

criteria) is utilized. This may cause confusion for the reader and lead to discrepant classification of traumatic brain injury severity when examining objective injury severity characteristics. The cerebrovascular disease chapter provides a good description of the etiology of strokes most frequently encountered, but there is little description of stroke syndromes or their associated neuroanatomical locations. The brain tumor chapter would have been enhanced by including a discussion of most common chemotherapy agents and potential benefits and side effects, and the hypoxia/anoxia chapter could have been improved by including information about management in the post-acute stages. The ABI secondary to substance use disorders chapter was vague and could have been improved by providing a more in-depth discussion about the potential confounding factors when attempting to draw links between acquired brain injuries and substance use disorders. For example, it is well documented that cigarette smoking and using cocaine increase risk for stroke, but is this a direct link or are those disorders among a number of “vascular risk factors” that cumulatively increase risk for stroke? The addition of chapters about ABI in children and the elderly is a nice supplement to the discussion of numerous clinical syndromes, but entire books can be written about ABI in these patient populations, which resulted in chapters that read as a bit indistinct.

Inclusion of a chapter dedicated to feigning in the context of ABI is certainly appropriate, but the title was a bit misleading and as with the pediatric or geriatric brain injury literature, the issue of validity is large enough to warrant an entire volume. When litigation is a factor, one can attempt to infer motivation behind less than optimal engagement. However, in cases where there is not clear evidence of secondary gain, explanations for reduced engagement are not always linked to volitional attempts to underperform (why call it feigning as opposed to reduced task engagement or poor effort?). This chapter might also have been enhanced if the title was changed to “feigning issues in mild traumatic brain injury cases,” which is the primary focus of the chapter. The chapter content is consistent with the existing literature, but it is extremely brief. It may have been better positioned as the final section of the mild traumatic brain injury chapter as opposed to a stand-alone chapter.

Overall, however, this book is well suited to serve as a basic primer for professionals with an interest in ABI (especially those outside neuropsychology or students entering into the field) as a brief overview to guide further reading. However, for readers seeking an in-depth discussion of these content areas, or who encounter these populations on a regular basis, this book would be insufficient as a primary or stand-alone reference. For these readers, an additional reference would probably be needed.

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Remembering H.M.: Review of “*PATIENT H.M.: A Story of Memory, Madness, and Family Secrets*” Luke Dittrich (2016), Random House, New York, NY (2016). 464 p., \$11.85. ISBN-10: 0812992733, ISBN-13: 978-0812992731.

## Influential Case Studies

Although many influential case reports in neuropsychology exist (Code, Wallesch, Joannette, & Lecours, 1996), there are certain patients who stand out because, based upon the historical zeitgeist in which their brain injuries occurred and the attention that those cases received, their neurobehavioral deficits and circumstances of their injury greatly altered our knowledge of brain-behavior relationships.

Among the most famous of these cases is Phineas Gage, the railroad foreman whose personality dramatically changed following frontal lobe injury in 1848 from an accidental explosion that thrust his tamping iron through his skull. Gage’s survival after such a serious injury was a surprise, but Gage’s contribution to clinical neuroscience was his significant personality change, aptly described by his physicians with the pithy observation, “Gage was no longer Gage” (Macmillan, 2000). Although his personality changes were well documented soon after the accident, much of Gage’s long-term outcome may have been exaggerated for entertainment value (Macmillan & Lena, 2010). Thus, the lasting neurobehavioral effects of

Gage's frontal lobe injury and how the deficits may have evolved over time remain clouded in the historical record due to the absence independent scientific characterization.

The second patient is Louis Victor Leborgne, whose expressive language disturbance from a left frontal lobe lesion was described in 1861 by the famous French neurologist Pierre Paul Broca. Monsieur Tan, as he was informally called because "tan tan" was his typical verbal output, retained his capacity to understand commands. The deficits of Monsieur Tan, supported by subsequent cases, demonstrated that language could be fractionated into different components associated with distinct brain regions, and that language was predominately a function of the left brain. Monsieur Tan's contribution, however, was in no small part due to Broca's distinguished reputation as a physician and scientist since localized language effects had been previously described by Jean-Baptiste Bouillard (Sondhaus & Finger, 1988).

The third and most studied of these three cases is patient Henry Molaison (H.M.). H.M. suffered a dense and persistent anterograde amnesia following bilateral medial temporal lobectomy in 1953 to treat intractable epilepsy (Scoville & Milner, 1957). His scientific fame derives from the dramatic demonstration of the critical role that the mesial temporal lobe structures play in learning and memory. Unlike Gage and Monsieur Tan, H.M.'s brain injury was iatrogenic, being an unanticipated adverse event associated with the surgical treatment of his epilepsy. Another important difference is that H.M.'s surgery injury occurred in what can broadly be considered to be the beginning of the modern era of neuroscience (Shepherd, 2010). Thus, his cognitive abilities were subjected to formal characterization with extensive neuropsychological testing over five decades, providing a much richer characterization of his clinical semiology compared to Gage or Monsieur Tan.

H.M.'s amnesia framed how the neuroscience community would eventually conceptualize basic memory mechanisms, beginning with Brenda Milner's early demonstration that multiple memory systems exist such that declarative and procedural memory are readily dissociable (Milner, 1965). Clinically, H.M.'s amnesia meaningfully influenced pre-operative epilepsy surgery protocols across the world. After several additional cases of post-surgical amnesia developed following unilateral temporal lobectomy, it was hypothesized that the functional reserve of the contralateral temporal lobe was insufficient to support the encoding of new memories following resection of the epileptogenic temporal lobe and mesial structures, and multiple methods for characterizing functional hippocampus status were developed (Milner, 1975). What remains poorly reported in standard textbooks, however, is the historical context in which the decision to undergo epilepsy surgery was made, the blurring between experimental clinical techniques and informed consent, and the profound effects on H.M.'s quality of life.

To provide this broad historical context of H.M., Luke Dittrich has published *PATIENT H.M.: A Story of Memory, Madness, and Family Secrets* (Dittrich, 2016a). This is far from a narrative review of H.M.'s contributions to understanding memory, and it is also not a typical biography. However, as the grandson of William Beecher Scoville, MD, the neurosurgeon who performed H.M.'s operation and a prolific practitioner of psychosurgery, Dittrich provides a unique "insider" perspective and captivating description of that era's medical zeitgeist that could not be easily achieved without such a personal relationship. In fact, much of the book does not directly involve H.M.'s life story, but rather, the management of significant psychiatric disease prior to the development of neuroleptics.

## Psychosurgery and Asylums

Scoville's neurosurgical practice primarily involved surgery for psychiatric indications rather than epilepsy surgery. The early development of psychosurgery's goals is exemplified with a quote from the 19th century physician Dr. Gottlieb Burckhardt, who resected undifferentiated brain areas, that illustrates the depersonalization of patients with psychiatric disease: "Mrs. B. has changed from a dangerous and excited demented person to a quiet demented one" (p. 79). It was in late 1935, after listening to the report of operations on two chimpanzees, that Egas Moniz oversaw the first in his series of approximately 20 frontal leucotomies/lobotomies. This series significantly influenced Walter Freeman (neurologist) and James Watts (neurosurgeon) who initially worked together performing prefrontal lobotomies. The distinct approaches to frontal lobotomy developed by Scoville and Freeman also provide a striking contrast in how to best decrease the institutional burden of psychiatric disease. Although Scoville is described as an adventurer who liked expensive sports cars, he was a meticulous neurosurgeon with painstaking preparation before and during all surgical cases. Freeman's enthusiastic efforts to expand the use of frontal lobotomy was reflected by his technique in which an ice pick, inserted through the orbital sockets to a depth of approximately 3 inches, was moved back and forth for frontal disconnection before repeating the procedure on the opposite side. As practiced by Freeman, frontal lobotomy required approximately 15 min to complete, could be performed without a surgeon or an operating room, and multiple procedures could be easily performed in a single day. "Any reasonably competent psychiatrist (could be trained) to perform the ice-pick lobotomy in an afternoon" (p. 151). One can go elsewhere for the

complete story of Freeman, his activities and their aftermath, which has been covered by others including the exquisite text by Elliot Valenstein (1986).

Dittrich's concerns regarding psychiatric therapies during this era are not limited to psychosurgery. His grandmother, Scoville's wife, experienced a breakdown sometime after their marriage, suffered a brittle psychiatric course, and was institutionalized at the Hartford Institute of Living while her husband was director of neurosurgery there and was performing lobotomies at both the Institute of Living and Hartford Hospital. A variety of harsh non-surgical but unproven psychiatric treatments were used that included: (1) Continuous hydrotherapy in which patients were submerged in a tub with only their heads protruding through a small aperture. (2) Pyrotherapy in which patients were placed in a small copper coffin appearing device that, over a repeated treatment period of days, would elevate core temperatures to 105–106 °C. (3) Electric Shock Therapy. In response to patients' fears about these therapies, treatment names were changed. "Since these treatments produce states of unconsciousness akin to normal slumber ... we are adopting the names that are more truly descriptive of these treatments—INSULIN, METRAZOL, and ELECTRIC SLEEP" (p. 73). Karl Pribram, who was head of research at the Institute of Living at that time, claimed that Scoville had performed a frontal leucotomy on his wife, although Dittrich could not independently substantiate that assertion.

A recurring theme throughout *PATIENT HM* is the concept embodied by the Hippocratic Oath of "*primum non nocere*" (first, do no harm) as it contrasts with "*melius anceps remedium quam nullum*" (it is better to do something than nothing). The tension between these approaches lies at the foundation of modern informed consent in which risks and benefits are carefully weighed as part of the decision-making processes prior to treatment initiation or when deciding to participate in clinical research. Informed consent discussion is not restricted to psychosurgery, shock therapies, or H.M. The rationale for informed consent includes the development of surgical treatment for vesicovaginal fistula by J. Marion Sims during the mid-19th century that was conducted on his slaves prior to application to white women, to the U.S. Public Health Service Tuskegee Syphilis Experiment in the 1930s, and the history of the Doctors Trial at Nuremberg after World War II resulting in the Nuremberg Code.

### Temporal Lobectomy

Scoville was a practitioner of psychosurgery rather than epilepsy surgery, and prior to H.M.'s surgery, Scoville had performed multiple bilateral temporal lobectomies for psychiatric indications. Although he describes H.M.'s surgery as an "experimental operation," he also states that the procedure was considered due to H.M.'s seizure frequency and severity despite adequate medical therapy, and that surgery was "carried out with the understanding and approval of the patient and his family" (Scoville & Milner, 1957).

By the time of H.M.'s surgery in 1953, the first reported series of temporal lobectomies for epilepsy had been published from the Montreal Neurological Institute (MNI) (Penfield & Flanigin, 1950). Dittrich describes the important contributions of Wilder Penfield in epilepsy surgery development that ranged from identification of motor and sensory homunculi to how Penfield established a multidisciplinary and state of the art institute by including neurology, electrophysiology, and neuropsychology colleagues. It was in this context that Penfield hired Brenda Milner. A brief biography of Milner's early life is presented in which she designed psychological aptitude tests at Cambridge University during World War II before moving to Montreal and enrolling at McGill University as a graduate student of Donald Hebb.

Although H.M.'s surgery was not performed at the MNI, Milner's neuropsychological testing of epilepsy surgery patients at the MNI made her arguably the most appropriate individual to characterize H.M.'s memory impairment. The first formal scientific presentation of H.M.'s amnesia was published in 1957 by Scoville and Milner although his "very grave, recent memory loss" was described in 1953 at a meeting of the Harvey Cushing Society (Scoville, 1954). However, the 1957 report also contains formal testing on additional temporal lobectomies performed on "seriously ill schizophrenic patients who had failed to respond to other forms of treatment" (p. 11), two of whom also developed significant amnesia following bitemporal resection. Orbital undercutting was extended to include the medial temporal lobes in the "hope that still greater psychiatric benefit might be obtained" (p. 11). The significant psychiatric disease of these patients decreased clinical awareness of memory change without Milner's formal testing given that "the psychotic patients were for the most part too disturbed before operation for finer testing of higher mental functions to be carried out" (p. 12). Thus, the extent of the memory impairment was unknown due to the significant overlaying psychiatric disease in the non-epilepsy patients on whom Dr. Scoville had performed bitemporal resection prior to H.M.

Scoville was sufficiently enthusiastic about the procedure to travel to teach other surgeons the technique. Interesting is mention of Scoville's trip to Manteno State Hospital, an extremely large psychiatric facility located south of Chicago in

Manteno, Illinois. Here faculty from the University of Illinois were performing anterior temporal lobectomies that included hippocampal resection, something not undertaken by Percival Bailey in his series in Chicago. Dittrich mentions another severely amnesic case (D.C.) as an outcome of Scoville's surgery at Mantero, a physician from Chicago with a premorbid IQ of 122. He was evaluated postoperatively with the resulting amnesia, comparable to H.M., confirmed by Brenda Milner. This case was apparently very unsettling to Scoville.

## Controversy

It is impossible to review *PATIENT HM* without consideration of outside events that occurred after its publication. *The New York Times Magazine* published a book excerpt on August 3, 2016, beginning with interviews with H.M. illustrating the magnitude and severity of his memory impairment, briefly discussing post-mortem brain ownership disagreements between the University of California at San Diego and Massachusetts Institute of Technology, presenting background material on the tension between research groups surrounding manuscript preparation describing an previously unknown lesion in H.M.'s frontal lobe that was detected at autopsy, and discussing how H.M.'s court-appointed guardian was identified. The excerpt concludes with interview quotations from Dr. Suzanne Corkin, who was the principal investigator of H.M.'s amnesia since 1977 following the death of Hans-Lukas Teuber. Again, in an interesting personal twist, Corkin lived across the street from the Scovilles, and was one of Dittrich's mother's best friends during their childhood and adolescence.

After *The Times'* excerpt appeared, MIT and other organizations quickly issued statements disputing Dittrich's assertions and conclusions (Eichenbaum & Kensinger, 2016; MIT News Office, 2016). The main points of contention included: (1) allegation that research records were or would be destroyed or shredded, (2) allegation that the finding of an additional lesion in left orbitofrontal cortex was suppressed, and (3) allegation that there was something inappropriate in the selection of (the conservator) as Mr. Molaison's guardian. In addition, a letter signed by over 200 scientists supporting Corkin dated August 5, 2017 was sent to *The Times* (DiCarlo et al., 2016) asserting that Dittrich's claims were untrue.

Part of the interest in the quick response by the scientific community presumably was that Corkin died on May 24, 2016 prior to the book's publication and was unable to respond to these concerns. While Dittrich (2016b) has directly addressed each of the MIT concerns, their response has nevertheless led many of our colleagues and students to assume that Dittrich's book was incendiary, and whose entire story should not be believed.

While the interested reader will examine both sides of the argument (see Vyse, 2016), there is no evidence to suggest that any of Dittrich's factual allegations are wrong. Thus, there are two important points to consider when deciding if this controversy should make otherwise interested individuals pass on reading the book. First, in response to the assertion that research records were shredded, some have suggested Corkin's use of "shredding" was either colloquial or referred to material no longer considered relevant. Corkin is explicit in her description of data shredding in the audio clip of her interview that Dittrich posted (Dittrich, 2016b). Certainly, the presence of many files in a storage room says nothing about whether any files had been shredded, particularly since there has never apparently been a comprehensive catalog of the material established. Non-published information can still inform our understanding of H.M.'s clinical course as demonstrated by Dittrich's observation that H.M. had a significant memory impairment prior to surgery, a fact that had not been formally published. Similarly, non-significant findings or "failed experiments" also demonstrate a broader representation of functions either affected or unchanged following surgery. As Dittrich notes, Corkin was a "meticulous investigator, keeping careful notes" (p. 270), and these notes have both scientific and historical value.

H.M.'s legal guardianship merits greater discussion compared to disagreements about scientific ownership and publication disputes, however, which unfortunately are sufficiently common that university committees exist to address such conflicts. Conservatorship, however, is central to this story because it affects the informed consent for H.M.'s research participation, as well as influencing the final disposition of H.M.'s brain after autopsy. Similar to research study reporting standards, the nature of informed consent has evolved over the course of H.M.'s research participation. Consequently, the absence of any conservator or formal consent process early in H.M.'s research participation reflected generally accepted standards at that time. In 1992, an independent conservator was sought for H.M. to mitigate against unintended conflict of interest by H.M.'s investigators, reflecting greater overall awareness of the importance of informed consent.

The eventual conservator was a son of a former landlady of H.M. Dittrich provides evidence that, in contrast to formal court filings, the conservator was not a relative, and that one of H.M.'s relatives was a first cousin sharing H.M.'s last name (Frank Molaison). We will never fully know how the various points are intertwined or even if H.M.'s relatives had been contacted and were not interested in assuming the role of conservator, and part of this controversy is that Corkin's perspective on Dittrich's claims cannot be obtained. Nevertheless, Dittrich's reporting these issues are neither irrelevant nor inappropriate.



Careful consideration of H.M.'s ability to provide informed consent, and how conservatorship is established in circumstances in which research subjects cannot fully consent, will increase awareness of ambiguities that will allow future researchers to confidently ensure full and appropriate consent is obtained prior to research participation.

## Conclusion

Most of the book presents a non-controversial narrative, however, and that was not adequately captured by *The Times'* excerpt. What we found to be particularly enjoyable in this book is that it provides new details on the contours of H.M.'s life. Prior to H.M.'s death, there were few personal details known to the scientific community, so it should not be surprising that much of this book's appeal is due to its biographical content reporting a variety of details about H.M.'s past. Upon hearing of H.M.'s death, the initial knowledge of his full name was both exciting but then also associated with some sense of guilt and dismay as if suddenly becoming privy to secret information that had been inadvertently revealed. We enjoyed reading about H.M.'s confusion of The Beatles with The Rolling Stones when examining a photograph, but then accurately spelling B-E-A-T-L-E-S rather than beetles, but there are many others throughout the book such as H.M.'s thick New England accent. When asked "Who, or what, is Sue Corkin," H.M. replied "She was a ... well, a senator." The book also describes frequent angry outbursts including physical harm to himself, which contrasts with the typical H.M. description of his being agreeable and passive, and it is interesting to speculate whether this behavior might have been related to the orbitofrontal damage identified during autopsy. These pieces of personal information help humanize H.M. rather than simply being either a research subject or clinical syndrome. A particularly poignant comment by H.M. was his statement that "every day is alone in itself. Whatever enjoyment I've had, and whatever sorrow I've had" (p. 375).

Despite the controversies that arose after publication of *The Times'* excerpt, or perhaps because of them, this book provides a unique glimpse into the blurring of experimental therapy and research during the mid-20th century, motivations for finding treatments for psychiatrically intractable patients prior to the development of neuroleptics, as well as professional interactions and conflicts that may arise in collaborative research settings. Unlike Gage and Monsieur Tan, the depth of clinical research and the modern era in which he lived not only makes H.M. one of the most influential case studies in clinical neuroscience, but also provides one of the most compelling individual stories about how unanticipated surgical effects robbed H.M. of the capacity to form meaningful and lasting relationships with others due to the inability to form new memories. Though clearly not a textbook, and undeniably chatty at times, this is a volume that neuropsychologists at all levels of training and experience, and particularly those with interests in the history of medicine, will enjoy reading and remembering for a long time.

## Author Notes

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