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Single Cell Biology

Perspective

# Sustainable Management of Uncultivated Microbial Cells for Single Cell Genomics and its Future Cultivation

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## DESCRIPTION

Traditionally, pure cultures of microbes grown on culture media in the lab have been used for research. The great majority of this untapped microbial diversity that lives on our planet has enormous potential for use in medicine, agriculture, the environment, and industry, according to metagenomic research. The only practical solution is to cultivate and properly preserve the original material in order to unlock its buried potential. Because of this reality, microbiologists have begun utilising high-throughput methods of microbial cultivation to look for these as-yet-undiscovered bacteria, giving rise to a field currently known as culturomics. In the early days of microbiology, culturing was widespread, but the recent resurgence of culturomics has successfully brought some through creative methods, hitherto uncultured bacteria into the laboratory. Many of these required the use of various carbon sources and/or electron acceptors in the medium, prolonged incubation at a variety of pH and temperature levels, and development in lab settings that resembled the natural environment, such as in diffusion chambers or linked to carriers. Growing various organisms and preserving them in culture collections for use in the future and research is still a difficult task. The availability of a live culture will enhance the knowledge on the physiology, functionality, and industrial applications of the organism that has been obtained *via* metagenomics investigations. Although culturomics requires a lot of time and effort, it has given rise to the optimism that, with careful consideration of culture medium and cultivation circumstances, it is conceivable to produce microbes that have not yet been done so for study and use. Laboratory-adapted microorganisms may not accurately reflect the true biology of the microbe in its natural habitat. The majority of currently used methods for cultivating, isolating, and purifying bacteria are based on cell populations, which are copies of a single cell created through repeated divisions or generations. Cells are known to acquire somatic variants or cellular heterogeneity during cell division and multiplication, in addition to the accumulation of preservation-induced mutations. Cellular heterogeneities may go unnoticed in most metagenomic studies if they are more prominent at the transcriptome level. Further, the majority of information on the physiology, functionality, genomes, and transcriptomes of microorganisms is available from cell populations, which neglects the handling of single cells and the extraction and error-free amplification of DNA from a single cell. Through single cell genomics, the requirement to investigate bacteria at the single cell level is now developing into an organised strategy.

Single cell genomics is now more accurate and simple to perform than it was just a few years ago thanks to cell sorting, microfluidics, and microdisections methods, whole genome amplification using the multiple displacement amplification polymerase chain reaction, development of high throughput next generation sequencing, and advancements in bioinformatics.

It was widely believed that, in contrast to plants and animals, microorganisms are ubiquitous, do not risk extinction, and are not in danger.

But recent advances in metagenomics and microbial ecology have demonstrated that microbial cells have also experienced alterations as a result of the impact of climatic variation. In order to prevent the loss of valuable microbial diversity due to climatic change and environmental perturbation, the preservation of microbial diversity-especially from highly vulnerable ecosystems and extreme environments like hot springs and thermal vents-is essential. With the exception of a few classes of species, such as non-spore producing fungi and some fastidious bacteria, *ex situ* preservation of grown microbes has almost reached its peak. All culture collections now only deal with produced pure cultures, and very little preservation research has been done on uncultivated single microbial cells, mixed cultures, or microbiomes. Thus, it is crucial to protect untamed bacteria that are threatened by extinction or environmental change in their natural state.

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