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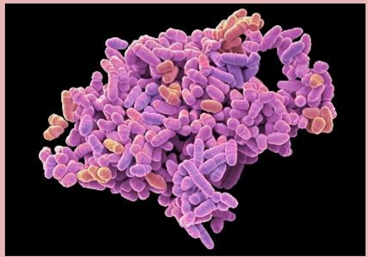
How Do Cells Acquire Their Shapes? New Mechanism Discovered



A multi-disciplinary team of scientists at Lehigh University and the University of Lausanne discover and characterize a new mechanism by which the fission yeast cell acquires its tubular shape.

When cells move or grow, they must add new membrane to those growth regions, says Vavylonis. The process of membrane delivery is called exocytosis. Cells also must deliver this membrane to a specific location in order to maintain a sense of direction-called “polarization”-or grow in a coordinated manner.

“We demonstrated that these processes are coupled: local excess of exocytosis causes some of the proteins attached to the membrane to move (‘flow’) away from the growth region,” says Vavylonis. “These proteins that move away mark the non-growing cell region, thus establishing a self-sustaining pattern, which gives rise to the tubular shape of these yeast cells.”

This is the first time that this mechanism for cell patterning-the process by which cells acquire spatial nonuniformities on their surfaces-has been identified.

The Vavylonis team’s simulations, spearheaded by Postdoctoral Associate David Rutkowski, led to experimental tests which the Martin group then performed. Vavylonis and Rutkowski analyzed the results of the experiments to confirm that the distribution of proteins they noticed in their simulations matched the data gleaned from the experiments on live cells.

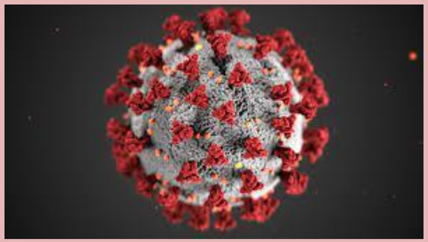
The team says that the work could be of particular interest to researchers investigating processes that relate to cell growth and membrane traffic such as neurobiologists and those studying cancer cell processes.

“Our work shows that patterns in biological systems are generally not static,” says Rutkowski. “Patterns establish themselves through physical processes involving continuous flow and turnover.”

“We were able to provide support for the model of patterning by membrane-flow,” said Vavylonis. “In the end, the Martin group was able to use this knowledge to engineer cells whose shape can be controlled by light.”

Coronavirus disease (COVID-19): Vaccines

There are now several vaccines that are in use. The first mass vaccination programme started in early December 2020 and the number of vaccination doses administered is updated on a daily basis. At least 13 different vaccines (across 4 platforms) have been administered.
The Pfizer/BioNtech Comirnaty vaccine was listed for WHO Emergency Use Listing (EUL) on 31 December 2020. The SII/Covishield and AstraZeneca/AZD1222 vaccines (developed by AstraZeneca/Oxford and manufactured by Serum Institute of India and SK Bio respectively) were given EUL on 16 February. The Janssen/Ad26.COV 2.S developed by Johnson & Johnson, was listed for EUL on 12 March 2021. The Moderna COVID-19 vaccine (mRNA 1273) was listed for EUL on 30 April 2021 and the Sinopharm COVID-19 vaccine was listed for EUL on 7 May 2021. The Sinopharm vaccine is produced by Beijing Bio-Institute of Biological Products Co Ltd, subsidiary of China National Biotec Group (CNBG). The Sinovac-CoronaVac was listed for EUL on 1 June 2021.



What types of COVID-19 vaccines are being developed? How would they work?

Scientists around the world are developing many potential vaccines for COVID-19. These vaccines are all designed to teach the body's immune system to safely recognize and block the virus that causes COVID-19.
Several different types of potential vaccines for COVID-19 are in development, including:

- *Inactivated or weakened virus vaccines*, which use a form of the virus that has been inactivated or weakened so it doesn't cause disease, but still generates an immune response.
- *Protein-based vaccines*, which use harmless fragments of proteins or protein shells that mimic the COVID-19 virus to safely generate an immune response.
- *Viral vector vaccines*, which use a safe virus that cannot cause disease but serves as a platform to produce coronavirus proteins to generate an immune response.
- *RNA and DNA vaccines*, a cutting-edge approach that uses genetically engineered RNA or DNA to generate a protein that itself safely prompts an immune response.

What are the benefits of getting vaccinated

The COVID-19 vaccines produce protection against the disease, as a result of developing an immune response to the SARS-Cov-2 virus. Developing immunity through vaccination means there is a reduced risk of developing the illness and its consequences. This immunity helps you fight the virus if exposed. Getting vaccinated may also protect people around you, because if you are protected from getting infected and from disease, you are less likely to infect someone else. This is particularly important to protect people at increased risk for severe illness from COVID-19, such as healthcare providers, older or elderly adults, and people with other medical conditions.
Even if you have already had COVID-19, you should be vaccinated when it is offered to you. The protection that someone gains from having COVID-19 will vary greatly from person to person. The immunity people get from being vaccinated after having a natural infection is consistently very strong. Getting vaccinated even if you have had COVID-19 means you are more likely to be protected for longer.

DISTANCE LEARNING

Distance learning, also called **distance education, e-learning**, and **online learning**, form of education in which the main elements include physical separation of teachers and students during instruction and the use of various technologies to facilitate student-teacher and student-student communication.

ADVANTAGES OF DISTANCE LEARNING

1. You can pursue a job along with studies: A major chunk of students who actually opt for distance education are those who don't want to give up their jobs but want a higher education, too. Distance education comes as a blessing for such students. You can study on the weekends, when you're back from work or even in the middle of the night. You get to **learn while you earn**!

2. You can save money: For any given program, the fee of a distance education degree (online or otherwise) may be much more affordable than the fee of a regular on-campus degree. Students who are looking for economically viable options can go for a distance learning program.

3. You save time: There's no time wasted in going to and from college, **no time wasted waiting for a bus or train**. In a distance learning program, your classroom is right in your bedroom - the study material on your desk or the e-material on your computer. Students who don't have enough time on their hands can turn to distance education as an option and pursue it from the comfort of their homes.

4. You can learn at your own pace: The prospect of going back to classroom education can be intimidating for many of us. Asking a question or revealing that you are unable to grasp a concept in class can be quite embarrassing for many students. Distance education comes to your rescue here!

5. You can study whenever, wherever: Except in scenarios where you have to attend an online tutorial at a given time or a lecture through videoconferencing, you can pretty much study whenever you want to, wherever you choose to.

Spider Uses its Web Like a Giant Engineered Ear

To hunt for alien life, human scientists build bigger and more sensitive arrays in the hopes of picking up a radio transmission from a faraway world. It turns out that *Larinioides sclopetarius*, also known as the bridge spider or gray cross spider, uses a similar trick. Instead of hunting for E.T., the spider can tune in to its surroundings and hear across great distances by treating its round, orb-shaped web like a comparatively giant acoustic array, according to new research.

The bridge spider uses its web as an engineered “external ear” up to 10,000 times the size of its body, according to a preprint study posted to *bioRxiv* on October 18. The discovery, which has not yet been peer reviewed, challenges many assumptions that scientists have held for years about how spiders and potentially other arthropods navigate and interact with the world around them.

“Evolutionarily speaking, spiders are just weird animals,” Jessica Petko, a Pennsylvania State University York biologist who didn’t work on the new study, writes in an email to *The Scientist*. “While it has been long known that spiders sense sound vibration with sensory hairs on their legs, this paper is the first to show that orb weaving spiders can amplify this sound by building specialized web structures.”

Spiders—both orb-weavers and others—are perfectly capable of hearing at closer distances without their webs thanks to the tiny hairs and organs on their legs that sense vibrations as air flows past. But the majority of spider biologists assumed that they could only hear sounds in their immediate vicinity, senior study author and Cornell University neurobiologist Ronald Hoy tells *The Scientist*.

Lead study author and Binghamton University mechanical engineer Ronald Miles had demonstrated that spider silk is sensitive to airflow across a wide range of frequencies in a 2017 study published in *PNAS*. Armed with the knowledge that strands of silk and the hairs on a spider's legs could vibrate to the same frequencies of noise, Miles and his colleagues aimed to determine whether vibrations in one could be transmitted to the other.

First, the researchers had to ensure that the spiders were actually hearing through their webs and not directly through those sensory hairs. To do so, the scientists brought spiders into the lab and waited while they wove new webs on wooden frames. Once the spiders' handiwork was complete, the scientists perturbed the web using a carefully-engineered and directed sound stimulus that hit the web but not the spider sitting in the center.

"That is one of the hardest parts: showing that they don't have a little hidden ear on them that's picking it up," Miles tells *The Scientist*. "To do that, we created a sound source in the air that would propagate sound over a very short distance."

Once they heard the signal, the spiders responded by crouching, flattening out, or otherwise giving a startled response, the study authors explain. Because the web is so much larger than the spider, the paper suggests this mechanism allows the spider to hear noises it would otherwise miss, such as birds or crickets from over ten meters away.

The discovery that the bridge spider uses its web as an external auditory sensor is fascinating, University of California, Davis, arachnologist Lisa Chamberland, who didn't work on the study, tells *The Scientist*, because it's such a drastic departure from what scientists previously assumed about a spider's hearing.

"I think this opens up doors for some exciting research," Chamberland says, adding that she hopes scientists will start "looking at the evolution of sound systems across spiders."

Plenty of questions remain not only about why the spiders started using their webs as comparatively giant acoustic arrays, but what purpose it serves.

"While I am sure the authors had fun doing this research, it is not a trivial finding," University of Cincinnati biological sciences professor George Uetz, who studies spider sensation but didn't work on the new paper, tells *The Scientist* in an email. "I think it will have a large impact on arachnology and beyond. For example, people have often speculated that spiders might use airborne vibration from prey activity to determine an optimal web location, and this is an ecological question worth exploring." Another question, he adds, is how differences in webs among species "could impact both the process of sensing and function in prey capture and communication, which is an important evolutionary question." Finally, there's more to learn about how spiders "tune" their webs to specific stimuli.

The researchers speculate that spiders may increase their hearing range to help dodge predators or track prey, but the spiders in this experiment primarily responded to the noise stimuli with apparent alarm and confusion. Down the road, the study authors say they hope others in the field will pick up where they left off by studying whether the noises given off by, for example, a hungry bird or a tasty insect elicit different behaviors. A further open question is whether other species of spider, orb-weaver and otherwise, use the same giant-ear trick. For example, Uetz wonders whether the wolf spiders that he studies, which don't spin webs, could use other objects like leaves as external ears to help them detect predatory birds.

"It will be interesting to find out whether other web building spiders (like the ones that make messy cobwebs) use webs for a similar purpose or if this evolutionary marvel is restricted to orb weavers," Petko writes.

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