

Acknowledgements

A book is never the outcome of one lonely individual's efforts. This too isn't. It has benefited from the results of several publications and from the workshops and conferences that I had the opportunity to take part in from 2009.

Therefore, I need to first thank Anna and my children, Nicolò and Sebastiano, for the endless patience they showed during the preparation of this work.

I am also grateful to Phil Macnaghten for his explanations concerning the rise of the Commission Code of Conduct for responsible nanoscience and nanotechnology research (Potsdam 14-15.04.2014) and his comments on RRI, especially with regard to the underlying reasons of its socio-empirical version (Trento 7-8.11.2015).

I would like to express my gratitude to Elena Pariotti for her suggestions on the main features of the RRI model.

I would like to express my sincere thanks also to Roger Brownsword for his clarification related to the different conceptualisations of human dignity and for his help when I worked on the part regarding the right to bodily integrity.

I am grateful to everyone at Pan Stanford Publishing who worked together with me to accomplish this result.

This work had the support of the Centre for Environmental, Ethical, Legal and Social Decisions on Emerging Technologies (CIGA) of the University of Padua, which I thank, together with my colleagues.

Lastly, demerits are all mine.

Index

- abortion 238, 319, 320, 327
- accountability 51, 53, 56, 65, 69,
70, 72, 81, 143–145, 226, 412
- accountability principle 145, 147,
148, 226
- ACHPR, *see* African Charter on
Human and Peoples Rights
- actors 49, 51–53, 55, 59–61, 65,
72, 81, 137, 143, 145, 167,
173, 201, 206, 209, 211, 212,
216, 219, 226, 227, 249
- non-state 50, 53, 80, 81, 83
- Advanced Informed Agreement
(AIA) 170
- African Charter on Human and
Peoples Rights (ACHPR) 393,
431
- agriculture 37, 38, 69, 104, 108,
109, 390
- AI, *see* artificial intelligence
- AI systems 405–408, 420
- AIA, *see* Advanced Informed
Agreement
- air quality 149
- alien species 162
- invasive 162
- allergenicity 113, 196, 204
- Alzheimer's disease 28, 233, 369
- analytical-deliberative model 232
- anguish 347, 382
- animal health 120, 123–125, 153,
188, 193
- animal ovum 301
- animal rights organizations 143,
233
- animal zygote 291
- antibiotics 160, 162
- anticipation models 231, 234, 241,
252
- anticipative attitude 245
- anticipatory attitude 232, 249
- antigen-presenting cells 321
- antiterrorism measures 36
- anxiety 37, 324, 327, 397
- arbitrariness 422
- Aristotelian ideal of good life 227
- arm-prostheses 381
- arrest, lawful 314, 351, 365, 395
- artificial bacterium 160
- artificial cells 194, 204
- autonomous 196
- artificial chromosomes 182
- artificial insemination 326
- artificial intelligence (AI)
405–407, 409, 424, 428
- artificial intelligence systems 7
- artificial limbs 369
- artificial organs 341, 367
- atmospheric fallout 397
- atomic bombs 11
- atomic scale 137
- autarkic nature 68
- authority substitute 343, 364
- autonomy 12, 181, 217, 282, 311,
315, 340, 342–344, 365
- principle of 12, 28, 339, 343
- private 80

- Bacillus subtilis 103
- bacteria 103, 160
 - engineered 198
- bacterial plasmid 106
- bargaining power, inequality
 - of 361, 372
- BCI, *see* brain-computer interfaces
- behaviour
 - collective 236
 - criminal 354
 - ethical 71
 - prudent 106
 - self-interested 228
- bio-samples 247, 278
- biobank 436
- biochemistry 197
- biocidal products 136, 153, 154
 - market and use of 153
- biocides 136, 153, 159
- biocontainment 198
 - improved 197, 199
- biodiversity 18, 102, 107, 130, 162, 164, 167–169, 171, 203, 205, 394
- biodiversity loss 162
- biodrugs 160, 206
- bioethical issues 41
- biohackers 342, 370
- biohacking 162, 164, 166, 179, 184
- bioinformation 23, 179
- biological agents 171, 177, 178
- biological assessments 199
- biological diversity 15, 106, 130, 131, 162, 163, 167, 169, 170, 203, 392
- biological materials 31, 197
- biological stability 196, 204
- biological systems 161, 165, 169, 170, 197, 200
 - artificial 161, 191
 - complex natural 191
 - complex non-standard 204
- biology
 - do-it-yourself 162, 179, 198, 204
 - garage 162, 199
- biomechanical arm-prosthesis 381
- biomedical research 12, 13, 25, 28, 29, 309, 311, 385
- biomedicine 22, 24, 25, 27, 28, 34, 179, 181, 239, 286, 299, 308, 309, 313, 339, 340, 344, 364, 432, 434
- biosafety 166, 168, 169, 195
- biosafety issues 166, 167
- biosafety modules 204
- biosecurity 164, 166, 170, 172, 175, 181, 182, 202
- biosecurity scientists 184
- biotechnology 4, 6, 15, 23, 31, 41, 101–109, 111, 130, 133, 134, 137, 149, 160, 169, 170, 173, 175, 187, 201, 202, 207, 235, 236, 340
 - modern 107, 109, 169
 - regulated 109
 - synthetic 191
 - traditional 160
- bioterrorism 164, 166, 179, 184
- biovaccines 160
- bioweapons 206
 - new lethal 160
- blood 438
 - human 26
- brain 332, 369
 - human 41
- brain cells 296
- brain-computer interfaces (BCI) 366, 384
- brain enhancement 296
- brain-wounded warfighters 369
- business ethics 85
- cancer 82, 136, 300, 310, 400
 - aggressive lung 289

- cannabis 378
- carbon dioxide 135, 305
- carbon nanotubes 50, 135, 159, 305, 319
 - toxicology 135
- CE, *see* cognitive enhancement
- cell fusion 106, 113
- cell nucleus 296
 - somatic 301
- cells
 - autonomous 196
 - engineered 195
 - germ 182
 - human cloned stem 28
 - human somatic 290
 - muscle 289
 - white blood 135, 305
- CGMS, *see* continuous glucose monitoring system
- chlorobenzene 238
- classification, labelling and packaging (CLP) 151, 156
- cloning techniques 17
- cloud computing 429
- CLP, *see* classification, labelling and packaging
- CO₂ emissions 109, 202
- CO₂ removal techniques 390
- cognitive enhancement (CE) 368, 378
- cognitive performance 366
- cognitive sciences 41, 42, 149
- colour blindness 342, 370
- commercialization 39, 141, 143, 147, 149, 153, 155, 231
 - progressive 42
- Commission on Human Rights 14, 85, 393
- communications, digital 411
- computer implant technology 409
- conflicts, societal 223
- consent
 - expressed 339, 371
 - free 346
 - patient's 358
 - withdrawal of 343, 364
- consent principle 333
- constitutional principles 223, 241
 - fundamental 221, 254
- constitutional traditions 20, 21
- containment, semantic 205
- contaminants 171
- contamination, unintentional 128
- continuous glucose monitoring system (CGMS) 428, 429, 435
- corporate social responsibility (CSR) 6, 81–83, 85–87, 89, 248
- cosmetic products 150
- cosmetics 50, 82, 136, 145, 150, 159, 184, 251
- cosmetics companies 150
- crime, international 10
- criminals 407, 436
- CRISPR, gene-editing technique 290
- CRISPR-Cas9 289, 291, 300
- crops
 - agricultural 128
 - food 129
 - modified 128
 - non-GM 129
 - non-GMO 129
 - organic 120, 128, 129
- cross-pollination 127
 - avoiding 120
- CSR, *see* corporate social responsibility
- data
 - digital 161
 - genetic modification 200, 204
 - judiciary 406
 - medical 418
 - scientific 108, 137, 439

- data protection 101, 166, 247, 250, 279, 280, 405, 409, 411, 413, 415, 424, 435
- data protection law 279
- data protection policies 414
- de-extincted animals 205
- de-extinction 203
- decisions
 - end-life 243, 278, 292
 - end-of-life 247, 330, 332
- deep neural network 407
- deep thalamic stimulation 332
- democracy, deliberative 218
- democratic deficit 65
- democratic engagement 233
- democratic legitimization 60, 66, 186, 193, 209
- democratization 69, 208, 229
- deprivation of life 314, 351, 365, 395
- detention conditions of
 - prisoners 248, 279
- devices
 - electronic 154
 - implantable 154
 - invasive 154
 - medical 154
 - performance-enhancing 374
 - wearable 155, 323, 429
- dexterity 341, 367
- diabetes 427, 428
- dignity
 - empowerment conception of 288, 295
 - individual's 384
 - protection of 287, 434
- dignity of human beings 286, 291
- disabilities 248, 250, 252, 279, 280, 287, 306, 324, 341, 342, 360, 366, 374, 379, 382, 384
 - mental 345
 - multiple 358
 - physical 384
- disability pension 324, 440
- disabled people prostheses 367
- diseases
 - eye 417
 - human 15
 - infectious 321, 417
 - inherited 290
 - mental 369
 - neurodegenerative 331, 351
 - neurological 296
 - sex-related 311
 - transmissible 238, 295
 - transmissible viral 326–328
- disinfectants 136, 153
- disorder
 - mental 25, 356
 - post-traumatic stress 369
 - psychiatric 372, 373
- diversity, cultural 18
- DNA 15, 126, 160–162, 197, 204, 289, 290, 310, 348, 436
 - animal mitochondrial 301
 - healthy 290
 - recombinant 113
- DNA sequences 165, 166
- DNA synthesis 190, 194, 199, 204
 - large-scale 199
 - non-commercial 166
- doctor, digital 428
- doxorubicin 155
- drugs
 - nanotechnological 136, 305
 - pharmaceutical 340, 367, 436
 - smart 383
- ECHA, *see* European Chemicals Agency
- ECHR, *see* European Convention on Human Rights
- ECOB, *see* European Coexistence Bureau
- ecological balance 200
- ecosystems, self-coordinated 49
- ecotoxicological studies 138

- ecotoxicology 135, 145, 305
- EFSA, *see* European Food Safety Authority
- electric cauterization 318
- electrical impulses 369
- electronic communications 414
 - private 415
 - professional 414
- electronic equipment 150, 154, 420
- electronic patient record system (EPRS) 237, 239
- electronic tattoos 427
- EMA, *see* European Medicines Agency
- embryonic stem cell research 311
- embryonic stem cells 28
- embryos 28, 243, 290, 292, 294, 295, 298, 300, 301, 311, 326–328, 437
 - cloned 28
 - cryopreserved 437
 - fertilized 295
 - healthy 238
- energy
 - fossil fuel 183
 - renewable 157
- energy saving 202
- enhancement
 - cognitive 368
 - cosmetic 359
 - genetic germline 250
 - moral 361, 372
 - prosthetic 342
- environmental harm 169
- environmental protection 20, 61, 101, 166, 393, 399
- EPO, *see* European Patent Office
- EPRS, *see* electronic patient record system
- ESC, *see* European Social Charter
- ethical acceptability 107, 209–215, 221, 249, 250
- ethical advisory boards 52, 58, 161, 176, 177, 181, 185
- ethical controversial issues 291, 294
- ethical enterprise 76
- EU Charter of Fundamental Rights 108, 288, 433
- EU governance of emerging technologies 102, 103, 105, 107, 109, 111, 113, 115, 117, 119, 121, 123, 125, 127, 129, 131, 133–135, 137, 139, 141, 143, 145, 147, 149, 151, 153, 155, 157, 159–161, 163, 165
- EU policies on GMOs 103
- European Chemicals Agency (ECHA) 156
- European Coexistence Bureau (ECoB) 129
- European Convention on Human Rights (ECHR) 9, 18, 19, 22–24, 27, 30, 32, 34, 35, 180, 239, 242–244, 246, 254, 281, 282, 286–288, 291–299, 307, 309, 312–316, 321, 331, 343–346, 357–359, 365, 373–379, 381–385, 394–397, 414–416, 418, 419, 432–434, 439
- European Food Safety Authority (EFSA) 105, 108, 116–119, 123, 124, 152, 153, 157, 163, 188, 194
- European governance of emerging technologies 99, 100, 102, 104, 106, 108, 112, 114, 116, 118, 120, 122, 124, 126, 128, 130, 132, 134, 136, 138, 140, 142, 144, 146, 148, 150, 152, 154, 156, 158, 160
- European Medicines Agency (EMA) 155
- European Patent Office (EPO) 185

- European Social Charter (ESC) 30, 32, 33, 35, 308, 312, 361, 372
- European Space Agency 100
- European Union Agency for Fundamental Rights 279
- exoskeleton technology machines, smart 341, 368
- exoskeletons 341, 366, 378, 380, 382
 - smart 368
- eyeborg antennae 342, 370

- FDA, *see* Food and Drug Administration
- fibromyalgia 378
- Food and Drug Administration (FDA) 174, 289, 435
- food chain contamination 397
- food ingredients, novel 122
- food labelling 152, 159
- food packaging 82
- food security 108, 109
- food webs 203, 205
- freedom of expression 18, 243, 292, 320, 344, 401, 422, 433, 438
- freedom of research 430, 436, 437, 439
- functions
 - normative 78
 - para-law 78
 - plus-law 79
 - pre-law 78
 - regulatory 78
 - uncharacterized biological 204
- fundamental freedoms 11, 14, 15, 20, 40, 242, 285, 286, 293, 299
- fundamental rights 18–21, 23, 71, 74, 86, 88, 108, 140, 143, 146, 180, 216, 220, 221, 224, 227, 234, 237–242, 244, 246, 251, 252, 279, 288, 307, 433
- gender identity 360
- gender reassignment 359
- gender representativeness 217
- gene modification techniques 132, 191, 193
- gene patenting 182
- gene therapy 311
 - improving 310
 - unregulated 289
- genes 103, 106, 166, 188, 289, 429
 - artificial 161
 - defective 290
- genetic enhancement 27, 280, 282, 287, 288, 292–294, 296–300, 340
- genetic firewall 197, 198, 200
- genetic modification (GM) 6, 28, 105–107, 117, 118, 124, 126, 129, 132, 133, 172, 174–176, 179, 186, 188, 190, 191, 194, 195, 197–200, 204, 288, 289, 291–294, 299, 313, 340
- genetic modification
 - germline 299
 - human 6, 289, 292, 293, 300, 313, 340
 - zygotes 199
- genetically modified crops 129
- genetically modified food 121
- genetically modified
 - micro-organisms 110, 112, 177, 195
- genetically modified
 - microorganisms (GMMs) 106, 110–113, 115, 118, 119, 124, 130, 133, 177, 178, 198
- genetically modified organisms (GMOs) 16, 101–107, 109–111, 113–133, 163, 164, 169, 170, 174–179, 183, 184, 186, 188–192, 194–197, 199, 200, 204, 206–208, 238
- genome editing 190, 194, 199, 204

- genomics 429
 - synthetic 133, 191
- geoengineering 4, 6, 217, 219, 282, 389, 390, 403
 - stratospheric 390
- globalization 50, 82, 99
 - technological 11
- glucose monitoring systems, continuous 428
- GM, *see* genetic modification
- GM animal feed 104, 127
- GM crops 113, 128, 129
- GM microorganisms 133, 178, 191
- GMMs, *see* genetically modified microorganisms
- GMOs, *see* genetically modified organisms
 - deliberate release of 110, 176, 178
- governance 3–6, 49–76, 78, 80, 82, 84, 88, 90, 102, 105, 106, 136, 137, 140, 164, 172, 175, 186, 187, 194, 200, 201, 206–212, 214, 219–222, 231, 234, 236, 237, 240, 241, 245, 250, 251, 253, 254, 280, 389
 - participatory 164
 - self-coordinated 173
 - supranational 56
 - technological 75, 245
- governance of emerging technologies
 - 53, 54, 235, 237, 239, 241, 243, 245–247, 249, 251
- governance of nanotechnologies 6, 160
- gynaecological examination 316, 349
 - forced 316, 346, 349
- hazardous waste dump 334
- health, mental 307, 380
- health care 225, 311
 - preventive 225
- health hazards 149
- health monitoring systems, wearable 42
- health of women 307, 320
- HETs, *see* human enhancing technologies
- HIV infection 326, 417
- human artificial procreation 300
- human chromosomes 289
- human cloning 17, 25, 301, 309, 340
 - ban of 250, 280
- human dignity 6, 12, 17–19, 22, 26, 27, 41, 108, 114, 179–182, 220, 224, 238, 250, 282, 285–292, 294, 296, 298–300, 313, 340, 391, 434, 436, 437, 443
 - protection of 24, 26, 286, 309
- human embryos 28, 237, 287, 290, 294, 296, 297, 301, 311, 340, 437
 - editing 290
 - manipulating 297
 - modified 290
- human enhancement technology 42, 298, 340, 366
- human enhancing technologies (HETs) 252, 340–342, 361, 366, 368, 370, 372, 377, 379
- human genome 16, 17, 27, 31, 180, 286, 299, 300, 311
- human health 108, 111–115, 119, 122, 123, 130, 131, 139, 144, 153, 162, 170, 177, 178, 182, 197, 199, 220, 225, 397
- human ovum 296
- human pancreas 291
- human rights
 - basic 14, 179, 392
 - fundamental 11, 432
 - implementation of 4, 5, 250

- protecting 18, 83, 89
- protection of 6, 10, 15, 18, 20, 24, 83–85, 90, 179, 239, 242, 248, 253, 286, 308, 391, 432, 434
- human rights law 11, 18, 19, 23, 26, 52, 75, 180, 242, 249, 251, 254, 280, 430
- international 26, 286, 343, 364, 411, 434
- human rights law practices 75
- human rights practice 246, 250
- human–animal chimeras 250, 291
- human–animal hybridization 291, 298, 300, 340
- human–pig chimera 291
- hybridity
 - developmental 73
 - functional/developmental 73
 - fundamental normative 73
 - instrumental/developmental 73
- hybridity thesis 72, 73
- hybridization techniques 106, 113

- ILO, *see* International Labour Organization
- ILO Code of Practice 412
- immoral acts 361, 372
- immune response 321
- immunotherapy 203
- implants 295, 342, 360, 368–370, 384
 - breast 154
 - neural 342
 - spinal disc replacement 154
- individual rights 4, 71, 88, 89, 224, 225, 235–238, 240, 245, 246, 249, 251, 253, 277, 278, 280, 281, 287, 390, 392, 396
- industry
 - automotive 136
 - chemical 183
 - high-tech 100
 - information technology 100
 - nanotech 40
 - solar energy 390
 - textile 184
- infant mortality 307
- infertility 326, 328, 359
 - male 326
- innovation 3–5, 40, 41, 67, 70, 71, 99, 100, 140, 143, 144, 157, 158, 187, 189, 191, 201, 208–214, 216–223, 226–234, 236–238, 247, 249, 250, 278, 281
- insect repellents 136, 153
- International Labour Organization (ILO) 84, 412
- international law 9, 10, 14, 15, 52, 57, 75, 79, 82–84, 168, 179, 254, 298, 299, 309
 - general principles of 396, 434
- International Penal Court 10
- Internet access 420
- Internet instant messaging service 419
- Internet of Things (IoT) 369, 409
- Internet usage 416, 418
- IoT, *see* Internet of Things

- justice
 - biological 165
 - distributive 311
 - intergenerational 108, 182
- kidney problems 377

- lab-on-a-chip 42, 427
- labelling 38, 101, 107, 116, 121, 125, 127, 131, 136, 150, 151, 159, 184, 189, 207, 251

- mandatory 39, 105, 126, 127, 150, 152, 153, 184, 251
- lethality, induced 195
- leukaemia 322, 323
- livestock 104, 127, 131, 207
- livestock farmers 127, 131
- living cells 174, 199
- living organisms 103, 105, 168–170, 178, 179, 189–191, 196, 199, 204
 - genomes of 179, 198
- living will 358
- macro-injection 106
- macrobiotic diet 438
- MAP, *see* medically assisted procreation
- medical attention 307
- medically assisted procreation (MAP) 28, 184, 243, 247, 278, 292, 295, 325, 326, 328
- medicine
 - clinical 203, 363
 - novel 202
 - reproductive 436
 - therapeutic 367
 - traditional top-down 428
- mental handicap 382
- mental health problem 287
- mental illness, existing 383
- micro-encapsulation 106
- micro-injection 106
- micro-organism 112
- microchips 369, 378, 409
- microelectronics 100
- microorganisms 112, 118, 194
 - modified 110, 112, 177, 178
 - pathogenic 194
 - synthetic 181
- mifamurtide 155
- misuse of biology and medicine 26, 286
- mudslides 402
- muscle-wasting disorders 233
- muscles 331, 351, 369, 378
 - artificial 319
- mustard gas 324
- mutants 198
- mutations 198, 290
- nanobiotechnologies 179
- nanofood 144, 251
- nanomaterials 36, 37, 134, 135, 148–157, 159, 192, 251
 - definition of 151, 152, 159, 193
 - engineered 134, 135, 305
- nanomedicine 23, 82, 135, 136, 138, 140, 145, 149, 154, 155, 159, 218, 305, 308
 - ethical aspects of 146
- nanoparticles 36, 50, 138, 148, 155, 308, 321, 323, 332
 - silver 160
 - titanium dioxide 135, 306
- nanoremediation of oil spill 136
- nanosciences 64, 87, 134, 138, 139, 141
 - sustainable 146
- nanotechnology research 63, 215, 226, 443
 - responsible 142
- nerve gas 324
- network
 - self-organizing 50
 - self-regulating 55
- neural defects, treatment of 54, 237, 296, 434
- neural network approaches 405
- neuromuscular disorders 341, 368
- neuroprosthetics 341, 366, 367
- neuroscience 340
- neurostimulators 366, 378
- new governance method (NGM) 61, 62, 65–71, 141, 142, 159

- new governance paradigm 6, 67, 68, 134, 167, 235, 236
- new plant-breeding techniques (NPBTs) 113, 126, 191
- NGM, *see* new governance method
- NGOs, *see* non-governmental organizations
 - international 33
- non-canonical biochemistries 197
- non-criminals 407
- non-degradable nanospheres 320
- non-discrimination 12, 23, 88, 158, 286–288, 311, 326, 340, 374, 376
- non-governmental organizations (NGOs) 58, 156, 215, 248, 252, 253
- noninvasive glycemic monitoring 427
- NPBTs, *see* new plant-breeding techniques
- nuclear experimentations 400
- nuclear power station 398
- nuclear tests 322, 400, 440
- nuclear tests program 400
- nuclear weapons 180
- nucleic acid molecules 106
 - synthetic 173, 174
- nucleic acids 174
- nutrients 333, 356
- nutrition 117, 332, 355
 - adequate 307
 - artificial 332, 355, 356, 385
- OECD, *see* Organisation for Economic Co-operation and Development
- OLED technology (organic light-emitting diode) 49, 82
- oligonucleotide 133
- OMC, *see* open method of coordination
- open method of coordination (OMC) 62, 139
- organic light-emitting diode 49, 82
- Organisation for Economic Co-operation and Development (OECD) 53, 63, 84, 102, 103, 406
- organisms
 - artificial 164, 239
 - biological 161
 - disease-carrying 171
 - disease-causing 171
 - engineered 194, 195, 204
 - environmental 149
 - host 106
 - non-modified 119
 - non-natural 111
 - pathogen 194
 - self-replicating 196
 - single cell 195
 - sterile 106
 - synthetic 179, 183, 187, 205
 - transgenic 188
 - xenobiological 197
- orthopaedic care 381
- ovarian ducts 318
- patent law 430
- pathogenicity 196, 204
- pathogens 178, 194, 208
- personal data 23, 31, 41, 155, 315, 365, 406, 411–414, 416, 418, 420
 - automatic processing of 31, 413
 - confidentiality of 29, 416
 - processing of 280, 410, 414
 - protection of 20, 158, 224, 248, 310, 410, 418
 - retention of 247, 278
 - sensitive 406
- personal identity 330

- personal integrity 12, 18, 22, 23, 309, 315, 317, 333, 346, 348, 356, 364, 365, 368, 370, 375
 - violation of 316, 349
- pesticides 109, 128, 136, 153, 203, 238
- PGD, *see* preimplantation genetic diagnosis
- plants
 - cisgenic 188
 - genetically modified 119, 178
 - intragenic 188
 - transgenic 192
- policies
 - economic 62
 - social 32
- policy deliberation 222
- policy formulation 59
- political liberties 254
- political rights 12, 20, 24, 32, 35, 74, 307, 314, 394, 410
- political theory 50, 53
- pollutants 203, 206
- pollution 69, 169
 - environmental 136, 160
 - marine 397
 - spray 109
- post-traumatic stress disorder (PTSD) 369
- posthumanism 342
- power-assisted gauntlets 341, 368
- preimplantation genetic diagnosis (PGD) 28, 238, 239, 325, 327
- procreation, artificial 329
- programming languages 162
- prosthesis 341, 367, 368, 374–376, 383
 - robotic 378
- prosthesis performance 375
- prosthetic arms 360
 - advanced biomechanical 381
- prosthetic technologies 319, 341, 342, 367
- proteins 103, 126, 161
- protocells 178, 179, 194, 196, 199, 204
 - autonomous 199
 - non-living 204
- psychotic delusions 383
- psychotropic substances 366
- PTSD, *see* post-traumatic stress disorder
- public health, protection of 26, 310, 317, 318
- radiation
 - direct solar 390
 - environmental 400
- radiation exposure 322
- radio badges 409
- ratione materiae 34, 437
- ratione personae 34
- rationes decidendi 281
- regulation theory 77
 - reflexive 77
 - responsive 77, 78
- regulatory foresight 247, 277, 282
- research
 - genomic 17
 - human embryo 311
 - human embryonic stem cell 158
 - socially-robust risk 232
 - stem cell 158, 237–239, 437
- resilience 206, 216, 218, 231, 236
- resistance
 - herbicide 103
 - insect 103
 - societal 107
- respiratory protection 136, 306
- responsibilization 88, 138, 141, 142, 147, 149, 166, 209
- responsible research and innovation (RRI) 74, 157, 158, 200, 201, 208–217, 219, 221, 223, 225–227, 229, 231, 233–236, 240, 241, 245, 250, 253, 389, 430, 443

- reverse breeding 133
- risk assessment 37, 38, 40, 111, 112, 114, 117, 118, 120, 123, 130, 131, 134, 138, 149, 152, 155, 157, 159, 167, 168, 181, 186, 188–190, 193–195, 200, 202–205, 207, 212, 232–234, 241, 402
 - environmental 114, 116, 118, 119, 121, 188, 194
 - food safety 153
- RNA 197, 204
- RNA-dependent DNA methylation 133
- robotics 340, 341, 367
- RRI, *see* responsible research and innovation
- Ruggie's principles 85

- scanning tunnelling microscope 137
- schizophrenia 382
- self-determination 6, 28, 224, 299, 306, 315, 331, 332, 340, 343–345, 350–353, 360, 365, 373, 386, 433
- self-governance 68, 150, 164, 175, 201, 206, 209
 - effective 164
- self-governance stakeholders 68
- self-harm 383
- self-organization 68
- self-plagiarism 144
- self-reference 77
- self-reflexivity 77
- self-regulation 52, 58, 63, 78, 80, 81, 83, 85, 88, 89, 137, 141, 142, 149, 173, 209, 246, 277
 - enforced 78
- self-regulatory attitude 102, 138, 140
- semantic confusion 146
- semantic unclearness 226
- sexual assault 349, 350
- sexual orientation 407
- sexual reproduction 197
- social assumptions 213
- social barriers 380
- social dialogue 62, 65, 67, 69, 108, 141, 188, 209, 220, 221, 234, 235, 241
- social rights 19, 21, 32, 35, 74, 307, 308, 314
- social security 33
- socio-empirical
 - approach 212–214, 217, 222, 229, 232, 250–253, 430
- soft law 30, 34, 39, 51, 52, 56, 60, 63, 65, 66, 73, 75–81, 90, 180, 184, 234
 - semi-private 80
- solar energy generation 390
- sperm washing 326
- spermicides 153
- stakeholder democracy 89
- stakeholder engagement 185, 219
- stakeholder theory 86
- stem cells 54, 233, 237, 238, 291, 296, 297
- stem cells patentability 296
- stigmatization 27
- suicide 243, 292, 330, 331, 351–354, 357, 379
- sun creams 135, 306
- surrogacy 243, 292, 297, 328, 329
- surrogacy arrangement 328
- surrogacy techniques 329
- surrogatory character 68
- SynBio 162, 163, 169, 170, 189, 190, 193, 194, 198, 200, 203, 204, 207, 239
 - activities 195
 - applications 174, 176, 181, 218
 - definition 193, 203
 - developments 199
- SynBio products 207
- SynBio systems 178

- synthetic biology 4, 23, 35, 41,
 - 101, 103, 105, 109, 110, 113,
 - 132, 133, 160–165, 167, 168,
 - 170–176, 178–196, 198–209,
 - 235, 239, 279, 289, 320, 340
 - applications of 168
 - docking of 132, 133
 - governance of 6, 164, 167, 205,
 - 236
- synthetic biology organisms 183,
 - 190, 200
- synthetic biology products 181,
 - 185
- synthetic biology research 165,
 - 175
- synthetic DNA 162, 165, 166

- technoscience 3, 6, 10, 247
- thalamocortical network 332
- β -thalassemia 290
- tissue donation 339
- tissue-typing 30
- tissues 287
 - xeno-generating transplantable
 - human 291
- titanium dioxide 49
- toothpastes 49, 82
- torture 292, 314, 344, 365,
 - 375
 - prohibition of 243, 347
- toxic substances 159
- toxicity 113, 197
- toxicological studies 159
- toxicology 38, 117, 135, 145,
 - 305
 - carbon nanotube 305
- toxins 171
- toys 49, 82, 145
- transgenic fish, novel 289
- transhumanism 342
- transplantation 291, 296,
 - 309
 - human 25
- transport, sustainable 157
- treatment
 - gender re-assignment 359
 - inhuman 315, 318, 365, 375,
 - 376
 - life-saving 359
- tuberculin test 317
- tuberculosis 317

- UNESCO Declaration of Human
 - Genetic Data 17
- UNESCO Universal Declaration on
 - Bioethics and Human Rights
 - 17, 180, 285, 299, 307, 343,
 - 364
- UNESCO Universal Declaration on
 - Human Genome and Human
 - Rights 286
- United Nation Convention on
 - Biological Diversity 167
- uterus 28, 301, 328

- vaccination 310, 320, 321
- vaccine antigens 321
- vaccines 162, 203, 320
- vagus nerve stimulation 332
- vegetative state 332
 - chronic 358
- violence 316, 346, 350
 - unlawful 314, 351, 352, 365,
 - 395
- viruses 106, 160, 205
- volcanic eruptions 390

- Warsaw Declaration 40
- waste electrical and electronic
 - equipment (WEEE) 154
- waste recycling 151
- waste treatment 115
- water pollution 109

WEEE, *see* waste electrical and
electronic equipment

xeno-compounds 205

xenobiology 194, 199, 204

xenotransplantations 25, 31, 309

XNA 197

zinc finger nuclease 133

'In his book, Daniele Ruggiu makes an important contribution to the literature, recounting the ways in which European regulators have sought to engage more effectively and acceptably with emerging technologies but, most importantly, putting human rights front and centre in his narrative.'

Prof. Roger Brownsword
King's College London, UK

What is the state of current European governance on new and emerging technologies, and where is it going? What is, and what can be, the role of human rights in governance arrangements? These are the main questions that this book answers for both European and non-European scholars. It provides a wide picture of current European governance, notably in biotechnology, nanotechnology and synthetic biology, and discusses the model of Responsible Research and Innovation, which is gaining popularity within the European Union, under a human rights perspective. It shows how human rights can contribute to governance frameworks without posing obstacles to research and innovation.

The theory presented in the book is followed by practical guidelines drawn from human rights law. Starting from the Strasbourg Court jurisprudence, it provides a complete review of the wide range of rights that the European Convention on Human Rights protects in light of the challenges of technoscientific advances. This analysis will come in handy for private actors, policymakers, regulators, as well as judges in solving difficult cases raised by techno-scientific progress in the future.



Daniele Ruggiu received his PhD in law in 2008. He is assistant professor at the Department of Political Science, Law, and International Studies in the University of Padova, Italy, where he teaches legal theory. His main interests include the impact of emerging technologies on human rights with special attention to the jurisprudence of the European Court of Human Rights and the system of the Council of Europe.

Dr Ruggiu has worked on several EU-funded projects on new and emerging technologies (Synth-Ethics, EPOCH, ResAgora, NeroLaw network, etc.), published in several international scientific publications (*Nanoethics*; *Biotechnology Law Report*; *Law, Innovation & Technology*; *European Journal of Law and Technology*, etc.), and participated in several national and international conferences. He was a member of the Centre on Environmental, Ethical, Legal and Social Decisions on Emerging Technologies (CIGA) at the University of Padova (2009–2015), of the Society for the Studies of New and Emerging Technologies (S.NET) and of the editorial board of *Ars Interpretandi: Journal of Legal Hermeneutics*.



PAN STANFORD PUBLISHING

www.panstanford.com

V662
ISBN 978-981-4774-93-2



9 789814 774932