

## Index

### a

- active droplet array (ADA) 260
- active droplet merging 116
- active droplet sorting 116
- acute infectious diseases 177
- adhesion molecules 164
- alkenyl succinic acid anhydrate (ASA) 182
- alkyl ketene dimer (AKD) 182
- Alzheimer's disease (AD)
  - FISH-on-a-chip for 401
- anaerobic human intestine chip 301–303
- anoxic-oxic interface-on-a-chip (AOI chip) 303
- antibody-dependent methods, for CTC identification 244
- antibody-independent methods, for CTC separation 243
- anticancer immune response 149
- antigen-presenting cells (APCs)
  - processing and TAA presentation 165–166
  - T cell priming and activation 159–162
- anti-miR363 401, 402
- atomic force microscopy (AFM) 96, 97, 403, 406

### b

- bacterial invasion 288–289, 306
- Bacteroides fragilis* 285, 287, 303
- barcodes 32–35, 336, 337
- B cells 154, 156, 158–159, 284
- Bifidobacterium adolescentis* 303

- Bifidobacterium longum* 285
- biodegradable cellulose paper 178
- biodots 212, 222, 231
- biohybrid devices
  - applications 370
  - electrical stimulation 366–367
  - integration with other tissues 369
  - interface between medium and air 356
  - interface between muscle and artificial structure 353–355
  - living machines 370
  - long-term maintenance and self-healing 369–370
  - mechanical pairing of muscles 355–356
  - muscle-actuated 348
  - muscle cells and tissue arrangement 352
  - optical stimulation 367–368
  - 3D culture 354–355
  - 3D printed 368
  - 2D culture for 353–354
- biohybrid robotics 347
- biological diagnosis
  - digital microfluidic systems 223–232
  - fluorescent biodots 221–223
  - paper-based diagnostics 226–231
  - quantum dot-based microfluidic biosensor 212–213
  - upconversion nanoparticles (UCNPs) 219–221
- biomimetic nanomaterials 384
- biomimetic platforms 305

- biophysical property sensing
  - cell contractility measurement 96–98
  - cell deformability 98–99
- bioprinting technology 368
- biosensing techniques
  - based on electrical readouts 93–95
  - based on optical readouts 89–93
  - in bio-recognition 88
  - signal transduction 88
- biosensors, nanoparticle based 334–336
- bottom-up approach 87, 222, 325
- brain organoids 387
- bulk electroporation (BEP) 395, 396
  
- C**
- Caco-2 cell cultures 298, 301
- Caco-2 Intestine Chip 301
- cadmium selenide/cadmium sulfide/zinc sulfide (CdSe/CdS/ZnS) QDs 126–128
- cadmium selenide (CdSe) QDs 130–131, 137
  - synthesis 130, 131
- cadmium selenide/zinc sulfide (CdSe/ZnS) QDs 121–123
- cadmium sulfide (CdS) QDs 129–130
- cadmium telluride/zinc sulfide (CdTe/ZnS) QDs 121–123
- caesium lead halide perovskite QDs 133
- cancer cells
  - killing by immune effector cells 162–163
  - and MΦs interactions 163, 166
  - NK cells 162–163
- cancer-immunity cycle 149, 150, 159
- cancer interrogation 398–401
- capillary force 57, 269, 356
- carbon-based nanosensors, for infectious diseases 195–198
- carbon-based quantum dots 212
- carbon nanotube size-tunable enrichment microdevice (CNT-STEM) 254, 255
- cardiomyocytes, biohybrid devices with 348–350
- CAR T cells 156, 166, 167, 170
- C57BL/6 murine NK cell migration 161
- CD64 expression, characterization of 241–242
- CdS/CdSe core-shell nanoparticles 14
- CD4 + T lymphocyte enumeration 242, 243
- cell-based point-of-care testing 240
  - blood cell counting 240–241
  - CD64 expression, characterization of 241–242
  - CD4+ T lymphocyte enumeration 242–243
  - circulating tumor cells isolation and analysis 243–245
- cell contractility 85
  - measurement 96–98
- cell deformability 85, 98–99
- cell membrane-coated nanoparticles 329
- cell microencapsulation 23–25
- cellulose paper 178, 179, 193, 200, 226, 229
- centrifugal microfluidics 7, 243, 246
- chemical modification, of paper surface 182–183
- chemical warfare agents (CWAs) 405
- chemiluminescence 60–61
- chemiluminescence resonance energy transfer (CRET) 213
- chronic traumatic encephalopathy (CTE) 390–392, 407
- circulating tumor cells (CTCs) 93, 98, 240, 243
  - isolation and analysis 243–245
- c-Myc* oncogene, LAMP-based amplification of 224
- colorectal cancer (CRC) 285, 287–288
- colorimetric detection 185–187, 202, 262
- commensal bacteria 284, 285, 303
- competitive volumetric-barchart chip (CV-chip) 267

- compound semiconductor nanoparticles 119–112
  - contact angle 48–51, 53, 56, 61
  - continuous-flow microfluidics
    - design considerations 114–118
    - for nanoparticle synthesis 112–114
    - quantum dot synthesis 118–128
  - contractile characteristics, of muscles 348–350
  - contractile force, of tissue engineered muscle 361
    - C2C12 cells 361–364
    - primary myoblasts 364–366
  - copper indium sulfide/zinc sulfide (CuInS<sub>2</sub>/ZnS) QDs 123–125, 134–135
  - core-shell cell encapsulation 25
  - core-shell microparticles 7–9
  - core-shell MOFs composite synthesis 18
  - coulter counter 99
  - CRISPR system 338
  - CsPbX<sub>3</sub> perovskite QDs synthesis 133
  - cyclic olefin copolymer (COC)
    - microfluidic reactor 121
  - cytotoxin associated gene A (CagA) 286, 294
- d**
- dendritic cells (DCs) 149, 157, 284
  - digital microfluidics (DMF) 47, 259
    - advantages 48
    - biofouling 63
    - biological applications 63–72
      - for biological diagnosis 223–225
    - cell-based applications 68–72
    - cell culture 70
    - closed system 223
    - detection system integrated with 59–62
    - device fabrication 55–56
    - disposable 55
    - DNA-based applications 66–68
    - drug screening 70
    - electrochemical detection 61–62, 224
    - enzyme assays 63
    - FET-based sensor 62
    - heater module integrated with 59
    - heterogeneous immunoassay 65, 224
    - human genomic DNA extraction from 66
    - immunoassay 63–66
      - integrated with magnetic lens 58
    - loop-mediated isothermal amplification 224
    - magnetic particle-based immunoassays 224
    - microbial analysis 70
    - micro-PCR on 68
    - open system 223
    - pyrosequencing with 68
    - sample processing system integrated with 56–58
    - surface enhanced Raman scattering 61
    - surface plasmon resonance 61
    - wide-field imaging fluorescence detection system 60
  - dried blood spot (DBS) samples 56
  - droplet-based microfluidic devices 15, 260
  - droplet-based microfluidic reactors 116, 129, 130
  - droplet manipulations by EWOD
    - actuation 53, 54
  - droplet merging 116, 117
  - droplet microfluidics 1
    - barcodes 32–34
    - biosensors 29–32
    - cell microencapsulation 23–25
    - drug delivery 19
    - IFN- $\alpha$  production in human DCs 157
    - micro-structured material synthesis 4
    - nano-structured material synthesis 13
    - tissue engineering 25–29
  - droplet sorting 116, 117
  - droplet splitting 117
  - droplet trapping 117

- drug delivery systems
  - droplet-synthesized materials 19
- dynamic laser scattering (DLS) 326
- dysbiosis 282, 285
- e**
- elastic scattering 90, 91
- electrical stimulation 347, 348, 355, 361, 366–367, 369
- electrochemical detection-based
  - microfluidic devices 193
- electrode-based humidity sensing 335
- electrophysiology 99–100
- electroporation strategy 71, 72
- electrowetting-on-dielectric (EWOD)-based DMF 48
  - contact angle 49
  - contact angle saturation 53
  - device configuration 53
  - electromechanical approach 52–53
  - energy minimization approach 51–52
  - interfacial force 49
  - thermodynamic approach 49–50
- enzyme-accelerated signal enhancement (EASE) 254, 255
- enzyme amplification techniques 254
- enzyme assays 48, 63, 64
- enzyme-linked immunosorbent assay (ELISA) 84, 253
- Eubacterium hallii* 303
- EVIDENT platform 169
- extra cellular matrix (ECM) patterning 354
- f**
- fibronectin 288, 353
- field effect transistors (FETs) 62, 94, 95
- firmicutes 282, 285, 301, 303
- FISH-on-a-chip methods 401
- FITC-SiO<sub>2</sub> nanoparticles 334
- flexographic printing 182
- fluid rheology 85, 99
- fluorescence enzyme assay, on DMF 64
- fluorescence optical detection system 187
- fluorescence resonance energy transfer (FRET) 92, 93, 213, 220
- fluorescent biodots 221–223
- fluorescent nanomaterials-based approaches 211
- fluorescent nanotags 229
- Forster resonance energy transfer (FRET) 92, 93, 213, 220
- functionalized nanomaterials 86
- functional nanoparticle synthesis 319, 323
  - bio-nanoparticle interactions 325
  - biosensing 334–336
  - controllable multilayer structures 328–329
  - curved microchannels 325
  - double-spiral microchannels 325
  - drug delivery 330–332
  - fluorescence imaging 333–334
  - gene delivery 332
  - herring bone mixers 325
  - hydrodynamic focusing 323–324
  - hydrophilic drug delivery 331–332
  - limitations 320
  - magnetic resonance imaging 332
  - mechanical properties 327–328
  - mixing strategies 323–325
  - origami microchannels 325
  - photo responsive drug delivery 332
  - pH sensitive drug release 330–331
  - surface modification 326–327
  - theranostics 336–337
  - ultrasonic imaging 334
  - well-controlled size 325–326
- fused deposition modeling (FDM)
  - 3D-printers 256
- fusobacterial FadA protein 287
- Fusobacterium nucleatum* 286–288, 306
- fusobacterium phospholipase
  - autotransporter (FplA) 287
- g**
- gastric cancer 286, 288
- gel loop-mediated isothermal amplification (gLAMP) chip 249

- gene delivery 325, 332, 338  
 glass capillary microfluidic devices 87  
 gold-based nanosensors, for infectious diseases 198–200  
 gold nanoclusters (AuNCs), biosensors based on 92  
 gold nanomaterial-based visual detection 229  
 gold nanoparticles (AuNPs)  
   electrochemical reactions 94  
   LSPR system 89–90  
   for SERS 91  
*Granulicatella adiacens* 288  
 graphene oxide (GO) biosensors 195, 249  
 Gut-on-a-Chip model 297–298, 301
- h**
- Hanging Basket method 291  
 heart muscles (cardiomyocytes) 348  
 heater modules 59  
 heat-shock transformation 72  
 helical microstructured materials 11  
*Helicobacter pylori* 285, 286, 293  
 heterogeneous core/shell quantum dots  
   in continuous flow 121  
     cadmium selenide/zinc sulfide 121–123  
     cadmium telluride/zinc sulfide 121–123  
     copper indium sulfide/zinc sulfide (CuInS<sub>2</sub>/ZnS) 123–125  
     indium phosphide/zinc sulfide 125  
     zinc selenide/zinc sulfide 121  
   in segmented-flow 134–135  
 hollow bacterial cellulose microparticles 26  
 homogeneous core-type quantum dots  
   in continuous flow  
     cadmium selenide (CdSe) 119–120  
     cadmium sulfide (CdS) 118–119  
 homogeneous structure quantum dots  
   in segmented flow  
     cadmium selenide 130–131  
     cadmium sulfide 129–130  
     caesium lead halide perovskite QDs 133  
     lead halide perovskite QDs 132–134  
     lead selenide 131–132  
     lead sulfide 131–132  
 horseradish peroxidase  
   (HRP)-H<sub>2</sub>O<sub>2</sub>-chemiluminescence substrate system 60  
 human IgG detection 64  
 human-microbial crosstalk (HuMiX) model 297, 299–301  
 humidity detection 335  
 hybridoma B cells 158  
 hydrodynamic focusing 323–324, 332, 334, 336, 338  
 hydrodynamic trap array 154  
 hydrogel scaffolds 291  
 hydrogen detection 335, 336  
 hydrophilic drug delivery 331–332  
 hydrophobic nitrocellulose membrane 179  
 hypoxia-induced necrosis 356
- i**
- IgG (goat anti-mouse)-conjugated Qdot barcode microbead sandwich assay 213  
 immune and tumor cell interaction analysis 159–163  
 immunochromatographic strip test (ICT) 196, 199, 200  
 immuno-oncology therapy targets 150  
 immunotherapy 151–153, 156, 164, 166, 167, 170, 171, 282, 289, 388  
 impedance-based cell counting approach 240  
 impedance-based microfluidic leukocyte analysis device 241  
 implanted biohybrid machines 370  
 indium phosphide/zinc sulfide (InP/ZnS) QDs 125  
 infectious diseases  
   acute 177  
   diagnosis, nanosensors for 193  
   point-of-care detection 179  
 infrared light stimulation 368

inkjet etching 180, 182  
 inorganic nano-structured materials  
 13–16  
 InP/ZnS QDs 125, 126  
*in situ* fluorescence spectroscopy 138  
 integrated paper-based biosensor 185,  
 186  
 intestinal 3D organoid cultures 293  
 intestinal epithelial cells 284, 293, 297  
 intestine, cellular architecture of 284  
 Intestine Chip models 297–306  
 intraductal papillary mucinous  
 neoplasms (IPMNs) 288  
*in vitro* diagnostics (IVD) 83  
 biophysical property sensing  
 95–100  
 features 84  
*in vivo* diagnostics 83  
 ischemic stroke 393, 396  
 isothermal amplification methods 247

## j

Janus particles 7, 35

## l

lab-on-a-chip 47, 178, 211, 253, 389  
 lab-on-disc system (LoD), for nucleic  
 acid analysis 246  
 LaMer model 111, 112  
 laminin 288, 353, 387  
 laser ablation 87, 183  
 lateral flow immunoassay (LFIA) test  
 strip 269, 270  
 lead halide perovskite QDs 132, 133  
 lead selenide (PbSe) QDs 131–132  
 lead sulfide (PbS) QDs 131–132  
 ligation-rolling circle amplification  
 (L-RCA) reaction 249  
 Lippmann–Young's law 49, 50  
 localized surface plasmon resonance  
 29, 86, 89–90, 171  
 loop-mediated isothermal amplification  
 (LAMP) 59, 184, 224, 247,  
 249

## m

Mach–Zehnder interferometer (MZI)  
 nanodevices 405  
 magnet separation 58–59, 62  
 mammalian cell culture, on DMF 70  
 masking 321  
 mass spectrometry (MS) 48, 62  
 Measles–Rubella box (MR box) 259,  
 260  
 medical tests 83, 84  
 metal nanomaterials 86  
 metal nanoparticle-based sensors 29  
 metal-organic frameworks (MOFs) 16  
 micro-and nanotechnology (MNT)  
 383, 384  
 limitations 406–407  
 neurodegenerative disorders  
 389–392  
 neurodevelopment 386–388  
 neuro-oncology 388–389  
 traumatic brain injury 392  
 microbiome 281  
 bacterial invasion 288  
 and cancer 285–286  
 co-culture with 298–299  
 composition and biogeography  
 282–285  
 and host-microbiome interactions  
 289  
 3D cell culture models 291–294  
 2D cell culture models 291  
 microengraving method 154  
 microfluidic-based electroporation  
 (MEP) approach 395  
 microfluidic chips fabrication 320, 321  
 microfluidic devices  
 fabrication 87, 183  
 oxygen distribution in 359–360  
 microfluidic paper-based analytical  
 devices ( $\mu$ PAD) 189, 226  
 microfluidics-based nanoparticles  
 synthesis 338  
 micro-PCR, on DMF 68  
 micropost array detector (mPAD) 96

- micro-structured materials (MMs) 4
    - core-shell microparticles 7–9
    - Janus particles 7
    - porous microparticles 9–10
    - simple spherical microparticles 4–7
  - micro total analysis systems ( $\mu$ TAS) 47, 211
  - microwell-based capture methods 154
  - miniaturized paper/PMMA hybrid
    - microfluidic microplate 187, 188
  - miniaturized systems, physics of 385
  - miniaturized total analysis system ( $\mu$ TAS) 112
  - molecular dynamic (MD) simulation 328
  - monodisperse alginate hydrogel microparticle 5
  - MoS<sub>2</sub> transistor biosensors 95
  - MTB isothermal solid-phase amplification/detection (MTB-ISAD) sensor 249
  - mucin 284, 303, 304
  - mucosal immunity 284
  - multilayered paper-based devices, for multiplexed detection 190, 191
  - multiparameter affinity microchip 242
  - multiplexed bar-chart SpinChip (MB-SpinChip) 249
  - muscle-actuated biohybrid devices 348
    - advantages 347
    - heart muscles 348–350
    - non-mammalian muscle cells 352
    - skeletal muscle cells 350–351
    - smooth muscle cells 351–352
  - muscle cells 96, 100, 350–356, 367, 369, 370
  - muscle contractions, control of 366
  - MXenes 87
  - myoblasts cell sources, for biohybrid devices 351
  - myooids 350, 351, 366
- n**
- nanochannel electroporation (NEP) 395, 396, 398–401
  - nanoelectrospray ionization mass spectrometry (nESI-MS) 62
  - nano-engineered fluorescence probes 91–93
  - nanomaterials
    - bottom-up approach 87
    - classification 86
    - functionalized 86
    - metal 86
    - top-down approach 87
  - nanoneedles 384
  - nanoparticles
    - active targeting strategies 319
    - functional nanoparticles 319
    - passive targeting 319
  - nanoparticle surface energy transfer (NSET) 91, 92
  - nano-structured materials (NMs)
    - inorganic 13–16
    - organic 16
    - properties 13
  - nanotechnology
    - defined 86
    - quantum dots 93
  - nanotopography-based cell capturing 93
  - nanotransistor based assays 94–95
  - nanowire-based transistor arrays 99
  - neural systems on a chip (NSCs) 393
  - neuron-directed cellular reprogramming 394–396
  - non-isothermal amplification 245–246
  - non-mammalian muscle cells 352
  - non-muscle cells 96, 353
  - N*-(3-oxododecanoyl)-L-homoserine (OdDHL) 289
  - nucleation 13, 14, 111, 113, 118, 120, 125, 128, 130, 133, 137–139, 323

**O**

on-chip brain injury 403–405  
 on-chip testing, of tumor  
   immunotherapy 166  
   immune checkpoint blockade  
     167–170  
   TCR T cells 167  
 one-dimensional nanomaterials 86  
 open-cell porous PNIPAM microgel  
   particles 9–10  
 optical biosensors 211  
 optical stimulation 355, 364, 366–368  
 optics-based cell counting methods  
   240  
 optogenetics 355, 364, 367, 368  
 organic nano-structured materials 16  
 organoid cultures 290, 293  
 organoids-based drug screening 70  
 organoids-on-a-chip systems 387  
 Organ-on-a-Chip models 295  
 Organs-on-Chips approaches 153  
 origami  $\mu$ PAD, for HIV biomarker  
   detection 200, 201  
 oxygen supply, in muscle tissue  
   engineering 356  
   improving 360–361  
   microfluidic devices 359–360  
   numerical simulations 357  
   static culture conditions 358  
   vascularization 360

**P**

paper-based barcode 336  
 paper-based DMF 55  
 paper-based electrochemical ELISA  
   193, 194  
 paper-based microfluidic devices  
   biological signal amplification 226  
   disadvantages 226  
   feature of 226  
   fluorescent nanomaterial 229–231  
   gold nanomaterials 228–229  
   label-free biosensing 228  
   labelled biosensing 228  
   nanomaterial-based signal  
     amplification 227  
   nanoparticles integration with 228

  paper, structure and chemistry 226  
   physicochemical properties,  
     improvement strategy 226  
 paper-based microfluidic platforms  
   179  
   building materials for 179  
   carbon-based nanosensors 195  
   chemical modification 182–183  
   colorimetric detection 185–187  
   electrochemical detection 191  
   flexographic printing 182  
   fluorescence detection 187–191  
   gold-based nanosensors 198  
   inkjet etching 182  
   laser ablation 183  
   paper cutting and taping 183  
   photolithography 180, 181  
   physical blocking of pores, in paper  
     180–181  
   screen printing 182  
   wax printing 181  
 paper-based sandwich ELISA technique  
   185  
 paper cutting and taping 183  
 paper hybrid microfluidic platforms  
   carbon-based nanosensors 195–198  
   colorimetric detection 185–187  
   electrochemical detection 191–193  
   fabrication 183–184  
   fluorescence detection 187–191  
   gold-based nanosensors 198–200  
 paper/PDMS/glass hybrid microfluidic  
   biochip 195  
 paper/PDMS hybrid biochips 184  
 paper/PMMA hybrid CD-like  
   microfluidic SpinChip 184  
 paper/PMMA hybrid microfluidic chips  
   184  
 passive droplet merging strategy 116  
 passive droplet sorting 116  
 passive hydrodynamics-based  
   microfluidic cell trap platform  
     159  
 PbS QDs synthesis 132  
 PDMS-based microfluidic devices 183  
 PDMS microfluidic devices 88, 183,  
   184

- PDMS/paper hybrid microfluidic device 248
- PDMS/paper hybrid microfluidic platform 190, 192
- PEGylated pyrene-AuNPs dyads 92
- photomasking 321
- photonic crystals (PhCs) 32, 336, 337
- photopolymerization 4, 6, 13, 32
- photo-responsive drug release 332
- pH sensitive drug release 330–331
- plasmacytoid DCs (pDCs) 157
- Plasmodium falciparum histidine-rich protein 2 (pfHRP2) 216
- PMMA/paper hybrid microfluidic SpinChip, for mQ-LAMP detection 196, 197
- point-of-care testing (POCT) 84, 239
- cell-based 240
  - coffee ring effect 268
  - digital and droplet microfluidics 259–262
  - distance-based detection 266, 267
  - droplet magnetofluid platform 246, 248
  - drug abuse, quantitative detection of 267
  - forehead thermometer 266
  - limiting factors 253
  - metabolites and small molecules 262–271
  - with microfluidic paper-based device 269
  - microfluidic paper-based devices 268
  - multiplexed organic electrochemical transistors 268
  - of nucleic acids 245–252
  - protein detection 253
  - readout mechanism 265, 266
  - skin-like microfluidic system 264
  - sweat chrono-sampling 264
  - sweat monitoring device 262, 263
  - 3D-printed microfluidic devices 256–259
  - water-actuated valves 265
- poly(dimethylsiloxane) (PDMS) 385, 386
- poly(lactic-co-glycolic acid) (PLGA) 8, 324, 326, 327
- polydiacetylene (PDA) 334, 336
- polydimethylsiloxane (PDMS) 5, 56, 88, 178, 213, 247, 295, 304, 320
- polydimethylsiloxane-based microfluidic chips
- fluidic pressure tolerance 321–322
  - soft lithography technique 321
- polydopamine-based
- enzyme-accelerated signal enhancement 254, 255
- polymerase chain reaction (PCR) 59, 177, 245, 255
- polymer disperse index (PdI) 326
- poly(vinyl alcohol) (PVA) microgels 8, 26, 27
- porous microparticles 9
- Porphyromonas gingivalis* 288
- precision-cut tissue slices (PCTS) 294
- pre-concentration by liquid intake by paper (P-CLIP) 57
- pressure tolerance 320–322
- printed circuit board (PCB) substrates 55
- probiotics 281, 285
- pyrosequencing 59, 66, 68
- q**
- quantum dot-based disease diagnosis
- infectious disease 213, 216
  - influenza virus detection 216
  - Plasmodium falciparum histidine-rich protein 216
  - subclinical ketosis 216
  - target analytes 213
- quantum dot-containing barcode particles 32
- quantum dots 92, 93, 118, 254
- quantum dots (QDs) 333
- description 110
  - electronic band gap on particle size 110
  - nucleation and growth 138–139
  - supercritical fluid-assisted synthesis 120

quantum dots (QDs) (*contd.*)

synthesis 128

vapor-phase synthesis 111

## r

Rayleigh scattering 90–91

reverse engineering, of animals 370

reverse genetics approach 290

Reynolds Number 85, 115, 323

## s

scaffold-free skeletal muscles 350

Schwarz–Christoffel conformal

mapping 52

screen printing 55, 180, 182, 193, 200, 229

segmented-flow microfluidics

design considerations 115

quantum dot synthesis 128

semiconductor nanoparticles,

compound 109–112

semiconductor quantum dots 212

silica-based nanoparticles 333

silver nanoparticles (AgNPs)

LSPR system 89–90

for SERS 90–91

silver precipitation 254

simple spherical microparticles 4–7

single-cell barcode (SCBC) microchip 156

single immune cells 153, 155, 159

single-plane EWOD actuation

configuration 55

skeletal muscle cells 350–351, 353

skin-like microfluidic system 264

smooth muscle cells 96, 304, 350–352

soft lithography 5, 8, 88, 96, 183, 295, 321

solid-phase microextraction (SPME)

56, 57

solvent evaporation method 17

spheroids 168, 169, 294, 295, 356

stable host-microbiome interaction

281

stereolithographic (SLA) 3D-printing

256

stroke-on-a-chip platform 404

subclinical ketosis (SCK) 216

substrate materials, for DMF plates 55, 114

superabsorbent polymers 265

superparamagnetic iron oxide

nanoparticle (SPION) 336

surface enhanced Raman spectroscopy

(SERS) 31, 48, 61, 66, 91, 269

surface plasmon resonance (SPR) 13,

61, 89, 90, 198

suspension-drop electroporation (SDE)

395

sweat chrono-sampling 264

sweat monitoring device 262, 263

synthetic biology 72

SynVivo 294

## t

tail-shaped alginate microparticles 11

T cells

priming and activation 159–162

single immune cell analysis 153

trafficking and migration 164–165

TCR-MHC interactions 161

TCR T cells 156, 167

temozolomide (TMZ) 401

theranostics 336

3D microfluidic glioblastoma (GBM)

model 166

3D nanomaterials 86

3D printed biohybrid devices 368

3D-printed microfluidic devices, for

protein biomarker detection

258

three-phase droplet reactor, for CdSe

QD synthesis 137

thromboelastography 95

tissue-liquid extraction 56, 58

tissue nano-transfection (TNT) 396

top-down approach 87, 222, 320

traction force microscopy (TFM) 96

transition metal dichalcogenide

(TMDC) monolayer 86

transwell approach 291

tripropylenglycol diacrylate (TPGDA)

micro-structured materials 11

- tumor immune microenvironment
    - modeling 163
    - T cell priming and activation 165
    - T cell trafficking and migration 164–165
  - tumor immunotherapy 166
  - tumor infiltrating lymphocytes (TILs) 154
  - two-dimensional nanomaterials 86
  - two-layer thermoplastic PCR chip 247
  - two-plane EWOD actuation
    - configuration 55
- U**
- ultrafast rtPCR system 246
  - upconversion nanoparticles (UCNPs) 212, 219–221
- V**
- vacuolating cytotoxin A (VacA) 286
- W**
- water-actuated valves 265
  - wax printing 182–182, 198, 200
  - Whatman filter paper 179
  - world-to-chip interface 56–58, 62
  - world-to-DMF interface 57
- Z**
- zero-dimensional nanomaterials 86
  - zinc oxide nanowires (ZnO NWs) 200, 254
  - zinc selenide/zinc sulfide (ZnSe/ZnS) QDs 121, 122

