NEWS RELEASE

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NTU Singapore-led team captures first-ever 'twitch' of the eye's night-vision cells as they detect light, paving the way for earlier detection of blindness-causing diseases

For the first time, an international research team led by **Nanyang Technological University, Singapore (NTU Singapore)** has recorded a tiny mechanical "twitch" in living human and rodent eyes at the exact moment a rod photoreceptor detects light.

The research breakthrough could provide a new, non-invasive way to assess retinal health and enable earlier diagnosis of blinding eye diseases, according to the research team, which involves multiple institutions including the **University of Washington (UW)**, **Singapore Eye Research Institute (SERI), and Duke-NUS Medical School**.

Rod photoreceptors are the cells in the eye that enable us to see in low-light conditions. These "night-vision cells" are extremely sensitive and are often the first to deteriorate in eye conditions such as age-related macular degeneration. However, existing tools to study and measure rod photoreceptor function are limited in their sensitivity and can be uncomfortable for patients.

Lead investigator Dr Tong Ling, Nanyang Assistant Professor at NTU's School of Chemistry, Chemical Engineering and Biotechnology, said: "The 'twitch' of the eye's night-vision cells is akin to the ignition spark of vision. We have long known that these cells produce electrical signals when they absorb light, but no one had, until now, ever reported the accompanying mechanical contraction of these cells inside the living eyes of humans or rodents."

"The findings reveal a fundamental step in the process by which rod photoreceptors detect light and send visual information to the brain. These cells make up about 95% of all photoreceptors in the human retina," Dr Ling, who is also affiliated with NTU's School of Electrical & Electronic Engineering, added.

The findings were first presented by Dr Ling at the Association for Research in Vision and Ophthalmology 2024 Annual Meeting and published in full in the peer-reviewed journal *Light: Science & Applications* yesterday.

Non-invasive eye imaging for the future

Using an advanced imaging method called **optoretinography (ORG)**, which can detect incredibly small movements in eye cells without any dyes or labels, the research team discovered that rod photoreceptors undergo a rapid contraction of up to 200 nanometres within roughly 10 milliseconds of light reaching the retina – faster than a single flap of a hummingbird's wings.

By combining their measurements with biophysical modelling, they found that this tiny motion is caused when rhodopsin – the eye's light-sensitive molecule – is activated by light. This response is one of the earliest steps in converting light into electrical signals that the brain can interpret as vision.

Co-corresponding author Professor Ramkumar Sabesan, **a vision scientist at University of Washington School of Medicine,** said: "This is the first time we've been able to see this phenomenon in rod cells in a living eye. Rod dysfunction is one of the earliest signs of many retinal diseases, including AMD and retinitis pigmentosa. Being able to directly monitor the rods' response to light gives us a powerful tool for disease detection and tracking treatment responses earlier and with greater sensitivity than any conventional diagnostic instrument."

Why this matters for patients

Rod photoreceptors are often the first cells to deteriorate in diseases that cause blindness. Along with the technique developed by the same research team group and published in *Nature Communications* in 2024 – which measures the rod photoreceptors' relatively slow movements in response to dim visual stimuli – the new approach detailed by the research team provides a non-contact, non-invasive method for clinicians to detect and monitor rod function.

Giving an independent comment, **Professor Jost Jonas**, **an ophthalmologist, clinical scientist and Chairman of the Department of Ophthalmology, Heidelberg University, Germany**, said: "Optoretinography as brand-new technique is clinically and scientifically very interesting and promising, since it allows for the first time the non-invasive visualisation of movements of the cellular structures in a living person's eye at the nanoscale. This holds true for the rods as photoreceptors as well as for other cells in the retina."

"It may thus open new avenues to better understand retinal cells in their working and in their relationship with neighbouring cells as well as may clinically allow a more detailed, and potentially earlier, diagnosis of retinal diseases, in particular of disorders primarily affecting the photoreceptors," added Professor Jonas.

The research brought together biomedical engineers, physicists, and clinical scientists from various institutions, including teams led by **Professor Leopold Schmetterer**, and **Associate Professor Veluchamy Amutha Barathi** at **SERI** and **Duke-NUS**, who provided key expertise in retinal imaging and rodent models for the study.

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Notes to Editor:

Paper titled "Optoretinography reveals rapid rod photoreceptor movement upon rhodopsin activation", published in *Light: Science & Applications*, 7 January 2026. DOI: 10.1038/s41377-025-02149-6

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About Nanyang Technological University, Singapore

A research-intensive public university, Nanyang Technological University, Singapore (NTU Singapore) has 35,000 undergraduate and postgraduate students in the Business, Computing & Data Science, Engineering, Humanities, Arts, & Social Sciences, Medicine, Science, and Graduate colleges.

NTU is also home to world-renowned autonomous institutes – the National Institute of Education, S Rajaratnam School of International Studies and Singapore Centre for Environmental Life Sciences Engineering – and various leading research centres such as the Earth Observatory of Singapore, Nanyang Environment & Water Research Institute and Energy Research Institute @ NTU (ERI@N).

Under the NTU Smart Campus vision, the University harnesses the power of digital technology and tech-enabled solutions to support better learning and living experiences, the discovery of new knowledge, and the sustainability of resources.

Ranked amongst the world's top universities, the University's main campus is also frequently listed among the world's most beautiful. Known for its sustainability, NTU has achieved 100% Green Mark Platinum certification for all its eligible building projects. Apart from its main campus, NTU also has a medical campus in Novena, Singapore's healthcare district.

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