

## Index

Note: Page references in bold type indicate the major chapter headings.

- Acanthamoeba castellanii* 156–7, 158, 321  
*Acanthamoeba polyphaga* 157, 158  
*Acanthamoeba rhysoides* 321  
 acidulants 203–4, 204, 208  
*Acinetobacter* 57, 166, 169  
 acquired immune deficiency syndrome (AIDS/HIV) virus 226  
   and enteric infections 81, 116  
   surface survival 224, 230, 233, 241  
   transmission of 10, 12, 15, 21  
   and UV radiation 216  
 actinometry 332, 335  
   biological 336, 337–8, 339  
   chemical 338–40, 344  
 adenoviruses/*Adenovirus*  
   characteristics of 78, 79, 80  
   detection 85, 88  
   surface survival 232, 241, 250  
   UV susceptibility 319, 320  
*Aeromonas* 77  
   *A. hydrophila* 322  
 aerosols 4, 11, 17, 22, 25–6  
   disinfection methods **215–23**  
     HEPA filtration 220–1  
     UV inactivation 217–19  
   and food contamination 198  
   and sewage 18, 20  
 aflatoxins 197  
 aggregation, cellular 141, 144, 146, 153, 159, 163, 165–7, 173, 175  
   and UV inactivation 317, 326, 327, 357  
 air cleaning units 217–18  
 Alcare 249  
 alcohol 293  
 algae, growth in food 202  
*Alicigenes faecalis* 171  
 allergies 19  
*Alphavirus* 15  
 American Type Culture Collection (ATCC) 171  
 ammonium disinfectants 143–4, 166, 171, 244, 248, 249  
 ampicillin resistance 273, 275–6  
 analysis of variance, use of 60, 61  
 analytic models 60–5  
 animals  
   as disease reservoirs 13–18, 23, 25, 259  
   epidemic model in 9–10  
   water contamination by 89–90, 93, 101, 102  
 anthrax 26  
 antibiotics 33  
   natural 203  
   resistance to 170, 272–6  
 antibodies 7–8, 107–8  
   in microbe detection 86, 87, 88, 89  
 antiseptics 164–5, 224, 245–6, 289–90  
 AOAC Sporicidal Test 294–6, 304  
 Aquaress 249  
*Arenavirus* 26  
 Arrhenius relationship 377–9, 386–8, 389–90  
 arthropod vectors 4, 13, 14–16, 21  
*Aspergillus* 12, 26, 220  
*Astrovirus* 22, 100

398 *Index*

- Bacillus* 58  
 spores 201, 294–5  
   thermal inactivation 374, 380–4,  
   390–1  
   UV susceptibility 320, 322, 325,  
   338  
*B. anthracis* 26  
*B. cereus* 374  
*B. licheniformis* 374  
*B. megaterium* 168, 169, 175  
*B. pantothenicus* 374  
*B. stearothermophilus* 374, 380–1,  
 383–4, 387, 390–1  
*B. subtilis* 168, 174, 374, 382–3  
   effect of UV 218, 274  
 bacteria  
   colonization of body 55–9  
     modeling strategies 60–7  
   resistance to water disinfectants  
     **140–92**  
   toxins 116, 197–8  
   transmission routes of  
     aerosols 25–7  
     control by surface disinfection 24,  
     **258–84**  
     direct physical contact 13–16  
     environmental non-water related  
     21–8  
     food 24–5, 26  
     infection probabilities 109  
     intermediate host 28–9  
     medical devices 21, 23  
     surfaces 24  
     water 16–22  
   UV susceptibility 317–18, 322  
   *see also* spores  
 bacteriocins 203  
 bacteriophages 91, 93, 172–3  
   f2 321, 329–30, 331, 359  
   MS-2 154–5, 159, 320–2, 325, 336–8  
   Q $\beta$  321, 338  
   T7 154, 159  
*Bacteroides* 57, 58, 59  
 Bacti-Stat 249  
 batch culture 65–6  
 Beer–Lambert law 323  
 benzalkonium 175  
*Bifidobacterium* 58  
 biofilm 161–5, 169  
 Bioprep 249  
 biopreservation 205, 209  
 birds 13, 17, 102  
 blindfolded bowler analogy 107–13  
*Bordetella pertussis* 26  
*Borrelia burgdorferi* 15  
 botulism 12, 198  
*Branhamella catarrhalis* 57  
*Brevibacterium* 57  
 bromine 150, 166, 167, 174  
*Brucella* 26, 195  
 Bunsen–Roscoe law 316  
  
*Calicivirus* 22, 27, 100  
   foodborne 195, 197, 199  
 Camel 165  
*Campylobacter/campylosis* 17, 19, 24  
   foodborne 26, 195, 197  
   infection probabilities 114  
   minimum infectious dose 265  
   on surfaces 261, 263, 267  
   waterborne 22, 76–7, 83, 100  
   *C. jejuni* 78, 156, 158  
   UV susceptibility 317–18  
*Candida* 15  
   *C. albicans* 57  
   *C. parapsilopsis* 329–30, 331  
 canning processes 200–1  
 capsid 168, 169  
 capsule 141, 159, 161–5, 169, 170, 173  
 carbolic acid 293  
 cattle 10, 17, 28, 29, 226  
 cefoxitin 306  
 cell  
   action of disinfectants on 147–50  
   protection from 159–69, 170  
   photoreactivation 356–7  
   *see also* aggregation  
 cell–recycle culture 66  
 cetrimide 164, 174, 175, 249  
 chickenpox 16, 26, 27  
 chiggers 14  
 children, disease transmission 23,  
 79–81, 227–8, 238, 266–71  
*Chlamydia* 27  
   *C. psittaci* 26  
   *C. trachomatis* 13–14, 24  
 chloramines 152, 157, 159, 166  
   bacterial resistance to 163–4, 167, 169  
   disinfectant action 140, 147, 148–9,  
   158  
 chlorhexidine 168, 169, 174, 175, 249  
 chlorine 32  
   and disinfection of medical devices  
   293–4  
   as food preservative 203–4  
   in water disinfection 33, 34, 127, 140

- mechanism of action 146–8
- resistance to 142, 150–60, 162–9, 171, 176–7
- chlorine dioxide 140, 143–4, 149, 171, 172
  - resistance to 164, 166, 169, 173, 177
- 4-chloro-3,5-xyleneol 249
- chlorophenol 167–8, 169, 175
- cholera *see Vibrio cholerae*
- Citrobacter freundii* 156
- Clostridium* 58, 59
  - C. botulinum* 12, 374
    - food poisoning 198
  - C. difficile* 267, 272–3
  - C. perfringens* 12, 201
    - as microbe indicator 92–3
  - C. sporogenes* 294–5, 374
  - C. tetani* 12
- clothing 31–2, 215–16, 270, 273
- cluster analysis 61
- coagulants 32, 127, 140
- Coccidioides* 12, 26
- colicins 168, 172–3
- coliphages *see* bacteriophages
- colonization, microbial **55–71**
- Colorado tick fever 15
- Coltivirus* 15
- common cold 26, 27
- compartmental models 5–10, 30, 205, 227–8
- condoms 32
- conjunctivitis 26, 79, 226
- continuous culture 66–7
- cooking in food processing 197, 198, 200, 201, 207, 208
- copepods *see* crustaceans
- Coronavirus* 22, 26, 100
- corrosion 141, 150–1, 158
- Corynebacterium* 26, 57, 59
- coxsackieviruses 83
  - A 79, 80
  - B 79, 80
  - detection 85, 87
  - infection probabilities 113, 114–15
  - surface survival 232
  - UV susceptibility 318–19, 320
- crabs 112
- crops/vegetables 202
  - contaminated 16, 17, 20, 22, 24
    - by chemicals 193–4
  - diseases from 195–6, 199
- crustaceans
  - contamination of 20, 22, 24, 102–3, 195, 197, 201
    - in water distribution systems 112, 155, 156
- cryptosporidiosis 17, 18, 19, 21, 81
- Cryptosporidium*
  - cyst collection 86, 87
  - cyst UV susceptibility 320
    - and disinfectants 267
  - infection probabilities 125–6
    - in water 75, 81–4, 91–2, 106
  - C. parvum* 22, 26, 27, 99, 100
    - infection probabilities 113, 114, 116
      - minimum infectious dose 109
- cutaneous ecosystem *see* skin
- Cyclops* 155–6, 158
- Cyclospora* 113
- Cytomegalovirus* 15, 241
- cytoplasm 147
- dairy products 24, 195, 198, 200, 202
- Daphnia* 156, 158
- day-care centers 266–71
- decontamination 287, 289
- Deltavirus* 15
- dengue 14, 15
- detergents 32, 168, 172, 172–3
- Dettol 165, 249
- diabetes 80
- diapers, and disease 267–9, 270, 271
- diarrhea 267, 270
  - bacterial 77, 272
  - protozoan 81
  - viral 19, 26, 79, 226
- differential scanning calorimetry (DSC) 376, 392
- dinoflagellates 194, 197
- diphtheria 26
- direct transmission 4, 5, 10–16
- disease
  - prevention 28–37
  - portals of entry 3–4
  - risk estimation 103, 106
  - transmission modeling 5–10, 30, 34–7
    - see also* disinfection; transmission
  - disinfection 3, 32–3, 228
    - of aerosols **215–23**
      - bacterial resistance to **140–92**
        - cell-mediated protection 159–69
        - effect of growth conditions 142, 163–4, 168–77
        - inactivation kinetics 142–50

400 *Index*

- disinfectant evaluation 294–6
  - mechanisms of action 150–68
  - relative efficiencies of 143–4, 246–50
- and food preparation 25
- of medical devices **285–310**
- Poisson distribution analysis 166–7
- of sewage 20
- of surfaces
  - and bacterial control **258–84**
  - and viral transmission 244–50
  - thermal inactivation **369–96**
  - viral resistance to 159, 167, 169
- of water 32–3, 35, 37, 127, 141–50
  - bacterial resistance to **140–92**
  - see also* ultraviolet light
- DNA, UV susceptibility 315, 316–17, 319
- dogs 21
- drug resistance 272–6, 306
- drying 201–3, 208, 229–30
- ducted air disinfection 217, 220
- dyes 168, 172–3
- dysentery *see Entamoeba; Shigella*
- ear 4
- echoviruses/*Echovirus* 79–80, 83, 87
  - infection probabilities 109, 113, 115
  - resistance to disinfectants 167, 168, 169
  - surface survival 232, 241
  - UV susceptibility 318, 320
- eggs 195, 197, 201, 202
- encephalitis 13, 14, 15, 22, 100
- endemic disease 99, 100, 103, 127, 128
  - modeling 3, 6–7
- endoscopes 23, 287, 290, 304–7
- Entamoeba* 80
  - E. histolytica* 22, 100, 158
  - and disinfectants 144, 146
- enteritis 26, 195
- Enterobacter aerogenes* 163, 169
- Enterobacter agglomerans* 156, 163, 169
- Enterobacter cloacae* 153, 156, 162–3, 169
- Enterococcus faecalis*, vancomycin-resistant (VRE) 273, 275–6
- Enterococcus faecium*, vancomycin/ampicillin-resistant (VAREC) 273, 275–6
- enteroviruses/*Enterovirus* 11–12, 226
  - characteristics of 78–80
  - concurrent infections 117
  - detection 85, 87–8
  - Enterovirus-70 226, 241
  - environment transmitted 26, 27
  - and pH 112
  - prediction of 91, 92–3
  - surface survival 230, 232, 241
  - and UV 318–20
  - water transmission 11, 22, 84, 100, 124–5
  - see also* coxsackieviruses; echoviruses; polioviruses
- envelope, cellular 142, 147, 169–70, 172–6
- environment
  - and disease transmission 3, 4, 11, 16–28
  - see also* aerosols; food; medical devices; surfaces; water
- enzymes 149, 160, 202, 204
- epidemic disease 16, 99, 100
  - modeling 3, 5–10
- Escherichia* 26
  - E. coli* 58
  - and disinfectants 144, 160
  - resistance to disinfectants 169, 171, 172, 174, 177
    - cellular alterations 167, 168, 169
    - particle association 152
    - vector association 156, 158
  - foodborne 195
  - surface contamination 264, 267
  - thermal inactivation of 374
  - UV susceptibility 218, 315, 317–18, 329–31, 357, 359
  - waterborne 76–7, 78, 83
    - infection/illness/death probabilities 114
- ethanol 249
- ethylene oxide 288–91, 297–8, 300–1, 307–8
- Eubacterium* 58, 59
- eye 4, 19, 79
- factor analysis 61
- feces
  - disinfection studies 152, 154, 155
  - food contamination 14, 21, 199
  - land contamination 20
  - microbial content 78–9, 108
  - surface contamination 268, 270
  - viral discharge 228–9

- water contamination 16, 17, 18, 89–90, 102
- Filovirus* 26
- filters
  - HEPA 216, 218, 220–1
  - for microbe collection 86, 87, 88, 93
  - in water treatment 126, 127, 140
- fimbriae 165, 166
- fish 102, 195, 197, 199, 226
- Flavivirus* 15
- Flavobacterium* 142, 177
- fleas 14
- flies 14, 21, 28
- flocculation 140
- fluorescein isothiocyanate (FITC) 87
- fomites *see* surfaces
- food
  - infectious disease from 4, 11, **193–212**, 227, 261–6
    - contamination sources 5, 14, 16, 24–5, 102, 196–208
      - chemical 194–5
      - nature of 26–7, 194–6
      - risk modeling 205–8
    - preserving quality of 200–5
  - Food and Drug Administration (FDA):
    - regulation of disinfection 286, 296–304
  - foot-and-mouth disease 25
  - formaldehyde 171, 292–3
  - Francisella tularensis/tularemia* 21
    - and biting flies 14, 15, 38
    - and food 26, 38, 195
    - and water 22, 38, 99, 100
  - freezing, and pathogens 201–2, 203, 208
  - frozen foods 198, 202
  - fruit 24, 199, 202
  - fungi 12, 20, 24, 25, 57
    - growth in food 196, 202, 203, 205
    - resistance to disinfection 294
    - toxins 197
  - fungicides 194
  - Fusobacterium* 58, 59
  - Gallionella* 151
  - gamma irradiation 32, 201, 308
  - Gardnerella vaginalis* 59
  - gas gangrene 12
  - gases as preservatives 203–4, 208
  - gastroenteritis 75, 76, 78
    - bacterial 12
    - protozoan 320
  - viral
    - aerosol transmitted 27
    - foodborne 195, 201
    - surfaceborne 11, 226, 228, 241
    - waterborne 16, 18, 19, 21–2, 78–9, 99, 100, 101, 125
  - gastrointestinal tract 4
    - diseases of 14, 16, 24, 77, 78, 100–1
      - see also* diarrhea; gastroenteritis
    - microbial ecosystem 58
  - generalized estimation equations (GEE) 64–5
  - genitourinary tract 4
  - Giardia*/giardiasis 91
    - cyst collection 86–7
    - and disinfectants 267
    - foodborne 24, 25, 196, 199
    - infection probabilities 83–4, 109, 125–6
    - waterborne 17, 18, 21, 75, 80–1, 92, 106
  - G. lamblia* 26–7
    - cyst UV susceptibility 320, 321
    - infection probabilities 109, 113
    - minimum infectious dose 109
    - in water 22, 82, 100
  - G. muris* 321
  - glutaraldehyde 171, 292, 305, 306, 308
  - gonorrhoea 10, 15
  - granular activated carbon (GAC) 153–4, 158, 164
  - growth phase, and disinfectant resistance 171, 175, 177
  - Guillain–Barré disease 78
  - hair follicles 56
  - hands
    - and disease transmission 260, 262, 264, 266
      - viral 224, 229, 231, 236–8, 241–4
    - washing of 32, 270, 271, 273
      - formulations for 245–6, 247–50
  - heart, diseases of 79, 80, 226
  - heat
    - in food preparation 200
    - sterilization 288–91
      - as water treatment 126–7
    - heavy metals 168, 172–3, 193
  - Helicobacter pylori* 317–18
  - helminths 28, 155, 196, 202
  - Hemophilus* 57
  - hemorrhagic fever 25, 26
  - Hep–2 cell-associated virus 154

402 *Index*

- HEPA filters 216, 218, 220–1
- hepatitis 154
- transmission 15
    - by food 27, 201
    - by medical devices 21
    - by water 19, 22, 100
- A 12
- and disinfectants 267
  - foodborne 20, 195
  - infection probabilities 115
  - on surfaces 11, 232, 236, 239, 249
  - UV susceptibility 319, 320
  - waterborne 75, 78, 79, 80
- B 13, 226, 232–3, 243
- E 99, 115, 116, 124
- Hepatitis virus* 22, 27, 100, 195, 197
- herbicides 194
- herpes simplex 13
- herpesviruses 233, 236, 241
- hexachlorophene 249
- high efficiency particulate filters (HEPA) 216, 218, 220–1
- Histoplasma* 12
- H. capsulatum* 26
- histoplasmosis 21
- horizontal transmission 10
- host susceptibility 3–4, 5–9, 14, 226–7, 259–60, 268
- host–microbe ecosystems 55–9
- modeling of 59–67
- Hyalella azteca* 156
- Hycolin 165
- hydraulic indices 314, 349, 350–1
- hydrogen peroxide 146, 170, 200
- hydrogen sulphide 141
- ice 22, 195–6
- immunity 5–9, 122
- immunization 28, 29–31
- immunofluorescence assays 196
- indicator organisms 90–1, 92–3
  - and UV 314, 316–17, 321–2, 336–8
- indirect transmission 4, 5, 10–12, 16–28
- see also* aerosols; food; medical devices; surfaces; water
- infant botulism 198
- infant salmonellosis 263
- infection control 31–3, 260, 269–71, 286–8
- see also* disinfection
- infectious disease *see* disinfection; transmission
- influenza/influenzaviruses 11, 26, 226
- surface survival 233, 237
- insect vectors 4, 13, 14, 155
- insecticides 194
- intermediate hosts 28, 29
- intestinal tract, host–microbe ecosystem 55
- iodine 33, 127, 247–8
- resistance to 165, 167, 171, 177
- iron compounds 141, 151
- irradiation 201, 208, 300, 308
- isopropanol 249
- Izal 165
- keratoconjunctivitis 23
- Klebsiella* 164
- K. aerogenes* 264
  - K. oxytoca* 156
  - K. pneumoniae* 58
    - disinfectant resistance 151, 156, 158, 163, 169, 173, 177
  - K. terrigena* 318, 322, 325
- Lactobacillus* 57, 58, 59, 65, 205
- Lambert's law 342
- Legionella* 26, 27, 157, 158
- L. gormanii* 156
  - L. pneumophila* 12, 22, 102, 317–18
- Lentivirus* 15
- leprosy 31
- Leptospira interrogans* 22, 26
- leptospirosis 17, 19, 21
- lipopolysaccharides 170, 175, 176
- Listeria* 26, 195
- livestock 17, 28
- epidemic model 9–10
- logistic regression 64
- Lyme disease 14, 15
- Lymphocryptovirus* 15
- Lyssavirus* 15
- malaria 99
- malnutrition 116
- Mastadenovirus* 22, 26
- measles 16, 26, 116
- meat 195–6, 198, 201, 202
- medical devices
- and disease transmission 21–3, 26, 27, 227, 246, 259
  - disinfection/sterilization of **285–310**
    - effects of device type 304–7
    - evaluation 294–6
    - FDA regulation 296–304
    - methods 291–4

- standards for 307–8
- meningitis 22, 24, 26, 79, 100
- menstrual cycle 58–9, 62
- methicillin resistance 273–5
- microbial colonization, modeling **55–71**
- microbial fate 103
- microbial risk assessment *see* risk assessment
- Micrococcus* 57, 59
  - M. luteus* 218
- microwaves 32, 201
- minimum infectious dose 108–10, 123, 283–9
- mixed-effects models (MIXMOD) 63
- models
  - compartmental disease transmission 5–10, 30, 205, 227–8
  - disinfection/inactivation kinetics 144–6, 316–35
  - disinfection model for the home 265
  - first-order kinetics models 143
  - mixed second-order models 324–7
  - multi-target models 145, 324–6, 327–8, 329–31, 334–5
  - series-event models 145, 324–6, 328–9, 329–31, 334–5
  - thermal death 375–92
  - host–microbe ecosystems
    - analytic 60–5
    - simulation 60, 65–7
  - risk assessment 106–26
    - foodborne 205–8
    - waterborne dose–response models 81–5
  - UV dose 351–6
  - UV intensity 314, 323–4, 340–8
  - waterborne epidemic model 35–7
- molluscs
  - and disease 20, 22, 24, 195, 197
  - prevention 200–1
- mononucleosis 15
- Monte-Carlo simulation method 389
- Moraxella* 164, 169
- Morbillivirus* 26
- Morrill dispersion index 350, 353
- mortality, disease related 6–7
- mosquitoes 14, 19
- mouth: microbial ecosystem 57
- multi-drug-resistant pathogens 272–6
- multi-target models 145, 324–6, 327–8, 329–31, 334–5
- mumps 16, 226
- muskrats 17
- Mycobacterium boris* 218
- Mycobacterium chelonae abscessus* 306–7
- Mycobacterium chelonae* 171
- Mycobacterium fortuitum* 171
- Mycobacterium tuberculosis*
  - animal sources 25, 26
  - disinfection methods for 217, 220, 221
  - quarantine 31
  - var. *bovis* 304
- Mycoplasma hominis* 59
- mycoplasmas 57
- Naegleria* 22, 157, 321
  - N. gruberi* 167
- nappies *see* diapers
- natural community models 240
- Neisseria* 57, 59
  - N. gonorrhoeae* 15, 175
- nematodes 141, 150, 155, 158
- neonates 56
- Newcastle disease 25
- nonparametric tests 61
- Norwalk virus 79, 80, 85, 101, 195
- nosocomial infections 228, 272–8, 285–90
- Notavirus* 85
- nucleic acid hybridization probes 196
- nucleic acids
  - denaturation 148–50
  - UV susceptibility 315, 319
- Omp proteins 172
- Onchocerca volvulus* 28, 29
- operating theaters 215
- oral ecosystem 57
- oronasal tract 55
- Orthohepadnavirus* 15
- Orthopoxvirus* 26
- oxygen 91, 146–7, 172, 582
- ozone
  - as disinfectant 140, 149–50
  - resistance to 152, 167, 169
  - as food preservative 203–4
- pandemics 16, 110
- parainfluenzaviruses 26, 234, 236
- paralysis 79
- Paramyxovirus* 26
- paratyphoid 22, 100

404 *Index*

- particle association 141, 151–5, 158, 159, 163, 358
- pasteurization 200
- pathogen monitoring, risk assessment **75–98**
- PCR (polymerase chain reaction) 87, 88–9, 196, 241
- penicillin 168, 174
- Peptostreptococcus* 57, 58, 59
- peroxydisulfate-*t*-butanol 339
- pertussis 16, 26
- pH
  - and aggregation 165
  - and disinfection 292
  - and disinfection resistance 143
  - and microbial growth in food 202, 203
- phage sensitivity testing 160
- phage-typing tests 174
- pharyngoconjunctival fever 18, 19, 22
- phenolic disinfectants 244, 248, 293, 306
- 2-phenoxyethanol 168, 175
- photoreactivation 356–7
- physical contact 4, 13–16
- pigs 10, 28, 29
- plague 13, 14, 15, 25, 26
- plankton 156
- pleurodynia 79
- Pneumocystis carinii* 26
- pneumonia 27
- poliomyelitis 19, 27, 30, 226
- polioviruses 11
  - infection probabilities 115
  - minimum infectious dose 108–9, 123
  - and surfaces 230, 234, 249
  - UV susceptibility 318–19, 320
  - and water disinfectants 144
    - resistance to 154, 155, 159, 160, 169, 176
  - waterborne 12, 79, 80
- polychlorinated biphenyls 194
- polymer production, microbial 141, 159
- polymerase chain reaction (PCR) 87, 88–9, 196, 241
- populations, modeling disease in 5–10, 33–7
- porins 170
- potassium ferrioxalate 339, 344
- poultry 24, 195, 197, 263
- pregnancy 99, 116, 259–60
- preservatives 200–5
  - listed 204
- Prevotella* 65
- primary transmission 5
- Propionibacterium acnes* 57, 59
- protein denaturation 147–9
- protozoa
  - colonization of body 57, 58
    - and disinfectants 143
      - resistance to 150, 156–7, 158
  - foodborne 24–5, 27, 196, 202, 208
  - infection probabilities 113, 114, 116, 119, 125–6
  - and medical devices 23, 24, 25–6
  - minimum infectious dose 109, 110
  - and pH 112
  - risk estimation 118–21
  - UV susceptibility 320–1
  - waterborne 4, 17–22
    - cysts/oocyst levels 85–7, 89, 104–6
    - indicators of 90, 91, 93
- pseudoinfection 23
- Pseudomonas* 23
  - P. aeruginosa* 306
    - resistance to disinfectants 165, 166, 167, 169, 175, 177
      - in swimming pools 164, 171
  - P. alicigenes* 171, 177
  - P. cepacia* 175
  - P. fluorescens* 218
  - P. multivorans* 174
  - P. paucimobilis* 164, 169
  - P. pickettii* 164, 169
  - P. viscosa* 385
- pseudorabies 10
- psittacosis 26
- quarantine 31
- rabies 10, 13, 14, 15
- racoons 10, 13, 14
- random-effects models 63
- regression
  - analysis 62–5, 90–1
  - trees 61–2
- reinfection rates 117–18
- Reiter's syndrome 78
- reoviruses 88
  - UV susceptibility 319, 320
- reservoirs (of disease) 3–4, 13, 16–18, 101, 259–60, 268
- residence time distribution (RTD) 338, 348–56
- respiratory diseases 19, 26, 27, 79, 267
- respiratory syncytial virus 234, 236, 237
- retorting 200–1



- rheumatic diseases 226
- rhinoviruses/*Rhinovirus* 26, 27, 226, 228  
 surface contamination 234–5, 236, 237, 241, 247–8
- Rickettsia* 14, 15
- rinderpest 10
- risk assessment  
 of foodborne disease 205–8  
 from contaminated water **75–98**, **99–139**  
 methods 75–89  
 hazard identification/exposure 76–89  
 modeling 81–2, 83, 85, 106–26  
 probabilities of illness/death 113–16  
 pathogen monitoring programs 89–94  
 of transmission by surfaces 261–78
- RNA, UV susceptibility 319
- Rocky mountain spotted fever 15
- rodenticides 194
- rodents 13, 17, 18
- rotaviruses/*Rotavirus* 226  
 concurrent infections 117  
 and disinfectants 248, 267  
 surface contamination 11, 26, 227–8, 235, 236–8, 241  
 UV susceptibility 318–19, 320, 325  
 waterborne 18, 22, 78–9, 100, 101  
 detection of 85  
 infection probabilities 83, 84, 113, 115  
 minimum infectious dose 108–9
- RTD 338, 348–56
- rubella 15, 226
- Rubivirus* 15, 26
- Ruminococcus* 58
- Saccharomyces cerevisiae* 322, 338, 374
- Salmonella*/salmonellosis 14  
 foodborne 24, 26, 195–6, 197, 201  
 minimum infectious dose 265  
 surface transmission 261–2, 263, 267  
 waterborne 76–7, 78, 155, 158  
 infection probabilities 83, 84
- S. anatum* 374, 385
- S. paratyphi* 22, 100
- S. sentenberg* 374
- S. thompson* 374
- S. typhi*(typhoid) 5, 16, 19, 21–2, 76, 100  
 infection probabilities 113, 114  
 levels in water 105  
 minimum infectious dose 109  
 protection from disinfectants 153  
 severity of infection 77, 78  
 typhoid endemics 3, 33–4  
 UV susceptibility 318, 322
- sanitation 242–50, 267  
 in food production/preparation 198–9, 200  
*see also* hands, washing of
- Sarcinia lutea* 218
- Savlon 165, 174–5, 249
- Schistosoma* 29
- Scrub Stat IV 249
- scrub typhus 14
- secondary transmission 5
- sedimentation 140
- sepsis 23
- septicemia 12
- Septisol 249
- series-event models 145, 324–6, 328–9, 329–31, 334–5
- Serratia marcescens* 218
- serum-associated bactericidal agents 175–6
- sewage, treatment 18, 20, 88, 89–90, 102
- sexually transmitted diseases 10, 13, 32, 247
- shellfish *see* crustaceans; molluscs
- Shigella*/shigellosis  
 foodborne 21, 26, 195  
 surface transmission 267  
 vector associated 158  
 waterborne 22, 75, 76–7, 78, 100  
 probability of infection 83
- S. dysenteriae* 317–18
- S. flexneri* 114
- S. sonnei* 153, 156
- simian immunodeficiency virus 14
- simulation models 60, 65–7, 240, 246
- skin 4, 11, 13, 19, 25  
 decontamination 32  
*see also* hands, washing of  
 host–microbe ecosystem 55, 56–7
- smallpox 11, 16, 24, 26, 30
- snails 28, 29
- soap 32, 245
- sparganosis 27, 29, 195
- Sphaerotilus* 151
- spirochetes 58
- Spirometra* 27, 29, 195

406 *Index*

- spores 201  
 sporocidal tests 294–6, 304  
 thermal inactivation 371, 373, 374, 380–4, 390–1
- Staphylococcus* 57, 65, 171  
 food poisoning 198  
*S. aureus* 59  
 disinfectant resistance 165, 169  
 foodborne 201  
 methicillin resistant (MRSA) 273–5  
 penicillin resistant 168, 174  
 surface contamination 264  
 UV inactivation 315  
*S. epidermidis* 58, 59
- steam sterilization 290, 291, 298, 300, 307
- sterilization 228, 285–310  
 assurance levels (SAL) 297–9, 307  
*see also* disinfection
- stratum corneum 56
- streptococcal pharyngitis 25
- Streptococcus* 57, 58, 59  
 food contamination 199  
*S. faecalis* 168, 174, 374  
*S. salivarius* 171
- surfaces 4, 11, 24, 26, 27  
 bacterial control by disinfection of **258–84**  
 risk assessment 261–78  
 food contamination from 198  
 viral transmission 24, 26, **224–57**  
 interruption of 244–50  
 and modeling 226–40  
 surface survival/transfer 229–38, 240–4  
*see also* medical devices
- surfactant 166
- swimming pools 18, 150, 160, 164, 171, 174
- swine 10, 29
- syphilis 13, 15
- T-test, use of 60, 62
- Taenia* 27, 28, 29, 195–6
- tapeworms 28, 29, 195–6
- temperature  
 and aggregation 165  
 and disinfection 292  
 and disinfection resistance 143, 171, 172, 173, 175  
 and foodborne disease 205  
 as microbe indicator 90–1  
 and microbe survival 91–2, 103  
 and microbial growth in food 202, 203  
 and virus survival 229
- tetanus 12
- Tetrahymena pyriformis* 156, 157, 158
- thermal abuse 25, 203
- thermal inactivation 200–1, **369–96**  
 kinetics experiments 370–5  
 modeling 375–90  
 applications 385–90  
 exponential death 376–9  
 non-exponential death 379–84
- ticks 14
- toxic substance theory 146–7
- toxins, bacterial 116, 197–8
- toys 11  
 and bacterial transmission 268, 269–70, 271  
 and viral transmission 238, 242–3
- transmission **3–54**  
 endemic 7  
 epidemic 6, 8, 9, 30  
 modeling 5–10  
 physical barriers to 34, 35, 37  
 prevention of 3, 28–37  
 effectiveness 33–7  
 routes 10–28  
 by environmental: water 16–21, 22; non water 21–8  
 by food 24–5, 26–7  
 by intermediate host 28–9  
 by physical contact 13–16  
 medical devices 21–3, 26  
 by intermediate host 28–9  
 via surfaces 24, 26, **224–57**, 259–61  
*see also* aerosols; food; medical devices; surfaces; water
- Treponema pallidum* 15
- Trichinella* 27, 195–6
- Trichomonas vaginalis*, UV susceptibility 321
- Triclosan 249
- tuberculation 141, 150–1, 158
- tuberculosis *see Mycobacterium tuberculosis*
- tularemia *see Francisella tularensis*
- turbidity 103  
 and disinfection 141, 151–3, 154  
 as microbe indicator 92  
 and UV inactivation 317, 358
- typhoid *see Salmonella typhi*
- typhus 14, 15

- ultraviolet light (UV) disinfection 32, 91, 200, 229
  - adverse effects 216, 218–19
  - of aerosols (UVGI) 216–19
  - of water **313–68**
    - batch inactivation 322–31
    - continuous flow 314, 331–56
      - actinometry 332, 335–40
      - flow dynamics 332–4
      - hydraulic indices 314, 349, 350–1
      - intensity modeling 323–48
      - kinetics 334–5
      - residence time (RTD) 338, 348–56
    - dose 314, 316–17, 351–6
    - inactivation kinetics/models 314, 316–35
    - indicators 316–17, 321–2
    - intensity 314, 337
      - modeling 314, 323–4, 340–8
      - and UV dose 351–6
    - interferences 314–15, 317, 356–9
    - lamps/sources 340–8, 358–9
    - mathematical nomenclature 359–60
    - microbial susceptibility 315–22
- Ureoplasma urealyticum* 59
- urine 16, 17
- urogenital tract, host–microbe ecosystem 55
- vaccination 7, 9, 30–1, 80
- vaccinia virus 235
- vagina
  - microbial ecosystem 58–9
  - modeling 62–5
- vancomycin resistance 273, 275–6
- Varicellovirus* 26
- vectorborne disease 4, 14–16, 155–8
- vehicleborne disease 4
- Veillonella* 58, 59
- ventilation systems 215, 220–1
- vertical transmission 10
- Vibrio*
  - foodborne 22, 195, 197, 199
  - V. cholerae*/cholera
    - acid resistance 112
    - endemic 102–3
    - foodborne 21, 26
      - and shellfish 20, 102–3, 156, 201
    - infection probabilities 113, 114, 116
    - minimum infectious dose 109, 110
    - pandemics 16, 110
    - UV susceptibility 317–18, 322
    - in water 19, 21, 22, 76, 99–100, 102–3
      - levels 105
  - V. vulnificus* 12
- viruses
  - detection of 85, 87–8
  - discharge 228–9
  - foodborne 202, 208
  - infection probabilities 109
  - resistance to disinfectants 154–5, 159, 160, 167–76
  - transmission routes of
    - aerosols 25–7
    - direct physical contact 13–16
    - food 24–5, 27
    - medical devices 21, 23
    - surfaces 24, **224–57**
    - water 16–22
    - see also* aerosols; food; medical devices; surfaces; water
  - UV susceptibility 318–20
- washing 32
- wastewater *see* water
- water
  - contamination indicators 90–3
    - as disease transmission route 4–5, 11–12, 16–22
  - distribution systems 150–1, 161–2, 163, 169, 177–8
    - contamination 126
    - vectors in 155–8
  - in food production 193, 195, 196, 197, 198
  - infectious diseases from 22, 84, 99–106
    - hospitalization rates 75–6, 77, 78, 81–2
    - risk assessment **75–98, 99–139**
      - probability of illness/death 113–16
  - ingestion rate 107, 118, 123–4
  - microbial monitoring 89–94
    - treatment 32–7, 83, 92–3, 100, 126–8
    - disinfectants and resistance **140–92**
      - pathogen monitoring 89–94
      - risk reduction 119–21, 125
      - UV disinfection **313–68**
- Wilcoxon rank sum test 62

408     *Index*

wounds 4, 11, 12, 13, 19–20  
    and food contamination 25,  
    199

yeasts 57, 58, 196–7  
yellow fever 15

*Yersinia* 77, 158

*Y. enterocolitica* 78, 153, 156, 173,  
    177, 317–18

*Y. pestis* 15, 26

zoonoses 14–15