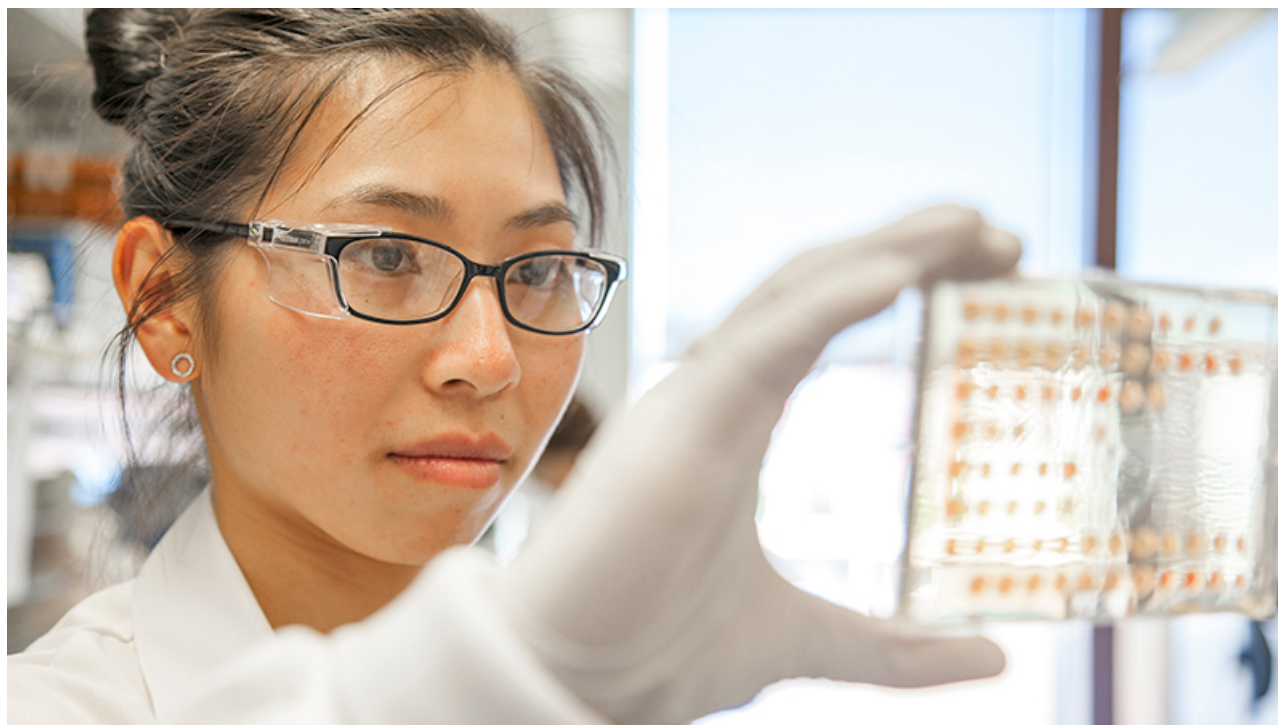


## Chemical Biology in Biomedical Research

The Biomedical Research unit is the innovation engine of Novartis. We collaborate across scientific and organizational boundaries, with a focus on powerful new technologies that have the potential to help produce therapeutic breakthroughs for patients.



Researchers have used the standard tools of biology and chemistry to develop many successful treatments, and we'll continue to use them. However we recognize that these tools leave many drug targets—key proteins and nucleic acids known to play a role in disease—out of reach. We would like to hit these targets to fight diseases, many of which have dodged the conventional molecules in our arsenal. To address this challenge, we are blazing a new path: organizing our early discovery efforts around a scientific discipline called chemical biology.

Chemical biology brings together experts from different fields—including biology, chemistry and computer science—to create new types of molecules and use them to probe biological systems. Our teams are increasingly breaking down barriers between fields to make progress toward tackling difficult targets. For instance, one team includes biochemists, structural biologists and others, all working to invent molecules that will influence the cell's own system for degrading proteins. The goal is to degrade particular proteins that we can't hit with conventional molecules.

This approach to drug discovery requires researchers to make connections across the company and beyond. Internally, the Biomedical Research unit works in concert with the Development unit to prioritize research projects with the greatest potential to impact the lives of patients. Also, we aim to strengthen ties with external collaborators such as academic labs and biotechnology companies generating disruptive tools and technologies that might significantly accelerate our work.

To encourage collaboration, we're recruiting a Faculty of Scholars, inviting some of the brightest minds in academia to work in our labs. We're making it easier for Novartis teams to share compounds with labs outside

the company to help advance science more quickly. And we continue to form strategic alliances when appropriate. In 2016, for example, Novartis signed a deal with Xencor to access bispecific antibodies for immuno-oncology. These antibodies latch onto two targets instead of one to harness and direct the power of the immune system against cancer.

Our brand of chemical biology is directed at the discovery of potential therapies, for which Biomedical Research leads research from their conception through the proof of concept in Phase I and II trials. When molecules are ready for testing in humans, our proof-of-concept studies enroll small numbers of patients to make an early assessment of a drug's safety and effectiveness. Based on results of these early studies in patients, Biomedical Research and Development colleagues select which drug candidates show enough promise to qualify them for additional testing in further clinical trials.

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