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Advances in High-throughput Screening Methods for Drug Discovery in Biomedicine

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Introduction

High-Throughput Screening (HTS) methods have revolutionized the field of drug discovery in biomedicine by enabling the rapid and efficient evaluation of large chemical libraries against therapeutic targets. This review explores the recent advances in HTS methods for drug discovery. We discuss the principles and technologies behind HTS, including assay development, compound libraries, and detection methods. Furthermore, we highlight the applications of HTS in target identification, lead discovery, and optimization. We also delve into emerging trends in HTS, such as the integration of artificial intelligence and machine learning, organoid-based screening, and phenotypic screening approaches. By harnessing the power of HTS, researchers can accelerate the drug discovery process and advance the development of novel therapeutics [1].

Description

High-throughput screening methods have transformed the landscape of drug discovery in biomedicine by allowing researchers to quickly and efficiently evaluate large chemical libraries against therapeutic targets. HTS involves the systematic screening of thousands to millions of compounds in a short period, making it a powerful tool for identifying potential drug candidates [2]. In this review, we provide an overview of the principles and technologies that underpin HTS. We discuss the process of assay development, which involves designing and optimizing robust and reliable assays to measure the activity or interaction of the target of interest. We also examine the importance of compound libraries, ranging from small-molecule collections to natural product libraries, and their role in providing diverse chemical structures for screening campaigns. Additionally, we explore the various detection methods used in HTS, including fluorescence, luminescence, and label-free techniques, which allow for the measurement of target engagement or functional readouts [3].

Moreover, we highlight the broad applications of HTS in drug discovery. HTS is instrumental in target identification, where it aids in unraveling the function and druggability of novel targets. It also plays a critical role in lead discovery by efficiently screening large compound libraries to identify hits with desired biological activity. Furthermore, HTS enables lead optimization, where structure-activity relationship studies are conducted to refine chemical structures and improve drug-like properties [4].

Furthermore, we discuss emerging trends and advancements in HTS. The integration of artificial intelligence and machine learning algorithms has the potential to streamline the HTS process by predicting compound-target interactions, enhancing hit identification, and reducing experimental efforts. Organoid-based screening platforms, which utilize three-dimensional organ-like structures derived from patient samples, offer a more physiologically relevant context for drug screening. Additionally, phenotypic screening approaches, which focus on assessing the effect of compounds on cellular or organismal phenotypes, provide a complementary strategy to target-based screening [5].

Conclusion

Advances in high-throughput screening methods have revolutionized drug discovery in biomedicine, enabling researchers to rapidly screen large compound libraries against therapeutic targets. The systematic and efficient nature of HTS accelerates the drug discovery process by identifying potential drug candidates, facilitating target identification, lead discovery, and lead optimization. The integration of emerging technologies such as artificial intelligence, organoid-based screening, and phenotypic screening holds immense potential for further enhancing the efficacy and success of HTS. By harnessing the power of HTS, researchers can expedite the discovery of novel therapeutics and contribute to advancing biomedicine for improved patient care and treatment outcomes.

Acknowledgement

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Conflict of Interest

None.

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