MEDIA RELEASE

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New platform to evolve proteins for better therapies

Researchers from the Centenary Institute, in collaboration with the University of Sydney, have developed a powerful new tool to evolve proteins directly within mammalian cells, offering a more effective way to design medical treatments tailored to the human body.

Published in the prestigious journal *Nature Communications*, the study reports on the development of PROTEUS (PROTein Evolution Using Selection), a cutting-edge platform that enables directed evolution.

A laboratory technique that mimics natural selection, directed evolution encompasses cycles of mutation and selection to produce proteins with new or improved functionality.

“Directed evolution is a powerful method for developing proteins with specific properties, but it’s usually done in bacteria or yeast, which don’t replicate the complexity of human cells,” said Associate Professor Daniel Hesselson, joint senior author of the study and Head of the Centre for Biomedical AI at the Centenary Institute.

“With PROTEUS we can now guide the evolution of these proteins directly within mammalian cells, creating a more stable system that’s much closer to the environment these proteins will ultimately need to work in.”

The researchers say the PROTEUS platform uses virus-like particles to introduce mutations and select improved proteins inside the mammalian cells, without disrupting or damaging the cells themselves.

Joint first author of the study, Dr Alex Cole, also from the Centenary Institute’s Centre for Biomedical AI, said the team had successfully used PROTEUS to improve a specific protein that regulates how genes are turned on or off. They had also evolved a nanobody (a small antibody-like protein) that responds to DNA damage, an important focus in cancer research.

“This platform is a major step forward,” Dr Cole said.

“By bringing directed evolution into mammalian cells, PROTEUS is opening the door to developing new therapies that are more effective and designed to function where they’re needed, in the human body.”

The researchers believe that PROTEUS could help drive future advances in gene therapy, disease research and next-generation medical treatments.

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Images:
Associate Professor Daniel Hesselson:
https://drive.google.com/file/d/1ENqabCuHQ70AdQFUdOElc7JsRrw_I8lD/view?usp=sharing

Dr Alex Cole:
https://drive.google.com/file/d/1yxkHenx5ajvgfc3bpclPKXWQc8VmYhmX/view?usp=sharing

Publication:
A chimeric viral platform for directed evolution in mammalian cells:
https://www.nature.com/articles/s41467-025-59438-2

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About the Centenary Institute
The Centenary Institute is a world-leading independent medical research institute, closely affiliated to the University of Sydney and the Royal Prince Alfred Hospital. Our research spans the critical areas of cancer, cardiovascular disease, rare diseases, inflammation, infectious diseases, healthy ageing and biomedical AI. Our strength lies in uncovering disease mechanisms and applying this knowledge to improve diagnostics and treatments for patients.

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