

# Role of Medicinal Chemist in the Modern Drug Discovery and Development

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The history of drug research over a period of a century [1,2], since Paul Ehrlich [3] introduced the concept of chemotherapeutic agents, is an amazing journey of accomplishments including the serendipitous success of antibiotics [4]. Drug discovery has changed over the years but the goal remains the same: to find safer medicines for the deadliest diseases. Traditionally, the discovery of new drugs has arisen from observations that various plant extracts possess interesting biological effects. However, early users of such plant extracts did not understand or realize which components in the material were responsible for achieving these therapeutic benefits. The main difference between modern and age-old medicine is identifying the composition of matter, or the active form, within the medicine itself. This modern drug discovery and development is mostly a complex, expensive, time consuming and market-driven process with very few novel drug candidates actually making it through the Food and Drug Administration (FDA) for approval. Discovery and development of new drugs does not rely so much on miracles or serendipity anymore, but instead utilizes highly planned processes involving cutting edge technologies. The previous era of modern drug discovery was dominated by chemistry, whereas now a more rational approach is employed where knowledge about enzymes and receptors has required a unique dialogue between chemists and biologists.

Medicinal chemists have an ever changing role in modern drug discovery. No longer are the days of simple synthesis; instead, complex synthetic methods and technologies such as combinatorial chemistry (combiChem), microwave assisted organic synthesis (MAOS) and high-throughput (HTS) biological screening methods have evolved the daily life of a chemist. These new technologies are helping him to attain his goal much faster in the discovery process. Drugs must be designed, synthesized and purified successfully in order to aide in the first step of development. Medicinal chemist combines comprehensive knowledge of the synthetic chemistry, medicinal chemistry, and biology literature with the ability to drive the project forward. They are scientifically broad innovators who propose and work on all available drug targets.

Finding viable drug targets (the so-called biological approach) [5] has become increasingly used in recent decades with the advancements in the field of genomics and proteomics. A medicinal chemist uses this information to seek out relevant targets capable of being affected by the addition of compounds. These specifically synthesized drug molecules are proposed, synthesized and tested for direct action on these protein targets in order to effectively treat a wide variety of illnesses. In previous times, "classical medicinal chemists" would modify the existing bio-active molecules from natural products. These natural products were the source of most of the active ingredients in most medicine [6]. With the help of molecular biology in combination with computer-assisted drug design, medicinal chemists can now rationally design new drug molecules with known targets in mind. These compounds would have computational data encouraging the intended results even before they screen. This saves time and allows for a more comprehensive understanding of the drug-target interplay. To succeed in the discovery process medicinal chemists have to perform these initial important tasks: i) **identification of lead** molecules which

have the desired biological activity using new technologies such as HTS and combinatorial chemistry ii) **the lead modification or optimization** which could be done by employing structure-activity analysis (SAR) in order to improve the desired pharmacological properties by considering absorption, distribution, metabolism, and excretion (ADME) profile, and iii) **scale-up of the optimized lead** for further drug development process and efficacy testing.

Medicinal chemists, especially in academia, are now increasingly involved in drug discovery and development process; they have become tremendously important in the innovation and discovery of drugs. Therefore, many industries are realizing this potentiality from academia and they are approaching for possible collaboration. In medical research the industry-academia cooperation often pair university (medicinal chemistry research) with industry (resources) for technology transfer to bring new medicines from bench to bedside. Such collaborations have and will continue to improve human health by facilitating novel and innovative drug molecules and treatments.

In summary, new biological targets, methodologies and advanced computing have improved modern drug discovery and have given medicinal chemists a more profound skill set and toolkit to grasp the nuances of disease pathophysiology. Driven now by target identification and specificity of action, these new molecules and their development are revolutionizing healthcare. Not only are these new techniques and approaches innovative, but they are cost-effective as well. Medicinal chemists are essential players in this process and are relying heavily on new scientific literature to drive this process forward more efficiently. Open access journals such as organic chemistry: current research from OMICS group is playing a very important role by providing essential up-to-date research information to scientific community worldwide. The hope here is that these journals will add to the every growing knowledge created by the medicinal chemist to have a great impact in drug discovery process.

## References

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