

# Henry's Story

by Luke Dittrich

On August 25, 1953, in the Hartford Hospital neurosurgical suite, Dr. William Beecher Scoville leaned over the operating table and carefully lowered his custom trepan onto the glistening exposed skull of his patient, a 23-year-old epileptic. The trepan was, like many of Scoville's surgical instruments, home-made, cobbled together from tools more often found in garages than in hospitals. It consisted of a simple hole saw he'd purchased for about a dollar, attached to a standard Hudson drill handle, the kind you crank by hand. He positioned the instrument's wide-mouthed serrated drill-bit just above one of his patient's eye sockets, and began bearing down. After extracting a button of bone roughly the size of a poker chip, he put the trepan aside and an assistant gave him a scalpel, which he used to slice through the meninges, the membranes that lie just just beneath the skull. He asked a scrub nurse to flush out the dark mixture of blood and cerebrospinal fluid that was pooling in the hole, then leaned closer, peered inside, and in the sharp light of his headlamp caught the world's first glimpse of Henry Molaison's brain. One of Molaison's frontal lobes, pale and covered in a thin skein of veins, shone under the light. Scoville inserted a slightly curved metal retractor and used it to lever the lobe up and out of the way, so he could reach the hidden structures deeper in the recesses of his limbic system. Once he found what he was looking for, the sea-horse-shaped hippocampus and its adjacent organs—the hook-shaped uncus, the almond-shaped amygdala—he proceeded with the extraction. He used an electric cautery to cut the tissue and a skinny vacuum to suck it out. He had performed variations of this operation on a number of deeply troubled asylum residents, but never on a sane patient like Molaison. Still, he knew that the hippocampus—an organ whose precise function was a mystery to him, as it was to everyone

else in 1953—had been implicated in some forms of epilepsy, and that many surgeons had successfully reduced seizure frequency and severity by removing one half of it, performing a so-called unilateral resection. With Molaison, however, Scoville decided to see what would happen if he removed both sides, not just one. Once he had finished the first extraction, he repeated the process on the opposite hemisphere, using his home-made trepan to open a second hole above Molaison’s other eyebrow, levering up his other frontal lobe, digging once more into the hidden structures deeper inside. In all, taking both hemispheres into account, he ended up removing several tablespoons of neuronal tissue. Before he plugged the holes, he used another tool to snap a few tiny silver clips onto the frayed far frontier of the fresh lesion. The operation was, as he would later write, a “frankly experimental” one, and these clips, visible in X-rays, would help him document its parameters. On that day, on that operating table, Henry Molaison underwent the transformation that would lead to his becoming the most studied individual in the history of neuroscience. Before Molaison had even left the hospital, Scoville noticed that the operation had caused startling and unexpected damage to his patient’s memory. Eventually hundreds of researchers would spend decades studying and testing Molaison—or “Patient HM”, as he became known in academic literature—and what they learned laid the foundation for much of what we now know about how memory works. They learned, for example, that what Scoville took from Molaison’s brain—those few crucial tablespoons—was absolutely essential to the process of creating new episodic memories. And, just as importantly, they learned that what Scoville removed did not prevent Molaison from learning new procedural skills, proving the existence of two distinct and independent memory systems in our brains. But despite all the questions that the study of Henry Molaison answered, a few basic ones remained: What, exactly, did Scoville remove? And what was the condition of what he left behind? There were puzzling exceptions to Molaison’s amnesia. Were these exceptions a result of Molaison’s brain somehow compensating for its losses? Or had Scoville left behind something important—some vestigial stump of functional hippocampal tissue, say—that allowed certain experiences to stick? Scoville gave his own estimates of the measurements of the

lesion, based both on his operative notes and on the post-operative X-rays in which the silver clips he'd left behind were visible. His estimates, it would later turn out, were wrong. Over the decades, as neuroimaging technologies advanced, new and more accurate estimates were made. But when confronted with something as complex as the human brain, even the most powerful MRI machine can only produce a coarse and relatively low resolution image. The fact is, it wasn't until December 2, 2008, a few hours after Molaison died, and a few moments after a saw had removed the top of his skull, that Henry Molaison's brain again came into clear sight. Ever since then, Dr. Jacopo Annese and his team at the University of California San Diego have been engaged in the work of preserving Molaison's brain for future study. It has been a long, painstaking process, involving a combination of cutting-edge technology and time-tested labwork. Already, they've created a remarkable computer-generated model of the surface of Molaison's brain. Today, with this website, they're launching the next stage of their work: Ultra-high-resolution images of cross-sections of the actual brain itself, freely available to anyone with an Internet connection. These images, so detailed that individual neurons are visible, will allow individuals all over the world to examine Molaison's brain for themselves, and draw their own conclusions. While he was alive, researchers gathered more clinical data about Henry Molaison than any man in history. Now, five years after his death, that unprecedented amount of clinical data will be joined by an unprecedented amount of neuroanatomical data. Soon, perhaps, some of the lingering questions about exactly what happened to Molaison on Scoville's operating table during that long-ago late-summer day will finally be answered.

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