

# ACHOO Syndrome: A Strange Reflex That Causes Sneezing in the Sun

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As a teenager, [Manuel Spitschan](#) discovered that just like his father, if he felt the urge to sneeze, looking at bright light could induce it. What seemed like a funny family quirk is actually rooted in genetics: Both Spitschan and his father have the photic sneeze reflex—also called autosomal dominant compelling helio-ophthalmic outburst (ACHOO) syndrome—where bright light triggers an involuntary sneezing response.<sup>1</sup>



Manuel Spitschan, a neuroscientist who studies the effect of light on human physiology at the Technical University of Munich and Max Planck Institute for Biological Cybernetics.  
Verena Müller, Max Planck Institute for Biological Cybernetics

“Most people who have it see it as a quirk...rather than something that is debilitating,” said Spitschan, now a neuroscientist who studies how light affects human physiology at the Technical University of Munich and Max Planck Institute for Biological Cybernetics.

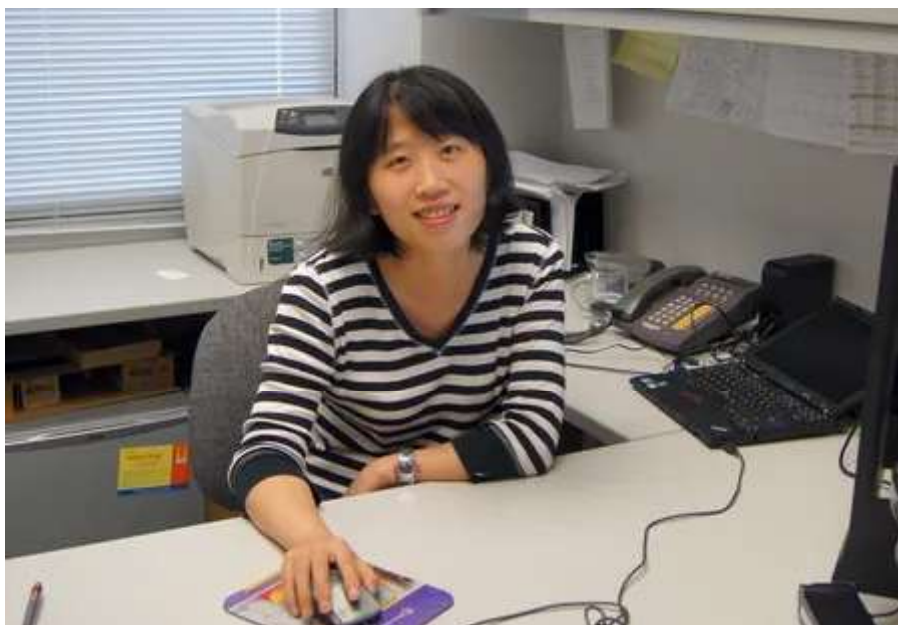
Though it may not cause serious trouble, ACHOO syndrome affects almost a fourth of people worldwide. Tracing it through families helped scientists understand its autosomal dominant inheritance pattern and pinpoint some genetic variants underlying the condition.<sup>2,3</sup> While the exact [neural mechanisms of sneezing](#) due to light elude scientists, some studies hint that [visual overstimulation](#) may trigger a cascade of reactions finally inducing a sneeze.<sup>4</sup> A better understanding of the condition can reveal how the brain and body communicate in unusual ways.

## ACHOO Syndrome Through the Ages

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Several people throughout history, including Aristotle in 350 BC, were intrigued by the photic sneeze reflex.<sup>5</sup> Almost 2,000 years later, English philosopher [Francis Bacon](#) showed that looking into light rather than heat from the sun triggers sneezing when he stepped into the sunlight with his eyes closed.

Scientists from the 18<sup>th</sup> to 20<sup>th</sup> century proposed several neural mechanisms underlying the response.<sup>6</sup> Some hypothesized that light coactivates adjacent light-sensing and sneeze-regulating neurons, while others theorized that optic nerve stimulation cross-activated nearby trigeminal nerves that regulate sneezing. Although there is no clear evidence yet, many believe that the latter theory is plausible.



Qin Liu studies the neural components of sneezing and coughing at the Washington University in St. Louis.

Qin Liu

“Light [probably] activates the optical nerves and accidentally activates [the sneezing center in the brain], inducing sneezing responses,” said [Qin Liu](#), who studies neural components of sneezing and coughing at the Washington University in St. Louis.

Spitschan agreed, “Light information is not something that the trigeminal nerve, which usually underlies sneezing...is interested in,” so there is probably some crosstalk between the retina and the trigeminal nerve.

Comparing the EEGs of people with and without the response has provided some insights: People with ACHOO syndrome showed heightened excitability of the visual cortex and other somatosensory brain regions upon exposure to light.<sup>4</sup>

In addition to exploring the neural basis of ACHOO syndrome, scientists also investigated potential genetic variants underlying the condition.<sup>3</sup> Examining genes of people with and without photic sneezing revealed the DNA regions and single nucleotide polymorphisms linked to this reflex.

## **Studying ACHOO Syndrome**

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According to Liu, pinpointing the genes underlying ACHOO syndrome will allow scientists to develop animal models for the condition. “Then we can use the genetic approach to study the mechanisms,” she said.



Josef Trinkl, a doctoral student in Manuel Spitschan's lab, investigates the stimuli that their team believes cause sneezing.

Verena Müller, Max Planck Institute for Biological Cybernetics

While understanding the mechanism is important, Spitschan believes that scientists must first understand even more fundamental aspects, like the exact stimuli, that result in photic sneezing.<sup>7</sup> Light is composed of various wavelengths and understanding the parameters that trigger sneezing could offer a better understanding of the underlying light-sensitive mechanisms. "Cataloging the [natural] conditions under which the sneeze occurs...is a good start," he said.

To this end, Spitschan and his team recently recruited a participant with ACHOO syndrome to record light levels every time he sneezed using a wearable light logger.<sup>8,9</sup> Analyzing the data revealed that illuminance was about 10 times higher during a sneeze

event, indicating that a sudden increase in environmental lighting conditions could induce photic sneezing.

Both Spitschan and Liu noted that there are many unanswered questions about ACHOO syndrome, and that answering these could provide fundamental insights into the nervous system. “Broadly speaking, it could lead to a better understanding of integration of signals from different modalities,” said Spitschan.

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