

Index

A

- Abdominal ultrasonography (US), 190
- ¹¹C acetate, 10, 60, 63–65
- Acetyl coenzyme A, 51, 67, 202
- AD. *See* Alzheimer's disease (AD)
- Adaptive immune system, 158
- Adrenoleukodystrophy (ALD), 207, 208
- Alanine transaminase (ALT), 224
- Alexander disease, 313, 314
- Alzheimer's disease (AD), 210, 211
- Amino acid metabolism, 132, 134, 167, 191, 205, 247
- Amino acid metabolism disorder, 205, 206
- AMP-activated protein kinase (AMPK), 34, 146, 147
- Anabolic metabolism, 30
- Anaplerosis, 248
- Arterial spin labeling (ASL), 295, 296
- Aspartate transaminase (AST), 224
- Autofluorescence microscopy, 6
 - FLIM imaging, 116
 - NADH and FAD
 - autofluorescence properties, 112
 - in cellular respiration, 113, 114
 - physiological origins of variations, 114, 115
 - for redox ratio imaging, 115, 116

B

- BAT. *See* Brown adipose tissue (BAT)
- Batten disease, 300, 301
- Beta cell mass (BCM), 178–184, 186–188, 190, 193
- Beta-glucuronidase sensor, 97
- Biochemical principles, 29–31
- Bioluminescence imaging (BLI), 4, 6, 18, 19
- Bioluminescence resonance energy transfer (BRET), 19
- Biotinidase deficiency, 315
- Blood oxygenation imaging
 - optical coherence tomography, 110, 111
 - photoacoustic microscopy, 105–108
 - two-photon and confocal microscopy, 108–110
- Blood-brain barrier (BBB), 53, 58, 59
- Blood-oxygen-level dependent (BOLD)
 - method, 53, 103, 200, 210
- Brain imaging
 - AD, 210–211
 - amino acid metabolism, 205

- central energy metabolism disorders, 202–203
- cholesterol synthesis disorders, 204, 205
- depression, 215–217
- diabetes, 213–215
- DTI/DSI, 201
- fMRI, 200
- history, 199–200
- HP-MRI, 201
- lysosomal storage disorders
 - Fabry's disease, 208
 - Hunter syndrome, 209
 - Krabbe's globoid cell dystrophy, 209
 - metachromatic leukodystrophy, 207
 - Niemann-Pick disease, 208–209
 - Sandhoff disease, 209
 - Tay-Sachs, 209
- MRSI, 200–201
- organic acidosis disorder, 206, 207
- PD, 211–213
- peroxisome disorder, 207
- SPECT/PET, 201
- SPM, 202
- urea cycle disorders, 203
- Branched-chain ketoacid dehydrogenase complex (BCKDC), 40
- Branched-chain ketoaciduria. *See* Maple syrup urine disease
- Brown adipose tissue (BAT), 57

C

- Canavan disease, 205
- Cancer metabolism, 136
 - amino acid metabolism, 132–134
 - glioblastomas, PI3K/AKT/mTOR pathway, 135, 136
 - glycolysis, 130–132
 - IDHs mutations (*see* Isocitrate dehydrogenases (IDHs) mutations, gliomas)
 - metformin, 146
 - oncogenic reprogramming, 135–143
 - one-carbon metabolism, 133–135
 - pyruvate dehydrogenase, 146
 - therapeutic targeting, 143–146
 - vitamin C, 146
 - Warburg effect, 129–131

- Cancer stem cells model, 69
- Carnitine palmitoyl transferase (CPT), 246, 307, 308
- Cell-autonomous metabolism
- anabolic, 33
 - catabolic, 31, 32
 - glucose metabolism, 31
 - regulation of metabolic activity, 33–36
- Central energy metabolism, 202
- Cerebral creatine deficiency, 309, 310
- Cerebral glucose metabolic rate (CMRglu), 215
- Cerenkov luminescence imaging, 4, 6, 19
- Chelators, 14, 50, 121, 190
- Chemical exchange saturation transfer (CEST), 92–94
- Chemical shift imaging technique, 85
- Cholesterol synthesis disorder, 204, 205
- Choline, 66–68
- Choline acetyltransferase (ChAT), 67
- Chronic encephalopathies of infancy
- lipidoses
 - CPT II deficiency, 307, 308
 - MPS, 308, 309
 - mucopolidoses type I (I-cell disease), 306, 307
 - mucopolidoses type IV, 306, 307
 - lysosomal disorders
 - Gaucher disease, 305
 - Krabbe's disease, 301–303
 - MLD, 303, 304
 - NCL, 300, 301
 - Niemann-Pick disease type C, 305, 306
 - Tay-Sachs, 305
 - mitochondrial disorders
 - Leigh disease, 295, 296
 - MELAS, 297, 298
 - pyruvate dehydrogenase deficiency, 299, 300
 - white matter changes, 298, 299
 - peroxisomal disorders
 - X-ALD, 293–295
 - Zellweger syndrome, 292, 293
 - PKU, 291, 292
- Citric acid cycle, 202
- Coherent anti-Stokes Raman scattering (CARS), 235
- Computed tomography (CT). *See* Positron-emission tomography/computed tomography (PET/CT)
- Continuous wave (CW) techniques, 101
- Contrast-enhanced T₁- and T₂-weighted technique, 233
- Copper (Cu)-diacetyl-bis(N4-methylthiosemicarbazone) (Cu-ATSM), 70
- Cyclooxygenase (COX) activity, 167–168
- D**
- Danger-associated molecular patterns (DAMPs), 155
- Deep-tissue optical imaging
- advantages, 100
 - diffuse optical technologies
 - brain oxygenation level tracking, 103, 104
 - CW techniques, 101
 - FD techniques, 101
 - features, 100
 - for small animal imaging, 104
 - in breast cancer, 102, 103
 - TD techniques, 101
 - with anatomic imaging modalities, 102
 - optical absorption, 100
 - optical scattering, 100
- Depression, 215–217
- Diabetes
- blood glucose levels, 177
 - etiology, 177
 - GLP-1 agonists, 177
 - imaging, 180–191
 - BCM, 178, 179
 - Edmonton Protocol, 179
 - modalities, 179
 - pancreatic imaging (*see* Pancreatic imaging)
 - initial occult phase, 177
 - medications and lifestyle changes, 175, 177
 - molecular imaging outside pancreas, 191
 - occult phase, 177
 - pancreas/islets physiology, 175–177
 - type 1 and 2 diabetes, 175, 177, 178
- Diabetes mellitus, 41, 42
- Diffuse optics, 100
- Diffusion-weighted imaging (DWI), 233, 284, 285, 288–290, 294, 296, 297, 299
- 3,4-dihydroxy-6-[¹⁸F]fluoro-L-phenylalanine (FDOPA), 58–60, 211–213
- Dixon method, 230, 231
- DNA synthesis, 61, 165, 166
- DNP technique, 90, 91
- Doppler imaging techniques, 15
- Drug-induced parkinsonism (DIP), 213
- Dynamic nuclear polarization (DNP) technology, 90, 91, 234, 255, 256, 258
- E**
- Edmonton protocol, 179
- Elastase, 168
- Endocytosis, 164–165
- Enhanced permeation and retention (EPR) effect, 15
- F**
- Fabry's disease, 208
- Fat fraction, 227–229
- Fatty acid synthase (FASN), 62–65
- Fatty acid synthesis (FAS), 62, 63
- Fatty liver disease
- CT, 226, 227
 - MR techniques
 - ¹H MRS and fat fraction, 227–229
 - contrast-enhanced T₁- and T₂-weighted, 233
 - DWI, 233
 - fat imaging and Dixon method, 229–231
 - MRE, 231–233
 - MTC, 233
 - non-contrast-enhanced CT, 226, 227
 - preclinical techniques

magnetic resonance, 234, 235
 optical imaging, 235
 PET, 235
 US imaging
 B-mode, 224, 225
 TE, 225, 226
 FDOPA. *See* 3,4-dihydroxy-6-[¹⁸F]
 fluoro-L-phenylalanine (FDOPA)
¹⁸F-fluciclovine (18F-FACBC), 11, 167
¹⁸F]fluoroacetate, 63, 65
¹⁸F]fluorodeoxyglucose (FDG) PET imaging
 AD dementia, 210
 BAT, 57
 carbohydrate based tracers, 51–52
 dementia, 55
 epilepsy, 54
 fatty liver disease, 235
 follicular lymphoma, 53
 glucose metabolism, 165
 myocardial imaging, 56, 57
 myocardial ischemia, 261
 neuroimaging, 53–55
 oncologic imaging, 52, 62, 67, 68
 uses, 56
¹⁸F-fluoro-deoxythymidine (¹⁸F-FLT), 11, 165, 166
 4-[¹⁸F]-(2S,4R)-fluoroglutamine (FGLn), 59
 16-[¹⁸F]fluorohexadecanoic acid (FHDA), 66
¹⁸F]Fluoromisonidazole (FMISO), 70, 71
 Fluorescein isothiocyanate (FITC), 6, 18
 Fluorescence imaging (FLI), 4, 6, 16–18, 185,
 188–190, 192
 Fluorescence lifetime imaging microscopy (FLIM),
 116, 121
 4-(3-[¹⁸F]-(2S,4S)-fluoropropyl) glutamate (FSPG), 59
 Folate receptor, 164
 Frequency domain (FD) techniques, 101
 Frontotemporal dementia (FTD), 210
 Functional MRI (fMRI), 200, 205

G

Gadolinium-chelates, 94–97
 Gadolinium-ethoxybenzyl-diethylenetriamine
 pentaacetic acid (Gd-EOB-DTPA), 233
 Gadopentetate dimeglumine (Gd-DTPA),
 14, 94, 96, 164
 Gamma-aminobutyric acid (GABA), 90
 Gastrin-releasing peptide receptor (GRPR), 11, 60
 Gaucher disease, 207, 305
 Gjedde-Patlak method, 51
 Glioma-specific CpG island methylator phenotype
 (G-CIMP), 139
 Glucagon-like peptide-1 (GLP-1) agonists, 177, 181,
 184–186, 189, 192, 265
 GlucoCEST enhancement (GCE), 93, 95
 Glutaminolysis, 133
 Glutaric aciduria (GA) type I, 288, 289
 Glutaryl-CoA dehydrogenase (GCDH), 288
 Glyceraldehyde-3-phosphate dehydrogenase
 (GAPDH), 248

Glycine dehydrogenase (GLDC), 135
 Glycogenolysis, 247, 248
 Glycolysis, 202, 247, 248
 Glycolytic pathway, 51, 52
 Gradient-recalled echo (GRE), 229
 Green fluorescent protein (GFP), 6
 Guanidinoacetate methyltransferase (GAMT)
 deficiency, 309

H

Henderson-Hasselbalch relationship, 257
 Hepatorenal contrast, 225
 Hunter syndrome, 209
 Hurler syndrome, 209, 309
 β-hydroxybutyrate, 245, 246
 Hyperammonemia, 203, 204
 Hyperpolarization MRI (HP-MRI) techniques, 201
 Hyperpolarized (HP) MRS, 90–92
 Hyperpolarized ¹³C spectroscopy, 92, 234,
 255, 256, 262, 263
 Hypoxia, 69–71

I

Image inflammation, 158–160
 Immune metabolism
 cell-surface receptors and transporters imaging
 endocytosis, 164–165
 folate receptor, 164
 iron-binding proteins, 163–164
 scavenger receptor, 164
 translocator protein, 163
 enzyme activity imaging
 cyclooxygenase activity, 167–168
 elastase and matrix metalloproteinase activity, 168
 ¹H-NMR, 168
 MRS, 168
 myeloperoxidase activity, 167
 hybrid PET/MR imaging, 169
 hyperpolarized MR, 169
 lymphocytes, 160, 161
 macrophages, 161, 162
 metabolic and transcriptional data, integrative
 analysis, 169
 metabolic profiles, 156
 metabolic substrates imaging
 amino acid metabolism, 167
 DNA synthesis, 165, 166
 glucose metabolism, 165
 lipid synthesis, 166
 neutrophils, 162, 163
 T-cell function, 169
 Inborn errors of metabolism (IEMs), 40, 283, 291
 Alexander disease, 313–315
 biotinidase disease, 315
 cerebral creatine deficiency, 309, 310
 chronic encephalopathies (*see* Chronic
 encephalopathies of infancy)
 diagnosis, 281

- Inborn errors of metabolism (IEMs) (*cont.*)
 etiologies, 281
 gray matter, 282
 molybdenum cofactor deficiency, 310, 311
 neonatal (*see* Neonatal-onset metabolic diseases)
 pyruvate dehydrogenase deficiency, 300
 Rett syndrome, 311, 312
 SLOS, 312, 313
 substrate-depletion model of injury, 282
- ¹¹¹In-pentetreotide, 12
- Infantile NCL (INCL), 300, 305
- Inflammation
 adaptive immune system, 158
 chronic inflammation, 155
 definition, 155
 image inflammation, 158–160
 immune cells recruitment, 157
 inflammatory responses, 155, 156
 innate immune system, 157
 stepwise model, 155, 156
 systemic inflammatory responses, 158
- Innate immune system, 157
- Intrahepatic triglyceride (IHTG), 223
- ¹²³I-beta-methyl-P-iodophenylpentadecanoic acid
 (¹²³I-BMIPP), 250
- Iron-binding proteins, 163–164
- Isocitrate dehydrogenases (IDHs) mutations, gliomas
 Arg132 mutation, 137
 (D)-2HG, 139, 140
 G-CIMP, 139
 IDH1, 136–138
 IDH2, 136, 137
 IDH3, 136
 JmjC histone lysine demethylases, 139
 α-ketoglutarate conversion, 137, 138
 Kras^{G12D} mutation, 139
 c-MYC proto-oncogene, 140–142
 NADPH production, 137
 renal carcinomas, 142, 143
 SIRT3, 137
 TET2-mediated 5-mC hydroxylation, 139
 tumorigenic effects, 139
- J**
- Jumonji C (JmjC) histone lysine demethylases, 139
- K**
- Ketone body synthesis, 63
 Krabbe's disease, 301–303
 Krabbe's globoid cell dystrophy, 209
 Krebs cycle, 202
 k-space, 85
 Kufs' disease, 300
 Kupffer cell activity, 234
- L**
- Lactic acidosis, 203
 Larmor frequency, 83
 Late-infantile NCL (LINCL), 300
 Leigh's syndrome, 202, 203, 296
 Lewy bodies (DLB), 210
 Lipid synthesis, 142, 143, 161, 166, 167
 Liver stiffness, 226, 231, 232, 235, 236
 Liver/spleen attenuation ratio, 227
 Long-chain fatty acid (LCFA), 66, 308
 Lumped constant, 52, 252, 254
 Lysosomal storage disorder, 207
- M**
- Magnetic resonance elastography (MRE), 231–233
- Magnetic resonance imaging (MRI)
 biomedical applications of nuclei, 86
 conventional, 13
 description, 82
 fatty liver disease, 234
 hyperpolarization techniques, 14 (*see also* Magnetic resonance spectroscopy (MRS))
 principle, 13
 relaxation, 84
 scanners, 83
 spatial encoding, 84, 85
 spin, 82
 SPIO, 14
 tissue contrast, 84
- Magnetic resonance spectroscopy (MRS), 168
 clinical application, 86–87
 description, 82
 HP ¹³C MRS, 90 (*see also* Magnetic resonance imaging (MRI))
 hyperpolarized, 90–92
 NMR-active nuclei, 86
 nuclei in situ, 87–90
 echo time, 87
 GABA, 90
 glioblastoma multiforme, 88–89
 maple syrup urine, 88
 metabolic reprogramming, in prostate cancer, 89
 normal brain, 87
 pH-sensing, 96–97
 PRESS, 85
 STEAM, 85
- Magnetic resonance shift imaging (MRSI), 86–89,
 91–93, 200, 201, 203–209
- Magnetization transfer contrast (MTC), 233
- Mammalian target of rapamycin (mTOR) pathway, 58,
 134–136, 140
- Maple syrup urine disease (MSUD), 88, 205, 206, 283,
 284
- Matrix metalloproteinase (MMP), 168
- Metabolic defects
 cancer, 37–40
 diabetes mellitus, 41, 42
 IEM
 MSUD, 40, 41
 PKU, 40, 41
- Metabolic flexibility, 271
- Metabolic infarctions, 287
- Metabolic pathways structure, 29

Metabolic programming, 89, 97
 Metabolic regulation, 30
 Metachromatic leukodystrophy, 207
 Metachromatic leukodystrophy (MLD), 303, 304
 Metformin, 147
¹¹C-Methionine, 11
^{99m}Tc-methylene diphosphonate (^{99m}Tc-MDP), 12
 Methylmalonic academia (MMA), 207, 286, 287
 Mild cognitive impairment (MCI), 210, 211
 Mitochondrial defect, 203
 Mitochondrial encephalomyopathy, lactic acidosis, and stroke-like episodes (MELAS), 297, 298
 Mitochondrial encephalopathy with ragged-red fibers (MERRF) syndrome, 203
 Mitochondrial encephalopathy, lactic acidosis, and stroke-like episodes (MELAS) syndrome, 203, 297, 298
 Mitochondrial neurogastrointestinal encephalopathy (MNGIE) syndrome, 203
 Molecular imaging
 advantages, 3
 definition, 3
 future perspectives, 19
 MRI, 13–15
 nuclear imaging, 6–8
 optical imaging
 bioluminescence, 18–19
 Cerenkov luminescence, 19
 fluorescence, 16–18
 PET, 8–12
 sensitivity, penetration depth and spatial resolution, 4
 SPECT, 12–13
 timeline history, 5–7
 ultrasound, 15–16
 Molybdenum cofactor deficiency, 310, 311
 Monoclonal antibodies (mAb), 11
 Monosaccharides, 50
 Morquio syndrome, 209
 MRI perfusion imaging, 201
 MSUD. *See* Maple syrup urine disease (MSUD)
 Mucopolipidosis type II (I-cell disease), 306, 307
 Mucopolipidosis type IV, 306, 307
 Mucopolysaccharidoses, 209
 Mucopolysaccharidoses (MPS), 308, 309
 Multi-hit hypothesis, 223
 Multispectral optoacoustic tomography (MSOT), 15
 Multisystem atrophy (MSA), 211, 213, 214
 Myeloperoxidase activity, 167
 Myocardial hypertrophy
 ¹³C HP, 265, 266
 PET and SPECT, 264–265
 potential synergies, 266, 267
 Myocardial ischemia
 ¹³C HP, 262, 263
 PET and SPECT, 261, 262
 potential synergies, 263
 Myocardial metabolism
 ¹³C HP
 acetate, 258
 butyrate, 258
 diabetes and insulin, 271

 future developments, 272
 lactate, 258
 potential synergies, 271
 probe and pathways, 256
 pyruvate, 256, 257
 substrate competition, 259
 energy production
 acyl-CoA, 245, 246
 anaplerosis, 248
 glycolysis, 247, 248
 lactate, 247
 pyruvate, 247
 pyruvate compartmentation, 249
 PET and HP
 advancement, 260
 diabetes and insulin, 268, 269, 271
 myocardial hypertrophy (*see* Myocardial hypertrophy)
 myocardial ischemia (*see* Myocardial ischemia)
 obesity, 267–271
 potential synergies, 271
 radionuclide methods, 250, 251
 validation and potential, 272
 pyruvate, 257, 258
 radionuclide methods
 carbohydrate metabolism, 252
 fatty acid metabolism, 253–255
 lactate metabolism, 252, 253
 oxygen consumption, 251, 252
 PET, 250, 251
 SPECT, 250

N

Neonatal-onset metabolic diseases
 aminoacidopathies
 MSUD, 283, 284
 NKH, 285
 GA type 1, 288
 organic acidemias
 GA type 1, 288, 289
 MMA, 286, 287
 PA, 288
 UCD, 289, 290
 Neuronal ceroid lipofuscinosis (NCL), 300, 301
 Nicotinamide adenine dinucleotide (NADH), 51, 70
 Nicotinamide adenine dinucleotide (NADH) and flavin adenine dinucleotide (FAD)
 autofluorescence properties, 112
 in cellular respiration, 113, 114
 physiological origins of variations, 114, 115
 Nicotinamide adenine dinucleotide phosphate (NADPH), 51
 Nicotinamide phosphoribosyltransferase (NAMPT), 39
 Niemann-Pick disease, 208
 Niemann-Pick disease type C, 305, 306
¹³C NMR isotopomer, 249
 Nonalcoholic fatty liver disease (NAFLD), 223, 224, 235
 Nonischemic cardiomyopathy, 265
 Nonketotic hyperglycemia (NKH), 205, 285
 NP-DO3A, 96

- Nuclear imaging
 advantages, 8
 definition, 6
 PET principle, 8–12
 SPECT principle, 9, 12, 13
- O**
- Obesity and diabetes
 cardiomyopathy, 267
 HP MR, 271
 PET
 sexual dimorphism, 268, 269
 type 2 diabetes mellitus, 268
 western diet, 270
 women, 267–270
- One-carbon metabolism, 34, 133–135
- Optical coherence tomography (OCT), 110, 111
- Optical imaging, 100–121
 autofluorescence microscopy (*see* Autofluorescence microscopy)
 bioluminescence imaging, 18
 Cerenkov imaging, 19
 fatty liver disease, 235
 fluorescence imaging, 16–18
 OMCA
 cell signaling, 120, 121
 classes, 118
 enzyme activity, 119
 local chemical environment, 119, 120
 metabolic processes, 117
 nutrient uptake, 118
 oxygenation imaging (*see* Oxygenation imaging)
- Optical metabolic contrast agents (OMCA)
 cell signaling, 120, 121
 classes, 118
 enzyme activity, 119
 local chemical environment, 119, 120
 metabolic processes, 117
 nutrient uptake, 118
- Optical scattering, 100
- Optoacoustic imaging, 15
- Organic acidosis disorder, 206, 207
- Ornithine carboxymethyl transferase deficiency, 204
- Ornithine transcarbamylase deficiency (OTCD), 289
- Oxidative phosphorylation (OXPHOS), 31, 32
- Oxygenation imaging
 blood oxygenation imaging
 hemoglobin oxygen saturation, 105
 optical coherence tomography, 110, 111
 PAM, 105–108
 two-photon and confocal microscopy, 108–110
 deep-tissue optical imaging, 100–104
- P**
- Pancreatic cancer, 38–40
- Pancreatic imaging
 CT contrast agents, 180
 GLP-1 receptor-targeted agents, 181
- insulinitis nuclear imaging, 188
 molecular probe design, fluorescence imaging, 189–191
- MRI, 181–183
 MRI contrast agent, 180
 nontargeted exogenous contrast agents, 181
 PET/SPECT, 182–188
 quantitative analysis, 180
 targeted molecular imaging, 182–189
 VMAT2 receptor-targeted agents, 181
 volume fraction, 180
 voxel dimensions, 180
- Parkinson's disease (PD), 211–213
- PASADENA method, 90
- Pathogen-associated molecular patterns (PAMPs), 155
- Pentose phosphate pathway (PPP), 248
- Peroxisome disorder, 207
- pH sensing MRI, 96–97
- Phase-corrected water, 230
- Phenylketonuria (PKU), 205, 291, 292
- Photinus pyralis*, 6
- Photoacoustic microscopy (PAM), 15, 105–108
- Picomolar tracer, 8, 49, 181, 182
- Piezoelectric effect, 6
- Pittsburgh compound B (PiB), 210–212
- Pneumoencephalography, 200
- Point-resolved spectroscopy (PRESS), 85, 228
- Positron-emission tomography/computed tomography (PET/CT), 200
 advantages, 48
 amino acids
 glutaminolysis, 60
 neuroendocrine tumors, 60
 neuro-oncology, 58, 59
 prostate cancer, 60
 protein synthesis, 60
 structure of radiolabel, 58
- carbohydrates
 BAT, 57
 cardiac imaging, 56, 57
 neuroimaging, 53
 oncologic imaging, 52
 structure, 51
 tracer, 51
- fatty acids
 [¹¹C]acetate, 63
 [¹⁸F]fluoroacetate, 63
 advantages, 62
 cardiac imaging, 65
 LCFAs, 66
 oncologic imaging, 63–65
- features, 48
 hypoxia, 69–71
 limitations, 50
 membrane synthesis
 choline structure, 67
 oncologic imaging, 67–69
- nucleoside analogs
 oncologic imaging, 62

- structure, 61
 - tracers, 61
- radionuclides, 49–50
- specific activity, 49
- tracer principle, 49
- Prediabetic insulin resistance, 213
- Propionic academia (PA), 288
- Prostate-specific membrane antigen (PSMA), 11, 19, 60
- Proton density fat fraction (PDFF), 229, 231
- Pyruvate dehydrogenase (PDH), 130, 143, 146, 202, 247, 257–259, 262, 265, 271
- Pyruvate dehydrogenase complex (PDC), 51, 202
- Pyruvate dehydrogenase deficiency, 299, 300

- R**
- Radiogenomics, 5
- Refsum disease, 207
- Renal carcinomas, 142, 143
- Rett syndrome (RS), 311, 312

- S**
- Sandhoff's disease, 209, 304
- Sanfilippo syndrome, 209
- Scavenger receptor, 164
- Second harmonic generation (SHG), 235
- Signal fat fraction (SFF), 229, 230
- Single-photon emission computed tomography (SPECT), 4–8
 - brain disorders, 200, 201
 - in diabetes, 179
 - GLP-1R, 186
 - myocardial hypertrophy, 264–265
 - myocardial metabolism, 250, 261, 262
 - pancreatic imaging, 182, 191–193
 - principle, 9, 12, 13
- Single-voxel technique, 85
- Smith-Lemli-Opitz syndrome (SLOS), 312, 313
- Smith-Magenis syndrome, 205, 206
- Solute carrier (SLC), 58, 60
- Spatial encoding, 84, 85
- Spectral editing, 90
- Spin-echo (SE) images, 229
- Standardized uptake values (SUVs), 48, 49, 61, 62, 64, 212, 235
- Statistical parametric mapping (SPM), 202
- Stimulated echo acquisition mode (STEAM), 85, 228
- Succinate dehydrogenase complex, 202

- Superparamagnetic iron oxide (SPIO) nanoparticles, 14, 95, 182, 233, 234
- System L, 58, 59
- Systemic metabolism, 36, 37

- T**
- Tay-Sachs disease, 209, 304, 305
- Thymidine, 11, 61, 132, 165
- Thymidine phosphorylase (TYMP), 203
- Time domain (TD) techniques, 101
- Toll-like receptors (TLRs), 157
- Transient elastography (TE), 225, 226
- Translocator protein, 163
- Tricarboxylic acid (TCA) cycle, 51, 62, 63, 65, 202
- Tumor necrosis factor α (TNF α), 157
- Two-photon excitation fluorescence (TPEF), 235
- Two-point Dixon technique, 229
- Type 1 diabetes mellitus (T1D), 41
- Type 2 diabetes mellitus (T2D), 41, 213, 214

- U**
- Ultrasound imaging, 15, 16, 224, 225
- Uncoupling protein 1 (UCP-1), 57
- Unified Parkinson's Disease Rating Scale (UPDRS), 212
- Urea cycle disorders (UCD), 203, 204, 289, 290

- V**
- Ventriculography, 200
- Ventriculomegaly, 202, 209, 292, 307, 314
- Vesicular monoamine transporter 2 (VMAT2)
 - receptor-targeted agents, 181
- Vitamin C, 90, 146

- W**
- Warburg effect, 10, 52, 89, 129–131

- X**
- X-linked adrenoleukodystrophy (X-ALD), 293–295

- Z**
- Zellweger syndrome, 207, 292, 293