

Ode to E Pluribus Unum for Sunday June 12 2022



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Spiral Galaxy NGC 1512: The Inner Rings



Image Credit: NASA, ESA, Hubble Space Telescope

Most galaxies don't have any rings -- why does this galaxy have two?

To begin, the bright band near NGC 1512's center is a nuclear ring, a ring that surrounds the galaxy center and glows brightly with recently formed stars. Most stars and accompanying gas and dust, however, orbit the galactic center in a ring much further out -- here seen near the image edge.

This ring is called, counter-intuitively, the inner ring. If you look closely, you will see this the inner ring connects ends of a diffuse central bar that runs horizontally across the galaxy. These ring structures are thought to be caused by NGC 1512's own asymmetries in a drawn-out process called secular evolution.

The gravity of these galaxy asymmetries, including the bar of stars, cause gas and dust to fall from the inner ring to the nuclear ring, enhancing this ring's rate of star

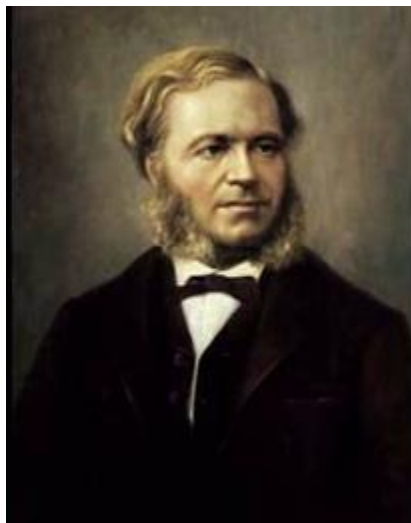
formation. Some spiral galaxies also have a third ring -- an outer ring that circles the galaxy even further out.

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César-Auguste Franck (1822-1890)



Franck was a Romantic composer, pianist, organist, and music teacher who worked in Paris during his adult life. In 1858, he became organist at the Basilica of St. Clotilde, Paris, a position he retained for the rest of his life. Though born in Liege, he became professor at the Paris Conservatoire in 1872; he took French nationality, a requirement of the appointment. His pupils included Vincent d'Indy, Ernest Chausson, Louis Vierne, Charles Tournemire, Guillaume Lekeu and Henri Duparc. After acquiring the

professorship, Franck wrote several pieces that have entered the standard classical repertoire, including symphonic, chamber, and keyboard works.

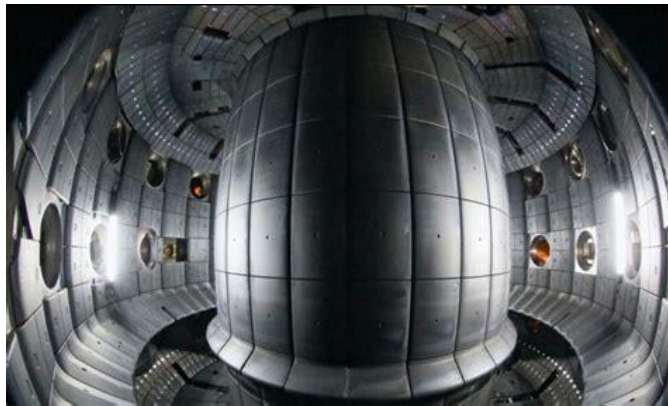
Prelude, Fugue & Variations <https://youtu.be/IPFNd4d6C6s>

Sonata in A Minor for Violin and Piano <https://youtu.be/C0GfR-GAs9Q>

Symphony in D Minor <https://youtu.be/0nF6TobCyV4>

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A Foundational Rule for Nuclear Fusion Reactors Could Unleash Twice the Power



https://www.space.com/fusion-reactors-could-produce-more-power?utm_source=SmartBrief&utm_medium=email&utm_campaign=58E4DE65-C57F-4CD3-9A5A-609994E2C5A9&utm_content=A0116345-5135-4F1C-A2FC-E71980295AD5&utm_term=259fcfb-705f-4282-8a39-1d5a56b9ef08

What lies beyond the Greenwald Limit? Perhaps the answer lies somewhere in the French countryside.

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Sometimes, not saying anything is the best answer. You see, silence can never be misquoted.

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Scientists Watch a Memory Form in a Living Brain

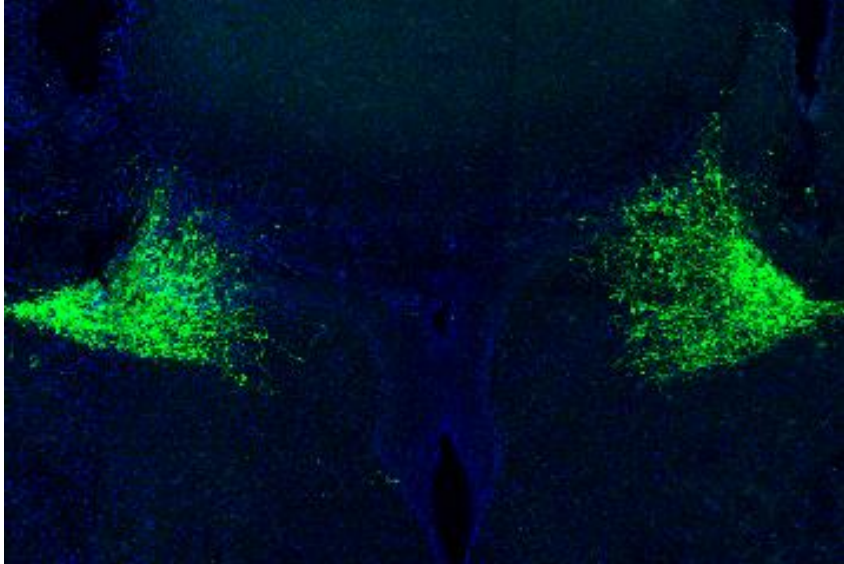
While observing fearful memories take shape in the brains of fish, neuroscientists saw an unexpected level of synaptic rewiring.



https://www.wired.com/story/scientists-watch-a-memory-form-in-a-living-brain/?bxiid=617fdd8c62717d23af47aa50&cndid=67131721&esrc=growl2-regGate-0321&source=EDT_WIR_NEWSLETTER_0_DAILY_ZZ&utm_brand=wired&utm_campaign=aud-dev&utm_content=WIR_Daily_03202022&utm_mailing=WIR_Daily_03202022&utm_medium=email&utm_source=nl&utm_term=P4

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How the Brain Responds to Surprising Events



Unexpected outcomes trigger release of noradrenaline, which helps the brain focus its attention and learn from the event.

Anne Trafton | MIT News Office

When your brain needs you to pay attention to something important, one way it can do that is to send out a burst of noradrenaline, according to a new MIT study.

This neuromodulator, produced by a structure deep in the brain called the locus coeruleus, can have widespread effects throughout the brain. In a study of mice, the MIT team found that one key role of noradrenaline, also known as norepinephrine, is to help the brain learn from surprising outcomes.

“What this work shows is that the locus coeruleus encodes unexpected events, and paying attention to those surprising events is crucial for the brain to take stock of its environment,” says Mriganka Sur, the Newton Professor of Neuroscience in MIT’s Department of Brain and Cognitive Sciences, a member of MIT’s Picower Institute for Learning and Memory, and director of the Simons Center for the Social Brain.

In addition to its role in signaling surprise, the researchers also discovered that noradrenaline helps to stimulate behavior that leads to a reward, particularly in situations where there is uncertainty over whether a reward will be offered.

Sur is the senior author of the new study, which appears today in *Nature*. Vincent Breton-Provencher, a former MIT postdoc who is now an assistant professor at Laval University, and Gabrielle Drummond, an MIT graduate student, are the lead authors of the paper.

Modulating behavior

Noradrenaline is one of several neuromodulators that influence the brain, along with dopamine, serotonin, and acetylcholine. Unlike neurotransmitters, which enable cell-to-cell communication, neuromodulators are released over large swathes of the brain, allowing them to exert more general effects.

“Neuromodulatory substances are thought to perfuse large areas of the brain and thereby alter the excitatory or inhibitory drive that neurons are receiving in a more point-to-point fashion,” Sur says. “This suggests they must have very crucial brain-wide functions that are important for survival and for brain state regulation.”

While scientists have learned much about the role of dopamine in motivation and reward pursuit, less is known about the other neuromodulators, including noradrenaline. It has been linked to arousal and boosting alertness, but too much noradrenaline can lead to anxiety.

Previous studies of the locus coeruleus, the brain’s primary source of noradrenaline, have shown that it receives input from many parts of the brain and also sends its signals far and wide. In the new study, the MIT team set out to study its role in a specific type of learning called reinforcement learning, or learning by trial and error.

For this study, the researchers trained mice to push a lever when they heard a high-frequency tone, but not when they heard a low-frequency tone. When the mice responded correctly to the high-frequency tone, they received water, but if they pushed the lever when they heard a low-frequency tone, they received an unpleasant puff of air.

The mice also learned to push the lever harder when the tones were louder. When the volume was lower, they were more uncertain about whether they should push or not. And, when the researchers inhibited activity of the locus coeruleus, the mice became much more hesitant to push the lever when they heard low volume tones, suggesting that noradrenaline promotes taking a chance on getting a reward in situations where the payoff is uncertain.

“The animal is pushing because it wants a reward, and the locus coeruleus provides critical signals to say, push now, because the reward will come,” Sur says.

The researchers also found that the neurons that generate this noradrenaline signal appear to send most of their output to the motor cortex, which offers more evidence that this signal stimulates the animals to take action.

Signaling surprise

While that initial burst of noradrenaline appears to stimulate the mice to take action, the researchers also found that a second burst often occurs after the trial is finished. When the mice received an expected reward, these bursts were small. However, when the outcome of the trial was a surprise, the bursts were much larger. For example, when a mouse received a puff of air instead of the reward it was expecting, the locus coeruleus sent out a large burst of noradrenaline.

In subsequent trials, that mouse would be much less likely to push the lever when it was uncertain it would receive a reward. “The animal is constantly adjusting its behavior,” Sur says. “Even though it has already learned the task, it’s adjusting its behavior based on what it has just done.”

The mice also showed bursts of noradrenaline on trials when they received an unexpected reward. These bursts appeared to spread noradrenaline to many parts of the brain, including the prefrontal cortex, where planning and other higher cognitive functions occur.

“The surprise-encoding function of the locus coeruleus seem to be much more widespread in the brain, and that may make sense because everything we do is moderated by surprise,” Sur says.

The researchers now plan to explore the possible synergy between noradrenaline and other neuromodulators, especially dopamine, which also responds to unexpected rewards. They also hope to learn more about how the prefrontal cortex stores the short-term memory of the input from the locus coeruleus to help the animals improve their performance in future trials.

The research was funded, in part, by the Quebec Research Funds, the Natural Sciences and Engineering Research Council of Canada, a NARSAD Young Investigator Award from the Brain and Behavior Research Foundation, the National Institutes of Health, the Simons Foundation Autism Research Initiative through the Simons Center for the Social Brain, the National Natural Science Foundation of China, and the NIH BRAIN Initiative.

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Catatonia: The Body May Be Frozen, but the Mind Is Not

One theory for catatonia is that it is similar to an animal's “death feint.”



Marten Newhall / Unsplash

By Jonathan Rogers

Occasionally, as a doctor, I am asked to see a patient in the emergency department who is completely mute. They sit motionless, staring around the room. I lift up their arm and it stays in that position. Someone takes a blood test and they don't even wince. They haven't eaten or drunk anything for a day or two.

Questions start running through your mind. What's wrong with them? Would they respond to someone else? Do they have a brain injury? Are they putting it on? And – hardest of all – how am I to know what's going on if they can't tell me?

I'm a psychiatrist and a researcher specialising in a rare condition known as catatonia, a severe form of mental illness where people have problems with movement and speech.

Catatonia can last anywhere from a few hours to weeks, months or even years. Some people have reoccurring episodes. I've spoken to doctors, nurses, academics, patients and carers about this condition. One question comes up more than any other: what are people with catatonia thinking? Are they even thinking?

When a person can hardly move or speak, it's easy to assume that they aren't conscious either. Research in recent years has shown that this isn't the case. In fact, if anything, it's the opposite. People with catatonia often express intense anxiety and say they feel overwhelmed with feelings. It's not that people with catatonia have no thoughts – it might be that they have too many.

But what are these thoughts? What could the mind possibly do that would make you freeze? In a new study, my colleagues and I have tried to shed some light on this.

Hundreds of patients

By looking at the case notes of hundreds of patients who had experienced catatonia, we found that a few had spoken about what had happened, either at the time or later on. Many weren't aware of or didn't remember what was happening.

Some described experiencing overwhelming fear. Some were aware of the pain of staying rigid for so long, but, nonetheless, seemed unable to move. What we found most interesting, though, were those people who had – on one level – a rational explanation for the catatonia. One patient's notes read:

I met him kneeling on the floor with his forehead on the floor. He said he had adopted the position to save his life and kept asking to be seen by a neck doctor ... He kept talking about his head falling off his neck.

If you actually believed that your head was at imminent risk of falling off, maybe it wouldn't be such a bad idea to hold it in place on the floor.

For others, it was voices (hallucinations) that were instructing them to do certain things. One person was being told that his head would explode if he moved – a fairly compelling reason to stay still. Another thought God was telling him not to eat or drink.



A woman with catatonia.
Internet Archive Book Images/Wikimedia

Death feint

One theory for catatonia is that it is similar to the "death feint" that some animals show. When faced with a predator of overwhelming size or strength, some prey animals will freeze and presumably the predator may not notice them.

One patient in the study vividly described seeing a snake (which also spoke to her). We can't say from one example that her body was adopting a primitive defence to a predator, but it's certainly a possibility.

Catatonia remains a mysterious condition, stuck halfway between neurology and psychiatry. At least by understanding what people may be experiencing, we can provide reassurance and empathy.

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Ship Tracks over the Pacific Ocean



Image Credit: NASA, Terra, MODIS; Text: Raymond Shaw (MTU)

What are those unusual streaks? Some images of planet Earth show clear bright streaks that follow the paths of ships. Known as ship tracks, these low and narrow bands are caused by the ship's engine exhaust.

Water vapor condenses around small bits of exhaust known as aerosols, which soon grow into floating water drops that efficiently reflect sunlight. Ship tracks were first discovered in 1965 in Earth images taken by NASA's TIROS satellites.

Multiple ship tracks are visible across the featured image that was captured in 2009 over the Pacific Ocean by the MODIS instrument on NASA's Terra satellite.

Inspired by ship-tracks, some scientists have suggested deploying a network of floating buoys in the worlds' oceans that spray salt-aerosol containing sea-water into the air so that, with the help of the wind, streams of sunlight-reflecting clouds would also form. Why do this? These human-made clouds could reflect so much sunlight they might help fight global warming.

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Can Drinking Coffee Lower Your Risk of Death?



People in the U.K. who had more than one daily cup of coffee had a lower mortality risk than non-coffee drinkers, a study found.

By Aria Bendix

Contrary to popular myth, forgoing coffee isn't likely to improve your health. The opposite might be true: Years of research suggests that drinking coffee is linked with a lower risk of death.

The latest addition to that body of research was published Monday in the Annals of Internal Medicine. The study looked at around 120,000 people in the U.K. who regularly drank unsweetened or sugar-sweetened coffee over seven years. The findings suggested that those who drank 1.5 to 3.5 cups a day had a lower risk of death during those seven years than non-coffee drinkers, even if they added a teaspoon of real sugar — not artificial sweetener — to every cup.

On the whole, people who drank unsweetened coffee were 16 percent to 21 percent less likely to die during the study period than people who didn't drink coffee at all, the results showed.

But the researchers didn't look at causality, so they couldn't say whether coffee is directly responsible for the outcome.

"Biologically, it is plausible that coffee could actually confer some direct health benefits," said Dr. Christina Wee, an associate professor of medicine at Harvard Medical School. Wee edited the study and wrote an accompanying editorial about the results.

But she added: "We can't say for sure that it's the coffee drinking per se that leads to the lower mortality risk."

It's possible, for example, that people who regularly drink coffee are wealthier and therefore more likely to have better health care or more time for leisure or fitness than non-coffee drinkers, which could lower their mortality risk.

A spoonful of sugar doesn't negate coffee's benefits

The participants in the new study were around 56 years old, on average, and they were recruited from 2006 to 2010. The researchers accounted for factors like diet, smoking, socioeconomic status, pre-existing health problems and exposure to air pollution.

The results suggested that people who drank sugar-sweetened coffee were 29 percent to 31 percent less likely to die than non-coffee drinkers — a slightly higher risk reduction than was observed among people who drank unsweetened coffee, though in the same range.

The study didn't find conclusive results for people who drank coffee with artificial sweeteners; neither did it look specifically at people who added milk or cream.

<https://www.today.com/video/how-drinking-coffee-every-day-benefits-heart-health-136119877659>

As with anything connected to words such as May or Might, I'd suggest a little judicious skepticism...but I sure like the sound of the proposition.

Of course there's always someone around with a different opinion:

<https://www.healthline.com/health-news/6-cups-of-coffee-a-day-is-safe-but-more-isnt-healthy>

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Spaghetti and an Affair



For several years, a man was having an affair with an Italian woman.

One night, she confided to him that she was pregnant. Not wanting to ruin his marriage, he said he would pay her a large sum of money if she would go to Italy to secretly have the child. If she stayed in Italy to raise the child, he would also provide child support until the child turned 18.

She agreed, but asked how he would know when the baby was born.

To keep it discreet, he told her to simply mail him a post card, and write 'Spaghetti' on the back. He would then arrange for the child support to begin.

One day, about 9 months later, he came home to his confused wife.

'Honey, she said, 'you received a very strange post card today.'

'Oh, just give it to me and I'll explain it later,' he said. The wife watched as her husband read the card, turned white, and fainted.

On the card was written:

Spaghetti, Spaghetti, Spaghetti.
Two with meatballs, one without.
Send extra sauce

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Wildlife Photographer Runs Everest Marathon in a 33-Pound Tiger Suit



A British wildlife photographer completed the Everest marathon while wearing a tiger suit in order to raise over £100,000 (\$126,198) to help protect the endangered predators.

Paul Goldstein spent more than 12 hours running the grueling Everest marathon carrying the nine-foot tiger costume that weighs about 15 kilograms (about 33 pounds).

The race starts at 17,000 feet above sea level and took place on Sunday. It is considered to be one of the toughest marathons in the world, even for those not wearing a 30-pound apparatus.

"That was the most miserable 12 hours I've had in my life. It was agony," Goldstein tells the Times.

“The majority of that mountain was above 4.500m — you’re up the height of Mont Blanc or above. At that sort of altitude, you should be walking with the speed of a pensioner,” he adds.

“The altitude takes it out of your legs, it takes it out of your lungs. The first two miles are ice, rock, and loose scree. So you’ve done an hour and only about a mile and three quarters. There were a couple of hours where I had a headwind so you can imagine that the tiger on your back is like a sail.”

https://www.instagram.com/p/CeJBV7XMiW6/?utm_source=ig_embed&utm_campaign=embed_video_watch_again

Goldstein, who has captured remarkable images of tigers, is passionate about animal conservation and particularly the mistreatment of the apex predators in nearby China which motivates him to raise money for them.

“I’m fuelled by rage. When you’re at Everest base camp, you’re only a couple of miles from the Chinese border and when you realize they’re still harvesting tigers over that side of the border, it makes me incandescent.”

Goldstein finished the epic marathon in 12 hours, 47 minutes, and 37 seconds but somehow still beat around 30 people, despite the massive tiger on his back slowing him down.

He claims that this is the last marathon he will do after raising £100,000 (\$126,198) to protect endangered Bengal tigers. The money was raised after running both the London and Everest marathons.

Goldstein has been running the *Worth More Alive* campaign since 2010 and has ran 20 marathons with the 9ft tiger costume in that period.

The money raised will go towards protecting the tiger habitat and improving the lives of local people living within the boundaries of Bandhavgarh National Park in India.

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Ever notice when geese fly in a v formation, one side is always longer than the other?
This is because there are more geese on that side.



Same is true of pelicans except they prefer right echelon

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Billy Strings



Bill Warner shared this with me.

One of the primo guitar pickers today is a kid who calls himself Billy Strings. A child prodigy, he'd won several Grammys by the time he was in his mid-20s. The guy who cuts my hair has tickets for two Billy Strings shows at the Red Rock Amphitheater in Colorado this spring. He was lucky, he said -- both shows sold out ten minutes after the tickets went on sale. So, Strings might well be the hottest act in all show biz right now.

For my own taste, he occupies that zone where folk and jazz meet in the nominal genre of bluegrass. His vocals and flat-pick style are a lot like those of the great Doc Watson, while his eclectic repertoire and penchant for long instrumentals seem to put him in line with the Grateful Dead. And he's regularly touted to be the heir to Watson's mantle as well as Jerry Garcia's. I know several longtime, old-time guitar pickers around the Asheville area who see him as a kind of godsend, breathing new life into bluegrass music.

Anyway... the good news is that, if you like Billy Strings, there is no end of his work on YouTube, and hours can be spent wandering from one astounding video performance to another. A few of my favorites are here, especially the rendition of "Summertime," which features fellow virtuoso Marcus King in a duet. (And King, I'm proud to say, is a native of Greenville, South Carolina.)

<https://www.youtube.com/watch?v=1RNNQYpnuka>

<https://www.youtube.com/watch?v=I7X2hY6zw84>

<https://www.youtube.com/watch?v=ypS96LGN6WY>

<https://www.youtube.com/watch?v=HIIdItPvb8aE>

https://en.wikipedia.org/wiki/Billy_Strings

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Q&A: Stanford Smart Grid Project Launched a Decade-Long Journey for a Recently Acquired Climate-Tech Startup

By Mark Golden



The road from research to full commercialization for sustainability technologies is long, full of surprises and devoid of certainty.

Amit Narayan with a UC-Berkeley PhD in electrical engineering launched a couple semiconductor startups when he had the epiphany that perhaps the complex software algorithms used in chip design could also be used to optimize the electric grid. After all, the chips, though tiny, carry signals at gigahertz speeds making nano-scale metal wires behave as transmission lines. He broached this idea in 2010 to Abbas El Gamal, a Stanford University professor of electrical engineering and an advisor to one of Narayan's semiconductor startups. Intrigued, El Gamal invited Narayan to Stanford to explore this further. On May 11, Autogrid, the climate-AI startup that Narayan began working on at Stanford, announced that it is being acquired by Schneider Electric, a Fortune Global 500 company in energy efficiency and sustainability technologies.

Here, Narayan describes his decade-long journey and the road ahead.

Congratulations on the acquisition. How does that make you feel?

It's a great outcome. When I started the company, my son was in kindergarten. He will start college this fall. So, I feel like two of my kids have graduated at the same time! Schneider is the right place to maximize the impact of our technology. They operate in more than a hundred countries and have many complementary products. Most importantly, they share our values and commitment to decarbonize our planet. From an impact perspective this gives us the opportunity to scale faster.

From the beginning this has been a sustainability issue for you, right?

I vividly recall the day when I was driving my 5-year-old son to school. Stuck in traffic, with all the smoke around him, he started crying afraid that he was going to run out of oxygen. This is when I started thinking about the world he will have to grow up in and the dangers of climate change. I realized that the electricity sector was one of the major sources of carbon emissions, but also the biggest opportunity to transition into a

sustainable world. If we could deploy solar and wind, and use this renewable energy to power our cars and homes, we would make a big dent in the problem.

However, I soon realized that the architecture of our electricity grid would need to change. For decades what the utilities did when demand peaked on a hot summer day was fire up these old, fossil-fuel based peaker plants. These peaking generators are 10 times more expensive and four times more polluting than average fossil fuel plants. And more than half of them are located in the most vulnerable communities: low-income neighborhoods and ethnic minorities with limited political power. Part of what we're trying to do is get rid of these environmentally and ethically unjust peaker plants.

How far into the future do you think an integrated smart energy system will be effective and widely deployed?

I think it is right here, right now. We're deploying more and more renewables. The wind doesn't always blow, and the sun doesn't shine at night. If, for every megawatt of renewable generation, we have to add an equivalent megawatt of a fossil-fuel plant as a backup, it defeats the whole purpose.

Fortunately, there's a better way. When I started working on this problem, I realized that by utilizing the power of AI and the cloud, we can break the century-old assumption that power can only flow one way. We could harness the flexibility of all energy assets to keep the grid balanced in a cheaper, cleaner, more reliable manner than before. We called these 'software-defined' virtual power plants.

I think smart grid will have arrived when I can give my utility some control over my air conditioning and large appliances in exchange for a lower rate and a more reliable system. I don't have that option.

Most Americans have that option today. In California, we now have over a million EVs. If we can use the batteries of parked EVs, we can back up the entire California grid. And, by renting these EVs, the owners of these vehicles can earn money. It's like making your car available for the Uber fleet, but unlike Uber you don't have to drive your car. It can stay at home, plugged into the wall, and can make money by helping stabilize the grid. It's better than a self-driving car version of Uber!

A lot of utilities are offering this, but they are not very good at marketing it to consumers. Also, many times the incentives are not structured properly. So, the bigger thing is the increased sale of these assets – electric vehicles, solar panels, smart thermostats and appliances. The point of sale is the time to get people into these optimization programs, which can offset the cost of purchasing the devices by 30 to 40 percent.

From the consumer perspective, do you think "set it and forget it" technology will be key?

Absolutely. Nobody has time to think about this on a daily basis. Nor should they. In our view, it should all be seamless, automated, behind the scenes. As long as your car is charged when you need it in the morning, you don't worry about it.

That's also where artificial intelligence comes in. It understands your preferences and personalizes the use of your assets so that you don't notice. You do know that you're getting 100 percent carbon-free electricity.

How did this journey for you start at – and continue to intersect with – Stanford?

The TomKat Center for Sustainable Energy had just started and was looking to fund its first batch of research projects, specifically for a smarter electricity grid. Stanford was very active in solar, wind, batteries, EVs. But at the time no one was really looking at the whole system.

We identified that the fundamental challenge lies in dealing with the intermittency of renewables. We made the system open and extensible, just like the Internet. We said it doesn't matter if the asset is an EV or solar panels, we only need to know how much power it can produce or use, and then optimize the entire system. So, (with professors El Gamal, Stephen Boyd, and Benjamin Van Roy, and adjunct professor Daniel O'Neill), we got the research project GridSpice funded by TomKat. I was a visiting professor at the time. The project was about modeling and simulating a smart grid system, how that could work and optimize millions of distributed assets.

Once we showed that it could work, I wanted to build the software for actually controlling assets and optimizing real systems. That was the focus for AutoGrid.

Over the years, we have collaborated closely with several Stanford professors. Steve Eglash, who is now at SLAC but was at Precourt then, introduced me to executives of the City of Palo Alto Utilities, which became our first customer. And the unit that manages the university's endowment made a small, early venture investment in us, which validated what we were doing in the eyes of follow-on investors. And quite a few Stanford graduates have and continue to work for us.

Stanford gave me the opportunity to enter the energy field when I didn't know much about the domain. The amount of encouragement and support I received, despite being an outsider to the industry, was remarkable. I really don't think any other university would have done it. The environment of taking risks, collaborating with industry, connections, freedom to explore is unique.

What were some of the early breakthroughs or pivotal moments in this journey?

Soon after starting AutoGrid, I learned about the Department of Energy's newly created ARPA-E (Advanced Research Projects Agency-Energy) program, of which Arun Majumdar was the founding director at the time. (Majumdar later joined the Stanford faculty, directed the Precourt Institute for Energy and was recently named dean of Stanford's new Doerr School of Sustainability). Unknown to me, he was looking to fund precisely these types of disruptive ideas, borrowed from other fields, that could be transformative for the electric grid. As a five-person startup, we got R&D funding from ARPA-E which put us on the map.

For a software company, 12 years is a long development period. How did you keep investor interest?

We did survive some difficult times in funding. Cleantech is not an easy place for some investors, due to complex regulatory issues. We avoided the Silicon Valley venture cap funds, who weren't interested in cleantech, especially after the cleantech bust of 2008. Fortunately, we were able to find some true believers such as Dan Ahn from Clearvision Ventures, who had invested in my previous company, and saw the potential early.

I also learned that if you just go to the customers – E.ON, NextEra, National Grid, CLP, Schneider Electric – they understood the future was software, data, and AI. Oil and gas companies such as Shell and Total started making big investments in clean energy, too. Today more than 70 percent of our revenue is from non-utilities such as Sunrun, Sunnova, Shell and Total.

Still, some investors didn't think it would take this much time. Late 2019, when the pandemic was starting, some investors started getting tired and felt that maybe we had done what we could do. Maybe it was time to sell the company.

But, the pandemic actually accelerated our growth as customers got more used to cloud-based technologies, and realized the urgency of climate change. That's when Schneider Electric's new investment fund, SE Ventures, came in and led an \$85 million investment round. We started working closely with their business units and sales teams which ultimately led to this combination.

What's the future for AutoGrid as the acquisition takes hold?

The goal is to connect to all the energy assets out there and transition to a zero-carbon energy world. The more data we can get the better optimization we can do. We are very much like an Android operating system. Our software is based on open standards. We are managing six gigawatts of assets today. That's enough to power about 4.5 million U.S. homes. But our mission is to get to 1,000 GW. That is a big number, but I am hopeful we can get there within 10 years.

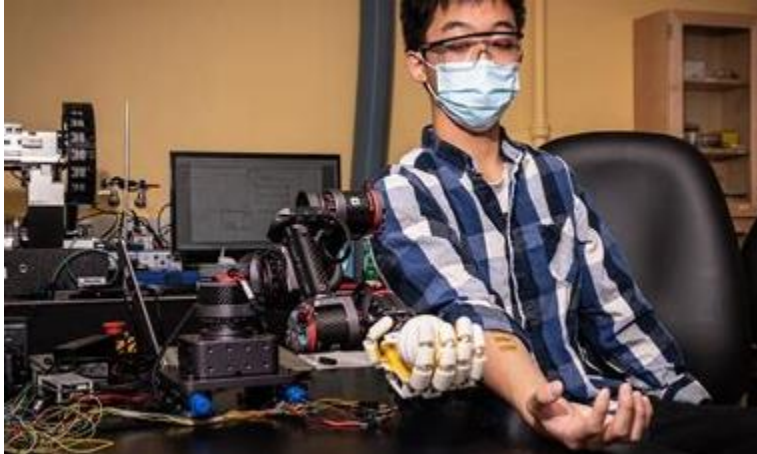
And what's your future after the acquisition is completed?

I feel we are just getting started. The plan is to keep the company as a separate entity within Schneider and continue growing.

Personally, I'm also super excited by the new School of Sustainability at Stanford, and the school is very fortunate to have a visionary like Arun at the helm. I would like to pay it forward by engaging with the next generation of entrepreneurs and researchers, sharing my experience and connections for them to be able to accelerate their time to impact.

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Artificial Skin Gives Robots Sense of Touch and Beyond

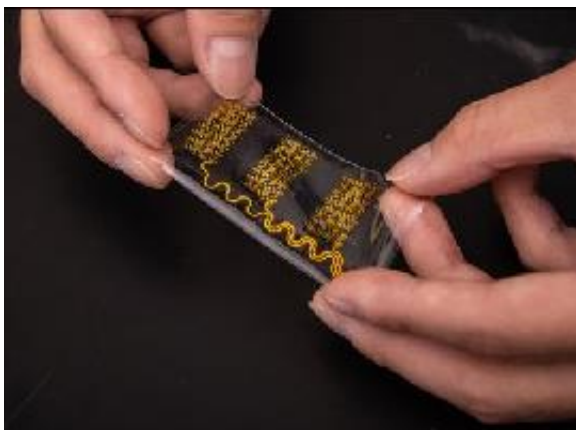


We tend to take our sense of touch for granted in everyday settings, but it is vital for our ability to interact with our surroundings. Imagine reaching into the fridge to grab an egg for breakfast. As your fingers touch its shell, you can tell the egg is cold, that its shell is smooth, and how firmly you need to grip it to avoid crushing it. These are abilities that robots, even those directly controlled by humans, can struggle with.

A new artificial skin developed at Caltech can now give robots the ability to sense temperature, pressure, and even toxic chemicals through a simple touch.

This new skin technology is part of a robotic platform that integrates the artificial skin with a robotic arm and sensors that attach to human skin. A machine-learning system that interfaces the two allows the human user to control the robot with their own movements while receiving feedback through their own skin. The multimodal robotic-sensing platform, dubbed M-Bot, was developed in the lab of Wei Gao, Caltech's assistant professor of medical engineering, investigator with Heritage Medical Research Institute, and Ronald and JoAnne Willens Scholar. It aims to give humans more precise control over robots while also protecting the humans from potential hazards.

"Modern robots are playing a more and more important role in security, farming, and manufacturing," Gao says. "Can we give these robots a sense of touch and a sense of temperature? Can we also make them sense chemicals like explosives and nerve agents or biohazards like infectious bacteria and viruses? We're working on this."



This sensor attaches to the forearm skin of a human and allows them to control a robotic system through their own muscle movements

Credit: Caltech

The skin

A side-by-side comparison of a human hand and a robotic hand reveals glaring differences. Whereas human fingers are soft, squishy, and fleshy, robotic fingers tend to be hard, metallic, plasticky, or rubbery. The printable skin developed in Gao's lab is a gelatinous hydrogel and makes robot fingertips a lot more like our own.

Embedded within that hydrogel are the sensors that give the artificial skin its ability to detect the world around it. These sensors are literally printed onto the skin in the same way that an inkjet printer applies text to a sheet of paper.

"Inkjet printing has this cartridge that ejects droplets, and those droplets are an ink solution, but they could be a solution that we develop instead of regular ink," Gao says. "We've developed a variety of inks of nanomaterials for ourselves."

After printing a scaffolding of silver nanoparticle wires, the researchers can then print layers of micrometer-scale sensors that can be designed to detect a variety of things. The fact that the sensors are printed makes it quicker and easier for the lab to design and try out new kinds of sensors.

"When we want to detect one given compound, we make sure the sensor has a high electrochemical response to that compound," Gao says. "Graphene impregnated with platinum detects the explosive TNT very quickly and selectively. For a virus, we are printing carbon nanotubes, which have very high surface area, and attaching antibodies for the virus to them. This is all mass producible and scalable."

An interactive system

Gao's team has coupled this skin to an interactive system that allows a human user to control the robot through their own muscle movements while also receiving feedback to the user's own skin from the skin of the robot.

https://youtu.be/DJi_-BLR2d4

This part of the system makes use of additional printed parts—in this case, electrodes fastened to the human operator's forearm. The electrodes are similar to those that are used to measure brain waves, but they are instead positioned to sense the electrical signals generated by the operator's muscles as they move their hand and wrist. A simple flick of the human wrist tells the robotic arm to move up or down, and a clenching or splaying of the human fingers prompts a similar action by the robotic hand.

"We used machine learning to convert those signals into gestures for robotic control," Gao says. "We trained the model on six different gestures."

The system also provides feedback to the human skin in the form of a very mild electrical stimulation. Bringing back the example of picking up an egg, if the operator were to grip the egg too tightly with the robotic hand and was in danger of crushing its

shell, the system would alert the operator through what Gao describes as "a little tingle" to the operator's skin.

Gao hopes the system will find applications in everything from agriculture to security to environmental protection, allowing the operators of robots to "feel" how much pesticide is being applied to a field of crops, whether a suspicious backpack left in an airport has traces of explosives on it, or the location of a pollution source in a river. First though, he wants to make some improvements.

"I think we have shown a proof of concept," he says. "But we want to improve the stability of this robotic skin to make it last longer. By optimizing new inks and new materials, we hope this can be used for different kinds of targeted detections. We want to put it on more powerful robots and make them smarter, more intelligent."

The paper describing the research, titled "All-printed soft human-machine interface for robotic physicochemical sensing," appears in the June 1 issue of Science Robotics. Co-authors are medical engineering graduate students Jiahong Li, Samuel A. Solomon, Jihong Min, Changhao Xu, and Jiaobing Tu; postdoctoral scholar research associate in medical engineering Yu Song; former postdoctoral scholar research associate You Yu; and visiting student Wei Guo.

Funding for the research was provided by the National Institutes of Health, the Office of Naval Research, NASA's Translational Research Institute for Space Health, the Tobacco-Related Disease Research Program, and the Carver Mead New Adventures Fund at Caltech.

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Trained Dogs Sniff Out COVID-19 as Well as Lab Tests Do

And the canines are even better than PCR tests at identifying infected people with no symptoms



Dogs, including this one from the United Arab Emirates, have been trained to sniff out cases of COVID-19. The dogs are as reliable as PCR tests, a new study suggests.

By Tina Hesman Saey

Dogs are as reliable as laboratory tests for detecting COVID-19 cases, and may be even better than PCR tests for identifying infected people who don't have symptoms. A bonus: The canines are cuter and less invasive than a swab up the nose.

In a study involving sweat samples from 335 people, trained dogs sniffed out 97 percent of the coronavirus cases that had been identified by PCR tests, researchers report June 1 in PLOS One. And the dogs found all 31 COVID-19 cases among 192 people who didn't have symptoms.

These findings are evidence that dogs could be effective for mass screening efforts at places such as airports or concerts and may provide friendly alternatives for testing people who balk at nasal swabs, says Dominique Grandjean, a veterinarian at the National School of Veterinary Medicine of Alfort in Maisons-Alfort, France.

"The dog doesn't lie," but there are many ways PCR tests can go wrong, Grandjean says. The canines' noses also identified more COVID-19 cases than did antigen tests (SN: 12/17/21), similar to many at-home tests, but sometimes mistook another respiratory virus for the coronavirus, Grandjean and colleagues found. What's more, anecdotal evidence suggests the dogs can pick up asymptomatic cases as much as 48 hours before people test positive by PCR, he says.

In the study, dogs from French fire stations and from the Ministry of the Interior of the United Arab Emirates were trained in coronavirus detection by rewarding them with toys — usually tennis balls. "It's playtime for them," Grandjean says. It takes about three to six weeks, depending on the dog's experience with odor detection, to train a dog to pick out COVID-19 cases from sweat samples.

The dogs then sniffed cones housing sweat samples collected from human volunteers' underarms. Swabbing the sweat off the back of people's necks or giving the woofers a whiff of used face masks worked just as well, Grandjean says.

Those results indicate that odors from multiple body sites can be used for canine screening, says Kenneth Furton, a forensic chemist at Florida International University in Miami who was not involved in the study.

The results are similar to previous, smaller studies that also found that dogs perform as well as or even better than PCR tests for detecting SARS-CoV-2, the virus that causes COVID-19, Furton says. He and colleagues have used dogs at schools, a music festival and in a small trial screening airline employees for coronavirus infections.

One of the biggest advantages dogs have over other tests is their speed, Furton says. "Even with what we call a rapid test, you're still going to have to wait tens of minutes or even hours, where the dog in a matter of seconds or even fractions of seconds can make a response."

It's not clear exactly what dogs are smelling when they detect COVID-19 or other diseases, says Cynthia Otto, director of the University of Pennsylvania School of Veterinary Medicine's working dog center, who was not involved in the study. It may not be a single chemical, but rather a pattern of increasing and decreasing levels of

certain aromas. "It's not like you could create an odor perfume bottle that would be the scent of COVID," she says.

Even with repeated studies demonstrating dogs' COVID-detection prowess, some doctors, scientists and government officials have been skeptical of the claims, Grandjean says. He finds the reluctance puzzling, because dogs are already used to sniff out drugs and explosives, and are being tested for detecting other diseases, such as cancer, he says. "Every time you take a plane, it's because dogs have been sniffing your luggage [and found] no explosives. So you trust them when you take a plane, but you don't want to trust them for COVID?"

One challenge with dogs, says Furton, is that people don't think of them as high-tech the way electronic sensors are. "But dogs are one of the highest-tech devices we have. They're just biological sensors, instead of electronic sensors," he says.

Another drawback for dogs is that they take time to train and there currently aren't even enough dogs trained to detect explosives, let alone diseases, Otto says. And "dogs that work well in that lab setting may not work well in a people setting," she says. Handlers can also influence the dog's response and must be able to read the dog well, she says. "We need more good dogs."

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For Those of Us Who Take to the Boonies...a Warning



https://www.sfgate.com/centralcoast/article/why-California-rattlesnake-population-is-booming-17195152.php?utm_source=join1440&utm_medium=email&utm_placement=newsletter

This is about California rattlers, but it's a good reminder elsewhere.

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Young MC



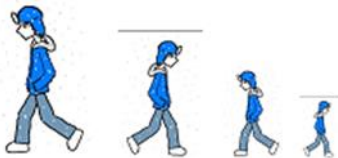
"Bust a Move" is a song by British-American rapper Young MC. It won the 1990 Grammy Award for Best Rap Performance. It appeared on his album Stone Cold Rhymin' and was his biggest hit, reaching number 7 on the Billboard Hot 100 and topping the charts in Australia. The song stayed on the Billboard Hot 100 for 39 weeks and 20 weeks in the top 40 alone.

The song is built on a sample of "Found a Child" by the group Ballin' Jack.

Bust a Move <https://youtu.be/tZQQGX24Teg>

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My Walking Thoughts



June 12 2022

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Another Outtake from Phantoms from Vietnam

Arthur's

Gordon was a big-time alcoholic, though in rare moments of lucidity he realized he was destroying himself.

Daily, he resolved to overcome his monster but as the noon-hour approached, he wavered and weakened. Daily, he faltered and succumbed, the shame creating an ever-increasing need for forgetfulness. In such a state, all roads led to Arthur's.

A Gordon lunch was the standing joke of the studio. Hardly a day passed in which some hapless victim was not made aware of one of the true legends of Vine Street. Popular mythology had it Arthur's Camelot Bar and Grill owed its existence to Gordon's patronage, and fully a score of his fellow workers made it their daily mission to drop in over the noon hour to make sure he was keeping the faith.

The noon hour was presaged by the rasping tones of a factory whistle (it quavered somewhere in the octave above middle C) located on Western Avenue near Melrose, and though it had nothing whatsoever to do with Far West Productions, it carried with it the full force of tradition launched during the halcyon days of World War II, therefore, not to be lightly dismissed in the wake of the Korean or Vietnam debacles.

The factory whistle did its thing for thirty seconds at exactly five minutes before mid-day, and you could set your navigational chronograph by it, not that Gordon had need to do so. Possessed of a remarkable sense of direction and an even keener feel for distance, he would coordinate his sojourn with the first toot. Three steps from the end of his desk to the door; a hard left for 25 paces to the staircase; 18 steps down; a slight jog to the right and then straight ahead for 20 paces; two steps down then 68 paces to the gate guard's bailiwick; 16 paces to the Vine Street curb; half-left for two choruses of "I wish I were a little tiny flea"; half-right at the curb; and five more strides to Arthur's door. Rain or shine; traffic or no traffic; three sheets or six to the wind, Gordon was a lead pipe cinch to hit the first stool to the right of the waitresses' stand at the dead stroke of noon...you could make book on it.

With suitably solemn mien, Sylvester the barkeep would apply a final shake to the raw gin he winkingly called his medium dry martini and decant it into a double shot glass containing three olives. This, he would explain to anyone who bothered to ask, was the sum and substance of the Gordon luncheon entree. Glass, napkin and Gordon arrived in a dead heat. God was in his holy temple and all was right with the world.

There had been a time when the Gordon luncheon included bright, witty conversation. In truth, Gordon suspected it had never been all that bright or witty, though it evoked an occasional bit of laughter. But over the years, what brightness and wittiness might have been gave way increasingly to silence as Gordon tired of his own ramblings, finding instead solace in becoming invisible.

The invisibility thing first occurred to him when he noticed toward the end of the noon hour; people began talking about him as if he were absent. It stung him a bit to begin with, but after a while the situation began to show some interesting possibilities. "What a waste," they'd say, or "think of all the cheese cloth they'd have if he donated his liver to science."

It was when they'd wink at each other knowingly when he wouldn't respond to their, "right, Gordon," or "what do you think, Gordon?" testimonial requests proving he was on the right track. Before too long, the regulars ceased checking for his response, and he gave himself a well-deserved pat on the back.

One day, he decided the only person he would allow to penetrate his invisible shield was Sylvester, but only when he felt like having another drink or paying his tab. He considered extending the courtesy to Beermaid Molly, but decided against it as a bad precedent.

"Time for serious work," Gordon would announce with suitable gravity as he slid from his throne at precisely 1255 and retraced his route back to the office.

Greeted by the comfortable clatter of typewriters and tickertape machine with his cloak of invisibility still intact, none of the regulars paid him the slightest attention. Just occasionally there was an interloper from the outside world around to witness his arrival, but for the most part the magic remained in place.

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