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抗疫生物材料

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致病性细菌和病毒以及癌细胞在人体内可快速甚至爆炸性增殖, 长期对人类生命健康造成严重威胁。特别是 2019 年末, 全球范围内暴发的新冠病毒肺炎疫情引起了全球对此类重大突发公共卫生事件的高度关注。细菌、病毒、癌细胞的快速检测、诊断及治疗对维护人类生命健康发挥着重要作用。除了常规的医学诊疗手段, 基于一些功能纳米材料发展的新型传感技术, 对病毒、细菌、癌细胞的检测及对三者引起的疾病治疗, 展现出广阔的发展前景, 但在新型诊疗策略向临床验证转化方面还面临着生物活性、稳定性、可重复性等挑战。目前实际用于临床诊疗的新技术非常少。

一些具有电学、磁学、光学功能性的纳米材料, 因其特殊的表面性质、量子尺寸效应、小尺寸效应而展现出的优异传感特性, 可用于构建快速响应、高灵敏度、高准确率的生物传感器件, 并可通过光热、磁热、高催化活性达到治疗目的, 有望使诊疗一体化成为现实。随着纳米材料、纳米传感技术、生物技术的发展, 材料和医学检测的结合不仅致力于控制大规模暴发的疫情, 实现生物分子的快速筛查和诊断, 而且有望构建一种普适化的检测诊断平台, 及时应对各种突发的疫情和疾病。在生物材料和医学检测领域, 一方面需要考虑材料的性质所受生物环境的影响, 如复杂生物环境内杂质的干扰造成的结果误判, 被检生物分子或杂质对材料荧光造成不可预判的淬灭等; 另一方面需要考虑材料对生物分子的毒性、材料的可控性及大规模生产、体内检测时生物屏障的影响、诊疗一体化的实现等问题。此外, 一些纳米技术本质上缺乏特异性, 生物传感技术应考虑如何巧妙地构建传感元件(包括但不限于构建特殊微观结构和功能化修饰)来保证对目标分子的高特异性。最重要的是, 为了应对新型冠状病毒肺炎这类大规模暴发的疫情, 新型诊疗技术应该具备高通量特性。

近年来, 我国科研人员在材料生物传感技术的合理设计、制备、功能化修饰、理化机理探索以及生物医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生物医学检测领域的最新研究成果, 激发社会各界对生物材料及传感新技术的广泛兴趣, 本人应《无机材料学报》编辑部邀请担任特邀编辑, 组约稿件出版 “抗疫生物材料” 专栏。本专栏收录了病毒、细菌、癌细胞检测和诊断相关的最新综述文章和研究论文, 涉及用于新冠病毒检测的新型生物传感技术(电化学传感器、SERS 生物传感器、SPR 生物传感器等), 荧光检测技术、抗菌纳米酶技术等。希望通过本专栏的一得之见, 促进来自多个领域、具有不同学科背景的研究人员合作, 共同推动生物医学检测这一领域的发展, 以期创新、发展临床医学对各种疾病的诊断和治疗方式, 更好地造福人类健康。

Anti-epidemic Biological Materials

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Pathogenic bacteria and viruses and cancers pose serious long-term threats to human life and health because of their quick or even explosive proliferation in the body. In particular, the global outbreak of COVID-19 in late 2019 has raised high concerns about this major public health emergency. Rapid detection, diagnosis and treatment of bacteria, viruses and cancer cells play an important role in maintaining human life and health. In addition to conventional medical diagnostic and therapeutic means, novel sensing technologies based on certain functional materials have shown promising development prospects for the detection and treatment of viruses, bacteria and cancer cells. However, the transition from novel diagnosis and treatment strategies to clinical validation still faces challenges such as biological activity, stability and reproducibility. Currently, few new technologies are actually used in

clinical diagnosis and treatment.

A number of functional materials, with excellent electrical, magnetic, optical and other properties, can be applied to construct biosensors with fast response, high sensitivity and high accuracy. Particularly, nanoscale materials exhibit excellent sensing properties due to their peculiar surface properties, quantum size effects and small-size effects, which can be used for therapeutic purposes through photothermal, magnetothermal and high catalytic activity with promising integration of diagnosis and treatment. With the development of nanomaterials, nano-sensing technology and biotechnology, combination of materials and medical detection are not only committed to controlling the existing large-scale outbreaks and realizing the rapid screening and diagnosis of biomolecules, but also hoped to build a universal detection and diagnosis platform to timely respond to various outbreaks and diseases. In the field of biological materials and medical detection, on the one hand, we need to consider whether the properties of a material can be affected by factors in the biological environment, such as misjudgment of results caused by interference of impurities in a personal body, and the unpredictable quenching caused by detection of substance or impurities on the fluorescence of materials. On the other hand, we need to take into account the toxicity of the material to biomolecules, the controllable and large-scale production of the material, the impact on biological barriers in the *in vivo* testing, and the realization of integrated diagnosis and treatment. In addition, some nanotechnologies lack specificity in nature, and biosensing technologies should consider how to construct sensing elements (including but not limited to the construction of special microstructure and functional modifications) to ensure a high degree of specificity for the target molecules. Most importantly, in order to respond to large-scale outbreaks such as COVID-19, new diagnostic and treatment technologies should be with high-throughput.

In recent years, Chinese researchers have done a lot of representative work in rational design, preparation, functional modification, exploration of physicochemical mechanisms, and biomedical application of biomaterial-based biosensor technologies. To showcase the latest research achievements of Chinese scientists in the field of biomedical detection and stimulate the wide interest of all sectors of society in biomaterials and novel sensing technologies, the editorial office of *Journal of Inorganic Materials* invited me as the Guest Editor to organize a topical section on the theme of "Anti-epidemic biomaterials". This topical section contains the latest review articles and research papers related to the detection and diagnosis of viruses, bacteria and cancer cells, involving new biosensor technologies for COVID-19 (electrochemical sensor, SERS biosensor, SPR biosensor, *etc*.), fluorescence detection technology, anti-bacterial nano-enzyme technology, *etc*. It is hoped that this topical section will promote the cooperation of researchers and scientists from various fields with different disciplinary backgrounds, and jointly promote the innovation and development of the field of biomedical detection, with a view to changing and optimizing the diagnosis and treatment of various diseases in clinical medicine so as to better benefit human health.

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