15) from *Toscanini’s Fumble and Other Tales of Clinical Neurology*

With the help of our bookstore we obtained appropriate copyright releases and compiled these readings into a single packet, purchased by the students as the text for this course. Throughout the course, we also provided personal stories related to neurological cases. While not detailed enough to give students a holistic look at the desired end products, these stories provided brief journalistic models for the students as they worked on their own cases. One such narrative follows:

H.M.

It's spring of 2000 and I'm dining with neurological royalty. I'm having a conversation with H.M. (a.k.a., Henry Molaison) who I had the good fortune to meet during a sabbatical at the Massachusetts Institute of Technology (M.I.T.). H.M. famously suffered a seizure disorder that was treated with bilateral temporal lobe surgery - removing most of his hippocampus. The surgery left him with severe anterograde amnesia and propelled him into "rock star" status in the very insular world of neuroscience.

I ask H.M. if he thinks that his memory is good. "In a way," he responds. And he's right in the sense that his memory of events from his childhood (before his surgery) is excellent. It's the creation of new memories that's the problem.

I ask H.M. what career he chose. "You know, I wanted to be a brain surgeon." Really?" I say. "Yes, but I wear glasses and so I said 'no.' Maybe a nurse would go to mop my head with a towel during surgery and she might knock my glasses and then I would make a mistake. And that would not be good." "No, that would not be good," I agree.

H.M. is an old man now and spends most of his time in a wheelchair. He's frail and I can't help but notice that he's more than a little overweight. He sits, hunched over, before his plate and tells me that he can't remember what he had for breakfast. He will not remember this lunch. Does he forget he has eaten? Is it his poor memory that makes him overweight? Or, is he perennially hungry? Has his motivation or metabolism changed following his surgery? Case studies are not controlled experiments. But these are the kind of questions that case studies can raise as we generate hypotheses about brain functioning – hypotheses that we can later test in the laboratory.

Our conversation resumes. "Is your mother still alive?" I ask. "I think so," H.M. says. [Sadly, she died over a decade ago.] "What kind of work did your father do?" "He was born in Louisiana and he worked as an electrician." [All true and perfectly verifiable.] But then H.M. looks a little puzzled and says, "You know, I wanted to be a brain surgeon." "Is that so?" I say. "But, I wear glasses." (GAM)

IDENTIFYING POSSIBLE CASE SUBJECTS

An important part of this course was identifying willing individuals with various neurological diseases, neurodevelopmental disorders, or brain trauma to serve as the subjects of the case studies. When we first began planning this course we anticipated that this might be the most difficult aspect of the experience to arrange. In practice, however, it was relatively easy. First, we encouraged students who had a family member or friend

with a brain disorder to think about doing their case analysis with this person. It is unfortunate that disorders of the nervous system are so prevalent, but about half of our cases were identified in this way. A secondary advantage of this method was that, in many instances, students had a built-in rapport with their subjects. This made the sometimes-lengthy interviews easier to arrange and often allowed unfettered access to medical records and conversations with health care professionals. Even before the course began we sent an email advertisement to our campus telling about the course and soliciting participants. We received a tremendous response and, unfortunately, could not accommodate all of the people who wished to be part of the course. Finally, the medical director of our campus health center volunteered information about a local support group for people with traumatic brain injury (TBI) (<http://www.hansontbiclubhouse.org/index.html>). We made contact with the program director at the Hanson House TBI Clubhouse and he served as an intermediary to recommend several individuals who might wish to participate.

TRAUMATIC BRAIN INJURY

The students from our class walk into the Berea OH recreation center where our local traumatic brain injury support group ("Hanson House") has reserved a room and is about to have their weekly meeting and lunch. It's an odd mix of smells — chlorine from the pool and the smell of lunch on the table. The students are anxious, as am I, because this is the first time many of us will have talked to someone with TBI. Will the TBI survivors be able to talk? Can they tell us their stories? Will they consider us an intrusion? This is a stretch for many of us. We get a brief sense of what the TBI survivors must feel every day. We are outsiders. We are not members of this exclusive club.

We are greeted warmly by Paul, the program director for Hanson House, and he, in turn, introduces us to some of the TBI survivors - people we will get to know with some intimacy over the next few months. Some words are slurred. Some thoughts are disjointed or slow in coming. We notice that they are as nervous as we are and they are anxious to make us feel welcome. But along the way we discover what we should have known all along. They are injured but they are still people. They are fathers and brothers and sisters. They are us after all. Humanity abides. And they have some extraordinary stories to tell. (GAM)

Each of the channels used to identify potential cases produced access to some extraordinary people who were exceedingly generous with their time and very open in talking about their circumstances. Faculty selected the final cases from this large pool with an eye to exposing the students in the class to a diversity of neurological problems. For example, while we had several people with Multiple Sclerosis (MS) volunteer to participate, we avoided the repetition that this would present to the class by only accepting one such case. We also shied away from cases with more psychological components and tended to accept cases that had frank neurological origins. While recognizing that there is no real line separating the

neurological from the psychological we did not accept any cases of depression, bipolar disorder, or the like. With psychological disturbances, our concern was that students might be drawn into feeling as if they were doing “therapy” as they interviewed the participants – something they were clearly unqualified to do. In the end, our students were assigned to write case studies about individuals with a variety of traumatic brain injuries, Alzheimer’s Disease, myasthenia gravis, multiple sclerosis, seizure disorder (with accompanying synesthesia), spinal muscular atrophy, reflex sympathetic dystrophy, and autism, to name a few.

Students who wrote about family members had some obvious advantages — proximity and intimate knowledge of their subjects, for example — but they also faced difficulties because of family politics and intimacy. In at least one case, a student discovered unexpected and upsetting details about her family’s psychological history. In another iteration of this class we would continue to allow students to work with family members, but we would have a longer conversation about the advantages and disadvantages of such a situation.

MEDICAL RECORDS, CONSENT, ETHICS

As part of our consent process, participants allowed access to medical records and permitted discussions with health care professionals [within the constraints of the U.S. Health Insurance Portability and Accountability Act (HIPAA)]. This was particularly important as students attempted to understand the nature of the nervous system damage and its underlying neuroanatomy and neurophysiology. Faculty with neuroscience expertise provided advice regarding the best questions to ask these professionals and resources to help with medical terminology and jargon. Family and friends of the participants were often also willing to speak with our students.

The ethical rules that guided students as they did their interviews rested on the border between common journalistic principles and the established ethics of human research. One of us (DAH) had a career in newspaper journalism before moving into academia. The other author (GAM) came from a background in experimental psychology and neuroscience research. These different backgrounds provided for some important discussions about how we would handle student interactions with our participants. When journalists are ferreting out a story, they do not follow the same rules as those used by scientific investigators. Interviews by reporters are done with little fanfare and pre-approval. This is true even when people are involved who find themselves in compromised situations. Further, the expectation is that names of individuals involved will be used in published accounts unless other arrangements, which are rare, are made. Of course, interviews conducted as part of scientific research follows different methodologies — including Institutional Review Board (IRB) review of protocols, consent forms and concerns about informed consent. In the end, we decided that we would model the conservative use of our human participants for our students and seek both IRB approval and written informed consent from our cases. After

discussing what we were planning with the chair of our IRB we applied for and received an expedited review of our plans. Our protocol called for interviews of the persons with neurological damage as well as discussions with family members and attending health care providers. We also planned for requests of medical records (with the patient’s permission and in compliance with HIPAA requirements). [But note: This was almost always unnecessary as the participants frequently had possession of extensive medical records and shared them freely. In the one or two cases where students requested medical records, this was done through standard hospital procedures and they were sent to one of us (GAM) with neuroscience background who could then help the student interpret the findings. As the students were actively writing their case studies, both professors scheduled individual meetings with all of the students to assist them with interpretation of medical information, story structure, or whatever happened to be challenging the student at the moment.] Informed consent presented special challenges for only a very small sub-set of our participants. For the most part, we selected cases where current mentation was clear. We provided students with training on how to discuss the consent form (see Appendix 1) with the participant. If there was any doubt of the participant’s understanding, next of kin or custodian signatures were required. Participant and family identities were kept anonymous and pseudonyms assigned unless the individual requested otherwise. Although our consent form said that “There are no known benefits to you for taking part in this study”, many of the brain damaged individuals who participated in our course voiced pleasure in doing so. It was a way for them to see “something good” come out of their unfortunate situation. Most also enjoyed their interaction with the students and appreciated the students’ interest in them.

INTERVIEWING TECHNIQUES

We discussed interviews and supplied a list of sample questions that our students might use. We urged students to come prepared, to be active listeners, to ask open-ended questions, and to take good notes. Students were asked to interview their primary subject multiple times, they were encouraged to do something active with their primary subject, and they were expected to also interview the participant’s family members, friends, and other interested parties. One of the keys to being a good reporter is building trust; that takes time, genuine interest, and empathy.

Here are examples of the questions/prompts we provided:

Questions Related to Symptoms

- Do you ever have memory problems?
- Do you ever have trouble making decisions?

Questions Related to the Case

- What led to your diagnosis?
- What’s your relationship like with your physicians?

Questions about Life in General

- Describe a typical day for me.
- What should I know about you?

Biographical Information

- Where and when were you born?
- What was your childhood like?

As we drafted this article, we discussed whether some of our sample questions for students might contain an inherent bias that could lead participants in a particular direction or perhaps evoke false memories. In many interview situations, it's impossible to craft completely bias-free questions, but nevertheless we plan to reassess these questions before we teach the class again.

WRITING STYLE

While scientists and journalists strive for objectivity, the creative and observational nature of case studies often requires a subjective viewpoint. The writer of a case study becomes part of the case. Accordingly, our students wrote their cases in the first-person point of view, which is the *modus operandi* for Oliver Sacks, Harold Klawans, and even the authors in some portions of this paper. Students brought in different skill sets. For some the science was frightening. For other writing "creatively" was a worrisome new activity.

Students were asked to strive for factual truth and objectivity and to summon up a full and detailed picture of their subjects with neurological disorders. For example, here's Emily Mastroianni's word portrait of her subject:

"Ray tells me his memories in bits and pieces, and that's how I'm getting to know him. When I think of him, I picture his brown shoes and high white socks that reach to the middle of his calf. It's the first thing I see as I sit waiting in the entrance-way to the Berea Recreational Center. Soon, the rest of his figure comes into view. He's wearing the usual khaki shorts and blue tie-dyed t-shirt. He's a short, round man who looks at you with squinty hazel eyes behind large magnifying lenses. His light brown hair is usually ruffled, and a crease appears across his forehead as we talk. When he's focused he's intense, with words that are often interrupted by a seemingly chronic case of the sniffles and snorts." (Mastroianni, 2008)

Following the journalist's mantra to quote fully and accurately, Natalie Hogan recreates the verbal tics and gestures of her participant with traumatic brain injury:

"I don't know much, bu' wha' I do know is tha' I'm really lucky.' He rocks back and forth slightly and unfolds his arms. 'I'm amazed wha' ken happen to a person.' Bill emphatically gestures, making a hitch-hiker's thumb toward his chest and continues. 'I'm a lucky guy – I do know tha'. I'm a lucky guy.'" (Hogan, 2008)

And, finally, Ellen K. Mackall's study of a person with MS shows the depth students can bring to the medical and analytical aspects of their cases:

"Lesions in the brain can affect cognitive functions as well and are the probable cause of the symptoms Janice has. Many MS lesions formed around the ventricles in the brain and the corpus callosum, which connects the brain's hemispheres; these areas control much of the cognitive functioning that can be affected by MS, such as memory and information processing (Kalb, 2000). Janice has several lesions in the area around her ventricles and has a very visible lesion in the white matter next to the corpus callosum, as seen on her MRI. It is likely that these lesions are causing many of her cognitive symptoms, such as problems understanding what others are saying and

processing information, forgetting what she has just done, and even complex tasks like her impaired decision-making." (Mackall, 2008)

In the interest of accuracy, the students were expected to speak to a number of different sources for each case study. Because of cognitive difficulties, some subjects weren't able to fully or accurately discuss their situations. That's where insight from family members and friends became vital. Getting multiple sources and multiple viewpoints is also a standard journalism practice. Although we had no official system for checking facts, the workshop process sometimes led to discussions about small areas where case studies seemed incomplete and/or inaccurate. Like most students, our writers were operating on the honor system; unless something in a case raised a red flag, we trusted that the students did honest and accurate reporting. In the end, we found no evidence of students fabricating their cases. If we had developed such suspicions, the faculty had contact numbers for the subjects and/or their family members, and we would have called them to follow up and verify facts.

THE FORMAT OF WRITING WORKSHOPS

The writing portion of this class was a workshop, the main classroom model for creative writing classes. Under this model, students disseminate their work to the entire class via photocopies or electronic copies, and the group reads the work outside of class. In the actual classroom, professors and students fully and openly discuss the work; the goal is to help the student writer see the work through the eyes of unbiased outside readers and to help the student writer revise and improve the work.

We started each workshop with a short reading quiz. Most students in workshops are eager to read their peers' work, but quizzes help promote consistent, careful reading. We then split our workshop into two rounds: An initial round in which we asked the following general questions: What do you like about this case study? What works? Students were urged to give specific and thoughtful feedback. If a student supplied a generic comment such as "It was well written", the professor running the workshop followed up, asking, "What do you mean? Can you give an example?" After each student supplied some kind of positive comment, we switched to the second round, which focused on constructive criticism. Some possible prompting questions were: What could be better? What doesn't work? What could be added? Where does the writing need to be sharpened? Again, students were required to supply specific and thoughtful feedback. In each round, we talked about the style of the piece and the substance, including the validity of the students' scientific writing and neurological interpretations.

Because students needed to revise their pieces, they understood that the second round of workshop was vital to their success in the course. A few students were initially resistant to commenting on their peers' work, but most students became accustomed to the process. In most workshops, the student writer is not allowed to speak until the very end of workshop, which ensures that the discussion focuses on the written work, not the student.

One key of workshop is building an *esprit de corps*. Personal comments — whether positive or negative — are banned, and students are reminded at all times that the comments are about the work and the work only.

Workshops bring in a number of unique learning possibilities: Students get accustomed to giving and receiving both praise and criticism. Students practice ethical responsibilities by treating all work fairly. Workshops put student work at center stage and create an active classroom. Workshops also present some drawbacks: They are difficult classes to prepare for because free-form discussion can lead in many possible directions. Students' feelings may be hurt. Workshops also require deadlines and a great amount of classroom coordination.

In most workshop cultures, the professor is a leader, an expert, and a facilitator, but all people in the room are considered important contributors. Every voice should be heard and listened to. This often creates disagreements, which if aired politely, can greatly benefit the student whose work is being discussed.

Workshops work best with about 15 students, but a class of 20 or so can work fairly well under this model. *Narratives and Neurons* had 19 students.

We found that almost all students are capable of providing smart and interesting feedback to their peers. One student, an English major who had been in previous workshop classes, provided feedback for her classmates via e-mail on a day when she had to miss class (Paine, 2007).

About one student's case, she wrote: "*Perhaps one of the strongest and most resonant aspects of your story is how well you develop the perspectives from each family member you spoke with. The multiple perspectives really allow us to see how your grandmother plays a role in your family. It is important to hear all voices, and I commend you for making sure that everyone was heard, even if it was painful for them. The only thing I wish I could have seen a bit more of is explanation of Alzheimer's as a disease. I mean, I know some basic facts about how it damages the brain, but I could have used some more details about how it manifests itself in your grandmother. However, I'm afraid that if you try to go with my suggestion that it will disrupt the wonderful narrative pacing of your essay... I don't know.*" (Paine, 2007)

Although this student was a particularly strong workshopper, the quality of her suggestions is representative of what most students supplied in class discussions. We reminded workshopppers that they didn't need to come up with all the answers; they needed to weigh in, ask questions, and make thoughtful comments. In an effective workshop setting, a true conversation grows, and students spur each other on to new insights and new ideas.

OTHER FORMATS, TEAM TEACHING

It is possible, but not ideal, to run this class without using a workshop model. If so, we recommend that students turn in multiple drafts of their case studies and receive feedback on each in order to hone the studies and improve them.

We also suggest that students be required to share their case studies with their classmates.

And we highly recommend team-teaching. Although a variation of this course could be taught with a single professor, we urge professors interested in such a class to team-teach. Although a few professors might be qualified to teach neuroscience *and* college-level writing, it seems unlikely on most campuses. In our classes, we had clear roles and were able to blend our skills and expertise. Moreover, team-teaching allowed us each to learn more about a different discipline. Students found writing the case studies hugely rewarding and correspondingly challenging. Accordingly, the course was time-consuming for everyone involved, and team-teaching the class allowed us to share the burden of outside meetings with students who wanted to review medical records with us or discuss the craft of writing.

STUDENT DIVERSITY

One of the challenges of this course was the diversity of the students in terms of their background and training. The course was cross-listed in our catalogue as an Honors course, a Psychology course, an English course and a Neuroscience course. Although we did not engineer this, we were lucky enough to enroll science students who had a good grasp of how the brain works as well as two English students who were well versed in the structure and execution of story writing. Psychology majors made up about a quarter of the class, and the rest of the group varied greatly, with students majoring in subjects as diverse as Spanish, Biology, and music therapy. We found that, over time, this produced a good mutually supportive milieu in which students could feel competent in at least one aspect of the course while expanding their boundaries of understanding in other parts. For example, before the test that assessed the part of the course devoted to basic neuroanatomy, neurophysiology and neurochemistry, one of our Neuroscience majors volunteered to make study guides for the other students. She also held well-attended study sessions that helped her peers cope with this new material. Likewise, we were delighted when one of the English majors offered to help one of his classmates develop the narrative of his case study.

ASSESSMENT OF THE COURSE: STRENGTHS AND WEAKNESSES

The success of this course was evaluated via two different assessments of student enthusiasm for the course and our progress towards achieving the course objectives. Further, the quality of several of the case studies was evaluated independently.

Four of the students submitted their case studies for publication in the *Baldwin-Wallace College Journal of Research and Creative Studies*. This is a peer-reviewed journal with rigorous acceptance criteria. The current acceptance rate is 46%. However, 100% of the *Narratives and Neurons* case studies were accepted. (See: http://www.bw.edu/resources/dean/fscs/jrcs/Journal_Cover_2008.pdf.) This reinforced the sense that the faculty had that the papers produced in this course were of high

quality.

One set of student evaluations of the course employed the use of standardized, nationally normed, IDEA ratings (Individual Development and Educational Assessment; for information about IDEA see: <http://www.theideacenter.org/node/5>). Of the five course objectives considered either “essential” or “important” (see above), average student ratings ranged from 4.1 to 4.8 on a 5-point scale (1 = no apparent progress on this objective; 2 = Slight progress, I made small gains on this objective; 3 = moderate progress, I made some gains on this objective; 4 = Substantial progress, I made large gains on this objective; 5 = Exceptional progress, I made outstanding gains on this objective). In particular, progress on the following three objectives scored either “higher” (upper 20%) or “much higher” (upper 10%) than other courses in the national IDEA database.

- Learning to apply course material (to improve thinking, problem solving, and decisions).
- Learning to analyze and critically evaluate ideas, arguments, and points of view.
- Learning how to find and use resources for answering questions or solving problems.

One other IDEA objective, “Gaining factual knowledge,” was used to evaluate the students’ perceived progress in learning about basic neuroscience. Progress towards this objective was rated by our students as 4.1 (on the 5-point scale) and, in terms of comparison to national norms, fell in the average range (52nd percentile). Our in-class evaluation of the student’s knowledge about neuroscience was in the slightly-above-average range. A test over this material produced a mean score of 81% (\pm standard deviation of 9.54%). Most of our students had never before taken a neuroscience course and so, while these scores are not outstanding, they indicate that the students had some competence upon which they could build their case studies.

Because this course was available to students in our Honors Program, we received additional ratings from these students indicating a high degree of acceptance of the course material and general satisfaction with the methods of teaching employed. All students in the course rated it as a 5 or a 6 (1= lowest rating; 6 = highest rating) on measures of “Intellectual challenge,” “Active student learning,” “Encouraging constructive critique,” and “Development of communication skills.”

A typical written comment: “This course absolutely fulfills all the critical parts of the liberal arts and sciences in one class. The independence and class interaction presented a good balance. The instructors were approachable and helpful. New realms of knowledge were explored in this class which I thoroughly enjoyed. Tough but worth it.”

SUMMARY

Narratives and Neurons was a great adventure – one we invite other colleagues to take. It was simultaneously a great challenge and an intellectual growth experience for faculty and students alike. It forced us all to go beyond the academic study of neurological disorders and traumatic

brain injury and, instead, to understand the impact these problems can have on not only the individual but also their family and friends. Beyond this, it taught us to appreciate and admire how our participants struggle and survive their ailments each day as they move toward being the new person that they must become.

REFERENCES

- Broca PP (1861) Loss of speech, chronic softening and partial destruction of the anterior left lobe of the brain. *Bull Soc Anthropol* 2:235-238. [Translation by Christopher D. Green]
- Bower GH, Clark MC (1969) Narrative stories as mediators for serial learning. *Psychon Sci* 14:181-182.
- Freud S (1996) Three case histories. New York, NY: Touchstone Simon & Shuster.
- Hogan N (2008) Life as a consequence: A case study. *B-W J Res Creative Studies* 1:26-33. Available: <http://www.bw.edu/resources/dean/fscs/jrcs/article4.pdf>
- Kalb R (2000) Multiple sclerosis: The questions you have—The answers you need (3rd ed.). (Kalb R, ed) New York, NY: Demos Medical Publishing, Inc.
- Klawans HL (1988) Toscanini’s fumble and other tales of clinical neurology. Chicago, IL: Contemporary Books.
- Klawans HL (1990) Newton’s madness: Further tales of clinical neurology. New York, NY: Harper & Row.
- Macmillan M (2000) An odd kind of fame: Stories of Phineas Gage. Cambridge, MA: MIT Press.
- Mackall EK (2008) Living with quirks. *B-W J Res Creative Studies* 1:18-25. Available: <http://www.bw.edu/resources/dean/fscs/jrcs/article3.pdf>
- Mastroianni E (2008) Gray matter. *B-W J Res Creative Studies* 1:1-8. Available: <http://www.bw.edu/resources/dean/fscs/jrcs/article1.pdf>
- Meil, WM (2007) The use of case studies in teaching undergraduate neuroscience. *J Undergrad Neurosci Ed* 5:A53-A62.
- Miller G (2009) The brain collector. *Science* 324:1634-1636.
- Paine KL (2007) Personal communication.
- Parker ES, Cahill L, McGaugh JL (2006) A case of unusual autobiographical remembering. *Neurocase* 12:35-49.
- Ramachandran VS, Blakeslee S (1998) *Phantoms in the brain*. New York, NY: William Morrow and Co.
- Robbins G (2006) UCI studies woman who can’t forget: UCI researchers assess woman with 'nonstop, automatic' memory. *The Orange County Register*. Available: <http://www.oregister.com/articles/uci-studies-woman-1043889-who-cant-forget>
- Rizzolatti G, Craighero L (2004) The mirror neuron system. *Annu Rev Neurosci* 27:169-192.
- Sacks O (1987) *The man who mistook his wife for a hat*. New York, NY: Harper & Row.
- Sacks O (1995) *An anthropologist on mars*. New York, NY: Vintage Books.
- Speer NK, Reynolds JR, Swallow KM, Zacks JM (2009) Reading stories activates neural representations of visual and motor experiences. *Psychol Sci* 20:989-999.
- Willingham DT (2004) Ask the cognitive scientist: The privileged status of story. *American Federation of teachers*. Available: http://www.aft.org/pubs-reports/american_educator/issues/su mmer04/cogsci.htm

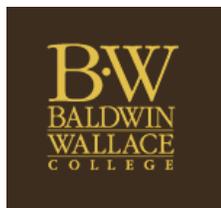
APPENDIX 1

Appendix 1 contains the consent form used in the *Narratives and Neurons* course.

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APPENDIX 1:

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Consent to Participate in a Research Study
Case Studies of Persons with Neurological Damage

Introduction and purpose of the study: You are being invited to take part in a study investigating how nervous system damage changes a person's brain, behavior, mental abilities, and personality. Case studies (or stories) will be written about individuals with a variety of neurological problems. These stories will be composed by Baldwin-Wallace College students taking a course called *Narratives and Neurons* during fall semester 20XX. You are being invited to participate in this research study because you are an adult who has some injury to you brain or peripheral nervous system.

If you decide to participate in this study, you must sign this form to show that you want to take part. We will give you a copy of this form to keep. Your participation is completely voluntary. Please ask questions if there is anything that you do not understand.

Why are these case studies being written? The primary purpose of the case studies is to teach undergraduate students about how the nervous system works and how damage can affect the brain's functioning. The case studies will also help them develop their writing and communication skills.

Description of procedures: The research will be done at times and locations that are mutually convenient to you and the student. You, your family members, friends and/or health care professionals will be interviewed. You may be asked to share your medical records. You also may be asked to complete some short pen-and-pencil tasks. With your verbal consent, interviews may be recorded.

Access to health and medical records: In order to precisely determine the damage to your nervous system it may become necessary to have access to your medical records. In most cases, student interviewers will ask to see medical records in your possession. But if you do not have the needed information the student may approach your health care provider to obtain that information. Unless you give explicit written permission, student interviewers will not copy your records but may take notes while viewing them.

How long will I take part in this study? The case studies will be written during the fall semester of 20XX and will be completed by XX December 20XX. The length of time you may be asked to spend with the student will depend on your particular situation but it will be at least 5 hours. The time may be spread over several days or weeks.

Possible risks or discomforts: You may experience some discomfort if talking about your disorder is troubling to you. Otherwise, to the best of our knowledge, the things you will be doing in this study pose no more risk of harm than what you would experience in everyday life.

Benefits to subjects: There are no known benefits to you for taking part in this study.

Costs: You do not have to pay to participate in this study, but you may have to pay for the cost of getting to the locations of the interviews. If the interviews are at Baldwin-Wallace College, we will arrange for you to receive a free parking pass for on-campus parking if you plan to drive.

Compensation: There is no monetary compensation for participation in this study.

Right to withdraw from project: Your participation is voluntary and you may discontinue participation at any time without penalty or loss of any kind.

Confidentiality: You will work primarily with one student and perhaps with the project supervisors, Drs. Mickley and Hoyt, who will all know your identity. However, beyond this small group, your name or other identifying information will not be released to anyone without your explicit written permission. The written case study will

refer to you by a false name or initials. All data associated with your participation will be stripped of identifiers. This informed consent document, with your name on it, will be stored in a locked filing cabinet in Dr. Mickley's office at Baldwin-Wallace College, and no one but Dr. Mickley, Dr. Hoyt or the student members of the class will have access to the cabinet.

Although it happens very rarely, we may be required to show information that identifies you, like this informed consent document, to people who need to be sure we have done the research ethically. These would be people from a group such as the Baldwin-Wallace College Institutional Review Board that oversees research involving human participants.

The information you give will be used in writing stories or case studies. But you will not be identified when the Baldwin-Wallace College student, Dr. Mickley or Dr. Hoyt writes up the study to share it with other class members, researchers at professional meetings or in publications.

Contact person for questions or concerns: You should feel free to ask questions of the student interviewers during the study. You may also contact the Professors for the *Narratives and Neurons* course, Dr. G. Andrew Mickley and Dr. Daniel Hoyt, with any questions or problems. They can be reached during weekdays at 440-826-XXXX and 440-826-XXXX, respectively. Also, if you feel pressured to take part in this study, or to continue with it, they want to know and can help.

Certification:

I have read and I believe I understand this Informed Consent document. I believe I understand the purpose of the research project and what I will be asked to do. I have been given the opportunity to ask questions and they have been answered satisfactorily.

I give permission for the student interviewer _____, Dr. Mickley, or Dr. Hoyt to request access to my health record and to receive information about my medical condition from my doctors or other health care providers.

I understand that I may stop my participation in this research study at anytime and that I can refuse to answer any question(s).

I understand that my identifying information will remain confidential, that all information associated with my participation will be stripped of identifiers, and that I will not be identified in published reports on this research.

I have received a signed copy of this Informed Consent document for my personal reference.

I hereby give my informed and free consent to be a participant in this study.

Signatures:

Date

Consent Signature of Participant

Printed Name of Participant

Date

Consent Signature of Custodian or Next of Kin

Printed Name of Custodian or Next of Kin

Statement of student interviewer or person obtaining consent:

- I have explained the study to the Participant.
- I have answered all questions to the best of my ability.

Date

Printed Name of Person providing information & witness to consent

Signature of Person providing information & witness to consent