Molecular Epidemiology
of Infectious Diseases
Principles and Practices

LEE W. RILEY
School of Public Health
University of California
Berkeley, California

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To Jesse Furman, Nicolas, Samantha, and Emma
Contents

Preface xiii

Principles and Approaches 1

Introduction 1

Definitions 2

Differentiating Molecular Epidemiology from Taxonomy and Phylogeny 4

Epidemiologic Problems Addressed by Molecular Strain-Typing Techniques 5

Determining dynamics of disease transmission in geographically widespread areas 5

Identifying risk and quantitating attributable risk fractions in sporadic occurrence of infectious diseases 7

Stratifying data and refining epidemiologic study designs 8

Distinguishing pathovars from nonpathovars 9

Addressing hospital and institutional infectious disease problems 9

Identifying genetic determinants of disease transmission 10

Application to Epidemiology of Molecular Strain-Typing Methods 11

When to use molecular strain-typing methods 11

How to select molecular strain-typing methods to apply to epidemiologic investigations 14

Validating new molecular strain-typing methods 15

Concluding Remarks 25

References 25
Laboratory Methods Used for Strain Typing of Pathogens: Conventional and Molecular Techniques 29

Introduction 29

Phenotypic Strain-Typing Methods 30
Typing by growth and morphologic characteristics 30
Typing based on biochemical characteristics 31
Typing by serologic characteristics 32
Typing by functional or physiologic characteristics 33

Genotypic Strain-Typing Methods 39
Nucleic acid extraction: overview 39
Analysis of extrachromosomal DNA elements 43
Genome-based typing methods 45

Concluding Remarks 55

References 55

Laboratory Methods Used for Strain Typing of Pathogens: PCR-Based Strain Typing Methods 63

Introduction 63
Overview of PCR procedure 63

Epidemiologic Application of PCR-Based Strain-Typing Methods 65
Simplicity 66
High throughput 67
Cost 67
Appropriateness 67
Limitations of PCR tests 68

Strain-Typing Methods Based on PCR Assays 69
PCR strain-typing methods based on random sequences 69
PCR strain-typing methods based on heterogeneity within restriction endonuclease sites 71
PCR strain-typing methods based on interspersed DNA repetitive elements 76

Concluding Remarks 83

References 83

Analysis of Similarity and Relatedness in Molecular Epidemiology 91

Introduction 91

Methods of Classification 92
Cladistic models to infer relationships 94
Phenetic methods to infer relationships 100

Assessing Validity and Reliability of Relationship Measures 115
Computer-Assisted Analyses of Pathogen Relationships 119
Concluding Remarks 121
References 122

Distinguishing Epidemic and Endemic Occurrence of Infectious Diseases 125
Introduction 125
Endemic versus Epidemic Occurrences of Infectious Disease 126
Epidemiology of Antimicrobial Drug-Resistant Pathogens 127
Sources of drug-resistant strains of Salmonella 127
Spatial transmission patterns of drug-resistant infectious diseases 135
Epidemiology of Drug-Susceptible Infectious Diseases 140
Concluding Remarks 142
References 143

Stratification and Refinement of Data in Epidemiologic Investigations 149
Introduction 149
Characterizing Dynamics of Infectious Disease Transmission in Community Settings 150
Drug-resistant salmonellosis in Brazil 151
Multidrug-resistant (MDR) tuberculosis in New York City 153
Determining Attributable Risks in Community- or Institution-Acquired Infections 157
Salmonellosis traced to precooked roast beef in New Jersey and Pennsylvania 158
Food-borne disease surveillance in Minnesota 160
Nosocomial infections with vancomycin-resistant Enterococcus faecium 160
Refining Analytical Epidemiologic Study Designs 162
Drug-susceptible tuberculosis in New York City 163
Making new inferences from rare events revealed by strain typing 165
Creating opportunities to identify new intervention strategies 167
Concluding Remarks 168
References 169
## Distinguishing Pathovars from Nonpathovars: *Escherichia coli* 175

### Introduction 175

#### E. coli Classifications 176

#### E. coli Associated with Intestinal Diseases 178

Conventional techniques used to differentiate *E. coli* strains that cause diarrhea 178
Molecular biology techniques used to differentiate *E. coli* strains that cause diarrhea 184
Differentiation of diarrheagenic *E. coli* pathotypes in epidemiologic investigations 189

#### Extraintestinal E. coli Infections 190

Clinical spectrum of ExPEC infections 190
Approaches used to differentiate ExPEC 191
Molecular epidemiologic approach to discriminate ExPEC 193

### Concluding Remarks 197

### References 198

## Distinguishing Pathovars from Nonpathovars: *Streptococcus pneumoniae* 209

### Introduction 209

#### S. pneumoniae (the Pneumococcus) 211

Clinical spectrum of pneumococcal disease 211
Conventional strain-typing methods for pneumococci 212
Genotyping methods for *S. pneumoniae* 213

#### Application of Strain-Typing Methods to Epidemiologic Investigation of Pneumococcal Infections 214

Penicillin-resistant pneumococcal infections 214
Pneumococcal colonization and infection 216
Comparison of strain types between invasive disease and NP isolates 217
Comparison of strain types from outbreaks 219
Comparison of pathogenicity of strain types in the mouse model 220
Genotype-specific risk factors for sporadic pneumococcal invasive diseases 221

### Concluding Remarks 221

### References 222
Distinguishing Pathovars from Nonpathovars: Helicobacter pylori 229

Introduction 229

H. pylori 230
Clinical spectrum of H. pylori diseases 230
Conventional strain-typing methods for H. pylori 230
Genotyping methods for H. pylori 230
Whole-genome analysis of H. pylori 231

Application of Strain-Typing Methods to Epidemiologic Investigation of H. pylori Infections 233
Genotypic differences in H. pylori strains isolated from stomachs with disease versus asymptomatic colonization 233
Colonization and population structure of H. pylori strains in the stomach 237
Demonstrating clustering of disease and colonization 239

Concluding Remarks 241

References 242

Hospital Infections: Staphylococcus aureus 249

Introduction 249

Overview of Clinical and Epidemiologic Issues Related to Bacterial Nosocomial Infections 250

Staphylococcal Nosocomial Infections 252
Clinical spectrum of staphylococcal diseases 252
Drug-resistant infections 253

Strain-Typing Methods for S. aureus 255
Conventional strain-typing methods for S. aureus 255
Genotyping methods for S. aureus 256

Application of Strain-Typing Methods to Epidemiologic Investigation of Nosocomial S. aureus Infections 258
S. aureus colonization versus infection 259
Determining clonal distribution of S. aureus isolates 262
Comparative genomics approach to differentiate S. aureus strains 266
Endemic versus epidemic occurrence of S. aureus hospital infections 268

Concluding Remarks 270

References 271
11 Hospital Infections: Gram-Negative Bacteria 281

Introduction 281

Clinical Spectrum and Epidemiology of Infections Caused by Gram-Negative Bacteria 282

Antimicrobial Drug Resistance in Gram-Negative Bacilli 284

Strain-Typing Methods for Gram-Negative Bacterial Organisms 289

Conventional strain-typing methods for gram-negative organisms 289

Genotyping methods for gram-negative organisms 290

Application of Strain-Typing Methods to Epidemiologic Investigation of Nosocomial Infections Caused by Gram-Negative Bacteria 291

Monoclonal versus polyclonal infections 291

Reinfection versus relapse infections 291

Colonization, environmental contamination, and infection with gram-negative bacteria 292

Endemic versus epidemic occurrence of nosocomial infections caused by gram-negative bacteria 294

Concluding Remarks 298

References 299

12 Identifying a Pathogen’s Biologic Determinants of Disease Transmission 307

Introduction 307

Modes of Disease Transmission 308

Identifying Genetic Determinants of Disease Transmission 309

Tuberculosis: identifying phenotypic and genetic factors of M. tuberculosis associated with rapid progression to disease 309

UTI caused by E. coli: the comparative genomics approach to identify new genes associated with transmission 313

Salmonellosis: identifying bacterial factors that allow the organism to establish a reservoir that becomes a risk factor for human transmission 315

Concluding Remarks 317

References 318

Glossary 323

Annotated Websites of Databases Useful for Molecular Epidemiologic Investigations 333

Index 339
This book is designed to provide a background in the principles and practices of epidemiology that take advantage of new molecular biology tools to solve infectious disease problems. The book is mainly intended for health care professionals working with infectious diseases, faculty and students in medical schools interested in infectious diseases, and faculty and students in schools of public health interested in epidemiology. A rudimentary knowledge of epidemiology or molecular microbiology would be useful in reading this book. However, for epidemiologists or students of epidemiology not familiar with molecular biology, for molecular microbiologists or students of molecular microbiology not familiar with epidemiology, and for clinicians and medical students not deeply familiar with either epidemiology or molecular microbiology, the relevant concepts in both of these disciplines are discussed in appropriate sections of the book. In addition, standard terms frequently used in these two disciplines are defined in the glossary. Thus, some of the discussions may seem elementary for those who already have a background in one of these disciplines. The main goal of this book, however, is to introduce interested epidemiologists to the standard vocabulary of molecular biology, interested molecular biologists to the basic concepts of epidemiology, and interested clinicians to the vocabulary and concepts of both disciplines. The idea of this book is to provide in one place information that can be referred to by researchers and professionals with diverse backgrounds who have a common interest in epidemiology of infectious diseases.

Although the title of the book includes the seemingly sweeping set of words “molecular epidemiology of infectious diseases,” the reader will recognize that a large proportion of the book is dedicated to discussions about bacterial infectious diseases. Examples in the book that are used to illustrate practices of molecular epidemiology are almost all related to bacterial organisms. The main reason for this emphasis is that I have spent most of my
last 20 years as a researcher on bacterial diseases. However, except perhaps for concepts related to the genetics of diploid organisms and how it may influence the population structure of these organisms, most of the ideas introduced in the book should be generalizable to other categories of infectious diseases. The examples that use bacterial diseases, therefore, should be viewed as ways to illustrate different principles that define this new discipline of epidemiology.

The discipline of epidemiology of infectious diseases, as acutely demonstrated by new infectious diseases or new forms of infectious diseases that emerge every few years somewhere in the world, evolves constantly and requires continuous improvements. The most recent of these emerging infectious diseases—severe acute respiratory syndrome (SARS)—has demonstrated more than anything else in recent history the importance of linking basic epidemiologic methods to molecular biology techniques to solve a global health problem. The information provided in this book will, I hope, facilitate improved communication and exchange of ideas between those who mainly design and analyze epidemiologic data and those who mainly work in the laboratory in detecting and typing microorganisms. Then, I hope, the data and knowledge generated from this exchange of ideas will help those who take care of patients to make better clinical decisions and help those who work in public health organizations to implement novel public health intervention strategies and set policies. The final hope is that they all learn the same language of molecular epidemiology in order to be always prepared to address the problems of infectious diseases locally and globally.

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### SUBJECT INDEX

**A**
- Abscisic acid, 392
- Acarbose, 370–371
- ACC deaminase, 395
- Access and Benefit Sharing partnerships, 436–438
- Access regulation, 432–433, 462–463
- Accretion ice, 139
- Acellular slime molds, 63
- *Acetobacter diazotrophicus*, 206
- Acetogens, 124
- N-Acetylneuraminate lyase, 298
- Acid precipitation, 422
- *Acidianus*, 146–147
- *Acidianus in femus*, 147
- *Acidithiobacillus ferrooxidans*, 246
- *Acidobacterium*, 21, 82–83, 132–133
- Acidophiles, 146–147
- *Acidovorax*, 205
- *Acinetobacter*, 137, 338, 401
- Aclacinomycin, 330
- Aclarubicin, 349
- *Acremonium chrysogenum*, 326, 337
- Acrylamide, 5–6
- Actinobacteria, 20, 132–133
- Actinoleukin, 329
- *Actinomadura carminata*, 349
- Actinomycetes, 7, 74–76
  - antimicrobial production, 325–326, 340–342
  - chemotaxonomy, 291–292
  - deep-sea sediments, 25–26
  - diversity of natural products, 344, 347, 351
  - sponge-associated, 180–182, 185
- Actinomycin, 325, 341, 363
- *Actinoplanes*, 330, 370–371
- Actinoplanic acid, 366
- Actinorhodin gene cluster, 304, Color Plate 9
- Activated sludge, 400–402
- Acyl tyrosines, 115–117
- Adenylyl sulfate, 170
- Adriamycin, 330
- *Aeropyrum pernix*, 149, 296
- Aerobacter, 183
- *Ambrosia virginiana*, see *Saintpaulia*
- Agar plate diffusion assay
  - antibacterial, 324–325
  - based on spheroplast formation, 327
  - compounds detected, 325–327
  - narrow-spectrum screening concept, 327
  - screen against permeation barrier, 327–328
  - antifungal, 328
- Agriculture, 319–320, 421, 474
- *Agrobacterium tumefaciens*, 392
  - Ant(s), fungus-cultivating, 198
- Anthracin, 329
- Anthracyclines, 344
- Antirrhinum majus, 328
- Antioxidants, 324–325
- Apoptosis, 324–325
- Apricin, 329
- Air pollution, 422
- Airborne microbes, 137
- *Akkadix-INBio RCA*, 447–448
- Algae, 61, 133–136, 341, 346
- Algicides, 407
  - assays, 332
- Algorithm sampling plan, 73
- *Allicyclobacillus acidocaldarius*, 147
- Alkaliphiles, 147, 151
- All Species Foundation, 16
- Allopatric speciation, 41, 219
- *Allorhizobium*, 205
- α-Diversity, 73, see also Species richness
- Alternaria, 345
- *Alteromonas*, 346, 407
- *Alteromonas haloplanctis*, 148
- Allohydroins, 183
- Alveolates, 59–61
- *Amanita*, 207
- Ambrosia beetles, 198–199
- *Ambrosiella*, 199
- Ambruticin, 349
- *Amebae*, 219, 227
- Aminoglycosides, 341
- Ammonia monooxygenase, 296–297
- Amphotericin B, 328, 336–337, 339, 341, 348
- *Amycolatopsis mediterranei*, 296, 326
- Amylases, 378, 382–383
- Anaerobes, sulfate-reducing bacteria, 69, 169–176
- *Anaerobranca gottschalkii*, 147
- *Anaerobranca horikoshii*, 147
- Andrimid, 182
- *Anidulafungin*, 340
- Animal(s)
  - speciation, 40–41
    - transport of microbes, 221
- Animal feed, 6
- Annotation, 251–252
- Antitumor agents, 324–325
- Antiparasitic agents, 324–325
- Antifoulants, 407
- Assays, 324–328
- Anthropogenic activities, 424
  - causing increase in microbial diversity, 422
  - causing reduction in microbial diversity, 421–422
  - with no effect on microbial diversity, 422
- Antimatetics, 336, 338–340
  - assays, 332–328
pediatric, 339
searching for new drugs, 246
sources for future drugs, 347–348
synergism between, 348
targets, 350
Anti-biofilm agents, 405–412
Antibiosis, 71
Antibiotics, 7
resistance, see Drug resistance
semisynthetic, 6
soil metagenomic libraries, 115–117
Antifungals, 336, 338–340
antifoulants, 407
assays
agar plate diffusion assay, 328
for inhibition of cell wall synthesis, 329
for morphological changes of hyphae, 328
sources for future antibiotics, 348–349
Antimicrobials, 317–318, 336–355
assessing DNA diversity, 346–347
bacterial diversity in production, 342–345
chemical versus biological diversity, 340–342
fungal diversity, 345–346
marine microbes, 346
need for new natural product antibiotics, 338–340
world sales, 338–339
Antiparasitic assays
in vitro, 331
in vivo, 331
Antitumor agents, 182, 336, 340, 346, 351, 356, 363–368
assays
in vitro, 329–330
in vivo, 330
sources for future drugs, 349–350
Aphids, 195–196
API20E system, 54
Apicomplexans, 59–61, 245
Aplysina aerophoba, 179, 182
Aplysina fistularis, 178
APS reductase, 169–171
Aquaculture, 421
antifoulants for, 408
sponges, 187
Aquaspirillum arcticum, 148
Aquilax, 148–149
Aquifex, 149
Aquifex pyrophilus, 149
Aquificales, 84
Arbuscular mycorrhizal fungi, 74, 204, 207
Arbutoidea mycorrhiza, 207
Arbutus, 207
Archaea, 20, 22
insect-associated, 194
sponge-associated, 181
Archaeal-like genes, 254–255
Archaeoglobus, 148–149, 228, 297
Archaeoglobus fulgidus, 149, 170, 293
Archaeoglobus lithotrophicus, 149
Arenastatin A, 184
Armillaria mellea, 207
Arsenic, reduction by sulfate-reducing bacteria, 173
Arsenic contamination, 422
Arsenobobus nasoniae, 195
Arsenobobus triatominae, 196–197
Arthrobacter, 137, 141
Arthrobacter agilis, 141
Arthrobacter glacialis, 148
Arthropod diversity, 17–18, 21, 73
Arthrospira, 217–218
Ascomycetes, 62–63
Ascomycin, 300
Aspergillus, 6, 208, 341, 345, 378
Aspergillus aculeatus, 369
Aspergillus alliaceus, 357
Aspergillus terreus, 331, 356, 368–369
Asperlicin, 357
Aspergins, 346
Atorvastatin, 368
ATP sulfurylase, 170–171
Auxin, 392, 394
Avarol, 183
Avermectins, 331–332, 341, 351
Avilamycin, 337, 341
Axinella mexicana, 181
Azithromycin, 350
Azoarcus, 295
Azorhizobium, 205
Azospirillum, 391
plant growth-promoting agents, 393–394
Azospirillum amazonense, 393–394
Azospirillum brasiliense, 393–394
Azospirillum halopraeferens, 394
Azospirillum irakense, 393–394
Azospirillum lipoferum, 393–394
Azotobacter, 394
Azotobacter chroococcum, 295
Aztreonam, 337
B
Bacillus, 50, 149, 182, 185, 205, 337, 341, 378, 394
alkaliphilic, 147
biogeography, 229
desert-dwelling, 229
Bacillus acidocaldarius, 149
Bacillus anthracis, 50–52, 256, Color Plate 1
Bacillus brevis, 325, 337
Bacillus cereus, 51, 148, Color Plate 1
Bacillus halodurans, 296, 305
Bacillus licheniformis, 361
Bacillus licheniformis, 337
Bacillus mojavensis, 50, 229
Bacillus polymyxa, 337
Bacillus psychrosaccharolyticus, 148
Bacillus sphaericus, 50
Bacillus stearothermophilus, 149
Bacillus subtilis, 5, 46, 50, 229, 263–264, 296, 305, 344, 379, Color Plate 1
Bacillus thuringiensis, 51, Color Plate 1
Bacitracin, 337
Bacteria, see also Prokaryotes
species concept, 32–37, 41–42
phylospecies, 42–43
Bacterial artificial chromosome, 409
Bacterial diversity, see Microbial diversity
Bacterial speciation, 13, 40–48
biological factors, 44
chemical and physical factors, 43–44
constraints on genetic fluidity, 45–46
cospiculation, 44
dispersal and, 43
environmental factors, 43–44
genetic exchange and, 43
gene size and, 46–47
geographic factors, 43–44
growth rates and, 43, 45
haploidy and, 45
horizontal gene transfer and, 44–45
intrinsic factors, 44–45
mutation and, 45
oligobacteria, 162–163
population sizes and, 45
Bacteriocyte, 192, 195
Bacteriome, 192, 195
Bafilomycin, 349
Baicalin, 348
Balanol, 366
Ballast water, 222
Bark beetles, 198–199
Barophiles, see Piezophiles
Basalt rocks, 125
Basidiomycetes, 62–63
Benefit sharing, 429–439, 462–463
INBio in Costa Rica, 429–430, 445–449
in practice, 436–437
β-Diversity, 15
β-Lactams, 345, 348
Bialaphos, 341, 344
Bioactivity, screening for, 317–318, 324–335
Biocartography, 232–236
Biocatalysts, 4–5, see also Enzymes
development, 317–318, 375–390
Biochemical systems theory, 282
Biocontrol agents, 205
antifoulants, 408
bacterial, 206
fungal, 208
Biodiversity, 290, see also Microbial diversity
bioprospecting for industrial enzymes, 376–381
conferred value, 430
Convention on Biological Diversity, 429–439
definition, 15
economic benefits, 472
economic valuation, 469–470
biodiversity as information, 474
equation of well-being, 470–472
in practice, 474
techniques, 475
ecosystem functioning and, 423–424
effect of anthropogenic activities
increase in microbial diversity, 422
lack of, 422
reduction of microbial species, 421–422
estimation, 16–19, 29, 424
extinction, see Extinction
hot spots, 77, 419, 458–466
International Cooperative Biodiversity Groups, 458–466
taxonomy as roadmap, 239–240, 288–313
Biodiversity as information, 474
where to look, 76–77
Yellowstone-Diversa agreement, 429–430, 450–457
Bioprospecting targets
anti-biofilm agents, 317–318, 405–412
antifoulants, 317–318, 405–412
antimicrobials, 317–318, 336–355
biotreatment, 317–318, 397–404
enzymes, 317–318, 375–390
pharmacological agents, 317–318, 356–374
plant growth-promoting agents, 317–318, 391–396
screening for bioactivity, 317–318, 324–335
Bioreactor design, 398
Bioremediation, 173, 246, 397
Bioscreen C system, 281–282
Biosensors, 322
Biotechnology
applications, 3
clean, 5
contribution to sustainable industry, 5
impact, 5–6
sectors and markets, 317–323
Biotin synthesis, 382
Biotransformation, linking microbial community structure with function, 93–95
Biotreatment, 173, 317–318, 397–404
ex situ, 398
in situ, 397
novel microbes, 399–400
Bisabolsols, 369
Bisulfite reductase, 169–170
Black smokers, 148
Blasticidin S, 349
Blattabacterium cuenoti, 196, 198
Bleomycin, 329, 349, 356, 363
Blyeomycin, 329, 349, 356, 363
Blokmannia, 196–197
Borrelia burgdorferi, 273, 293
Borrelia garinii, 263
Botanical gardens, 435, 441, 464
Bradyrhizobium, 205
Branhamella catarrhalis, 148
BrdU method, linking microbial community structure with function, 93
Bruchobrix thermosphacta, 148
Brock, Thomas, 450–451, 455–456
Brucella abortus, 268, 271
Brucella melitensis, 263
Brucella ovis, 273
Bryostatins, 184–187
Buchnera, 46, 297
Buchnera aphidicola, 195–196
Bugula neritina, 186–187
Burkholderia, 205, 246
Busy Lizzie, 440–442
By-product secretion, 281
Calicheamicins, 364–365
Calyptophyllum trincata, 184
Callystatin A, 184
Candida, 340
Candida albicans, 63, 245, 339–340
Candidaspongia flabellata, 181
Candidate genes, 251–252
Candidatus, 36
“Candidatus Accumulibacter phosphatis,” 402
“Candidatus Brocadia anammoxidans,” 399
“Candidatus Competibacter phosphatis,” 402
“Candidatus Endobugula sertula,” 186
“Candidatus Kuenenia stuttgartiensis,” 399
“Candidatus Pelagibacter ubique,” 82, 85
Capacity building, 446–447
Carbon cycle, 167
Cefoxitin, 337
Cepacidine A, 349
Cephalosporins, 6, 326, 336–337
Cephamycin C, 327, 348
Ceratoporella nicholsoni, 179
Cercospora rosicola, 392
Cerivastatin, 368
Chlamydia, 46, 52
Chlamydia pneumoniae, 305
Chlamydia trachomatis, 305
Chloramphenicol, 326, 336–337, 341
Chlorobium tepidum, 46
Chlorofusin, 366–367
(S)-Chloropropionic acid, 6
Chlorotetacycline, 337
Choanoflagellates, 62
Chromatium, 147
Chromium, reduction by sulfate-reducing bacteria, 173
Chromobacterium violaceum, 337
Chytrids, 62
Ciliates, 21, 59–60, 193, 217–221, 227
Cilofungin, 329
Cinachyra, 183
Cinachyrolide A, 183
Cinchona, 441
CJ-14,897, 362-363
CJ-15,183, 369
Cladistics, 19
Cladosporium, 362-363
Clarithromycin, 350
Clavariadelphus truncatus, 366-367
Claviceps, 341, 345
Claviceps purpurea, 205, 356
CJ-14,897, 362-363
Claviceps purpurea, 205, 356
Clays, deep terrestrial, 124
Clean biotechnology, 5
Click chemistry, 322
Cloning
environmental nucleic acids, 90–91
to obtain enzymes for testing, 378
Clostridium, 149
Clostridium acetobutylicum, 46
Clostridium botulinum, 148
Clostridium halophilum, 150
Clostridium pasteurianum, 295
Clostridium thermosulfurogenes, 149
Clorimazole, 339–340
Coal refuse piles, 146
Coal reservoirs, deep, 124
Coccidioides immitis, 339
Cochliobolus lunatus, 363
Cochliobolus lunatus, 363
Colpoda inflata, 218
Cockroaches, 194, 196, 198, 200
Codon cube, 384
Cohesion species concept, 31
Cold biosphere, 130, see also Icy biosphere
depth, 125–126
Cold-adapted microbes, 140–141, 147–148
Colletotrichum magnas, 204, 208
Colonial bioprospecting, 440–441
Colonization, see also Biofilms
surfaces by bacteria, 406–408
Colpoda inflata, 218
Colwellia, 293, 306
Colwellia hadaliensis, 306
Combinatorial chemistry, 7–8, 324, 429, 434
Common species, 15
Community diversity profile, 71
Community genomics, see Metagenomic libraries
Compact, 208, 368
Comparative genome hybridization, 250, 255–256
Compatible solutes, 151
Competition, multispecies, 71–72
Complete gene random mutagenesis, 384
Complexity hypothesis, 299
Comprehensive Microbial Resource, 252
Conservation
discursive icons, 442
economic aspects, 469–475
Consumer’s surplus, 470
Continuous culture systems, 74–75
Convention on Biological Diversity, 429–440
access to genetic resources, 432–433
benefit sharing and, 431–439
key provisions, 432
move to fairer partnerships, 433–435
objectives, 429, 431, 450
recent developments, 435
Cooperative Research and Development Agreement, 451–457; see also Yellowstone-Diversa CRADA
Copeotrophs, 160
Core genes, 36
Correlations research, 73
Corynebacterium, 291–292
Corynebacterium diphtheriae, 103
Corynebacterium glutamicum, 103, 379
Coryneforms, 291–292
Cosmopolitan species, see Microbial cosmopolitanism
Cospiculation, 44
Costa Rica, INBio, 429–430, 347, 445–449
Crenarchaeota, 130
Cribrochalina, 185
Crickets, 193
Cryoonite holes, 135–136
Cryptic species, 20
Cryptococcus neoformans, 339
Cryptophycins, 184
Culturability, 100, 162
loss in laboratory cultures, 101–102
Culture collections, 378, 415–416, 434–435
Culture-dependent microbiology, 69, 73–76, 80–87,
241–242, 377–378
enrichment and micromanipulation, 83–84
extinction culture, 75–76, 82, 84–85, 163, 409
future, 85–86
media, 81
plating methods, 81–83, Color Plate 2
pure cultures, 80–81
Culture-independent microbiology, 74–76, 88–99,
241–242, 250, 256–257
analysis of environmental nucleic acids, 89–93
DNA extraction from environmental samples, 88–89
future, 96
horizontal gene pool analysis, 95–96
linking microbial community structure with function,
93–95
need for, 88
RNA extraction from environmental samples, 89
Curiosity-driven research, 76
Curve extrapolation methods, 23
Cusfopugin, 337
Cyanobacteria, 341
alkaliphilic, 147
cryoconite holes, 135–136
icy biosphere, 132–135
Cyanophycin, 321
Cybernetic modeling, 282
Cycloclasticus oligotrophus, 75, 82, 85, 161–162, 166–167
Cyclusserine, 326, 337, 341
Cyclosporin, 328, 345, 351, 356, 359–361, 429, 441–442
Cylinder plate assay, 325
Cymbimicins, 361–362
Cystathiazole, 349
Cytochrome bd, 173
Cytochrome c
c-type cytochromes under pressure, 155–157
multiheme c-type cytochromes, 169, 172–173
Cytokinins, 394
Cytophaga, 341
Cytophagales, 133
D
Dactinomycin, 349
Dalfopristin, 348
Data mining, 243
Database, molecular biology, 243–244
Daunomycin, 356, 363
Daunorubicin, 300, 330, 344, 349
Deep biosphere, 69, 120–129
cold, 125–126
marine sediments, 120–124
petroleum and coal reservoirs, 124
significance, 126–127
terrestrial, 124–125
Deep-sea environment, 18–19, 25–26, 72, 75–76, 148, 154
Deep-sea subsea floor biosphere, 417–418
Deforestation, 422
Dehalococcoides ethenogenes, 399
Dehalogenase, 6
Deinococcus radiodurans, 256
Deletions, see Gene deletions
Denaturing gradient gel electrophoresis, 91–92
Dercitamide, 183–184
dereplication, 9, 20, 343, 350, 357–358
Pharmacological agents, 357–358
at species level, 305–306
Desert locust, 193
Desmids, 221
Desulfbacter, 172
Desulfbacterium, 171
Desulfbacterium autotrophicum, 172
Desulfbacterium catecholicum, 172
Desulfbaculina, 297
Desulfbaculina toholica, 297
Desulfobulbus, 171–172
Desulfobulbus propionicus, 171–172
Desulfococcus, 149, 171
Desulfococcus multivorans, 172
Desulificomicrobium, 170, 172
Desulfochromobacterium baculatum, 172
Desulfochromobacterium norvegicum, 173
Desulfomaculum, 170–172, 297
Desulfomaculum auripigmentum, 173
Desulfomaculum reducens, 173
Desulfomaculum ruminis, 297
Desulfomaculum thermocisternum, 297
Desulfovibrio, 169–172
Desulfovibrio aminophilus, 171
Desulfovibrio desulfuricans, 170–173, 296
Desulfovibrio fructosovorans, 171, 173
Desulfovibrio gigas, 170, 172–173
Desulfovibrio profundus, 123–124
Desulfovibrio sulfidomutans, 171
Desulfovibrio termophilus, 172–173
Desulfovibrio vulgaris, 171, 173, 246
Deuteromycetes, 62–63
Developing countries, Convention on Biological Diversity, 431–439
2,4-Diacetylphloroglucinol, 349
Diagnostic species concept, 31
Diatoms, 60–61, 219–221, 322
Diazotrophs, icy biosphere, 135
Dicarboxylic acid acylase, 6
Dictyostelium, 63
Dietzia, 292
Dihydromaltophilin, 349
Disocyanoanociane, 183
Diketopiperazines, 182
Dilute environments, 69, 160–168
Dilution culture, see Extinction culture
Dimethyl sulfide, 162
Dimethyl sulfoxide reductase, 296–297
Dinoflagellates, 60–61, 217, 341
Dinophysis, 183
Diplococcaceae, 63–64
Directed evolution, 247–248
Industrial enzymes, 383–386
candidates for basis of next generation, 385
coupling DNA mutants and protein variants, 384–385
DNA variation, 384
iterative aspect, 385–386
Dirithromycin, 350
Disciplinary matrix, 241
Discoderma, 179
Discoderma dissoluta, 185
Discodermolide, 184
Discounting, 471, 473
Dispersal, free-living microbes, 213–214, 216–224
Diversa CRADA
Diversa-INBio RCA, 447–448
Yellowstone-Diversa CRADA, 429–430, 450–457
DNA
environmental, 75, 88, 346–347
detecting unculturable bacteria, 22–23
dot blot hybridization and gene arrays, 92–93
extraction, 88–89
molecular analysis, 89–93
molecular fingerprinting, 91–92
PCR, cloning, and sequencing approach, 90–91
oligobacteria, 161–162
DNA sequencing, 9
environmental DNA, 90–91
methods, 250–251
whole-genome, 250–251, 297–298, 305
DNA shuffling, 247, 385
DNA-based typing methods, 35
DNA-DNA hybridization
delineation of bacterial species, 33–35
microbial identification, 50–51, 55
species concept based on, 41–42, 47
DNase, 382
Docetaxel, 349–350
Doratomyces, 208
Dormancy, 100–105
Dot blot hybridization, quantitative, 92–93
Doxorubicin, 349, 356, 363
Drosophila, 195
Dunaliella, 150
Dust storms, 221
Dysidea, 182
Dysidea arenaria, 184
Dysidea avara, 183
Dysidea herbacea, 177
E
E-CELL project, 247
Echinocandins, 328–329, 336, 340, 346, 349
Ecome, 243
Economics, environmental, 469–475
Ecosystem functioning, microbial diversity and, 423–424
Ecosystem functions, 472
Ecosystem resilience, 472, 474
Ecosystem restoration, 205, 207
Ecteinascidia turbinata, 186–187
Ecteinaclisids, 186–187
Ectoine, 151
Ectomycorrhizal fungi, 206–207
Edmonds Institute v. Babbitt, 452–453
Elaophylin, 300, 302–303, 306
Elementary mode analysis, 282
Emiliana huxleyi, 217–218
Encephalitozoon cuniculi, 62
Endangered habitats, 416
Endemism, see Microbial endemism
Endophytes, 204
bacterial, 206
fungal, 18
of leaves, 208
Endosymbiont theory, 57
Energy yield, genome size and, 47
Enzymes
chemotaxonomy, 291
enzyme inhibitory assays, 330
extremophiles, 4, 151–152
industrial, 4, 151–152, 317–320, 375–390
bioinformatics in enzyme discovery, 379
bioprospecting, 376–381
cloning from nonculturable microbes, 380–382
cloning to obtain enzymes for testing, 378
directed evolution, 383–386
genome analysis for novel genes, 379–380
manufacturers, 375
metagenomics approach, 380–382
molecular screening, 378–379
rational protein engineering, 381–383, 386
screening based on culturing of microbes, 377–378
screening programs, 375–376
worldwide use, 375
Ephemeral habitats, 416
Epigallocatechin gallate, 348
Epothilones, 349–350, 364–365
Epoxomicin, 368
Epulopiscium fisheloni, 256
Equation of well-being, 470–472
Erbstatin, 366
Ergokin A, 349
Ergot, 356
Ergotamine, 345
Ericoid mycorrhiza, 207
Ewinia, 148
Erythromycin, 326, 336–337, 341
Erythromycin resistance, 274
Escherichia coli, 225, 296, 299, 305
comparison with primate host species, 42
environmental, 110
genome sequence, 20, 256, 298
genome size, 46
in silico strains, 247
phenomics, 283–286
proteome database, 263–264
specific affinity, 166
Escherichia coli O157:H7, 255
Escovopsis, 198
Esterases, 382, 453
Ethericsins, 328
Ethnomedicine, 461
Ethylene, 391–392, 394
Euglenids, 62
Euglenozoa, 61–62
Eukaryotic microbes
alveolates, 59–61
biogeography, 226–227
definition, 57–59
diplomonads, 63–64
diversity, 21–22
eye, 58
euglenozoa, 61–62
evolutionary relationships, 57–58
foraminifers, 63
heterokonts, 61
lineages, 59–64
metabolism, 58
mycetozoans, 63
opisthokonts, 62–63
parabasalids, 63
photosynthetic, 58–59
species concept, 31–32
Eupenicillium, 208
Euplotes aediculatus, 218
Europa (moon of Jupiter), 131
Evaporite lagoons, 150
Everninomycin, 337
“Everything is everywhere” concept, 422–423
Evolution
cold-adapted species, 140–141
directed, see Directed evolution
eukaryotes, 57–58
on frozen earth, 131–132
loss of evolutionary history, 415–420
plant-microbe associations, 204
resuscitation-promoting factor, 105–106
understanding genomics, 254–255
Evolutionary species concept, 31
Ex situ programs, conservation of microbes, 416
Exiguobacterium, 141
Exploitable microbiology, 3–5, 7
exhaustion of exploitable organisms, 7–8
Expression cloning, enzyme production, 378
Extinction, 415–420, 422–423, 434
habitats destruction, 419
random vs. nonrandom nature, 418–419
Extinction culture, 75–76, 82, 84–85, 163, 409
Extraterrestrial life, 125, 127, 130–131, 142
Extreme halophiles, 150–151
Extreme pathway analysis, 282
Extreme thermophiles, 149
Extremophiles, 69, 146–153
biocatalysis by, 4. 151–152
growing around boiling point of water, 148–149
growing around freezing point of water, 147–148
living at extreme salinity, 150–151
living at extreme pH, 146–147
living at high pressure, 154–159

F
FST, 25
Faerifungin, 339
Family shuffling, 247, 385–386
Fatty acid analysis, microbial identification, 53, 55
Fatty dienic alcohols, 115–117
Favolaschia pustulosa, 358–359
Feed enzymes, 6
Feedstocks, industrial, 3–4
Fermentation, by sulfate-reducing bacteria, 171
Fervidobacterium, 52, 149
Fervidobacterium pennivorans, 149
“Field of bullets” scenario, 418–419
Filter disk plate diffusion assay, 325
Fjord water, 82
FKS06, 300, 341, 351, 360–361
Flagellates, 217–219

Flavobacterium, 166, Color Plate 2
Flexibacter polymorphus, 292–293
Fluconazole, 339–340
Fluorescent in situ hybridization, 84, 94
Fluvastatin, 368
Flux-balance analysis, 282–284
Fog particles, 137
Fourier-transform infrared spectroscopy, microbial identification, 53–55, 292
Francisella tularensis, 272–273
Free-living microbes
absolute abundance, 216–217
mechanisms of dispersal, 220
animals, 221
human activities, 221–222
wind and water, 220–221
ubiquitous dispersal, 213–214, 216–224
evidence from genotypes, 217–219
evidence from morphospecies, 217
evidence from sibling and physiological species, 218–219
indirect evidence, 219
Friedmanniella antarctica, 141
Friedmanniella spumicola, 141
Fumagillin, 364–365
Functional diversity, 15
Functional genomics, 250, 252, 255–256, 260
Functional redundancy, groups of microbes, 415
Functional screening assays, enzymes, 376
Fungi, 62–63
aerial transport, 221
antimicrobials from, 341, 345–346, 351
diversity, 17–18, 22
insect-associated, 198–199
plant-associated, 205–208
sponge-associated, 182
Fungus-cultivating insects, 198–199
Fusaric acid, 392
Fusarium, 345, 378
Fusarium oxysporum, 208
Fusidic acid, 337, 341, 345
Fusidium coccineum, 337

G
G+C content, 35, 42
γ-Diversity, 15
Gas hydrate sediments, 121–122
Gasoline contamination, 421–422
Gemtuzumab ozagamicin, 364
Gene(s)
identification, 251–252
inferring from biomarkers, 291–292
lineage-specific loss, 22
taxonomy and, 291–298
Gene deletions, flux-balance analysis, 284
INDEX 485

Gene expression, 260, 288, see also Proteomics
drug-induced, 275
in vivo expression technology, 270–273
studies of, 256
Gene pool, microbial, loss of, 415
Gene trapping methods, 380
Genetic diversity, 23–25
Genetic fluidity, 45–46
Genetic headroom, 20
Genetic resources, 3

Genome
oligobacteria, 161–162
species genome, 20, 36
Genome sequencing, 250–252, 297–298, 305
Genome size, 76
bacteria, 46–47
Buchnera, 195–196
upper limit, 47
Genome species concept, 297, 306
Genomics, 241, 243, 249–259
bioinformatics analysis of genome sequence, 251–252
eukaryotic, 254
functional, 250, 252, 255–256, 260
insights into metabolic diversity, 252–254, Color Plate 8
limitations, 260, 280
sequencing methods, 250–251
tools for comparing genomes, 252–254
unculturable species, 250, 256–257
understanding evolution, 254–255
Genotype-phenotype relationship, 280–287

Geobacter metallireducens, 296

Geographic information systems, Yellowstone National
Park Microbial Database and Map Server, 214,
232–236, Color Plates 3 through 7

Geography, bacterial speciation and, 43–44

Giardia, 58
Giardia lamblia, 63–64, 295
Gibberella fujikuroi, 392
Gibberellins, 392, 394
Glaciers, 125–126, 136–138, 148
Glarea lozoyensis, 337
Gidobactin, 349

Global Biodiversity Information Facility, 244

Glomer, 394
Glucose isomerase, 4
Glucosidase inhibitors, 330
Glyceraldehyde phosphate dehydrogenase, 274
Glycogen-accumulating organisms, 400–402
Glycosidases, 453

Gonium pectorale, 218
Gordonia, 292
Gramicidin, 337, 341

Green fluorescent protein, 94–95
Griseofulvin, 328
Growth rate, 280
bacteria, 43, 45, 81, 160

Gut microbes, insect-associated, 192–194, 200

Gymnoascus, 207
Gymnodinium, 218

Gyornodinium catenatum, 217
H

Habitat destruction, 416, 419
Habitat simulation, 74

Haemophilus influenzae, 225, 246, 267, 274
gene sequence, 250
proteome database, 263–265
Haliangicin, 349
Halichondria melanodocia, 183
Halichondria okadae, 183, 185
Halichondria panicea, 182
Halichondrin B, 184
Haloclona, 183, 185

Haloalkaliphiles, 147
Haloanaerobium praevalens, 150
Haloarcula marismortui, 296, 299
Halobacteria, 150
Halobacterium denitrificans, 150
Halofex furcicullii, 150

Halophiles, 150–151
Haploidy, bacterial speciation and, 45
“Hardangervidda fungus,” 441–442

Heavy metal contamination, 422

Hebeloma, 207
Helicobacter pylori, 245, 267–268, 273–274, 284, 305
drug-induced gene expression, 275
gene sequence, 256
proteome database, 263, 265–266
Herbaspirillum, 205
Herbicides, 422
assays, 331–332
Heterokonts, 61

Heterotrophs, icy biosphere, 135
Hierarchical Classification System, 244
High-pressure environment, 154–159
High-fructose syrup, 4

High-throughput screening, 324, 356–357

Hindgut malces, 192–193

Histoplasma capsulatum, 339–340

HMG-CoA reductase inhibitors, 330–331, see also Statins
Holophaga, 132

Homocysteovolens, 125

Homaoasterionin, 183

Horizontal gene pool, culture-independent study, 95–96
Horizontal gene transfer, see Lateral gene transfer
Hot fumaroles, 148
Hot spots, biodiversity, 77, 419, 458–466
Hot springs, 146, 148

Human genome, 298
Hurricanes, 221
Hyatella, 182

Hydrogen sulfide, 172
Hydrogenase, 169–173
Hydrothermal vents, 83, 148, 154, 227–228
4-Hydroxybutyrate dehydrogenase, 382

Hypromycin, 344
Hyalphon synhaln, 298

Hymenoscyphus ericae, 207

Hypaphorine, 341

Hypersaline sites, 76, 147

Hyperthermophiles, 148–149, 151, 227–228
Hypomyces, 208
Hypothesis-driven science, 243
Hypoxylon, 345
Hyritios altum, 183

I
Iceobacter, 217
Icy biosphere, 130–145
cold deep biosphere, 125–126
cold-adapted species, 140–141
cryoconite holes, 135–136
evolution on frozen earth, 131–132
extraterrestrial life, 130–131
glacial ice, 136–138
microbes growing around freezing point of water, 147–148
permanent Antarctic lake ice, 132–135
subglacial lakes, 139–140
Idarubicin, 349
Ignecoccus, 148
Igneous rock, 125
Ignicoccus, 228
Illicicolin, 349
Imipenem, 327, 336–337
Immunocompromised patients, 339
Immunosuppressive agents, 359–363
Impatiens sultani, see Busy Lizzie
In silico strains, 247
In situ hybridization, whole cells, linking microbial community structure with function, 94
In situ programs, conservation of microbes, 416
In vivo expression technology, 270–273
INBio (Costa Rica), 429–430, 437, 445–449
achievements of bioprospecting, 448
Akkadix-INBio RCA, 447–448
Chagas space program, 448
Diversa-INBio RCA, 447–448
future, 449
La Gavilana RCA, 448
Merck & Co-INBio RCA, 445, 447–449
microbial bioprospecting agreements, 447–448
research collaborative agreements, 445–447
Indigenous peoples, 462–463
Indirubin, 115–117
Indoleacetic acid, 394
Indole-3-glycerol phosphate synthase, 248
Industrial sectors, penetration of biotechnology, 319–320
Infrared spectroscopy, microbial identification, 53–55, 292
Insect-associated microbes, 191–203
bioprospecting within, 199–200
ectosymbionts, 198–199
extracellular endosymbionts, 192–194
intracellular endosymbionts, 194–198
terminology, 191–192
Insulin mimetic, 371
Intellectual property rights, 437, 462–463
Intercontinental trade, 221–222
International Agricultural Research Centres, 435
International Cooperative Biodiversity Groups (ICBG), 429–430, 458–466
access, intellectual property rights, and benefit sharing, 462–463
bioinventory results, 460–461
bioprospecting results, 461–462
capacity and capability accomplishments, 463
conservation outcomes
capacity-building efforts, 464
dissemination of findings, 465
ex situ botanical conservation, 464
integrated conservation and development, 464–465
natural resources management, 464
interactions with industrial partners, 462
program summaries, 458–460
International law, 429
International Treaty on Plant Genetic Resources for Food and Agriculture, 434–435
Intertidal sediments, 74
Inventive problem solving, 321
Inventory project, 73
Inverse flux analysis, 282
Invertebrates, marine, 186–187
Ionophores, rhizosphere, 392–393
Irccinia, 185
Irinotecan, 349–350
Iron-reducing bacteria, 94, 173
Isaria sinclairii, 361–362
Isopentyladenine, 392
Isoprenoids, 291, 293–295, 341
Isotope-coded affinity tags, 262

K
Kanamycin, 337
Kasugamycin, 341
Keratinase, 382
Ketoconazole, 339–340
Kinetoplastids, 62
Kissing bugs, 196–197
Kitasatosporia, 368
Klebsiella, 394
Klebsiella oxytoca, 193, 296
Klebsiella pneumoniae, 296, 305
Kluvyera ascorbata, 395

L
L-671,776, 358–359
L-783,281, 370–371
La Gavilana S.A., 448
Labyrinthula macrocystis, 61
Labyrinthulids, 61
Lactacystin, 367–368
Lactic acids, chiral, 4
Lactobacillus casei, 50
Lactobacillus paracasei, 50
Lactococcus lactis, 337
Ladybird beetles, 195
Lake Vostok, Antarctica, 126, 130, 139–140
Land tenure, 437
Landfills, 398
INDEX 487

Latency, 100
Lateral gene transfer, 22, 32, 57–58, 254–255, 288, 293–300, 305
  bacterial speciation and, 44–45
prokaryotes, 35–36
Latrunculins, 183
Laulimalide, 350
Legionella pneumophila, 271
Leishmania, 246
Leishmania donovani, 272
Leishmania major, 62
Lentinus edodes, 206
Leptodontium elatius, 368
Letters of intent, 437
Lliblomycin, 329
Lichens, 207
LightCycler, 52
Lincomycin, 336–337, 341
Linezolid, 350
Lipases, 382–383
Lipids, membrane, under pressure conditions, 154–155
Lipopolysaccharides, 291
Lipstatin, 370–371
Lissodendoryx, 184
Listeria monocytogenes, 148, 267, 271
Lovastatin, 330–331, 341, 351, 368–369
Lucilactaene, 366
Luffisphaera, 219
Lyngbia, 346
M
Magainins, 322
Magnaporthe grisea, 205
MALDI-TOF mass spectrometry, 54
Maltophilin, 341
Manganese, reduction by sulfate-reducing bacteria, 173
Manufacturing industries, 319–320
Manzamines, 180, 185–186
MAR1, 343
Marasmiellus, 362–363
Marine environment, 8, 18–19, 81–82, 84–85, 419
  bacterial diversity, 25–26, 346, 405–412
invertebrates, 186–187
Marine industries, biofouling, 405–412
Marine saltern, 150
Marine sediments
  basement rock beneath, 123
depth, 120–124
Marine sponges, see Sponge(s)
Marinobacter arcticus, 165
Marker genes, 94–95
Market(s), for biotechnology products, 321
Market forces, 470
Mars, life on, 130–131
Mass extinction, 417–419
Mass spectrometry, 262, see also specific types of mass spectrometry
Material Transfer Agreement, 436–437
Matsuebacter chitosanotabidus, 82–83
McMurdo Dry Valleys, 132–135
Mealybugs, 196–197
Media, 81
Menonialla echinata, 358–359
Memorandum of understanding, 437
Merck & CO-INBio RCA, 445, 447–449
Mercury contamination, 422
Mesorhizobium, 205
Metabolic control analysis, 282
Metabolic diseases, drugs to treat, 368–371
Metabolic diversity
  eukaryotic microbes, 58
  P. falciparum, 253, Color Plate 8
Metabolic engineering, 246, 282
Metabolic measurements, 280–281
Metabolism
  linking microbial community structure with function, 93–95
  oligobacteria, 162
  reconstructing pathways from genome analysis, 253–254
Metabolome, 243, 260
Metagenomic libraries
  heterologous gene expression, 117
  screening for industrial enzymes, 380–382
  soil microbes, 109–119
  biological insights from, 115–117
  challenges and limitations, 115
  experimental strategy, 113–114
  future, 117
  metagenomics as experimental strategy, 113–114
Metal reduction, sulfate-reducing bacteria, 173
Metalsphaera, 147
Meteorological events, extreme, 221
Methane, 162
Methanobacterium thermoautotrophicum, 46
Methanobrevibacter, 194
Methanococcus, 148–149
Methanococcus jannaschii, 46, 149, 155
Methanogens, deep biosphere, 124–125
Methanohalobium evestigatum, 150
Methanomicrococcus blatticola, 194
Methanopyrus, 148–149
Methanopyrus kandleri, 149
Methanosarcina barkeri, 295
Methanothermus, 149
Methanothermus fervidus, 146, 149
9-Methoxystrobilurin E, 358–359
Mevastatin, 331, 368–369
Mevinolin, 208, 330–331, 356
Micafungin, 340
Microarray technology, 243–244, 246, 250, 255–256, 424, Color Plate 1
  analysis of environmental nucleic acids, 92–93
Microautoradiography, 94
Microbacterium, 182
MicrobeLynx system, 55
Microbial area-species curve, 73
Microbial cosmopolitanism, 225–226
eukaryotic microbes, 226–227
prokaryotic microbes, 227–228, 230
Microbial diversity, 4, 340, see also Biodiversity
bacterial speciation, 13, 40–48
defining, 13, 29–39
disproportionate taxonomic effort, 21
estimating and comparing uncountable species, 22–25
eukaryotic, 13, 57–65
mapping, 214, 232–236
marine bacteria, 25–26
microbial identification, 13, 49–56
numbers and diversity, 20–21
phylogenetic framework, 21–22
supersaturated coexistence, 71–72
unit of count, 19–20

Microbial ecology
deep biospheres, 69, 120–129
dilute environments, 69, 160–168
extremophiles, 69, 146–159
icy biosphere, 130–145
insect-associated microbes, 191–203
plant symbionts, 69, 204–210
resuscitation of uncultured microorganisms, 100–108
soil metagenomics, 69, 109–119
sponge-associated microbes, 177–190
sulfate-reducing bacteria, 69, 169–176

Microbial identification, 13, 49–56
approaches, 49
cell composition, 53–55
DNA-DNA hybridization, 50–51, 55
fatty acid analysis, 53
Fourier-transform infrared spectroscopy, 53–55, 292
mass spectrometry, 54
nucleic-acid-based procedures, 49–52
PCR-based procedures, 51–52, 54–55
physiology-based methods, 54–55
protein analysis, 52–53
ribotyping, 52
Micrococcus, 182
Micrococcus cryophilus, 148
Micrococcus lotus

dormancy and resuscitation, 101
resuscitation-promoting factor, 102–105

Microcolony technique, 81
Microcystis, 217
Microdochium caespitosum, 366–367
Microfossils, 417
Micromanipulation, 83–84
Micromonaspora, 350, 361
Micromonaspora carbonacea, 337
Micromonaspora chalcea, 340
Micromonaspora echinospora, 364–365

Microorganisms Sustainable Use and Access Regulation
International Code of Conduct (MOSAICC), 435–436
MicroSeq 500 Bacterial Identification System, 50
Microsphaeropsis, 182
Microsporidians, 62
Mining practices, effect on microbial diversity, 421

Mithramycin, 349, 363
Mitomycin C, 341, 349, 356, 363
Mitoxantrone, 349
Mobile genetic elements, culture-independent study, 95–96
Moderate halophiles, 150
Moderate thermophiles, 148–149
Molecular complexity index, 8
Molecular ecology, 290
Molecular phylogeny, 17, 75
Molybdenum, reduction by sulfate-reducing bacteria, 173
Monascus, 208, 345
Monascus ruber, 331
Monensin, 337, 341
Monophyletic species concept, 31, 34
Monorend, 359–359
Monotropoid mycorrhiza, 207
Moraexella, 148
Moritella, 155, 293
Moritella japonica, 155
Moritella marina, 148
Moritella yayanosii, 155
Morphologic species concept, 31–32, 40, 217
Morphospecies, see Morphologic species concept
MOSAICC, 435–436
Most-probable-number methods, 81, 83, 102
mRNA expression profiles, 256
MUMmer, 252
Mupirocin, 337
Muramic acids, 292
Mutagenesis, 384
Mutation, bacterial speciation and, 45
Mycetocyte, 192
Mycetome, 192
Mycetozoans, 63
Mycobacterium, 291–292
Mycobacterium avium, 103, 272
Mycobacterium bouis, 103, 269–271, 296
Mycobacterium leprae, 76, 103
Mycobacterium smegmatis, 272
Mycobacterium tuberculosis, 76, 103, 268–273, 296, 345

drug-induced gene expression, 275
drug-resistant, 339
proteome database, 263, 266
Mycolic acids, 291–292
Mycophenolic acid, 345, 361
Mycoplasma, 267
Mycoplasma genitalium, 247, 250
Mycoplasma pneumoniae, 263, 268
Myriocins, 361–362
Myxalamide, 349
Myxin, 349
Myxobacteria, 343, 349, 351
Myxococcus, 46

N
NADH oxidase, 172
"Nanoarchaeum equitans," 46, 228
Natamycin, 349
National Environmental Policy Act, 452–453
National Park Service
bioprospecting on federally owned land, 450–457
current state of bioprospecting in parks, 453–454
evaluation of bioprospecting in parks, 454–456
Natural products, 3, 7–8
biosynthesis, taxonomic distribution, 299
dereplication methods, see Dereplication
gene libraries, 346–347
marine, 8, 346
pharmacological agents, 317–318, 356–374
screening for bioactivity, 317–318, 324–335
taxonomy as roadmap to genes, 239–240, 288–313
Navicula pelliculosa, 322
Negombata magnifica, 183
Neisseria gonorrhoeae, 267
Neisseria meningitidis, 225, 256, 267, 297, 305
Nematode diversity, 21
Neomycin, 336–337
Nigericin, 302–303, 306
Nikkomycin, 328, 340–341, 349
Nisin, 337, 341
Nitrate reductase, 172, 296–297
Nitrate reduction, dissimilatory, by sulfate-reducing
cell, 172
Nitrile hydratase, 5–6
Nitrite reductase, 172
Nitrite-oxidizing bacteria, 94
Nitroso bacteria, 400
Nitrogen, removal from wastewater, 398–399
Nitrogen fixation
icy biosphere, 133, 135
rhizobia, 205–206
sulfate-reducing bacteria, 172
taxonomic significance, 295
Nitrogenase, 295
Nitrospira, 297, 399
Nocardia, 291–292
Nocardia lactamurans, 327, 337
Nodulisporic acid, 341
Nodulisporium, 208, 345
Nonactin, 344
“Nonculturable” organisms, see Unculturable/uncultured microbes
Nonparametric estimators, 24
Nonproportionate sampling, 73
Nonuse value, 472
Nosocomial infections, 338
Novobiocin, 326, 337
Nram, gene, 272–273
Nitrogenase, 295
Numerical taxonomy, 19, 33
Nycotethus ovalis, 58, 193
Nystatin, 328, 336–337, 339, 348
O
O-antigens, 297, 306
Ocean circulation, 221
Oceanapia, 183
Octadecabacter, 227
Oidiondrond, 207
Oidiodendron griseum, 363
Okadaic acid, 183
Oligobacteria, 69, 160–168
activity control by substrate concentration, 163–167
composition, 161
metabolism, 162
speciation, 162–163
transporters, 162–167
viability, 163
Oligomycin, 349
Oligonucleotide fingerprinting, 51–52, 424
Oligonucleotide microarray, 51, Color Plate 1
Oomycetes, 61
Open reading frame analysis, 251–252, 260
Operational taxonomic unit, 19, 23
Ophiostoma, 199
Opisthokonts, 62–63
Opportunistic infections, 469–470
Optical tweezers, 84
Option agreements, 437
Orbulina universa, 218, 221
Oregonic acid, 366
Origins of life, 131–132, 142
Oxidase, 371
Oscillatoria chalybea, 296
Oscillatoria spongelliae, 177
Outer-membrane proteins, piezophiles, 156
Oxygen
reduction by sulfate-reducing bacteria, 172–173
uptake rate, 280
Oxytetracycline, 337, 341
PCR-based analysis
environmental nucleic acids, 90-91
microbial identification, 51-52, 54-55
Taq polymerase, 450-451

Pediococcus, 52
Pellina, 185
Peloruside A, 350
Penicillin, 324, 336-337, 341, 345
Penicillin G expandase, 6
Penicillin resistance, 274
Penicillium, 208, 341, 345
Penicillium brevicompactum, 331, 368-369
Penicillium chrysogenum, 6
Penicillium citrinum, 368-369
Penicillium griseofulvum, 328
Penicillium notatum, 324, 337
Penestatin, 349
Peptaibol, 349
Peptide mass fingerprinting, 262
Peptide synthetases, nonribosomal, 341
Peptidoglycans, 291-292
Peptimycin, 329
Perchlorate-reducing bacteria, 219
Periodicity atlas, 252
Periwinkle, 349, 441-443
Permafrost, 130
Pestalotiopsis microspora, 205
Planctomyces, 133
Planococcus mcmeekinii, 141
Planococcus okeanokoites, 141
Planococcus psychrotoleratus, 141
Phage display technology, 322
Pharmacogenomics, 245
Pharmacological agents, 3, 8, 317-318, 356-374
diversity, reactivity, and toxicity of natural products, 358-359
high-throughput screening, 356-357
sample presentation and chemical dereplication, 357-358
searching for new drugs, 245-246
sponge-associated microbes, 181-182
trends and prospects, 371-372
Phenazine-1-carboxylic acid, 206
Phenetic (polythetic) species concept, 31, 33-34
Phenome, 243
Phenomics, 239-241, 280-287
flux-balance analysis, 282-284
gene deletions, 284
impact on biotechnology, 285-286
measurement tools, 281-282
phenotypic measurements, 35, 280-281
phenotypic phase plane analysis, 284-285
predicting and analyzing data, 282-285
Phenotype Microarrays, 281
Phenotypic phase plane analysis, 284-285
Phepropeptins, 368
Pheromones, bacterial, 102
Phleomycins, 329
Phoma, 76-77, 208, 345, 363, 369
Phomopsis, 363

Phosphoribosylanthranilate isomerase, 248
Phosphorus, removal from wastewater, 400-402
Photobacterium profundum, 153-156
Photorhodopsin gene, 113
Photosynthesis, eukaryotic microbes, 58-59
Phototrophic microbes, icy biosphere, 135
Phyletic gradualism, 41
Phylodiversity, 90
Phylogenetic diversity, 24-25
Phylogenetic markers, 90
Phylogenetic species concept, 31-32, 40-43, 47
Phylogenetic systematics, 19
Phylogenetic trees, 22, 252
Phylogeny, 21-22, 305
Phylogeographic studies, 76
Phylogeography, 239-241, 280-287
flux-balance analysis, 282-284
gene deletions, 284
impact on biotechnology, 285-286
measurement tools, 281-282
phenotypic measurements, 35, 280-281
Phylophenetic species concept, 34
Phylospecies, 42-43, 47
Phytoplankton, 160
Pigment production, antifouling activity and, 406-407
Pimaricin, 349
Pisolithus, 207
Planctomyces, 133
Planococcus mcmeekinii, 141
Planococcus okeanokoites, 141
Planococcus psychrotoleratus, 141
Plant(s), speciation, 40-41
Plant growth-promoting agents, 317-318, 391-396
ACC deaminase, 395
from Azospirillum, 393-394
ionophores, 392-393
from Trichoderma, 394-395, Color Plates 10 and 11
Plant growth-promoting bacteria, 205
Plant growth-promoting fungi, 207-208
Plant-associated microbes, 69, 204-210
eukaryotic symbiosis, 206-208
prokaryotic symbiosis, 205-206
prospects for exploitation, 208-209
Plasmids

Plate reader, 281-282
Plating methods, 81–83, Color Plate 2
Placmycin, 349
Pluramycins, 329
pmoA gene, 90
Pneumocandin, 341
Pneumocystis carinii, 63, 339–340
Polaribacter, 227
Polyenes, 302, 328
Polyethylene terephthalate, 3–4
Polyketide(s), 341
Polyketide keto synthase, 299–300
Polymyxin B, 337
Polyphasic species, 20
Polyphasic taxonomy, 13, 35, 289–290
Polyphosphate-accumulating organisms, 400–402
Polythetic species concept, see Phenetic (polythetic) species concept
Polyunsaturated fatty acid synthesis, taxonomic significance, 292–294
Porphyromonas gingivalis, 253–254
Pradamycins, 340, 349
Pravastatin, 351, 368
Pressure-adapted bacteria, 154–159
Prionos, 185
Principles on Access and Benefit-Sharing for Participating Institutions, 435
Process innovation, 6
Process replacement, 5–6
Processing industries, 319–320
Prochlorococcus, 160
Prochlorococcus marinus, 218
Product improvement, 6
Prokaryotes, see also Bacteria
biogeography, 227–228, 230
genetic exchange, 35–36
recognition of new species, 36–37
species concept, 32–37
1,3-Propanediol, 3–4
Proportionate sampling, 73
Prorocentrum concavum, 183
Prorocentrum lima, 183
Protein(s)
consensus approach for stabilizing, 248
membrane, under pressure conditions, 155–157
microbial identification from protein analysis, 52–53
rational design, 248
Protein chips, 262
Protein engineering, rational, improving industrial enzymes, 381–383, 386
Proteinase, 382–383
Proteome, 260
databases, 262–266
Proteomic signature, 261–262
Proteomics, 241, 243, 249–250, 260–279
bacterial pathogenesis at proteome level, 268–273
development of therapeutic strategies, 273–275
microbial typing at proteome level, 267–268
Protozoa, insect-associated, 193
Pseudoalteromonas, antifoulant production, 406–408
Pseudoalteromonas aurantia, 407
Pseudoalteromonas citrea, 407
Pseudoalteromonas haloplanktis, 408
Pseudoalteromonas luteoviolacea, 407
Pseudoalteromonas rubra, 407
Pseudoalteromonas tunica, 406–408
Pseudoalteromonas siluae, 406–407
Pseudobactin, 392
Pseudomassaria, 370–371
Pseudomonas, 205–206, 229, 391, 394–395
Pseudomonas aeruginosa, 46, 274, 296, 338, 345
Pseudomonas azotoformans, 141
Pseudomonas fluorescens, 95, 110, 246, 296, 337, 392
Pseudomonas fragi, 148
Pseudomonas isachenhovii, 296
Pseudomonas putida, 6, 233, 296, 392–393
Pseudomonas synxantha, 141
Pseudomurien, 291
Psychrobacter, 138, 148, 227
Psychrobacter glacincola, 141
Psychrobacter immobilis, 141, 148
Psychrobacter marincola, 141
Psychrobacter submarinus, 141
Psychroflexus torquis, 293
Psychrophiles, 147–148, 151–152
piezophilic, 155
Psychrotolerants, 147–148
Psyllids, 196–197
Puccinia melanocephala, 221
Punctuated equilibrium, 41
Pure culture, 80–81
Pyoluteorin, 349
Pyropyrene A, 369–370
Pyrobaculum, 149
Pyrobaculum aerophilum, 149, 296
Pyrobaculum islandicum, 149
Pyrococcus, 148–149, 155, 228, 255
Pyrococcus abyssi, 155
Pyrococcus furiosus, 4, 149, 256, 305
Pyrococcus horikoshi, 305
Pyrococcus woesei, 151
Pyrodictium, 148–149, 228
Pyrodictium occultum, 149
Pyrodictium ocultum, 149
Pyrolobus fumarii, 149
Pyrolysis mass spectrometry, 9, 54, 292
Pyrophosphate phosphohydrolase, 170
Pyrolysin, 328, 349
Pythium, 207
Q
Quasi-option value, 474
Quinupristin, 348
R
Ractinomycins, 329
Raffaelea, 199
Ralstonia, 205
Ralstonia metallidurans, 246
Ralstonia solanacearum, 345
Random shotgun sequencing strategy, 250–251
Rapamycin, 300, 303, 306, 328, 344, 349, 351, 360–361
Rare species, 15, 219, 288, 442
Rarefaction analysis, 23, 72
Raromycin, 329
Ratjadon, 349
Real estate leases, 437
Real-time PCR, 52
Renewable raw materials, 3–4
Reporter genes, 94–95
Research collaborative agreements, INBio, 445–447
Resorcyclic acid lactones, 363
Resormycin, 349
Respiration systems, pressure-regulated, 156
Resuscitation-promoting factor, 102–106
Revacryl 380 Tm, 408
Reverse dot blot hybridization, 51
Reverse transcription-PCR, 91
Rhizobacteria, 391–396
Rhizobia, 205–206
Rhizobium, 205, 295, 394
Rhizoctonia, 207
Rhizopogon, 207
Rhizosphere, 92, 95, 204, 391–396
Rhodobacter, 296
Rhodobacter sphaeroides, 46
Rhodococcos, 291–292
Rhodococcus koreensis, 299
Rhodococcus ruber, 291–292
Rhodopseudomonas palustris, 46
Rhopaloeides odorabile, 178–181, 187
Rhynchomonas nasuta, 217
Riboflavin, 5
Ribotyper, 52
Ribosequencing, 49–50
Ribotyping, 52
Rice paddy soil, 76, 82–83
Richness estimators, 23–24
Rifampin, 327, 337
Rifamycin, 326, 336, 341
Rigid (fixed) sampling, 73
RNA
environmental
dot blot hybridization and gene arrays, 92–93
extraction, 89
molecular analysis, 89–93
molecular fingerprinting, 91–92
PCR, cloning, and sequencing approach, 90–91
oligobacteria, 162
Roseobacter, 81–83
Royalties, 438, 452, 456
rpoB gene, 90
rRNA genes
genus-level biogeography, 228–229
microbial identification, 49–51, 54
oligobacteria, 163
16S or small-subunit, 21–25, 33–35, 42, 75–76, 80–81, 90, 289–290
soil microbes, 112–113
sponge-associated microbes, 179–180
taxonomic significance, 289–290, 299
Rubber, 441
Russula, 207
Rustmicin, 340, 348
S
Saccharomyces cerevisiae, 154, 157, 166, 284, 286
Saccharopolyspora erythraea, 102, 337
Saccharothrix, 366
Safe minimum standards approach, 470
Saintpaulia, 440–442
Salinibacter ruber, 83
Salmonella enterica, 271–272, 297–298, 305
Salterns, 82, 150
Sampling effort, 73
Sampling strategy, 72–73
Sand layers, deep terrestrial, 124
Sanglifehrins, 361–362
Sapropels, 122–123
Sarcina ventriculi, 147
Sarkomycin, 329
Schizochytrium, 293
Sea ice, 130, 227
Search strategy, 3, 306, 375–376
Seawater, see Marine environment
Seed banks, 464
Selenium, reduction by sulfate-reducing bacteria, 173
Self-assembly, 322
Serratia ficaria, 92
Service industries, 319–320
“Sex ratio Spiroplasma,” 195
Sherlock Microbial Identification System, 53, 55
Shewanella, 155, 292–293, 306
Shewanella benthica, 155
Shewanella violacia, 155, 157
Shrinkwrap license, 437
Sibling species, 218–219
Siderophores, 392–393
Sigma 54, pressure-regulated, 157
Silicification, 322
Similarity species concept, 32
Simocyclinones, 332–333
Simonsiella, 44
Simvastatin, 368
Sinefungin, 349
Sinorhizobium, 205
Single-strand conformation polymorphism, 91
Sinorhizobium, 205
Site-directed mutagenesis, 384
Skermania, 292
Slime molds, 63
Snowball Earth Hypothesis, 132
Soda lakes, 217–219
Sodalis glossinidius, 196–197
Sodium/proton antiporter, 382
Soil
DNA extraction, 88–89
saline, 150
Soil microbes

functional diversity, 113

history of soil biology, 109–111

linking phylogeny and function, 113–115

metagenomic libraries, 109–119

 biological insights from, 115–117

 challenges and limitations, 115

 experimental strategy, 113–114

 future, 117

 metagenomics as experimental strategy, 113–114

Soil structure, 110–111

Solfataras, 146–149

Sorangicin, 349

Sorangium cellulosum, 349, 364–365

Sordarin, 340, 349

Spatial variability, microbial population, 72

Species

common, 15

definition, 23

rare, 15, 219, 288, 442

unit of biodiversity, 15

Species 2000, 16, 19

Species accumulation curves, 17, 72–73, 76

Species concept, 13, 19, 29–39, 290

bacteria, 41–42

 phyllospecies, 42–43

eukaryotic microbes, 31–32

 formulation, 30–31

 prokaryotes, 32–37

 polyphasic approach, 35

 uncultured bacteria, 36

Species genome, 20, 36

Species inventories, 15–16

Species redundancy, 415, 417

Species richness, 15, 415

 effect of human activities, 421–422

 estimation, 23–24

 global, 219

 scale effects, 72

 supersaturated coexistence, 71–72

 Specific affinity theory, 163–167

 Spectinomycin, 337, 341, 344

 Spergualin, 361

Sphero assay, 348

Sphingofungin, 349

Sphingomonas, 137, 141

Sphingomonas alaskensis, 75, 82, 85, 166

Spinosyn, 351

Spirastrella spinispirulifera, 183

Spirochetes, insect-associated, 194

Spirulina, 147

Sponge(s), 177–190

 anatomy and physiology, 177

 aquaculture, 187

Sponge 01IND 35, 180–181, 185–186

Sponge 01IND 52, 185–186

Sponge-associated microbes, 177–190

 diversity, 179–181

 manzamine-containing sponges, 185–186

 microbiology, 177–179

 natural products from, 181–185

Spongia, 183

Spongiosatins, 183

Sporormiella intermedia, 368

Spray-ionization mass spectrometry, 54, 292, 333

Squalestatins, 368–369

Stable isotope technique, linking microbial community

 structure with function, 93–94

Stachybotrys, 369

Staphylococcus, 185, 291

Staphylococcus agalactiae, 256

Staphylococcus aureus, 225, 256, 296–297, 306

 drug-induced gene expression, 275

 drug-resistant, 338–339

Staphylococcus carnosus, 296

Staphylococcus epidermidis, 256

Staphylococcus pneumoniae, 256

Staphylothermus, 149

Stated preference techniques, 475

Statins, 330–331, 351, 356, 368

Stauroporine, 366

Stellata, 184

Stephanodiscus niagarae, 220

Stigmateliin, 349

Strain development, 285–286

Strain discrimination, 9

Strain typing, at proteome level, 267–268

Stramenopiles, 61

Streptococcus equisimilis, 274

Streptococcus pneumoniae, 225, 253

 drug-resistant, 274, 338

Streptococcus pyogenes, 273

Streptogramins, 336

Streptomyces, 246, 305, 340–342, 361–362, 366

 antitumor agents, 363

 sponge-associated, 182

taxonomy, 291

“Streptomyces aerovirens,” 295

Streptomyces albiflaviniger, 303

Streptomyces antibioticus, 325, 332, 344, 349

Streptomyces anulatus, 367–368

Streptomyces argillaceus, 349

Streptomyces asiaticus, 300

Streptomyces auranticolor, 303

Streptomyces aureofaciens, 326, 337

Streptomyces avermitilis, 246, 299–300, 332, 344

Streptomyces caespitosus, 349

Streptomyces cangkringensis, 300

Streptomyces cinnamonensis, 337

Streptomyces clavuligerus, 337

Streptomyces coelicolor, 46, 103, 246, 253, 296, 299–300, 306, 344

Streptomyces coeruleorubidus, 330

Streptomyces cattleya, 327, 337

Streptomyces clavuligerus, 337

Streptomyces clavuligerus, 337

Streptomyces diastaticus, 330
Streptomyces erythraea, 326
Streptomyces felleus, 326
Streptomyces fradiae, 327, 337
Streptomyces galilaeus, 330, 349
Streptomyces garyphalus, 326
"Streptomyces geldamyceticus," 300, 303
Streptomyces griseiniger, 303
Streptomyces griseolosporeus, 295, 341
Streptomyces griseus, 337, 344
Streptomyces hygroscopicus, 300, 303, 328, 344, 360-361
Streptomyces indonesiensis, 300
Streptomyces javensis, 300
Streptomyces kanamycetus, 337
Streptomyces lavendulae, 186-187, 326
Streptomyces lincolnensis, 337
Streptomyces lividans, 306
Streptomyces malaysiensis, 300
Streptomyces mediterranei, 337
Streptomyces melanosporofaciens, 300
Streptomyces niveus, 295, 326
Streptomyces nodosus, 328, 337
Streptomyces noursei, 328, 337
Streptomyces orchidaceus, 326, 337
Streptomyces orientalis, 337
Streptomyces parvulus, 349
Streptomyces peucetius, 349
Streptomyces phaeogriseichromogenes, 303
Streptomyces phaeoluteichromogenes, 303
Streptomyces phaeoluteigriseus, 303
Streptomyces pristinaespiralis, 337
Streptomyces rhizosphaericus, 300
Streptomyces rimosus, 326, 337
Streptomyces sparsogenes, 303
Streptomyces spectabilis, 337
Streptomyces spheroides, 295, 326, 337
Streptomyces tendae, 328
Streptomyces toxytricini, 370-371
Streptomyces tsukubaensis, 360-361
Streptomyces venezuelae, 326, 337
Streptomyces verticillus, 329, 349
Streptomyces violaceoruber clade, 303-304, 306, Color Plate 9
Streptomyces violaceusniger clade, 300-303, 306
Streptomyces viridochromogenes, 325, 337
Streptomyces viridofaciens, 337
Streptomyces yogyakartensis, 300

Subsurface environment, 120-129
Subtilisin, 386
Suillus, 207
Sulfate-reducing bacteria, 69, 94, 169-176, 297
dissimilatory sulfate reduction, 169-171, 297
fermentation of inorganic sulfur compounds, 171
fermentation of organic substrates, 171
metal reduction, 173
reduction of elemental sulfur, nitrate, and oxygen, 172-173
Sulfide-producing bacteria, 124, 170
Sulfite oxidase, 296-297
Sulfite reductase, 297
Sulfolobus, 146-147, 149
Sulfolobus acidocaldarius, 147
Sulfolobus brierley, 147
Sulfolobus "islandicus," 228-229
Sulfolobus metallicus, 147
Sulfolobus solfataricus, 149, 255
Sulfur, elemental, reduction by sulfate-reducing bacteria, 172
Supercooled clouds, 137
Supersaturated coexistence, 71-72
Suppressive subtractive hybridization, 255-256
Sustainable industry, 5
Swinholide A, 182-183
Symbionts, 21, 76
of insects, 191-203
of marine invertebrates, 186-187
of plants, 204-210
of sponges, 177-190
Sympatric speciation, 41
Synechococcus, 160, 296
Synechocystis, 46, 263
Synercid, 337, 348
Syringomycin, 349
Syringopeptin, 349
T
TA, 343
Tacrolimus, see FK506
Taq polymerase, 450-451, 454
Taxic diversity, 15
Taxols, 350, 364
Taxomyces andreanae, 205
Taxon, 30
Taxonomic databases, 75
Taxonomy
α-taxonomy, 19
β-taxonomy, 19
biodiversity estimates from, 17
genes and, 291-298
history, 289
importance, 19
modern era, 289-291
morphologically based, 289
phylogeny-based, 289-290
as roadmap to genes, 239-240, 288-313
role in bioprospecting, 288-313
Taxonomy Workbench, 244
Taxon-to-taxon ratios, 16
Taxus, 349
Technological innovation, recovery of microorganisms, 74–75
Technology transfer, 429, 431–432, 438, 446–447, 449
Tedania ignis, 182
Telemostatin, 367–368
Temperature gradient gel electrophoresis, 91–92
Temporal variability, microbial population, 72
Tenipocide, 349
Tensin, 349
Tephritids, 193
Terminal restriction fragment analysis, 91
Termites, 192–194, 196, 198–200
Termitomyces, 199
Terpenoids, 341
Terragine, 115–117
Tethya aurantia, 322
Tetracenomycins, 327
Tetracyclines, 326, 336–337
Thauera, 94
Thelephora, 207
Theonella swinhoei, 179, 181–183
Theopalauamide, 182–183
Thermoalkaliphiles, 147
Thermoanaerobacter, 149
Thermoanaerobacter ethanolicus, 149
Thermobispora bispora, 299
Thermococcus, 148–149, 155, 228
Thermococcus aggregans, 149
Thermococcus alcaliphilus, 147
Thermococcus peptonophilus, 155
Thermodesulfobacterium, 170, 297
Thermofilum, 149
Thermomicrospira, 217
Thermomonospora chromogena, 299
Thermophiles, piezophilic, 155
Thermoplasma, 146
Thermoplasma acidophilum, 147
Thermoproteus, 149
Thermoproteus tenax, 146, 149
Thermotoga, 148–149
Thermotoga neapolitana, 4, 149
Thermus, 83, 149
Thermus aquaticus, 149
Thermus thermophilus, 296
Thienamycin, 327
Thiobacillus caldus, 147
Thiobacillus ferrooxidans, 147
Thraustochytrium, 293
Time-series description, discovery of new species, 16
TNP-470, 364
Trichoderma, 207–208, 345, 378, 384, 391
Trichothecene, 341
Trichothecins, 392
Tryprostatin, 341
Tryptophan uptake, pressure-sensitive, 157
Tsetse flies, 196–197
U
Ubiquitous dispersal, free-living microbes, 213–214, 216–224
UCN-01, 366–367
Ultramicrobacteria, 85
Ulva reticulata, 407
Unculturability/uncultured microbes, 22–25, 74–76
antifoulant production, 409
classification, 36
culture-independent microbiology, 88–89
genomics, 250, 256–257
industrial enzyme production, 377, 380–382
metagenomics approach, 109–119
resuscitation, 100–108
soil, 109–119
Uranium, reduction by sulfate-reducing bacteria, 173
Urauchimycins, 182
Uronema, 219
Usnic acid, 207
V
Vaccine development, 246, 273–274
Valinomycin, 341, 344
Transcriptional regulation, piezophiles, 157–158
Transcriptome, 260
Transcriptomics, 241, 243
Transglutaminase, 377
Transporters, oligobacteria, 162–167
Transchepetic organisms, 163
Travel behavior, 475
Trebolysa princeps, 196–197
Treponema, 194
Treponema pallidum, 244
Trichoderma, 207–208, 345, 378, 391
plant growth-promoting agents, 394–395, Color Plates 10 and 11
Trichoderma harzianum, 208, 394–395, Color Plates 10 and 11
Trichoderma polysporum, 8–9, 328
Trichomonas, 38
Trichomonas vaginalis, 63, 298
Trichostatin A, 366
Trichothecene, 341
Trisporic acids, 392
Trihalotane pathway, 170
Tryptophan, 341
Tryptophan uptake, pressure-sensitive, 157
U
Ubiquitous dispersal, free-living microbes, 213–214, 216–224
UCN-01, 366–367
Ultramicrobacteria, 85
Ulva reticulata, 407
Unculturability/uncultured microbes, 22–25, 74–76
antifoulant production, 409
classification, 36
culture-independent microbiology, 88–89
genomics, 250, 256–257
industrial enzyme production, 377, 380–382
metagenomics approach, 109–119
resuscitation, 100–108
soil, 109–119
Uranium, reduction by sulfate-reducing bacteria, 173
Urauchimycins, 182
Uronema, 219
Usnic acid, 207
V
Vaccine development, 246, 273–274
Valinomycin, 341, 344
Vancomycin, 336–337
Vancomycin resistance, 338–339
Verrucomicrobia, 82–83, 133
Vertical gene transfer, 32
Verticillium balanoides, 366
Viability, 100
  oligobacteria, 163
"Viable but nonculturable," 88, 288
Vibrio, 182, 407
Vibrio anguillarum, 408
Vibrio cholerae, 293–295, 298
Vibrio parahaemolyticus, 166, 408
Vibrio psychroerythreus, 148
Vibrio splendidus, 408
Vinblastine, 349, 441
Vincristine, 349, 441
Vinorelbine, 349
Violacein, 115–117
Violaceol I, 346
Virginiamycin, 337
Virtual whole-cell models, 247
Virulence, investigations at proteome level, 268–273
Vicosinamide, 349
Volcanic eruptions, 221
W
Wastewater treatment, 397–404, 422
  nitrogen removal, 398–399
  phosphorus removal, 400–402
Water, transport of microbes, 220–221
Water molds, 61
Weevils, 196
Well-being, equation of, 470–472
Western Australian Department of Conservation and
  Land Management, 437
Whiteflies, 196–197
Whole-genome sequencing, see Genome sequencing
Wigglesworthia glossinidia, 196–197
Willingness to pay, 470–471, 473
Wind, transport of microbes, 220–221
Wolbachia, 195
Wolbachia pipiensis, 195
WORLDMAP project, 16
Wortmannin, 366
X
Xanthomonas, 345
Xenical, 351
Xenobiotics, 397
Xestospongia, 185
XR774, 362–363
XR842, 364–365
Xylaria, 345
Xylella fastidiosa, 162, 263, 345
Y
Yellowstone National Park
  hot pools, 84
  Taq polymerase, 450–451, 454
Yellowstone National Park Microbial Database and Map
  Server, 214, 232–236, Color Plates 3 through 7
Yellowstone-Diversa CRADA, 429–430, 450–457
  benefit distribution, 455–456
  effect on conservation, 454–455
  legal challenges, 452–453
  sustainable use of biotic resources, 455
Yersinia enterocolitica, 148, 271
Yersinia pestis, 298
Yew tree, 349–350
Z
Zaragozic acids, 368–369
Zeatin, 392
Zygomycetes, 62–63