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Microbial genomics: the borderless compass of the One Health concept

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Abstract

It is nowadays recognized that it is fundamental not to dissociate the human, animal, and environmental aspects when talking about health. In terms of infectious diseases, it is well known that pathogenic microbial agents, whether bacteria, viruses, fungi, or parasites, and their respective drug resistance genes, often circulate in these three "host environments", causing animal or human disease. This phenomenon is exacerbated in this era of globalization and free market, marked by intense migrations, intensive production, and international trade of food products, as well as increasing proximity to wild animals. In this regard and within the framework of the One Health concept, microbial genomics shows up as the comprehensive approach to understanding the interconnectedness of human, animal, and environmental health. By leveraging high-throughput sequencing technologies, researchers can thus unravel the genetic diversity of microbial communities across these diverse ecosystems, highlighting the importance of collaborative efforts in disease surveillance and control. Through comparative genomic analyses, researchers can trace the origins and transmission dynamics of infectious diseases, elucidating pathways of cross-species transmission and spillover events. Furthermore, microbial genomics facilitates the prediction and mitigation of emerging infectious threats, guiding the development of targeted interventions and public health strategies. By integrating genomic data from diverse sources, such as clinical samples, wildlife reservoirs, and environmental samples, researchers can identify potential reservoirs of pathogens and assess the risk of zoonotic transmission. In conclusion, microbial genomics embodies the essence of the One Health concept by transcending disciplinary boundaries and fostering interdisciplinary collaboration. By elucidating the complex interplay between humans, animals, and the environment at the genetic level, microbial genomics provides valuable insights into the dynamics of infectious diseases and informs evidence-based approaches to promote global health security.

Keywords: One Health; microbial genomics; surveillance; infectious diseases

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