

Neuropathology with Dr. Mary Alexis Iaccarino

Ologies Podcast

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Oh heeey, hi. It's your brother-in-law who weighs his coffee beans, but in a cool way, Alie Ward. I'm back with a foggy, and groggy, and super timely episode that I never knew so many of us needed. So, we're knockin' noggins this week. Neuropathology. Yes, I did phone up an expert on concussions.

But this is a podcast; it's not an appointment with your doctor, so of course nothing here is intended to diagnose or treat my (or your) head injury. I'm just putting that up top because, as a person with a very recent head trauma, I know that things can get a little soupy. But as I learned this week, over half of folks have sustained at least one concussion in their lives, so chances are your brains are curious about this, or someone you know or love has goose-egged their way into Concussiontown.

Thank you to everyone who has been concerned, and sent really sweet messages, and looked at my pictures of me in an ambulance and the ER. Thank you also to patrons for sending in great questions on short notice for this episode. You too can join for as little as a buck a month. It's at Patreon.com/Ologies. But for free you can also help out the show just by telling friends, and tweeting, and 'gramming. You can leave a review, which I have read all of them, including this fresh one from an angel named AngryUndies, who wrote that *Ologies* is like a warm hug for your brain. (Timely) We love you, Angry Undies, a bunch.

Speaking of brain embraces, Neuropathology, we're going to get into it. It's the study of diseases of the nervous system, and neuro or neuron are those long stringy cells that relay our brainy messages via chemicals and zip-zaps of energy. That word, neuron, comes from the Greek for sinew, cord, or penis. What? Yes. According to Ancient Greek scholars, your brain is just a tangled clod of electric disco dicks. And 'pathology' derives from the Greek for passion; passion gets its root from suffering.

I'm going to go into detail about my recent head trauma and why I asked for recommendations for experts on this later in the episode, but we were really lucky that she made room in her schedule to record this, like, two days ago, even though I was five minutes late. This ologist went to medical school at Georgetown, she did her residency in physical medicine and rehabilitation at Harvard Medical School and at Spalding Rehabilitation Hospital, where she was chief resident. She also works with nonprofits to assist veterans who are suffering from mild traumatic brain injuries. She is the attending physician in the Massachusetts General Hospital for their children's youth concussion program. She's on boards to help identify risks in contact sports and is an instructor in the Department of Physical Medicine and Rehabilitation at Harvard Medical School. What a feast for brains!

But wait, there's more. I also talked to Dr. Headbutt, and in a bonus mini-episode out this week we're going to take a brief look at concussions in the animal world. That is coming out later this week, but right now, affix your head protection and gear up for a chat about everything from brain bruises, to after-school rugby, falling off horses, headaches, ADHD, seeing stars, comorbidities, video games, solitary confinement, convulsions, the best time to tumble down some stairs, post-concussive syndrome, old romcoms, and more with head trauma specialist, minor traumatic brain injury researcher, and concussion coach, and neuropathologist, Dr. Mary Alexis Iaccarino.

Dr. Mary Iaccarino: My name is Mary Alexis Iaccarino. And I go by Alexis. She/her.

Alie Ward: I didn't plan on this episode at all, *at all*, but you fall down some stairs and then before you know it, you're like, "Who knows something about concussions??!"

Dr. Iaccarino: That's usually how people get in touch with me. Nobody likes coming to my office. But yeah, so I'm sorry to hear that. I did think, "Well, I'll give her an extra ten minutes since she's recovering from a concussion."

Alie: [*laughs*] I know. You know, I haven't had my phone on me much as a clock the last week because I have been ordered off screens, essentially. But here's the deal: what happened was... I'll make this quick. I bounded down the stairs to surprise my sister-in-law. We flew in early and I was like, "I'm here!" And absolutely ate shit on a flight of stairs. But I hit the back of my head pretty hard, and I was like, "Oh no, I just really killed the vibe." And then I was like, "I'm fine. I'm fine." And then I got up and then I passed out. And apparently I started convulsing. They picked me up, I passed out again, and then at that point all of the "Yay you're here" turned into, like, "The ambulance is on its way." [*Such a buzzkill.*"]

So, I have never, to my knowledge, had a concussion before. But what is happening when you get bonked on the noggin like that?

Dr. Iaccarino: Wow. Well, that sounds like you had a pretty significant injury. But you know, concussions, even within themselves, can vary. There can be these very mild hits to the head, and then people might have convulsions, or loss of consciousness, or even amnesia for some time. But essentially, a concussion is the brain shaking within the skull from some force or impact. That can be a direct blow, like I fell and I whacked my head or I got hit with something. But it can also be a shaking motion like if you're in a car accident and you get whiplash; the head shakes back and forth but never actually hits another object.

And the other time we can see it is if somebody's around an explosion, right? Because remember, the brain sits in fluid. It has this Jell-O-like consistency, and it sits in fluid, and there's space there for it to move within the skull. Which is really good because if there's a little swelling or something like that, there's some room for the brain to expand a little. But that also means that it can shake around and hit the sides of the skull. So essentially, when you're talking about concussion, you're talking about some force making the brain shake inside the skull. And it usually doesn't produce your classic bruising or bleeding. It actually is this more microscopic kind of injury or change.

And sometimes you can get changes in some of the electrical activity in the brain which is why you can get a shaking spell right afterwards. So that's something that can happen, but I'll tell you it's pretty rare. Pretty rare but possible.

Aside: Okay, so if you're shopping for a minor traumatic brain injury, there are three flavors of concussions. It's exciting. Grade 1, there's mild, with symptoms like headache, or dizziness, or blurred vision that last less than 15 minutes; there's no passing out.

Grade 2, moderate. Those symptoms I mentioned lasting longer than 15 minutes, still no passing out. Then there's Grade 3, which is severe, in which the person loses consciousness, sometimes for just a few seconds. So, I'm kind of an overachiever and I went for Grade 3, but I don't fully remember it.

I fell down the stairs and I got up a minute later. Then I walked to the kitchen and the next thing I knew I was on the floor again apologizing. And I actually heard my sister-in-law on the phone with 911 saying that I passed out twice, and I was like, "No I didn't..." But honestly, I was the worst eyewitness in the room because I was not conscious... twice. But

I'm told that my limbs seized up and started shaking, and my speech was slurred, and my eyes rolled back.

So, it was scary for everyone. Was this a seizure though? Hm, depends who you ask. But TBI researchers didn't want this post-concussion brain activity to be confused with seizures caused by epilepsy, so the rather musical term 'concussive convulsions' arose to describe those benign impact seizures. And as the medic in the ambulance explained, it's kind of like your brain shutting down and then rebooting.

Also, in the bonus episode about headbutting, we're going to go into exactly what it takes to assess impact damage to neurons. What they're really looking for when you go to the ER is the big stuff, like visibly bleeding traumas in your head rather than the microdamage, which is probably what I got.

Dr. Iaccarino: Yeah, so it's not something we can really see if we were to take, like, a conventional CAT scan of your brain, where we get a picture or an MRI of your brain. We usually wouldn't see anything because it's something happening closer to a cellular level. But nonetheless, it can be quite impairing and can give people a lot of symptoms. It's a tough injury that way because you want to be able to see it, right? If you break a bone, you want to look at the x-ray and see where it's broken. But with concussion, we don't really have that nice, neat picture to show people where injury happened.

Alie: Yeah, I keep wondering, like, is there a spot on the back of my brain where I hit that is, like, a bruised peach? If I could look into my brain, would there be, kind of, some redness there? Or would it really, really be microscopic where you're like, "I can't tell that there's..." Like, busted, oozing cells? I'm trying to get a mental picture so that I take better care of myself.
[laughs]

Dr. Iaccarino: Yeah, it is a hard thing to visualize. And it's hard for a lot of people too because it's not like we put a band-aid on your head or put your head in a cast, right? So, here you are walking around and you look just fine to most people. But you don't feel fine. So, that also can make it kind of a tough injury in that way for a lot of people.

Alie: And from what I understand, a concussion is something that's a clinical diagnosis, right? They can't, like, look at a scan necessarily, but they can say, "Based on what you told me, it sounds like you did have a concussion."

Dr. Iaccarino: Yes. You are exactly right. It is a clinical diagnosis, meaning we hear about the injury, and you have some force that was substantial enough to cause trauma, and then we ask people how they looked and felt right afterwards. We can do some examination testing, like balance testing or cognitive testing where we test things like reaction time, or memory, or attention, and that can show us sometimes that people are not doing well in some areas. But there is no single diagnostic test like a blood test or a scan that we can do to clearly diagnose concussion or to actually say that it's over. People also want to know, "When am I better?"

Alie: Yes!

Dr. Iaccarino: And "Could you also get me a scan or a blood test that says this is gone?" And we actually don't have that either. It's a very gray space.

Alie: Ah ha! In every way.

Dr. Iaccarino: In every way.

Alie: Gray matter space.

Aside: But let's wedge some terminology into our squishy gray matter space.

Alie: Can you explain the difference between a concussion, and an mTBI, and a TBI?

Dr. Iaccarino: I am happy to try to explain that. *[laughs]* But I will tell you that even among scientists there is some debate still between the terms concussion and mTBI. So, for most of us, me included, concussion and an mTBI, the 'm' standing for mild, so a concussion and a mild TBI are the same thing. Not everybody out there would agree with me but most, I think, people in this area of medicine and this space would agree.

Aside: So as you can imagine, there's all kinds of terminology and things change really quickly, and looking it up, I felt like your mom in 2015 googling BDE on Urban Dictionary. But I have also learned that there is a ton of debate with concussions and traumatic brain injuries. Like, so much. There's a ton of shit we do not know. There's also a lot of money at stake, either via industries that involve occupational hazards or through making money on the recovery from them. And some doctors have moved to call athletics head injuries SRCs, sports-related concussions, instead of using the term 'minor traumatic brain injury'.

Others consider a concussion a subset of mTBIs, which are in and of themselves a subset of more serious conditions that may include skull fractures, penriv... penetratiff... penetratrivee... injuries – I'm not going to say that word right but it means getting poked real bad with something – and hematomas, which would be considered TBIs. So, all of those things: under the umbrella of TBIs. It's confusing even if you haven't recently blacked out on a kitchen floor and then passed out being carried to a couch. It's been a wild week, folks. I'm not going to say penetratrive right.

Dr. Iaccarino: Now, TBI is a broader term. Traumatic brain injury encompasses everything from concussion through people who have severe trauma to the brain and are in a coma or have paralysis. So, it encompasses all trauma to the brain; from very mild through very severe. So, within this category of traumatic brain injury, MTBI, or concussion, is the most mild.

Alie: And when should a person get checked out? I feel like since the death of Natasha Richardson, for what seemed like a relatively minor skiing accident...

[news clip: "Richardson suffered a head injury Monday while taking a ski lesson in Canada. She was pronounced dead Wednesday at a hospital in New York."]

... she died two days later. I feel like there's something really innately scary about, as my dad would say, thumping your pumpkin really hard. When is it time to go to urgent care and make sure you don't have, like, a giant hematoma? And when is it just, like, "If you're not passing out you're probably fine"?

Dr. Iaccarino: I think it's good for most people to get checked out. Not everybody will and there are certainly some symptoms that people get that should make them get checked out more than others. For example, if you have a shaking spell or a seizure, you absolutely need to get checked out. If you've been unconscious for any period of time, you definitely should get checked out. If you have other trauma, like if you got hit hard enough or you have a big enough accident that you broke other stuff, you probably should get checked out.

If you're somebody who's prone to bleeding, sometimes older folks who are on blood thinners, those people definitely need to get checked out. And then if you're somebody who's thinking about going back to do something where you're going to whack your head

again, [clip from *Tommy Boy*: “Son of a... That’s going to leave a mark!”] you definitely should get checked out.

But really, anybody who thinks they’ve experienced any head trauma, whether... You know, you can’t say with certainty it’s just a concussion or it’s something else, like in the case of Natasha Richardson. So, it’s very reasonable to go get checked out. Most people should feel comfortable doing that. It’s not an overreaction to go and get checked out and make sure that this is really just a concussion versus something like an epidural hematoma, or a skull fracture, or something else that is going to require more monitoring or potentially a surgical intervention.

Aside: Okay, so now we understand that within TBIs there are mTBIs, and within mTBIs there are concussions, and then within concussions there are SRCs (sports-related concussions). And I promised myself when we started this that this episode would be easy, but researching it was actually... it felt like carving a set of Russian nesting dolls out of my own skull bones and then painting it with other people’s flame wars about concussion severities and subsets. But let’s take a more objective approach.

There is the industry standard medical quiz. It’s called the Glasgow Coma Scale, and it goes from a 15 down to a 3. 15 is doing just fine, walking away from it unscathed. And 3 is literally dead. So, I guess there’s 2, which must be just a frustrated ghost, and maybe 1 is a poltergeist that hides your keys and shakes its junk at you. I’m not sure. But yeah, 15 to 3, Glasgow Coma Scale, or GCS for TBI.

Now, one term you may also hear is CTE, which is chronic traumatic encephalopathy, which arises from repeated trauma to the head. And according to last year’s Second National Institution on Neurological Disorders and Stroke and the National Institution of Biomedical Imaging and Bioengineering Consensus Meeting to Define Neuropathological Criteria for the Diagnosis of Chronic Traumatic Encephalopathy, leading researchers there associate CTE with symptoms including aggression, depression, suicidal ideation, tendency towards substance abuse, dementia, some motor challenges, even Parkinson’s disease, cognitive challenges, and financial impulsivity and more.

But before any armchair quarterbacks start becoming armchair neuropathologists, it is imperative to know that CTE can only be diagnosed with an autopsy, or, from 3 to 1 on the Glasgow Coma Scale. So yes, you must be dead to be diagnosed. At least for now.

And the film *Concussion* with Will Smith is a biopic of Dr. Bennet Omalu, who is a forensic pathologist who’s made strides in CTE recognition. But not all researchers agree with all of his work. Again, lots of debate in this field. And there’s Boston University’s Dr. Ann McKee, she’s also a leading researcher in this, and her website has scans of the tau proteins, is what they’re called, that appear in individuals with CTE. She writes:

CTE has been found in athletes, military veterans, victims of domestic violence, and others who experienced multiple falls or injuries. CTE has been known to affect boxers since the 1920s (it was initially termed punch-drunk syndrome or dementia pugilistica), but more recently has been found in players of American football, ice hockey, rugby, soccer, MMA, professional wrestling, and other contact sports.

We’ll have more on the diagnosis postmortem in the bonus episode on headbutting coming out this week. What a treat.

But back to concussions and getting those diagnosed when you’re just a regular ol’ alive person.

Alie: I wonder if, depending on the healthcare system your country has, if more people get checked out for concussions somewhere with universal healthcare versus, you know, like, “I bonked my head but if I call an ambulance that’s like two grand.” I wonder if there’s a reluctance in certain, like, cultures or systems to get checked out for things.

As soon as my sister-in-law called 911, I was like, “Good idea. I am having a little bit of convulsions and a seizure. But also, like... It’s going to be so expensive.” [laughs]

Dr. Iaccarino: Yeah, I mean that’s something that a lot of people have to grapple with. “Am I really going to go get checked out about something that’s seemingly mild?” And I think... You know, certainly for some of the things we just discussed, those things are potentially signs that you’ve had something worse than a concussion and you probably need a scan or something bad could get missed.

For folks who don’t have any really concerning features at all, they might do okay just going to the urgent care by car, as opposed to the ambulance ride; that might be a little bit more economical. But yeah, it’s certainly... the ability to access healthcare for a lot of people, it can make my recommendations about getting checked out more difficult for sure.

Aside: PS: 100% the right thing to do. I was knocked off my rocker so hardcore, and I had this weird combo of, like, foggy reasoning plus a big helping of, “I wonder what my yearly deductible is for a ride in the wee-ooh-wee-ooh-mobile.” But given that TBIs account for, I now know, 30% of the accident deaths in the US every year, fully, no-contest warranted and worth it to be in a neck brace and get a brain scan.

But I’m probably not alone here, so instead of making this easy, I decided to dig up a bunch of research. I found a 2019 Centers for Disease Control morbidity and mortality weekly report called “Traumatic Brain Injury–Related Deaths by Race/Ethnicity, Sex, Intent, and Mechanism of Injury — United States, 2000–2017.” Plus, a more recent CDC article on brain injury trends that said that over the last two decades, TBI contributed to the death of over a million people, and in that period, over 400,000 US service members were diagnosed with TBI. And other research suggests that 46% of people in correctional facilities have a history of TBI. Folks who experience homelessness are up to four times more likely to have had a TBI and up to ten times more likely to have had a moderate or severe one like I had.

Survivors of intimate partner violence who sustain traumatic brain injuries also have worse prognoses, and anyone with lower incomes or without health insurance, at least in the US, has far less access to TBI care. Country folks, also, if you live in a rural area, the chance of a fatal TBI is higher as specialized medical care can be farther away, harder to get to quickly. And the CDC report continued on that Indigenous folks have higher rates of TBI hospitalization and death than other groups. People of color, less likely to receive follow-up care and rehabilitation following a TBI compared to their white emergency room neighbors.

So who is granted quality and sufficient care is huge, as are increased risk factors and resources to cover the bill. And what kind of bill are we talking, in the US? According to the 2019 study, “In-hospital costs after severe traumatic brain injury: A systematic review and quality assessment,” in-hospital costs per patient were generally pretty high and ranged from \$2,000 to \$400,000, which is *so many dollars*. So, I have health insurance and, luckily, like six jobs right now. And after passing out twice with convulsions before the horror-stricken faces of my loved ones this week, the thing I thought about the most lying on a

gurney in the hallway of a crowded ER in isolation a day before Christmas on the East Coast during an omicron surge... The thing on my mind the most? The expense. And I have it the easiest.

So what about Dr. Iaccarino? Has she ever been on the other side of the gurney?

Alie: Have you ever had a concussion?

Dr. Iaccarino: Yes, I have had a concussion. Mm-hmm. At the time, I was a kid and I don't think anybody really recognized it for what it was, but now that I live, breathe, and work in this space all the time I can absolutely say that I... I fell off a horse, I hit my head. I was helmeted, luckily, but I was nauseous, I threw up afterwards. I don't really remember, you know, the next couple of hours so well. So, I feel like I can say with certainty that I've had a concussion myself.

Alie: Yeah, you're like, "I can clinically diagnose myself from the future." Did you have any lasting effects from it?

Dr. Iaccarino: I don't think so, no. And again, I was a kid, and at that time we weren't looking so closely like we do now about concussions in sports. So, I don't think that I had any lasting effects, no.

Alie: How do you trace your path to becoming a doctor at Harvard who is working on this?

Dr. Iaccarino: Yeah, absolutely. So, my specialty of medicine is called physiatry.

Alie: Hm! [*"Come again?"*]

Dr. Iaccarino: I don't know if that's something you've ever heard of; a lot of people haven't. My own family sometimes thinks I'm a podiatrist and I'm like, "Nope. Not feet. *Brains.*" So, a physiatrist is someone who specializes in recovery from injury, so that could be a knee injury, or it could be something like a brain injury, or stroke, or a spine injury. It really runs the gamut.

I was super interested in neurorehabilitation, or rehabbing the brain and spinal cord after injury, and I'm a huge sports person. So, I struggled between going into sports medicine and going into neurorehabilitation. And this is where I, kind of, found my happy place, if that's even possible to have a happy place in concussion. But I work with a lot of young people, I work with a lot of athletes, I work with a lot of young military service members, so a high-functioning group of people who've had this neurological disturbance and now are trying to recover.

Aside: And Dr. Iaccarino was herself a patient of rehab. She also suffered a spine injury as a teenager and was steered toward this work helping others recover, which is amazing.

Now, if you're listening to all this and you're like, "You know what? I'm going to sell my rollerblades to my cousin and I'm going to keep up my holiday lights until next year because I'm staying off the roof," let's talk about how people wind up with a minor TBI.

Studies show that 50% of us have had a traumatic brain injury in our lifetimes. Dudes, bad news, you're twice as likely to be hospitalized, three times more likely to die. Overall, 30-50 million of us out in the world will knock our noggins pretty hard this year. So, hello, welcome to my club. Enjoy the sweatpants.

Now, according to the National Center for Injury Prevention and Control, the most common causes are: falls, that's the most popular one, been there done that, don't recommend; then motor vehicle accidents; getting struck by objects including sporty things; then there's

violence, assault, and intentional self-harm, which has the highest mortality rate. But yes, for most of us, it's just not paying full attention to safety or physics being an asshole.

Dr. Iaccarino: Lots of people have concussions. They fall down the stairs, they get in a car accident, they have an injury at work. So, it's pretty common in a lot of people, and many people have probably had a concussion and, you know, they didn't have a seizure, or they didn't feel so bad, and they never saw a doctor, and within a few days they were kind of back to their usual self. So, the reporting on concussion is probably lower than the number of concussions that actually happen.

I think one of the reasons there's a big focus on people in sports and the military is because these are areas where people are at high risk of getting concussions and potentially more concussions; they're doing things that put them at risk of a head injury on a pretty regular basis. So that's probably why there's a lot of focus on those groups.

Alie: What does recovery entail? If you are in physiatry, which is a word I now know, when you are treating someone who has had a concussion or multiple, first line of defense... is it, like, "Get off your iPad, you don't need to be scrolling social media now"? Or is it cognitive puzzles? I was told to stay off screens and literally not to think too much, like not to play Scrabble or anything. And I'm not sure how long people have to be wary of that. What's your plan for people?

Dr. Iaccarino: Yeah, so it's really interesting because the field of neuro recovery and concussion recovery, it has really changed in the last 10, 15 years. So, we used to tell people to rest; and not just, like, hang out on the couch, but go in a dark room and... pretty much sensory deprivation. Don't look at anything bright, don't turn on the lights. [*"Please just leave me alone."*] Don't listen to anything loud. And what we found is actually people didn't get all that much better doing that, and we didn't really have any good science to say why people should do that. It just seemed like kind of the thing to do.

And now we've really moved much more to a more, sort of, modern approach, which is that we don't think people need to be sensory deprived or put in dark rooms. We actually think that will make it harder for them to maybe get better, just because you're completely removing yourself from all your usual validating life activities. Putting people in solitary confinement makes them depressed, right? And anxious; you have nothing else to do but sit there and think about how bad you feel. So that doesn't actually do a lot of people so much good.

But what we like to see now is that people do what I like to call relative rest. So, hang out, don't overexert yourself like go for a big workout, or certainly don't put yourself in harm's way of getting another head injury. So, if you're an athlete, don't get back out on the field before you're better. But it's okay for people to watch a little TV, be on their phone or their computer a little bit. You might find that being on screens or being in a really loud place or a crowded place makes you not feel so well. And if that happens, then you kind of back off from doing those things. But there's not really great evidence to support people staying off screens, staying in dark rooms, just for the sake of it.

So, we really like to go with how people feel and how they are responding as an individual to various stimuli because this is a very individualized injury. I'm sure you've talked to other people who've had concussions and maybe they haven't experienced the same things you have. And that's because it really boils down to the person, and maybe what their sensitivities are, and some of their other medical conditions or background. Everybody's

going to be a little bit different, so we want people to have a few days of relative rest, like bumming around the house. And then actually, after about day three, we're okay with people getting back to a little bit of work, a little bit of school, and just seeing how they do and kind of using their symptoms as a guide. But everybody will be different so there's no reason to give everybody the same exact prescription on how to get better.

Alie: Okay, that's actually great to know because I had posted something where I'm like, "I got a li'l concussion... I'm fine... CAT scan came back fine," and I got a lot of comments on Instagram being like, "Watch the fuck out because... Don't look at screens..." Someone would say, "I got a concussion, I got post-concussion syndrome; be really, really careful." So, I was kind of left not sure, "Is this going to make something worse? Is it not?"

I hadn't heard of the term post-concussion syndrome before this. Is that something that is a scientific clinical term, or is that, like, a catch-all?

Dr. Iaccarino: So, post-concussive syndrome is a term that refers to people who have symptoms for longer than expected. And it's actually being phased out. So, it used to be a clinical diagnosis that was made and we'd actually phased the term out because of what I just talked about; that everybody's individualized. And sometimes, you know, people will have symptoms that last a little longer but they might be related to another condition they have, like somebody who already has migraines or somebody who already maybe has light sensitivity or noise sensitivity.

So, it's a term that's getting phased out, and I kind of prefer to think of it as persistent symptoms or prolonged recovery because I'm also really mindful that when you give somebody a diagnosis as a doctor, right, "You have the post-concussion syndrome, but I don't have any treatments or really great cures for that," it can actually make people feel a little worse, right? If you tell them that they've got some prolonged syndrome, we can actually maybe kind of change the narrative in a bad way. So, the term has fallen out of favor for a lot of reasons, but it still kind of means the same thing, that some people experience symptoms longer than other people.

Aside: Okay, so I'm very lucky to have an in with Dr. Jane McGonigal from the Ludology episode on video games, who has done a ton of research and even a TED Talk on her own mTBI sustained from accidentally slammed her *cabeza* into a cabinet at home which I do *not* envy. So, two days after my own fall down a flight of stairs I emailed her asking for advice, and she was amazing. She echoed to take it easy, get some rest and fresh air, maybe some walking, watching some familiar or comforting movies, perhaps pressuring a loved one to give me a foot massage, which I did. She said if something felt like it was "off" or too much, to back off and don't push through it.

And this part really struck me – did not intend that pun – but it mirrors what she said in her Ludology episode. With her permission, I'm going to repeat it here. I'm going to read part of the sweet email that she sent to me last week. She said:

The other thing that really helped me was learning that some people experience depression as a neurological side effect of a concussion. During healing, the brain is trying to put the brakes on your normal activity and it wants to avoid another impact. So to preserve your precious energy, literally the glycogen your brain needs to heal, it depressed you. So your brain wants you to stay in bed and feel like nothing is worth doing until it heals. For me, learning that this depression was a natural and helpful physiological response to concussion, and not a fact of my life, or a

psychological weakness, or just an emotional response helped me ride it out and see it as a healing response without suffering as much.

Many people don't experience depression after a concussion, so this may not come into play for you at all. But it is common enough that I always try to tell people that if it happens, know that it's just your brain trying to keep you restful and it's not a feeling that continues after you recover. When a concussion is healed, those feelings go away.

I hope you are one of the many people who recover quickly and relatively comfortably. And if, like me, you take a little longer, just surf it out. Don't fight the waves, go with them, give yourself grace. Rest. Because there's no benefit to fighting your own brain.

Ah! Dr. Jane McGonigal: a frickin' saint! Her website and her talks are linked at my website which is linked in the show notes so you don't have to remember anything or write anything down. Also, sidenote, serious huge thank you to my sister-in-law and wedding dress designer Samantha Sleeper, who has continued to house Jarrett and I for a long, languid, two-week vacation of fireplace hangouts with Chris and Mason while I neuroplasticize my noggin.

What is that word... neuroplasta...? Okay, so I looked up studies, and in the 2016 book *Translational Research in Traumatic Brain Injury*, it explained that neuronal circuits can adapt structurally and functionally to injury. Neuroplasticity. They recruit new cells to replace the damaged ones and then your brain uses molecular modifications to reroute and get the job done. So if you're feeling a little weird, or down, or funky after a concussion, just consider it kind of like a renovation. So, pardon your own dust during the remodel. You're figuring it out!

Alie: And what about right afterward? I know we talked about how you don't have to go into solitary confinement necessarily, and I did notice, you know, I was fine to do some things. Luckily, I'm at a relative's house and I've just been beaching myself by the fireplace, but as soon as I started playing *Super Smash Brothers* with my nephew I was like, "All right, this is too much flashing lights and screaming gorillas."

Dr. Iaccarino: Yeah, I often tell people to try to do all the good things for the body. So, stay hydrated, try to eat a relatively balanced diet. There are no specific diets that have been shown to make concussion go away faster, nor have there really been shown to be any supplements that'll do it. There's lots out there and people can definitely try them, but nothing that's a slam dunk. And then, you know, have the ability in your day to take it easy if you need to, right? If you find that you kind of overdid it playing video games, have the ability to say, "I'm just going to step away for a little bit." Or "I'm going to work part-time for a couple of days and take some breaks during the day."

We actually used to recommend that people not do any exercise until they were all better, and now there are some studies that show... they're mostly studies in athletes because that's where this tends to be a common issue, that some light aerobic exercise that does not make your symptoms worse might actually help people feel a little better. So this would be like, you know, taking a brisk walk, or getting on an exercise bike, or something like that. So, it's been interesting that we went from people not doing anything, right, to actually, "Oh, maybe getting moving a little bit in a controlled way that doesn't make you feel worse might be helpful."

Aside: So if your idea of a workout is maybe some light cage fighting, perhaps hold off just for a bit. Your usual triple-shot cortado? What about that? Yes or no?

Dr. Iaccarino: I've heard people say, "I cut out all my caffeine," right? Well, how many cups of coffee did you used to drink? "Two in the morning and now I have a raging headache and I'm tired." I'm like, "Okay, just go back to your usual coffee intake," because I think we've actually... by eliminating coffee you have actually made yourself feel worse, right? So, we want people to be on their normal routine. We don't want them to turn themselves inside out and take away all their usual behaviors and activities completely or they can actually make themselves feel a little bit worse.

I think some of the things that we want to stay away from right after concussion are things like alcohol and stuff that can make you feel hungover and be mind-altering, right? Because that usually doesn't make people feel better.

Alie: What about glycogen? I read somewhere that your brain needs a lot of glycogen to heal.

Dr. Iaccarino: Your brain needs a lot of glucose, which is sugar. That's the only thing your brain survives on. So, fasting is probably not a great idea when you have a concussion, or being extremely restricted in what you eat. But otherwise, there's not a lot of dietary stuff that might really make a big impact for most people, so we don't tend to really recommend it.

Aside: So that being said, side note, there is emerging research on very low carbohydrate or ketogenic diets and brain function after injury, and the journal *Frontiers in Neuroscience* published a 2019 study from the University of Connecticut that showed a high-fat diet reduced aggression in males, they say, after concussions. And the scientists explained some evidence that concussions might cause some brain cells to die off by overexciting them during a trauma, and then that causes the cells to use up all their glucose all at once, all too fast, and die.

Now, brain cells usually run on glucose, right, stored mostly in the form of glycogen in non-neuronal glial cells. They're called astrocytes; doesn't really matter but it's good to know. But the brain can also use ketone bodies, or fat metabolites, in a pinch if you have no more glycogen left. Many past neurological studies point to ketogenic diets as a way to keep brain cells kind of out of that "excite-o-toxicity zone," which can prevent things like seizures. So, it's possible that this 2019 research into ketogenic fuel and concussions could help prevent mTBI damage in folks who are prone to concussions like pro athletes, which could be huge in this field.

Shoot, I forgot to mention, all the research was done with fruit flies. So, animals who don't have to work on spreadsheets, or navigate society, and whose brains are the size of a poppyseed. But listen, before you scoff at fruit fly research, let's remember with our big meat brains that their fly brains do have 100,000 neurons and tens of millions of connections. So yes, they are a small model but they're a mighty model nonetheless. But we do have a long-ass way to go. So, ask your own doctor because opinions on brain trauma recovery and prevention are, like your own brain, pretty split down the middle.

I myself have been eating lots and lots of holiday cookies and right now I'm pondering how much of my sluggishness is fully the result of a brain injury versus just some good old-fashioned pancreatic overwhelm in January. So just be kind to your construction zones, is all I'm saying.

Now, what about just firing up your bong, or buying some Goop-certified white-lady cannabis? I asked another neuroscientist pal who said that CBD is definitely being

researched and used in TBI recovery. I found a study called “Review of the neurological benefits of phytocannabinoids: Neuroprotective, anti-inflammatory, and immunomodulatory benefits,” and I was like, “Okaaayyy....” But then, all the way at the bottom in the conflicts of interest section, there was a disclosure that the leading researcher was a shareholder in a CBD gummy startup. But maybe he just really believes in it, which is totally fine too.

Once again, a lot of research is emerging, a lot of it has merit, but I’m not your doctor. I’m just a lady with a brain injury googling her way out of confusion and then back into deeper confusion. As I record this at 2pm on the same day that it’s getting released and I’m still wearing pajamas I put on 36 hours ago, a question remains:

Alie: Important question: How long can I milk this? I fell down some stairs. Like, when do I have to start returning emails?

Dr. Iaccarino: *[laughs]* Yeah, I mean, everybody is different. You don’t have to be 100% better to start re-engaging in a little bit of school or work. You want to go by your symptoms. But it’s also very reasonable to not just jump back into everything right away and work an 18-hour day with dinner and drinks at the end of the day, and three hours of sleep, and then do it again the next day and the next day, right?

So, the people who do best are somewhere in the middle; who don’t just rest for days, and days, and days, and they don’t go full tilt on their daily schedule. They’re doing this sort of middle-of-the-road, working-my-way-back in a controlled fashion. So, easing back into it is probably good, and that’s hard for a lot of people. If you’re a busy person, like I imagine you are, it’s very challenging. But that’s usually how people get better fastest.

Average times for recovery... Again, this is really quite broad so I hesitate to even throw numbers out there. But anything from a week to, honestly, like, 10 to 12 weeks is considered normal. It’s considered within the normal range for feeling all the way better.

Alie: Oh that’s good to know.

Dr. Iaccarino: Those one-week people are at one end of the spectrum and the people taking a couple of months may be a little bit at the other end of the spectrum. And unfortunately, there is a group of people who take longer. There is mixed reporting on this kind of data, like who has prolonged symptoms...

Aside: And again, ‘prolonged symptoms’ is how most doctors refer to it, but it was once commonly called ‘post-concussive syndrome’. And I’ll be honest, as soon as I heard the term, ‘post-concussive syndrome’ I personally kind of freaked out. So I understand from my own perspective how it’s helpful to frame it as something less scary and less permanent. That being said, that prolonged recovery does happen, but to how many folks who actually get seen by doctors?

Dr. Iaccarino: Estimated anywhere from 5% to, some studies, closer to, like, 25-30% of people that have at least a symptom longer than that. Now again, I think it depends on what population you study, right? If you’re studying a group of people who are really interested in concussion and have prolonged symptoms, you’re going to get a higher number. Where if you study those people who don’t even go to the doctor, those people probably get better pretty fast. So, I think it depends on the population you study, but there is this group of unfortunate folks who do have symptoms even longer than that.

Alie: If you get a concussion, should you go enroll yourself in a study? Because I imagine it's really hard to study because you're like, "Who out there has concussion?!" You can bonk someone and *then* do experiments on them. That's not ethical! [*laughs*]

Dr. Iaccarino: Yeah, nope. Not ethical at all. And the human brain is really different than other brains. Even a lot of the data that we have that comes from animal models, you still, at the end of the day, are like, "Well, okay but it's not the human brain," which is an extremely complex organ. I think if you're somebody who gets a concussion and you are willing to help science better understand that injury, then you are an awesome person.

Aside: So if you're concussed, maybe you can give your time. I looked into studies I could participate in as long as I had a messed-up brain, but most of them were either looking for former NFL players between the ages of 45 and 74, or they only needed my brain between a 1 to 3 on the Glasgow Coma Scale, if you know what I mean.

There are folks doing really great research under the \$30 million CARE Consortium, which is the world's largest investigation into traumatic brain injuries, and it's funded by the NCAA, the National Collegiate Athletic Association, aka college football, and the US Department of Defense. Have I mentioned you should follow the money with this stuff? You should.

In this case, let's aim our own money hoses toward some causes of the ologist's choosing. This week, Dr. Iaccarino asked that it go to Home Base, which is a Red Sox Foundation and Massachusetts General Hospital program and it's dedicated to healing the invisible wounds for veterans of all eras, service members, military families, and families of the fallen through world-class clinical care and wellness, education, and research. And Home Base operates the first and largest private-sector clinic in the nation devoted to providing lifesaving clinical care and support for the treatment of the invisible wounds to include post-traumatic stress, traumatic brain injury, anxiety, depression, co-occurring substance use disorder, family and relationship challenges, and other issues associated with military service. You can learn more about the great work they're doing at HomeBase.org. That donation was made possible by some sponsors of the show.

[*Ad Break*]

So, a lot of you had repeated questions, so let's hit it. It's about getting hit repeated times; multiple concussions. I'm looking at your noggins, patrons Scott Duncan, Leah Lodevico, Marisa Holzman, Allen Lee Palmgren, Alia Myers, Timothy Hwang, Chelsea Rabl, Ross Beaulieu, Heather Moore, Cumulus Clouttower, Ali Vessels, Peng Fei Dong, Lulu Hall, Karen Seidler, Claudia Dana, Beverly Sobelman, Jessica Beckwith, Specs Owl, and Julia Splittorff, whose life highlights include running face-first into a brick wall to meet Harry Potter, then getting kicked in the head by a mule, and getting whacked in the head by a baseball bat by someone trying to break open a pinata at their birthday party, which landed them in a helicopter to the hospital for a few weeks.

Julia's question: How am I alive and functioning? Let's ask a doctor.

Alie: Olivia Schafer says: How many is too many? A lot of people are like: I play hockey... I was in roller derby... I played football. The repeated concussions. What's the deal with that? [*clip of Jerry Seinfeld: "What is the deal..."*]

Dr. Iaccarino: Yes. This is a hard question but one that I field a couple days a week. So, the answer is that there is no number. There's no specific number where we say, "Okay, hang up your roller skates. Turn in your varsity letter jacket. It's over." And this really goes back to that "every

person is different.” Every person is different. How they respond to the injury is different, how long it takes them to get better is different, *and* what they’re going back to in their life is different. If you’re a person who’s had three concussions because you’re in car accidents, we’re not going to tell you to never get in the car again. That makes no sense.

But where we get a little bit concerned about folks is if they’re in a recreational activity like sports, or a job, where they are pretty much guaranteed to get repeated head injuries, those are people that we want to start talking and thinking about “How much do you want to expose yourself to a head strike?” Or how much risk do you want to take?

So, when we talk about repeated injuries, those are the groups that we start to get a little bit worried about because we know that they’ve signed up for more events where they could take another hit. And we do think that many hits over time could – in some people, not everybody – could lead to either symptoms that never go away, so you don’t actually get all the way better, or that as you get older you start to maybe experience cognitive difficulties, like thinking, and remembering things, and paying attention, or other symptoms. And those may be related to all those hits to the head.

We do worry in some groups about how many, but there’s not a specific number. And the other thing we worry about is also how frequent. So, like a boxer takes, you know, 20 blows in a fight, whereas a gymnast – and I’m not saying all gymnasts, but let’s just say a different sport – where you can hit your head and you probably do from time to time, but that’s not the goal, right? The goal is not to hit someone in the head. Those are different things.

So, we worry about how many and then we worry about how frequent they are, how close together. Did the brain get time to recover sufficiently? Or do you think you took more hits when the brain wasn’t fully recovered? Those are factors we care about. Number matters and then frequency and time to recover also probably really matter.

But I would say, if a person is concerned that they’ve had a lot of concussions and they are worried that they’ve signed themselves up for more, like, “I’m going to continue to do my sport,” or “I’m going to continue in this field of work,” it is very reasonable to try to see somebody who’s a psychiatrist like me, or a neurologist, or someone who has experience in concussion to talk about what might be the threshold for stopping that activity. But I think it’s reasonable for people who’ve had a lot of injuries or work in fields where they know they’re going to have a lot of head injuries to have these sort of discussions and know what their options are.

Alie: If you see someone riding a bike without a helmet, do you ever scream out your window, like, “Put a helmet on!!”?

Dr. Iaccarino: [*laughs*] So, I scream with my windows up. And then, occasionally if it’s, like, kids in my neighborhood, yes. But I try to keep it on the inside. You know, concussions can be tough injuries for some people, and as we said, there are some people who take a long time to get better. But let me assure you that it is still the mildest form of a head injury, and if you are unhelmeted you are *much* more likely to get a skull fracture, or a brain bleed, or something way, way worse than a concussion, so...

Alie: Helmet up!

Dr. Iaccarino: Yeah, helmet up because when I see bikers who are helmeted and come to me with concussion, you know, they’re obviously upset they have a concussion. But what is missing from the discussion is, “Thank goodness you had a helmet on or else you might not be

walking into my office to talk about your concussion. I might be seeing you over in the neurological ICU because you had a huge brain bleed.” So, everybody: Helmet up.

And I’ll just say, I’m up here in Boston, skiers, sledders, I know you might not feel cool if you go sledding with your helmet on, but you know, sledding is job security for me because people hit their head sledding. Snowmobiling, activities on wheels where a helmet will save your life and you can just come to a concussion clinic to talk about that. So yes, I am a huge helmet person.

Aside: So, big applause to helmeted ologites out there, Kelley Uhlig, Rob Lara, Tony Vessels, Cycling Tiger, and motorcyclist Doug Stewart, who said: Don’t worry DadWard, I ATGATT. (I had to google it. All The Gear, All The Time.)

And for anyone who has had multiple concussions, remember that neuroplasticity that reroutes and compensates for injured areas? Well, do that many, many, many times and that’s more of a rerouting burden on the brain. Some scientists call this ‘suboptimal signaling pathways’ in your brain. So, protect that coconut; you only get one. And it’s resilient, but don’t push your luck. Wear a helmet.

Also, when it comes to safety gear, definitely consider it a wise investment and do your research to get the best and the safest you can for your budget. And if you can buy in person, it’s best to get fitted for a helmet so that you’re not seeing phosphenes, aka experiencing photopsia, aka seeing stars, which, sidenote, is your brain playing tricks on you from sudden changes in oxygenation and pressure, especially from a bonk that affects the vision system in your occipital lobe in the back.

Which brings me to the next question: Is your skull like real estate? Many of you, such as Anthony, Sephie, John Worster, Karen Burnham, Jess Swann, and Jessica Morgan, one of whom asked about hitting someone with a rock to incite a concussion and will remain anonymous *Sephie*, but wants to know, essentially: Is it location, location, location?

Alie: Some folks wanted to know: Is it worse to bonk different areas of your head? Like, I hit the back of my head; is that not as bad as hitting the front?

Dr. Iaccarino: No, I would say that’s probably a bit of a myth. Because remember, in the beginning I said to you that you don’t actually have to directly strike your head to get a concussion.

Alie: Yeah, you could just get shaken.

Dr. Iaccarino: Shaking or, like, an explosion with a blast wave or something. So no, not necessarily.

Alie: Last listener question. Michael Satumbaga, Rosario Neyra, Sarah Crowder, Megan Ramirez, Greg Walloch, Rachel Selby, Nathan Ogden, first-time question-asker, Kyle Pawlik, Heather Dykes, all of these people wanted to know about drowsiness and sleepiness with a concussion and can you not go to sleep after a concussion? Will you die in your sleep if you go to sleep after a concussion??

Dr. Iaccarino: So, the concept that somebody would be awake and then die in their sleep actually more closely ties back to injuries that are not concussion but something more severe. So like Natasha Richardson, right, who hit her head, was kind of walkie-talkie, and then went to... she didn’t go to sleep. She probably collapsed. But you can imagine, if it was evening, you’d go to sleep and never wake up. And that wasn’t necessarily due to a concussion. She had a hemorrhage. But if you go get checked out and you just have a concussion, you can go to sleep. Where people get more concerned about not letting people fall asleep is if people are so drowsy they can’t stay awake.

So, I'm sitting next to you, you just hit your head, and it's broad daylight, and you literally can't keep your eyes open, right? Then I'm worried about you because your brain is not able to maintain consciousness. And that's actually a reason to go get checked out and maybe get a scan because we're worried about something maybe more severe than just concussion. But if you have a concussion and not a more severe brain injury, you should be safe to go to sleep. If somebody's so concerned about somebody being sleepy right after a head injury, that person should go get seen at a hospital.

Alie: Okay, that's good to know. I was yawning afterward and I was like, "Why is this happening?" But I think that there's this myth that you have to stay awake for 24 hours like a telethon in order to prevent dying in your sleep. I don't know what movie it came from, but I feel like we all saw a movie in the '90s where that happened or something.

Dr. Iaccarino: I'm sure we did. And it's very common to be tired after a concussion or want to sleep more. That's actually a common thing. And that is okay to do as long as you actually have a concussion and not a more severe brain trauma.

Aside: Okay, I looked for at least an hour, maybe two hours. I have no idea what movie made us all believe that you can't sleep after a concussion, but if you have been checked out and had a scan and you don't have a brain bleed or severe trauma, the doc will give you the okay to snooze. And if you know what movie is lodged in our heads, please tweet at me because it is just frying my ganglia. I cannot figure it out. I'm so tired.

Alie: Any responses in general to concussions in the media, or the movie concussion, or just in general, anything in pop culture that gets it right or gets it really wrong?

Dr. Iaccarino: I don't know that I'm going to go on the record about...

Alie: Yeah, yeah. That's fine.

Dr. Iaccarino: Just like any other medical condition, there are tremendous myths about concussion that probably get perpetuated through the media. And of course, you know, various nonscientific entities and some aspects of social media. It's a serious condition that, if you experience it, you should get checked out. But for the overwhelming majority of people, they're going to get better, and feel just fine, and probably forget that it happened to them. Again, not true for everybody, and the things you're going to read on the internet are probably those folks who are struggling for sure and trying to caution others. But there's many, many people out there who've had a concussion and are doing just fine.

Alie: That's such good news, and that's very hopeful. Because I think I got a little bit more scared the more I read about it. And I did find myself, kind of, tiptoeing and it's been really great to rest, and I've definitely noticed, like, "My eyes feel a little bit tired. I'm done for today." But this tiptoeing, that you'll make it worse if you resume normal activities, kind of freaked me out a little bit, to be honest, you know?

Dr. Iaccarino: Yeah, and I talk to people every day who are just so... Actually, the worry and the anxiety about, "Can I do this? Should I do that? Did I injure myself more?" It can become its own beast. There are good resources. The CDC is a great resource. The Brain Injury Association of America is a great resource. And there are, you know, a number of good resources out there. But also, if you're somebody who is, you know, not getting better, "It's been a few weeks and I'm not getting better," and you're able to and in a position to, it's always very reasonable to reach out to a person like me to get some more focused guidance.

Alie: What about the most troubling thing or the hardest thing about your job?

Dr. Iaccarino: Hmm... [*thinking*] The hardest thing about my job... Well, I think one of the hardest things about my job is talking to those folks where we think that their brain has had enough and, you know, it might be time to think about no longer engaging in combat or collision sport or thinking about a career change. Those are hard discussions. And I don't have them that often; overwhelmingly, I think people being active and in sports has so many benefits to their mood, to their health. We want to keep people doing what they love, but there are times when a person is just not recovering, showing too many symptoms, or has had too many injuries, or plays a certain way, or works in a certain way where they're just very, very high risk. Those are hard discussions.

I rode horses for many, many years. I can't imagine if somebody told me, "Look, you've hit your head too many times. You have to hang it up." I would be beside myself. It's such a passion and many people are passionate about their careers and their sports. So, I think those are the hard ones.

Alie: What about the best days of your job? Or research or clinical work? What do you love about this?

Dr. Iaccarino: Getting people better!

Alie: What do you love about head trauma? [*laughs*]

Dr. Iaccarino: Yeah, what do I love about head trauma? People get better! The brain is an amazingly resilient organ. We think of it as very fragile, and in some respects it can be. But overwhelmingly, it is quite resilient. Many, many people can have head injuries, some more severe than concussion, and they get better. It can take time, and they need the right rehabilitation, but they really do get better and people go back to doing what they love. Those are the best days.

Alie: Well, thank you so much for doing this on such short notice. Definitely did not have this on the schedule for this week, but I appreciate you fitting me in to let my brain ask your brain questions about my brain.

Dr. Iaccarino: Absolutely!

So ask smart brain people all of your simple brain questions, or your complicated ones if you are lucky enough to just have one that you can ring up, or have a podcast, because that's one way to do it. You can find Dr. Mary Alexis Iaccarino on Twitter [@IacorinoMD](#). She is wonderful. Also, stay tuned for a bonus episode coming out this week on headbutting in animals. I recorded it; I was going to put it in this one; decided to make it a bonus episode. That's coming out in a few days. Cross your fingers.

You can find us @Ologies on [Instagram](#) and on [Twitter](#). I'm [@AlieWard](#) on [both](#). You will find a link in the show notes to this episode page where there are *tons* more links and research. All kinds of good stuff. Also, a link to HomeBase.org, which is where we sent a donation. Links to sponsors are also linked in the show notes.

Thank you to Erin Talbert who admin's the wonderful [Facebook group](#) full of *Ologies* listeners. Hello out there! Hello to the [SubReddit](#). Hi! Thank you to Shannon and Boni who help with [merch](#). Thank you to Susan Hale and Noel Dilworth who do so much *Ologies* business behind the scenes. Thank you to Kelly Dwyer who makes our website. She can make yours as well. Her link is in the show notes. Thank you to Emily White of The Wordary, who makes professional transcripts available. Those are for free on our website to anyone who needs them for any reason at

AlieWard.com/Ologies-Extras. We also have bleeped episodes. Thank you Caleb Patton for bleeping those.

If you have seen *Smologies* episodes in the feed, heads up, those are short, small episodes for smologites. They are classroom-safe, they are everybody-safe. A little bit less saucy but they get right to the point. Thank you Zeke Rodrigues Thomas for working on those with some help from Steven Ray Morris. Thank you also to Nick Thorburn who wrote and performed the theme music. And thank you to lead editor, primary husband, and person who carried me to the couch while I passed out, Jarrett Sleeper, who has been taking excellent care of me, including some foot massages and literally, like, waiting on me as I'm just beached on the couch in front of a fireplace. Thanks, Jarr!

[Jarrett in the background: "I love you!"] [Alie giggles]

And if you listen through the very, very end of the episode, you know I tell you a secret. One secret is that when they loaded me in the gurney, they have, like, a picture on the side of the ambulance that shows, like, how the gurney is to be lifted, and I swear it looks just like a cricket or a grasshopper. And they were loading me into it and I was like, "Doesn't that look like a cricket or a grasshopper?" And I think they probably thought, like, "Awww...." But I remember thinking at the time, like, "Ah, shoot. That probably sounded weird," but I would've said that on any normal given day just because crickets are cool.

My other secret is that I was trying to make new calendar sheets for my little planner binder, and I was in bed trying to use my nephew's Swiss Army knife to poke holes in the pages for the binder, and then I fell asleep doing it, and I woke up in the morning to just, like, open Swiss Army knife in the bed, dangerously close to my baby Gomlee, which is a dog. But I closed it really quick and Jarrett was like, "Is that a knife?? Did you just close a Swiss Army knife?? Was that in the bed?? Did you sleep with that open in the bed after you were punching holes??" And I was like, "... maybe..." So, it's been great to blame a lot of this on a concussion but I think a lot of this probably would've happened anyway. Sorry, Jarr!

[Jarrett in the background: "We survived!"]

We survived! Okay, protect your noggins. Thank you for listening to this very long episode with a lot of asides. There was so much more research than I thooooought! I hope it helps someone out there.

All right. Berbye.

Transcribed by Emily White at TheWordary.com

Links you may enjoy:

A donation was made to HomeBase.org

[Dr. Jane McGonigal's Ludology \(VIDEO GAMES\) episode](#)

JaneMcGonigal.com Jane's new book, "[Imaginable](#)" is due out March 22,2022!

[Brain Injury Association of America](#)

[Concussion basics](#)

[CDC reports on health disparities and TBIs](#)

[MMWR Morbidity and Mortality Weekly Report](#)

[Concussion study via ConcussionFoundation.org](#)

[Boston University's concussion research program](#)

[The Second NINDS/NIBIB Consensus Meeting to Define Neuropathological Criteria for the Diagnosis of Chronic Traumatic Encephalopathy](#)

[A Review of the Role of Chronic Traumatic Encephalopathy in Criminal Court](#)

[J Am Acad Psychiatry Law. 2021 Mar; 49\(1\): 60–65.](#)

[Emergency care for mTBI](#)

[Management of Concussion and Mild Traumatic Brain Injury: A Synthesis of Practice Guidelines](#)

[2018 Sport concussion and attention deficit hyperactivity disorder in student athletes: A cohort study](#)

[Systemic Inflammation Persists the First Year after Mild Traumatic Brain Injury: Results from the Prospective Trondheim Mild Traumatic Brain Injury Study](#)

[Review of the neurological benefits of phytocannabinoids](#)

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