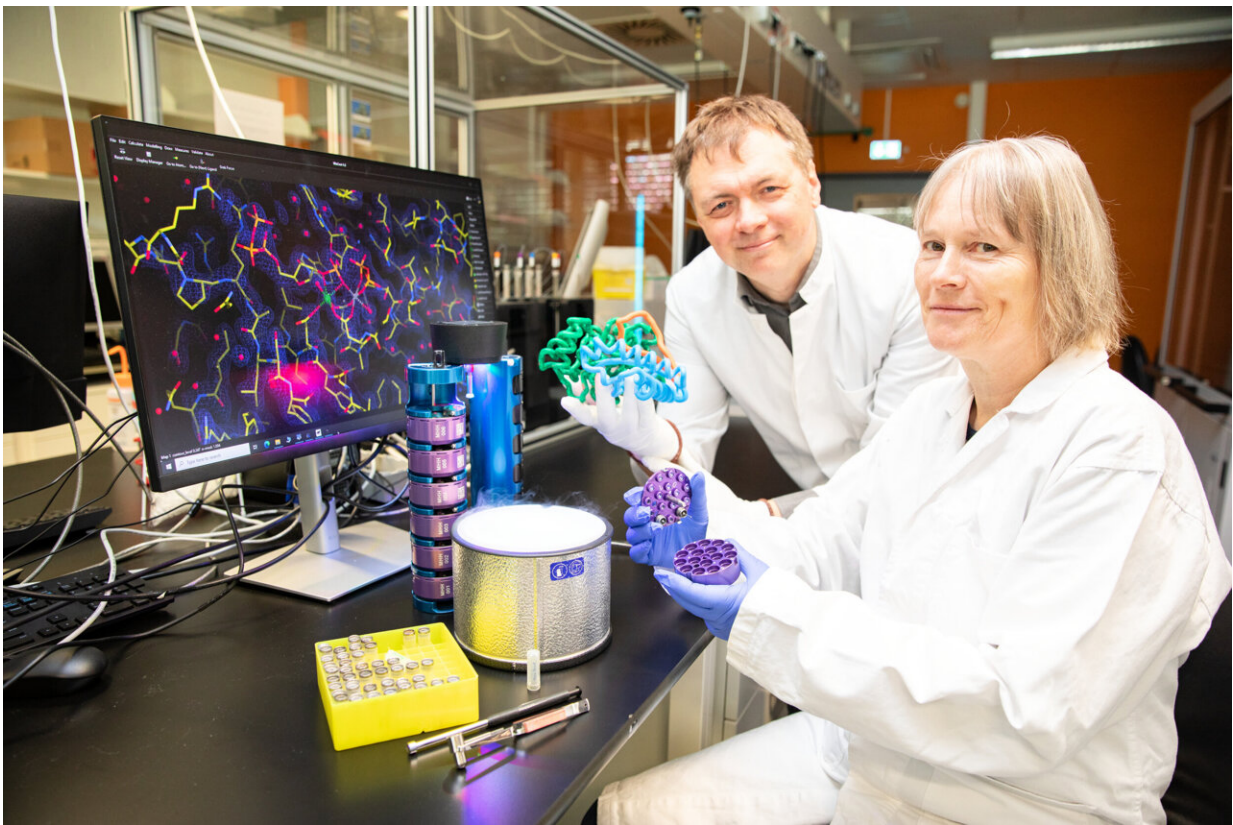


An ancient quantum machine controls our immune system—and researchers just discovered how it works

May 6 2026, by Inka Burow



Prof. Dr. Roman Fedorov (left) and Petra Baruch at the MHH Institute of Biophysical Chemistry. Credit: Karin Kaiser/MHH

Our immune system is much older than we think. Long before dinosaurs

existed, early life forms had developed a powerful defense system. Innate immunity has existed since the Cambrian period—that is, since the time when almost all of today's animal phyla first emerged. This ancient mechanism has been passed down through the course of evolution and continues to protect us today against viruses, cancer and other diseases.

A research team at Hannover Medical School (MHH) has now discovered a fundamental mechanism that activates the innate immune response. It likely originated more than three and a half billion years ago and has therefore existed for as long as life has existed on Earth. This mechanism activates the immune system through quantum mechanical phenomena.

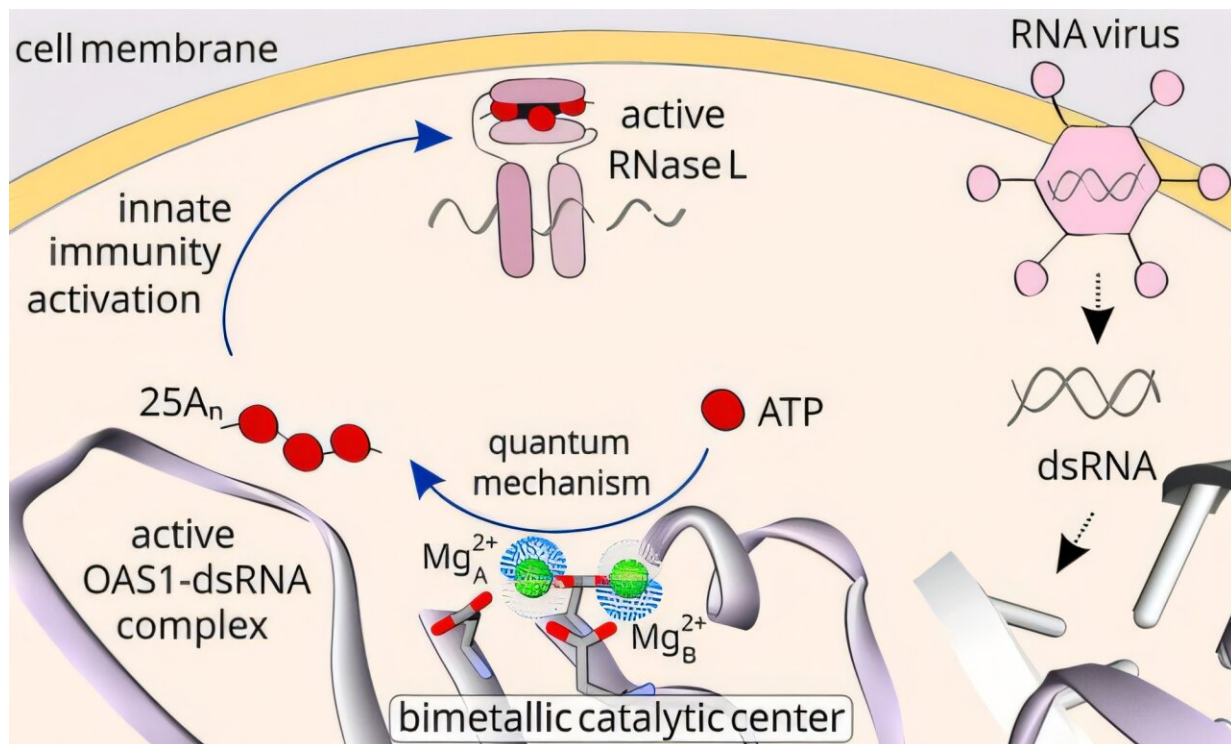
The research findings of Prof. Dr. Roman Fedorov's team at the MHH Institute of Biophysical Chemistry could serve as a basis for the development of drugs to treat viral infectious diseases such as COVID-19, autoimmune diseases and cancer. Furthermore, they demonstrate that quantum phenomena play a significant role in biology. They were [published](#) in the journal *ACS Omega*.

Proteins that work like smoke detectors

The scientists focused on a group of very ancient proteins found in all our cells. These oligoadenylate synthetases (OAS) function like smoke detectors: they detect a viral infection or damage to the body's own tissue and then activate the immune response. These molecular sensors are found, for example, in the cells of the nasal mucosa, where they play a role in the initial defense against SARS-CoV-2 viruses.

Using methods from structural biology, biochemistry and quantum chemistry, the team discovered that the function of these proteins is controlled by their so-called metal center—a region of the protein that

contains magnesium. The researchers found that quantum mechanical processes in the metal center ensure that OAS trigger defense mechanisms against viruses or damaged tissue. The findings confirm, as do many other recent research findings, that quantum phenomena play a significant role in biology.



Graphical abstract. Credit: *ACS Omega* (2026). DOI: 10.1021/acsomega.5c13236

Highly optimized quantum machines

Quantum mechanics describes how nature works at its deepest, most fundamental level—where the rules of everyday life no longer apply. In our familiar world, objects behave predictably: a ball follows a clear path, and a switch is either on or off. But in the quantum world, particles

can behave simultaneously as waves and as particles, exist in multiple states at once, and only "choose" a specific outcome when they interact with their environment. Quantum effects enable matter to perform tasks with extraordinary precision and efficiency.

"When such principles operate in [biological molecules](#)—as our work shows—they transform proteins into tiny, highly optimized 'quantum machines' capable of controlling complex processes such as immune responses with remarkable accuracy," says Professor Fedorov.

Ancient immune components shape our lives

"We believe that the metal center probably formed more than three and a half billion years ago, almost at the very dawn of life—perhaps even earlier," says Professor Fedorov.

They came to this conclusion because it is virtually identical to the catalytic center found in ancient organisms. Our immune system is therefore based on a quantum machine that is billions of years old, which has been preserved throughout evolution and continues to actively protect us to this day.

Building on these research findings, it is now possible to develop drugs that activate OAS in viral infections and cancer, or inhibit it in autoimmune diseases. This process will take several more years.

More information: Pavel Kats et al, The Enzymatic Mechanism of OAS: How Metal Ions and Quantum Effects Help Activate Innate Immunity, *ACS Omega* (2026). [DOI: 10.1021/acsomega.5c13236](https://doi.org/10.1021/acsomega.5c13236)

Provided by Hannover Medical School

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