

The Integration of Nanomedicine and Bioinformatics: A New Frontier of Accurate Diagnosis and Treatment

Mengmeng Li*

College of Life Sciences, Shandong First Medical University, Jinan, China

Email address:

1772626952@qq.com (Mengmeng Li)

*Corresponding author

Abstract

The deep integration of nanomedicine and bioinformatics is reshaping the pattern of precision medicine. With their adjustable physicochemical properties, nanodrugs have shown unique advantages in the fields of targeted delivery, gene therapy and diagnostic imaging, but their clinical transformation has long been trapped in the challenges of complex nano-biological interactions, batch differences and safety prediction. Bioinformatics provides systematic solutions to the above problems by integrating multi-group data, molecular simulation and artificial intelligence algorithms. This article is trying to explore new learning and development directions. This article systematically reviews the latest progress in this cross-field: at the level of drug design, molecular dynamics simulation and machine learning models can accurately predict the transfection efficiency, protein crown formation and cell uptake behavior of lipid nanoparticles (LNPs); in the optimization of targeting strategies, bioinformatics tools can explore tumor characteristics Heterosexual biomarkers (such as FOLH1) are combined with molecular docking to guide the surface functional modification of nanocarriers and significantly improve their active targeting ability. In addition, the AI drive platform represented by NanoForge is realizing the rational design and high-throughput screening of nanodelivery systems through closed-loop iteration of dry and wet experiments. Although data standardization, in vivo and external correlation and regulatory framework still need to be improved, nanoinformatics, as an emerging interdisciplinary discipline, is promoting nanomedicine from "experiential exploration" to "predictive design" by integrating multimodal data and advanced computing models, providing complex indications such as cancer, genetic diseases and pediatric diseases. A safer and more efficient personalized treatment strategy.

Keywords

Nanodrugs, Bioinformatics, Artificial Intelligence, Drug Delivery, Targeted Therapy, Nanoinformatics