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Science AMA Series: I'm Dr. Adrian Owen, a neuroscientist whose research focuses on brain imaging, cognitive function and consciousness. We're finding new ways to decode the complex workings of the brain. AMA.

PROFADRIANOWEN [R/SCIENCE](#)

I'm Dr. Adrian Owen, a professor of neuroscience, here to answer your questions about our breakthroughs in brain science. I've been fascinated with the human brain for more than 25 years: how it works, why it works, what happens when it doesn't work so well. At the Owen Lab at Western University in Canada, my team studies human cognition using brain imaging, sleep labs, EEGs and functional MRIs. We've learned that one in five people in a vegetative state are actually conscious and aware (I recently wrote a book on it – www.intothegrayzone.com, if you're interested).

We've also examined whether brain-training games actually make you smarter (pro tip: they don't).

Now my team is working on a cool new project to understand what happens to specific parts of people's brains when they get too little sleep. We're testing tens of thousands of people around the world to learn why we need sleep, how much we need, and the long- and short-term effects sleep loss has on our brains. A lot of scientists and influencers, such as [Arianna Huffington and her company Thrive Global](#), have already raised awareness about the dangers of sleep loss and the need for research like this. Since we can't bring everyone to our labs, we're bringing the lab to people's homes through online tests we've designed at www.worldslargestsleepstudy.com or www.cambridgebrainsciences.com. We hope to be able to share our findings in science journals in about six months.

So ... if you want to know about sleep-testing, brain-game training or how we communicate with people in the gray zone between life and death ... AMA!

I will be here at 1:00pm EDT (10:00am PDT / 5:00pm UTC), with researchers from my lab, Western University and the folks who host the www.worldslargestsleepstudy.com platform—ask me anything!

Update: We're here now! Ask us anything! Proof that I am real: <http://imgur.com/a/NvPMK>

Update 2: I appreciate all the questions! I tried my best to answer as many as I could. This was really fun. See you next time. Now, time for some pineapple pizza! <http://imgur.com/a/Yy88r>

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Has brain/gut interactions started to gain more time in your research ?

[BrightenthatIdea](#)

I saw a fantastic talk about exactly that in Beijing, China just a couple of weeks ago by Catherine Tallon-Baudry! Check out her website and some of her papers here: <http://iec-inc.ens.fr/visual-cognition-group/membres-94/> Catherine is soon to become a Fellow of our Azrieli Program in Brain, Mind and Consciousness at CIFAR (<https://www.cifar.ca/research/brain-mind-consciousness/>).

If ethics wasn't a concern what sorts of experiments would you want to run?

[CousCousOtterCat](#)

whose research focuses on brain imaging, cognitive function and consciousness. We're finding new ways to decode the complex workings of the brain. AMA., *The Winnower* 4:e150038.82260, 2017, DOI: [10.15200/winn.150038.82260](https://doi.org/10.15200/winn.150038.82260)

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This is a great question and one that we face on a regular basis. There are numerous cases from the past where both amazing and horrifying studies have been conducted in more lenient ethical times. However, I have to say, there is no study that I would like to conduct that falls outside of our current ethical frameworks. In fact, having more refined and confined ethical standards forces scientists to be more careful, and creative in designing studies that address the questions we are most interested in.

If brain games don't make us smarter, are there other cognitive benefits besides intelligence that they do lend? Are there similar activities that you believe you would find to yield the types of results that "brain games" promise?

As a follow-up, what types of methods do you use to study any improvement of cognitive performance following an activity?

[Nemo309](#)

Brain games can be fun, which is a cognitive benefit of its own. Practising brain games can also make you better at those specific games, which can be satisfying for those who want to master a task. There is just no evidence that they have benefits beyond those rather obvious ones. They don't make you smarter. That doesn't mean there aren't activities that do improve brain health and various aspects of cognitive performance. [We've done research](#) that found a relationship between long-term engagement in certain leisure activities (such as Sudoku and video games) and maintained cognition with age. Games that are combined with physical activity (e.g. virtual reality) may have some promise as well. That hints at what really makes a difference - changes to lifestyle that have wide-ranging benefits, such as optimizing exercise and sleep. We use standardized cognitive testing to evaluate improvements, with tests we developed that have a long history in psychology and neuroscience. We've made those tests available to the public, alongside a system for tracking lifestyle changes, at <http://www.cambridgebrainsciences.com> (it's free to sign up and start tracking your performance but, just so you know, some advanced features are paid).

Do you believe that research focused on psychedelics and psychoactive substances (that induce altered states of consciousness) can provide meaningful insights for our understanding of consciousness and other concepts in neuroscience?

[nneuronicc](#)

I believe that this type of research can help us discover how the brain works. In a way, my research on vegetative state patients and sleep looks at "altered states of consciousness." Early research on the brain relied a lot on people with disruptions to regular cognition, such as brain injuries. For example, if someone is missing a piece of their brain and impaired on a very specific cognitive function, we can infer that the missing piece played a role in that function. Deviations from regular waking consciousness can serve a similar function, giving us hints about how consciousness in general works.

Hello, If you are in bed and cannot get to sleep but you are still lying there, do you get similar effects as sleep just on a milder level or is it just the same as being asleep. Always bugged me, thanks!

[dabigfattapatta](#)

Great question! I have not looked into this in great detail, but my suspicion is that part of the benefit of sleep comes from physical rest, so it is better than nothing. However, although we don't know all the mechanisms yet, other benefits require the specific changes in the brain that only occur during various stages of sleep. Sometimes lying in bed without sleeping can even prevent further sleep; some experts recommend getting out of bed and doing something else for a while if you are tossing and turning for

long, which will make it easier to get the deep sleep you need later.

Thank you for doing this AMA, Dr Owen.

A childhood dream of mine was to create a device that could 'record' your dreams and you could look at them later. Would it be possible in the future to somehow image or gather the data from your dreams?

Are you planning on looking into the possibilities of teaching people skills/talents/facts while they're asleep?

Has there been any case with the grey zone studies that was a breakthrough?

What is the most fascinating thing you've found or learned during your time as a neuroscientist?

Also, lastly, what sparked your fascination for brains?

[IcyTigris](#)

Here's an amazing paper from 2013 that used functional MRI (fMRI) to measure brain activity in people who were dreaming during sleep (<http://science.sciencemag.org/content/340/6132/639>). The participants told the researchers what they were dreaming about just before they awoke. The scientists compared the patterns of brain activity in these sleeping people to brain scans of other people viewing all sorts of pictures, and found that they could predict (or "decode") what the sleepers were dreaming about! That's because activity in visual parts of the brain is similar when you are looking at or imagining a specific something. Obviously, decoding what someone is dreaming about is not as good as getting an actual video recording of a dream, but that doesn't seem far out of the realm of possibility... Check out this study where researchers were able to reconstruct the video of what a person was watching from brain activity recorded (with fMRI): <https://www.youtube.com/watch?v=nsjDnYxJ0bo>, <http://www.sciencedirect.com/science/article/pii/S0960982211009377?via%3Dihub>

Dr Owen, thank you for participating in the AMA and thank you for your research.

What do you wish that you had the ability to measure that you do not? What is the next technology beyond fMRI that will give us a better understanding of how the brain works?

[sbb214](#)

In the past decade or so, many great studies have been published that utilize high density intracranial electrodes, electrocorticography (ECoG), to measure brain activity with high spatial and temporal resolution. This technology directly overcomes some of the limitations of fMRI: it actually measures neural activity, and it has excellent temporal resolution. On the other hand, it is extremely invasive and can only be done in patients who are undergoing brain surgery. A non-invasive equivalent of ECoG would be useful, but I don't think we're near being able to do this. While it's nice to think that we could someday non-invasively and simultaneously measure every single neuron in the brain, a major hurdle would be actually organizing and analyzing that quantity of data. So, I also think that machine learning and data science tools are going to be required in order to glean any insights from those huge datasets.

Is it worth it to lose sleep in order to exercise? I consistently have to do so in order to go out on runs, as I do not have an opportunity to do so at any other time of the day.

[Orbx](#)

Sleep and exercise seem to have an interesting reciprocal relationship. It's pretty well known that

exercise during the day can help improve sleep, and better sleep quality is also associated with better performance during physical exercise (and a reduced risk of injury!). Should you sacrifice sleep to get more exercise? Well, that's a question only you can really answer at this point - are you getting what feels to be enough sleep? In terms of sleep hygiene (i.e., the habits and environment you form around sleep), it is often suggested to avoid exercising right before going to bed. This could be something to be aware of if you are having trouble falling asleep right after a run.

You talked about communicating with people in comas? That's remarkable. How do you communicate and by what means do you measure their response?

My first thought was telling someone to think about something which the region of the brain it triggers has been well characterized. If you see brain activity there (but not before the prompting) then you see a response.

Keep up the great work! As an undergrad going into grad school soon, I will keep an eye on your sleep loss research. I will need it haha

[brownaj010](#)

That's exactly how it works! Actually, we communicate with people thought to be in vegetative state rather than a coma (see my earlier answer on the difference between coma and vegetative state here https://www.reddit.com/r/science/comments/6o0gcr/science_ama_series_im_dr_adrian_owen_a/dkdzbc7) but how you've described it is basically how it works. Good luck on your grad work (and your sleep)!

1st question: Do people in a vegetative state have any concept of time passing? I would imagine they do have some concept, but since people are always using reference material to tell the time, it seems like they are just using the last few thoughts or sensory inputs to give a small time frame of what's been happening. Would they be able to notice if days, months, or years are passing?

2nd: Why are images so vivid while asleep, but so fuzzy when fully awake? Not just speaking of dreams either, because dream images actually feel as if they are real, while imagination within the mind's eye always seems distant and ever-changing. Does this have anything to do with memory consolidation?

3rd question: Since brain-training doesn't make you smarter, what does? Is it possible for someone to truly become more intelligent? How does someone even determine an increase in intelligence?

4th question: Have you ever had somebody look at their brain on an imaging machine in real time? I have always wondered if you could see your brain as you think, you may be able to have better control over your mind and maybe get a "feeling" for what is what in your sensory experience of your brain.

Extra question: I am an undergraduate of psychology and my senior thesis is approaching next semester. I am especially interested in neuroscience and want my thesis to reflect that, but I don't have access to any equipment that let's me see the brain in action. Are there any interesting types of tests that I could conduct with relatively no equipment?

Thank you Dr. Owen, I appreciate what you do greatly!

[ALSwans](#)

Hope you're ok that I spend most of the reply on answering the first question: Certainly some of them can have a concept of time passing. But I need to be quite clear about the difference between truly vegetative-state patients and those who clinically appear to be vegetative, but actually turn out not to be when we scan them. In the former case, it's unlikely that they have any sense of anything. But some of the 'gray zone' patients certainly do understand the passage of time. The patient featured in

this video (<http://intothegrayzone.com/pain/>), for example, was thought to be vegetative for 14 years, yet when we eventually managed to scan him and open a line of communication he was able to tell us that he was aware what year it was, how much time had passed since his accident and also about some events that had occurred in the years in between then and now. There's a chapter in 'Into The Gray Zone' about this patient (<http://intothegrayzone.com/recovery/>) who recovered from an apparent vegetative state and was able to tell us absolutely everything about what it was like to be in that situation, including being familiar with the passing of time. If you want to read more about him and patients like him, check out intothegrayzone.com

What do we know about a newborn baby's brain function? I'm a father of a 7 week-old, and I'm constantly wondering how confusing things must be for a child whose brain has barely begun to form connections.

[rich115](#)

This a great question! I have colleagues here at the Brain and Mind Institute who study the development of brain function in very young infants (from before birth, even!). On more than one occasion, we have noted that studying newborn infants is kind of like studying vegetative state patients: they can't follow verbal instructions, and so it's very difficult to assess what their brains are capable of. Just as in my vegetative state patient research, these researchers are using functional MRI to study how the newborn brain responds to the world. You might (or might not) be surprised to learn that newborn brains are quite capable! They can recognize all sorts of sounds, like their parents' voices, songs and books that they heard while in the womb, and they can distinguish different languages. Their little brains are packed with connections (in fact, more than an adult brain), which get pruned as they learn important relationships and patterns (like spoken language) in their environment.

Biochemist here. I've always suspected that quantum phenomenon play a role in memory storage and ultimately give rise to consciousness. What are your opinions on this? Are you aware of any research currently being done on the subject?

[biochemthisd](#)

Quantum mechanics (QM) and consciousness are often brought up together because they are both complicated and seemingly mysterious phenomena, but that is no reason to suppose that they must be the same thing - or that they are even related. Scientists are making progress in understanding consciousness and without having to resort to QM. Check out work about engrams (one model for a physical trace of how memories are stored in the brain):

<http://www.nature.com/nrn/journal/v16/n9/abs/nrn4000.html>

We've also examined whether brain-training games actually make you smarter (pro tip: they don't).

Do any games help, like shooters? I've heard they did help with something, but I forget what.

We've learned that one in five people in a vegetative state are actually conscious and aware

Has anyone come out of a vegetative state, and if so, are there treatments for the brain damage?

We're testing tens of thousands of people around the world to learn why we need sleep, how much we need, and the long- and short-term effects sleep loss has on our brains.

I'd like to know more about this.

how we communicate with people in the gray zone between life and death

And this as well!

[NamesAreHard4](#)

This is an all-encompassing question! 1) there are a number of games that can be helpful to cognition. What's important is to remember that the games you play make you better at those games — for instance there is some evidence that video-game playing can be beneficial — but there is no evidence that playing specific games makes you better at other games or improves cognition in general. 2) There have been a few a number of cases where people who are diagnosed as being in a vegetative state do recover. In my career, of all the patients we have seen, three have recovered to varying degrees. The most recent case is particularly fascinating because he is now fully integrated into society. We have a video here: <http://intothegrayzone.com/recovery/> 3) We are currently undertaking what we plan to be the world's largest sleep study ever conducted. We know surprisingly little about what happens to our brains and specific aspects of our cognition (the way we think) when we are sleep deprived. This is really important because we all experience a bad night of sleep fairly regularly. Our goal is to understand what effects sleep deprivation has on the brain. Tens of thousands of people are signing up to www.worldslargestsleepstudy.com to help us uncover questions like, what is the optimal number of hours of sleep, whether that is true for everyone (e.g., younger vs. older adults), and what aspects of cognition suffer the most when you are sleep deprived. 4. The gray zone is a state where patients show no overt signs of awareness: for instance, they cannot follow commands but may in fact retain residual level of conscious awareness. I have spent most of my career trying to communicate with patients who have been diagnosed with a disorder of conscious using various neuroimaging methods. To learn more, visit <http://intothegrayzone.com>

Does the time of day that one gets sleep dictate how "quality" the sleep is? If I sleep from 11pm-7am, awesome, feel great. If I sleep from 3am-11am, I feel like I got hit by a truck. What accounts for this?

[cuticleitch](#)

This is an excellent question, because I don't think there is a conclusive answer (yet)! It's possible that a night's sleep that is drastically different from your regular sleep pattern results in sub-optimal sleep. Or, why did you go bed at 3am? Perhaps a night out with friends (and a few too many beverages) is causing you to feel like you were hit by a truck? Anyway, these are the kinds of things that we are hoping to learn about with www.worldslargestsleepstudy.com

Hello Dr. Owen,

How much does stress affect cognitive function? And, does waking up during one of the four sleep stages affect how we feel the rest of the day?

[PrimeCedars](#)

Stress affects cognition—in a recent review of the top factors that have an impact on cognition, stress was near the top. What's interesting is that it's not a simple relationship, and more stress isn't always bad. A lot of research finds an "inverted U" relationship, where *no* stress impairs cognition, and *too much* stress impairs cognition -- and that there's a 'Goldilocks' zone in the middle is just right.

Dr. Owen, thanks for the AMA!

I lived on a submarine for years. When the hatches shut, a majority of the crew shifted to 18hr days in which you work 12hr and sleep 6hr (on average, sometimes sleeping more and sometimes less). Can you think of any long term consequences from such a schedule?

I ask because I find it difficult to sleep/stay in bed for 8 hours.

[2b11](#)

This is a really interesting and important question! The scenario you describe applies to all sorts of professions with work that disrupts normal sleeping patterns: doctors who pull long shifts on call; police officers, nurses, paramedics and other critical care providers who work rotating shift schedules; oil rig workers who may work weeks offshore in long shifts; etc. Do these disrupted sleep patterns affect people's cognitive abilities, such as the ability to make complex and important decisions? Unfortunately, I don't have a straight answer, because we just don't know the effects of abnormal and prolonged sleep disruption on brain function. This is exactly the sort of question that sparked www.worldslargestsleepstudy.com We need people of all ages, from a variety of backgrounds and occupations, to help provide data to answer these critical questions.

Is it normal to have hallucinations when you sleep too little? I had a period when I was 18 when I had a lot of anxiety and couldn't sleep more than 3 hours or so at night and during the day I kept seeing things that weren't there and even experiences that I can only describe as being out of the dumbo acid sequence, and I didn't use any drugs.

Do you think that neuroscience will contribute to the development of artificial intelligence? I'm not an expert in either field but I've read that some AI techniques have been inspired by the brain, but it is not understood well enough yet to be used as a basis for a "true AI".

[sad over stella glow](#)

There are plenty of reports that sleep deprivation can cause visual and auditory hallucinations, but I'm not sure that anyone has ever specifically indicated having flashbacks to the Dumbo acid sequence. As for your question about AI, I'm definitely not an expert in that field but I have paid attention during talks from my colleagues, and maybe even learned a thing or two. I can think of one example where neuroscience informed the development of "AI", and that is in the area of convolutional neural networks. These neural nets use an architecture that was directly inspired by mammalian visual cortex, and are used for a variety of tasks like image and video recognition, natural language processing, etc. These techniques aren't really a true "AI", but models that are trained to be really good one specific task. They are also useful for neuroscientists, in helping us make sense of large amounts of data generated from brain imaging studies!

Curious about your thoughts regarding giving ambien to patients in a vegetative state. Is there any real research to back this claim? Or is it mostly anecdotal evidence?

[54321blastoff](#)

My various correspondences with clinicians who have tried Zolpidem (also known as Ambien) in different patients are overwhelmingly disappointing. The responses observed are, for the most part, very minor, transient and in some cases are difficult to disentangle from the likely effects of the increase in encouragement and stimulation from the family that these trials typically engender. There have been countless trials of the zolpidem, and few have resulted in consistent results in vegetative patients. A comprehensive recent study by my colleague Steven Laureys in Liège, Belgium, failed to show an improvement in even one of sixty patients with disorders of consciousness who were tested on the drug. For further details, see Thonnard et al., Effect of Zolpidem in Chronic Disorders of Consciousness: A Prospective Open-Label Study, *Functional Neurology* 28 (4) (2013): 259–64.

Thank you for your time Dr. Owen.

I am what my mother calls a "short sleeper" (I've admittedly never heard the term), in that I get between 3 and 6 hours of sleep a night and do not feel unrested or fatigued. I can also admit I am not in great shape nor do I have a great diet so I may be naive to my own health, but for the most part I feel "normal" all day. I have also read that some important figures in history claim to sleep even less than I do. Osama Bin Laden, for example, was said to usually sleep 3 hours a night during most of his lifetime.

My question is: are there any findings as of yet that point to whether a longer sleep schedule will absolutely benefit one's health, or do certain people feel the same level of well-restedness with different amounts of sleep?

[LucidsESO](#)

That is a great question! The peculiar thing about sleep is that many of us are chronically sleep-deprived, yet we feel that we are functioning "normally" during the day. The problem is that we do not really know whether that is true. This is one of the fascinating things about research on sleep; we know very little about how sleep deprivation affects cognition, and whether it affects everybody equally. We know that not getting enough sleep can be very harmful to your health and in fact can be lethal. However, we do not know how cognition changes when someone gets too much sleep. To address these questions, we are currently conducting the world's largest sleep study - www.worldslargestsleepstudy.com We hope to collect data from over 100,000 people from all over the world, from various backgrounds in order to determine what aspects of cognition is most affected with different sleeping patterns, but more importantly to determine certain groups of people who are affected more than others.

What're your professional thoughts on the upcoming head transplant procedure as someone who studies the brain?

[kaimedar](#)

Transplants fascinate me, because they have changed medicine in so many fantastic ways, yet the idea of 'head transplants' really is fundamentally different. Without a heart we can live on with the help of machines. A patient with an artificial heart is still the same person. Without a liver or kidneys we can survive, personality unchanged, until the death of another person provides us with a transplanted organ with which we can resume our lives, pretty much as we did before. We can lose arms, legs, eyes, and more and remain the same people, altered but nevertheless still us. Yet without our brains we are nothing more than a memory to others. We are not even a shadow of our former selves. We are gone. I suppose what I am saying here is that a head transplant is basically a 'person transplant'. Your brain is who you are. It's every plan you've ever made, every person you've fallen in love with, and every regret you've ever had. Your brain is all there is. It's the pulsating essence of you as a person. Without a brain (or after a 'head transplant'), you really would be someone else.

How would you validate f-MRI scans as a way to figure out what is happening in people's minds? Do you think we think of things in isolation and if not, how would one be able to scan a brain and attribute it's state to certain things?

Thanks

[Villain191](#)

I might be misunderstanding the question, but let's give this a shot. One method we often use in brain imaging statistics is cross-validation: we can test how well a pattern of brain activity (that is measured in response to a specific image, thought, or task) generalizes to other people's brain activity, or to your own brain activity at another point in time. If we see, for example, that imagining the same picture

evokes the same pattern of brain activity across a group of people, then given a new pattern of brain activity in the future, we can quantify how certain we are that that scan came from the brain of a person imagining the same thing. Of course, in the case of mental imagery (or "decoding" thoughts) this requires that brain scanning participants are cooperative and truthful! Do we think of things in isolation? Well, right now I'm thinking about answers to lots of these questions all at once (or at least doing my best!).

Will it ever be possible to have computers implanted in our brains and controlled by our thoughts, if so how long?

[KM4WDK](#)

I think we're already close to the situation you describe. At the Brown Institute for Brain Science in Providence, Rhode Island, a patient was recently taught to control a robot arm using just her brain. A sensor implanted in her brain and connected to a decoder turned her thoughts into instructions to move the robotic arm. The patient had suffered a catastrophic brain-stem stroke in 1996. The stroke left her locked in—unable to move any of her limbs and unable to speak. But with the aid of this system, she was able to steer a robotic arm toward a bottle, pick it up, and drink her morning coffee. I believe that in the not-too-distant future, this new technology may allow people in the gray zone to take online courses, type e-mails, hold conversations, and express their innermost feelings. Challenges remain, both technical and ethical. Brain surgery is risky, and implanting electrodes on the surface of the brain should not be undertaken without careful thought and consideration.

what postbio-transhuman pipe dream do you think is more feasible, uploading the consciousness or conversion of the brain to a computer network?

Personally I believe it's not possible to transfer the consciousness - it'll always be a copy while the original is "frozen" (suspended animation or artificial coma, overwriting the personality with itself when it's "returned") or is actually killed by the process.

[waiting4singularity](#)

Any answer to this kind of question can be no more than wild speculation, at this point! I can honestly say that we just don't know enough about the brain to have a computer adequately describe or capture the whole thing. How is information encoded in the brain? Are the codes for different processes (e.g., language, motor planning, etc.) the same? There is also a whole field — called embodied cognition — that studies how the environment and the body affect cognition and perception. It's probable that a brain without a body wouldn't experience the world, or think, in the same way as a regular human. Again, it's all just wild speculation (but it's fun to think about, all the same).

Are there ways to tell if someone in the vegetative state is in the "gray zone" ? Does the type of brain insult affect this? Where would you start to try to recover wakefulness and function in someone who may be in the gray zone? Is there anything in Canada to help those who cannot yet communicate (those who aren't even tracking and who may be afflicted with global aphasia) ?

[shangalang](#)

Yes, there certainly are ways to tell if someone in the vegetative state is in the "gray zone". In fact, that is really the main focus of my recent book 'Into The Gray Zone' which is an account written about our quest to discover and eventually communicate with some of these people using techniques like fMRI (functional magnetic resonance imaging) and EEG (electroencephalography). The type of brain injury does make a difference - in our experience, patients who have had a traumatic brain injury (e.g. a blow

to the head) are far more likely to be in the gray zone than those who have had a non-traumatic brain injury (e.g. oxygen deprivation). Unfortunately, there is, as yet, no agreed treatment or intervention that is proven to bring people out of this state, but we can make a significant difference to their quality of life. For example, when we communicate with patients in the gray zone, we do try to ask them what would make them more comfortable and, where possible, act on it (e.g. "Are you in pain"). You can watch a video of us communicating with a patient here <http://intothegrayzone.com/pain/>

What got you into brain research 25 years ago?

[mathewh](#)

An odd series of coincidences led me into a career in brain science. During my undergraduate in the late 1980s I took a course in neuropsychology, which got me really interested in brains. Then, for my PhD I decided to study patients who had had surgery for the relief of intractable epilepsy, the removal of tumours etc. The histories and stories of what had happened to these patients once their brains had been tampered with fascinated me. One patient I worked with had minimal frontal-lobe damage but became wildly disinhibited as a result. Before his injury he was described as a "shy and intelligent young man." Post-injury he abused strangers in the street and carried a canister of paint with him to deface any public or private surface he could get his hands on. His speech was littered with expletives. His wild behavior escalated: he persuaded a friend to hold his ankles while he hung from the window of a speeding train, a lunatic activity by any measure. His skull and most of the front part of his cortex were crushed when he crashed headlong into a bridge. By some circular twist of fate, his minor frontal-lobe injury led directly to major damage to the same part of his brain. I saw many patients like that and their stories still fascinate me. If you are really interested, I tell some of their stories in 'Into The Gray Zone' or you can watch some videos at intothegrayzone.com

Nootropics and its effects on cognitive reactions. What is your take?

[g0f0](#)

There are a lot of unknowns when it comes to nootropics. Some might have genuine effects, but the devil is in the details. We've done research on methylphenidate, and found that it improved performance on some of our Cambridge Brain Sciences tests, Token Search (<https://intercom.help/cambridge-brain-sciences/tests-and-challenges/tests/what-is-the-token-search-test>). Effects really depend on the specific supplement, specific person, specific dose, etc. So there needs to be more research, both from science and for any individuals considering taking nootropics long-term. One goal of our brain-test research is for people to really evaluate any steps they take to improve cognition, like nootropics, to ensure they're not being taken in by companies that put products out before there is proper evidence that they work.

What advice would you give a youngster (17 years old) who is extremely interested in the field of neuroscience?

[pincgwin](#)

My advice would be, do it! I made the decision, many years ago, not to pursue a traditional medical career. I never wanted to be a physician, listening to people's ailments and treating them according to standard protocols. I wanted to try to understand the mysteries of the way our minds work and perhaps discover new approaches to treatment and cures. That's what neuroscientists do, and I would encourage anyone else to do the same. I haven't regretted that decision for an instant. There are many great university courses in neuroscience available. (We have a bunch of these courses here at Western University in London, Canada, and we always welcome bright, enthusiastic scholars - check

us out at at uwo.ca.)