

“Multi-Organ-on-a-Chip” for Drug Testing Applications

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April 27, 2024

Abstract

Drug discovery and testing is a lengthy process that is essential before human clinical trials. Animal models are vital in preclinical drug assessment, yet ethical concerns and species variations persist. Although cell-based models are used, they struggle to precisely predict drug efficacy, toxicity, and organ interactions due to cultured cells' inability to maintain original functions and structures in typical in vitro systems. To overcome these limitations, the emerging technology of organ-on-a-chip is being developed as an alternative to traditional preclinical drug testing models. The implementation of organ-on-a-chip technology holds great potential in significantly enhancing the accuracy and efficacy of preclinical testing, thereby enabling more precise prediction of a drug's performance in clinical trials. Moreover, the development of multi-organ-on-a-chip (MOC) systems enables the replication of various organs in vitro, making the study of drug-body interactions possible. In this review, we first introduce the design of organ-on-a-chip devices. Subsequently, we describe the applications of different tissue co-culture configurations in organ-on-a-chip for drug testing. Finally, we summarize the challenges and prospects associated with organ-on-a-chip technology. In conclusion, this review provides a comprehensive overview of organ-on-a-chip technology, multi-organ-on-a-chip for drug testing, and the challenges and prospects for the future.

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