

## Cool Facts Friday #4

Dave Asprey:

Welcome to a new edition of Cool Facts Friday.

### Cool Fact 1:

This cool fact is about sheep brainwaves. Neurobiology researchers at the University of Cambridge have found that sleeping sheep's brains have bursts really similar to that found in sleeping humans. And those brain bursts are fast zags of neural activity called spindles, and they show up as a burst of electrical activity on an EEG, and we think they help people solidify memories during sleep. What they're doing for sheep, I don't know, but I will tell you as a sheep farmer, sheep do recognize individual people so maybe they're doing the same thing.

The researchers implanted electrodes in six female Merino sheeps brains and collected electrical patterns over a period of two nights and a day. And they found that in sheep, those spindles occurred during the day, and when the sheep are awake, and that made the researchers say, "Hey, maybe people are more sheep-like than we thought, and maybe people have those spindles that we thought were sleep spindles when they're awake. And that if those days spindles exist in us, they might help people with memory retention when we're awake," which would be phenomenal and a major finding in brain science. And compared to night spindles, day spindles appeared less abundant, more localized, and at unpredictable spots in the sheeps brains. What does that mean for us? Well, we're probably going to find the same thing is true in people. It's just hard to implant electrodes and have us walk around, but there are definitely companies looking at doing that. Of course, Elon Musk is one of the guys looking at that.

We'll probably also be able to capture this with external EEG leads. And I think what we're going to find is that there are applications where things like Alzheimer's, Parkinson's and Huntington's, but more interestingly for everyone, even if you're not in a high risk category for those things, what if there was a way to turn those on at the right time, at the right part of the brain to help you learn things faster? So you study and you do something to cause those spindles. And right now, research has shown that if you just relax and spend 10 minutes doing nothing after you study, that you'll actually remember the stuff better. And maybe during that 10 minutes of doing nothing, we're actually having our own spindles during the day. We're going to find out soon.

Source: <https://www.sciencenews.org/article/sleep-sheep-spindles-brain-memory>

### Cool Fact 2:

This cool fact of the day is about a new technology to protect against electromagnetic interference that's based in deep materials science. Researchers at the Swiss Federal Laboratories for Materials Science have succeeded in applying aerogels to microelectronics. Aerogels themselves came out of the Space Program and they're very, very light materials. Electric motors and electronic devices generate electromagnetic fields that sometimes have to be shielded so they don't interfere with our computers and our cell phones or our health. In fact, there are standards about how much EMF power supplies are allowed to leak out into the environment around you, believe it or not. The Swiss researchers use nanofibers of cellulose as the basis for an aerogel, which is super light and very porous and that just comes from wood. And then they added nanofibers made out of silver. They ended up with an ultralight and very fine structure that provides excellent shielding against EMFs.

Virtually all radiation in that frequency range is intercepted by the silver material, but then they upped the game. They pulled out the silver nanowires from the composite and they connected the cellulose nanofibers themselves with two dimensional nanoplates of Titanium carbide, the same stuff we use on drill bits. What they ended up with was the lightest ever material that has such high shielding properties. So titanium carbide nanocellulose aerogel is the new standard for weighing almost nothing and blocking all EMFs. There aren't any companies using aerogel to block EMFs yet, but there are companies making EMF-blocking clothing with silver nanowires, like Getlambs. Go to [getlambs.com](http://getlambs.com) to learn more about how silver wires in your clothing can block EMFs.

Source: <https://www.sciencedaily.com/releases/2020/07/200702113703.htm>

#### Cool Fact 3:

This cool fact is about one of my favorite topics, the swimming patterns of human sperm. Well, everyone knows that sperm are super strong swimmers. What keeps messing with scientists' heads is how they swim. They don't rotate their tails like propellers. Instead, they kind of flick their tails lopsidedly and they roll. And that balances out their off-center strokes. About 300 years ago, scientists saw sperm under a microscope for the first time and described sperm tail swing in a symmetric pattern like that of a snake or an eel. But that's not actually what happens in three dimensions according to researchers in the journal *Science Advances*. Of course we deployed high-speed 3d microscopy to show that sperm corkscrew as they move. Now, mathematicians at the University of Bristol in England used automated tracking of swimming sperm and mathematical analysis of position data to look at sperm tail movement. One movement was a wiggle to only one side of the cell, which normally would be like swimming in circles. But as second tail movement caused the sperm to rotate, balancing out the lopsided strokes and keeping them swimming straight ahead.

Researchers say it's like the sperm are almost drilling into the fluid surrounding them, and researchers still aren't yet sure if the sperm move the same way inside the female reproductive tract where they have to contend with fluid movement and narrow passages to get to the eggs. What does that mean for you? Well, if you're dealing with infertility, it could make a big difference, but if you're not dealing with infertility, it could be just purely of recreational interest or more interestingly, knowing how these things work is going to inform how nanomachines can actually move around. Because as we do more work with building very small structures that can move around and do what we want inside the human body, understanding how insects, bacteria, cilia, cell membranes, and yes, human sperm, how they work is really, really important. So human sperm also have an amazing amount of energy and they're able to store ATP and use ATP differently. So we're going to learn how to power our new kinds of technology by looking at little old sperm.

Source: <https://www.sciencenews.org/article/human-sperm-tail-swim-biophysics>

#### Cool Fact 4:

This cool fact is about how your little dog cares about your face, or your big dog. Dogs brains aren't really that impressed by our faces. And they're not impressed by faces of other dogs or people or anything else. This is new research because researchers in Hungary and Mexico uses brain-scanning technology on pet dogs to figure their response to our faces. Dogs were trained to lie still in a Sphinx position inside an MRI tube and rest their head on a chin rest while watching a screen. Scientists then played two second video clips showing the front or back of a human head and the front or back of a dog's head. Now, in this study, they don't actually say how they trained their dogs to do that because my dog would never do that.

Anyhow, the part of the dogs brains that processed vision didn't seem to care about faces at all, at least according to the research in the Journal of Neuroscience. No brain areas had greater activity when they looked at a face compared to the back of a head and the dog's visual system is processed whether the video featured a dog or a human because well dogs like other dogs. 30 human volunteers in MRI machines saw the same short videos. And when humans are shown a face of either a human or a dog, our visual systems become super active. Those same brain regions were quieter when the people saw the backs of heads. What does that mean for you? Don't look at the back of your dog's head. Well, in reality, these study results are about brain responses, not behavior. It doesn't mean that dogs themselves don't see or don't care about faces. And other studies have shown that dogs can recognize people's facial cues. That just means their brains care more if you're a human or another dog.

Source: <https://www.sciencenews.org/article/dog-brain-human-faces-expressions-neuroscience>

#### Cool Fact 5:

This cool fact is about how human feet have evolved. A study at Yale University found that a less obvious arch of the human foot probably evolved to help human ancestors walk and run on just two feet unlike all the other primates. We actually have two arches that help us stiffen our feet and allow us to walk and run upright. The better known arch you know about goes from the ball to the heel along the inside of your foot, that's called the longitudinal arch, but the other less obvious arch is formed across the width by bones in the middle of the foot, it's called the transverse tarsal arch.

Both arches are part of stiffening your foot while still maintaining flexibility and they work in opposite directions. And researchers just figured out that the transverse arch is what makes materials more rigid. They concluded that that arch is important for the stiffness that lets us walk upright. And when researchers removed the arch from cadavers, the foot stiffness decreased by about 54%. And we looked at skeletons and figured out that curved foot arches only happened about 3.4 million years ago. And what does that mean for you?

Well, understanding the central arch in your feet can lead us to make new treatments for people like me with flat feet and better design in prosthetic feet, but it also means that even if your feet work pretty well, that you can do things to strengthen the arch that almost no one knows about, that are going to change how you stand. And when you change how you stand, it changes how your hips and pelvis sit, which change how your spine sits, which changes how your head sits, which changes the flow of cerebral spinal fluid into your brain, and the amount of muscular tension that you hold all day long. If you have excess muscular tension in your body, all the mitochondrial energy that goes to doing something is just making muscles tense instead of going to thinking, doing, being, loving, caring, or just watching Breaking Bad. Anything you could do with that is wasted. So let's fix our feet which fixes the entire structure of the body. And it also might help us make better high-heeled shoes but no promises.

Source: <https://www.sciencenews.org/article/evolving-arch-across-foot-width-helped-hominids-walk-upright>