Henry Molaison: the amnesiac we'll never forget

Henry Molaison, aged 60 in 1986, sits for tests at MIT. By this point, he had been the subject of study for half his life. Photograph: Jenni Ogden from the book "Trouble In Mind: Stories from a Neuropsychologist's Casebook"

In 1953, a young man named Henry Gustav Molaison, of Hartford, Connecticut, lost his memory and helped to invent neuroscience. Henry Molaison's amnesia was the result of a highly risky "psychosurgical" procedure, an operation designed to cure the debilitating epilepsy he had suffered since childhood. In an attempt to remove the part of the brain that was causing Henry's fits, two holes were drilled in the front of his skull and a portion of his brain, the front half of the hippocampus on both sides, and most of the almond-shaped amygdala, was sucked out. The procedure, hopeful at best, went badly wrong and Henry, then aged 27, was left with no ability to store or retrieve new experiences. He lived the subsequent 55 years of his life, until his death in 2008, in the permanent present moment.

Henry Molaison's tragedy was, however, perhaps also the single most significant advance in understanding the function of memory made in the past century. Until his operation, it had been believed that memory was a property of the whole brain. The accident of his surgery proved a large part of its capacity to be localised in this one area. The "cleanness" of Henry's amnesia made his brain the perfect subject for study of cognitive function in many other ways, too. After his operation, living first with his parents and later with carers, he became known to science as "HM" to protect his identity. It was through these initials that a young postgraduate researcher called Suzanne Corkin, now

professor of behavioural neuroscience and head of the Corkin Lab at the Massachusetts Institute of Technology, got to know him.

Their relationship seemed a little bit like fate. When Corkin came across Henry's case in medical journals from the late 1950s, she discovered that their lives had already overlapped in curious ways. She had grown up a couple of miles from him, in Connecticut, and as a child had lived over the road from the surgeon who had operated on Henry's brain; the surgeon's daughter had been her childhood friend. In 1962, as part of her research, Corkin interviewed Henry. Over the next 46 years they spent many days in each other's company, though for Henry, of course, it was always the first time. Corkin has now written a compelling memoir of that bond between scientist and subject, *Permanent Present Tense*, a relationship which Henry once described neatly: "It's a funny thing – you just live and learn. I'm living and you're learning."

Corkin's book is both a case study and a biography, partly written with the mission to show that HM was much more than a filing cabinet of test scores and brain images; he was Henry, "an engaging, docile man, with a keen sense of humour, who knew he had a poor memory and accepted his fate … and hoped that research into his condition would help others live better lives." The striking thing about Henry's memory loss was how specific it was. He forgot all of his experiences after the operation within 30 seconds, but he retained a good deal of the texture of life he knew up until the age of 27. His personality remained intact, he still had above average IQ and language skills, though for more than 50 years he was able to acquire only the tiniest fragments of self-knowledge.

Speaking to Corkin by phone at her lab in Boston, I ask if she has missed Henry since his death. She laughs a little. "I feel that in a way he is not gone," she says. "Partly because I have been writing this book but also because when he died he donated his brain to MIT. So we continue to study him. He has gone but is still very present for us every day."

There is an estranging moment at the end of Corkin's book, where in the hours after his death Henry's brain is removed from his skull and Corkin gets to look at the physical object she has been probing with her questions for most of her adult life. She describes that moment with a mixture of high scientific excitement and human loss. When she looked at the "tofu-like" mass of that organ, did the neuroscientist have a sense of it be-

ing the man she had known?

"Well," she says, "he will always be a real person for me. I tried to understand his brain when he was alive and now he is dead it is just another way of getting to know him better." After being preserved in formaldehyde, Henry's brain was sent to a lab in San Diego, where it has been sliced into 2,401 fine sections, on slides, as a permanent neurological research resource, soon to be available online. "Some people say Henry has been translated into 2,401 objects," Corkin says, "but I don't see him like that."

One of the fascinating, unsettling impulses in reading Henry's life is that sense of identity being a bundle of all of the stories we tell ourselves about ourselves. Henry loved to relate the few clear memories of his childhood, over and over, though he lacked a context for them and the face he surprised himself with in the mirror each morning did not quite connect with them. Corkin heard those stories many times over the years; every time she left the room for a minute and returned to Henry he introduced himself as if they had never met before, and told the stories again. Some were the family lore of how his father had moved north from Louisiana; others involved going roller skating as a child in the park, taking banjo lessons, driving with his parents along the Mohawk Trail.

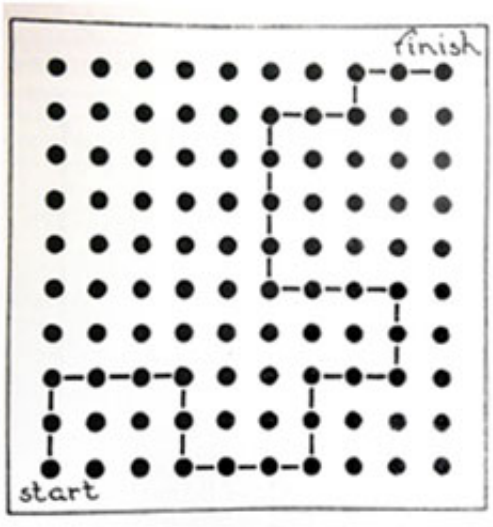
"The interesting and important thing scientifically about these stories was that he would give you the gist of them, but they were never linked to a specific time and place," Corkin says. "You and I can say what we did on our last birthday. But Henry could never remember what else happened. There were no connections, no associations for him in that way."

In talking to Henry and testing his recall over all those years, Corkin discovered only two exceptions to that rule. One was a plane ride that Henry took as a teenager, as a present for graduation from junior high school. The other was an occasion he stole a cigarette from his father and smoking it made him sick, and he got into trouble with his parents. Both of these stories Henry could describe in quite obsessive emotional detail distinct from anything else he talked about. Again, this offered insights into the way memory functioned. In the case of the plane ride there was the anticipation of it, the buying of the tickets, all of the detail of the flight itself, sights and sounds, and then the telling of it to others once it was over.

"It was clear that he had encoded all that information and stored it across many parts of his brain," Corkin says. "All memories are not stored in one specific spot. Strong memory is a creative process that takes in sights and sounds and textures and emotions, so a really important memory will link with all of these areas of the brain. And when we recall it there is a creative process of putting it all together. Similarly with the smoking incident, that appears to have been very emotional also. So: a very negative experience and a very positive one."

It was out of these things, on a daily basis, that Henry seemed to work out who he was. The metaphor of well-trodden neural pathways and formative experiences which have been laid down seems particularly physically expressive here.

Henry was not capable of learning new information, though his knowledge of past events, the Wall Street Crash, Pearl Harbor and so on, was clear. Only a very few tiny details of TV programmes he watched repetitively ever stuck. He could, however, learn and retain new motor skills, which led to important understanding of the difference between conscious memory and unconscious. The latter category would include learning how to play tennis or ride a bicycle, or even play the piano – things that the brain encodes and transmits to the muscles through conditioning, memories which we come to think of as intuitive.



Two memory tests given by Suzanne Corkin to Henry Molaison.
Left) **Mooney face perception test**: scores the subject's ability to form mental pictures

from minimal visual information. Henry did very well.
Right) **Visual stepping stone maze**: Henry had to discover and remember a prescribed 'correct' route across the dots – wrong moves elicited a click noise. In 215 tests, Henry failed to reduce his errors, indicating a declarative memory deficiency.

In all of this revelation, Henry opened up as many questions of the mystery of memory as he answered. MRI scans have helped unpick some of this, but shouldn't be relied on too heavily, Corkin says. She places more faith in the new science of optogenetics, which has begun to understand memory processes at the level of "a specific circuit and the neurotransmitters and brain chemicals that modulate long-term memory. The future of memory research will focus on being able to activate or deactivate these circuits in the hippocampus," Corkin says, "and see how they promote or impair memory function."

Partly through the physical example of Henry, she has no truck with any more esoteric ideas of mind. "The mind is the brain in my view. Your mind is not in your big toe. The brain is a very physical structure, it is like your arm, but it has grey matter and white matter and a huge number of cells we are just beginning to understand called glia. All your mind is contained in there."

As we talk, I wonder if Henry was able to feel things like guilt or regret, emotions with a temporal component. She suggests not, though "he knew that he'd had a brain operation. He knew not many people had had the operation before him. He never used the word 'experiment', but I think he had the sense of himself as that word. Of the original operation, he once said: 'I think they possibly did not make the right movement at the right time.'"

She did not remind Henry of this too often, however, in the same way that it was too painful, after his parents passed away, to have to let him know, as if for the first time, that they were dead. The amnesia was both a prison and a liberation in this sense. His operation had given Henry by default the kind of concentration on the present to which Buddhist meditation might aspire. "He was never sad or depressed," Corkin says, "though I don't think any of us would want to change places with Henry. He had a tragic life and he made the best of it. He showed the world you could be saddled with a tremendous handicap and still make an enormous contribution to life. I found his resilience inspirational."

In all their meetings Henry betrayed only the most fleeting traces of recognition of Corkin. For all of her objective rigour, it seems she clung to those intimations of connection. "If I said my name was 'Suzanne', he would say 'Corkin'," she explains, "but he didn't really know who I was. If I said: 'What do I do?', he would say 'doctoress', which was a name he used only for me, so that was heartwarming." It helped that they had grown up in the same places. Corkin did one test with him where she intermingled his family photos with her own. In one of Corkin's pictures of her mother holding her sister, Henry recognised the park in which they stood.

It is gratifying to Corkin to know that the public memory of Henry Molaison will long outlive them both. His unique brain will continue to be studied for years to come. Of all the hundreds of things she learned from Henry, I wonder, what are the images of him that come first to the top of her own mind in that curious process of remembering?

She offers three, all pointedly emotional. In the first, during an interview, Henry had gone to the bathroom with a nurse and when he returned she gave him her usual question: have we spoken before, Henry? On this occasion, for whatever reason, he said: "Yes, we were speaking just now." Her second memory is of the last time she saw him, when he was demented and uncomprehending; she stood by him and said who she was, and she had a sense that he turned toward her with a trace of a smile.

The final memory is the oddest of all. "It is when we put his brain on a plane to San Diego," she says. "It was strapped into a seat of its own. I watched the plane take off on its trip across the country and I had this swelling of emotion, remembering Henry and his plane ride. It was the perfect goodbye."

• This article was amended on 16 July 2013. The original referred to Molaison's brain having been sliced into 4,201 fine sections. That should have been 2,401 sections, and has been corrected.