

# 材料医学中的医学材料

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随着社会发展,人们对疾病的预防、诊断、治疗和预后的要求日益提高。特别是,新冠肺炎疫情暴发对人类生命健康造成了巨大威胁,也给全球社会和经济带来了明显冲击。生物材料(包括但不限于各种微纳米级生物材料和大量三维块体/植入体生物材料)领域的快速发展,为解决医学健康问题提供了新的方向和可能性。但是,生物材料的临床转化进展相对缓慢,目前只有少量基于生物材料的产品获得了临床批准。

基于材料科学和临床医学的发展,跨学科融合产生了一个新的学科——材料医学,其从临床医学问题和挑战出发,设计并制备满足直接应用目的/需求的生物材料/医用材料,期望直接解决临床面临的关键问题。因此,材料医学重点关注的是临床问题,通过材料学的技术解决临床问题,并进一步拓展至与临床医学直接相关的医用材料(医学材料),包括医疗设备相关的材料体系等。一方面,材料医学聚焦于解决传统医学面临的问题,包括生物利用度低、治疗效果不理想、靶向特异性差和全身毒副作用等;另一方面,无机、有机和无机/有机杂化材料在微纳米尺度上具有独特的理化性质,可被开发成多功能医用材料用于生物成像和疾病治疗。尤其是,材料医学中的诊疗学将疾病诊断与治疗作为互补技术巧妙结合,在影像引导下实现治疗和监控。其他基于材料医学发展的医学技术和医学材料,例如组织工程材料、生物传感材料和抗微生物材料等,也显现出巨大的潜力。尽管材料医学的各个分支都经历了爆炸式增长,并为以更安全、更有效的方式进行疾病诊断和治疗提供了许多机会,但其临床转化仍面临着一些关键挑战,例如医学材料的可控制备、大规模生产和毒性评价,体内生物屏障,诊疗一体化等。

近年来,我国科研人员在医学材料的合理设计、制备、功能化修饰、理化机理探索以及生物医学应用等方面做出了许多代表性工作。为集中展示我国科学家在材料医学领域的最新研究成果,激发社会各界对材料医学和医学材料的兴趣,《无机材料学报》编辑部邀请上海大学陈雨教授担任特邀编辑,以“医学材料”为主题出版专辑。本专辑收录了医学材料的最新综述文章和研究论文,涉及压电半导体纳米材料、VA族单元素二维纳米材料、生物活性玻璃陶瓷、金属合金和氧化硅基杂化胶束等。希望本专辑能够抛砖引玉,促进来自不同领域、不同学科背景的研究人员的合作,共同推动材料医学这一新兴学科的发展,以期改变和优化临床医学对各种疾病的诊断和治疗方式,造福人类。

## Medmaterials in Materdicine

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With the rapid development of the economy and society, the requirements of human beings for disease prevention, diagnosis, treatment, and prognosis are increasing day by day. In particular, the outbreak of the COVID-19 pandemic worldwide has posed a huge threat to human life and health, as well as an extreme impact on the global society and economy. The prosperity of biomaterials and nanotechnology, including but not limited to a variety of micro-/nano-scale biomaterials and a large number of three-dimensional bulk biomaterials, provides new directions and possibilities for solving medical health problems. However, the process with respect to the clinical translation of biomaterials is relatively slow, and currently, only a few biomaterial-based products have received clinical approval.

Benefiting from the advances of materials science and clinical medicine, the interdisciplinary integration of these two disciplines, termed materdicine, starts from the issues and challenges in clinic, rationally designs and synthesizes biomaterials/medmaterials with direct application purposes/needs in order to further effectively address the critical problems in clinical practice. Therefore, materdicine

chiefly focuses on clinical medicine issues, satisfies the medical requirements through the corresponding biomaterial-involved platforms and technologies, and further extends to medmaterials that are directly related to clinical medicine including materials systems for medical devices. On the one hand, materdicine concentrates on handling the problems faced by traditional medicine, such as low bioavailability, unsatisfactory therapeutic outcome, poor targeting specificity, and systemic side effects. On the other hand, inorganic, organic, and inorganic/organic hybrid medmaterials own unique physicochemical properties at the micro-/nano-scale and can be developed into multifunctional systems for biomedical imaging and disease therapy. More importantly, theranostics in the field of materdicine elaborately combines diagnostic imaging and therapeutic medicine as complementary technologies to implement imaging-guided treatment and monitoring. Other medical technologies and medmaterials based on the development of materdicine, for instance, tissue engineering materials, biosensing materials, and antibacterial materials, also exhibit considerable potential. Although materdicine has experienced explosive growth in every branch and offered substantial opportunities for disease diagnosis and treatment more securely and effectively, its clinical translation still faces several key challenges, such as the controlled synthesis, large-scale production and toxicity evaluation of medmaterials, *in vivo* biological barriers, integration of diagnosis and treatment.

In recent years, Chinese researchers have done a myriad of representative works in the field of rational design and construction, surface functional engineering, optimization and mechanism exploration of physicochemical properties, and biomedical applications of materdicine and medmaterials. To showcase the state-of-the-art research achievements of Chinese scientists in the field of materdicine and stimulate the interest of all walks of life in materdicine and medmaterial, the Editorial Board of the *Journal of Inorganic Materials* herein invited Prof. CHEN Yu from Shanghai University as the guest editor to compile this Special Issue themed “Medmaterials”. This issue contains the latest reviews and research papers related to medical materials, including piezoelectric semiconductor nanomaterials, group VA single-element two-dimensional materials, bioactive ceramics, metal alloys, and silica-based micelles. It is hoped that this special issue will promote the cooperation of researchers and scientists from many fields with different disciplinary backgrounds, and jointly promote the development of the field of materdicine and medmaterial, so as to revolutionize the diagnosis and treatment of various diseases in clinical medicine for the benefit of human health.



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国抗癌协会青年理事会常务理事、中国化学会青年工作委员会委员、中国超声医学工程学会超声分子影像专业委员会委员、中国医师协会超声分子影像及人工智能专业委员会委员、中国医药生物技术协会纳米生物技术分会第二

届委员会委员、中国抗癌协会纳米肿瘤学专业委员会第一届青年委员会委员、中国科学院青年创新促进会会员、《Exploration》副主编、《BME Frontiers》副主编、《Science Bulletin》执行编委、《Materials Today Chemistry》编委、《无机材料学报》编委等。陈雨的主要研究工作基于“材料医学”的基本原理, 围绕生物医用微/纳功能材料的可控制备、生物学效应及其在生物医学中的应用, 发展了多种新型的制备方法, 获得了具有临床应用前景的医用材料体系, 并发展了多种高效的肿瘤治疗模式。在此基础上提出“计算生物材料”的研究思路, 为医用材料的设计提供理论指导。作为第一或通讯作者共发表 SCI 收录论文 250 余篇, 论文被引用 29000 余次, H-index 为 92, 连续入选 2018–2021 年“全球高被引科学家”。

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