

Index

- Abbott Laboratories, 149, 196
Abello Co. (F. R.G.), 130
acquired immunodeficiency syndrome (AIDS), 125, 132
Advanced Genetic Sciences, Inc., 82
Agent Orange, 222
Agricultural Genetics (U.K.), 71, 82, 320, 425
Ajinomoto Co., 83, 131, 196, 197, 505
Allied Corp., 82
American Association for the Advancement of Science, 309
American Association of Universities, 421
American Cancer Society, 123
American Commercial Co., 87
American Cyanamid, 80, 81, 167
American Hospital Supply, 196
American Society for Engineering Education, 341
Amgen Co., 80, 130, 149, 167
Amicon Co., 54, 88
analysis, framework for, 263-266
 competitiveness in biotechnology, factors influencing, 263
 firms commercializing biotechnology, 265
Anheuser Busch, 102, 247
animal agriculture industry, 6, 79-81, 162-171
 animal nutrition and growth promotion, 167
 commercial aspects of biotechnology, 169
 diagnosis, prevention, and control of animal diseases, 162
 animal vaccines, 163, 164
 monoclonal antibody diagnostic products, 162
 future research, 186
 genetic improvement of animal breeds, 168
Animal Vaccine Research Corp., 99
Applied Biosystems, 84, 87, 148
antitrust law, 435-449
 biotechnology licensing agreements, 447
 biotechnology research joint ventures, 446
 European Economic Community, 441
 findings, 448
 issue, 449
 relevant U.S. and foreign antitrust laws, 438
 research joint ventures, 435
 technology licensing, 437
ARCO, 82
Arkansas, 384
Armour Pharmaceutical, 134
Aronson v. *Quick Point*, 399
Atlantic Richfield Co., 228
Australia, 523
automated DNA and peptide synthesizers, 86

Bailey, James, California Institute of Technology, 44
Baltimore, David, 575
basic and applied research, U.S. Government funding of, 307-328
 Department of Defense, 311
 Department of Energy, 311, 323
 findings, 323
 generic applied research, 312
 international comparisons, 317
 issues and options, 325
 National Institutes of Health, 310, 323
 National Science Foundation, 310
 USDA, 311, 323
Baxter Travenol Laboratories, 134, 196
Baxter, William, Assistant Attorney General, 436
Bayer Co., 83
Beckman Instruments, 87, 88
Becton Dickinson Co., 145
Beecham Co. (U.K.), 75
Bell Laboratories, 308, 532
Berkey Photo, Inc. v. Eastman Kodak Co., 440
Bethesda Research Laboratories, 84, 199
bioelectronics, 7, 253-256
 biochips, 254
 biosensors, 253
 future research, 256
bioengineering, novel techniques, 3, 4, 25
Biogen Co., 99, 101, 122, 133, 134
Bio Logicals, 85, 90
Biopol, 211
bioprocessing separation and purification
 instrumentation, 88
bioprocess technology, 5, 44-57
 biocatalyst, 51
 continuous bioprocessing, 48-50
 culture of higher eukaryotic cells, 55
 essentials, 46
 monitoring and associated instrumentation, 52
 priorities for future research, 56
 processing modes, 47
 raw materials, 51
 separation and purification of products, 54
 steps in, 46
BioSearch Co., 84, 87
Biotechnica International, 80, 82
Bio-Technology General Corp., 80, 82, 167
Biotechnology Industrial Associates, 99
Biotechnology Institute and Studies Centre Trust, 320
Blanch, Harvey, University of California, Berkeley, 44, 576
Boehringer Ingleheim (F. R.G.), 75
Boehringer Mannheim (F. R.G.), 82, 199
Bok, Derek, president, Harvard University, 421
Brazil, 527
Bristol Myers, 102
British Technology Group, 320
Budapest Treaty on the International Recognition of the Deposit of Microorganisms for the Purpose of Patent Procedure, 389
Burroughs-Wellcome (U.K.), 130, 171

Calgene Co., 421
Cambridge Reports, Inc., 496, 497
Canada, 525
Canadian Development Corp., 247

- cancer treatment, 126
cell fusion, 3, 4, 174
Celltech (U.K.), 71, 87, 125, 200, 320, 425
Centocor Co., 92, 144
Cetus Corp., 80, 82, 90, 92, 99, 101, 122, 148, 166
Chiron Corp., 80, 137
Ciba Geigy Co., 74, 75
City of Hope Medical Center and Research Institute, 42, 121
Cohen-Boyer patent, 389, 390, 411, 478
Collaborative Research Co., 84, 200
Columbia University, 421
commodity chemicals and energy production, 237-249
 biomass resources, 239
 lignocellulose, 241
 conversion of biomass to commodity chemicals, 242
 hydrolysis, 243
 pretreatment, 242
 future research, 248
 international research activities, 247
 microbial production, 244
Commission of European Communities, 441
Commodity Control List, 455, 456
companies commercializing biotechnology
 in the United States, 67-70
Congress:
 Subcommittee on Investigations and Oversight, 492
 Subcommittee on Science, Research, and Technology, 492
congressional interest, 22, 325, 347, 376, 403
Connaught Laboratories, 134
Cooney, Charles, MIT, 44
Coordinating Committee for Multilateral Export Controls, 455
Cornell University, 244
Corning Glass, 99
Creative Biomolecules, 84, 87
Cruachan Chemicals Co., 87
Cutter Laboratories, 144

David, E., 413
definitions of biotechnology, 3, 503
Demain, Prof. Arnold, 344
Demon Biotech Corp. (U.S.), 43
Diamond Shamrock, 81, 99
Diamond v. Chakrabarty, 386, 387, 391, 392, 394, 400, 403
Du Pont, 82, 99, 102

Eastman Chemicals, 202
Ecogen, Inc., 82
Elf Aquitaine (France), 12, 75
Elf-Bioindustries, 76
Elf-Bioresearch, 76
Eli Lilly & Co., 54, 80, 92, 99, 102, 121, 122, 127, 130, 150, 168, 446
environmental applications, 217-230, 555
 commercial aspects of biotechnology in, 224
 conventional wastewater treatment process, improvement of, 219
 future research, 230
 grease decomposition, 223
 heavy metal contamination, control of, 221
 microbial enhanced oil recovery, 228
 microbially produced compounds in oil wells, use of, 229
 microbiological mining, 226-228
 commercial aspects of biotechnology in, 228
 concentration of metals, 227
 mineral leaching, 226
 microorganisms in oil wells, use of, 229
 organic micropollutants, control of, 220
 slime control, 223
 toxic waste treatment, 222
 treatment of nontoxic liquid and solid wastes, 217

Enzo Biochemical, 148, 149
E. R. Squibb, 121
established U.S. companies, 99-103
 collaborative ventures with U.S. NBFs, 103
 investments in biotechnology, 99
 role in U.S. competitiveness in biotechnology, 102
European Economic Community (EEC), 358, 365, 366, 435, 441, 461, 551, 556, 559
European Molecular Biology Laboratory, 89
European Patent Convention, 393, 395, 397, 564
European Patent Office, 393

Florida State University, 421
Fluor Co., 101
food additives, 6
France:
 antitrust laws, 444
 Biotechnology Mission, 477
 competitiveness, 8, 9
 environmental control, 557
 export controls, 459
 financing and tax incentives, 519
 funding of biotechnology, 317
 government funding of basic and applied research, 519
 government targeting policies, 477, 518
 intellectual property law, 564
 industry, 518
 Institut Pasteur, 140, 322, 339, 343
 investment control laws, 461
 law of trade secrets, 569
 Ministry of Health, 369
 Ministry of Research and Industry, 477
 National Biotechnology Committee, 478
 National Center for Scientific Research, 343, 426
 National Control Commission, 359, 554
 patent law, 565
 personnel availability, 339, 520
 pharmaceutical industry, 75
 plant breeders rights, 570
 R&D SUPPORT, 482
 rDNA research control, 359, 554
 regulation of biotechnology products, 369
 research, 322

- undergraduate and graduate education, 343
- university/industry relationship, 426, 520
- worker health safety, 560
- Fuqua, Congressman Don, 315
- Gaden, Elmer, University of Virginia, 44
- G. D. Searle, 102
- Gellman Research Associates, Inc., 91
- Genencor, 99, 103, 200
- Genentech (U.S.), 42, 53, 66, 80, 85, 90, 92, 93, 95, 96, 98, 99, 101, 121, 127, 128, 133, 142, 150, 164, 167, 376, 384
- generic applied research, 8, 14
- Genetica Co., 76
- Genetic Sequence Data Bank (GENBANK), 89
- Genetics Systems Co., 92, 144
- Genex Corp., 80, 84, 93, 98, 99, 101, 133, 167, 197, 200
- Georgetown University Medical Center, 89
- German Cartel Office, 443
- German Research Society, 342, 424
- German Society for Chemical Engineering, 424, 510
- Germany, Federal Republic of @. R.G.):
 - antitrust laws, 442
 - competitiveness, 8, 9, 424
 - Control Commission for Biological Safety, 552
 - Dangerous Industrial Substances Committee, 559
 - environmental control, 556
 - export controls, 458
 - Federal Environmental Agency, 556
 - Federal Health Office, 366
 - Federal Ministry of Science and Technology (BMFT), 18, 317, 338, 424, 476, 478, 481, 510, 511
 - financing and tax incentives for firms, 511
 - government funding of basic and applied research, 317, 511
 - government targeting policies, 476, 510
 - intellectual property law, 395, 396, 564
 - law of trade secrets, 568
 - Max Planck Society, 342, 511
 - Ministry of Education, 476
 - NBFs, 71
 - organization of basic and applied research, 318
 - patent law, 565
 - pharmaceutical industry, 74, 75
 - plant agriculture industry, 82
 - plant breeders rights, 569
 - personnel availability and training, 337, 512
 - R&D SUPPOrt, 481
 - rDNA research control, 359, 552
 - regulation of biotechnology products, 366
 - Risk Financing Society, 512
 - specialty chemicals industry, 83
 - Society for Biotechnology Research, 82, 318, 319, 478
 - summary of biotechnolo~, 510
 - undergraduate and graduate education, 342
 - university/industrial relationships, 423, 512
 - worker health safety, 559
- Gist-Brocades NV, 199
- Glaxo (U.K.), 12, 75
- Goodfield, June, 495
- Goodman, Howard, 575
- Gore, Cong. Albert, 419, 421, 495
- grants, 347
- Green Cross Co., 133, 135, 137, 481
- Guide to Research Joint Ventures*, 439
- Gulf Universities Research Consortium, 421
- Hagiwara Institute of Health, 420
- Harvard University, 412, 414, 417, 421
- health, safety, and environmental regulation, 355-378
 - environmental regulation, 371-373
 - findings, 374
 - issue and options, 376
 - rDNA research guidelines, 356
 - approved requirements, 358
 - containment requirements, 358
 - effect on competitiveness, 359
 - enforcement, 359
 - scope, 357
 - regulation of biotechnology products, 359
 - European Economic Community, 365-370
 - United States, 360-365
 - worker health and safety regulation, 373-374
- Henkel Co., 202
- Hewlett-Packard, 53, 84, 88, 90
- Hoechst (F. R.G.), 12, 74, 83, 122, 130, 343, 417, 510, 575
- Hoffmann-La Roche, Inc. v. Golde*, 384
- Hoffmann-La Roche (Switzerland), 12, 74, 75, 92, 125, 130, 420
- Human Services Research, 91
- Humulin", 446, 538
- ICI (U.K.), 12, 75, 204, 211
- Idaho, 384
- Idaho National Engineering Laboratory, 228
- impact on reseach community, 25
- Industrial Biotechnology Association, 421
- industrial development of, 5, 9
- Integrated Genetics Co., 149
- intellectual property law, 383-405
 - evaluation of effectiveness, 400
 - foreign countries, 401
 - United States, 400
 - findings, 401
 - issue and options, 403
 - United States, 384-393
 - law of trade secrets, 384
 - patent law, 385
 - plant breeders' rights statutes, 392
 - U.S. and foreign, comparison of, 393
 - patent law, 393
 - plant breeders' rights, 399
 - trade secret law, 398
- Intelligenetics Co., 84
- international competitiveness factors:
 - analysis of, 8-10
 - antitrust laws, 18
 - financing and tax incentives for firms, 12
 - government funding of basic and applied research, 13
 - government targeting policies, 19

- health, safety, and environmental regulation, 15
- intellectual property law, 16
- personnel availability and training, 14
- public perception, 20
- technology transfer, investment and trade, 18
- university/industry relationships, 17
- International Congress of Plant Tissue and Cell Culture, 179
- International Genetic Engineering, 82
- international technology transfer, investment, and trade, 453-470
 - export controls and biotechnology, U.S. and foreign, 455
 - findings, 468
 - issue, 470
 - patent law provisions, 459
 - compulsory licensing, 460
 - national security restrictions, 459
 - regulation of technology imports and foreign investment, 461
 - trade barriers affecting biotechnology products, 463
 - trade laws, 467
- International Union for the Protection of New Varieties and Plants, 392
- Intervet Corp., 166
- Israel, 524
- Japan:
 - amino acids, 196
 - antitrust laws, 445
 - Associated Finance Corp., 507
 - bioprocessing, 12
 - Biotechnology Forum, 478
 - biotechnology projects, 318
 - competitiveness, 7, 9, 11, 21
 - Council for Science and Technology, 475
 - diversification of chemical, food processing, and textile and pulp processing companies into pharmaceuticals, 76, 77
 - environmental control, 588
 - export controls, 458
 - Fair Trade Commission, 445
 - financing and tax incentives, 13, 507
 - funding of biotechnology, 317
 - intellectual property law, 393, 396, 397, 402, 571
 - investment control laws, 462
 - joint ventures in pharmaceutical applications of biotechnology, 78
 - Keidanren (Japan Federation of Economic Organizations), 76, 77, 79
 - law of trade secrets, 572
 - Ministry of Agriculture, 317, 476, 506
 - Ministry of Education, 423, 555
 - Ministry of Finance, 445
 - Ministry of Health, 77, 370
 - Ministry of International Trade (MITI), 9, 12, 78, 83, 86, 317, 341, 423, 445, 458, 476, 479, 481, 506, 507, 558
 - New Technology Development Fund, 423, 481
 - Nikkei Sangyo *Shimbun* (Japan Industrial Daily), 77, 79
 - organization of basic and applied research, 318
 - Csaka University, 423
 - patent law, 571
 - personnel availability, 337, 508
 - personnel engaged in rDNA R&D, 506
 - pharmaceutical industry, 76, 77, 78, 79
 - plant agriculture industry, 83
 - plant breeders' rights, 572
 - R&D SUPPORT, 480
 - rDNA research control, 359, 554
 - rDNA technology expenditures, 505
 - regulation of biotechnology products, 370
 - Science and Technology Agency, 86, 317, 341, 423, 480, 506
 - specialty chemicals industry, 83
 - summary of biotechnology, 505
 - support firms, 84, 86
 - targeting policies, 475
 - Tokyo University, 341
 - trade barriers, 464
 - transnational training, 343, 344
 - Tsukuba Science City, 481
 - undergraduate and graduate education, 341
 - university/industry relationships, 422, 508
 - University of Tsukuba, 341
 - worker health safety, 561
- Japanese Cancer Institute, 131
- Johns Hopkins University, 412, 414, 417
- Johnson & Johnson, 149, 254
- KabiGen AB, 127, 128
- KabiVitrum AB, 128, 133
- Kansas, 384
- Keidanren survey, 76, 77, 79, 344, 345
- Kelco Co., 210
- Kennedy, Donald, 308
- Kohler, George, 39
- Kyowa Hakko Co., 83, 196, 197
- Lawless, E. W., 490
- legislation:
 - Act Against Restraints of Competition (F. R.G.), 442
 - Act Concerning Prohibition of Private Monopoly and Maintenance of Fair Trade (Japan), 445
 - Act No. 77-806 (France), 444
 - Agricultural Chemicals Law (Japan), 464
 - Basic Law for Environmental Pollution Control (Japan), 558
 - Chemicals Act (F. R.G.), 556
 - Chemicals Control Law (France), 557
 - Chemical Substances Control Law (Japan), 558
 - Clayton Act, 438, 439
 - Clean Air Act, 556
 - Clean Water Act of 1977, 555
 - Competition Act of 1980 (U.K.), 443
 - Control of Pollution Act of 1974 (U.K.), 557
 - Export Administration Act, 455, 456, 470
 - Fair Trading Act (U.K.), 443
 - Federal Cartels Act (Switzerland), 444

- Federal Food, Drug, and Cosmetic Act (FDCA), 360, 361, 362, 363, 365, 376, 377
 Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), 365, 555
 Federal Trade Commission Act, 438
 Foreign Exchange and Foreign Trade Control Law (Japan), 458, 462
 Federal Water Pollution Control Act, 555
 Health and Safety at Work Act of 1974 (U.K.), 560
 Health Research Education Act of 1983, 495
 H.R. 3577, 405
 Import, Export, and Customs Powers Act (U.K.), 458
 Industrial Safety and Health Law (Japan), 561
 International Emergency Economic Powers Act, 458
 Law on the Reform of Drug Legislation (F. R.G.), 366
 Marine Protection, Research and Sanctuaries Act of 1972, 556
 Medicines Act of 1968 (U.K.), 367
 Occupational Safety and Health Act of 1970, 374, 558
 Patent Act of 1977 (U.K.), 566
 Pharmaceutical Affairs Law (Japan), 370, 464
 Plant Patent Act of 1930, 392, 399, 400, 404
 Plant Variety Protection Act, 392, 399, 400, 404, 460
 Price Ordinance No. 15-1483 (France), 444
 Public Health Service Act, 360, 361
 Public Law 96-517, 411, 419
 Research Association Law (Japan), 445
 Sherman Act, 438
 Small Business Innovation Development Act, 313
 Solid Waste Disposal Act, 556
 Swiss Patent Act, 566
 Tariff Act of 1930, 467
 Toxic Chemicals Law (Japan), 464
 Toxic Substance Control Act (TSCA), 365, 371, 372, 555
 Trade Act of 1974, 453, 466, 469
 Virus, Serum, Toxin Act of 1913, 363, 365, 377
 Water Protection Act (Swiss), 557
 Lilly, Malcolm, 342
 local efforts to promote biotechnology development in United States, 26
 Los Alamos National Laboratory, 89
 Lubrizol Co., 101

 Massachusetts General Hospital, 144, 343, 417, 418, 419, 424, 510, 575
 Massachusetts Institute of Technology (MIT), 344, 412, 414, 417, 418, 421, 575
 Max Planck Institute for Biotechnology, 164
 Max Planck Institute for Plant Research, 82, 425
 Merck Co., 137, 201
 messenger RNA (mRNA), 34
 Mexico, 238
 Michigan State University, 418, 576
 Microelectronics Computer Corp., 447
 Militarily Critical Technologies List, 457
 Millipore Co., 54, 88
 Milstein, Cesar, 39
 Minnesota, 384
 Mitsubishi Chemical Co., 76, 133, 505

 Mitsui Toatsu Chemicals, 198
 Miyoshi Oil and Fat Co., 206
 Molecular Biology Institute, 418
 Molecular Genetics, Inc., 80, 82, 166, 167
 monoclonal antibodies (MAbs) technology, 5, 8, 25, 38-43
 industrial uses for, 43
 large-scale production of, 42
 preparation, 40
 sheep red blood cells (SRBCs), 39
 and rDNA technology, 42
 Monsanto, 80, 82, 99, 101, 167, 197, 417, 574
 Motulsky, A. G., 498
 multidisciplinary nature of biotechnology, 25
 McDonnell Douglas, 54
 McTaggart, John, 88

 National Academy of Sciences, 26, 332
 National Aeronautics and Space Administration, 54, 123, 314, 315
 National Assessment of Education, 496
 National Biomedical Research Foundation, 89
 National Cancer Institute, 123
 National Council of Churches, 493
 National Institutes of Health, 84, 89, 119, 123, 127, 151, 307, 308, 310, 312, 313, 335, 343, 348, 357, 358, 360, 371, 372, 418, 489, 491, 551
 National Institute of Occupational Safety and Health, 373
 National Research Council, Canada, 244
 National Science Foundation, 91, 228, 247, 309, 310, 312, 313, 315, 316, 327, 335, 347, 348
 Netherlands, 522
 new biotechnology firms (NBFs), 6, 7, 11, 12, 13, 65, 66, 91-98
 collaborative ventures with established foreign companies, 108
 commercial pursuits of, 93
 emergence and financing, 92
 future prospects, 95
 joint ventures, NBFs and established firms, listing of, 104
 licensing, 454
 role in U.S. competitiveness, 97
 New Drug Application (NDA), 361
 New England BioLabs, 84, 199
 New England Monoclonal Resources, 94
 New York University (NYU), 142
 Nippon Oil and Fat Co., 206
 Nippon Zeon Co., 86
 Norden Co., 80
 Norman Research Institute, 423
 North Carolina Biotechnology Center, 26, 75, 418
 Notice of Claimed Investigational Exemption for a New Drug (IND), 360
 Novo Industri A/S, 121, 199, 247
 Nucleopore Co., 54, 88
 Nucleotide Sequence Data Library, 89
 Nucleic Acid Sequence Database, 89

 Occupational Safety and Health Administration (OSHA), 374, 558

- Oppenheimer & Co., 94
Organization for Economic Cooperation and Development, 71
organization of report, 27
Organon Co., 130
OTA/NAS survey of personnel needs of firms in the United States, 547
- Paris Convention, 460
Paul Ehrlich Institute, 366
Perkin Elmer Co., 88
Perlmann, David, 336
personnel and training, 331-350
 availability of personnel in the United States, 335
 categories of technical expertise, 333-335
 findings, 345
 issues and options, 347
 labor force, size and growth of, 332
 personnel availability in other countries, 336
 secondary school education, U.S. and other countries, 339
 translational training, 343
 undergraduate and graduate education, U.S. and other countries, 340
Petroferm, 229
Pfizer Co., 102, 229
pharmaceutical industry, 72-79, 119-152
 antibodies, 143
 blood products, 131-136
 antihemophilic factor (AHF), 133, 134
 human serum albumin (HSA), 132
 thrombolytic and fibrinolytic enzymes, 134
 commercial aspects of biotechnology, 150
 DNA hybridization probes, 148-149
 drug delivery systems, 123
 foreign companies, 74
 future research, 151
 human growth hormone, 127
 interferon gene cloning projects, companies involved, 128
 lymphokines, 130
 melanocyte stimulating hormone (MSH), 128
 monoclonal antibodies, 143-147
 diagnostic products, 144
 preventive and therapeutic products, 147
 neuroactive peptides, 128
 proteins being developed with rDNA technology, 129
 R&D expenditures, 75
 regulatory proteins, 120
 human insulin, 120
 interferon, 122-126
 top 20 U.S. and foreign companies, 73
 U.S. companies, 72
 vaccines, 136, 143
 bacterial disease vaccines, 139
 parasite disease vaccines, 140
 viral disease vaccines, 136
- Pharmacia, 88
plant agriculture industry, 6, 172-186
 commercial aspects of biotechnology, 185
 disease-suppressive and growth-regulating microorganisms, 184
 foreign, 82
 future research, 186
 methods of plant cell culture, 175
 microbially produced insecticides, 183
 nitrogen fixation, 181
 photosynthetic efficiency, 180
 plant growth rate, 180
 plant-produced pesticides, 181
 primary plant products, 178
 secondary compounds from plants, 179
 specific plant characteristics, improvement of, 174
 United States, 81
 uses of microorganisms for crop improvement, 181
 vector construction and transformation, 176
P-L Biochemical Co., 84, 87, 199
Pope John Paul II, 493
President's Commission for the Study of Ethical Problems in Medicine and Biomedical and Behavioral Research, 493, 494, 495
public perception, 489, 499
 arguments raised, 492
 difficulties in weighting the risks, costs, and benefits, 494
 factors influencing, 490
 findings, 499
 implications for competitiveness, 497
 influence of the media, 495
 issues, 499
 surveys, 496
- Quidel Co., 94
- recombinant DNA technology (rDNA), 3, 4, 5, 25
 environmental regulation, 355
 guidelines, environmental laws, and regulation of health and safety, 550-561
 in industrial processes, 37-38
 preparing rDNA, 36, 37
 structure and function, 33-36
Reckitt & Colman (U.K.), 130
regulation of worker health and safety, 558
research funding, U.S. Government, 14
Rhone Poulenc (France), 12, 74, 75, 76
Roussel Uclaf Co., 130
- Salt Institute, 99
Sandoz Co., 74, 130
Sanofi Co., 75
Saudi Arabia, 238
Schering AG (F.R.G.), 75, 84
Schering-Plough (U.S.), 150
Science 71'mes, 496
Scripps Clinic and Research Foundation, 134
SDS Biotech Corp., 81
Shell, 82
Showa Denko, 81, 83
SmithKline Beckman, 80
Soviet Acquisition of Western Technology, 458

- specialty chemicals industry, 6, 83-84, 195-212
- amino acids, 195-198
 - aspartic acid, 198
 - glutamic acid, 196
 - lysine, 197
 - methionine, 195
 - phenylalanine, 198
 - tryptophen, 197
 - aromatic specialty chemicals, 208
 - commercial aspects of biotechnology in, 211
 - complex lipids, 205-207
 - fatty alcohols, 206
 - microbial oils, 206
 - sopherolipids, 207
 - enzymes, 198-200
 - future research, 212
 - polysaccharide copolymers, 209
 - single-en protein (SCP), 202,205
 - production plants, 204
 - steroids, 207
 - vitamins, 200-202
- Speywood Laboratories, 134
- Stanford Research Institute, 308
- Stanford University, 411, 412, 414, 415, 418, 420
- Sumitomo Chemical Co., 76, 505
- support firms, U.S. and foreign, 84-91
- product areas:
 - biochemical reagents, 85
 - instrumentation, 86
 - software, 89
- Sweden, 520-522
- Swiss Serum and Vaccine Institute, 140
- Switzerland:
- antitrust laws, 444
 - Commission for Experimental Genetics, 554
 - Commission for the Encouragement of Scientific Research, 322
 - competitiveness, 8, 9
 - environmental control, 557
 - export controls, 459
 - Federal Institute of Technology, 320, 426
 - Federal Office of Public Health, 370
 - government funding of basic and applied research, 517
 - industry, 516
 - intellectual property laws, 564
 - Intercantonal Convention for the Control of Medicaments, 370
 - law of trade secrets, 569
 - patent law, 565
 - personnel availability, 338, 517
 - plant breeders rights, 570
 - rDNA research control, 554
 - regulation of biotechnology products, 370
 - research, 320
 - tax incentives, 517
 - summary of biotechnology, 516
 - university /industry relationship, 426
 - worker health safety, 560
- Synagogue Council of America, 493
- Takara Shuzo Co., 86
- Takeda Co., 76, 130
- Taniguchi, Dr. Tadalsugi, 131
- targeting policies in biotechnology, 425
- findings, 482
 - industrials' role in policy formulation, 478
 - issue, 483
 - policy goals, 479
 - policy implementation, 480
 - timing and coordination, 475
- Techniclone Co., 94
- Toray Industries, 197, 505
- Transgene (France), 71
- Treaty of Rome, 441
- U.N. Industrial Development Organization, 26
- United Kingdom:
- antitrust laws, 443
 - biochemical supply, 86
 - bioprocessing, 12
 - biotechnology centers, 319
 - Center for Applied Microbiology, 320
 - competitiveness, 8, 9, 425
 - Department of Industry, 477, 478, 482
 - environmental control, 557
 - export controls, 458
 - financing and tax incentives, 514
 - Genetic Manipulation Advisory Group, 358, 515, 553, 560
 - government funding of basic and applied research, 312, 513
 - government targeting policies, 477, 513
 - Health and Safety Executive, 358
 - Imperial College, 342, 425
 - industry, 513
 - intellectual property laws, 399, 564
 - law of trade secrets, 568
 - Medical Research Council, 338, 425
 - Monopolies and Mergers Commission, 443
 - patent law, 565
 - plant agriculture industry, 82
 - plant breeders rights, 570
 - organization of basic and applied research, 319
 - personnel availability and training, 338, 514
 - R&D SUPPORT, 482
 - rDNA research control, 358, 552
 - regulation of biotechnology products, 367
 - Science and Economic Research Council, 338,425
 - summary of biotechnology, 512
 - financing, 514
 - funding, 513
 - industry, 513
 - personnel, 514
 - targeting, 513
 - undergraduate and graduate education, 342
 - university/industrial relationship, 425, 515
 - University Grants Committee, 342
 - worker health safety, 560
- United States v. Penn-lin Chemical Co., 439
- University Genetics, 148

- University/industry relationships, 411-427
 commingling of funds, 419
 consulting arrangements, 416
 effectiveness in biotechnology, 413
 guidelines for industrial sponsorship, 577
 industrial associates programs, 417
 intellectual property, 419
 issue, 429
 Pajaro Dunes Conference, 578
 patent rights and commingling of research funds, 579
 private corporations, 418, 576
 research contracts, 417
 research partnerships, 417
 selected agreements, 574
 tangible research property, 420
 university policies, 580-584
University of British Columbia, 244
University of California, Berkeley, 384, 411, 413, 418, 420
University of California, Davis, 415, 421
University of California, San Diego, 149, 420
University of California, San Francisco, 127, 137, 413
University of Geneva, 222
University of ~.orgia, 229
University of Gottingen, 222
University of Lueven (Belgium), 135
University of North Carolina, 244
University of Pennsylvania, 144
University of Virginia, 341
University of Washington, 144, 149, 418, 574
University of Wisconsin, 411, 412
Upjohn Pharmaceuticals, 133
U.S. Agency for International Development (AID), 26, 142
U.S. Air Force, 315
U.S. Army, 315
U.S. competitiveness, 7, 8
 antitrust laws, 18
 commitment to basic research, 14
 intellectual property system, 17
 NBFs, 11
 patent law, 16
 training of personnel, 15
U.S. Department of Agriculture, 164, 238, 310, 314, 347, 360, 373
 Plum Island Animal Disease Facility, 164
 venture capital, 12, 71
U.S. Department of Commerce, 200, 455, 457, 468
U.S. Department of Defense (DOD), 254, 310, 312, 313, 314, 316, 327, 415, 457
 Defense Advanced Research Projects Agency, 312, 315
 Defense Business Advanced Technologies, 314
U.S. Department of Energy (DOE), 228, 247, 310, 312, 314, 316, 349
U.S. Department of Health and Human Services, 315
 Public Health Service, 315
U.S. Department of the Interior, 228, 314
U.S. Department of Justice, 436, 438, 439, 440, 441
U.S. Department of Transportation, 314
U.S. Environmental Protection Agency (EPA), 183, 314, 360, 371, 372
U.S. federally funded research in biotechnology, 310-312
U.S. Federal Trade Commission, 438
U.S. firms commercializing in biotechnology, list of, 542
U.S. Food and Drug Administration (FDA), 16, 81, 121, 150, 355, 376, 377
 Bureau of Foods, 362
 National Center for Devices and Radiologic Health, 362
 Office of New Drug Evaluation, 361
 regulation of biotechnology products, 360
U.S. General Accounting Office, 361, 372
U.S. International Trade Commission, 391, 467
U.S. Naval Research Laboratory, 315, 316
U.S. Navy, 315
U.S. Nuclear Regulatory Commission, 314
U.S. Office of Management and Budget, 92, 419
U.S. Patent and Trademark Office, 386, 389, 390, 403, 459
U.S. semiconductor industry and biotechnology, a comparison, 531-541
 Bell Telephone Labs, 532
 development of U.S. industry, 532
 role of universities, 536
 role of U.S. Government, 533
 semiconductor devices, terminology and evaluation, 531
 structure of U.S. industry, 537
U.S. Small Business Administration, 91, 313
 Set Aside Program, 316
U.S. Supreme Court, 374, 386, 391, 400, 439
U. S. S. R., 204, 527
Valentine, Ray, 421
Varian Co., 88
Vega Biotechnologies, 84, 87
Vellucci, Alfred, 489
Wang, Prof. Daniel, 344
Ward, Dr. David C., 148, 149
Washington, 384
Waters Technologies, 88
Wisconsin Alumni Research Foundation, 411
Wellcome Research Laboratories (U.K.), 12, 75, 164
Whitehead, Edwin C., 575
Whitehead Institute, 418, 575
White House Office of Science and Technology Policy, 458
World Health Organization (WHO), 142
W. R. Grace, 196, 228
Xoma Co., 94
Yale University School of Medicine, 148
Yankelovich, Skelly, and White, survey, 497