Index

• A •

AABB (Web site), 229 abortion and stem cell research genetic testing, relationship to, 247 induced-abortion fetuses as stem cell sources, 97, 255, 287 legal and policy issues, 234, 253, 255, 262 myths about, 287-288 religious views on, 237, 240, 244 academic funding, 275-276 accrediting agencies for cord blood banks, 229 acquired characteristics in heredity, 41 acute myeloid leukemia, 132 adhesion molecule, 128 adipose tissue, 81 adult stem cells abilities of 74-77 about. 71 in bone marrow, 13-14, 78-81, 185 in brain, 81-82, 143 in cord blood, 84-85, 221-227, 331 defined, 17, 71, 72-74, 329 embryonic stem cells, compared to, 289 in heart. 82 identifying, 18 in intestines, 82 key properties, 17-18 limitations, 76–77 in lungs, 83 multipotent capability, 61, 71, 334 in pancreas, 83 quiescent, 74 in skin, 83 sources of, 77-84 tissue stem cells, compared to, 73 treatment successes. 292-293 uses. 76-77 working with, 85 workings of, 75-76 adult-onset diabetes, 168-169

Advanced Cell Technology, 113, 258 adverse event reporting for stem cell research, 268 age-related macular degeneration, 308 allogeneic transplant, 206, 207 ALS (amytrophic lateral sclerosis), 66, 107, 145-149, 306-307, 329 altered nuclear transfer (ANT), 91, 242, 329 Alzheimer's disease about. 138-139 clinical trials, 140-142 defined, 329 genetic causes, 141-142 progression of, 139-140 stem cell potential, 142–144 symptoms, 139 American Society of Reproductive Medicine (Web site), 327 amniotic stem cell, 329 amyloid plaques in Alzheimer's, 139 amyotrophic lateral sclerosis (ALS), 66, 107, 145-149, 306-307, 329 anemia, 329 angioplasty, 160 animal regeneration, 39-40 animal research animal model defined, 329 chimeras, 105-106, 107, 118 cloning in, 50, 108-109 cybrids, 90, 104, 114-119, 331 hybrids, 102, 104 mouse's role in, 12-15, 142 animal treatments, application to humans, 196 ANT (altered nuclear transfer), 91, 242, 329 antibodies, 64 aperesis, 205 apoptosis, 126, 329 applied research, 256 arrhythmia, 163 assay, 79 astrocyte, 24, 147, 329

asymmetric cell division, 23, 329 autografting, 46 autoimmune diseases, Natural Killer cell role in, 15 autologous transplant, 186, 206, 207 axon, 23, 330

• B •

Back to Sleep campaign for SIDS prevention, 244-245 banking stem cells about, 221 choosing a bank, 227-230 cord-blood banking process, 222-227 depositing into, 224-226 future of, 230 private compared to public storage, 223-224, 225 problems with, 226-227 Baptist churches' viewpoint, 236 basal cell carcinoma, 129 basement membrane, 128 basic research and innovation, 256-258, 330 Batten Disease, 149-150, 195 BDNF growth factor, 152 Be The Match Foundation (Web site), 217.326 beneficence principle in research on humans, 260 benign tumor, 128, 301 beta cells, pancreatic, 26, 30, 83, 166 bioethics issues. See also funding and profits; laws and policies abortion and stem cell research genetic testing, relationship to, 247 induced-abortion fetuses as stem cell sources, 97, 255, 287 legal and policy issues, 234, 253, 255, 262 myths about, 287-288 religious views on, 237, 240, 244 about, 1, 233-234 ANT technique, 91, 242, 329 chimeras, 242-243

cloning, 242 cooperation with evil problem, 239-241 embryos created specifically for research, 241-242, 288-289 eugenics, 245-246 fetal tissue research, 243-245, 255-256 genetic testing and manipulation, 245-247 goals of stem cell research, 247-248 human subject research, 260-261 "living and human compared to living human" issue, 238-239 national-level bioethics panels, 327-328 personhood definitions, 234-239 pluripotent alternatives to embryonic stem cells, 87-88 religious viewpoints, 235-238, 240, 244, 247 research goals, relationship to, 247-248 scientific community's self-policing, 267 - 268SCNT technique, 89-91, 108-114, 242, 337 selling of eggs problem, 241 Warnock Commission viewpoint, 238 biopsy, 131 biotechnology industry, 272, 277-279 blast crisis in leukemia, 131 blastocyst defined, 13, 330 development of, 55 ethical issues, 88, 262 germ layers defined, 333 ectoderm, 56, 331 embryoid bodies, 62, 332 endoderm, 56, 282, 332 mesoderm, 56, 334 blood brain barrier. 195 blood sources for stem cells bone marrow as stem cell source, 13-14, 78-81, 185, 203-204 cord blood about, 84-85 banking of, 221-230 defined, 331, 338 medical uses, 221-222 as stem cell source, 205

blood-forming (hematopoietic) stem cells, 72, 78, 202, 333 body systems overview, 30-32 body wall, 128 bone marrow as stem cell source, 13–14, 78-81, 185, 203-204 brain diseases and conditions cancer, 131 neurodegenerative diseases about, 137-138 ALS (Lou Gehrig's Disease), 66, 107, 145-149, 306-307, 329 Alzheimer's disease, 138-144, 329 Batten Disease, 149-150, 195 cerebral palsy, 150-151 commonalities, 138 defined, 137 Huntington's disease, 151-152, 306-307 Niemann-Pick Disease, 152-153, 335 Parkinson's disease, 153-156, 306-307, 335 spinal cord Injuries, 67, 156–157, 194-195, 306 stroke consequences, 157-158, 307 brain stem cells, 81-82, 143 Briggs, Robert (researcher), 88 Brown, Louise (first IVF baby), 49 Brownback, Sam (U.S. Senator), 119 Buddhist viewpoint, 236, 237 Bush, George W. (president), 251, 254, 263, 272.294

cancer basic progression of, 124-129 cancer stem cells, 96-97, 129-135 cell biology of, 23 cloning in research on, 108-109 collecting stem cells from tumors, 96-97 differences in cells, 132, 133 embryonal carcinoma cell, 96 genetic instruction changes, 125-126 history of treatment attempts, 123-124 living beyond normal lifespan, 127–128

metastasizing progress, 128-129 out-of-control growth problem, 126-127 teratocarcinoma, 96 treatments, 15, 130-131, 134-135, 187-188, 212, 303-304 types of, 131 cancers of unknown primary (CUP), 131 carcinogenic, defined, 124 carcinoma, 123, 131 cardiac muscle. 32 cardiomyocytes, 66 cardiovascular, defined, 161 catheter, 213 Catholic viewpoint, 235, 236, 240, 247 CDX2 gene, 329, 330 cell biology, basic about, 21 building tissues and organs, 29-33 stem cells compared to other cells, 33-35 structure and function, 21-29 cell body, 23, 330 cell communication, 29 cell division, 22-23, 55, 329, 330, 337 cell line, 60 cell membrane, 330 cell replacement, 19, 24 cell suicide, 126 cell (cell-based) therapies adult stem cell successes, 292-293 ALS (Lou Gehrig's disease), 66, 107, 145-149, 306-307, 329 Alzheimer's disease, 139, 140–144 animal treatments, applying to humans, 196 assessment of, 187-192, 312-313, 317 Batten Disease, 149-150, 195 bone marrow transplants for leukemia, 185 cancer history of treatment attempts, 123-124 treatments, 15, 130-131, 134-135, 187-188, 212, 303-304 cerebral palsy, 150-151 development of, 313-314 diabetes, 166-169, 191-192, 309-310

Index 341

cell (cell-based) therapies (continued) drug therapies about, 171 ALS (Lou Gehrig's disease), 107, 146-147, 148-149 Alzheimer's disease, 139, 141-143 cancer treatment, 130-131, 134, 135 clinical trials' role, 174-175, 176, 177-178, 179 cost of development, 174-179 development process, 171-179 genetic origins for response differences, 44 Huntington's disease, 152 for immune-suppression in transplant cases, 46-47, 48-49, 210-211 insulin therapy using cloning technique, 110 multiple sclerosis, 190 Niemann-Pick disease, 153 Parkinson's disease, 154, 155, 156 pros and cons of current, 172-174 regulation of, 178-179 safety and effectiveness, 176-178 stem cell role in, 68, 111, 179-180, 278-279, 290-291, 304-305 tolerance issue, 173 experimental, 314-315 expert opinions, 319 grafting skin to treat burns, 186–187 heart disease challenges with stem cells, 163-164 clinical trials involving stem cells, 162-163, 189-190, 301-302 current treatment options, 160-161 stem cell treatment, 161-162, 189-190, 309 hidden costs, 318-319 Huntington's disease, 151-152, 306-307 independent oversight and regulation of clinics, 312 informed consent issue, 319-320 liver disease. 159-160. 164-166 lupus, 192 multiple sclerosis, 190, 308 Niemann-Pick Disease, 152-153, 335 obstacles to, 295-302

Parkinson's disease, 153-156, 306-307, 335 patient testimonials, 317-318 replacement tissues, 305-306 reversing retinal degeneration, 308-309 risks and side effects, 315-317 scams and charlatans, 321-322 spinal cord injuries, 67, 156-157, 194-195, 306 as stem cell purpose, 19 stroke, 157-158, 307 cells. See also stem cells cancer, 23, 132, 133 common functions, 12 communication, 29, 63 culturing of, 330 differentiation, 16, 54, 55, 89, 331 diploid, 255 enucleated, 108, 332 eukaryotic, 12 feeder, 60, 332 genetic controls changing instructions, 125-126 growth factors, 44-45 heredity, 41-42 identifying stem cells, 46-47 mapping genetic library, 44 RNA, 25, 42, 336 germ, 89, 255, 333 glial, 82, 333 immune system, 15 inner cell mass, 16, 57, 119, 331, 334 in Lou Gehrig's Disease, 147-148 mixing and matching. See mixing and matching cells Natural Killer (NK), 15 oocyte (egg cell), 335 pancreatic, 26, 30, 83 photoreceptor, 309 progenitor, 14, 73, 127, 336 prokaryotic, 12 red blood, 204 rogue, 15 Schwann, 24, 336 sizing, 23-24 skin. 14-15

specialized, 14 stem cells compared to, 33-35 stromal, 63 suicide of, 126 terminally differentiated cell, 130, 337 transfer of materials, 25-29 white blood, 204 cell-swapping technology (cybrids), 114-119 cerebellum. 153 cerebral cortex, 152 cerebral palsy, 150-151 chimeras, 105-107, 118, 330 chimeric animals, 105-106, 118 chromosome, 25, 330 chronic myeloid leukemia, 130 circulatory system, 31 **Clinical Laboratory Improvement** Amendments (CLIA), 228 clinical trials ALS treatments, 146, 147-149 Alzheimer's disease, 140-142 animal treatment potential for humans, 196 Batten Disease, 150 cancer, 189 challenges of, 197-199 cost of, 301 defined, 330 design, 302 double-blind, 177, 292, 331 drug development, relationship to, 174-175, 176, 177-178, 179 heart disease, 162-163, 189-190, 301-302 NIH registry, 326 Parkinson's disease, 156-157 spinal cord injury, 67, 157, 194-195 Clinton, Bill (president), 253, 254 Clonaid (Web site), 113 clone, defined, 330 cloning animals, 50, 108-109 defined. 108 ethical issues, 242 of humans, 113, 291 primates, difficulties of, 111-114

reproductive, 89-91, 108, 242, 336, 337 research-related, 111 therapeutic, 108-109, 111, 337 Cohen, Stanley (researcher), 44 Cole-Turner, Ronald (clergy), 119 communication, cell, 29, 63 conception defined, 332 in vitro fertilization (IVF) blastocyst creation role, 57 defined, 49, 57, 333 development of, 49-50 genetic testing, relationship to, 93 in vivo fertilization, 333 zygote, 55, 338 conditioning prior to bone marrow transplant, 214 cones (photoreceptor cell), 309 connective tissue, 30 conservation, gene, 12 continuity of species, 41 cord blood about, 84-85 banking of about, 221 banking process, 222-227 choosing a bank, 227-230 depositing into, 224-226 private compared to public storage, 223-224, 225 problems with, 226-227 defined, 331, 338 medical uses, 221-222 as stem cell source, 205 coronary heart (artery) disease about, 159-160 challenges with stem cells, 163-164 clinical trials involving stem cells, 162-163, 189-190, 301-302 current treatment options, 160-161 definitions, 161 prevalence, 160 risk factors, 160 stem cell treatment, 161-162, 189-190, 309 Crick, Francis (researcher), 43

Index 343

crypts (intestinal crevasses), 82 culture medium, 59, 331 culturing, 13 CUP (cancers of unknown primary), 131 C.W. Bill Young Cell Transplantation Program, 326 cybrid (cytoplasmic hybrid), 90, 104, 114–119, 331 cytoplasm, 21, 90, 111 cytoplasmic hybrid (cybrid), 90, 104, 114–119, 331 cytoplasmic transfer, 115

• /) •

deep brain stimulation (DBS), 155 delivery agent, stem cell as, 19 dendrite, 23, 331 deoxyribonucleic acid (DNA) about, 25, 42-43 defined, 22, 25, 331 mitochondrial, 88, 114 recombinant, 110, 336 derivation of stem cell line, 16, 331 design patent, 280 designated proxies, 177 diabetes, 166-169, 191-192, 309-310 Dickey-Wicker Amendment, 254, 255 differentiation. cell. 16, 54, 55, 89, 331 diffusible signals in cell communication, 29 digestive system, 31 diploid cell, 255 directed differentiation, 331 diseases ALS (Lou Gehrig's disease), 66, 107, 145-149, 306-307, 329 Alzheimer's about. 138-139 clinical trials, 140-142 defined, 329 genetic causes, 141-142 progression of, 139–140 stem cell potential, 142-144 symptoms, 139 Batten Disease, 149-150, 195

cancer basic progression of, 124-129 cancer stem cells, 96-97, 129-135 cell biology of, 23 cloning in research on, 108-109 collecting stem cells from tumors, 96-97 differences in cells, 132, 133 embryonal carcinoma cell, 96 genetic instruction changes, 125-126 history of treatment attempts. 123–124 living beyond normal lifespan, 127–128 metastasizing progress, 128-129 out-of-control growth problem, 126-127 teratocarcinoma, 96 treatments, 15, 130-131, 134-135, 187-188, 212, 303-304 types of, 131 diabetes, 166-169, 191-192, 309-310 heart disease about, 159-160 challenges with stem cells, 163-164 clinical trials involving stem cells, 162-163, 189-190, 301-302 current treatment options, 160-161 definitions, 161 prevalence, 160 risk factors, 160 stem cell treatment, 161-162, 189-190, 309 Huntington's disease, 151-152, 306-307 liver disease. 159-160. 164-166 lupus, 192 multiple sclerosis, 190, 308 Niemann-Pick Disease, 152-153, 335 Parkinson's, 153-156, 306-307, 335 distributed tissue, 77 division, cell, 22-23, 55, 329, 330, 337 DNA (deoxyribonucleic acid) about, 25, 42-43 defined, 22, 25, 331 mitochondrial, 88, 114 recombinant, 110, 336 Dolly the sheep, 50 dominant gene, 247 donating stem cells and/or organs/tissues, 206-210, 215-218

dopamine, 63, 154 double helix, 43 double-blind clinical trials, 177, 292, 331 drug therapies about, 171 ALS (Lou Gehrig's disease), 107, 146-147, 148 - 149Alzheimer's disease, 139, 141–143 cancer treatment, 130-131, 134, 135 clinical trials' role. 174-179 cost of development, 174-179 development process, 171-179 genetic origins for response differences, 44 Huntington's disease, 152 for immune-suppression in transplant cases, 46-47, 48-49, 210-211 insulin therapy using cloning technique, 110 multiple sclerosis, 190 Niemann-Pick disease, 153 Parkinson's disease, 154, 155, 156 pros and cons of current, 172-174 regulation of, 178-179 safety and effectiveness, 176-178 stem cell role in, 68, 111, 179-180, 278-279, 290-291, 304-305 tolerance issue, 173 drug-like chemicals, finding, 175-176

• E •

early onset Alzheimer's, 141 EC (embryonal carcinoma) cell, 96 ectoderm, 56, 331 ectopic pregnancy, 244 egg donation, 241 electrical signals in cell communication, 29 embryo. See also blastocyst creation specifically for research, 241-242, 288-289 defined, 54, 332 fetus, compared to, 2, 238, 332 in lab research, 258

nuclear transfer techniques, 91-93 stages of development, 54-56 embryoid bodies, 62, 332 embryonal carcinoma (EC) cell, 96 embryonic germ cell, 97 embryonic stem cell line, 289-290, 332 embryonic stem cells about, 13, 53 adult stem cells, compared to, 289 defined, 33, 54, 332 growing, 57-62, 64-65 identifying, 18 limitations, 68-70 making cells and tissues, 62-65 possibilities, 68-70 pre-implantation, 336 properties, 16-17, 59-62 research issues, 65-68, 253-254, 293, 294 stages of embryonic development, 54-56 endocardium, 30 endocrine system, 31 endoderm, 56, 282, 332 endothelial stem cells, 78 Energy, Department of, 259 ensoulment, 235 enucleated cell, 108, 332 epicardium, 30 epidermal growth factor, 44 epigenome, 45 Episcopal Church's viewpoint, 236 epithelial tissue, 30, 131 ethical issues. See also funding and profits; laws and policies abortion and stem cell research genetic testing, relationship to, 247 induced-abortion fetuses as stem cell sources, 97, 255, 287 legal and policy issues, 234, 253, 255, 262 myths about, 287-288 religious views on, 237, 240, 244 about, 1, 233-234 ANT technique, 91, 242, 329 chimeras, 242-243 cloning, 242 cooperation with evil problem, 239-241

embryos created specifically for research, 241-242, 288-289 eugenics, 245-246 fetal tissue research, 243-245, 255-256 genetic testing and manipulation, 245-247 goals of stem cell research, 247-248 human subject research, 260-261 "living and human compared to living human" issue, 238-239 national-level bioethics panels, 327–328 personhood definitions, 234-239 pluripotent alternatives to embryonic stem cells, 87-88 religious viewpoints, 235-238, 240, 244, 247 research goals, relationship to, 247-248 scientific community's self-policing, 267 - 268SCNT technique, 89-91, 108-114, 242, 337 selling of eggs problem, 241 Warnock Commission viewpoint, 238 Ethics Advisory Board, 253 eugenics, 245-246 eukarvotic cell, 12 European Patent Office (EPO), 280 excretory system, 32 exit strategies for manipulated stem cells, 300 experimental treatments, 314-315 expert opinion, 319

• F •

FACS (fluorescent-activated cell sorter), 64, 332
FACT (Foundation for the Accreditation of Cellular Therapy) (Web site), 229
family cord blood bank, 223
FDA (Food and Drug Administration), 178, 222, 228, 259
federal government and stem cell research about, 251–252
basic research and innovation encouragement, 256–258
clinical trials registry at NIH, 326

cord blood banking practices, 228 ethical issues, relationship to, 239, 243, 244 funding role agency sources of, 252-253 benefits for stem cell research, 274 Bush administration rules, 251, 254, 263, 272, 294 pro and con arguments on, 273–274 regulation in U.S., relationship to. 251-252, 253-256 research-only embryos, restriction against, 243 U.S. system, 269-270, 271-272 political pressures, 262-264 regulation role, 251-252, 253-256, 258-261, 288 feeder cell, 60, 332 fertilization defined, 332 in vitro fertilization (IVF) blastocyst creation role, 57 defined, 49, 57, 333 development of, 49-50 genetic testing, relationship to, 93 in vivo fertilization, 333 zygote, 55, 338 fetal tissue research, 243-245, 255-256 fetus defined, 332 embryo, compared to, 2, 238, 332 induced-abortion fetuses as stem cell sources, 97, 255, 287 stem cells, relationship to, 287-288 viability question, 57 fight or flight response, 32 flow cytometer, 135 fluorescent-activated cell sorter (FACS), 64, 332 fMRI (functional magnetic resonance imaging), 138 Food and Drug Administration (FDA), 178, 222, 228, 259 Foundation for the Accreditation of Cellular Therapy (FACT) (Web site), 229

Franklin, Rosalind (researcher), 43 full-body donation, 217 functional magnetic resonance imaging (fMRI), 138 funding and profits about, 269 government funding role agency sources of, 252-253 benefits for stem cell research, 274 Bush administration rules, 251, 254, 263, 272, 294 pro and con arguments on, 273-274 regulation in U.S., relationship to, 251-252, 253-256 research-only embryos, restriction against, 243 U.S. system, 269-270, 271-272 patents and licenses, 279–283 private sector role academia, 275-276 argument for, 273 corporations, 258, 277-279, 291-292 nonprofit foundations, 276-277

• G •

gamete, 89, 255, 333 gastrula, 55 gene conservation, 12 gene therapy, 209 genes CDX2, 329, 330 cell control role DNA. See DNA growth factor, 44-45 heredity, 41-42 identifying stem cells, 46-47 mapping genetic library, 44 RNA, 25, 42, 336 defined, 332 as disease agents, 125-126, 141-142, 148, 151 master, 19 mutation of, 104, 151, 334 tumor suppressor, 126, 338

genetic testing and manipulation, 93–94, 245-247 genome, 25, 44, 45, 332 germ cell, 89, 255, 333 germ layers of blastocyst defined, 333 ectoderm, 56, 331 embryoid bodies, 62, 332 endoderm, 56, 282, 332 mesoderm, 56, 334 germ plasm concept, 41 Geron, 67, 157, 194-195 glaucoma, 308 Gleevec, 131 glial cells, 82, 333 global attitudes about stem cell research, 266-267 glucose, 166 glutamate, 146 glycogen, 164 gonads, 96 good manufacturing practice (GMP), 296 governmental role in stem cell research See also federal government and stem cell research international attitudes about stem cell research, 266-268 state level, 228-229, 264-265, 272 grafting skin to treat burns, 186-187 graft-versus-host disease controlling, 211, 304 defined, 333 donor-recipient match for transplants, relationship to, 206 function in transplants, 48, 185 growth factors, 44-45, 75, 152, 333 growth medium for embryonic stem cells, 59 Gurdon, John (researcher), 50, 89

• H •

Harvard Stem Cell Institute (Web site), 325 harvesting stem cells from bloodstream, 204 - 205

Heap, Brian (researcher), 119 heart, tissue layers of, 30 heart disease about. 159-160 challenges with stem cells, 163-164 clinical trials involving stem cells, 162-163, 189-190, 301-302 current treatment options, 160-161 definitions, 161 prevalence, 160 risk factors, 160 stem cell treatment, 161-162, 189-190, 309 heart stem cells, 82 healthcare delivery, 302 helix, 43 hematopoiesis, 204 hematopoietic (blood-forming) stem cells, 72, 78, 202, 333 hemoglobin, 164, 209 hemophilia, 93 hemorrhagic stroke, 157 hepatocyte, 73 hereditary anemia, 329 hereditary disease, 333 heredity, 41-42. See also genes HGP (Human Genome Project), 45 Hindu viewpoint, 237 hippocampus, 81 histones, 42 history of stem cell research about, 37 cloning animals, 50 genetic controls in cells, 41-46 regeneration of body parts, 38-40 transplanting organs and tissues, 46-49 in vitro fertilization, 49-50 HLA (human leukocyte antigen), 209 homing markers, 80, 163 Hooke, Robert (scientist), 41 hormone replacement therapy (HRT), 199 human chimeras, 106-107 human cloning, 113, 291 human compared to yeast cells, 12 human embryonic stem cells about, 13, 53 adult stem cells, compared to, 289 defined, 33, 54, 332

growing, 57-62, 64-65 identifying, 18 limitations, 68-70 making cells and tissues, 62-65 possibilities, 68-70 pre-implantation, 336 properties, 16-17, 59-62 research issues, 65-68, 253-254, 293, 294 stages of embryonic development, 54-56 Human Genome Project (HGP), 45 human leukocyte antigen (HLA), 209 human subjects, regulation of research on, 259-261 human-animal hybrid myth, 104, 247 humanzees, 247 Huntingtin gene, 151 Huntington's disease, 151-152, 306-307 Hwang Woo-suk (researcher), 113 hybrid vigor, 104 hybridization, 102 hybrids animal, 102-104 cytoplasmic hybrid (cybrid), 90, 104, 114-119, 331 defined, 101, 102, 333 human-animal hybrid myth, 104, 247 plants, 104 hydra, defined, 39

•] •

illnesses ALS (Lou Gehrig's disease), 66, 107, 145-149, 306-307, 329 Alzheimer's about, 138-139 clinical trials, 140-142 defined, 329 genetic causes, 141-142 progression of, 139-140 stem cell potential, 142-144 symptoms, 139 Batten Disease, 149-150, 195 cancer basic progression of, 124-129 cancer stem cells, 96-97, 129-135 cell biology of, 23

cloning in research on, 108-109 collecting stem cells from tumors, 96-97 differences in cells, 132, 133 embryonal carcinoma cell, 96 genetic instruction changes, 125-126 history of treatment attempts, 123-124 living beyond normal lifespan, 127-128 metastasizing progress, 128-129 out-of-control growth problem, 126-127 teratocarcinoma. 96 treatments, 15, 130-131, 134-135, 187-188, 212, 303-304 types of, 131 diabetes, 166-169, 191-192, 309-310 heart disease about, 159-160 challenges with stem cells, 163-164 clinical trials involving stem cells, 162-163, 189-190, 301-302 current treatment options, 160-161 definitions, 161 prevalence, 160 risk factors, 160 stem cell treatment, 161-162, 189-190, 309 Huntington's disease, 151-152, 306-307 liver disease, 159-160, 164-166 lupus, 192 multiple sclerosis, 190, 308 Niemann-Pick Disease, 152–153, 335 Parkinson's, 153-156, 306-307, 335 immune response, overcoming, 46-47, 48-49, 210-211 immune system cells, 15 immune/lymphatic system, 32 implantation, 333 in vitro fertilization (IVF) blastocyst creation role, 57 defined, 49, 57, 333 development of, 49-50 genetic testing, relationship to, 93 in vivo fertilization, 333 independent review guidelines for stem cell research, 267 induced pluripotent stem cells, 98, 333 informed consent, 177, 225, 259, 267, 319 - 320inner cell mass, 16, 57, 119, 331, 334 innovation, 188, 256-258, 330, 334

international attitudes about stem cell research, 266-268 International Organization for Standardization (ISO) (Web site), 229 International Society for Science and Religion, 119 International Society for Stem Cell Research (ISSCR) (Web site), 266, 267-268, 325 intestinal stem cells. 82 ischemic stroke, 157 Islamic viewpoint, 236 islets, 30, 166, 191 ISO (International Organization for Standardization) (Web site), 229 ISSCR (International Society for Stem Cell Research) (Web site), 266, 267-268, 325

•] •

Jewish Chronic Disease Hospital cancer study, 260 Jewish viewpoint, 236, 237 Jones Institute, 258 juvenile diabetes, 167–168, 191–192

• K •

karyotyping, 60 King, Thomas (researcher), 88 Kinney, Hannah (researcher), 244–245

• [•

Lamarck, Jean-Baptiste (naturalist), 41 Lao Tzu (philosopher), 20 laws and policies abortion, 234, 253, 255, 262 about, 249–250 drug therapy regulation, 178–179 human subjects, research on, 259–261 in other countries, 266–267 patents and licenses, 279–283 political pressures, 262–264 research regulation and funding

laws and policies (continued) about, 251-252 basic research and innovation encouragement, 256-258 funding role, 252-256 restrictions on questionable practices, 259 - 261safety regulation, 258-259 scientific and medical societies, 267-268 state laws, 228-229, 264-265 leukemia, 131, 132 Levi-Montalcini, Rita (researcher), 44 licenses and patents, 279-283 lipids, 152 lipoproteins, 28 liver disease, 159-160, 164-166 "living and human compared to living human" issue, 238-239 Lou Gehrig's disease (ALS), 66, 107, 145-149, 306-307, 329 lung stem cells, 83 lupus, 192 Lutheran churches' viewpoint, 236 lymphatic/immune system, 32 lymphoma, 131 lysosomal storage disease, 149–150, 195, 334, 335 lysosome, 149, 195, 334

• M •

macula, 308 macular degeneration, 308 mapping genetic library, 44 markers, stem cell, 80, 163 master genes, 19 McCulloch, Ernest (researcher), 13–14, 46, 47, 79 mechanical injury, 157 mechanical signals in cell communication, 29 mediate animation, 235 Medical News Today (Web site), 328 medical societies, 267–268 medical tourism, 311

medications (drug therapies) about, 171 ALS (Lou Gehrig's disease), 107, 146-147, 148 - 149Alzheimer's disease, 139, 141–143 cancer treatment, 130-131, 134, 135 clinical trials' role, 174-179 cost of development, 174-179 development process, 171-179 genetic origins for response differences, 44 Huntington's disease, 152 for immune-suppression in transplant cases, 46-47, 48-49, 210-211 insulin therapy using cloning technique, 110 multiple sclerosis, 190 Niemann-Pick disease, 153 Parkinson's disease, 154, 155, 156 pros and cons of current, 172-174 regulation of, 178-179 safety and effectiveness, 176-178 stem cell role in, 68, 111, 179-180, 278-279, 290-291, 304-305 tolerance issue, 173 membrane, cell, 22, 330 mesenchymal stem cells, 49, 78, 81, 88, 334 mesoderm, 56, 334 mesothelioma, 129 metastasis, 185 metastasize, defined, 128 Methodist churches' viewpoint, 236 microglia, 147 microns, 23 Miescher, Friedrich (biologist), 42 mitochondria, 22, 111, 115, 334 mitochondrial DNA, 88, 114 mixing and matching cells about, 101-102 cell-swapping technology, 117-119 chimeras, 105-107, 118, 330 cloning animals, 50, 108-109 defined, 108 ethical issues, 242 of humans, 113, 291

primates, difficulties of, 111-114 reproductive, 89-91, 108, 242, 336, 337 research-related, 111 therapeutic, 108-109, 111, 337 cybrids, 90, 104, 114-119, 331 hybrids animal, 102-104 cytoplasmic hybrid (cybrid), 90, 104, 114-119, 331 defined, 101, 102, 333 human-animal hybrid myth, 104, 247 plants, 104 mobilized blood, 185 moral issues. See also funding and profits; laws and policies abortion and stem cell research genetic testing, relationship to, 247 induced-abortion fetuses as stem cell sources, 97, 255, 287 legal and policy issues, 234, 253, 255, 262 myths about, 287-288 religious views on, 237, 240, 244 about, 1, 233-234 ANT technique, 91, 242, 329 chimeras, 242-243 cloning, 242 cooperation with evil problem, 239-241 embryos created specifically for research, 241-242, 288-289 eugenics. 245-246 fetal tissue research, 243-245, 255-256 genetic testing and manipulation, 245–247 goals of stem cell research, 247-248 human subject research, 260-261 "living and human compared to living human" issue, 238-239 national-level bioethics panels, 327-328 personhood definitions, 234-239 pluripotent alternatives to embryonic stem cells, 87-88 religious viewpoints, 235-238, 240, 244.247 research goals, relationship to, 247-248 scientific community's self-policing, 267 - 268

SCNT technique, 89-91, 108-114, 242, 337 selling of eggs problem, 241 Warnock Commission viewpoint, 238 morphology, 132, 334 motor neuron, 19, 23, 63, 334 mouse's research role, 12-15, 142 multiple sclerosis (MS), 190, 308 multipotent stem cells, 61, 71, 329, 334 Murray, Joseph, 46, 47 muscle tissue. 30 muscular system, 32 mutation, gene, 104, 151, 334 myelin sheath defined, 334 function of, 24 multiple sclerosis, relationship to, 190 spinal cord injuries, relationship to, 67, 156 stem cell repair of, 35, 67 myeloablation, 214 myeloma, 131 myocardium, 30 myths, stem cell, 287-294

• N •

Namenda, 139 nanometers, 42 National Academies (Web site), 267, 323-324 National Academy of Sciences (Web site), 243, 323-324 National Bioethics Advisory Commission, 243, 254 National Bone Marrow Program (Web site), 326 National Cancer Institute (Web site), 324 National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research, 260 National Council of Churches, 236 National Heart, Lung, and Blood Institute (Web site), 324 National Human Genome Research Institute (Web site), 324

National Institute of Diabetes and Digestive and Kidney Diseases (Web site), 324 National Institute of Neurological Disorders and Stroke (Web site), 324 National Institutes of Health (NIH) clinical trials registry, 326 funding for stem cell research, 252, 254, 271 guidelines for stem cell research, 251 regulation of stem cell research, 259 Web site, 324 National Marrow Donor Program (Web site), 215, 217 National Research Act (1974), 260 National Science Foundation (NSF), 250, 252 national-level bioethics panels, 327-328 Natural Killer (NK) cells, 15 nerve growth factor, 44, 152 nerve tissue, 20 nervous system, 32 neurodegenerative diseases and conditions about, 137-138 ALS (Lou Gehrig's Disease), 66, 107, 145-149, 306-307, 329 Alzheimer's disease, 138-144, 329 Batten Disease, 149-150, 195 cerebral palsy, 150-151 commonalities, 138 defined, 137 Huntington's disease, 151-152, 306-307 Niemann-Pick Disease, 152–153, 335 Parkinson's disease, 153–156, 306-307, 335 spinal cord Injuries, 67, 156–157, 194-195, 306 stroke consequences, 157-158, 307 neurofibrillary tangles (NFTs) in Alzheimer's, 139 neuronal stem cell, 142, 150, 335 neurons defined, 59, 335 motor, 19, 23, 63 sensory, 23 neurotransmitter, 154, 335

NFTs (neurofibrillary tangles) in Alzheimer's, 139 niche, stem cell, 20, 335 Niemann-Pick Disease, 152-153, 335 NIH (National Institutes of Health) clinical trials registry, 326 funding for stem cell research, 252, 254, 271 guidelines for stem cell research, 251 regulation of stem cell research, 259 Web site, 324 NK (Natural Killer) cells, 15 Nobel Foundation (Web site), 327 nongenetic ALS, 148 nuclear transfer techniques ANT (altered nuclear transfer), 91, 242, 329 defined, 88 embryo development, 91-93 SCNT (somatic cell nuclear transfer), 89-91, 108-114, 242, 337 nuclei, 42, 335 nuclein, 42 nucleoid region, 12 nucleus, 21, 335 Nuremberg Code, 259 nutritional counseling for ALS, 146

• () •

Obama, Barack (president), 251, 254 Occupational Safety and Health Administration (OSHA), 258 OCT-4 protein, 18 olfactory bulb, 81 oligodendrocyte, 24, 67, 194, 335 oocyte (egg cell), 335 open-label trial, 315 organ damage, 173 organ systems, 30 organelle, 22 OSHA (Occupational Safety and Health Administration), 258

• *p* •

pancreatic beta cells, 26 pancreatic cells, 30 pancreatic diseases. 159-160. 166-169. 309-310 pancreatic stem cells, 83 pancreatitis, 166 Parkinson's Disease, 153-156, 306-307, 335 parthenogenesis, 94-96, 335 passage in subculturing of stem cells, 60 patent thicket, 279, 282 patents and licenses, 279-283 patient testimonials, 317-318 penumbra, stroke, 158 personhood, beginning of, 234-238 PGD (pre-implantation genetic diagnosis), 93 - 94pharmaceutical companies, 174–175, 177, 274, 279, 283 PharmaStem licensing, 227 philosophical issues. See also funding and profits; laws and policies abortion and stem cell research genetic testing, relationship to, 247 induced-abortion fetuses as stem cell sources, 97, 255, 287 legal and policy issues, 234, 253, 255, 262 myths about, 287-288 religious views on, 237, 240, 244 about, 1, 233-234 ANT technique, 91, 242, 329 chimeras, 242-243 cloning, 242 cooperation with evil problem, 239-241 embryos created specifically for research, 241-242, 288-289 eugenics, 245–246 fetal tissue research, 243-245, 255-256 genetic testing and manipulation, 245–247 goals of stem cell research, 247-248 human subject research, 260-261 "living and human compared to living human" issue, 238–239 national-level bioethics panels, 327-328 personhood definitions, 234-239

pluripotent alternatives to embryonic stem cells, 87-88 religious viewpoints, 235-238, 240, 244.247 research goals, relationship to, 247-248 scientific community's self-policing, 267 - 268SCNT technique, 89-91, 108-114, 242, 337 selling of eggs problem, 241 Warnock Commission viewpoint, 238 photoreceptor cells, 309 physical therapy for ALS, 146 Pittsburgh compound B, 140 placebo, 177, 335 placebo effect, 317, 335 placenta, 61, 91, 335 plant hybrid, 104 plant patent, 280 plasticity (transdifferentiation), 17-18, 338 platelets, 127, 204, 336 pluripotent stem cells defined, 61, 87, 333, 336 engineering of, 98-99 generating, 93-96 reproductive sources, 97 from tumors, 96-97 polarized light, 112 policies and laws abortion, 234, 253, 255, 262 about, 249-250 drug therapy regulation, 178–179 human subjects, research on, 259-261 in other countries, 266-267 patents and licenses, 279-283 political pressures, 262-264 research regulation and funding about. 251–252 basic research and innovation encouragement, 256-258 funding role, 252-256 restrictions on questionable practices, 259-261 safety regulation, 258-259 scientific and medical societies, 267-268 state laws, 228-229, 264-265 politics of stem cell research, 262-264 prediabetic, defined, 168 pre-implantation embryonic stem cell, 336

pre-implantation genetic diagnosis (PGD), 93-94 Presbyterian churches' viewpoint, 236 President's Council on Bioethics (Web site), 328 primitive streak, 119, 238, 262, 336 primordial germ cell, 96, 97 private compared to public cord blood banks, 223-224 private sector and stem cell research academic funding, 275-276 argument for support from, 273 corporate funding, 258, 277-279, 291-292 nonprofit foundation funding, 276–277 profits and funding about, 269 government funding role agency sources of, 252-253 benefits for stem cell research, 274 Bush administration rules, 251, 254, 263, 272, 294 pro and con arguments on, 273-274 regulation in U.S., relationship to, 251-252, 253-256 research-only embryos, restriction against, 243 U.S. system, 269-270, 271-272 patents and licenses, 279-283 private sector role academia, 275-276 argument for, 273 corporations, 258, 277-279, 291-292 nonprofit foundations, 276-277 progenitor cell, 14, 73, 127, 336 prokaryotic cell, 12 protein, OCT-4, 18 protein isolation, 14 Protestant churches' viewpoint, 236, 237 public bank donations, 225 public sector role in stem cell research. See also federal government and stem cell research international attitudes about stem cell research, 266-268 state level, 228-229, 264-265, 272 pulse generator, 155

• Q •

quickening, 234 quiescence, 304 quiescent adult stem cell, 74

• R •

rabbit eggs as growth medium for stem cells, 118 radical mastectomy, 125 Raelian religious sect, 113 randomized clinical trial, 315 reach-through royalty provision, 282 reactive oxygen species, 133 receptor sites, 28 recombinant DNA, 110, 336 red blood cells. 204 red marrow, 203 regeneration of body parts, 38-40 regenerative medicine adult stem cell successes, 292-293 ALS (Lou Gehrig's disease), 66, 107, 145-149, 306-307, 329 Alzheimer's disease, 139, 140–144 animal treatments, applying to humans, 196 assessment of, 187-192, 312-313, 317 Batten Disease, 149-150, 195 bone marrow transplants for leukemia, 185 cancer history of treatment attempts, 123-124 treatments, 15, 130-131, 134-135, 187-188, 212, 303-304 cerebral palsy, 150-151 development of, 313-314 diabetes, 166-169, 191-192, 309-310 drug therapies about, 171 ALS (Lou Gehrig's disease), 107, 146-149 Alzheimer's disease, 139, 141-143 cancer treatment, 130-131, 134, 135

clinical trials' role, 174-175, 176, 177-178, 179 cost of development, 174-179 development process, 171-179 genetic origins for response differences, 44 Huntington's disease, 152 for immune-suppression in transplant cases, 46-47, 48-49, 210-211 insulin therapy using cloning technique, 110 multiple sclerosis, 190 Niemann-Pick disease, 153 Parkinson's disease, 154, 155, 156 pros and cons of current, 172-174 regulation of, 178-179 safety and effectiveness, 176-178 stem cell role in, 68, 111, 179-180, 278-279, 290-291, 304-305 tolerance issue, 173 experimental, 314–315 expert opinions, 319 grafting skin to treat burns, 186–187 heart disease challenges with stem cells, 163-164 clinical trials involving stem cells, 162-163, 189-190, 301-302 current treatment options, 160-161 stem cell treatment, 161-162, 189-190, 309 hidden costs. 318-319 Huntington's disease, 151-152, 306-307 independent oversight and regulation of clinics, 312 informed consent issue, 319-320 liver disease, 159-160, 164-166 lupus. 192 multiple sclerosis, 190, 308 Niemann-Pick Disease, 152–153, 335 obstacles to, 295-302 Parkinson's disease, 153-156, 306-307, 335 patient testimonials, 317-318 replacement tissues, 305–306 reversing retinal degeneration, 308-309 risks and side effects, 315-317

scams and charlatans, 320-321 spinal cord injuries, 67, 156–157, 194-195, 306 as stem cell purpose, 19 stroke, 157-158, 307 regulation about, 251-252 drug therapy, 178-179 federal role, 251-252, 253-256, 258-261.288 human subjects, research on, 259-261 scientific community's views, 261 state role, 228-229, 264-265 stem cell treatment clinics, 312 relapse, preventing disease, 211 religious positions on stem cell research, 235-238, 240, 244, 247 replacement, cell, 19, 24 replacement tissues, 305-306 reproductive cloning defined, 336 legal restrictions on, 263, 265 SCNT, 89-91, 108-114, 242, 337 reproductive sources for pluripotent cell types, 97 reproductive system, 32 reprogramming, defined, 336 research embryos, 241-242, 288-289 research model, 109 research on stem cells about. 87 animals, working with, 12-15, 142 clinical trials ALS treatments, 146, 147-149 Alzheimer's disease, 140-142 animal treatment potential for humans. 196 Batten Disease, 150 cancer, 189 challenges of, 197-199 cost of, 301 defined, 330 design. 302 double-blind, 292, 331 drug development, relationship to, 174 - 179

Index 355

research on stem cells (continued) heart disease, 162-163, 301-302 NIH registry, 326 Parkinson's disease, 156-157 spinal cord injury, 67, 157, 194-195 controversy overview, 87-88 current efforts, 66-67 drug therapies, relationship to, 179-180, 290-291, 304-305 embryonic stem cells. 65-68. 253-254. 293, 294 ethical issues. See ethical issues funding and profits. See funding and profits future directions, 67-68 goals, 19, 247-248 history about, 37 cloning animals, 50 genetic controls in cells, 41-46 regeneration of body parts, 38-40 transplanting organs and tissues, 46-49 in vitro fertilization, 49-50 human cloning, compared to, 291 identifying stem cells, 18-19 introduction, 1-7 laws and policies. See laws and policies mixed-and-matched cells. See mixing and matching cells nuclear transfer techniques ANT (altered nuclear transfer), 91, 242, 329 defined, 88 embryo development, 91-93 SCNT (somatic cell nuclear transfer), 89-91, 108-114, 242, 337 patents and licenses, 280-281 pluripotent cell generation, 93-96 politics of, 262-264 resources list, 323-328 status and public interest, 11 treatments from. See treatments unanswered questions, 19-20 resources list, 323-328 respiratory system, 32 retina, 308 retinal degeneration, reversing, 308-309

ribonucleic acid (RNA), 25, 42, 336 Rilutek, 146 risk-benefit profile, 172 risks and side effects of treatment, 315–317 RNA (ribonucleic acid), 25, 42, 336 RNA viruses, 42 Rockefeller Institute of Government (Web site), 272 rods (photoreceptor cell), 309 *Roe v. Wade* abortion case, 234, 253, 262 rogue cells, 15 Roman Catholic viewpoint, 235, 236, 240, 247

• 5 •

safety issues clinical trials, 197-198 drug therapy, 176–178 regulation, 258-259 stem cell treatment, 300-301 sarcoma, 131 Schwann cell, 24, 336 Science Daily (Web site), 328 scientific community. See also research on stem cells on ethical issues, 243, 244-245, 246, 265 goals of stem cell research, 247-248 National Academy of Sciences, 243, 323-324 on regulation, 261 self-monitoring efforts through professional societies, 267-268 stem cell research efforts, 65-68 SCNT (somatic cell nuclear transfer), 89-91, 108-114, 242, 337 self-renewing capacity of stem cells, 13, 35 seminal vesicle, 32 sensory axon, 23 sensory neuron, 23, 336 shrinking of brain tissue in Alzheimer's, 139 SIDS (sudden infant death syndrome), 244 - 245signal types, cell communication, 29

single twin, 106 single-blind trial, 177 single-celled organism, 25 sizing cells, 23-24 skeletal muscle, 32, 82 skeletal system, 32 skin, 14-15, 40, 83, 186-187 smooth muscle, 32 social justice imperative in stem cell research. 268 soft inheritance in heredity, 41 somatic cell nuclear transfer (SCNT), 89-91, 108-114, 242, 337 somatic stem cells, 89, 329, 337. See also adult stem cells specialization, cell, 14, 16 speech therapy for ALS, 146 Spemann, Hans (researcher), 50 spermagonial stem cell, 97 spinal cord injuries, 67, 156–157, 194-195, 306 spinal muscular atrophy, 66 spleen colonies, 13 sporadic anemia, 329 sporadic disease, 141, 337 state laws and regulations, 228-229, 264-265 statins, 141, 172 Stem Cell Research News (Web site), 328 stem cells adult. See adult stem cells amniotic, 329 banking about, 221 choosing a bank, 227-230 cord-blood banking process, 222-227 depositing into, 224-226 future of, 230 private compared to public storage, 223-224, 225 problems with, 226-227 blood-forming, 72, 78, 202, 333 from bone marrow, 13-14, 78-81, 185, 203-204 brain, 81-82, 143 cancer stem cells, 96-97, 129-135

compared to other cells, 33-35 cultivating for use, 296-297 culturing process, 13 defined, 33, 72, 337 directing cell specialization, 62-63 elimination, 297-298 embryonic. See embryonic stem cells endothelial, 78 engineering of, 98-99 fetuses, relationship to, 97, 255, 287-288 finding in tissue, 77-84 in gene therapy, 209 germ layers defined, 333 ectoderm, 56, 331 embryoid bodies, 62, 332 endoderm, 56, 282, 332 mesoderm, 56, 334 growing pure, 64-65 harvesting from bloodstream, 204-205 heart, 82 hematopoietic, 72, 78, 202, 333 identifying, 17, 46-47 intestinal, 82 lung, 83 mesenchymal, 49, 78, 81, 88, 334 multipotent capability, 61, 71, 329, 334 myths about, 287-294 neuronal, 142, 150, 335 pancreatic, 83 pluripotent, 61, 87, 96-99, 333, 336 properties, 16-18 pros and cons of sources, 205-206 replacement tissues, 19 research on. See research on stem cells self-renewing, 13 skin. 83 somatic, 89-91, 108-114, 242, 329, 337 spermagonial, 97 totipotent, 61, 338 tracking, 299-300 transporting, 299-300 treatments for. See treatments from tumors, 96-97 "Stembook" (Web site), 325 stent, 160

Index 357

sterile, defined, 214 stomach, properties of, 30 storing stem cells about. 221 choosing a bank, 227-230 cord-blood banking process, 222-227 depositing into, 224-226 future of, 230 private compared to public storage, 223-224.225 problems with, 226-227 straight face test, 240 striatum, 152 stroke, 157-158, 307 stromal cells, 63 subculturing stem cells, 60 substantia nigra, 152 Sudden Infant Death Syndrome (SIDS), 244-245 suicide, cell, 126 superoxide dismutase 1, 147 symmetric cell division, 22, 337 synapses, 24, 329, 330, 337 syngeneic transplant, 206, 207 synthesis, cell, 22, 337

• 7 •

tactile signals in cell communication, 29 Tagliacozzi, Gaspare (plastic surgeon), 46, 48 Taoism, 20 teratocarcinoma, 96 teratoma, 18, 96, 301, 337 terminally differentiated cell, 130, 337 testimonials, patient, 317-318 therapeutic cloning, 108-109, 111, 337 Thomson, James (researcher), 1, 241, 262 Till, James (researcher), 13-14, 46, 47, 79 tissue stem cells, 33, 71, 72, 73, 329. See also adult stem cells tissue type, 20, 209 tissues and organs, building, 29-33 totipotent stem cells, 61, 338 trachea, 32

transcription factors, 19 transdifferentiation, 17-18, 338 translational research, 256, 338 transplants about, 201-202 allogeneic, 206, 207 appropriateness, 202 autologous, 186, 206, 207 bone marrow, 185 challenges of. 203-211 chimera complications, 107 current state of practice, 218-219 donating organs and tissues for, 206-210, 215-218 graft-versus-host disease controlling, 211, 304 defined, 333 donor-recipient match for transplants, relationship to, 206 function in transplants, 48, 185 history, 46-49 immune response, overcoming, 46-47, 48-49, 210-211 stem cell role in, 49, 203-206, 211-215 syngeneic, 206, 207 treatments adult stem cell successes, 292-293 ALS (Lou Gehrig's disease), 66, 107, 145-149, 306-307, 329 Alzheimer's disease, 139, 140-144 animal treatments, applying to humans, 196 assessment of, 187-192, 312-313, 317 Batten Disease, 149-150, 195 bone marrow transplants for leukemia, 185 cancer history of treatment attempts, 123-124 treatments, 15, 130-131, 134-135, 187-188, 212, 303-304 cerebral palsy, 150-151 development of, 313-314 diabetes, 166-169, 191-192, 309-310 drug therapies about, 171

Index

ALS (Lou Gehrig's disease), 107, 146 - 149Alzheimer's disease, 139, 141-143 cancer treatment, 130-131, 134, 135 clinical trials' role, 174-179 cost of development, 174-179 development process, 171-179 genetic origins for response differences, 44 Huntington's disease, 152 for immune-suppression in transplant cases, 46-47, 48-49, 210-211 insulin therapy using cloning technique, 110 multiple sclerosis, 190 Niemann-Pick disease, 153 Parkinson's disease, 154, 155, 156 pros and cons of current, 172-174 regulation of, 178-179 safety and effectiveness, 176-178 stem cell role in, 68, 111, 179-180, 278-279, 290-291, 304-305 tolerance issue, 173 experimental, 314-315 expert opinions, 319 grafting skin to treat burns, 186–187 heart disease challenges with stem cells, 163-164 clinical trials involving stem cells, 162-163, 189-190, 301-302 current treatment options, 160–161 stem cell treatment, 161-162, 189-190, 309 hidden costs, 318-319 Huntington's disease, 151-152, 306-307 independent oversight and regulation of clinics. 312 informed consent issue, 319-320 liver disease, 159–160, 164–166 lupus, 192 multiple sclerosis, 190, 308 Niemann-Pick Disease, 152-153, 335 obstacles to, 295-302 Parkinson's disease, 153–156, 306-307, 335 patient testimonials, 317-318

replacement tissues, 305-306 reversing retinal degeneration, 308-309 risks and side effects, 315-317 scams and charlatans. 321–322 spinal cord injuries, 67, 156–157, 194-195, 306 as stem cell purpose, 19 stroke, 157-158, 307 Trembley, Abraham (zoologist), 39 trophectoderm, 91, 330, 338 tubal pregnancy, 244 tumor. See also cancer benign, 128, 301 collecting stem cells from, 96-97 teratoma, 18, 96, 301, 337 tumor suppressor genes, 126, 338 Tuskegee Syphilis Study, 259 Type 1 diabetes, 167–168, 191–192 Type 2 diabetes, 168-169 Type A, Niemann-Pick Disease, 152 Type B, Niemann-Pick Disease, 152 Type C, Niemann-Pick Disease, 153

• 11 •

umbilical cord blood about, 84-85 banking of about. 221 banking process, 222-227 choosing a bank, 227-230 depositing into, 224-226 private compared to public storage, 223-224, 225 problems with, 226-227 defined, 331, 338 medical uses, 221–222 as stem cell source, 205 undifferentiated cells, 338. See also stem cells Unitarian Universalist Association's viewpoint, 236 United Church of Christ's viewpoint, 236 United Network for Organ Sharing (UNOS) (Web site), 215

United States Patent and Trademark Office (USPTO), 279–280 University of California–San Diego Stem Cell Initiative (Web site), 325–326 ureter, 32 urethra, 32 uterus, 338 utility patent, 280

• 1/ •

ventricle, 81 venture capital, 278 vesicle, 26 viability, fetal, 57

• W •

WARF patents, 281–282 Warnock Commission viewpoint, 238 Watson, James (researcher), 43 web sites AABB, 229 American Society of Reproductive Medicine, 327 Be The Match Foundation, 217, 326 Clonaid, 113 FACT, 229 Harvard Stem Cell Institute, 325 ISO, 229 ISSCR, 266, 267-268, 325 Medical News Today, 328 National Academies, 267, 323-324 National Academy of Sciences, 243, 323-324 National Bone Marrow Program, 326 National Cancer Institute, 324

National Heart, Lung, and Blood Institute, 324 National Human Genome Research Institute, 324 National Institute of Diabetes and **Digestive and Kidney Diseases**, 324 National Institute of Neurological **Disorders and Stroke**, 324 National Institutes of Health (NIH), 324 National Marrow Donor Program, 215, 217 Nobel Foundation, 327 President's Council on Bioethics, 328 Rockefeller Institute of Government, 272 Science Daily, 328 Stem Cell Research News, 328 "Stembook," 325 University of California-San Diego Stem Cell Initiative, 325-326 **UNOS. 215** Weismann, August (biologist), 41, 50 Weissman, Irving (researcher), 46 white blood cells, 204 Wilkins, Maurice (researcher), 43 Willowbrook State School hepatitis study, 260 Witte, Owen (researcher), 1

• ¥ •

Yamanaka, Shinya (researcher), 98 yeast compared to human cells, 12 yellow marrow, 204

• Z •

zygote, 55, 338

Notes

Notes

Notes

Notes