

Omics in Soil Science



Edited by: Paolo Nannipieri, Giacomo Pietramellara and Giancarlo Renella

Department of Plant, Soil and Environmental Sciences, University of Firenze, Italy

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Soil is a unique biological system with an abundant microflora and a very high microbial diversity capable of performing multiple key ecosystem functions. The detection of genes in soil has improved the knowledge of unculturable microorganisms and led to a greater understanding of potential soil metabolic pathways. Further advances in understanding soil functionality are being realised by harnessing omics technologies such as metagenomics, metatranscriptomics, proteomics and volatilomics. The next challenge of systems biology and functional genomics is to integrate the information from omic approaches to give a more complete picture of soil as a biological system.

This volume presents the state-of-the-art of omic applications in soil science, a field that is advancing rapidly on many fronts. Distinguished authors describe the application of metagenomics, metatranscriptomics and proteomics to soil science. In particular the book covers the current and emerging omics techniques and the contribution of these approaches to a better assessment of soil functionality. The authors also explore the specific problems encountered in the application of various omics technologies to soil science and the future research requirements necessary to overcome the current limitations in this area. Topics covered include soil functional genomics, soil metagenomics, soil microbial ecology, soil metatranscriptomics, soil proteomics, soil volatilomics and soil proteogenomics. Omics techniques are also discussed in comparison with classical techniques.

This book is both a practical guide and a recommended reference volume for all soil scientists.

Chapter 1. Soil as a Biological System. *Nannipieri Paolo*

Chapter 2. Functional Genomics Analysis of Key Bacterial Traits Involved in Rhizosphere Competence during Microbial-Host Interactions. *Matthieu Barret, John P. Morrissey and Fergal O'Gara*

Chapter 3. Soil Metagenomics: Potential Applications and Methodological Problems. *Jan Dirk van Elsas, Mariana Silvia Cretoiu, Anna Maria Kielak and Francisco Dini-Andreote*

Chapter 4. Screening Phylogenetic and Functional Marker Genes in Soil Microbial Ecology. *Sotirios Vasileiadis, Edoardo Puglisi, PierSandro Cocconcelli and Marco Trevisan*

Chapter 5. Soil Metatranscriptomics. *Yongkyu Kim, Carl-Eric Wegner and Werner Liesack*

Chapter 6. Soil Proteomics. *Giancarlo Renella, Laura Giagnoni, Mariarita Arenella and Paolo Nannipieri*

Chapter 7. Soil Volatile Organic Compounds as Tracers for Microbial Activities in Soils. *Heribert Insam*

Chapter 8. Proteogenomics: a New Integrative Approach for a Better Description of Protein Diversity Found in Soil Microflora. *Céline Bland and Jean Armengaud*

Chapter 9. Analysis of Soil Metagenomes using the MEtaGenome ANalyzer (MEGAN). *Daniel H. Huson and Nico Weber*

Chapter 10. Classical Techniques versus Omics Approaches. *David D. Myrold and Paolo Nannipieri*

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