Index

Index

Abscisic acid (ABA), 49 Academic research, TSCA and, 17-18 Acetolactate synthase (ALS) enzyme, 158 Advisory committees for biotechnology-related decisions, 25 Agribusiness economic forces, 9-10 impact of new technologies, 144-146 impact of regulation, 214-216 use of expert systems, 7 Agricultural Biotechnology Research Advisory Committee (ABRAC), 189 Agricultural management technologies, 6, 10-11 expert systems, 101-102 skill requirements, 149 Agricultural Marketing Service (USDA) inspection activities, 282-283 Agricultural productivity biotechnology and, 9, 133-139 research, 27-28 Agricultural research, 28 congressional policy options, 29-31,423425 funding, 28-30,409416 legal environment, 417,419 political environment, 411-412 traditional base of support, 27 Agricultural Research Service (USDA), 409 biocontrol research, 54 transgenic swim research, 85, 86 Agricultural support industries, computer use, 7 Agrobacterium radiobacter, 59,60 Agrobacterium tumefaciens, 39,60 Alar controversy, 331-332 Alfalfa weevils, 154 Allelochemicals, 46-47 American Cyanamid, 71 American Red Cross, 86 Anabolic steroids, 74-75 Anaplasmosis, 65 Animal agriculture impact of new technologies, 140-144 management, 10-11 Animal and Plant Health Inspection Service (USDA), 184-185,260-261 biocontrol research, 54 EPA comparison, 262-263 inspection activities, 283 plants genetically modified for pest resistance, 15, 17 regulatory oversight, 12 regulatory purview, 13 Animal disease vaccines. See Vaccines Animal health technologies biotechnology and, 5-6 diagnostics, 6,90-92

early disease detection, 7 immunomodulators, 90 Animal production efficiency projections, 137-139 expert systems, 102-103 Animal technologies. See also Animal health technologies; Reproduction technologies; Transgenic animals growth promotants, 4-5,8 intellectual property protection, 11, 394-398 management issues, 167-173 potential for, 4,8 timing of commercial introduction, 135 USDA authority, 193 Animal well-being. See Farm animal well-being Animals, transgenic. See Transgenic animals Antifreeze proteins, 49 Antimicrobial agents, 72-74 Antisense technology, 4243,48 food processing industry use, 50 passive immunity provision, 90 **APHIS. See Animal and Plant Health Inspection Service** (USDA) Arcelin, 45-46 Arthropods biological control by parasites and predators, 54-55 biological control by pathogens, 55-57 biological control of weeds, 57-59 feeding activity, 58 artificial intelligence, 107-108 Augmentation approach to biological control, 51,52-53, 55.59 Autographa californica, 56 Avian Leokosis virus (AI-Y), 88 Bacillus subtilis, 59,89 Bacillus thuringiensis, 4,45,55,61, 164-165 **Bacteria** arthropod control, 55 plant resistance, 4 **Bacterial vaccines**, 88,89 **Baculoviruses**, 56-57 **BBEP.** See Biotechnology, Biologics, and Environmental **Program (APHIS)** Beta-agonists, 71-72 pork grading and, 357-358 **Bioassay methods**, 50 **Biocontrol research**, 53-54 **Biological control** frost damage, 60 plant diseases, 59-60 tools and techniques, 50-60 weeds, 57-59 Biosensors, 92, 121

-445-

Biotechnology. See also Biotechnology products; names of specific biotechnologies agricultural productivity and, 9 congressional oversight, 16-19,23-27, 339-349 definition, 3,38,65 food safety issues and options, 19-27 impact of new technologies, 8-12 intellectual property protection, 389-399 public sector research, 27-31, 409-410 regulation, 12-27 tools and techniques, 38-50 Biotechnology, Biologics, and Environmental Program (APHIs), 12,17 Biotechnology products. See also Commercial introduction of biotechnology products Federal regulations, 339-343 independent testing 25-26 safety assessment methodology, 307-309, 347-348 safety considerations, 300-307 Bovine sornatotropin, 69 consumer behavior and, 329-330 effects of, 4-5, 67 FDA review, 4,9 milk production and 9 moratoriums, 148 **bST** See Bovine somatotropin Bt. See Bacillus thuringiensis California, biotechnology regulation, 203 Callus culturing, 42 Canada biotechnology regulation, 206 CBI policy, 22,26 Canola, 15, 16 Cattle. See also Bovine somatotropin antimicrobial use, 73-74 reproduction technologies, 5 **CBI.** See Confidential business information Cell fusion, 37 Cell suspension regeneration methods, 42 Cellular techniques, 37 Cereals disease losses, 37 gene transfer methods, 39 Chemical residue grading standard, 375-377 Chicken-harvesting machine, 171-172 Cimaterol, 71 Citrus rust mites, 57 **Class I Major Histocompatibility Complex, 86 Classical** approach biological control, 51,52 genetic engineering of plants, 37 Clavibacter xyli, 55-56 **Clenbuterol**, 71 Coding moth granulosis virus, 56 COLLEGO, 57

Commercial introduction of biotechnology products, 264-265 options for Congress, 18 risk assessment, 235-247,259-261 risk management, 15 timing, 133-137 Committee on Biotechnology in Agriculture (CBA), 189 **Computer technologies** agricultural impacts, 8-12,99 agricultural management applications, 6-8 current state and future development, 123-124 integrated systems, 114-115 intellectual property protection, 11-12, 39942 interfacing technologies, 109-110 knowledge-based systems, 99-109 networks and telecommunications, 115-117 research, 28 **Computers** use by agricultural support industries, 7 use by farmers, 7 Confidential business information (CBI), 186, 187,346-347 new technology approval and, 21-22,26, 346-347 Congress environmental safety oversight of biotechnology, 16-19 food safety oversight of biotechnology, 23-27, 339-349 patent oversight, 11 policy options, 29-31,267-270,423425 Conservation approach to biological control, 51-52,55, 59 Consumer market behavior, food safety and, 324,325-329 **Cooperative State Research Service (USDA), 189** Coordinated Framework, 13-14, 17, 184, 185, 191, 198-199 Copyright, computer software, 8, 11-12, 399-400 Corn, insect resistance, 163-164 Corn/soybean rotations, herbicide use, 158-159 Cotton disease control, 59 herbicide use, 159-160 insect resistance, 163 Cotton bollworm, 56 **Council on Competitiveness**, 13 **Crop agriculture** impact of new technologies, 139-140 integrated pest management strategies, 153-156 management, 10-11 robotics, 118-119 **Crop Genetic International, 56** crop insurance payments, 37 crop losses, 37 **Crop production** efficiency projections, 137-139 expert systems, 103-105

rate of growth, 9 Crop rotation, 156 Crop technologies. See Plant technologies crop-seed mimicry, 153 Cross-hybridization. See Gene transfer Cryphonectria parasitic, 60 cST See Chicken somatotropin, 67-68 **Dairy industry** bovine somatotropin and, 4-5 impact of new technologies, 140-142 mastits costs, 65 robotics, 118 DDT resistance, 153-154 Dedalenus siricidcola, 57 **Developing countries** biotechnology regulation, 207 cross-hybridization risk, 16 DeVine, 57 Diamond v. Chakrabarty, 8,391 **Dicotyledenous plants** gene transfer, 39 virus resistance, 4, 48 Disease control in plants, genetic engineering, 4,4748, 49 **Displaced farm operators and workers**, 149 **DNX.86** Double-nil restrainer convevor systems, 172 Dutch elm disease, 235 Ecological risk of biotechnology, 231-235 Ecological Society of America, 12, 13 risk assessment report, 228-230,259 Economic Research Service (USDA), 409 Elcar. 56 Eli Lily and Co., 71 Embryo and sperm sexing, 77,79 Embryo cloning, 77 **Enkephalins**, 50 Environmental Protection Agency. See also names of specific offices advisory committees, 25 application of FIFRA, 196-197,261 application of TSCA, 200-201,261 authority of FIFRA, 193, 194-196 authority of TSCA, 193-194, 197-200 biocontrol research, 54 biotechnology oversight, 209-210 commercial v. research authority, 212-213 enforcement activity, 285 outside input, 284-285 pesticide residue tolerances, 290-291,298-300 regulation of commercialization, 18 regulatory delays, 262-263 safety of pest resistant plants, 24-25 statutory authority, 283-284

technical staff shortage, 16 virus registration, 56 Environrm ental safety, biotechnology regulation, 12-19 Ervthopoietin, 87 Escherichia coli, 88,89,90,92 Estrous cycle regulation, 75-77 Ethics of farm animal well-being, 168-169 Europe, biotechnology regulation, 204-206 **Expert systems** animal production applications, 102-103 crop production applications, 103-105 description, 100-101 farm and area-wide management applications, 101-102 research needs. 105-106 use by agribusiness, 7 Farm animal well-being biotechnology and, 172-173 development of public concern, 167-169 electro-immobilization, 171 impact of biotechnology, 11 Judeo-Christian ethic, 168 learned helplessness, 170-171 market failure, 168-169 market model of free enterprise, 168 nestbuilding, 171 quality of space, 170 thermal comfort, 169-170 Farm labor, impact of new technologies, 10, 146-147 Farm management See Agricultural management Farmers adjustment to change, 149-150 computer ownership and use, 7 FDA. See Food and Drug Administration Federal Food, Drug, and Cosmetic Act, 20, 193 Federal Insecticide, Fungicide, and Rodenticide Act CBI. under. 21 ERA appliccation, 196-197, 261 EPA authority, 193, 194-196 review processes under, 12, 13 Federal Meat Inspection Act 185,280 Federal Plant Pest Act, 185,186,187,195 **Federal Poultry Products Inspection Act, 280** Federal regulatory agencies, 275-291,339-343. See also Coordinated Framework; names of specific agencies animal technology, 394-396 CBI policies, 21-22,26,346-347 coverage, 210-213 enforcement. 22 impacts of, 213-216 jurisdiction and coordination, 207-210 product-based v. process-based approach, 260-261 public participation, 216-218 Federal Seed Act. 185 Field trials, 183-184,237-239

FIFRA. See Federal Insecticide, Fungicide, and Rodenticide Act Fish and Wildlife Act of 1956,285 Fish antifreeze proteins, 49 fish somatotropin, 70 transgenic fish, 87,211,291 Food additives FDA definition, 288-289 transgenic crops, 24 transgenic organisms, 24 Food, Agriculture, Conservation, and Trade Act of 1990, 31.149 Food and Drug Administration (FDA) advisory Commmitties 2 5 anabolic steroid review, 74 bovine somatotropin review, 4 CBI policies, 21,26,346-347 enforcement activities. 279.280 food additive definition. 288-289 food safety assessment 26-27,295-298,348 genetically engineered rennet approval, 6,92,309 inspection activities, 278-279,280 labeling of biotechnology food products, 22,348-349 outside input, 277-278 porcine somatotropin review, 4 regulation, 19-27,201-202,287-288, 289-290 staffing levels, 278 statutory authority, 275-277 Food grading system. See Grading system Food processing industry, biotechnology applications, 6, 49-50.61.92-93 Food safety biotechnology, 6,287-291 biotechnology regulation, 19-27 **CBI**, 21-22 enforcement of regulations, 22 Federal agency coordination, 20,286 international coordination, 22-23 issues and options relating to biotechnology, 19-27 labeling, 22,27,332-335,348-349 monitoring, 6 policy options, 23-27,339-349 public perceptions, 319-335 scientific issues, 295-314 sensor technology, 122 Food Safety Inspection Service (USDA) inspection activities, 281-282 regulation, 290 transgenic animal guidelines, 19,25 Food scares, 331-332 **Foreign genes** promotors, 41 selectable markers, 41 transfer, 39,41 Forest Service (USDA), 409

Freedom of Information Act of 1982, CBI requirements, 21.26.187 Frost damage, biological control 60 Fruit disease losses, 37 gradomg system, 366-381 postharvest pathogen control, 59 FSIS. See Food Safety and Inspection Service (USDA) Full-text retrieval systems, agricultural applications, 7, 113 Fungi arthropod control, 55 insect control, 57 mass production, 53 plant resistance, 4 Fungicides, resistant strains, 60 Gene deletion vaccines, 88 Gene identification, isolation, and purification transgenic animals, 79-82 transgenic plants, 38-39,40 Gene product classification, 24 Gene stability, 241 Gene transfer. See also Transgenic animals; Transgenic plants crop-to-weed gene transfer, 160 genetically modified and wild plants, 16 prevention, 250 risk 241-243,266 transgenic animals, 82-85 Genetic engineering, 6 See also Genetic engineering of plants; Transgenic animals; Transgenic plants Genetic engineering of plants. See also Plants genetically modified for pest resistance; Transgenic plants **APHIS oversight, 12** cellular techniques, 37 classical techniques, 37 disease control, 4,47-48,49 insect control, 4,4546, 162-164 molecular techniques, 38 policy implications, 166-167 risk 265-266 thermal and water stress, 48-49 weed control. 4.4647 Gene-detection viral vaccines, 5-6 Genome mapping, 88 Glaxo Animal Health, 71 Gliocladium virens, 57,59 Glyphosate tolerance, 159-160, 161 Grading system fruit and vegetables, 366-381 pork 354-366 **Grains. See Cereals** Growth hormone releasing factor, 70 Growth promotants, 4-5,8

Hardware issues, 109-110 Herbicides action, 46 antidotes, 46 microbial, 57,58 tolerant crops, 4.60, 157-160 use in corn/sovbean rotations, 158-159 use in cotton, 159-160 weed resistance, 153-154, 157-160 Hessian flies, 154 Heterobasidion annosum, 60 Hirsutella thompsonii, 57 Human hemoglobin production, 86 Hypertext, 113-114 **Immunomodulators**, 90 Information retrieval systems full-text retrieval, 113 hypertext, 113-114 natural language interfaces, 111-113 Information technologies. See Computer technologies Inhibin, 75 insect control fungi, 57 genetic engineering of plants, 4,4546, 162-164 nematodes, 57 protozoans, 57 viruses, 56-57 **Insecticides.** See Pesticides Insulin-like growth factor (IGF-I), 66-67 Integrated Pest Management (IPM), 153-156 Intellectual property protection, 8, 14 animal technologies, 3%-398 biotechnology, 389-399 computer technologies, 11-12,39942 plant technologies, 391-394 Interferon. 90 **Interleukins**, 90 International coordination, 22-23,291,349 International regulation, 204-207 **IPM. See Integrated Pest Management** Japan, biotechnology regulation, 206 kanamycin resistance gene, 41 **Knowledge-based** systems expert systems, 100-106 knowledge acquisition, 107-108 object-oriented simulation systems, 106-107 operation, 99-100 report generation, 108-109

Labeling of food products, 22,27,332-335,348-349 Laboratory testing, 236-237 Land grant universities

Kudzu vine, 235

biocontrol research, 54 funding, 29 policy options for Congress, 29-31,423-425 research mission, 27,28-29,410411 research privatization, 29 Iectins, 45 Livestock blood proteins production, 86 disease and reproductive losses, 65,67 feed and health Care Costs, 65 pregnancy detection, 76 Local government, approaches to regulation, 202-204 Lymphokines, 90 Lysostaphin, 90 Machine vision, 121 Marker genes, 302-303 Mastitis, 65 Meat and poultry products, USDA inspection authority, 280-283 Microbial contamination of food, 300 Microbial disease control, 59 Microbial herbicides, 57.58 Microinjection techniques, 82,83 **Microorganisms** biological control of weeds, 57-59 EPA definition, 212 **FIFRA** authority, 195 monitoring, 245 oversight under TSCA, 13, 15 risk concerns, 16,226,265-266 Minnesota biotechnology regulation, 202-203 Molecular genetics detection of pesticide resistance, 156-157 techniques for genetic engineering of plants, 38 Monoclonal antibodies, 6,4344 diagnostic kits, 50,91 passive immunity provision, 90 Somatotropin, 70-71 Monocotyledonous plants gene transfer. 39 virus resistance, 4,48 NationalBiologicalInpact Assessment Program (NBIAP), 189-190 National Environmental Policy Act (NEPA), 183, 185, 187-188 National Institutes of Health (NIH) food safety evaluation, 26-27 regulation, 201 **Recombinant DNA Advisory Committee, 189** National Marine Fisheries Service, 285-286 National Oceanic and Atmospheric Administration, 285 National Research Council, 12, 13 risk assessment report, 228-230,259

National Science Foundation research tiding, 31

Natural enemy pest control, 50-53,154 Naturalal language interfaces, 111-113 Near- infared (NIR) spectroscopy, 121 Nematodes, insect control, 55,57 Networks and telecommunications, 115-117 Neurotoxin genes, 65 New Jersey, biotechnology regulation, 203,204 NIH. See National Institutes of Health North Carolina biotechnology regulation, 202 Nosema locustae, 57 Noxious Weed Act, 185,186 Nuclear magnetic resonance (NMR), 1 21 Nucleic acid hybridization, 6.91 Nutrient content, 300-301,369-372 **Object-oriented simulation systems, 106-107** Office of Agricultural Biotechnology (OAB), 189 Office of Pesticide Programs (EPA), 1%-197, 261,262 Congress and, 18 oversight of pesticidal plants, 17 plants genetically modified for pest resistance, 13-15 review processes under FIFRA, 12, 13 Office of Science and Technology Policy (OSTP), 12,13 Office of Toxic Substances (ERA), 200,262 Congress and, 18 oversight of microorganisms, 13 regulation, 12-13, 16 Oncomouse, 395 **OPP.** See Office of Pesticide Programs (5A) **Organic Act**, 185 **Osmotin**, 49 **OSTP.** See Office of Science and Technology Policy **OTS. See Office of Toxic Substances (EPA) Ovine somatotropin**, 69-70 **Parasites** control of arthropods, 54-55 pest control, 51 production, 53 Patent and Trademark Office animal patents, 11,395 computer-related patents, 11-12

Patents animal patents, 11, 172,395 biotechnology products, 389-390 computer software protection, 400401,402 plant varieties, 8,391-394 Pathogen resistant crops, 160-161 Pathogenicity genes, 47 Pathogens. See *also* Bacteria; Fungi; Nematodes; Protozoans; viruses arthropod control, 55-57 pest control, 51 resistance to biological control agents, 60 weed control, 57 Paylean, 71

Peniphora gigantea, 59,60 Peptides, natural and synthetic, 89-90 P@ adaptation, delaying strategies, 164-166 Pest control Integrated Pest Management, 37,153-156 natural enemies, 50-53 Pest resistant plants. See Plants genetically modified for pest resistance Pesticidal plants. See Plants genetically modified for pest resistance Pesticide resistance influence of genetically engineered crops, 157-166 molecular genetics for detection, 156-157 Pesticides. See also Fungicides; Herbicides; Pesticide resistance delivery systems, 53 grading and 374-375 usage, 374-375 Pharmaceuticals, transgenic animals and 5,8 **Pigs. See Swine Plant diseases** biological control, 59-60 revenue losses from, 37 Plant Patent Act. 391 Plant Quarantine Act, 185,186 Plant technologies. See also Plants genetically modified for pest resistance; Transgenic plants definition, 3-4 genetic engineering for disease control, 4,4748,49 genetic engineering for insect control, 4,4546 genetic engineering for thermal and water stress tolerance, 48-49 genetic engineering for weed control, 4,4647 timing of commercial introduction, 136 Plant varieties, patent rights, 8,391-394 Plant Variety Protection Act, 8,391-394 Plants. See also Plants genetically modified for pest control; transgenic plants FIFRA authority, 195 intellectual property protection, 391-394 natural vs. genetically modified pest resistance, 13 USDA application, 188-191 USDA authority, 184-188 Plants genetically modified for pest resistance, 4546,155 ERA safety evaluation, 24-25 Federal review authority, 13-14 gene transfer or cross-hybridization, 16 large-scale introductions under APHIS, 17 **OPP** oversight, 17 regulatory oversight, 12 risk of becoming pests, 16 weediness, 166 Pleiotropic effects, 303-307 Polymerase Chain Reaction (PCR), 43 Porcine somatotropin, 6849,86, 142-144 consumer behavior and, 329-331

effects of, 4 FDA review, 4 pork grading and, 356-357,358 Pork grading system, 354-366 Potatoes, insect resistance, 163 Poultry antimicrobial use, 73 poultry somatotropin, 67-68 transgenic poultry, 85 USDA inspection authority, 280-283 **Poultry Products Inspection Act. 185** Predators, control of arthropods, 54-55 Premanufacture notice (PMN), 199-200 Pristophora erichsonii, 154 Productivity, agricultural. See Agricultural productivity **Promotors** transgenic animals, 85 transgenic plants, 41,46 Property rights. See Intellectual property protection Protoplasm culturing, 41 **Protozoans** arthropod control, 55 insect control, 57 Pseudomonas, 55-56 Pseudomonas aeruginosa, 89 Pseudomonas fluorescens, 59,60 Pseudomonas solanacearum, 48 Pseudomonas syringae, 60, 196 Pseudorabies virus vaccine, 6,88 pST See Porcine somatotropin **PTO. See Patent and Trademark Office** Public confidence and concern options for Congress, 18-19, 343-345 regulatory process and 20-21, 25, 321-323 technological innovation, 3 Pythium ultimum, 60

Ractopamine hydrochloride, 71 **Recombinant DNA techniques. See Genetic engineering Regeneration of transformed plants, 41-42 Regulatory agencies. See Federal regulatory agencies Regulatory genes. See Promotors** Rennet, genetically engineered, 6,92,309 **Reproduction technologies**, 5 embryo and sperm sexing, 77, 79 embryo cloning, 77 estrous cycle regulation, 75-77 possibilities, 5,8 transgenic animals and, 5 Research, agricultural. See Agricultural research **Restriction Fragment length Polymorphism (RFLP)** mapping, 39,46,92 **RFLP.** See Restriction Fragment Length Polymorphism Rhizoctonia solani, 60 **Risk assessment** adequacy of knowledge base, 259-260

biotechnology ecological risk 231-235 concerns and postulated risks, 225-227 monitoring, 244 overview, 227-228 research needs, 244-247 **Risk management** agronomic methods, 250-252 cost-benefit analysis, 248 generic v. case-by-case approach, 247,266-267 science-based regulations, 247 scientific methods, 249-250 Risk, personal perceptions of, 323-325 Robotics, agricultural applications, 7-8, 117-119 Rural communities, impact of new technologies, 10, 147-148 Salbutamol, 71 Salmonella, 91 Satellites, 115 Sensor technology, 119,121-122 silkworms, 154 Software intellectual property protection, 39942 international protection, 403 issues and policy options, 110-111,403-405 Somaclonal variation, 37 Somatostatin, 70,83 Somatotropin. See also types of somatotropin description, 66 mechanism of action, 66-67 related technologies, 70-71 Speech recognition, 109 St. Johnswort, 58 Staphylococcus aureus, 90 Starter cultures, 50,92 State Agricultural Experiment Stations (SAES), 412-417 States approaches to regulation, 202-204 biocontrol research, 54 funding for agricultural research, 28 Steinernema carpocapsae, 57 Stem cell method, 83-85 Suicide genes, 249-250 Superovulation, 5,75,76 Swine. See also Porcine somatotropin antimicrobial use, 73 growth hormone releasing factor, 70 impact of new technologies, 142-144 pseudorabies virus vaccine, 6 transgenic swine, 5, 85-86 Tansy ragwort, 58

Technological innovation. See also specific types of innovation impacts of, 8-12 policy issues, 148-150

public acceptance, 3 role in agricultural transformation, 3 **Tennessee Wiley Authority, 54** testing of biotechnology products, 25-26 Theileria annulata, 89 Thermal stress tolerance, 48-49 Ti plasmid, 39 Tissue culturing techniques, 4142,49-50 Tissue plasminogen activator (TEA), 87 Tomatoes antisense technology, 42,50 fungicide use, 375 Toxic constituents of food, 301-307 **Toxic Substances Control Act (TSCA)** applicability to living organisms, 263-264 ERA application, 200-201,261 EPA authority, 193-194, 197-200 microorganisms oversight, 13, 15 policy options, 17-19,268-269 Trade secrets, 390-391,394,401 Trade Secrets Act of 1982: CBI requirements, 21 Transgenic animals. See also specific types of transgenic animals creation process, 65, 79-85 FSIS guidelines, 19,25 human medical implications, 5 intellectual property protection, 394-398 possibilities, 5 research needs, 87-88 **Transgenic crops. See Transgenic plants** Transgenic fish, 87,211,291 Transgenic plants. See also Plants genetic-ally modified for pest resistance antifreeze proteins, 49 biotechnology techniques for creation, 38-49 commercial availability, 4 disease resistance, 60-61 FDA classification, 20 regulations and guidelines, 23 selectable markers, 41 Trichoderma, 60 Trypsin inhibitors, 4,45 **TSCA.** See Toxic Substances Control Act U.S. Army Corps of Engineers, biocontrol research, 54 **U.S. Congress. See Congress** U.S. Department of Agriculture. See also names of specific USDA agencies advisory committees, 25 application to plants, 188-191 application to veterinary biologics, 192-193 authority for animals, 193 authority for plants, 184-188

authority for veterinary biologics, 191-192 biocontrol research, 54

biotechnology oversight, 209-210 commercial v. research authority, 213,218-219,265 fruit and vegetable grading improvement options, 377-381 fruit and vegetable grading standards, 367-369 funding for agricultural research, 28,31 meat and poultry inspection, 280-283 outside input, 283 pork grading improvement options, 360-366 pork grading parameters, 359-360 pork grading standards, 354-355 regulation of commercialization, 18 statutory authority, 280-281 U.S. Department of Energy, biocontrol research, 54 U.S. Department of Interior, biocontrol research, 54 U.S. Environmental Protection Agency. See Environmental Protection Agency U.S. Patent and Trademark Office. See Patent and **Trademark Office** Universities. See Academic research; Land grant universities **USDA. See U.S. Department of Agriculture** Vaccina virus, 89 Vacines, 5-6,8,65,88-90. See also names of specific vaccines Vanilla, 49 Vector material, 303 Vectored vaccines, 89 Vegetable grading system, 366-381 Veterinary biologics, 5-6 USDA application, 192-193 USDA authority, 191-192 Viral coat proteins, 4,48,89 Virus resistant plants, 4,48 Virus-Serum-Toxin Act (VSTA), 185, 191 Viruses. See also names of specific viruses arthropod control, 55 mass production, 53 Water stress tolerance, 48-49 Weed control biological control by microorganisms and arthropods, 57-59 genetic engineering of plants, 4,4647 Weed pathogens, 57-58 Weeds, herbicide resistance, 153, 157-160 Wheat, disease control, 59 Whole Earth Decision Support System (WEDS), 114 Wholesome Meat Act of 1967,280 Wholesome Poultry Products Act of 1957,280 Woodwasps, 57 Yeast strains, genetically engineered, 6