

Index

- acetazolamide (AZA), 179, 181–186, 198
acetone–water interface, 96
activation energy, 9–10, 171
acyl chains, 139, 142, 143, 155, 208, 212, 215, 219, 222
ADH, 333–334
amino acids, 81–82, 99–101, 107, 193–194, 241, 243, 270, 303, 351
amphibians, 345, 347–348, 356
amphiphiles, 103, 205–207, 222
apparent diffusion coefficient (ADC), 171, 293–294, 296, 299–301, 309–310, 321–324
aquaporins, 65, 72–73, 75, 192, 199, 202–203, 275, 285, 297
aquatic animals, 346, 351, 354, 356
aquatic environment, 344, 347, 355, 357
arthropods, 345, 352, 354, 356, 358
astrocyte, 192, 273–274, 291
ATPases, 238–240
autism, 296
bound water, 31, 171, 309
bovine serum albumin (BSA), 174
brackish water, 350, 355–356
Bragg peaks, 25–26
brain, 171, 180–182, 192, 200, 252, 264, 270–271, 273, 280, 289, 290, 292, 295–303, 307, 309–311, 316–318, 333, 335–339, 359
activation, 272, 276, 289–292, 306, 315, 317
cells, 270, 335
connectivity, 295
edema, 179–180, 198
function, 291–292, 295, 315
ischemia, 179–180, 198, 294, 299
Brownian motion, 49, 292
BSA. *See* bovine serum albumin
bulk water, 25, 27–29, 33, 40, 42, 49–50, 113, 124–125, 130–131, 135, 143, 165–167, 171, 211–212, 305, 307–308

- biexponential model, 297–298, 300
bifurcated hydrogen bonds, 10, 304
binary mixture, 68, 207–209
biological systems, 32, 247–249, 255, 259
biomolecules, 17, 24, 49, 64, 81, 218, 259
blood flow, 272, 289, 290–291, 311, 315, 338
blood osmolarity, 311
blood, 270, 316, 355, 357
blood–brain barrier (BBB), 251–252
BOLD fMRI, 290–291, 296, 315
bond length, 7, 9, 14
boson peak, 55, 59–60
calcium, 224, 314, 347
calorimetry, 26, 38
cancer, 207, 294, 295, 306, 309, 359
cell membranes, 139, 145–146, 161, 197, 201, 207, 269–270, 279–280, 289, 292, 296–297, 303–306, 308, 314, 325
cells
adjacent, 197, 224, 250, 260
cultured, 254–255
epidermal, 251–252
eukaryotic, 233
glial, 179–180, 201, 273, 276, 284, 311
cell metabolism, 270

- cell swelling, 271, 273, 278, 281, 284, 299–300, 306, 310–311, 314–315
- cell water dynamics, 167
- cell water viscosity, 304
- cell water, 31, 165, 172–173, 304
- cerebral blood flow (CBF), 290, 337
- cerebrospinal fluid (CSF), 270, 301, 335–337
- chemical structure, 98, 181, 185, 205
- clathrate, 211
- claudins, 250–255
- clusters, 14–17, 19, 180, 262, 291
- computer molecular dynamics (CMD), *see* Molecular dynamics
- confined water, 24–25, 29, 40–43, 158, 171, 175
- confocal microscopy, 209
- covalency, 7–8
- C-phycocyanin protein (CPC), 27, 31–34, 36
- crystal structure, 93, 97, 152–153
- cubic ice, 25, 30
- cysteine residues, 193–194, 198, 200
- cytoplasm, 167, 171, 172, 222, 233, 269, 302–305, 307
- cytoskeleton, 17, 139, 236, 238, 259, 260, 262, 303, 306, 308, 314
- cytotoxic edema, 294–295, 299, 310
- dehydration, 11, 64–65, 168–169, 212–213, 217, 222–223, 251–253, 345–346, 354, 357
- deionized water, 109, 112, 115–116, 125
- deuterium, 50, 166, 170
- DHM, 277–279
- dielectric constant, 16, 23, 65
- dielectric spectroscopy, 40, 41
- differential scanning calorimetry (DSC), 29, 207, 208
- diffusion anisotropy, 295, 299
- diffusion MRI, 292, 294–296, 309, 311, 316–317, 339
- diffusion tensor, 295
- diffusion time, 292–293, 296, 298, 307, 309–310
- diffusion, 17, 34, 45, 75, 131, 173, 177, 262, 271, 289, 291–295, 297, 306–307, 309–310, 319–324, 327–328
- diffusion-weighted image (DWI), 293, 339
- digital holographic microscopy (DHM), 275–276
- dipolar water molecules, 304
- dissociation, 6, 76, 141
- DNA, 18, 32, 50, 347, 349
- drug molecules, 93, 96, 98
- dry liposomes, 222
- dynamical heterogeneity, 57–58, 113
- earth, 12, 23, 333, 343–345, 348, 351
- E. coli*. *See* *Escherichia coli*
- electrolytes, 82, 146–147, 149, 253, 270, 346, 357
- electronic structure, 4, 10
- enthalpy, 11, 174, 315
- entropy, 11, 38, 64–65, 92–93, 174, 205, 208, 315
- enzymes, 32, 82, 99, 176, 235, 238–45
- digestive, 99, 101
- microcompartmentation of, 245
- enzymatic activity, 31
- epidermis, 251–252
- Escherichia coli*, 37, 165–166, 171–174, 236–238
- ethanol, 115–116
- evaporation, 356
- integumentary, 347
- latent heat of, 11

- exchange, 9–10, 12, 166–168, 298–299, 305, 307–309, 346, 353, 356
- excitability, 328, 331
- excretion, 351
- external osmotic pressure, 214
- EZ water, 124–125, 130, 135
- fast diffusion, 293, 300, 306–307
- fast diffusion phase (FDP), 280, 298, 300, 308–310
- fast water permeation, 182, 187, 191, 198, 199
- fibers, 275, 292, 294–295, 309–310, 313
- fibrillar structures, 238
- fish, 90, 346, 348, 351, 353, 355–356
- fluid-attenuated inversion recovery (FLAIR), 339
- fluoro-deoxyglucose (FDG), 295, 299
- force constant, 53, 55–56
- free water, 31, 306–307
- freshwater, 12, 346–348, 350, 352–353, 355, 358
- functional neuroimaging, 289–291, 316–317
- GABA, 270
- gating charges, 151–154
- gating region, 78–79, 81
- gel phase, 142, 208–209, 211, 213, 217, 219, 221
- gel surface, 126–127
- glass transition, 27, 33, 38, 40
- glial lamellae, 180, 198–199
- glial laminae, 196
- glutamate, 198, 270–271, 273–274, 277–280, 290
- glycocalyx, 308
- gstropods, 355
- Haloarcula marismortui*, 172
- heat capacity, 11–12
- heat release, 313, 315
- heavy water, 8
- hemodynamics, 291
- hemoglobin, 18, 165, 171–173, 291
- heterotetramers, 193
- hexagonal ice, 5, 12, 15, 25
- hippocampus, 301, 310
- homeostasis, 180, 192, 247–249, 251, 254, 255, 263, 271, 273, 291, 303, 315, 333, 334
- Human Brain Connectome, 295
- hydrated state, 55, 218, 220–221
- hydration shells, 24, 165, 167, 171, 210, 306
- hydration water dynamics, 60, 170
- hydration water, 23–24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 50, 57, 59, 167
- bound, 171
- hydration, 38
- hydrocephalus, 335–336
- hydrogen bond, 6–10, 12–14, 16, 26–30, 56, 60, 73, 75, 181, 191, 197
- hydrogen bonding, 6–18, 24, 30, 188, 207
- hydrostatic pressures, 270, 351, 358
- incoherent scattering, 32, 50, 166–167
- inelastic neutron scattering (INS), 27, 31, 36, 50, 143
- inelastic scattering, 50, 52
- influenza A, 78
- ions, hydronium, 74, 75, 80, 131, 135
- IOS (intrinsic optical signals), 271–276, 279, 312

- interfacial water, 18, 24, 26–27, 31, 36, 38–40, 135, 143–144, 148–149, 155, 168, 210–211, 235, 237–238, 241, 305
- intermembrane water, 170
- intracellular water, 19, 24, 32, 165–166
- intrinsic optical signals. *See* IOS
- invertebrates, 351–353, 355, 357
- Janus interface, 115, 117
- Karger equations, 309
- kidney tubules, 254
- Kv1.2 channel, 150, 153, 154
- layers, membrane-bound, 306–307, 310
- leakage, 215–216, 218, 253
- light scattering, 41, 97, 173, 272, 280
- lipid mixtures, 207–208
- lipids, hydrated, 213, 219
- lipid membranes, 140, 148, 151, 210
- lipid species, 207–208
- lipid–water interface, 144
- liposomes, 181–182, 216, 218
- liquid crystal, 126, 135–136, 142
- liquid water, 9, 11–17, 19, 25–26, 31, 89–91, 304, 317, 343
- liquid–gas interface, 116
- macromolecules, 11, 24, 31–32, 166–167, 171–173, 292, 297, 303, 305, 307, 308, 314
- magnetic field gradient, 293, 294
- magnetic resonance imaging (MRI), 280, 289, 333
- magnetization, 289, 291, 293, 334
- membrane–water interface, 143–144, 147
- mental health disorders, 296
- metabolism, 263, 289, 309, 315, 338, 343, 356
- methyl rotation, 53
- microemulsions, 23
- microtubules, 259–261, 308, 314
- minerals, seawater, 333
- mitochondria, 233–235, 238, 303, 338, 344–345
- molecular dynamics (MD) stimulation, 36, 37, 39–41, 52, 73, 140–141, 169–170, 182, 211
- molecular structure, 69, 292
- mollusks, 347, 355, 358
- MSD, 32, 38–40, 51–53, 56–58, 169, 174
- multilayer polarization model, 305
- Mycoplasma pneumoniae*, 235–237
- myriapods, 345, 348
- methazolamide (MZA), 181–185
- Nafion, 125–126, 127–135
- nerve impulses, 359
- neuronal activation, 290–291, 296, 300, 310, 311, 317
- neurotransmission, 263
- neutron diffraction, 143, 165–168
- neutron scattering functions, 52
- neutron spectroscopy, 32, 165, 167–169, 171–172
- nitrogen gas adsorption, 29
- NMR cryoporometry, 29
- normal mode analysis (NMA), 52
- nuclear quantum effects, 8

- optical imaging, 271, 291, 311
- optical path length (OPL), 275
- ortho*-H₂O, 5, 8
- osmoconformers, 354
- osmolarity, 270, 273, 346, 350–355, 357
- osmotic pressure, 198–199, 269, 350–351, 353
- paracellular barrier function, 251–252
- para*-H₂O, 5
- parasites, 99
- Parkinson's disease, 264
- partial molar volume (PMV), 65, 71, 76–77
- passive water transport, 271
- permselective barrier function, 251
- permselectivity, 250, 253
- PET. *See* positron emission tomography
- phase separation, 128, 208–209, 216–217, 219, 221, 224
- phase signal, 277–279
- phase transitions, 208, 212, 315
 - gel-sol, 11
 - hydration-dependent, 212, 214
 - liquid-crystalline, 209
- phospholipids, 139, 205, 206, 208, 212–213, 215, 218, 220, 272, 307–308
- pituitary gland, 333–334
- plant tannins, 93, 98, 100–101
- platelets, 217, 221, 223
 - dry, 223, 224
 - fresh, 224
 - human, 216, 223
- polymer gels, 23, 315
- positron emission tomography (PET), 289
- proteins
 - globular, 31, 35, 37, 101
 - membrane-bound, 259
 - pure proteins, 181
 - salivary, 101–102
 - structural, 235
 - thermodynamics of, 66
- protein dynamics, 35–38, 41, 49, 50, 53–54, 56, 58, 165, 167–168, 170
- protein hydration, 38, 49, 54, 59–60
- protein-water adsorption, 304
- proteoliposomes, 181–185
- proton selectivity, 78
- quasi-elastic neutron scattering (QENS), 25, 34
- quasi-elastic scattering, 52, 56–59
- q-space, 297
- radial distribution function (RDF), 67, 76
- radioactive water, 289–290
- radioactivity, 289, 291, 295
- red blood cells (RBCs), 165–166, 171–173, 290
- refractive index, 12, 134, 275–278, 350, 272
 - intracellular, 276–280
- regulatory volume decrease (RVD), 273
- rehydrated platelets, 224
- rehydration, 216–219, 221, 224
- renal tubules, 253
- repulsion, water-mediated, 215
- residence time, 27–29, 33, 40, 298, 308–309
- resilience, 174
- respiration, 351, 356
- root-mean-square deviation (RMSD), 187, 188
- rotational motion, 26, 38–39

- saltwater, 352–353
scattering vector, 51–52, 100, 102, 167
schizophrenia, 264, 296
seawater, 346, 348, 350, 351–357
selectivity, 64, 254
selectivity filter, 150
shear moduli, 115, 117
silica gel, 24
size selectivity, 252
slow diffusion phase (SDP), 298, 300, 306, 308–310, 315
slow diffusion, 297, 300–301, 306, 308, 317
solute–solvent system, 65, 69
solvation thermodynamics, 65
specialized water channels, 271
status epilepticus, 300
stopped-flow measurements, 182–184
structural information, 18, 67, 206
structured water, 31, 305–306, 308, 314–315
supercooled water, 40
supercritical water, 6
surface forces apparatus (SFA), 108, 111, 112
surfaces, nucleating, 126–129, 131, 135
- tannins, 98–99, 102–103
temperature dependence, 27, 39, 51, 53, 56, 58, 171
tertiary structure, 55, 81
tetrahedral bonding, 5
tetramers, 179, 192–193, 195–196
thermodynamics, 64, 70, 166, 248
thermotropic phase transitions, 216
three-dimensional reference interaction site model (3D-RISM), 65–66, 71–72, 74, 76
- tortuosity, 171, 296–297, 299–300, 308–309
transporters, 252–254, 259–260, 297
trehalose, 56, 217–224
- unhydrated state, 53–55
urine, 334, 348
urine, 347, 354–357
valproic acid (VPA), 181–185
van der Waals forces, 91, 141, 207, 305
vertebrates, 345, 347, 351–353, 355, 358
vibrations, 6, 33, 54, 108
viscosity, 18–19, 125, 131–133, 135, 296, 346, 350–351
voltage sensor domain (VSD), 150–152, 153–155
voxel, 292–294, 309, 316
- water channels, 147, 149, 182, 191–192, 198, 280, 303
water dimers, 17
water distribution, 74, 80
water dynamics, 37, 167, 170, 212
water efflux, 275
water films, 107, 111, 113
Janus-type, 117
structure of, 118
water influx, 272, 274
water magnetization, 290
water mobility, 19, 241, 243, 305
water molecular structure, 317
water network, 306, 308
water permeability, 181, 183, 184, 185
water permeation, 179, 181, 187, 196
water selectivity, 198
water transport, 181, 270–271, 273, 276
water vapor, 343, 356
water wires, 146, 149

- water-membrane interface, 148
water-soluble polymers, 24
water-vapor interface, 117
white matter, 294–295, 299, 302, 306,
 309–310
X-ray crystallography, 66, 72, 188, 190,
X-ray diffraction, 25, 67, 143, 212, 214
yeast, 216–218, 262–264