UNIVERSITÉ DE GENÈVE

# PRESS RELEASE

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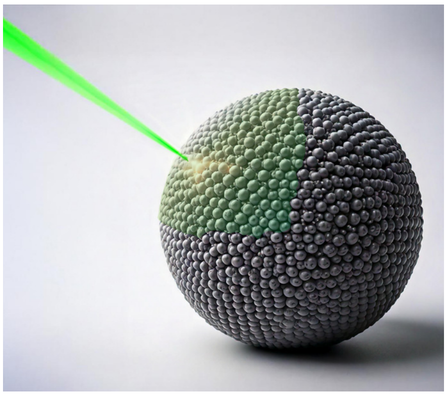
# Using light to activate treatments in the right place

UNIGE scientists have developed a tool that uses light to control the activity and localisation of a molecule, making it possible to control drug's site of action.

**Acting in the right place at the right time is the key to effective medical treatment with minimal side effects. However, this feat remains difficult to achieve. Biologists and chemists at the University of Geneva (UNIGE) have succeeded in developing a tool that controls the location at which a molecule is activated by a simple pulse of light lasting only a few seconds. Tested on a protein essential for cell division, this system could be applied to other molecules. The potential applications are vast, both in basic research and in improving existing medical treatments, such as those for skin cancer. These results are published in the journal *Nature Communications*.**

Regardless of how it is administered, a medication does not only act on the organ affected but has a systemic effect on the entire body. This lack of precision carries risks: it may miss its target and not have the desired effect, or it may cause potentially serious side effects. In Switzerland alone, thousands of people suffer from severe drug-related side effects each year.

The solution, simple in theory but highly complex in practice, would be to activate drugs only at the location where they are needed. This challenging research task would however make it possible to activate or inactivate a protein in a living organism at a specific location to better understand its functions. "Everything started from this methodological question," recalls Monica Gotta, Professor in the Department of Cell Physiology and Metabolism at UNIGE Faculty of Medicine, who initiated and coordinated this research with Nicolas Winssinger, Professor in the Department of Organic Chemistry at UNIGE Faculty of Science. "We were looking for a way to inhibit a protein involved in cell division, the Plk1 protein, when and where we wanted, to better understand its function in the development of an organism".





A simple pulse of light can control the activity of a molecule at a specific location without affecting surrounding cells, thereby limiting unwanted side-effects.

High resolution pictures

## Breaking a biological lock

By combining their expertise in chemistry and biology, the scientists were able to modify a Plk1 inhibitor molecule so that it would be activated by a pulse of light. "After a complex process, we were able to block the active site of our inhibitor with a coumarin derivative, a compound naturally present in certain plants. This coumarin could then be removed with a simple light pulse," explains Victoria von Glasenapp, a postdoctoral researcher in the laboratories of Professor Gotta at the Faculty of Medicine and Professor Winssinger at the Faculty of Science, and first author of the study.

The challenge was still to find a way to anchor the inhibitor at the exact point in the body where its action was desired. “We thus modified the inhibitor so that it becomes trapped in the targeted cell by adding a molecular anchor that is released only by light,” explains Nicolas Winssinger. “This enabled us to activate and anchor the inhibitor with the same light pulse, thereby inactivating Plk1 and stopping cell division at the precise desired location.”

### Countless possible applications

The system developed by the UNIGE scientists makes it possible to spatially and temporally control the activity of a molecule in a living organism using light. It can be adapted to numerous molecules to be able to activate a drug only where it is needed. In the future, a simple laser could therefore activate a treatment exactly where it is needed while sparing the surrounding healthy tissue, thereby limiting undesirable side effects. “We hope that our tool will be widely used, leading to a better understanding of how living organisms function and, in the long term, to the development of location-specific treatments,” concludes Monica Gotta.

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