EC MICROBIOLOGY
Editorial

Microbes, Priorities and Global Resilience

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The field of microbiology is more visible and crucial to global health than it has ever been [1,2]. The COVID-19 pandemic, caused by the novel coronavirus SARS-CoV-2, has served as a stark reminder that microbial threats, whether viral, bacterial, fungal, or parasitic, are not relics of the past, but active forces shaping both the present and future of humanity. As we progress into the 21st century, microbiologists and public health professionals are called upon not only to respond to epidemics, but also to anticipate, prevent and mitigate their impacts through globally coordinated strategies [3].

The increase in the incidence of emerging and re-emerging infectious diseases is being driven by factors such as climate change, urbanisation, international travel and the expansion of human activities into natural habitats [4-10]. Zoonotic diseases, transmitted from animals to humans, account for approximately 60% of human infectious diseases and 75% of emerging pathogens. The spread of avian influenza, Ebola and, more recently, monkeypox illustrates the evolving dynamics of microbes and the porosity of barriers between species.

In addition, antimicrobial resistance is now one of the most serious microbial threats [11,12]. The misuse and overuse of antibiotics in human and veterinary medicine, combined with inadequate surveillance systems in low-resource countries, is speeding up the emergence of resistant strains [13-15]. According to many health organizations, if this trend continues, antimicrobial resistance could lead to millions of deaths each year and economic costs exceeding those of previous financial crises [16,17].

In the face of these threats, microbiology must be at the forefront of global preparedness efforts. Surveillance systems must become more integrated and responsive, relying on molecular diagnostic tools and real-time data. Genomic epidemiology, for example, played a critical role during the COVID-19 pandemic by tracking the evolution of SARS-CoV-2 variants and informing public health decisions.

Interdisciplinary approaches such as One Health, which recognizes the interconnectedness of human, animal and environmental health, must be integrated into policies and practices. Microbiologists, veterinarians, ecologists and data specialists must collaborate to build robust early warning systems and risk assessment frameworks.

In addition, investment in microbiological research, particularly on neglected tropical diseases and fungal pathogens, must be increased. Fungal infections caused by Candida auris or Aspergillus fumigatus, which are increasingly resistant to treatment and often fatal, remain underfunded in research and poorly integrated into surveillance systems.

The post-pandemic era is also opening the way for profound transformations in the field of microbiology through advances in synthetic biology and artificial intelligence. Modified microbes are already being used in vaccine development, pollution control and agriculture. Artificial intelligence algorithms are revolutionizing diagnostics and drug discovery by enabling the rapid identification of microbial signatures and potential therapeutic targets [18-20].

However, these innovations require ethical governance and increased vigilance. Synthetic biology, due to its use, carries risks of accidental or intentional release of pathogens. It is therefore imperative to strengthen global governance mechanisms to ensure the safe and equitable deployment of microbiological technologies.

Microbiology is key to understanding and combating some of the greatest challenges of our time. To build a resilient future, it is essential to invest in microbiological research, strengthen international collaboration and translate scientific knowledge into concrete policies. The lessons learned from the recent pandemic must not be forgotten, but rather serve as a catalyst for strengthening global health security. The time to act is now.

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