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Emerging Technologies for Targeted Drug Delivery in Biomedical Applications

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Introduction

Targeted drug delivery is a rapidly advancing field in biomedical applications, aiming to enhance therapeutic efficacy while minimizing side effects. This article provides an overview of emerging technologies for targeted drug delivery. It explores various strategies and delivery systems that enable precise and controlled drug release at specific sites within the body. The potential benefits of targeted drug delivery include increased drug concentration at the desired site, reduced systemic toxicity and improved patient compliance. This review discusses recent advancements in nanotechnology, microfluidics and biomaterials, highlighting their applications and potential impact on the field of targeted drug delivery.

Nanotechnology-based drug delivery systems

Nanoparticles: Nanoparticles, such as liposomes, polymeric nanoparticles and metallic nanoparticles, have gained significant attention in targeted drug delivery. These Nano carriers can encapsulate drugs and enable their controlled release at the target site. For example, developed a liposomal nanoparticle-based system for targeted drug delivery in cancer therapy, achieving enhanced tumour accumulation and therapeutic efficacy [1].

Nanofibers and nanosheets: Nanofibers and nanosheets offer unique platforms for drug delivery due to their high surface area and tunable properties. They can be functionalized with targeting ligands to specifically interact with target cells or tissues. For instance, nanofibers for the localized delivery of antimicrobial agents, demonstrating effective bacterial eradication and wound healing [2].

Nanoemulsions and micelles: Nanoemulsions and micelles are self-assembled nanostructures that can encapsulate hydrophobic drugs, improving their solubility and stability. These systems can be surface-modified for active targeting and triggered drug release. PH-sensitive nanoemulsion for targeted delivery of anticancer drugs, achieving improved therapeutic outcomes and reduced systemic toxicity.

Description

Microfluidic-based drug delivery systems

Lab-on-a-chip devices: Microfluidic platforms, also known as lab-on-a-chip devices, offer precise control over fluid flow and enable the integration of multiple functions within a small-scale system. These devices facilitate on-chip synthesis, formulation and characterization of drug delivery systems. For example, microfluidic-based platform for the synthesis and screening of drug-loaded nanoparticles, allowing rapid optimization of formulation parameters.

Organ-on-a-chip systems: Organ-on-a-chip systems mimic the structure and function of human organs, providing a platform for studying drug interactions and assessing their efficacy in a more physiologically relevant environment. These systems allow for personalized drug testing and evaluation. A liver-on-a-chip model to evaluate targeted drug delivery for liver cancer treatment, demonstrating improved drug accumulation and selective tumor cell killing [3].

Droplet microfluidics: Droplet microfluidics enables the precise encapsulation of drugs within microscale droplets, allowing high-throughput screening and controlled release of drugs. This technology offers advantages in terms of scalability and compatibility with various drug formulations. For instance, droplet microfluidics for the preparation of drug-loaded microcapsules, enabling sustained drug release and enhanced therapeutic effects.

Biomaterial-based drug delivery systems

Hydrogels: Hydrogels are three-dimensional networks capable of encapsulating drugs and providing sustained release profiles. They can be engineered to respond to various stimuli, such as pH, temperature, or enzymatic activity, enabling controlled drug release at the target site [4]. For example, an injectable thermosensitive hydrogel for localized and sustained delivery of growth factors, promoting tissue regeneration.

3D Printing: 3D printing technologies allow the fabrication of complex structures and customized drug delivery systems with precise control over drug release kinetics. These systems can be tailored to fit patient-specific needs and optimize therapeutic outcomes. For instance, 3D printing to fabricate personalized drug-eluting implants for ocular drug delivery, achieving controlled release and prolonged therapeutic effect.

Bioresponsive materials: Bio responsive materials can actively respond to specific biological cues, triggering drug release at the target site. These materials can be designed to respond to changes in pH, enzymatic activity, or cellular signals. A bio responsive Nano gel system that released drugs in response to tumor microenvironment conditions, demonstrating enhanced tumor accumulation and improved therapeutic efficacy [5].

Conclusion

Emerging technologies in targeted drug delivery, such as nanotechnology, microfluidics and biomaterials, offer exciting opportunities for precise and controlled drug release in biomedical applications. These technologies have the potential to revolutionize drug delivery, enhancing therapeutic efficacy and reducing side effects. Continued research and development in these areas will further advance targeted drug delivery strategies, enabling personalized medicine and improving patient outcomes.

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Conflict of Interest

None.

References

1. Dutta, J. C. and Monalisa Hazarika. "Modeling of Enzyme biosensor based on pH-sensitive field effect transistor for detection of glucose." *IET Circuits, Devices Syst* (2012): 686-688.
2. Ansari, Anees A., M. Alhoshan, M. S. Alsalhi and A. S. Aldwayyan. "Nanostructured metal oxides based enzymatic electrochemical biosensors." *Biosensors* 302 (2010): 23-46.
3. Stepurska, Kateryna, Sergei Dzyadevych and Sergii Gridin. "Potentiometric enzyme biosensor for aflatoxin B1 detection–Kinetic simulation." *Sensors and Actuators B Chemical* 259 (2018): 580-586.
4. Liu, Yang, Lan Yao, Lingzhi He and Na Liu, et al. "Electrochemical enzyme biosensor bearing biochar nanoparticle as signal enhancer for bisphenol a detection in water." *Sensors* 19 (2019): 1619.
5. Ravariu, Cristian, Dan Eduard Mihaiescu, Alina Morosan and Daniela Istrati, et al. "Solution for green organic thin film transistors: Fe_3 O_4 nano-core with PABA external shell as p-type film." *J Mater Sci Mater Electron* 31 (2020): 3063-3073.

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