Medicinal Chemistry 101:

From Bench to Bedside

Overview

The drug development process is a team effort across multiple scientific disciplines, including **biology**, **chemistry** and **pharmacology**.

A medicinal chemist is a scientist with a background in organic chemistry who works in a lab to discover potential drug compounds that may combat disease.

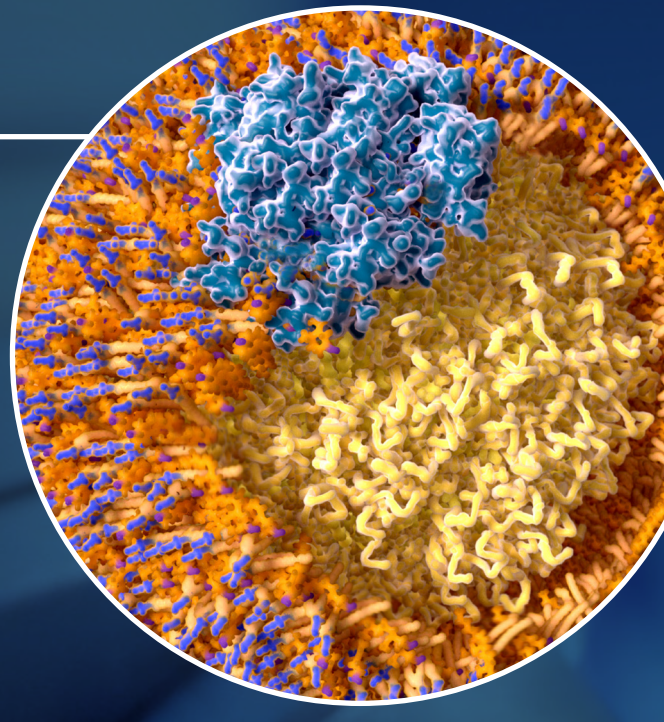
Medicinal chemists serve a very important role in the small molecule discovery process – **from bench to bedside**.

Target Identification and Validation

Finding a target

Multidisciplinary scientific teams work to identify something in the body that plays a role in disease. This process is called **target identification**. Targets are often proteins, which include enzymes, ion channels and receptors.

Once a target has been found, it must be confirmed that modulating the target can mitigate its disease-causing nature. This is called **target validation**.

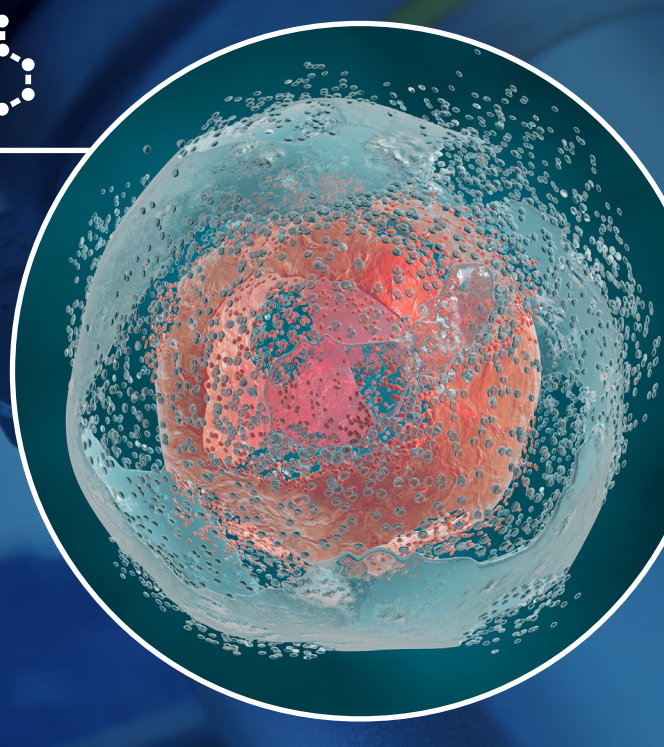


Hit-to-Lead

Getting the first hit

Once a target has been identified and validated, chemists will screen vast libraries of chemical compounds against the target to see which types of chemicals will engage with the target, known as **hit-to-lead**.

If successful, a few different chemical structures will show activity against the target. With these first hits, scientists can then begin optimizing these chemical structures.



Lead Optimization

Turning 'hits' into drug candidates

Using years of knowledge of organic chemistry, medicinal chemists are able to experiment with the chemical structures of the 'hits'. Medicinal chemists will make subtle alterations to the makeup of the structure, always refining to ensure the best engagement and activity with the target. This is known as **lead optimization**.

Pre-Clinical Development

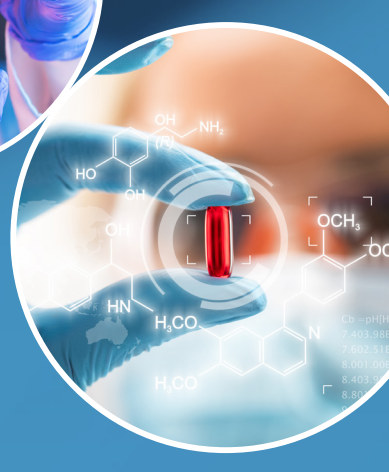
Moving closer to clinical trials

Refining and optimizing a chemical structure can take several years, until a drug candidate is selected. This molecule will have exceptional activity against a said target and will have been designed not to interact with any other 'off targets' within the body.

To determine potential side-effects of a drug, it is brought through **pre-clinical development**. These tests help determine what a drug does to the body, as well as what the body does to a drug. If these tests look good, a drug candidate will move into **clinical trials**, where it will be tested in human beings, and will be one step closer to becoming an approved product.

Clinical Trials

Even after this extensive drug discovery process, only 13.8 percent of drugs that enter Phase 1 trials will end up as approved therapies,[1] and the research and development efforts for new safe and efficacious therapeutic options will continue on.



Bristol-Myers Squibb

1. Wong, C. H., Siah, K. W., & Lo, A. W. (2018). Estimation of clinical trial success rates and related parameters. Biostatistics, kxx069. https://doi.org/10.1093/biostatistics/kxx069.