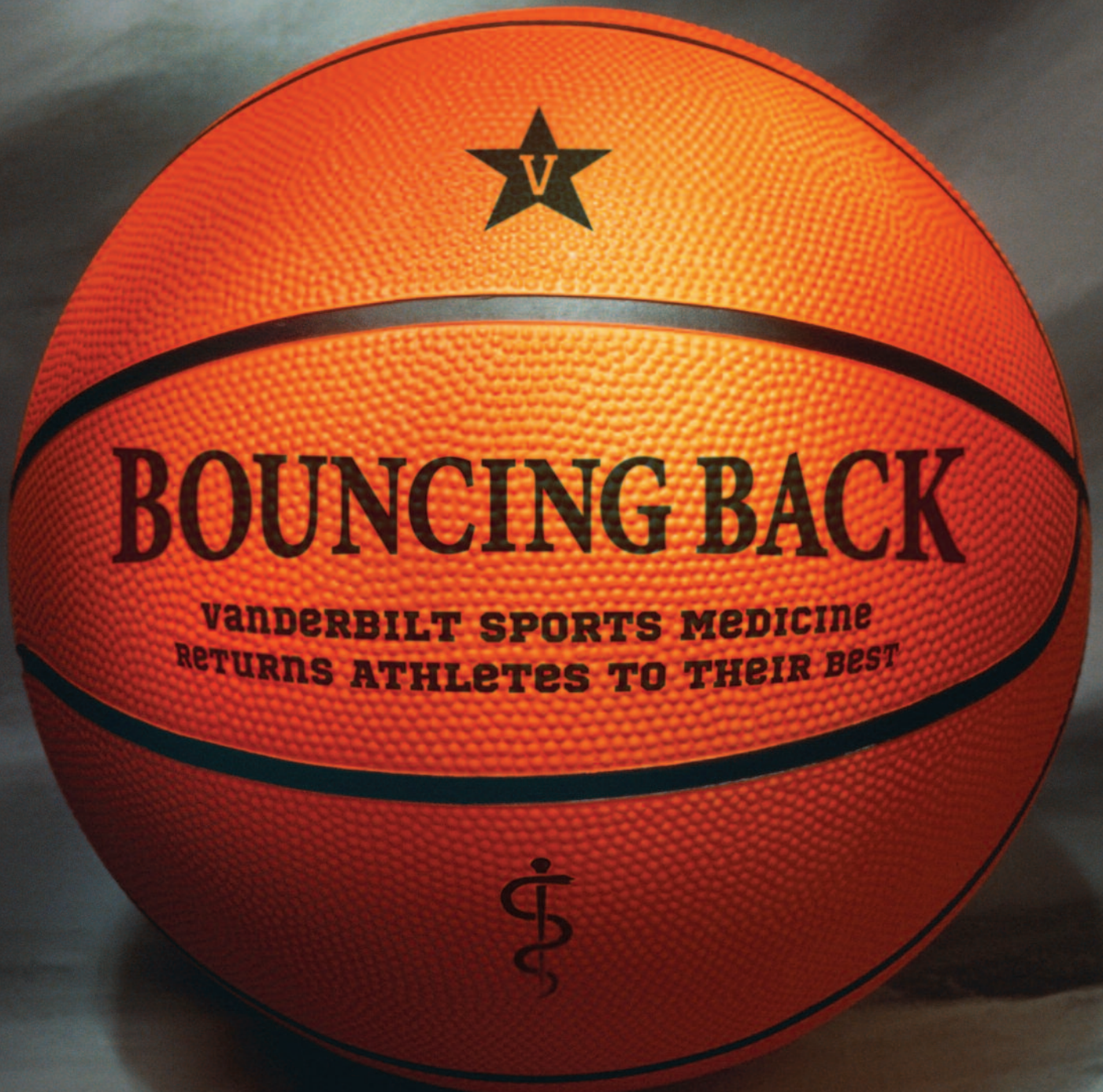


Vanderbilt**Medicine**

SUMMER 2012





H.K. Derryberry and his grandmother, Pearl

The Amazing Life

and memory

of H.K. Derryberry

In the summer of 1990, Mary* was 19 years old, six months pregnant, sitting on a cooler of beer, watching her boyfriend and his friends cut hay in Maury County, Tenn. When they left the fields after the sun went down, her boyfriend was driving with the radio up loud. Mary said something, and as he turned to hear her better, he lost control of the vehicle. It spun and went backward down an embankment, buckling against a tree and tossing Mary out the open window.

WRITTEN BY **LESLIE HILL**
PHOTOGRAPH BY **DANIEL DUBOIS**

**Editor's note: Mary's last name has been omitted at the request of her family.*

She

was flown to Vanderbilt with massive head injuries and would not survive. The boyfriend had only minor injuries and joined their mothers in the waiting room as a doctor posed this question: “Do you want us to take the baby or let him go with her?”

The boyfriend and his mother, Pearl, had no say in the matter, but Mary’s mother said, “Take him. Salvage what you can,” and Pearl says she is forever grateful for that decision to save the life of her grandson, H.K. Derryberry. The little boy was given his father and mother’s middle initials, shortened to H.K.

But there were no guarantees for a baby born at 27 weeks and weighing just over 2 pounds in 1990. H.K. was in the neonatal intensive care unit for 96 days. A severe brain hemorrhage likely caused his cerebral palsy, and the prematurity kept his retinas from forming, resulting in congenital blindness.

“I made a bargain with God in the NICU. I said you save him and I’ll spend the rest of my life trying to make his life better,” Pearl said, a promise she has kept, becoming H.K.’s primary caretaker and advocate, a father, mother and grandmother in one.

Born with a Gift

What happened to H.K.’s brain as he fought for survival left him with deficits but may also have bestowed an amazing gift: perfect memory of everything that has ever happened to him. Especially amazing

considering there is so much in his life most of us would want to forget.

Now 22, he can remember that time he ate spinach alfredo before watching *Star Search* on March 19, 2003.

That it was 70 degrees when he won second place in the 60-meter dash during the Junior Blind Olympics on Oct. 13, 1999.

That episode of *Everybody Loves Raymond*, when Ray and Debra went golfing together and got in a big fight, that he watched after having physical therapy on Sept. 22, 2003.

That Dec. 26, 2004, was not only the date of the devastating Indian Ocean

tsunami but also the day Vanderbilt football player Kwane Doster was killed. Oh, and in 2006, that was the same day Gerald Ford died.

He knows the date of every blood donation he made since turning 18, proven by pulling out his Red Cross donor card with the perfectly correct dates entered in little squares on the back.

His single grandmother raised him as his alcoholic father drifted in and out of his life. He was held back in school, after the intelligence of a blind boy with braces on his legs and a stunted right arm was questioned. He spent many weekends sitting at a table at Mrs. Winner’s Chicken & Biscuits, quietly listening to talk radio or gospel, as his grandmother worked the register.

Then two men entered his life – first a local businessman, then a budding memory researcher – and both believe H.K. has a lot to teach us.

An Unlikely Friendship

It’s a day Jim Bradford remembers as “sometime in the fall in probably 1999.” H.K. remembers that day as “Saturday, Oct. 16, 1999. It was 55 degrees that day.”

It’s the day Bradford had finished up his usual tennis game and was headed for a cup of coffee at the Brentwood, Tenn., Starbucks but veered into Mrs. Winner’s Chicken & Biscuits instead. Inside, the only person was a 9-year-old, 53-pound boy with an overgrown haircut and missing baby teeth. He asked a cashier about the boy and was told, “That’s H.K. He’s our sweetheart.”

Bradford thinks he probably offended the cashier with the look on his face when he was told H.K. sits there while his grandmother works, but “I was thinking my kids couldn’t have sat still like that for 10 minutes. It touched me. I had never reached out to people with disabilities before, but my eyes teared up and my chin quivered a little and I walked over and introduced myself,” Bradford said.

At age 9, H.K. couldn’t really carry on a full conversation and just asked question

H.K. at age 11





Nashville businessman Jim Bradford has been a friend and mentor to H.K. Derryberry for the past 13 years since he noticed the young boy sitting alone at a table at Mrs. Winner's Chicken and Biscuits.

after question. Bradford answered a few and then got out quick.

"I didn't want to answer all those questions, but all week I thought about him sitting there in that restaurant. I went back the next Saturday and he started up with the same sequence of questions."

Bradford, an executive at Unifirst with a wife and two grown daughters, started going to Mrs. Winner's every weekend he was in town to spend an hour with H.K. Eventually he asked Pearl if she trusted him enough to take H.K. someplace, and they went to run a few errands.

Today H.K. spends almost every weekend at the Bradford residence, and the pair hold court at Chick-fil-A at 6 p.m. every Thursday night. When they walk in, it's like a celebrity has entered the building. All the cashiers wave and call out greetings; the manager, who gave H.K. 52 coupons for Christmas – one for every week in 2012 – comes out to say hello. People know H.K. will be there and come just to eat with him. H.K. is unforgettable and he certainly remembers all of them.

When H.K. meets new people, he always asks their birthday and tells them on which day of the week they were born. iPhones are pulled out to confirm, and a smile of amazement forms on their faces.

"In a typical weekend, he tells me 12 or 14 things that happened in the past," Bradford said. "I stopped looking it up because he's always right."

Pearl says Bradford is the father and grandfather H.K. never had. H.K. calls him his mentor and always addresses him as "Mr. Bradford." They act like an old-fashioned comedy duo, Bradford setting up the joke and H.K. delivering the punch line, often accompanied by an excited giggle.

"One time we were looking for something in the grocery store, going up and down the aisles with the basket. And H.K. said..."

When H.K. meets new people, he always asks their birthday and tells them on which day of the week they were born. iPhones are pulled out to confirm, and a smile of amazement forms on their faces.

Right on cue H.K. comes in: "This is the blind leading the blind!"

"My wife and I are empty-nesters, and we include H.K. in 90 percent of everything we do," Bradford said. "He's a kid you just can't help but love. We have a special relationship that's wonderful for me. I've seen him develop in skills and have been able to introduce him to folks, and he's allowed me to do a lot of things."

They've sat in the private boxes at Tennessee Titans games and on Alan Jackson's tour bus. He has taken the controls of a friend's private plane, and sat in the chair of Nashville's mayor, Karl Dean. One year, H.K. got 590 birthday cards and they had to put a bucket on the front porch for the mailman's delivery.

H.K. graduated in June with his high school diploma from Tennessee School for the Blind. He plans to take some online courses through Hadley School for the Blind, but his dream is to be a motivational speaker. Bradford has already arranged some engagements for H.K. with the Rotary Club and at local schools, and they are working up a routine together. The theme is overcoming the odds and staying positive, two lessons H.K. knows better than anyone.

"I want people to know how important it is to have a positive attitude. When things don't work out, it can really get you down, but you have to stay positive," he said.

Studying H.K.'s Brain

Much of what we know about the brain today has come from exceptional cases. There's Phineas Gage, the 1850s railroad worker who survived a metal rod through the brain, his resulting change in personality giving doctors the idea that different parts of the brain had different functions.

Then there's H.M., or Henry Molaison, the most-cited case in all medical literature. In the 1950s, parts of his brain, the hippocampus and amygdala, were removed in an attempt to curb severe epileptic seizures. That part was successful, but H.M. lost the ability to create new memories, pointing to the hippocampus and amygdala as important structures for memory.

Pearl says H.K.'s memory was apparent from an early age. On their frequent trips to the doctor, he could recite his answers to medical history questions from age 5. Despite his blindness, he knew exactly where he was along the drive from their East Nashville home to Tennessee School for the Blind.

Then in 2001, when H.K. was 11 years old, Pearl heard him talking to himself in the other room: "In 1996, I had heel cord surgery and it was Valentine's Day," he said. Pearl got out her calendar to confirm the date. She asked about other

dates, what day Christmas was on, when they went on that picnic, and he was right every single time.

Now Pearl jokes that H.K. is her external hard drive. Her friends will call to ask H.K. what channel ESPN is because it's faster than scrolling through the guide, or to help them remember their own medical history before surgery.

H.K. doesn't mind being their "date machine." He loves to remember. When he's thinking of a particularly juicy memory, his muscles will tense, his head will start to bob and weave, a big grin will break out on his face and his voice will get fast and excited. He gets to experience being right back in that wonderful time.

"I think about all the good stuff," he said. "I remember the negative but I don't dwell on it because it's history."

It was H.K.'s medical history that helped confirm his hyperthymesia, a condition of exceptional autobiographical memory, meaning memories that have personal relevance.

His longtime neurologist Tom Davis, M.D., professor of Neurology, said H.K. could recite his whole medical record from an early age, including which providers he had seen on which day and what his weight and blood pressure were at all his visits.

"He wasn't doing it to show off, it was just in casual conversation. When he was young, I think he thought everyone had this ability. Can't everybody remember every single thing they've done? But as he got older, he realized how unusual it was. Plus, I had a long, detailed record of his life right in front of me. I could actually check it and knew he wasn't just making it up," Davis said.

Davis approached H.K. about participating in research, which he eagerly agreed to, and introduced him to Brandon Ally, Ph.D., assistant professor of Neurology, Psychiatry and Psychology at Vanderbilt University Medical Center.

Then Ally, along with his co-author and lab manager Erin Hussey, gathered H.K.'s entire medical record, which was on paper prior to 1996. They learned

about his neurological deficits but also culled factual details on which to test H.K.

The research revealed that H.K. has a normal IQ of 97 but confirmed his exceptional autobiographical memory. From age 11, his accuracy of recollection jumps to 90 percent and is near perfect from then on. Then, using structural MRI imaging to look at H.K.'s brain, Ally and collaborator Manus Donahue, Ph.D., from the Vanderbilt University Institute of Imaging Science, discovered two factors that may explain why he is so much better at reconstructing his memories than the rest of us — an amygdala four times bigger than normal with connections to the hippocampus 10 times greater than normal. (These are the same brain structures removed in the seminal case of H.M.)

"These previous case studies were about removing parts of the brain and seeing what fails," said Ally, who has been researching H.K.'s memory for nearly two years. "H.K. gives us the other side of that, somebody with a super ability."

The amygdala is about the size of an almond and sits at the base of the hippocampus, deep in the brain's temporal lobe. It is thought of as our emotion center — overstimulate the amygdala in monkeys and get a fearful or manic response. The hippocampus is the primary brain structure responsible for making memories. It takes all the information in a situation — sights, sounds, smells — binds them together and tags them for future retrieval.

In H.K., it seems that his exceptionally large amygdala is charging every personal experience with self-relevance and emotion, turning everyday occurrences like eating lunch and watching TV into seminal life events.

Changing the Way we Think about Memory

"If I gave him a list of 10 words to remember and asked him about them 20 minutes from now or if I asked him who was the 20th president of the U.S., his memory for this type of information would

Brandon Ally, Ph.D., said studying H.K.'s autobiographical memory and brain is a "once-in-a-career" experience.



DANIEL DUBOIS

Although it is hard to apply lessons learned in an exceptional case like H.K.'s to the general population, Ally says H.K. has the potential to change the way scientists think about autobiographical memory.

be no different from yours or mine. That's episodic and semantic memory. But if I asked him what he had for dinner or what he watched on television three months ago to the day or how he was feeling on a particular day, he could remember exactly. That's autobiographical memory," Ally said.

Given the date March 19, 2003, H.K. doesn't have the perfect ability for semantic memory, able to look up that date like an encyclopedia and know it was the day the U.S. invaded Iraq. Instead he starts reliving the day in his memory just as it happened. He first recalls what he watched on TV, and then will remember that President Bush broke in to announce the invasion of Iraq.

"One of the things we've spent years confirming is that the brain does not work like a tape recorder and a memory cannot just be recorded or cued up," Ally said. "A memory is reconstructed from separate pieces of information that we might have encoded. For the most part our memory is not totally accurate because we're constantly reshaping and reconstructing."

For H.K., however, reconstructing a memory isn't difficult and his accuracy is nearly infallible for memories after age 11. He says going back in his memory is effortless. It just happens. Dates come without any sort of calculation. He's right back there, living the memory exactly as it happened the first time.

"Most of us remember things as a third-party observer, hovering above the scene. But we have a few flash-bulb memories of really important things – our wedding day, what we were doing on Sept. 11 – that are seen through first person. For H.K., 80 percent to 90 percent of his autobiographical memories are first person. He's always right back in it," Ally said.

Ally's research of H.K. was published in the journal *Neurocase* in April, the same journal that published the first known case of hyperthymesia in a woman named Jill Price in 2006. Price has said she is haunted by her gift because she can remember all the negative events in her life and dwells on disappointments and embarrassments. After the condition was named, more people were identified, including *Taxi* actress Marilu Henner, and there are believed to be about 20 cases worldwide. H.K. is only the second case to be presented in scientific literature and the first to have structural imaging to examine the brain.

Ally came to Vanderbilt in 2010 with no idea that an individual with perfect autobiographical memory lived just a few miles from campus. "Given that there's only a handful of these folks in the world, it's a once-in-a-career thing for sure," he said.

Although it is hard to apply lessons learned in an exceptional case like H.K.'s to the general population, Ally says the young man has the potential to change the way scientists think about autobiographical memory.

"If you look at the literature criteria, one of the hallmark components of autobiographical memory is visual imagery because you have to mentally time travel back to the event, and for most of us that happens through the visual domain. Our MRI work showed that H.K.'s occipital lobes [brain region involved in vision] are very active and well connected to other brain regions. So a next step would be to figure out what role his occipital lobes play in all of this," Ally said.

He hopes to recruit a cohort of individuals who were born blind like H.K. for a functional imaging study.

This research also has implications for Alzheimer's disease because one of the



H.K. graduated from the Tennessee School for the Blind in June.

first things to go is autobiographical memory. Ally wonders if H.K. could point to potential brain targets for deep brain stimulation or pharmacotherapy.

"While the role of this drastically increased amygdala size and increased hippocampus connectivity in his memory ability is not definitive – we can't say with certainty this is why he has perfect memory – it certainly makes sense and provides the starting point of us understanding what might be contributing to this," Ally said.

"We have to try to gain as much data and insight from people like H.K. as we can. He's a special case, but it takes these once-in-a-career cases to get new insight into how the brain works." **VM**

WEB LINK

Brandon Ally, Ph.D., discusses H.K.'s autobiographical memory and its implications for the rest of us. To view the video, please visit mc.vanderbilt.edu/vanderbiltmedicine.