



# PRESS RELEASE

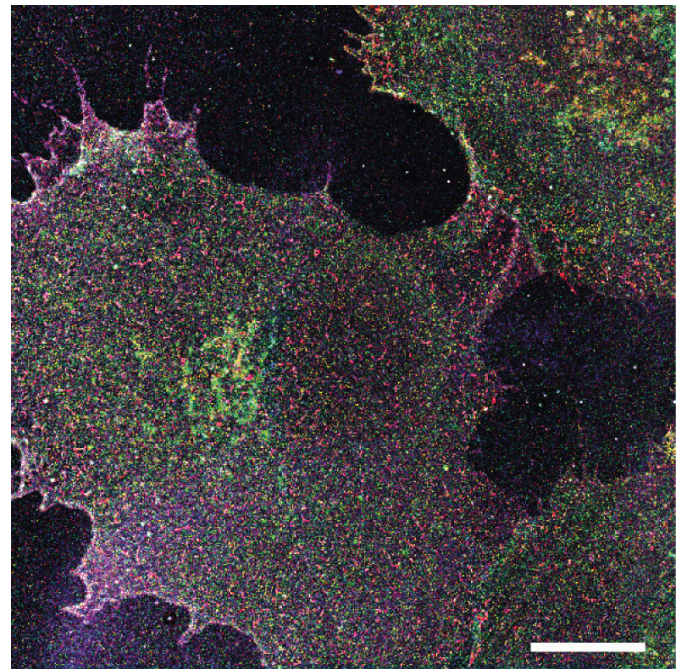
## When Cells Reveal Their Inner Workings

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Every human cell is surrounded by a sugar coating known as the glycocalyx. It not only interacts with its environment but also reveals a great deal about cells' internal states. Scientists at the Max Planck Institute for the Science of Light (MPL) have mapped sugar structures on cell surfaces using high-resolution microscopy. In initial studies, they were able to correlate the spatial arrangement of the sugar structures with specific physiological cell states. The results, recently published in *Nature Nanotechnology*, could pave the way for new diagnostic approaches, such as tumour detection.

The glycocalyx is a sugar structure that surrounds all human cells like a kind of coat. As the outermost part of the cell, it interacts with the environment. The spatial arrangement of these highly complex sugar structures is by no means rigid, but rather changes continuously. The independent research group "Physical Glycosciences", led by Prof. Leonhard Möckl at MPL, investigates the cell biology of the glycocalyx.

Using a new method called "Glycan Atlasing", the scientists were able to demonstrate for the first time how the spatial arrangement of these structures relates to the cell's physiological state. Various cell surfaces, ranging from cell culture lines to primary human blood cells and primary tissue sections, were mapped at the level of individual sugar structures using state-of-the-art super-high-resolution microscopy technology. In this way, the research group created a "map" of the glycocalyx. This approach demonstrated that the spatial arrangement of the glycocalyx "shifts" at the molecular level when the cell state changes. For instance, the sugar building blocks on immune cells were arranged differently relative to one another when the cells were stimulated, as would occur during an immune response. This provided the first direct evidence that the glycocalyx on the cell surface acts like a "screen", displaying information about the cell's state to the outside world.



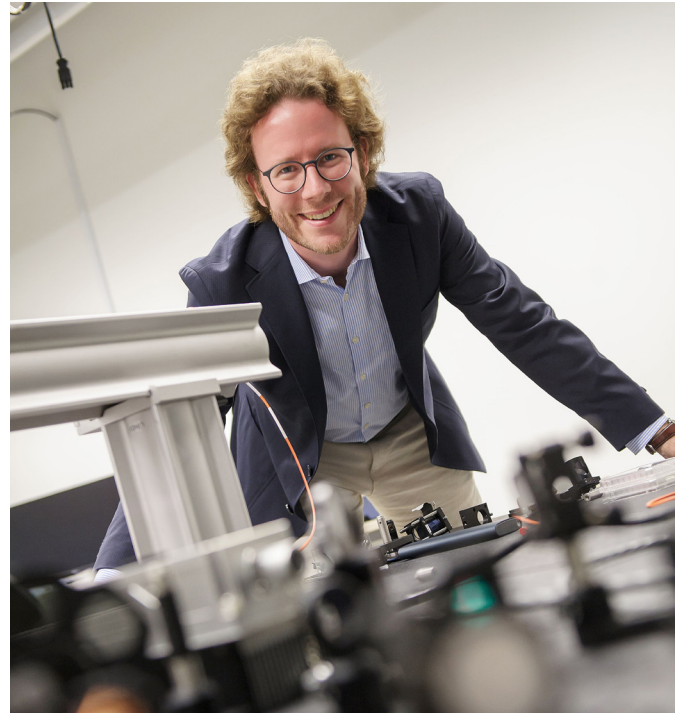
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Map of various glycan structures on a human blood vessel cell.

The data obtained on the spatial arrangement of the glycocalyx at the nanometer scale reliably distinguish the profiles of different cell states. The researchers were able to distinguish between different stages of cancer development, identify activated and non-activated immune cells, and differentiate tumorous from non-tumorous areas in human breast tissue. The scientific findings demonstrate that the cell surface functions as a structured display to the outside world and can be read using a standardizable method. "The results provide a promising foundation for the development of future diagnostic methods, as Glycan Atlasing delivers reliable results even in complex samples," explains Möckl, the study leader and corresponding author.



In the next step, the method will be applied to additional target structures and automated. The team's goal is to increase the number of samples to make the method suitable for routine medical use. "In large-scale studies, we want to investigate which surface patterns are associated with specific disease courses or therapeutic responses and how cell states can be detected early and objectively via the surface," Möckl explains, outlining his team's future plans.



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Prof. Leonhard Möckl, research group leader "Physical Glycosciences".

**Scientific publication in *Nature Nanotechnology*:**

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*Research at the Max Planck Institute for the Science of Light (MPL) covers a wide range of topics, including nonlinear optics, quantum optics, nanophotonics, photonic crystal fibres, optomechanics, quantum technologies, biophysics, and – in collaboration with the Max-Planck-Zentrum für Physik und Medizin – links between physics and medicine. MPL was founded in 2009 and is one of the over 80 institutes that make up the Max Planck Society, whose mission is to conduct basic research in the service of the general public in the natural sciences, life sciences, social sciences and the humanities.*