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Editorial

Culture Collections as Hidden Sources of Microbial Biomolecules and Biodiversity

Angelina Lo Giudice [1,*] and Carmen Rizzo [2]

[1] Institute of Polar Sciences, National Research Council (CNR-ISP), Spianata San Raineri 86, 98122 Messina, Italy

[2] Stazione Zoologica Anton Dohrn, National Institute of Biology, Department Marine Biotechnology, Villa Pace, Contrada Porticatello 29, 98167 Messina, Italy; carmen.rizzo@szn.it

* Correspondence: angelina.logiudice@cnr.it; Tel.: +39-090-601-5414

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Abstract: The application of modern advanced techniques in molecular biology is revealing unexpectedly high levels of microbial diversity and complexity. However, the invisible loss of microbial diversity in the environment deriving, for example, from global changes and anthropogenic activities, is not really perceived. In this context, culture collections worldwide have become a valuable resource for the sustainable use of microbial diversity and its conservation. They provide pure cultures and genetic materials that are required for a number of research and teaching purposes, as well as for bioprospecting aims and their subsequent exploitation in biotechnological fields. This Special Issue has been launched with the aim of showcasing the diversity and biotechnological potential of microorganisms (e.g., Bacteria, Archaea, cyanobacteria, microalgae, fungi, yeasts, and protozoa) belonging to culture collections kept worldwide.

Keywords: microbial isolates; culture collections; biotechnological value; biodiversity conservation

Public culture collections have the responsibility of maintaining and preserving microbial representatives and type strains, which can be distributed upon request for teaching and scientific purposes. On the other side, research laboratories worldwide frequently host their own microbial culture collections, often harboring microorganims from peculiar environments of different (and sometimes difficult to reach, requiring high sampling efforts) geographic regions and representing a hidden source of microbial biomolecules and biodiversity [1–5]. The importance of culture collections is, therefore, twofold as they represent a valuable source of biological and genetic materials for: (1) past, present, and future taxonomical research and biodiversity conservation; (2) biotechnological applications [6].

Recent advancements in the application of biomolecular techniques have profoundly changed our approach to the study of microbial communities in a wide range of environments, revealing unexpectedly high levels of microbial diversity and complexity and raising intriguing questions about how much we really know about the microbial world. It is noteworthy that culture collections certainly do not reflect overall trends in microbial diversity (and biotechnological potential) in the environment, as it is well known that only a small fraction of microorganisms can be isolated and maintained in pure cultures under laboratory conditions, which are failing to replicate essential aspects of the microbial natural environment [7]. However, while several experimental efforts are aiming for the discovery of the molecular and metabolic principles behind this recalcitrant growth, culture collections become key tools for the conservation of microbial diversity. In fact, a continuous and invisible menace, exerted by global changes and anthropogenic activities, leads to the unperceived environmental loss of the diversity of microorganisms and, therefore, of their pivotal functions in the functioning of ecosystems. At this regard, samples from habitats that could harbor undiscovered microbial diversity and risk

extinction or being irreparably altered, due to human and natural perturbations, should be a primary focus of culture collections [8–10]. Microorganisms (both prokaryotes and eukaryotes) also possess high biotechnological relevance for the synthesis of molecules with antimicrobial, antioxidant, or antitumor activities for the production of bioenergy and compounds (e.g., extracellular polymeric substances, enzymes, polyunsaturated fatty acids) to be applied in industrial and agricultural applications, as well as for eco-friendly use in the bioremediation field (e.g., the removal of recalcitrant compounds). All such applications depend upon the availability of viable microbial cultures [11].

For these reasons, as guest editors, we hope that this proposed Special Issue provides novel insights of broad interest and highlights the great importance and role of often untapped culture collections for the conservation and sustainable use of microbial diversity. We are confident that this Special Issue will not only show the research activities linked to microbial preservation, but will also inspire researchers to further explore culture collections for possible and yet untapped applications.

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References

1. Nichols, D.; Bowman, J.; Sanderson, K.; Nichols, C.M.; Lewis, T.; McMeekin, T.; Nichols, P.D. Developments with Antarctic microorganisms: Culture collections, bioactivity screening, taxonomy, PUFA production and cold-adapted enzymes. *Curr. Opin. Biotechnol.* **1999**, *10*, 240–246. [CrossRef]
2. Malik, K.A.; Claus, D. Bacterial culture collections: Their importance to biotechnology and microbiology. *Biotechnol. Gen. Eng. Rev.* **1987**, *5*, 137–198. [CrossRef]
3. Floyd, M.M.; Tang, J.; Kane, M.; Emerson, D. Captured diversity in a culture collection: Case study of the geographic and habitat distributions of environmental isolates held at the American Type Culture Collection. *Appl. Environ. Microbiol.* **2005**, *71*, 2813–2823. [CrossRef] [PubMed]
4. Lee, Y.M.; Kim, G.; Jung, Y.-J.; Choe, C.-D.; Yim, J.H.; Lee, H.K.; Hong, S.G. Polar and Alpine Microbial Collection (PAMC): A culture collection dedicated to polar and alpine microorganisms. *Polar Biol.* **2012**, *35*, 1433–1438. [CrossRef]
5. Selbmann, L.; Onofri, S.; Zucconi, L.; Isola, D.; Rottigni, M.; Ghiglione, C.; Piazza, P.; Alvaro, M.C.; Schiaparelli, S. Distributional records of Antarctic fungi based on strains preserved in the Culture Collection of Fungi from Extreme Environments (CCFEE) Mycological Section associated with the Italian National Antarctic Museum (MNA). *MycoKeys* **2015**, *10*, 57–71.
6. Emerson, D.; Wilson, W. Giving microbial diversity a home. *Nat. Rev. Microbiol.* **2009**, *7*, 758. [CrossRef] [PubMed]
7. Stewart, E.J. Growing unculturable bacteria. *J. Bacteriol.* **2012**, *194*, 4151–4160. [CrossRef] [PubMed]
8. Sievers, M. *Encyclopedia of Metagenomics*; Springer Science + Business Media: New York, NY, USA, 2013. [CrossRef]
9. Prakash, O.; Shouche, Y.; Jangid, K.; Kostka, J.E. Microbial cultivation and the role of microbial resource centers in the omics era. *Appl. Microbiol. Biotechnol.* **2013**, *97*, 51–62. [CrossRef] [PubMed]
10. Prakash, O.; Nimonkar, Y.; Shouche, Y.S. Practice and prospects of microbial preservation. *FEMS Microbiol. Lett.* **2013**, *339*, 1–9. [CrossRef] [PubMed]
11. Sharma, S.K.; Saini, S.; Verma, A.; Sharma, P.K.; Lal, R.; Roy, M.; Singh, U.B.; Saxena, A.K.; Sharma, A.K. National agriculturally important microbial culture collection in the global context of microbial culture collection centres. *Proc. Natl. Acad. Sci. India Sect. B Biol. Sci.* **2019**, *89*, 405–418. [CrossRef]