

## Index

### **a**

abortifacient disease 70–1  
accessibility of vaccines 183–5  
adaptive immunity 11–12  
adjuvants 14–17, 106–7, 124–5  
alum 14, 106  
*Anaplasma marginale* (bovine anaplasmosis) 80–1, 87–9, 92  
animal trypanosomiasis 78–9, 82–5, 90–1  
anthrax vaccines 371–81  
adverse reactions 378  
Carbosap 372  
combinations 375  
edible 373  
immune response 373–4  
manufacturers 378  
outbreak control 375–7  
outbreaks in vaccinated animals 377–8  
Pasteur’s 371–2  
postvaccination monitoring 377  
quality assurance and control 374  
recombinant 373  
specification 374  
Sterne 372–3  
vaccination strategy 374–5  
wildlife 377  
antibiotics  
    resistance 6, 67  
    vaccine manufacture 150  
anti-tick vaccines 93–4, 103  
association 174–5  
audit 140–1  
autogenous bacterial vaccines 66  
avian influenza vaccines 7, 229–51  
    adverse reactions 244  
    combinations 242–3  
    contraindications 245  
    control strategy 229–30

doses used in field 231, 235–7  
duration of immunity 237  
immune response 237  
inactivated 231  
licensed technologies 231, 232–5  
live 231  
manufacturers 244–5  
outbreak control 243  
outbreaks in vaccinated animals 244  
postvaccination monitoring 243–4  
quality assurance and control 239  
specification 237–9  
subunit 231  
vaccination strategy 239–42  
avian mycoplasmoses 73

### **b**

B cells 11, 12  
*Babesia* spp.) 80, 86–7, 91–2  
*Bacillus anthracis* 371  
backyard production 6–7  
bacterial seed 151, 153  
bacterial vaccines 63–76  
batch testing 162  
batch-to-batch consistency 168  
bath vaccination 114, 115, 116  
bluetongue vaccines 263–81  
    combinations 270  
    disabled infectious single animal (DISA) 272  
    disabled infectious single cycle (DISC) 271  
    duration of immunity 273  
    economic costs 264–5, 266, 269  
    genetically modified organisms 272  
    immune response 272–3  
    inactivated 266, 270–1  
    live attenuated 265–6

postvaccination monitoring 270  
quality control 269–70  
registered 266, 267–8  
reverse genetics 271  
serotyped 271  
specification 270  
subunit (VP2) 271  
vaccination strategy 273–4  
vector-based 271  
virus-like particles 271  
booster efficacy 172  
bovine anaplasmosis 80–1, 87–9, 92  
bovine babesiosis 80, 86–7, 91–2  
bovine leptospirosis 71  
brucellosis vaccines 6, 71, 295–316  
    *B. abortus* Δpgm 305  
    *B. abortus* 45/20 303  
    *B. abortus* RB51 303–4  
    *B. abortus* S19 297–302  
    *B. melitensis* B115 305  
    *B. melitensis* Rev1 297–302  
    "brucellosis (officially) free" status 308  
    control programs 308–10  
    DIVA 302, 305  
    economic costs 295–6  
    eradication programs 307–8  
    human disease 295, 296  
    mass (whole herd)  
        vaccination 308–10  
    protection against abortion 296–7  
    protein-deleted mutants 305  
    recombinant 306–7  
    rough 302–5  
    safety 297  
    smooth 297–302  
    vaccination strategy 307–10  
    xenogenic antigen-tagged 305–6  
    young replacement  
        vaccination 308

**c**

campaign production 143  
 capripox vaccines 383–97  
   adverse reactions 392–3  
   disease control 390–1  
   effectiveness 392  
   immune response 389–90  
   inactivated 386, 389  
   KSGPV O-240/O-180 386  
   live attenuated 386  
   manufacturers 387–9  
   outbreak control 391  
   postvaccination monitoring 392  
   quality assurance and control 390  
   recombinant 391  
   RM65 386  
   vaccination strategy 390–1  
 Carbosap vaccine 372  
 caseous lymphadenitis 74  
 CD4 cells 12–13  
 CD8 cells 13  
 cell banks 152, 153  
 cell lines 151  
 cell-mediated immunity 12–14  
 central memory T cells 13  
 challenge test 165, 171–2  
 chimeric viruses 121–2  
 chlamydiosis 70–1  
 classic swine fever vaccines 327–34  
   adverse reactions 333  
   baculovirus-expressed E2  
     protein 328  
   chimeric pestivirus CP7\_  
     E2Alf 328, 329  
   combinations 330  
   contraindications 331  
   endemic settings 330  
   immune response 328–9  
   manufacturers 333  
   marker 328  
   modified live viruses 327–8  
   outbreak control 330–1  
   outbreaks in vaccinated  
     animals 332–3  
   postvaccination monitoring 332  
   quality assurance and control 329  
   specification 329  
   subunit 328  
   vaccination strategy 329–30  
   wild boar 331–2  
 clostridial disease 69  
 colibacillosis 69

combination vaccines 67, 173–4  
 commercialization 181–2  
 Committee of the Americas for  
   Veterinary Medical Products  
     (CAMEVET) 30–1  
 compatibility of vaccines 174–5  
 confidence gaps 45  
 conjugate vaccines 66  
 contagious agalactia 73  
 contagious bovine pleuropneumonia  
   vaccines 72, 317–26  
   combinations 323  
   contraindications 323  
   immune response 319–20  
   manufacturers 324  
   outbreak control 323  
   outbreaks in vaccinated  
     animals 324  
   postvaccination monitoring 323  
   quality assurance and  
     control 321–2  
     specification 320–1  
     T1/44 and T1sr 318–19  
     vaccination strategy 322–3  
     Willems reaction 318, 324  
 contagious caprine  
   pleuropneumonia 72–3  
 cooperative programs 184–5  
 costs of vaccines 181, 183  
 coverage of vaccines 43  
 cowdriosis (heartwater) 81, 89–90,  
   92–3  
 coxiellosis 70  
 CpG oligodeoxynucleotides 14, 125  
*Culicoides* midges 264

**d**

development of vaccines 119–34,  
   180–1  
 diluents 151  
 dip vaccination 115–16  
 disabled infectious single animal  
   (DISA) vaccine 272  
 disabled infectious single cycle (DISC)  
   vaccine 121, 271  
 distribution networks 183  
 DIVA vaccines 20–1, 119, 302, 305,  
   345  
 DNA vaccines 56, 57–8, 89, 103–4,  
   122–3, 164, 211, 259  
 documentation  
   vaccination 42

vaccine manufacture 140, 149, 157  
 duration of immunity 172

**e**

East Coast fever 79–80, 85  
 echinococcosis 103  
 effectiveness of vaccines 44–5  
 effector memory T cells 14  
 efficacy (VE) 19–20, 38–9, 164, 171–5,  
   196–7  
*Ehrlichia ruminantium* 81  
 emergency vaccination 40–1, 189  
 emerging diseases 6–7  
 endotoxin content 163  
 enteric disease vaccines 68–70  
 enteropathogenic *E. coli* (EPEC) 69  
 enterotoxigenic *E. coli* (ETEC) 69  
 environmental risk assessment 170, 171  
*Escherichia coli* 69  
 European Medicines Agency  
   (EMA) 29, 35  
 European Pharmacopoeia 29, 35  
 European Union regulations 191  
 extraneous agent testing 163

**f**

field efficacy 44–5  
 field studies 171, 173  
 final product testing 161–6  
 fish vaccines 19, 113–18  
 Food and Agriculture Organization  
   (FAO) 27, 32, 35  
 food production 4–6  
 food safety 7  
 foot and mouth disease vaccines 5–6,  
   207–27  
   adverse reactions 218  
   carriers 209  
   combinations 217–18  
   DNA 211  
   immune response 211–12  
   killed 209, 210  
   live attenuated 210  
   manufacturers 220–4  
   mass vaccination 216–17  
   outbreaks in vaccinated  
     animals 218  
   peptide 211  
   postvaccination monitoring 218  
   progressive control pathway 209  
   quality assurance and  
     control 213–14

reactive vaccination 214–16  
recombinant 211  
regional virus pools 207  
ring vaccination 214  
risk-based vaccination 214  
schedule 210  
selection 212  
specification 212–13  
forecasting 183–4  
Freund's adjuvant 14

**g**

gene-deleted vaccines 53, 121  
genetically modified organisms 170, 272  
ghost vaccines 124  
Global Alliance for Livestock Veterinary Medicine (GALVmed) 27, 190–1  
goat pox *see* capripox vaccines

**h**

Health for Animals 27–8  
heartwater 81, 89–90, 92–3  
hemagglutination inhibition tests 165  
hemorrhagic septicemia 72  
herd immunity 18, 38, 39, 43  
herd immunity threshold 43, 216–17  
hydrogen peroxide inactivation 128

**i**

identity testing 162  
immune conversion 11–14  
immune correlates of protection 20  
immune-stimulating complexes (ISCOMs) 17, 125  
immunoglobulins 12  
impact measurement 44–5  
implementing vaccination 42, 43–4  
*in ovo* vaccination 19  
in-process tests 154–6, 163  
inactivated vaccines  
    bacterial 64, 66  
    inactivation tests 155, 163  
    potency tests 164, 165  
    protozoal and rickettsial 82, 90  
    viral 53–5, 57  
induced immunity 17–18  
innate immunity 11  
Inter-American Cooperation Group on Animal Health 30  
Inter-American Institute for Cooperation on Agriculture (IICA) 30, 35

International Alliance of Biological Standardization (IABS) 31  
International Cooperation on Harmonization of Technical Requirements for Registration of Veterinary Medicinal Products (VICH) 31  
intranasal administration 18–19  
irradiated vaccines 126–7

**j**

Johne's disease 69–70

**l**

legislation 167–8, 180–1  
leptospirosis 71  
licensing  
    vaccine manufacturing facilities 139–40  
    vaccines 167–77, 180–1

**live vaccines**

    bacterial 64  
    parasites 101–2  
    potency tests 164, 165  
    protozoal and rickettsial 82, 85–7,  
        88, 90  
    safety requirements 170  
    viral 52–3, 57  
lumpy skin disease *see* capripox vaccines

**m**

manganese peptide complex 127  
*Mannheimia haemolytica* 72  
manufacture of vaccines  
    campaign production 143  
    documentation 140, 149, 157  
    facilities 137–45, 181  
    final product testing 161–6  
    local production 142–3, 185  
    quality control and assurance 141–  
        2, 147–59  
    safety 138–9, 163–4, 165  
market size 181  
marketing 183  
marketing authorization 167  
master seeds 152–4  
maternally-derived antibodies 173, 339  
memory B cells 12  
memory T cells 13–14  
minor species or minor use (MUMS)  
    vaccines 175

**monitoring**

    strategic vaccines 197–8  
    vaccination implementation 43–4  
monophosphoryl lipid A 14  
montanides 14  
mucosal administration 17, 18–19  
multistrain dossier 175  
multivalent vaccines 173–4  
*Mycoplasma* vaccines 72–3

**n**

National Institute for Biological Standards and Control (NIBSC) 32  
National Veterinary Stockpile 7  
native antigen vaccines 102  
Newcastle disease vaccines 335–53  
    adverse reactions 348–9  
    antibody/antigen complex 337  
    combinations 346  
    contraindications 346–7  
    DIVA 345  
    eradication of disease 345  
    human infection 348–9  
    immune response 337–9  
    inactivated 337  
    live vectored 336–7  
    manufacturers 349, 350  
    maternal-derived antibody 339  
    "minor species" 345  
    outbreak control 346  
    outbreaks in vaccinated animals 348  
postvaccination monitoring 347–8  
preventive vaccination 345  
quality assurance and control 340–1  
recombinant 336–7  
routine vaccination 345  
specification 339–40  
"traditionally attenuated" live 336  
turkeys 345  
vaccination strategy 341–5  
nomadic herds 40

**o**

Official Control Authority Batch Release and Official Batch Protocol Review (OCABR/ OBPR) 29–30  
OIE *see* World Organization for Animal Health

- onset of immunity 172  
 Organization for Economic Co-operation and Development (OECD) 31, 35
- P**  
 packaging 182  
 Pan African Veterinary Vaccine Centre (PANVAC) 28–9  
 Pan American Health Organization (PAHO) 30  
 parasite vaccines 101–11  
 paratuberculosis 69–70  
 particulate vaccines 17, 125  
 passive immunity 17  
 pattern recognition receptors 14, 125  
 peptide vaccines 56, 123, 211  
 performance-based standards 141  
 peste des petits ruminants  
     vaccines 283–94  
     combinations 287  
     duration of immunity 286  
     immune response 285–6  
     live attenuated 283, 285  
     manufacturers 288, 289–91  
     quality assurance and control 286  
     specification 286  
     vaccination campaigns 287–8  
     vaccination strategy 286–7  
 pharmacovigilance 183  
 plant-based vaccines 56, 125–6  
 policy issues 8  
 polyphosphazenes 125  
 polysaccharide vaccines 123  
 porcine reproductive and respiratory syndrome vaccines 355–70  
 adverse reactions 362–3  
 combinations 361–2  
 contraindications 362  
 control measure 360–1  
 herd status classification 360  
 immune response 357–8  
 killed virus 356–7  
 live virus vectors 357  
 modified live virus 356  
 mucosal 357  
 outbreak control 362  
 outbreaks in vaccinated animals 362  
 postvaccination monitoring 362  
 quality assurance and control 359–60
- reverse genetics 357  
 specification 358  
 postsales support 183  
 postvaccination immunity 43  
 potency tests 164–5  
 pregnancy, passive immunity 17  
 presales support 183  
 preservatives 150–1  
 process controls 141–2  
 proficiency tests 156–7  
 protozoal vaccines 77–99  
 psoralen inactivation 127–8
- Q**  
 Q fever 70  
 quality control and assurance 141–2, 147–59, 196–7
- R**  
 $R_0$  43  
 rabies vaccines 399–413  
     adjuvants 401  
     adverse reactions 408  
     availability 408–9  
     boosters 404, 406  
     edible 402  
     fixed virus 401  
     human infection 405  
     immune response 402–4  
     inactivated 401  
     live 401  
     livestock vaccination 406  
     postexposure prophylaxis 406–7  
     postvaccination monitoring 407–8  
     quality assurance and control 405–6  
     rabies induction 408  
     recombinant 401  
     specification 404  
     street virus 401  
     vampire bats 407  
     wildlife 405  
 raw materials 149–52  
 recombinant vaccines 122, 211, 306–7, 336–7, 373, 391, 401  
     bacterial 66–7, 122  
     parasites 102–3  
     protozoal and rickettsial 82, 85  
     viral 53, 122  
 record-keeping  
     implementing vaccination 42  
     vaccine manufacture 140–1
- reference laboratories 32–3  
 registration  
     vaccine manufacturing facilities 139–40  
     vaccines 167–77, 180–1  
 residual toxicity tests 163  
 residue studies 171  
 respiratory diseases 71–2  
 respiratory syncytial virus vaccine 12  
 reverse genetics 120–1, 258–9, 271, 357  
 reverse vaccinology 128  
 rickettsial vaccines 77–99  
 Rift Valley fever vaccines 7, 53, 253–62  
     Clone 13 257  
     DNA 259  
     human infection 243–4  
     inactivated 256–7  
     live MP-12 258  
     live Smithburn 256  
     NSs and NSm proteins 254–6  
     reverse genetics 258–9  
     specification 259  
     subunit 259  
     vaccination strategy 257–8  
 rinderpest eradication 3  
 RNA vaccines 123
- S**  
 safety  
     live vaccines 170  
     manufacture of vaccines 138–9, 163–4, 165  
     registration of vaccines 169–71  
     strategic vaccines 196–7  
 salmonellosis 68  
 saponins 17  
 seed lots 152–4  
 serum 151  
 sheep pox *see* capripox vaccines  
 shrimp vaccines 116  
 Smithburn vaccine 256  
 stability testing 155–6, 168–9  
 standardization of vaccines 25–36  
 starting materials 149–52  
 sterility of vaccines 152, 155, 162  
 Sterne vaccine 372–3  
 storage of vaccines 156, 197–8  
 strangles 74  
 strategic vaccine reserves  
     (banks) 7–8, 185, 189–203

strategies of vaccination 39–41  
 subsidized vaccines 184–5  
 subunit vaccines 123, 231, 259, 271,  
   328  
   bacterial 66  
   parasites 104  
   potency tests 164  
   protozoal and rickettsial 82, 85, 86,  
   87, 88, 90  
   viral 55, 57  
 synthetic peptide vaccines 56, 123,  
   211  
 systemic administration 18

**t**

T cells 11, 12–13  
*Taenia solium* 6, 103  
 technical support 183  
 temperature-controlled storage 156  
*Theileria annulata* 79–80, 85–6, 91  
*Theileria parva* 79–80, 85, 91

tick vaccines 93–4, 103  
 tissue resident memory T cells 14  
 toll-like receptors 125  
 toxoid vaccines 66  
 transmissible spongiform  
   encephalopathy (TSE) 151–2  
 tropical theileriosis 79–80, 85–6, 91  
 trypanosomiasis (*Trypanosoma*  
   spp.) 78–9, 82–5, 90–1  
 trypanotolerance 91

**v**

vaccinate to die 215  
 vaccinate to live 192, 215  
 vaccination strategies 39–41  
 vaccine-associated enhanced  
   respiratory disease 12  
 vaccine banks 7–8, 185, 189–203  
 vaccine delivery systems 18–19  
 vampire bats 407  
 vector vaccines 53, 122

Veterinary Batch Release Network  
   (VBRN) 30  
 viral seed 151, 153  
 viral vaccines 51–61  
 virus-like particles 17, 55, 123–4,  
   271

**w**

water-in-oil emulsions 14  
 West Nile virus vaccine 4  
 whole cell bacterin vaccines 66  
 wildlife vaccines 19, 331–2, 377, 405  
 Willems reaction 318, 324  
 working seeds 152–4  
 World Health Organization  
   (WHO) 28, 32–3, 34–5  
 World Organization for Animal Health  
   (OIE) 26–7, 32, 33–4, 190

**z**

zoonotic diseases 6–7

















