

# A Glossary of Microanalytical Tools to Assess the Metallome

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*Dedicated to Dr. Sieglinde Menge †*

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**Abstract** Measurements of trace metals as parts of homeostatic networks for essential and nonessential metals in microbial cells need sensitive high-resolution techniques. The term “metallome” denotes metals and metalloid species within cells, encompassing both the inorganic element content and their complexes with biomolecules, especially with peptides and proteins. Elucidation of the physiological roles of metals and their bioinorganic speciation requires a set of microanalytical purification, separation, and identification methods. This chapter summarizes analytical tools useful to investigate bacterial responses to metal stress.

**Abbreviations**

|                |  |
|----------------|--|
| 2D             | Two-dimensional  |
| AAS            | Atomic absorption spectrometry   |
| AES            | Atomic emission spectrometry   |
| CE             | Capillary electrophoresis  |
| CEC            | Capillary electrochromatography  |
| CGE            | Capillary gel electrophoresis  |
| CZE            | Capillary zone electrophoresis   |
| EDS            | Energy-dispersive X-ray spectrometry   |
| EELS           | Electron energy loss spectroscopy  |
| EFTEM          | Energy-filtered transmission electron microscopy                             |
| ELNES          | Energy loss near edge structures   |
| ESI            | Electron spectroscopy imaging  |
|                | Electrospray ionization  |
| ETAAS          | Electrothermal atomic absorption spectrometry                                |
| ( $\mu$ )EXAFS | (Micro) extended X-ray absorption fine structure                             |
| FAAS           | Flame atomic absorption spectrometry   |
| GC             | Gas chromatography   |
| HPLC           | High-performance liquid chromatography                                       |
| ICP-MS         | Inductively coupled plasma mass spectrometry                                 |
| IEF            | Isoelectric focussing  |
| INAA           | Instrumental neutron activation analysis                                     |
| IUPAC          | International Union of Pure and Applied Chemistry                            |
| LA             | Laser ablation   |
| LC             | Liquid chromatography  |
| LIBS           | Laser-induced breakdown spectroscopy   |
| $m/z$          | Mass-to-charge ratio   |
| MALDI-TOF-MS   | Matrix-assisted laser desorption/ionization time-of-flight mass spectrometry |
| MS             | Mass spectrometry  |
| MT             | Metallothionein  |
| NEXAFS         | Near-edge X-ray absorption spectroscopy                                      |
| NMR            | Nuclear magnetic resonance spectroscopy                                      |
| PAGE           | Polyacrylamide gel electrophoresis   |
| PC             | Phytochelatin  |
| PCR            | Polymerase chain reaction  |
| PIXE           | Proton (or particle) induced X-ray emission                                  |
| PLE            | Pressurized liquid extraction  |
| PSD            | Postsource decay   |
| RP             | Reversed phase   |
| SDS            | Sodium dodecyl sulfate   |
| SE             | Size exclusion   |
| SEC            | Size exclusion chromatography  |
| SEM            | Scanning electron microscopy   |
| SPME           | Solid-phase microextraction  |
| STEM           | Scanning transmission electron microscopy                                    |
| STXM           | Soft scanning transmission X-ray microscopy                                  |
| SXRD           | Scanning X-ray diffraction   |
| SXRF           | Scanning X-ray fluorescence  |
| TEM            | Transmission electron microscopy   |