Index

A
acetylcholine receptor (AChR), 63
acne vulgaris, 132
adipose-derived stem cell (ADSC), 43
Alzheimer’s disease (AD), 230
amyotrophic lateral sclerosis (ALS), 231
analgesia, 172
androgenetic alopecia (AGA), 142, 145
arthritis, 4, 107, 109, 112
autoimmune diseases, 257

B
basic fibroblast growth factor (bFGF), 49
beam area, 10
Bernhard, Oskar, 23, 24
biceps brachii, 78
biomaterials, 98
bone morphogenetic protein (BMP), 65
brain-derived neurotrophic factor (BDNF), 48
burns, 138

calcium, 42
cartilage, 106
cellulite, 148, 150
cerebral blood flow (CBF), 26
channelrhodopsin (ChR), 38
coeherence, 11
creatine kinase (CK), 63
cyclic-monophosphate (cAMP), 41, 68
cycloheximide (CHI), 79
cytochrome c oxidase (CCO), 3, 37, 25, 40, 61, 211
cytoprotection, 58

dentine hypersensitivity, 170
diabetes mellitus, 93, 100, 123
dihydrotestosterone (DHT), 142

edema, 54, 181
endodontics, 171
endothelial nitric oxide synthase (eNOS), 54
energy, 11

fat, 68, 148
Finsen, Nils Ryberg, 22
fluence, 12, 78
fork-head box protein M1 (FOXM1), 46

Gould, Gordon, 29
gout, 184
H
hair, 66, 45, 141
heat-shock protein 27 (HSP27), 49
hematopoietic stem cell (HSC), 40
hepatocyte growth factor (HGF), 49
herpes simplex virus (HSV), 133
high-fluence low-power laser irradiation (HF-LPLI), 69
hormesis, 75
hypertrophic scar, 137
hypoxia-inducible factor (HIF-1α), 44, 90

I
inflammation, 57, 180
intravascular laser irradiation of blood (ILIB), 242–245
irradiance, 10, 76, 77
ischemic pre-conditioning (IPC), 12–15
ischemic stroke, 214, 215

K
keloid, 137
keratinocyte growth factor (KGF), 49

L
laser, 4
light, 5, 6
light absorption, 6
light-emitting diode (LED), 5
light-emitting diode therapy (LEDT), 18, 70
light scattering, 6
lipopolysaccharide (LPS), 15
low-intensity pulsed ultrasound (LIPUS), 97
low-level laser therapy (LLLT), 1
lung disease, 257
lymphedema, 188

M
Maiman, Theodore, 30
matrix metalloproteinases (MMPs), 58
mesenchymal stem cells (MSCs), 42
Mester, Endre, 31, 32
migration, 59
mitochondria, 210

N
neuropathic pain, 167, 179
nitric oxide (NO), 42
nociceptive pain, 179
nuclear factor kappa B, 42

O
ophthalmology, 256
oral lichen planus (OLP), 172
organic light-emitting diode (OLED), 3
osteoarthritis, 107, 110, 112, 183, 190
osteoblast, 92
osteoclast, 92, 94
osteocyte, 92
osteoglycin, 60
osteoporosis, 98

P
pain, 178, 179, 185, 186, 187
Palm, Theobald Adrian, 22
Parkinson’s disease (PD), 230
penetration depth, 9
peroxisome proliferator-activated receptors (PPAR), 46
photobiomodulation therapy (PBMT), 1, 59
pigmentation, 136
polarization, 11
power, 10
pre-conditioning (PC), 12, 65
proliferation, 59
prostaglandin E2 (PGE2), 57
psoriasis, 139
pulsed beam, 11

**R**
randomized controlled trial (RCT), 77
reactive oxygen species (ROS), 5, 38, 41
receptor activator of nuclear factor kappa-B ligand (RANKL), 43, 93
rest, ice, compression, and elevation (RICE), 55
Rollier, Auguste, 23, 24
runt-related transcription factor 2 (RUNX-2), 46

**S**
Schawlow, Arthur, 28, 29
skin, 67, 128
stem cells, 60, 40, 173, 254
stroke, 213, 214, 215, 216
survivin, 69

**T**
tendon, 118
tissue inhibitors of metalloproteinases (TIMPs), 130
Townes, Charles Hard, 27, 28
transforming growth factor (TGF-β), 47
transient receptor potential (TRP) channel, 38
traumatic brain injury (TBI), 220–226, 229

**U**
ultraviolet (UV) radiation, 27

**V**
vascular endothelial growth factor (VEGF), 48
vitiligo, 135

**W**
wavelength, 10, 192
World Association for Laser Therapy (WALT), 192, 201, 261, 263, 269
wound healing, 3, 26, 44, 58, 63, 64, 171
Michael R. Hamblin is a Principal Investigator at the Wellman Center for Photomedicine, Massachusetts General Hospital, and an Associate Professor at Harvard Medical School. He has interests in photodynamic therapy and photobiomodulation. He has published 396 peer-reviewed articles, is an Editor/Associate Editor for 10 journals, and serves on NIH Study-Sections. He has an h-factor of 85 and >28,000 citations. He has authored/edited 23 textbooks on PDT and photomedicine, including SPIE proceedings. Hamblin was elected as a Fellow of SPIE in 2011, and he received the first Endre Mester Lifetime Achievement Award Photomedicine from NAALT in 2017 and the Outstanding Career Award from the Dose Response Society in 2018.

Cleber Ferraresi graduated with a degree in Physical Therapy (2008) from the Federal University of Sao Carlos (UFSCar-Brazil), followed by a Specialist degree in Exercise Physiology (2009) and a Master’s degree in Biotechnology (2010) from UFSCar. He earned his Ph.D. in Biotechnology at the same school (2010–2014), including work at the Wellman Center for Photomedicine, Massachusetts General Hospital, Harvard Medical School (2012–2013) and the Faculty of Applied Health Sciences, University of Waterloo (Canada, 2014). Cleber Ferraresi was a Postdoctoral Research Fellow at the Wellman Center for Photomedicine (2015). He is currently a Professor and Principal Investigator with the Physical Therapy for Functional Health Postgraduate Program at the Universidade do Sagrado Coração (Brazil) and the Biomedical Engineering Postgraduate Program at the Universidade Brasil. He has experience in physical therapy with an emphasis in photobiomodulation combined with physical exercise; fatigue and muscle damage; sports; and tissue healing.

Ying-Ying Huang is an instructor at Harvard Medical School. She was trained as a dermatologist in China. She received her M.D. from the Xiangya Medical School of Central South University in China. She earned her M.S. in Dermatology from Sun Yat-sen University. She received her Ph.D. in Pathology from Guangxi Medical University. She has been at the Wellman Center for 9 years. She has published over 67 peer-reviewed articles and 24 conference proceedings and book chapters. She has an h-factor of 71 and nearly 6000 citations. She is a co-editor of two textbooks of photomedicine. She has co-authored/edited three textbooks on PDT and photomedicine. She is the co-chair of the antimicrobial photodynamic symposium of the 16th International Photodynamic Association World Congress. Huang’s research interests lie in photodynamic therapy (PDT) for infections, cancer, and the mechanisms of photobiomodulation (PBM) on brain disorders.
Lucas Freitas de Freitas graduated from the Biomedical Sciences program at the State University of Londrina - Brazil and received his Ph.D. in Bioengineering at the University of São Paulo - Brazil. Part of his research regarding the ablation of melanomas using gold nanorods decorated with phthalocyanines was performed under the supervision of Dr. Michael Hamblin. de Freitas has experience in cancer phototherapies using nanodevices, biomedical sciences, biochemistry, and pathology, and he is a reviewer of 3 periodicals.

James D. Carroll is the founder and current CEO of THOR Photomedicine Ltd. He began his career as an electronics engineer at Audix Ltd. UK in 1978. He received his degree in Electronics from Harlow Technical College, UK, in 1980. In 1986, he moved to government grant consultancy with a focus on the technology sector. One of his fundraising projects, for Guys Hospital in London, introduced him to basic science research on lasers and LEDs for stimulating wound healing. He was hired by their laser supplier, Omega Universal Technologies, in 1988 and has been in the industry ever since. Carroll has a particular interest and expertise in the irradiation parameters and dose of low-level laser therapy (LLLT).