Dear Students, 2020

Here are my lecture notes. As a point of reference, I left picture labels in **BOLD or** *italics* so you could figure out what point I was at in the lecture. The websites I used are below but no promise that they still work. You know how the internet is. I have included the research paper citations for most of the topics which is why it looks so messy. I could not find all of the citations but if there is something missing that you want to find, a few choice keywords on Google Scholar or Neurosciencenews.com should dig it up. Feel free to contact me with any questions a williamrahner1@gmail.com.

Pleasure having you in class,

William Rahner


Suggested reading/viewing:
How to change your mind. Michael Pollan - Psychedelics
I contain multitudes. Ed Yong. -Gut Bacteria
At days close, Night in Times Past. A Roger Ekirch -sleep
The Ascent of Man – Jacob Brownowski. Greatest documentary of all time, dealing with the progress of art and science, and the resistance to it, over the centuries.
Robert Sapolsky Rocks – Free web site of his neurology lectures – fascinating
Neurosciencenews.com – free newsfeed on new research

Web Bookmark list:

6 Bayesian face- https://www.youtube.com/watch?v=01LMFFpAWYM

15 Puppies at 30 sec: https://www.youtube.com/watch?v=mRf3-JkwqfU

24 Neurons and synapses 3 D https://www.youtube.com/watch?v=m0rHZ_RDdyQ

29 growing synapses https://www.youtube.com/watch?v=A9zLKmt2nHo

37 BM Piano puzzler https://www.youtube.com/watch?v=uNaQE9K3eO0

94 the divided brain https://www.youtube.com/watch?v=dFs9WO2B8uI

"Power of Introverts" by Susan Cain on TED.
https://www.ted.com/talks/susan_cain_the_power_of_introverts

**Perception, learning and memory** "There is nothing in this world good or bad but thinking makes it so."
These topics are usually taught separately, but that disregards the interwoven nature of how the mind works. Let's see how much of reality is real, and how much is generated in your head like the matrix.

**Spock's brain episode.**

The brain is in a box. It only knows of the outside world through the senses.
We used to think that reception was perception. The senses report to the brain and the brain gets the correct information. It's not like that at all.

**Vase/profile**

"Beauty is in the eye of the beholder."
2 people can look at the same thing and carry away very different impressions and memories.

**and old/ young woman.**

Young people tend to see a young woman and older people tend to see the older woman. Why? One of the tasks that consumes a lot of the brains resources – and one we take for granted - is figuring out how to get through the day. I mean literally.

**staircase**

Everything we do is enormously complicated**.** We have to gauge the distance to the staircase, how much power we will need in the legs, momentum, balance, etc. If you were to try to figure it out on paper it would take all day. Later we'll do an exercise to demonstrate how the simplest action is way complicated.
The brain is an extremely expensive piece of equipment. Pound for pound, it draws ten times more energy and resources than other systems. Therefore it is always looking for ways to cut costs. Our brains save a lot of time and computing power by seeking out patterns and filling them in. We have all these senses supplying the brain with way too much information, so the brain ignores a lot and makes assumptions about the rest. If it recognizes a pattern it will fill in the rest – not based on observation – which is hard – but from memory of previous experience – which is easy – but less accurate. This is how we finish someone's sentences for them – or not. Your brains are picking my words right now before you've completely heard them. We see a young face, or an old one based on what we see what we expect to see, not what is really there. Look at the person next to you. Is the face symmetrical? Not really. But that's what we see. Here is an example of how filling in a pattern can be wrong – over and over again.

BM Bayesian Face
https://www.youtube.com/watch?v=01LMFFpAWYM better

Since we know that faces are convex – they stick out at us, in a two dimensional image we will interpret a face sticking out, whether it is or not.

We make patterns in other ways. We associate personality traits with appearance and body type..

**Heroes aren't ugly and Villains are rarely good looking**
**unless you're Kate Blanchett.**

Real heroes are often not very attractive ***Lincoln, Gandhi,*** **and villains can be cute** ***Caligula, Kristin Gilbert.***

In advertising you always have someone attractive and positive pushing whatever pill they want, and putting them in a lab coat to pick up the trappings of scientific authority. These people are invariably thin. Thin is good, thick is bad.

*lab coat*

The advertiser doesn't have to say the actor is a doctor. People will make that connection. You may think people aren't fooled but a lot are. Even if you are not fooled there is an impression left that has no basis in reality.

**Batman**

A con man hired Adam West, the original Batman, to do a commercial for investing in gold coins. The coins were fake, but a lot of old people in Florida bought them based on nothing but the commercial. Would Batman lie? West knew nothing about the scam, he was just reading a script.

Let's alter the impression to one that equally has no basis in reality. Have you ever seen a pill add with the actor dressed like a clown?

*clown*
You could. It's an actor. They'll wear any costume you want.

*Santa. MD.* Advertisers love to use associations

If a good association is just impossible to make, we'll go with distraction to alter perception. Think of any drug commercial you've ever seen.

BM https://www.youtube.com/watch?v=mRf3-JkwqfU

**BM Puppies** "Bill-o-Vite" may cause heartburn, forgetfulness, suicidal tendencies, and internal bleeding which can in rare cases be fatal. Consult your doctor immediately if your fingers start falling off. Don't take Bill-o-Vite if you are pregnant, have an impaired immune system, are a Gemini, vote Democrat, or if it is Tuesday.

The government requires the manufacturers to talk about risks so the consumer is informed. If they posted pictures of *bleeding, suicide, infection and fingers falling* off people might get the right impression. We can't have that.

*Breathe in. Breathe out.*

Perceptions can be influenced by other things.

*Line length test.*

Take a good close look at these lines. Which one on the right is the same is the same length as the one on the left? Depends on what the circumstances are. In a famous experiment, when most people in a room (who are in on the experiment) insist that it is A or B, 1/3 of the subjects will go along with the crowd. Some had doubts and bowed to peer pressure but some were actually convinced that their own perceptions were off. You can convince people to ignore the information from their own senses about something that is right in front of them. People will be swayed by a crowd. Can you imagine how easy it is to sway people if the evidence is NOT right in front of them?
Hillary Clinton won the popular vote by 2.8 million votes – 2%. That's more than Kennedy won by. It is a verified piece of data. But if enough people say that somebody else won the popular vote enough times from enough different media sources the true memory will be supplanted by the false memory in a lot of people, and they perpetuate the problem. This alternative fact (which in the trade we call a lie) will now become the truth for them. This is how false memories can be planted, unless you are very careful. Sadly, once false information is accepted it is hard to eradicate. Our reward system kicks in on our formed opinion, cherry-picking information that reinforces the opinion, and ignoring information counter to it. It is hard to keep an open mind.

People can also be swayed by a good speaker.

*Lincoln, Obama*

Problem is, a good speaker not necessarily good.

*Hitler.*

This has an undesirable effect on our decision making especially in the corporate culture. If there is a business meeting where a decision must be reached, the most charismatic person in the room will usually convince the others of his/her point of view before the others even get a chance to make up their own minds. Problem is, the most charismatic, or possible just the loudest person in the room has no better judgement than anybody else. A better approach would be to present everyone with the problem and have them think about it quietly for a few minutes, and then open up discussion.

BM "Power of Introverts" by Susan Cain on TED.

https://www.ted.com/talks/susan_cain_the_power_of_introverts

This has an undesirable effect on our decision making especially in the corporate culture. If there is a business meeting where a decision must be reached, the most charismatic person in the room will usually convince the others of his/her point of view before the others even get a chance to make up their own minds. Problem is, the most charismatic, or possible just the loudest person in the room has no better judgement than anybody else. A better approach would be to present everyone with the problem and have them think about it quietly for a few minutes, and then open up discussion.

The best thing is thinking for yourself. Aldoux Huxley observed reading a speech is better then hearing it in a crowd. It's one on one, and you can form your own opinion without peer pressure or the swagger of the speaker. Your brain has a better chance of determining "Does this make sense?"

Breathe in, breathe out.

**Neural Net 1**

We make associations and go along with the crowd to save us mental work and time. Most of the time this works pretty well, but it is subject to error, and increasingly manipulation.

Just as we use patterns to make associations, we also make movement patterns. Let's take an immensely complicated task:

**Neural Net 2.**

Brushing your teeth.

How hard is it? Let's find out. Put your toothbrush in the other hand. The circuitry to brush your teeth with the other side of the brain is already there. You can definitely get signals from any part of the brain to any other part, but the circuitry to make that particular series of moves in the correct sequence has never been used like that before on this side of the brain. The path exists but it's never been used in this way. The brain is going to try all kinds of random neural pathways to get the job done and most of them are going to be wrong. It will be tragic.

You'll have the toothbrush up your nose, you'll be using way too much force. Your dominant hand will keep edging up to help you saying, "Oh please boss just let me do this already." But every so often a random command will – just by chance – be the right one, and you'll feel that it's right. You'll get that little eureka moment that you get whenever you've accomplished something difficult. Not only do you feel that victory, your brain releases a neurotransmitter that says "That's it. That is the sequence of moves right there got that back molar," and the neuron circuit that did that move is strengthened, the rest are not.

Brushing your teeth. Climbing the stairs. Tying your laces. Riding a bike. Walking itself. We take these things for granted because we learned them a long time ago. That doesn't make it any less miraculous.

If your already left handed you'll probably find brushing with the right not so hard. Lefties already have a lot of practice with the right hand because they know that everything from teacups to doorknobs is designed for right handed people. It's true right. Even that expression. It's a right man's world.
Don't feel bad lefties. You only make up 10% of the population but you do have more creative tendencies.

**Picture of Bart Simpson**

**Dendritic spines (they have thousands)**

**Increasing axonal tree.** The number of new connections you can make in a lifetime is endless.

Increasing Axonal tree 2

Synapses that get more use get more resources and get physically bigger and they stay that way, sort of like upgrading to high speed internet. Then you build on that. The following day it will still be hard – awful really, but you will have a rough path to follow. The third day it will be almost acceptable.

**Neurons growing over a week**
https://www.youtube.com/watch?v=A9zLKmt2nHo

Once the circuit (called an engram) is built it endures, hence the expression, "It's like riding a bike."

**bike on a highwire**.

You shouldn't be surprised at the random nature of building neural networks. That's how nature does things. An oak releases thousands on thousands of acorns. Very few make it. The number of species that lived and dies out is far greater than the number of species that made it to today. Nature experiments randomly, and things that stick survive. Neural networks that do the job, survive.

Due to our limited perspective, we see some amazing creation of nature and cannot understand how something so sophisticated – like the human eye – ever got created by random chance. It did. There were a lot of random chances over billions of years. Only the models that worked survived. If we could see all the all the experiments that failed it would make more sense, but they're not around. It's called survivor bias.

*Breathe in. Breathe out.*

Let’s look at the nuts and bolts of how this works.

**2 brain slides showing pic of cerebellum**

**2 pictures of the cerebellum autistic and not**

The cerebellum is known to be for coordination. Damage to the cerebellum damages coordination. **(Story of the phrenologists and the French doctor.)**

So what does it have to do with a learning disorder like Autism?

**Picture of the cerebellum and nerve pathways**

Lecture on cerebellar function including feedback like when you are trying to sit in the subway and it starts to move. Cerebelllum also seems to be involved with non movement cognition. There is a lot of interaction between the frontal lobe and the cerebellum during recall.

But this is also a great builder of intelligence. Babies in a rich environment surrounded by things to play with develop faster than children without much to play with. Why?
Cezanne and the bricks.

Interaction with the real world teaches you what works and what doesn’t. And isn’t that what intelligence really is? The ability to figure out what works and what doesn’t by trial and error? Learning from mistakes instead of doing the same thing over and over. If you are impaired this way from the beginning, you never learn how to learn. You never get that first basic lesson that some things work, and some don’t. Some people never get it. You can tell from their career choices, their relationship choices, their life choices…

And the more experimentation you do, the smarter you get.

It's playing really. The brain is playing and experimenting. Finding out what works. Finding out what doesn’t. When you are playing, sometimes you have an objective, (learning to brush your teeth) sometimes you don't.

**Kids building sandcastles at the beach**.

In the Piano Puzzler, Bruce Adolf plays around amazingly. He takes a pop song and writes it in the style of a famous composer, so you can have  "When Irish Eyes are Smiling" in the style of Debussy, or a Beatles tune by Stravinsky.

BM Piano puzzler

https://www.youtube.com/watch?v=uNaQE9K3eO0

That kind of play can lead to a lot of creative productivity.  Often when I'm writing, it's terrible, but I just keep going and the wellspring begins to flow sooner or later.

An exercise that painters do is to imitate the styles of other great painters they admire. It can take years, constantly going into unfamiliar territory.

**2 very different styles.**
**Forgers can copy a style exactly.**

Writers do it too. (James Joyce constantly changed styles in Ulysses, but he was just showing off.)

I don't know how much of this is in the nature of a person and how much can be nurtured. It comes down to curiosity and playfulness mixed with an awful lot of work. There has to be a certain attraction to doing things differently, but if you don't you get stuck in two dimensional thinking.

*Breathe in. Breathe out.*

The very flexibility of the mind can be a trap, because once the brain figures out how to do something it prefers to keep on doing it that way, because it is easier. The brain loves a pattern. The connections are strong and the course of least resistance is through them. The first time you sleigh down a hill you could go anywhere, but after a few times there is a trail in the snow and unless you steer out of it you just dig it in deeper until it is a rut. When it comes to thinking a rut is a grave that you forgot to cover over...
You can get fixity of thought, fixity of movement and you stop coming up with thoughts of your own. You just parrot others.

"Older people fall into rigid patterns. Curiosity, risk, exploration are forgotten by them."

- **Anais Nin**

And people start to get old in their 20's.
**Picture of me.**

If it is better to think and explore and experiment, why do so many people engage in mindless activities? If it is better to move and exercise, why do only 25% of people do it?
Energy.
All kids play. All kids are curious. That playing and exploring takes a lot of energy, which kids have in abundance.

But play and exploration cost calories and calories have been traditionally hard to come by. Since the dawn of time people have had to deal with scarcity and famine every few years. Rains fail. Herds move away.

*Dream of the pharaoh*

Who can survive the hard times? People who don't spend any more energy than necessary. Muscle and bone is costly to maintain and heavy to drag around. The body is constantly looking to trim you down to the least muscle and bone mass you need on a daily basis.

*Space station*

In space you start to get muscle and bone loss after 72 hours. Their bodies adapt to a weightless environment by doing away with the muscles and bones to such a point that when they return from the space station they have to be carried off the capsule on a gurney.

*Person being carried off the space station.*

**If you don't work out your body will adapt** to the least amount of infrastructure you need on a daily basis. That's why you have to work out twice a week just to maintain. If you want big muscles and bones you have to convince the body you need them by putting a strain on them. Then the body thinks you need more muscle and bone and supplies it. Someone with a lot of muscles burns more calories, even in sleep than someone who doesn't. One of the reasons it's easier to keep the weight off when you have a lot of muscle.
**The body loves fat instead**. Fat costs almost nothing to maintain and is an energy reserve to boot so it's a win/win for the body. So while we would like to be thin and muscular our bodies would prefer if we were fat and atrophied. You have to fight your own evolutionary lazy tendencies to be trim.

Our lifestyles used to do it for us. It is estimated that our old hunter gatherer ancestors walked about 7 miles every day pickin' up nuts and berries.

**Yogi bear**
If everybody still walked 7 miles every day to scrounge up about 1600 calories (if they were lucky) there wouldn't be any obesity.

*Breathe in. Breathe out.*

Another costly activity is thinking.
**Chess Alexandra Kosteniuk**
Chess masters can plow through 6000 calories a day just sitting at the board thinking. That's the same calorie burn as a lumberjack.

**lumberjack picture.**

Thinking is hard to do. It's costly. Exercise is hard to do. It's costly. So the next time you feel lazy and you don't want to exercise and you don't want to think don't be hard on yourselves. You are obeying an evolutionary impulse to save energy.

**homer at the plant**

The problem is, we have become so successful at attending to this impulse that our bodies and brains are atrophying. While being passive mentally and physically saves energy, we eventually get weaker.
Think of the problem of dinner. We are no longer compelled to do much exercise or problem solving.

**DINO Picture.**

Back in the day you'd have to search far and wide to get enough nuts and berries to get the job done. Or you'd have to figure out what stones you could use to sharpen other stones so you could tie them to a stick and chase after some animal who was likely to stomp on you if you didn't do it right.

Now dinner involves an app and a phone call. No exercise, no problem solving.

It is always easier to watch then to do, and that is what the way our time goes. Even reading is too much work for most people. NYC used to be the most literate city in the world, probably because everyone was stuck on the trains.

**Old picture of subways with everybody reading**

When I was a kid, everybody used to be reading, and that is exercise, even if you are reading trash. You still have to use your imagination. Think of the word; images in motion. Now you don't have to do that. Images are supplied. Now everybody is on their phones passively watching, and doing nothing as their brains atrophy. Watching sports instead of playing sports, playing candy crush instead of doing the crossword, looking on social media to see what everybody else is doing, without doing anything ourselves.
Most people would rather watch the game eating nachos then play the game. Otherwise they'd be playing the game. For every person out there still reading, there are a lot that prefer watching mindlessly and learning nothing.
This makes sense, from an evolutionary perspective. The herd needs to conserve energy, so most people are lazy which is usually a good strategy. It only takes a small percentage of the population are restless and driven. They will do all the science

*Franklin and Key*
*and art lin manual*
*and inventing  kitty hawk*
*and thinking Shakespeare*
*while everybody else is watching the game.*

Every great idea and invention and artwork was done by a doer, not a spectator. However for every success story they make movies about there are about a thousand **that go nowhere**. To go up against those odds you need a lot of drive, restlessness and perhaps a bit of a delusion that you can make it. It's a lot of work, and it's a risk in time, in effort, in money.

How many doers are there and how many watchers? To gauge the percentage, look on the subway. How many people still choose to read when they have other, easier choices? Which is more popular? Painting, writing and inventing or candy crush, Netflix, and social media? How many people work out when everybody knows it's good for you? 10% 25%

Everybody needs downtime. Parks and Rec. is my own guilty pleasure. The problem is we have created so much easy downtime that many of us have fallen out of the habit of physical action and social interaction. Now you can fill your life with leisure activities where you learn nothing.

Or you can spend your time differently.

**Yuja Wang Pianist**

Every technology gives us things and takes things away. Before recorded sound to hear music you'd have to go to a concert or make it yourself. The result, almost everyone played a musical instrument of some kind. Now you can hear the best of anything you want. That's great. But very few people learn an instrument. That's a loss. They never get to experience the joy they can give to themselves and others by sharing their own creation.

Since action is good for you good for you there are rewards. Once you overcome the inertia and start a workout you feel better. If you start doing crosswords or practicing an instrument or gardening or home improvement or any kind of problem solving you get into it. Your reward system starts to value the activity you release neurotransmitters that make you feel good; the runner's high, the joy of accomplishment.

*"I don't like writing. I like having written."*

Sometimes there is a certain amount of slogging you have to get through but the reward system is there too. That determination to keep on going is a personality quirk you need to do anything hard.

The difference between brushing your teeth and playing an instrument (for example) is time. Two weeks to really be a pro at brushing your teeth. Figuring two minutes, twice a day – total time, maybe 56 minutes to be a toothbrush virtuoso.

There are more moves to learn in playing a piano, and an almost limitless number of musical pieces learn. About 3 hours a day, every day, for ten years. 10,000 hours

**Yuja Wang Pianist**

10,000 hours laying down all the patterns to do this. Her hippocampus must be amazing. Activities that require concentration make you better at concentration. Trained musicians are much better at tuning out distractions then people without such discipline, and the more training they have the better they are at it. Musicians have the best memory in the world. "Efficiency of attentional networks in musicians and non-musicians," by Paulo Barraza, PhD, and David Medina, BMEd in *Heliyon* volume 5, issue 3 (March 2019), published by *Elsevier*.

**doi:**
10.1016/j.heliyon.2019.e01315

*Breathe in. Breathe out.*

**MEMORY**
I mentioned riding a bike earlier. Training to be a cab driver in London requires you have to visit every street in London on a bicycle.

*BM Google earth.*

Shot of a London Street, then a slow pullback to encompass the whole city.

It takes two years. During that time the hippocampus gets bigger because it is building so many synapses. The hippocampus is the brain structure that builds memories and recreates them on demand.

**hippocampus1 and 2.**

Human memory is not at all like a computer. In a computer you have a digital file located at an address on the hard drive, the file name. When you type in the address the computer retrieves the file and opens it.

**hard drive.**

In a process we don't fully understand, the hippocampus sends pieces of our experiences to different parts of our brains, and then when we want to recall them it grabs that information from all those parts and recreates the memory.

**Corona radiata.** Image of hippocampus sending things to different places.

Different parts of the brain are specialized for movement, touch, sound, vision, ,hearing, procedure and that aspect of our experience is stored in those places.

Think about the last thing you ate or drank. Think about the flavor. Think about how it looked. How it smelled. Was it warm or cold? Did you use a fork? Was it in a cup? All those different parts of that experience are located in different areas of the brain. You've just recreated a memory and now you can hold it in your mind's eye. However, if it is something you eat all the time, that memory is probably filled in (corrupted) by all the other times you ate it. Unless it is something novel, memories do bleed into each other.

And that's the trouble with remembering where you parked your car.

*Parking Lot*

Memory works pretty well but since it is a recreation not a copy it is subject to error and influence. Similar memories can seep into each other. You've parked so many times in so many similar situations they all get run together.

Also false memories can be planted unless you are very careful. Remember the popular vote and being swayed by a crowd. A famous example of this was the psychologist Piaget, who had a vivid memory of being abducted along with his Nanny. Years later she confessed that she made up the whole thing. He no longer believed the memory, but he still had it. Research reveals that this sort of thing is quite common, people hearing stories and then having memories that they were there.

Even worse, we lie to ourselves. If two people have an argument they will often end up with different memories – which become different realities - of who said what to whom. If you show them a tape of the argument they will often both be surprised.

***Usual suspects***

Police line ups have been changed due to this. They used to lineup the suspects together. Since someone on that lineup is bound to look more like the perpetrator than others, you end up with a person being accused whose only crime is to look more like the perpetrator than anyone else on the line up. Now police show the suspects one at a time so the person has to determine is this one person I am looking at the perpetrator or not?

People have gone to jail or been executed because of definite eye witness testimony, later proven to be a mistake (by DNA evidence for example). Another distortion in law is that the more serious the crime, the more likely the jury will believe the evidence for conviction. Fingerprints found at a murder get more weight then fingerprints found in shoplifting.

While it is unnerving to know how shifty memory can be, it is useful information. The next time you are in an argument, be careful about what you think you remember, and what you think you know. On the bright side, the person across the table is just as likely to be wrong.

Also, the plasticity of memory is essential for the artistic process. Almost everything created comes from something that already exists. Close your eyes. Think of the Empire State building. Now think of a giant bagel on the top. What kind of bagel did you make it? Plain, sesame seed, everything. Imagination.

***Ninja Homer***

But wait there's more. We do this kind of memory construction on our personal selves, picking and choosing memories that support our adopted sense of self and discarding memories that don't match our personal self-narrative. To thine own self be true turns out to be a very hard thing to do. https://neurosciencenews.com/real-you-myth-9894/

On the bright side, plasticity can also lead to openness. It used to be thought that individual and societal biases were ingrained. Over the last ten years, the overall trend in the US is toward less bias toward groups based on color, gender, gender orientation, and religion. This is based on 4

million tests on attitudes given over 14 years. It is likely the haters have become more vocal because of insecurity. So while you are seeing all that negative stuff on the news remember that both conscious and unconscious biases are declining across all groups and ages. Millennials are especially open minded, encouraging since they show the way things are going.

"Patterns of Implicit and Explicit Attitudes: I. Long-Term Change and Stability From 2007 to 2016" by Tessa E. S. Charlesworth and Mahzarin R. Banajiin *Psychological Science*. Published January 3 2019.
**doi:**10.1177/0956797618813087

This new knowledge is in accord with what we already know about the body. We think it is stable, but that is an illusion. Every second 2 million blood cells are being destroyed and created. As I speak there are crews of osteoblasts and osteoclasts reforming the inner structure of your bones to adapt to the stresses you put on them. Your skeleton has been replaced from the one you had two years ago and will be replaced again and again. Even you heart, and you can't get more central then that, is being replaced, cell by cell and beat by beat. It should not surprise us therefore that our memories, our beliefs and our perceptions are open to change. Don' try to change everybody else. Change yourself. Don't be trapped by your own narrative. As you navigate through each day, make sure the choices you make reflect the kind of person you want to be, and you will move in that direction.

***Cary Grant*** said, "I kept making believe I was the person I wanted to be until I became that person.

*Breathe in. Breathe out. 5 times with them.*

**Muscle tone and emotion**
Emotions and muscle tone are also plastic and open to manipulation.

Breathing. I've had you breathe through this seminar as a break, for posture, but also to keep you fresh. It alters the emotional state.

Xanax is an anti-anxiety drug and a muscle relaxer. How does that work? Reducing physic stress allows the muscles to relax. Or relaxing the muscles trough drugs or massage will relax the mind. The systems have a profound effect on each other. It used to be thought that myofascial stokes caused melting of the fascia. Not so. Myofascial strokes cause hydration of the fascia mostly by stimulating the parasympathetic nervous system. That in turn relaxes the smooth muscle in the fascia. Smooth muscle is not restricted to organs and blood vessels. Countless individual smooth muscle cells are found throughout the fascia. When you are tense, it's not just your muscles that get tight. Your fascia does too. It's like body armor. When it's tight like that it squeezes the water out of itself leading to adhesions, contracture and all kinds of problems. Everything is just too tight.

Let's fix this right now with PNF; reduce the tone, relax the emotions, hydrate the tissues so you can lead your client to a point where they can heal themselves.

*Breathe in. Breathe out.*

**This just in: Memory, learning, perception**

**-Texting fail** Multitasking does not exist. Big data reveals that people who engage in social media while studying (or walking or driving or listening to science lectures) do not do well and the more they are on their phones, the worse they do. People think they can multitask but what actually happens is you switch attention back and forth. When you study a topic, it takes time – uninterrupted time - to sink in. Say you are studying the muscles of the shoulder. All that info is in the cloud – the brain cloud we call short term memory. It's an unstable place that's always changing. If you keep at it those muscles will end up in long term memory and you will always have them. But PING, oh cool, look what your friend just instagrammed. Their dinner. In order to process that your short term memory just dumped everything you were doing. You think you covered it, but it never made it into long term memory. If you are struggling, turn your phones OFF.

https://doi.org/10.1016/j.chb.2012.10.011

-A separate study revealed **-women 18 – 25** who spend time on social media looking at women who they think are better looking than them come away with an even more negative body self image.

"The effects of active social media engagement with peers on body image in young women" by Jacqueline V. Hogue and Jennifer S. Mills in *Neurology*. Published November 12 2018.

**doi:**10.1016/j.bodyim.2018.11.002

**-**A growing body of evidence indicates an inverse proportion between social media use and the nucleus accumbens, a reward center in your brain. The more social media, the smaller the reward center. https://doi.org/10.1016/j.bbr.2017.04.035

-Another problem with social media is it is basically competitive. People are competing for attention and will put on images and reports that are a bit like salesmanship. What people post is framed in a way to be more glamourous than what they are actually doing.

-A solution to this problem is more interaction with the real word a.k.a. doing stuff, especially if it has a rich physical interaction; getting out into nature, cooking, knitting, gardening, painting, exercise, playing a musical instrument, playing with your dog. Even the simple act of making your own bed can have a big impact. Many of the solutions to reduce stress already suggest this; (Exercise, getting out into nature for 20 minutes a day, social activities)

Smart phone dependency lead to depression, no the other way around.

**Groucho** -Developing a sense of humor goes along with playfulness (playing with ideas). We need more of this at school, at work, everywhere.

**Kid reading** - reading fosters connections in the brain between auditory areas and visual recognition areas, raising all boats for language and imagination.

https://doi.org/10.1002/dys.224

-The single best way to learn something is by reading it aloud.

**Goodnight moon**-Baby electronic toys are associated with poorer language development then traditional toys and baby books, even toys marketed as educational. In a controlled experiment, babies with electronic toys had less verbal interaction with their parents and learned more slowly. Children vocalized less. Baby books worked the best with parents and children vocalizing a lot.

"Association of the Type of Toy Used During Play With the Quantity and Quality of Parent-Infant Communication" by Anna V. Sosa, PhD in *JAMA Pediatrics*. Published online December 23 2015 doi:10.1001/jamapediatrics.2015.3753

**Dog reading book**-Dogs do know words. Especially border collies. 300.

**Dancer**-brain neurons synchronize with the rhythm of music, which is why we love to dance. etc

**Homer sleeping again**-sleep loss causes an epigenetic change in adipose tissue, which increases, and muscle tissue, which is broken down. There is a decrease in glucose sensitivity in the AM which increases diabetes. It also causes inflammation. There is an increase in obesity and diabetes in shift workers.

A separate study discovered that the same neural mechanism controlling Inflammation controls the circadian rhythm. Disruption of this mechanism causes sleep disorders similar to that experienced by shift work, impairing the body's ability to fix itself at night. The circadian rhythm is set by epigenetic brain changes, among these a molecule called NF-kB. Activation of NF-kB by inflammatory stimuli inhibits clock repressors, disrupting the circadian clock circuitry. We used to think getting better sleep helped with inflammatory disease. It may be the other way around. This is another reason massage may be beneficial for inflammatory disorders like autoimmune and arteriosclerosis and diabetes. By decreasing inflammation, massage may improve sleep. Sleep is when the body repairs itself. Sleep that doth mend up the raveled sleeve of care.

**Macbeth** – Anxiety and depression may be just as bad for health as smoking and obesity. In 15,000 adults tracked over a four year period those with anxiety and depression had an increased incidence of 65% for heart condition, 64% for stroke, 50% for high blood pressure and 80% for arthritis then those without those disorders. (Cancer showed no correlation.)

"Comparing anxiety and depression to obesity and smoking as predictors of major medical illnesses and somatic symptoms" by Niles, Andrea N.; and O'Donovan, Aoife in *Health Psychology*. Published December 17 2018.

**doi:**10.1037/hea0000707

**Confused MD**-sleep deprivation causes procedural memory failure (ie, if you are doing something and you get distracted, you can't remember where you left off – bad for surgeons and flight controllers.)

**musical score**. Sleep important for memory consolidation. Pianists were given a new piece of music to practice in the AM. Then half of them were allowed to take a nap and half of them were not. The half that napped were able to play the piece better in the evening then the half who had not napped BUT they caught up in the morning. Moral of the story – cramming the morning of a test is pointless. In addition, the brain only remembers things it thinks are important, even if it didn't seem important at the time. In an experiment people were shown mundane images and tested on them later. Some were rewarded with a dollar near the time they saw some images. The memory close to the reward was better than the memory far from the reward, but only the next day (after sleep). So there is some sorting and choosing going on at night.

**Ventricle picture** Neurons shrink at night allowing the blood vessels and Ventricles to expand. An accumulation of Beta Amyloid and Tau proteins, which are linked to Alzheimer's and Parkinson's build up during the day as byproducts of neural activity. They are removed during the day but the circulation falls behind. Every night, like the tide coming into Venice, the blood vessels and Ventricles expand and the Cerebrospinal fluid washes away these proteins, leaving you to start every day with your canals nice and clean. **(Possible reason of CST effectiveness**)

Side note on Aristotle's greatest mistakes.

**Cavanaugh handicapped pic** . Drawing is the best way to encode memory (encoding and recall). People given a list of words were asked to write them or draw them or list attributes of them. Those drawing did much better. Very helpful for A & P.
"Drawing as an Encoding Tool: Memorial Benefits in Younger and Older Adults" by Melissa E. Meade, Jeffrey D. Wammes & Myra A. Fernandes in *Experimental Aging and Research*. Published October 9 2018.
**doi:**10.1080/0361073X.2018.1521432
**Student with book on head cartoon.** Students who met 8 hour sleep challenge did 4 % better on finals. That's 8 hours for 5 nights of finals week. The students were offered bonus points as an incentive and wore wrist devices to monitor their sleep. If practiced all semester long, that's the difference between a 66 average and a 70 average.
Baylor University"Students Who Meet 8 Hour Sleep Challenge Perform Better On Finals." NeuroscienceNews. NeuroscienceNews, 3 December 2018.
<http://neurosciencenews.com/8-hour-sleep-students-120197/>.

Drugs, and junk food.
**Guy Drunk**- hardly new but binge drinking (5 drinks for men, 4 for women in 2 hours) is bad for you. Not only causing blackouts but long term damage to the hippocampus, the seat of memory. Brain damage to the prefrontal cortex leads to rewiring and dysfunction, even when sober, setting up impulses to engage in more risk taking behavior, and inferior interpersonal skills.
https://doi.org/10.1016/j.ypmed.2004.04.044
**Picachoo**, alcohol (and other addictive drugs) can alter memories so you remember the good (having fun with friends) more than the bad – (hangover.) The memory distortion will fade after an hour with one glass of wine but takes more than 24 hours with 3 glasses in 3 hours.
**Crazy smoker**-early smoking and drinking linked to dementia
<http://neurosciencenews.com/smoking-dementia-9809/>.
**Smoking Dad**-nicotine in men causes epigenetic changes in sperm leading to more ADHD, hyperactivity and cognitive inflexibility for children and even grandchildren. In women these effects have already been documented.
https://dx.doi.org/10.1371/journal.pbio.2006497
**-broken cig**. New enzyme breaks down nicotine in the blood before it reaches the brain, reducing nicotine dependence without causing withdrawal symptoms or cravings. Also minimal side effects since it works in the blood, not the brain and less recidivism.
**-BobMarley**-THC upregulates receptors that downregulate inflammation in the brain.
**-** ***Eden Express*** unless you have a genetic mutation making you vulnerable to schizophrenia. In that case marijuana can cause inflammation that can tip you into schizophrenia and it can cause cognitive defects. This explains why some people can smoke in adolescence without harmful effects while others cannot.
"Adolescent Δ9-Tetrahydrocannabinol Exposure and Astrocyte-Specific Genetic Vulnerability Converge on Nuclear Factor-κB–Cyclooxygenase-2 Signaling to Impair Memory in Adulthood" by Yan Jouroukhin, Xiaolei Zhu, Alexey V. Shevelkin, Yuto Hasegawa, Bagrat Abazyan, Atsushi Saito, Jonathan Pevsner, Atsushi Kamiya,and Mikhail V. Pletnikov in *Biological Psychiatry*. Published August 17 2018.
**doi:**10.1016/j.biopsych.2018.07.024

-***Also*** heavy use can lead to addiction and withdrawal in some- typically those with other substance abuse vulnerabilities (about one in 5 people). Pot is 3 times stronger than it used to be. We've gone from pot being demonized to being seen as totally safe. The truth, as usual, is in between. Heavy use, especially in teens and preteens does cause memory problems. Since the brain is not complete in women until the age of 20 and in men until 25, we don't know if the memory problems will be permanent.
Iowa State University"Higher Average Potency Cannabis Increases Risk for First Disorder Symptom." NeuroscienceNews. NeuroscienceNews, 17 December 2018.
**Squirrel suit** – the last part of brain development is in the frontal lobes, which are responsible for judgement and restraint. This explains a lot about high risk behaviors that men under 25 engage in which they usually outgrow (if they live past 25) Also their driving. The connection between actions and consequences comes late in men. Could be an evolutionary explanation for this.
-Also marijuana use in pregnancy linked to slightly higher rated of psychosis in children by 10yrs.
**Dog in pot field** THC because of a viral infection millions of years ago. (decoding the genome)
**Dual snakes**-Speaking of drugs, DMT, the active ingredient in Ayahuasca promotes near death experiences.
-***And*** micro dosing psychedelics does increase creativity says new study (from the Netherlands). A follow up study confirmed the findings but also found increased neuroticism after 6weeks of continuous dosing. Clearly more work is needed. The Conversation"Does Microdosing Improve Mood and Performance?." NeuroscienceNews. NeuroscienceNews, 11 February 2019. <http://neurosciencenews.com/microdosing-mood-performance-10723/>.
**- Special K** In a correlational study of 41,000 pain sufferers people using ketamine as a painkiller had 50% less depression as compared to people using other painlkillers. K promotes dendritic spine development ffrom a single use. FDA has cleared a nasal spray version for depression.
UCSD "Study Reinforces Ketamine's Reputation as Antidepressant." NeuroscienceNews. NeuroscienceNews, 3 May 2017.
<http://neurosciencenews.com/ketamine-antidepressant-6569/>.
**Shakespeare** Nothing good or bad but thinking makes it so. People suffering from PTSD or phobia's can imagine the bad thing in a safe setting. Doing this repeatedly with nothing bad happening desensitized the person to whatever had been triggering them. The stronger the imagination, the greater the effect.
"Attenuating Neural Threat Expression with Imagination" by Marianne Cumella Reddan, Tor Dessart Wager, and Daniela Schiller in *Neuron*. Published December 6 2018.
**doi:**10.1016/j.neuron.2018.10.047
**-Rt side of brain** again identified for creativity by inhibiting old ways of thinking with alpha waves. Useful when you need to come up with a novel solution.
In this wonderful 12 minute presentation, "The Divided Brain" Iain McGildchrist talks about the very different perspective the two halves of the brain have and the way they work together - or not. His point is that a lot of the problems of the world are caused by a narrowing perspective.
www.thersa.org/discover/videos/rsa-animate/2011/10/rsa-animate---the-divided-brain

**Media Influence**
**-WTF**-ai can pick out depression from speech and bipolar from FB comments.

https://www.ted.com/talks/zeynep_tufekci_we_re_building_a_dystopia_just_to_make_people_click_on_ads/up-next
**-Liberty with burka** - herd mentality works in memes. A prejudicial meme is more likely to be believed as true if it got more likes, especially if the source is already one that you associate yourself with, like a political party. And of course the number of likes can be manipulated. Social scientist put this up with varying stats for likes to see what the reaction would be. <http://neurosciencenews.com/meme-belief-120186/>.
**Fox NEWS -** Newspaper articles and TV and radio broadcasts which imply coincidences and connections without proof are enough to lead people to believe false information. If the error is corrected with factual information before it is ingrained, the person can correct the mistake.
**-Wonder Woman** – Male superheros 5 times more violent than female superheros and more violent then villains. On the other hand, superheros are positive social role models and exposure to them does make people more prosocial. People who did experiments with a superhero poster on the wall were much more likely to help other people with tasks during the experiment.
**- Luke skywalker hand** A neural implant the size of an aspirin implanted in your brain can download motor thoughts to a Bluetooth which can then control a wireless mouse, enabling quadriplegics to use tablets to search the web and control robotic arms. Braingate technologies. "Cortical control of a tablet computer by people with paralysis" by Paul Nuyujukian, Jose Albites Sanabria, Jad Saab, Chethan Pandarinath, Beata Jarosiewicz, Christine H. Blabe, Brian Franco, Stephen T. Mernoff, Emad N. Eskandar, John D. Simeral, Leigh R. Hochberg, Krishna V. Shenoy, and Jaimie M. Henderson in *PLOS ONE*. Published November 21 2018.
**doi:**10.1371/journal.pone.0204566

Foods:

**Brain Fog-**probiotics can delay return to normal biome and cause "brain fog." Best advice is to eat a balanced diet.
http://neurosciencenews.com/probiotics-brain-fog-bloating-9659/
**-artificial sweeteners** and sport supplements containing them are toxic to gut bacteria , and some are carcinogenic
https://dx.doi.org/10.3390/molecules23102454
**- clinincal depression** linked to gut bacteria that makes insufficient gaba (an inhibitory neurotransmitter which probably communicates with newly discovered cells in the small intestine which then comm to the to the vagus and thence to the brain. It may be treatable by making a better biome.
http://neurosciencenews.com/bacteria-clinical-depression-10323/
**-Burger/fries/coke-** Junk food, known to cause inflammation, also causes depressionand cognitive decline. In an international metaanalysis of over 100,000 people, those with a diet of fast food, cake and processed meat had a 40% greater likelihood of depression. Junk food damages the perineuronal nets which protect neurons. Study is need to see if a Mediterranean diet can decrease depression. (maybe by improving the biome)
"An anti-inflammatory diet as a potential intervention for depressive disorders: A systematic review and meta-analysis" by Katie Tolkien, Steven Bradburn, and Chris Murgatroyd in *Clinical Nutrition*. Published December 18 2018.
**doi:**10.1016/j.clnu.2018.11.007

-**And we have it -** An analysis of data from almost 46,000 people has found that weight loss, nutrient boosting and fat reduction diets can all reduce the symptoms of depression. None of the diets were highly specialized; they basically avoided junk/processed food and refined sugar in favor of more veggies and grains. Women had even more benefit then men (Don't know why) and when the diets were combined with exercise the results were even better.
"The effects of dietary improvement on symptoms of depression and anxiety: a meta-analysis of randomized controlled trials" by Joseph Firth; Wolfgang Marx; Sarah Dash; Rebekah Carney; Scott B Teasdale; Marco Solmi; Brendon Stubbs; Felipe B. Schuch; André F. Carvalho; Felice Jacka; and Jerome Sarris in *Psychosomatic Medicine*. Published February 5 2019.
**doi:**10.1097/PSY.0000000000000673
**-Also** 70 % of processed foods have inorganic phosphate which interferes with muscle metabolism, making it harder to exercise and more likely to be a couch potato. Processed meats and frozen foods and sodas have this. Organic phosphate is not absorbed by the gut, but inorganic phosphate is. For example, parmesan cheese has organic phosphate, but commercially grated parm may also have inorganic phosphate to prevent sticking. Avoid foods with calcium phosphate, disodium phosphate or monopotassium phosphate
"High-Phosphate Diet Induces Exercise Intolerance and Impairs Fatty Acid Metabolism in Mice" by Poghni Allen Peri-Okonny, Kedryn K. Baskin, Gary Iwamoto, Jere H. Mitchell, Scott A. Smith, Han Kyul Kim, Luke I. Szweda, Rhonda Bassel-Duby, Teppei Fujikawa, Carlos M. Castorena, James Richardson, John M. Shelton, Colby Ayers, Jarett D. Berry, Venkat S. Malladi, Ming-Chang Hu, Orson W. Moe, Philipp E. Scherer, and Wanpen Vongpatanasin
in *Circulation*. Published January 7 2018.
**doi:**10.1161/CIRCULATIONAHA.118.037550
**-Crispy crème box**-High sugar diets suppress gut bacteria that can process raw vegetables seen in healthier diets. It was long thought that sugar never reached the gut, having been absorbed as a nutrient in the small intestine. However, if there is enough concentrated sugar in the diet it reaches the colon and influences the biome.
"Dietary sugar silences a colonization factor in a mammalian gut symbiont" by Guy E. Townsend II, Weiwei Han, Nathan D. Schwalm III, Varsha Raghavan, Natasha A. Barry, Andrew L. Goodman, and Eduardo A. Groisman in *PNAS*. Published December 17 2018.
**doi:**10.1073/pnas.1813780115
- **Sugar addiction is real.** Pigs showed significant changes in their opioid and dopamine reward centers after the first day of being given sugar water. Changes were even greater at the end of the 12 day trial. This by a researcher who was trying to dispel the idea that sugar works like a drug. https://doi.org/10.1038/s41598-019-53430-9
-Consumption of junk food while pregnant may contribute to autism by increasing levels of PPA, a preservative used to increase shelf life.
-Consumption of junk food while pregnant may contribute to autism by increasing levels of PPA, a preservative used to increase shelf life. https://doi.org/10.1038/s41598-019-45348-z
-Su**garloaf** mountain – As cigarettes kill you with cancer, sugar kills you with diabetes, which is now epidemic. There are many parallels between the two industries in manipulating science to move more product. In 1968 the sugar industry learned through their own research that sugar increases triglyceride levels by interfering with gut bacteria. Naturally they did not publish their own findings. Instead they funded research to support the safety of sugar. In a review of 60 studies on the link between sugar and diabetes, of the 26 studies that found no link, all were funded by the soft drink industry or conducted by people financially tied to it. Of the 34 studies

that found a link, only one was funded by big cola. If you are looking at the whole body of work, it looks like a 60/40 split in the evidence, but if you eliminate the studies funded by big cola, 100% of the studies found a danger. 2/3 of the country is now overweight.
UCSF "Sugar's Sick Secrets: How Industry Forces Have Manipulated Science to Downplay the Harm." NeuroscienceNews. NeuroscienceNews, 12 January 2019.
<http://neurosciencenews.com/sugar-industry-harm-10515/>.
-**Sherlock Holmes** Mice on a high fat diet gave birth to mice with Aspergers and low levels of lactobacillis ruteri bacteria in the gut. When the bacterial level were restored, the Asperger's improved. The bacteria stimulates the vagus nerve which releases oxytocin which promotes social interaction. (This may be the same way massage creates a feeling of the warm fuzzies. It could also be the mechanism through which massage has been found to decrease the anxiety and negative emotional impact of Alzheimers.)
**-Cezanne drinking coffee** Phenylindane 6, created in the roasting process prevents B amyloid and tau protein fragments from clumping as seen in Alzhiemers and Parkinson's. The darker the roast, the better. Decaf is ok. Maybe this is why we see less incidence of these diseases in coffee drinkers.
- **Also** developing brains of preterms benefit from caffeine therapy. It is the second most used drug in Nicu's after antibiotics.
-Brain damage from heavy metals is down but from fire retardants and pesticides is up costing an estimated nine million IQ points a year in US. Cost of care and loss to the economy estimated at 7 trillion dollars. Regulation of these toxins would be cheap in comparison.
https://doi.org/10.1016/j.mce.2019.110666

Miscellaneous:
**uterus kicks brain.** – Women who have hysterectomies sometimes have memory problems, especially if the hysterectomy occurs before natural menopause. Hormones? Arizona State University"Hysterectomy Linked to Memory Deficits." NeuroscienceNews. NeuroscienceNews, 7 December 2018.
<http://neurosciencenews.com/memory-hysterectomy-10313/>.
**Nfl PIC**- Brain damage from playing football (no data on watching it though). College players express markers for brain injury before the season begins, indicating lasting injury from previous seasons. Even players without concussion had injuries (subclinical concussion) Even high school players are showing a weakening of white matter and changes to grey matter in direct correlation to the location and frequency of getting hit as recorded by their helmets. These too with subclinical concussion. Also alterations in the corpus callosum from another study."Elevations in MicroRNA Biomarkers in Serum Are Associated with Measures of Concussion, Neurocognitive Function and Subconcussive Trauma over a single NCAA Division I Season in Collegiate Football Players" by Dr. Linda Papa, et al, *Journal of Neurotrauma*. Published October 20 2018
**-Split screen of scary movie and yogi on a lotus** -scary movies and haunted houses make people feel better by decreasing brain activity. It is a stimulation in the protective frame of entertainment. The scarier the better. With friends better, it intensifies the experience. EEG indicates similarities to people who practice mindfulness meditation. It probably takes the default mode network offline.
**-Person sneaking up on another Sensory gating**. The strength of the perception of a stimulus is controlled. For example, when you reach out to touch something your perception of the touch is

downregulated because you expected it. One reason it is hard to tickle yourself. A surprise touch of the same strength is perceived more strongly. Gating is controlled by the cortex which acts on cord and brainstem.
**Dentist pic**-Expectation of pain leads experience of pain. When people expected a painful stimulus the pain and fear centers of their brains showed increased activity, increasing the sensation of pain even when the stimulus delivered was not painful. Also their objective learning was impaired. If they got a high pain symbol followed by a mild stimulus, they anticipated high pain again even though the symbol was known by example to be false. No learning.
**- Selfish people** make less money and have less kids – possibly due to better social engagement of nice people
http://neurosciencenews.com/selfish-reproduction-earnings-10040/
**-Hannibal Lecter** – Is your SO a socio? 1 in 100 is a sosciopath, the same percentage of the population as teachers. While many criminals are often sociopaths, most sociopaths are not criminals. Their careful attention to detail can make them very successful. Things to look out for; narcissism, pathological lying, especially if covered up by charm, inflated feeling of self worth and a tendency to undermine other people's self worth, throwing a hissy fit when they don't get their way, followed by sad puppy eyes – anything that works, also a lack of remorse. Psychopaths are further along the spectrum and have a complete absence of remorse.
**- Wishful thinking** influences judgement. In decision making, as soon as a choice is preferred the reward system kicks in, lowering the influence of negative information re the choice. Basically, the brain overvalues info to support its choice and undervalues negative information about the choice, making it difficult to change an already formed opinion.
**-Exercise picture** Osteocalcin, a hormone released by osteoblasts during bone building reverses memory loss in an ageing brain by activating proteins which prop up the hippocampus. Exercise increases osteoblast activity. That may be part of the reason exercise has been found to reduce and even reverse memory loss.
**-Dog on treadmill** – But he doesn't believe it.
**-piano notes** Higher levels of theta wave activity before a task associated with better learning. Theta waves can be entrained by devices which cause increased theta activity even ½ hour after they are switched off.
**-Picture of the Grinch**- Plasticity works for personality traits. It is known that people who feel gratitude tend to be more altruistic. The reward center in their brains makes them feel better neurochemically then someone who is less grateful. Basically the reward center values altruism and rewards you for it. In an experiment, people who journaled gratitude every day felt more grateful over time and also felt better about doing altruistic things. These people became more supportive of others and had improved relationships. From the Greater Good science center. Maybe it really is better to give than to receive. It occurs to me that this works the other way too. People with depression have circular, negative thinking patterns that makes their world subjectively darker. In another study, people in therapy who were assigned grateful writing exercises had significantly improved mental states both 4 weeks and 12 weeks after the conclusion of the writing assignment then those who were assigned creative writing and those who did not have a writing assignment.
Expanding the Science and Practice of Gratitude Project through UC Berkeley's Greater Good Science Center

-***Limbic system***. Inhaling through the nose enhances memory by stimulating the olfactory nerve which is connected to the limbic system, your emotional brain. You remember something better if you were inhaling rather than exhaling. Brain activity varied with breathing rhythm.
**-Electrostim** OC disorder maybe caused by insufficient wiring betweeen the cingulo opercular network, which detects that something is not right, and the frontal lobes which are involved in executive function to stop aberrant behavior. The anxiety associated with the disorder might just be an artifact because people are aware that they are doing something wrong, but cannot stop it. This may be a good target for electrostim. (OC is being reconsidered as not an anxiety disorder) "Single-Neuron Correlates of Error Monitoring and Post-Error Adjustments in Human Medial Frontal Cortex" by Zhongzheng Fu, Daw-An J. Wu, Ian Ross, Jeffrey M. Chung, Adam N. Mamelak, Ralph Adolphs, and Ueli Rutishauser in *Neuron*. Published December 4 2018. **doi:**10.1016/j.neuron.2018.11.016
- **Further** research indicated this network in the frontal lobe changes its wave frequency when a mistake is made, but at different intensities. A stronger wave change communicated with other parts of frontal lobe and was predictive of changing behavior (like slowing down and focusing) to make less mistakes. A weaker change indicates that the mistake was registered, but it didn't alter behavior. It could be that we gauge the magnitude of a mistake and there is a judgment call as to whether it is big enough to merit a change in procedure.
**-unilateral electrostim** of the effective for depression. This is done with implanted electrodes. It changes brain scans to match people in a good mood. It remains to be seen if the effects are long lasting and can use DBS. Note how happy this picture is because it is part of marketing.
-***Bayesian face*.** Perception and figuring out the world. When the mind is faced with uncertain information/situations, it will rely on past experience to work through it. If you are in a dark room looking for a light switch, you will put your hand near a doorframe at a given height, because that's where switches are likely to be. This also works with complicated tasks like writing your name so it can appear in a mirror. The brain may also use regional mapping to connect concepts, such as knowledge of a lion and a tiger allows you to infer qualities of leopards even if you haven't seen one before.
-***the language center***s works the same way. They know what sounds are associated with language and focuses attention on those, often figuring out the word before you actually hear it completely. "Late Bayesian inference in mental transformations" by Evan D. Remington, Tiffany V. Parks & Mehrdad Jazayeri in *Nature Communications*. Published October 24 2018
-It is the smell **lavender** that is relaxing, not being absorbed into the bloodstream. The smell causes the release of relaxing neuro transmitters.

**Extra stuff I get to if there is time.**
-***No image*.** A cellular immunotherapy targeting Epstein Barr has helped with MS. T cells are removed from the patient, trained to be sensitized to EBV in the lab then put back in the patients. This is more evidence that EBV is implicated in MS. MS is also exacerbated by food allergies. The immune system kicks up inflammation. The fact that it only happens with with food allergies is more evidence that gut bacteria play a moderating/regulating role with immune function.
https://dx.doi.org/10.1172/jci.insight.124714
- ***A related** treatment* is being used for cancer. Cancer cells are removed from the patient and sequenced for their unusual markers. Then T cells from the patient that are highly reactive to those markers are cloned by the billions and reintroduced into the patient. Dec 2018 Nat Geo.

**- *New MRI tests*** 95% effective in predicting Alzheimers, clinincally helpful for getting more people in treatment sooner.
**- Axonal arbor** Vision improves due to hardware upgrade – Changes in the axonal arbor has been observed when learning the task of perceiving difficult objects (ie straight lines in a chaotic maze.)
"Axonal plasticity associated with perceptual learning in adult macaque primary visual cortex" by Timo van Kerkoerle, Sally A. Marik, Stephan Meyer zum Alten Borgloh, and Charles D. Gilbert in *PNAS*. Published October 9 2018.
**Camel cig-** a genetic mutation makes nicotine dependence even stronger in Mideast 50% prevalence and 30% European