

## Index

### a

abscisic acid (ABA) 201  
*Acetobacter* 69, 87  
 actinobacteria 67  
 active center 32f., 35  
 acyl homoserine lactone (AHL) 3, 100, 129, 132ff., 137, 139, 144ff.  
 – AHL blockers 146  
 – AHL synthases 145, 227  
*Agrobacterium* 63ff.  
 agroecosystems 177ff.  
 alkaline phosphatase (ALP) 200  
 alphaproteobacteria 63ff., 68  
 aminocyclopropanecarboxylic acid (ACC) 49, 59ff., 75, 216, 273, 297  
 aminocyclopropanecarboxylic acid (ACC)-deaminase 97ff., 215, 273, 297  
 ammonia 91  
 amplified rDNA restriction analysis (ARDRA) 84, 199  
 antibiotic-mediated suppression 214f.  
 antibiotics 138, 273, 275  
 antifreeze proteins (AFPs) 199ff.  
 arbuscular mycorrhizae 96f., 245ff., 251  
 arbuscular mycorrhizal associations 246  
 arbuscular mycorrhizal fungi (AMF) 245ff.  
 arbuscular mycorrhiza-rhizobacteria interactions 247ff.  
 arid soils 268, 271  
 atomic force microscopy (AFM) 37  
 autecological biogeography 179  
 autochthonous microflora 265  
 autoinducer 129, 132f., 136  
 autoinducer peptides (AIP) 139  
 auxin 12, 43, 46ff., 59ff., 92, 185, 201  
 – biosynthesis 47  
*Azoarcus* 88  
*Azorhizobium* 66

*Azospirillum* 70, 87, 208  
 – *Azospirillum brasilense* 20ff., 24, 29ff.  
*Azotobacter* 43, 73, 86

### b

*Bacillus* 73, 88  
 – *B. cereus* 238  
 – *B. pumilus* 239ff.  
 bacterial diversity 2, 82ff.  
 bacteriallike organisms (BLOs) 249  
 betaproteobacteria 67  
 biocontrol 214ff.  
 biodegradation 235ff.  
 biofertilizer 175, 178, 180, 182, 188f.  
 bioluminescence 130ff.  
 biosorption 285  
 biosurfactants 219, 224f.  
*Bradyrhizobium* 66, 95, 172, 269  
*Burkholderia* 67, 88, 134, 139, 249  
 N-butyl- $\gamma$ -homoserine lactone (BHL) 135

### c

carbon dioxide 165  
 carbon metabolism 198  
 catechols 44  
 cell-to-cell communication 138, 145, 227  
 cellulase 172  
 chaperone 121  
 chelant 9  
 circular dichroism (CD) 30ff.  
*Citrobacter* 70  
 cobalt 24ff., 32ff., 35  
 – binding studies 26ff.  
 cold tolerance, mechanism 200  
 colonization 172ff., 176, 208, 250f., 262  
 colony forming units (CFUs) 4  
 community-level physiological profiling (CLPP) 84

copper 24, 117, 121  
 cyanobacteria 68  
 cytokinins 48, 92, 201

**d**

damping-off 217f.  
 deleterious rhizobacteria (DRB) 216  
 denaturation gradient gel electrophoresis (DGGE) 81  
 desaturase 198  
 detergent 9  
*Devosia* 67  
 diaminopimelate (DAP) 113  
 diazotrophic bacteria 81ff.  
 – asymbiotic diazotrophic bacteria 86ff.  
 – diversity 85  
 – interaction with arbuscular mycorrhizae 96f.  
 – interaction with rhizobia 93ff.  
 – plant growth promoting mechanisms 90ff.  
 – symbiotic diazotrophic bacteria 85  
 dinitrogen fixation 63, 68, 84ff.  
 diversity indexes 5  
 drought 257

**e**

ecology 1ff.  
 electron flow 198  
 electron paramagnetic resonance (EPR) 37  
 emission Mössbauer spectroscopy (EMS) 25ff., 32ff.  
 endophytes 44, 168ff., 176f., 180, 185, 187  
 – identification 170  
 – isolation 170  
 endospore 262  
 enterobacteria 70  
 enteropathogenic *Escherichia coli* (EPEC) 136  
 enzyme 83, 266f., 274f.  
*Erwinia* 71, 137  
 essential growth factors (EGFs) 113  
 ethylene 48, 201  
 – biosynthesis 49  
 – regulation 49  
 ethylene-forming enzyme (EFE) 49  
 extracellular polysaccharides (EPS) 121, 138

**f**

fatty acids 197f.  
 firmicutes 73  
 Fourier transform infrared (FTIR) 20ff., 25, 235, 241f.  
*Frankia* 68, 85  
 frost injury protection 202

fungi 12  
 fungicides 218

**g**

gammaproteobacteria 70  
 gene expression  
 – quantitative gene expression 122  
 – transient gene expression 121  
 gene-inducing factors 113  
 genetic diversity 1ff.  
 genotype specificity 180f.  
 gibberellin 43, 46, 48, 92, 185, 201  
 glomalian fungi 245ff.  
*Gluconacetobacter* 69  
 glutamine synthetase (GS) 43  
 – active centers 32ff.  
 – cation-binding sites 32ff.  
 – characterization 29f.  
 – effect of divalent cations 31  
 – experimental studies 33f.  
 – secondary structure 30ff.  
 – structural studies 29ff.  
 glycolipids 220f., 224  
 gnotobiotic culture 177f., 182  
 Gram-negative bacteria 132, 139ff., 259, 275  
 Gram-positive bacteria 132, 139, 259  
 green fluorescent protein (GFP) 125, 174  
 green revolution 165  
 greenhouse effect 165

**h**

halophiles 263  
 heavy metals 20ff., 27, 246, 248, 252, 257, 284  
 – binding 28  
 – detoxification 207  
 – metabolic responses 21ff.  
 N-hexanoyl-homoserine lactone (HHL) 135  
 horizontal gene transfer (HGT) 249  
 hydroximates 44  
 hyperaccumulator 286  
 hypersensitive response (HR) 115

**i**

*in vivo* expression technology (IVET) 112ff., 118, 126  
 – principle 114  
 indole acetic acid (IAA) 85, 185, 204, 228, 273, 297  
 induced systemic resistance (ISR) 98, 250  
 inducer 129  
 inductively coupled plasma-mass spectrometry (ICP-MS) 37  
 infrared spectroscopy (IR) 143

iron 44, 51, 117f.  
 isoflavone synthase (IFS) 176f.  
 isomer shift (IS) 26f., 29, 33ff.

## k

*Klebsiella* complex 71  
*Kluyvera* 71

## l

las system 226  
 legume-nodulating bacteria (LNB) 57, 63ff.,  
 68  
 lipopolysaccharide (LPS) 28, 223  
 low-density polyethylene (LDPE) 235f., 240,  
 242  
 low-density polyethylene-g-polymethacrylic  
 hydrazide (LDPE-g-PMH) 235f., 241  
 low-density polyethylene-g-polymethyl  
 methacrylate (LDPE-g-PMMA) 235f., 241  
 luciferase 130  
 lux system 130ff., 134

## m

maiz 180  
 mass spectrometry (MS) 143  
 membrane 197f.  
*Mesorhizobium* 66  
 metal ions 283ff.  
 – conventional treatment of wastewater 285  
 – mechanisms of removal by plant roots  
 295f.  
 – microbial treatment of wastewater 285f.  
 – pollution 284  
 metalloprotease 137  
*Methylobacterium* 67  
 microbial activity 1  
 microbial biomass 4  
 molecular mechanisms 111ff.  
 Mössbauer parameters 26f., 29, 33, 35  
 multilocus enzyme electrophoresis  
 (MLEE) 58  
 mycobacteria 260f.  
 mycorrhizal helper bacteria (MHB) 248ff.  
 mycorrhizosphere 245ff., 250, 252

## n

niche-specific genes 112  
 nitrilase 122  
 nitrogen fertilizer 165, 168, 178f., 187, 189  
 nitrogen fixation 43, 59ff., 63, 251  
 – asymbiotic nitrogen fixation 82, 89f.  
 – endophytic nitrogen fixation 186  
 – methods for examining nitrogen fixation 89  
 – symbiotic nitrogen fixation 82

nodulation 95, 251  
 nodules 44  
 nuclear  $\gamma$ -resonance (Mössbauer)  
 spectroscopy 25ff.  
 – application 25ff.  
 – methodological background 25f.  
 nuclear magnetic resonance spectroscopy  
 (NMR) 143f.  
 nucleic acid metabolism 116  
 nutrient uptake 182ff., 208, 271

## o

oak 207  
 oligotrophic bacteria 264ff.  
 open reading frames (ORFs) 119  
 osmoregulator 99  
 N-3-oxodecanoyl-L-homoserine lactone  
 (ODHL) 135

## p

*Paenibacillus* 74, 89  
*Panoea* 72  
 paranodules 44  
 parasites 217  
 pathogens 274ff.  
 pathogenicity 132, 136ff., 145ff.  
 pectinase 172  
 pesticides 214, 155  
 phase variation 11  
 phenotype 122  
 pholoroglucinol 215  
 phosphate complexes 185ff.  
 phospholipid fatty acid analysis (PLFA) 5, 7  
 phosphorous 45, 51, 185, 248, 272f.  
 phosphorous-solubilizing bacteria  
 (PSB) 272f.  
 phyllosphere 55, 117, 262  
 phytofiltration 295  
 phytohormones 91f., 95, 266, 273  
 phytopathogens 213  
 phytoremediation 286, 296, 298  
 – advantages 288  
 – disadvantages 288  
 – goal 286  
 – technologies 289  
 phytosphere 111  
 phytostimulation 201, 261  
 plant growth promoters 56, 297  
 plant growth promoting activites 97ff.  
 plant growth promoting bacteria (PGPB) 55,  
 63ff., 214, 272  
 – asymbiotic PGPB 69ff.  
 plant growth promoting rhizobacteria  
 (PGPR) 1, 3ff., 19ff., 29, 170, 195ff., 248ff.

- action mechanisms 41ff.
  - activity in the rhizosphere 8f.
  - application in agriculture 21, 203
  - application in forestry 204
  - bacilli 6
  - biodiversity 5f.
  - characterization 202
  - chemical extraction methods 10
  - classification 55
  - cold adaptation 196ff.
  - colonization of a plant 111ff.
  - definition 41, 55
  - diazotrophic PGPR 6
  - direct mechanisms 45ff., 55, 196
  - ecology 5f.
  - examples 205f.
  - extracellular PGPR 57
  - field application 202
  - free nitrogen-fixing PGPR 42f.
  - indirect mechanisms 42ff., 55, 196
  - intracellular PGPR 57
  - membrane adaptation 197f.
  - phosphate-solubilizing PGPR 45
  - physiological and molecular mechanisms 41ff.
  - rhizobia 6
  - screening methods 74f.
  - screening strategies 9ff.
  - selection 202
  - siderophore-producing PGPR 44
  - symbiotic PGPR 63ff.
  - systemic resistance 50
  - taxonomy 55ff.
  - techniques for detection and quantification 101
  - plant growth promotion 91, 177
    - mechanisms 90ff., 182ff., 273ff.
    - mechanism at low temperature 201f.
  - plant growth regulators 46ff., 271
    - effect of bacteria 46
    - secretion 185
  - plant growth stimulation 268
  - plant health protection 129ff.
  - plant-induced gene expression 123ff.
  - plant-induced genes 113ff., 119ff., 126
    - activators 119ff.
    - regulation 120ff.
    - repressors 119ff.
  - plant-microbe association 167, 170f.
  - plant-microbe interactions 36f., 57, 82, 101, 145, 258f., 294
  - plant root exudates 83
  - plasmid 116
  - plastics 235ff.
  - poly-3-hydroxybutyrate (PHB) 21, 23
  - polyhydroxyalkanoates (PHA) 21, 23
  - polymerase chain reaction (PCR) 5, 57, 69
  - polymers 235, 237f.
  - polysaccharide (PS) 28, 97
  - posttranscriptional modifications 132
  - posttranscriptional regulation 120
  - potassium 272
  - promoter 114f., 117, 124
  - propolis 146
  - pseudomonads 6, 72, 116, 134, 249, 259
    - *P. fluorescens* 111ff., 134
    - *P. syringae* 115
  - Pseudomonas* quinolone signal (PQS) 136
  - pyoluteorin 215, 218
  - pyoverdine 117f.
  - pyrrolnitrin 215, 218
  - Pythium* 218
- q**
- quadrupole doublets 34
  - quadrupole splitting 26f., 29, 33, 35
  - quantitative microscopy 174
  - quorum quenching 36
  - quorum sensing 3, 13, 36, 41, 82, 99f., 102, 129ff., 222f., 226ff.
    - inhibition 147
    - phytopathogenic bacteria 137ff.
    - signal molecules 139ff.
  - quorum sensing interfering (QSI) 130, 144ff.
- r**
- Ralstonia* 67
  - reactive oxygen species (ROS) 50, 99
  - real-time polymerase chain reaction (RT-PCR) 76, 84
  - recombinase-based *in vivo* expression technology (RIVET) 113, 123ff.
    - principle 124
  - recrystallization inhibition (RI) 199, 201
  - remediation 286
    - available technologies 287
  - reporter gene 115
  - resistance 50f., 188, 213
  - resolvase 125
  - restriction fragment length polymorphism (RFLP) 5, 58, 69
  - rhamnolipids 219ff.
    - agricultural applications 226
    - application 219
    - biosynthesis 222
    - genetics 222
    - rhamnolipid-mediated biocontrol 224f.
    - regulation 223

- rhamnose 222  
 rhizobacteria 91, 96, 185, 214  
   – extraction 9  
   – physiological characterization 264ff.  
*Rhizobium* 57, 63ff., 85, 93ff., 165ff., 176f., 269  
   – association with other cereals 170  
   – association with rice 168ff.  
   – taxonomy 166  
 rhizofiltration 287, 289  
 rhizoplane 57, 167, 176  
 rhizosphere 1ff., 19, 23, 43, 57, 82ff., 87, 93, 167, 196, 218, 226, 245, 258, 260, 262  
   – definition 9, 294  
   – functional diversity 7f.  
   – methods to study 4f.  
   – microbial activity 7f.  
   – microbial ecology 1ff.  
   – microbial structure 4ff.  
 rhl system 226f.  
 rice 166ff., 178, 180, 184  
 rice-rhizobia association 165ff.  
   – colonization 172ff.  
   – genetic predisposition 176  
   – importance in agroecosystems 177ff.  
   – mechanism 171ff.  
   – mode of entry 171ff.  
   – rice varieties 180f.  
 root  
   – architecture 182ff.  
   – growth 182ff.  
 root colonization 94
- S**
- salicylic acid (SA) 98, 216  
 saline soils 268, 271  
 salinity 257, 259  
 salt tolerance 263  
 salt-tolerant rhizobacteria 257ff., 264  
   – biochemical characterization 267  
   – carbohydrate fermentation patterns 267  
   – colonization 261f.  
   – diversity 259ff.  
   – survival 261f.  
 salicylic acid (SA) 147  
 scanning electron micrograph 174f.  
 screening strategies 1ff., 9ff.  
 secondary metabolites 100, 266  
*Serratia* 72  
 siderophore 12, 44, 51, 59ff., 93, 117f., 273  
   – Fe-chelating siderophores 187  
 signal molecules 132f., 139  
   – chemical characterization 142ff.  
   – detection 141
- single-strand confirmation polymorphism (SSCP) 81  
*Sinorhizobium* 65f.  
 site-specific invertase 11  
 sodium dodecyl sulfate-polyacrylamide gel electrophoresis (SDS-PAGE) 58, 170  
 soil microorganisms 2  
 stable isotope probing (SIP) 9  
 stress tolerance 98  
 superoxide dismutase (SOD) 99  
 suppressor 120  
 surfactants 220  
*Swaminathania* 69  
 symbioses 165  
 systemic acquired resistance (SAR) 50f., 216
- t**
- taxonomy 57  
 terminal restriction fragment length polymorphism (TRFLP) 81  
 temperature 195, 198  
 temperature gradient gel electrophoresis (TGGE) 75, 81  
 temperature tolerance 263  
 thin layer chromatography (TLC) 129  
 thioquinolobactin 118  
 total viable count (TVC) 4  
 transposon 119f.  
 type III protein secretion system (TTSS) 115f.
- u**
- ultraperformance liquid chromatography (UPLC) 144
- v**
- Verticillium dahliae* 12  
 vibrational spectroscopy 20  
   – application 20ff.  
   – methodological background 20  
   – studies of *A. brasilense* cells 20ff.  
*Vibrio fischeri* 130f.,  
 violacein 141  
 vitamins 92, 250, 266
- w**
- wastewater 285f., 298  
 water hyacinth 283ff., 287, 290, 298  
   – ecology 292f.  
   – environmental impact 293  
   – management 293  
   – metal ion removal capacity 294ff.  
   – morphology 291f.  
   – scientific classification 290  
 wheat 178

**x**

*Xanthomonas campestris* 138  
x-ray crystallography 30, 37  
x-ray photoelectron spectroscopy (XPS) 37

**z**

zinc 25, 184  
zoospore 225, 228