Exploring Your Brain With Garrick Utley: The Broken Brain

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Garrick Utley: The fragile dwelling place of the soul … that's what the brain has been called. Fragile, indeed. More than two million Americans sustain brain injuries every year from falls, competitive sports, car crashes and gun shots. More than 50,000 die. And for many survivors life is never the same again.

Scientists are now taking up the challenge of trying to heal the broken brain. Head injuries can happen to anyone, but thrill seekers like Randall Chesnut are most at risk. He's always loved extreme sports, skiing, rock climbing, and, above all, mountain biking.

Dr. Randall Chesnut: When you're screaming downhill on a bumpy, muddy course, it's hard to let the daily troubles of the world stay in your mind.

Garrick Utley: It's young adults who sustain brain injuries most frequently. They drive too fast, play too hard, take too many risks.

Dr. Randall Chesnut: I'm not sure it's the risk that's the appeal of sports that some people would call extreme; I think it's the challenge.

Garrick Utley: But when we met Chesnut at this hospital in Portland, Oregon, it wasn't because he'd injured his head (though he did break his neck once while rock climbing); it's because Dr. Chesnut is Director of Neurotrauma here and one of the top neurosurgeons in the country.

Dr. Randall Chesnut: Traumatic brain injury is the leading cause of death in patients between 15 and 45, in the most productive years of their lives.

Garrick Utley: For those who survive, a brain injury can undermine everything that makes us human – our ability to think, to learn, to remember, and to relate to the people we love.

Dr. Randall Chesnut: Trauma is something that happens to people who don't deserve it. It comes out of the blue. They took off that day to drive across town, go climbing, go riding, and in a micro-second, out of the blue comes a trauma that changes their life forever.

Garrick Utley: He looks at first like any other Dad teaching his three-year-old son how to skate.

Pat LaFontaine: Il right, you have to skate over to Daddy.

Garrick Utley: But this father in Greenwich, Connecticut, knows his way around the ice.

Pat LaFontaine: Good job. All right, here we go.

Garrick Utley: It's Pat LaFontaine, who might be the best American-born hockey player ever. He played 14 years in the NHL and scored 468 goals. He'd still be playing now except for one problem. During his career Pat sustained at least six concussions.

Pat LaFontaine: You play with injuries, you play sick. It's kind of a ritual of a hockey player that you don't complain. You know, you're there and play and overcome the adversity and the injuries and just push through it.

Garrick Utley: But then came a concussion that even Pat couldn't ignore.

Pat LaFontaine: I remember trying to make a drop pass to one of my teammates who was cutting behind me and just at the last second I looked up and that was it. It wasn't til later that I — we found out that the player who hit me was 6'6", 235, and the only part of my body that was hit was my head.

And I had lost my helmet and my forehead had slapped off the ice.

Garrick Utley: Sports are a major cause of brain injury from youth leagues up to the pros. Studies show that every year seven to 10% of all football players sustain a concussion. Most of us think a concussion means being knocked unconscious, but neurologists define it much more broadly as any change in mental status resulting from trauma.

James Kelly is a nationally-recognized neurologist who has helped Pat LaFontaine and many other athletes.

Dr. James Kelly: The players commonly will withhold information about the symptoms they're having in order to get back at it. I even know of one young high school football player who died after having told a teammate don't tell the coach that I have a headache and I feel like I'm gonna throw up. And in the second half of that football game he died.

Garrick Utley: After his concussion, LaFontaine tried to soldier on. He played six more games, but his symptoms soon got worse.

Pat LaFontaine: I couldn't sleep, I started getting headaches —migraine headaches and I became very symptomatic. I was wiped out physically, I was emotionally depressed and … a total personality change.

Garrick Utley: How was this being manifested, felt in the family?

Pat LaFontaine: At one point I was reading a story to my daughters and had trouble focusing in on the words, and then skipping over words and then having to look at my daughters and say Daddy — Daddy's just gonna have to read this story another time.

Garrick Utley: Over the next six months his symptoms receded, and Pat yearned to play again. Doctor Kelly told him bluntly of the risks, but then he cleared Pat to play.

Dr. James Kelly: When I examined him in some detail, I couldn't find anything I was worried about. And as a physician, those are the individuals that I can say honestly to, "I think it's okay to go back, but you understand you run a statistical risk of this coming back and maybe even being worse even with a relatively lesser force."

And then it's up to the individual.

Garrick Utley: Pat played 67 more games for the New York Rangers, but then in March 1998 he banged into a teammate and got hurt again. It was a lesser collision this time; Pat wasn't even knocked out, but the effects (headaches and chronic sleep problems) lingered for months. This time Dr. Kelly told Pat it was time to quit.

Dr. James Kelly: One additional concussion could, indeed, tip him over the threshold into a permanent condition of memory deficits and difficulty with concentration and organizing his thinking. And it's just not worth the risk, because it has taken so long for him to recover from relatively mild forces.

And I don't think that his brain can tolerate much more.

Garrick Utley: For professional athletes and for the rest of us, the biggest risk is having repeated concussions based closely together.

Dr. James Kelly: As long as you're gonna be slamming into each other, you're gonna get hurt. We just need to make it so that when people have a concussion, they don't go right back out and play again. You can play for 10 years, have five concussions and do fine. If you play for 10 years and have five concussions in one season, you may never be the same.

Pat LaFontaine: You wanna go on the swing set?

Garrick Utley: Pat feels fine now, but Dr. Kelly says we need to take concussions much more seriously.

Dr. James Kelly: So we are advocating that at least some form of standardized mental status or neuropsychological testing be performed in athletes before their return to play. It's simply not enough to ask them how do you feel and how many fingers …

Garrick Utley: Instead, after every concussion we should be testing the ability to absorb new information. Dr. Kelly asks injured athletes to remember three random objects.

Dr. James Kelly: These athletes commonly are able to tell you who's the mayor, who's the team across the field, what day of the week is today, all those sorts of things, and then look at you as if you are from Mars when you ask them what are those things we pointed to because they could not encode it.

They didn't even remember that you asked them to remember something.

Garrick Utley: If these problems persist, you should be sent not just to the sidelines but to a doctor. But prevention is still the best approach to brain injury.

Dr. Randall Chesnut: I'm not going to advocate that we not do sports with some element of danger; however, those sports should be done as safely as possible. If you're gonna ride a bicycle, wear a helmet. If you're going to ski hard, consider wearing a helmet. Maybe someday if you're gonna drive your automobile, we'll be considering wearing a helmet.

Pat LaFontaine:
Okay, you gotta put your helmet on, though.

Garrick Utley: Helmets and seatbelts are essential, but they're no guarantee. The harder question is should we change our attitude to risk. We asked Dr. Kelly if he'd let his own son play a contact sport given the current level of risk.

Dr. James Kelly: I played football, and I wrestled, and I recognize now how unsafe those activities were that I engaged in. And I simply would not allow my son to be subjected to those risks now.

Garrick Utley: And Pat LaFontaine, whose career was cut short by six concussions, would he let Daniel play professional hockey?

Pat LaFontaine: Well, if he — if he continues to show the love of the game and enjoys it. Seeing him and seeing his face and his competitiveness, I have a feeling he's gonna play sports. And watching the enjoyment he gets out of just skating, he might be out there playing. But if he chooses to play at that

level, I don't think I'll have a problem.

Garrick Utley: In talking about brain injury, doctors focus on prevention because they still don't know how to repair the damage caused by brain injury. That's the challenge for basic researchers like Ronald McKay.

Dr. Ronald McKay: Generally in the adult nervous system the neurons that you have when you're born are the neurons that you're going to have throughout your life. So if you should injure them seriously, then there's no way that you can normally replace them.

Garrick Utley: But recent research suggests that even adults have a reserve of unused cells that might be available to replace damaged or dead cells.

Dr. Ronald McKay: And that's raised some very interesting ideas about how those cells might be activated or how they may be grown in the lab and re — and placed into the nervous system to slowly rebuild the structures of the brain.

Dr. Tracy McIntosh: She's cutting a brain.

Garrick Utley: At the University of Pennsylvania, Tracy McIntosh is looking for new drugs that'll actually repair injured cells. He's also testing a revolutionary form of surgery, taking cells from a healthy brain and transplanting them into the brain of an injured patient.

Dr. Tracy McIntosh: Right now we're working with models of brain injury in experimental animals showing that, in fact, memory and motor function, which is the ability of the animals to be — to coordinate and move, can be significantly improved with these transplants.

In the injured mice we typically see a behavior deficit whereby they cannot successfully traverse this pole. They'll slip; they'll fall off; they have a right-sided neurological deficit.

Garrick Utley: But after transplant surgery the injured mice perform much better. Even optimists like Dr. McIntosh can see that it might take 10 years for basic research to deliver results to human patients. One reason is that no study can easily replicate the real life conditions of brain injury.

Dr. Tracy McIntosh: The patient may be inebriated before trauma; they have their trauma; they laid at curbside for half an hour becoming cold and their blood pressure dropping, bleeding. They have a — not only a head injury but a leg injury, chest injury, belly injury. They are transported in an ambulance that's dark and bouncy.

And all of these other variables have never been seen in a laboratory and they make a huge difference in outcome.

Garrick Utley: Car crashes are the leading cause of brain trauma. These serious injures are hard to treat because the damage spreads throughout the brain. Theresa Rankin knows what that's like.

Theresa Rankin: I had lost everything. I had lost my position at my university, I lost my relationship with my family, and, more important than that, I lost my baseline of being an individual.

Garrick Utley: Theresa's life changed forever in 1977 when she was 21 years old. Her boyfriend Steve was taking her to San Francisco so she could meet his parents for the first time. He was driving a brand new Porsche.

Theresa Rankin: The car just propelled right off the cliff and traveled 75 to 100 feet through the air and then rolled down into the ocean.

Garrick Utley: Steve broke his ribs and punctured his lung, but he recovered in three months. Theresa injured her hip, her jaw, and her brain. She fell into a coma that lasted for three days with drastic consequences.

Dr. Randall Chesnut: The lesion was in the frontal area. She had swelling which probably represented cell injury or cell death. And there were these little white spots suggesting that there's been some injury to the axons.

Garrick Utley: Before the crash Theresa was an honors student and a champion debater, but for years afterward her injured brain betrayed her. She couldn't concentrate, couldn't read, couldn't think clearly.

Theresa Rankin: I couldn't figure out how it was that people stayed in motion, how you figured out what it was that you were going to do next. I was fascinated just with watching people. It was like a mystery how people talked and laughed and knew what to do.

Garrick Utley: For Theresa and for many people with severe brain injuries, the road to recovery begins here in the hospital emergency room.

Nurse: One, two, three.

Dr. Randall Chesnut: There's two injuries that occur when the brain is traumatized. One is the impact itself, the damage to the brain, and the second is what we call "secondary insults".

Garrick Utley: The impact can set off a chemical cascade that can destroy cells throughout the brain.

Dr. Randall Chesnut: And those, when you apply 'em to an injured brain, multiply the damage several-fold. It's not additive; it's one and one equals five.

Garrick Utley: The first hour after an injury is critical. Doctors call it "the golden hour." Thanks to brain imaging, doctors can now identify the damage more quickly and respond more precisely with drugs or with surgery. Many brain injuries cause severe damage to the axons, the millions of vines that send messages from one part of the brain to another.

Dr. John Myseros: All these little vines are packed together very tightly, millions of them, with little blood vessels in them. And if you took a bundle of these vines and just tore it like this, like a shear, just like a scissor, then you'd be looking end-on on a million little holes.

Well, some of those little holes are what are bleeding.

Garrick Utley: Bleeding and bruising cause the brain to swell and that can be dangerous.

Dr. John Myseros: The brain is in a closed space. It's unlike an arm or a leg where if you bruise it, it can swell almost indefinitely. The brain has nowhere to go so it swells and basically presses on itself. And that can cause progressive neurologic injury and it can kill ya.

Garrick Utley: Because controlling pressure is so important, surgeons sometimes insert a probe into the brain to monitor the pressure. In extreme cases Dr. Chestnut will even open a patient's skull just to relieve the pressure. With improvements in critical care, we've gotten better at arresting the damage to the brain. But the next step is often a problem.

Dr. Randall Chesnut: There's a handoff here that needs to be smooth. We need to … As acute caregivers, we need to smoothly hand the patient to the longer term caregivers, the physiatrists, the rehabilitation specialist.

Garrick Utley: For Theresa, as for many patients, that handoff to rehabilitation never happened. She was discharged from the hospital just nine days after the crash.

Dr. Randall Chesnut: When she got to a point where she looked pretty good, they let her go just like they would a broken arm. But the broken brain doesn't heal that fast.

Garrick Utley: Like Pat LaFontaine, Theresa suffered from headaches, depression, and memory loss. But perhaps the worst problem of all was something that doesn't show up on a medical chart.

Dr. Randall Chesnut: What people really complain about when you talk to patients five, six, 10 years out is social isolation. What they really want is friendship, a significant other, etc. And social interactions are so delicate and so multi-faceted that these deficits can take a person who should be fully functional and make 'em into a social isolate.

Garrick Utley: Theresa drifted away from her friends and family and lost her relationship with Steve. For 13 years she wandered around the country in search of help. Theresa finally settled in Washington, D.C., where she met neuropsychologist Celeste Campbell.

Dr. Celeste Campbell: The kinds of difficulties that a person like Theresa has tend to be somewhat invisible. She can walk, she can talk, she can, you know, put ideas together in a conversation, so it's hard to convince people that she's still having difficulty and it's very hard for her to maintain the level of cognitive functioning that she would need to maintain a job.

Garrick Utley: Dr. Campbell has given Theresa the chance to use voice activated software and other special tools, and she has helped Theresa to compensate for some of her cognitive problems.

Dr. Celeste Campbell: A lot of what the rehabilitation process is doing is waking up some of the other pathways in your brain, finding different ways for you to do what you used to do.

Garrick Utley: But what about new paths for treating brain trauma? Theresa participates in a research program funded by the National Institutes of Health. She's being treated with neurotherapy, a kind of EEG or brainwave biofeedback. It's designed to stimulate brain activity and promote more fluid thinking.

Dr. Mary Lee Esty: When Theresa came in, she had very little energy. Her speech was very, very slow, and I felt as if I could hear the gears in her brain working to find the next clump of words.

Dr. Mary Lee Esty: You don't remember your old friends? Here, the glasses. Can you put those on?

Garrick Utley: We don't know yet how neurotherapy works or even if it works reliably. The premise is that when a person's brain is injured, millions of connections are disturbed and the brain slows down.

Dr. Mary Lee Esty: We put a sensor somewhere on the head that's picking up the signal, reading the brain wave signal into the computer, which is studying the activity of the brain wave, and then a signal is sent back to the glasses. So there's a matching between the brain wave of the individual being treated and the feedback that goes in, and the brain likes this rhythmic input.

Garrick Utley: Dr. Esty emphasizes that this treatment is still experimental.

Associate: All the blocks are identical.

Garrick Utley: It'll take much more testing to determine whether neurotherapy is safe and effective, but so far Theresa's gotten much better at solving problems and speaking fluently. These days Theresa devotes most of her time to helping other survivors of brain injury.

Theresa Rankin: This is the library that really serves as my strategy room for all of the work that I'm involved with – the Centers for Disease Control and the National Institutes of Health.

Garrick Utley: It looks an awful lot like a kitchen.

Theresa Rankin: Well, it would be except that I …

Garrick Utley: Theresa still needs a lot of support from employment counseling to psychotherapy. She still can't work full time. But 20 years after the crash, she is slowly creating a new life for herself.

Theresa Rankin: So maybe it's like my brain is no longer pushed up against the boney structures inside my skull, so that looking and listening and walking and having a conversation is no longer bone on bone or rock against rock but more like watching a stream flow.

Dr. James Kelly: What people don't really fully acknowledge is that the brain is truly the organ of the psyche and that the things we think, the things we feel, not just memory and concentration and all those sorts of cognitive functions, but the true core parts of us, who we are, emanates from the brain. And injury to the brain changes who we are.

Garrick Utley: If the brain is who we are, we're now learning a lot about ourselves and with remarkable speed. Thanks to brain imaging, gene mapping, and other dramatic advances, we're beginning to learn how the brain works, why it breaks down, and how we can heal it. The brain remains the ultimate mystery. But brain research is revealing some of its most compelling secrets and offering hope to people in need. I'm Garrick Utley.