

# INDEX

## A

Activation enthalpies ..... 199, 200  
 ADP-BeF<sub>3</sub>.....13  
 ADP-bound state ..... 4, 12  
 Affinity  
   pull-down .....36  
   purification .....49–66  
 Alternating laser excitation (ALEX) ..... 351, 352, 355,  
   357–362, 365, 366  
 AMP-PNP (AMPPnP) .....13, 127, 129, 134,  
   168, 172, 174, 200  
 Annealing assay ..... 186, 189–191, 194  
 Anti-digoxigenin (anti-DIG)..... 231, 235, 236,  
   242, 247–249, 262, 269  
 ATPase  
   activity ..... 3, 14, 18, 20–21, 137, 142–144, 149,  
     150, 160, 171, 184, 224, 275, 303, 329  
   assay.....149, 161, 167–168, 171–172, 195, 218–219, 224  
   cycle .....3, 12  
   test .....296  
   turnover ..... 302–303, 309  
 ATP-bound state ..... 4, 12, 13  
 ATPγS..... 12, 13, 138, 140, 143, 149  
 ATP hydrolysis ..... 18, 21, 27–29, 137, 138,  
   183, 293, 294, 329  
 Autofluorescence ..... 212, 213, 309

## B

β-CASP nuclease .....453–465  
 β-galactosidase assay..... 341, 343, 344  
 Bioinformatics ..... 77, 84, 165–180  
 Biotin..... 231, 241, 259, 280, 283, 288, 289  
 Biotinylated DNA .....282, 314  
 BLAST search.....170  
 Bradford ..... 60, 128, 131, 195, 231, 296,  
   301, 316, 317, 322, 449, 460

## C

Cell  
   disruption ..... 54–56, 60–62, 64  
   fixation.....96  
   harvesting ..... 54–55, 60–62, 113  
   lysis .....38, 40–41, 44, 214, 456  
   permeabilization .....96–97

Chase oligonucleotide .....10–12  
 Chemical quench-flow .....277  
 ClustalW-XXL..... 167, 170  
 Cold  
   adaptation ..... 117, 118, 199, 200  
   sensitivity.....117  
   shock protein (CSPs)..... 117–119  
 Competent cells..... 109, 120, 234, 239  
 Competitive inhibitor.....177  
 Complementation assay.....119  
 Cross-linking..... 35–46, 174, 235, 242, 243, 251

## D

DEAD-box protein..... 14, 17–30, 137, 138,  
   166–180, 183–195, 199–208, 303  
 DEAH-box protein.....126  
 Diethylpyrocarbonate (DEPC) ..... 160, 167,  
   213, 340, 388–390, 395, 406  
 Diethylpyrocarbonate (DEPC)-treated water ..... 140, 142,  
   143, 148, 149, 160, 216–219, 222–224, 226, 308,  
   388–392, 394, 395, 398  
 Differential RNAsequencing (drRNA-seq).....70  
 Double-stranded RNA (dsRNA) ..... 18, 20–22,  
   29, 30, 88, 117, 126, 192–194, 212, 220, 222, 223,  
   226, 404, 405, 412, 427, 441, 465  
 Duplex  
   assembly.....306–307  
   preparation..... 185–186, 189  
   stability ..... 189, 206, 303  
   unwinding.....307–308

## E

EDTA contamination..... 160, 161  
 Electron-nuclear double resonance (ENDOR)  
   spectroscopy.....137–162  
 Electron paramagnetic resonance  
   (EPR) ..... 139, 143, 154–156, 158, 355  
 Electrophoretic mobility shift assay  
   (EMSA)..... 168, 172–174, 409  
 Electroporation.....99, 108, 109, 111–115, 447  
 EMOTE assay ..... 71–75, 77, 78, 81  
 EMSA. *See* Electrophoretic mobility shift assay (EMSA)  
 Endonuclease..... 70, 420, 422, 424, 439, 448, 453  
 Endoribonuclease ..... 79, 87, 88, 404, 419, 420  
 Energy barrier.....5, 13

EPR. *See* Electron paramagnetic resonance (EPR)  
 Equilibrium distribution..... 4, 8, 10  
 Exon-junction complex (EJC)..... 23, 29  
 Exonuclease ..... 70, 81, 103, 114, 418–425,  
 428–437, 439, 445, 446, 449, 450, 462, 465  
 Exonucleolytic activity..... 454, 455  
 Exoribonuclease activity assay ..... 428, 437–439, 443–444

**F**

FLAG-tag ..... 51, 54, 90, 96, 127–130, 133  
 Fluorescence  
 acceptor ..... 371  
 anisotropy (FA)..... 370, 371, 377, 381,  
 386–390, 392–401  
 detection ..... 297, 309, 370, 428  
 donor ..... 202–205, 208, 350  
 dye(s) (F-dye) ..... 356, 370–372, 423, 428,  
 432, 439, 440, 443–444, 446  
 emission ..... 202, 204, 370, 371, 378, 379  
 gel imager ..... 39, 42, 297, 320, 326, 352, 357  
 intensity ..... 98, 204, 208, 220, 222,  
 223, 371, 378, 391, 394, 400  
 labeling ..... 373–374, 379  
 reporter ..... 369–381  
 resonance energy transfer (FRET) ..... 22, 138, 200,  
 202–206, 208, 212, 241, 349–367, 370, 371  
 Fluorophore..... 10, 176, 189, 200, 202,  
 205, 206, 212, 216, 226, 318, 326, 349–351, 356, 357,  
 364, 370, 373, 378, 389–390, 399, 400  
 Footprinting ..... 14, 276–290, 403–414  
 FRET. *See* Fluorescence, resonance energy transfer (FRET)

**G**

Gel electrophoresis ..... 22, 56, 127, 129, 132,  
 141, 168, 212, 214, 232, 276, 277, 279, 281, 282, 296,  
 316, 317, 335, 352, 372, 407, 410–411, 420, 423, 427,  
 428, 430, 431, 433, 448, 455, 457, 458, 463, 465  
 Genetic screen ..... 23  
 Genomic stability ..... 125  
 GFP-trap..... 50, 53–54, 64  
 GlobPlot..... 167, 171  
 Glutathione sepharose..... 185, 188  
 G4 quadruplex..... 125–134  
 Gravity flow column..... 41, 128, 130, 237, 238  
 Growth phenotype ..... 18

**H**

Helicase  
 activity ..... 2, 18, 138, 139, 199–208, 212, 213,  
 220, 222, 224, 227, 230, 231, 241, 258, 295–310  
 assay..... 127, 129, 131, 132, 169–170,  
 173–177, 200–203, 212, 216–218, 220, 222–224,  
 226, 227, 303–307, 309  
 inhibition ..... 183–195  
 superfamily ..... 2

Hexamer..... 298, 302, 303, 307, 309,  
 369, 370, 375, 376, 379, 381, 406  
 High-throughput screening..... 212, 227  
 Hydroxyl radical ..... 403–414  
 Hyperthermophilic ribonucleases ..... 454

**I**

IC<sub>50</sub> value..... 222–223  
 IgG-Sephrose precipitation ..... 58–2  
 Image analysis..... 260, 263–266, 268, 270, 271  
 Immunofluorescence ..... 89–92, 94, 98  
 Immunostaining ..... 97–98  
 Inhibitory mechanism ..... 211–227  
 Inorganic phosphate contamination ..... 149  
 Interconversion ..... 9  
 Ionic strength ..... 7, 225

**L**

Labeling of synthetic RNA ..... 426  
 LabView..... 246, 247, 271, 358  
 Lactate dehydrogenase ..... 21, 149, 178  
 lacZfusion(s) ..... 339  
 Lambda *red* ..... 103, 104, 106, 114  
 Laser excitation ..... 253, 352, 355–357, 359, 360  
 LC-MS/MS ..... 36, 37, 42, 53  
 Local denaturation ..... 27

**M**

Magnetic tweezers ..... 257–272  
 Malachite green..... 21, 167, 171–172, 177–179  
 Mass spectrometry..... 36, 39, 42, 43, 45, 46, 50, 53, 57–59  
 Messenger ribonucleoprotein protien (mRNP)..... 36, 45  
 Messenger RNA (mRNA) ..... 4, 5, 23, 24, 26,  
 30, 35–46, 118, 125, 126, 184, 208, 334, 336, 338,  
 369, 403, 405, 412, 418  
 Mfold ..... 380  
 Microfluidic(s) chamber ..... 230, 235–236,  
 243–246, 248, 252, 262, 263  
 Microplate reader ..... 143, 178, 389  
 Microscopy ..... 89, 91–95, 98–100, 253, 257, 260, 353  
 Micro-volume spectrophotometer ..... 45, 406, 408, 409  
 miRNA..... 20  
 Molecular beacon ..... 371, 373, 378, 380  
 Monovalent salt concentration ..... 7  
 mRNA. *See* Messenger RNA (mRNA)  
 mRNP. *See* Messenger ribonucleoprotein protien (mRNP)  
 Mutagenesis..... 105–115, 170, 339, 344, 345,  
 423, 431, 433, 445, 447–449, 464  
 Mutational analysis..... 103–115

**N**

NADH ..... 21, 143, 149, 150, 178  
 Next generation sequencing..... 70  
 Nonhydrolyzable ATP analog ..... 28  
 Non-processive ..... 20, 23, 27–29

Nonsense mediated decay (NMD)..... 18, 24, 29  
Northern blot(ting) .....62, 63, 69, 80, 81  
NTPase.....212  
Nucleotide  
  binding site ..... 13, 138, 277  
  phosphates ..... 138, 140  
  triphosphate (NTP).....165, 250, 318, 335,  
  336, 340, 342, 343, 345, 418, 425, 437

**O**

Oligo(dT) cellulose..... 36–38, 40, 41, 45  
Optical tweezers .....229–253, 257  
Oxygen-scavenging system.....203

**P**

P-bodies ..... 36, 45  
PCR amplification.....24, 25, 105–107, 109–110,  
  112, 170, 240, 342, 344, 345, 444, 447, 460  
Pfam ..... 167, 171  
Phenol:chloroform..... 61, 406, 408, 410  
Phosphatase..... 406, 408, 457, 461  
Phosphorimager ..... 63, 168, 173, 174, 177, 186,  
  189, 194, 218, 219, 224, 225, 279, 284, 335, 340, 342,  
  411, 426–428, 439–441, 443, 450, 458, 463  
Phosphorimaging .....20, 175, 426–428, 439–441  
Phosphoryl group .....13  
Photobleaching.....203, 205–207, 358, 366, 3680  
Photodamage.....253  
Photostability .....356  
PolyA  
  enrichment .....35–46  
  pull-down ..... 38, 40–41  
Polyethyleneimine (poly[ethylenimine]).....219, 224  
Polystyrene beads.....230, 231, 234–235,  
  242–243, 248, 271  
POODLE ..... 167, 171  
Potassium permanganate (KMnO<sub>4</sub>) .....276  
PredictProtein..... 167, 170, 171, 178  
pre-mRNA splicing .....5, 17, 18, 23–25, 30  
Primer extension..... 69, 405  
Processive .....23, 88, 166, 230,  
  271, 303, 420, 462, 465  
Processivity ..... 2, 22, 27, 268, 275, 420,  
  437, 439, 454, 455, 462  
Protease (inhibitor) cocktail.....38, 52, 54, 64,  
  128, 130, 141, 142, 456  
Protein  
  aggregation ..... 42, 394  
  cofactor .....184–195  
  oligomerization ..... 105, 229  
Pulse-chase ..... 10, 11  
Purification of RNA..... 315–316, 421, 462  
Pyrophosphohydrolase..... 70, 78, 87, 88  
Pyruvate kinase ..... 21, 143, 149, 178

**R**

Radioactivity..... 21, 179, 194, 212, 277, 283, 286,  
  287, 289, 290, 425, 427, 437, 438, 440, 450  
Radioisotope..... 10, 212, 447  
Reaction velocity ..... 177, 222, 227  
Reactive oxygen species .....253  
Reannealing..... 206–208, 212, 222  
RecA..... 138, 165  
Reciprocal priming ..... 105, 110  
Recombineering .....103–115  
Reporter gene .....297, 303  
Reverse transcription .....73–76, 80–82, 84, 386  
Ribonucleases (RNase)..... 1, 18, 19, 21, 36, 50, 52,  
  62, 70–72, 74, 76, 78, 80, 88, 89, 91, 92, 98, 127, 133,  
  167, 185–188, 195, 213, 225, 297, 308, 317, 320, 323,  
  327, 329, 352, 363, 369, 371, 372, 403–414, 418, 421,  
  425–428, 431, 437, 439–441, 444, 453–465  
  activity ..... 411, 421  
  contamination..... 127, 133, 167, 186, 213,  
  225, 308, 363, 406  
  inhibitor(s).....72, 74, 76, 327, 425–428, 437, 441, 444  
  structure probing .....403, 404, 409–411, 413  
  treatment ..... 36, 186, 329  
Ribonucleoprotein (RNP) .....4–6, 23, 26, 27,  
  50, 166, 183, 404, 405  
Ribosomal RNA .....5, 49, 71, 74, 137, 138  
Ribosome biogenesis .....5, 17, 18, 20, 23–25, 27, 30, 49, 50  
RNA  
  annealing ..... 191, 369–381  
  binding .....17, 18, 20–23, 28, 103–115, 138, 166,  
  168, 172–173, 213, 220, 294, 334, 343, 369, 386,  
  388–394, 400  
  chaperone ..... 2, 4, 14, 88, 105, 117–122  
  concentration ..... 21, 45, 148, 176, 194, 233,  
  240, 306, 390, 391, 393, 399, 408, 439, 442  
  decay .....17, 20, 70, 88, 418  
  degradation ..... 30, 60, 70, 87–100, 167, 212,  
  213, 310, 329, 357, 417–420, 440, 453, 457–458, 462  
  duplex .....29, 126, 137, 190, 223  
  folding ..... 3, 8, 50, 142, 143, 148, 149, 390  
  helicase ..... 2, 4, 13, 14, 17–19, 30, 50, 87, 88, 125–134,  
  137–162, 165–180, 183, 184, 190, 199, 200, 206,  
  229, 230, 260, 303  
  helix .....2, 7–11  
  isolation ..... 61, 66, 74  
  ligation.....74  
  metabolism ..... 18, 20, 30, 229, 417, 453, 454  
  misfolding .....4  
  oxydation .....388–390  
  polyadenylation..... 87, 454  
  precipitation.....74  
  purification ..... 142, 147–148, 465  
  rearrangement..... 3, 9, 14

- RNA (*cont.*)  
 remodeling..... 1–15, 23, 138, 139, 166, 169, 229, 351–367, 405, 412  
 secondary structure ..... 2, 74, 334, 335, 340, 411, 465  
 substrate..... 88, 140, 143, 167, 170, 186, 190, 223, 231, 242, 258, 418–420, 427, 428, 437, 441, 444, 450, 451, 456–457, 460–463  
 tertiary structure ..... 2  
 translocase ..... 275–290, 293  
 translocation ..... 166, 257–272, 294  
 transport ..... 17  
 unwinding..... 8, 18, 21–23, 29, 125–134, 137, 191, 232–234, 238–241, 293–310  
 RNA-protein (RNP) structure ..... 5  
 RNase. *See* Ribonucleases (RNase)  
 RNase-free ..... 50, 62, 71, 140, 148, 188, 297, 318, 363, 371, 372, 406, 425–428, 437, 439–441, 444, 455, 460, 462, 463  
 RNA-seq ..... 70, 78, 84
- S**  
 Salt-titration assay ..... 387–401  
 Scansite..... 167, 171  
 Scintillation counting ..... 20, 190  
 Screening assay ..... 211–227  
 SDS-polyacrylamide gel electrophoresis (SDS-PAGE) ..... 36, 37, 39, 42, 45, 57, 66, 141, 144–146, 215, 221, 238, 296, 299, 301, 316, 317, 321–323, 330, 372, 379, 425, 435, 436, 449, 456, 459  
 Secondary antibody ..... 94, 97  
 Semi-native PAGE..... 370–372, 375  
 Sequence alignment(s)..... 170  
 Sequencing ..... 23–25, 53, 70, 72, 73, 75, 77–78, 80, 82–84, 99, 239, 250, 279, 289, 344, 345, 405, 407, 410, 411, 423, 424, 431, 433  
 Silane treatment ..... 99  
 Single-molecule ..... 230, 231, 236–237, 246–249, 257–272, 349, 350, 352–358, 363, 364  
 Single-molecule fluorescence resonance energy transfer (smFRET) ..... 230, 349–367  
 Single-stranded RNA (ssRNA)..... 3, 4, 8, 9, 22, 140, 175, 176, 180, 186, 193–195, 216, 224, 234, 238, 241, 253, 258, 267, 276, 303, 405, 412, 450  
 Spliceosome ..... 5  
 ssRNA. *See* Single-stranded RNA (ssRNA)  
 Standard curve..... 168, 172, 323  
 Stopped flow ..... 207, 234, 371, 373, 377–379, 381  
 Streptavidin bead(s)..... 248, 262, 271, 314, 318, 324–325, 328  
 Structural  
 homology..... 36  
 modeling..... 138  
 Substrate specificity..... 166, 183, 419, 420  
 SUMOtag ..... 428, 436  
 Suppressor mutation..... 26  
 SwissPDB Viewer ..... 167, 171
- T**  
 Tandem-affinity purification ..... 51–54  
 Tether extension ..... 258, 268  
*tetRA* cassette..... 105–107, 109–112, 115  
 Thin layer chromatography (TLC) ..... 20, 169, 174, 302, 318, 324, 419, 421, 425, 426, 437–439, 442, 448, 450, 455, 458, 463  
 Transcription  
 assay..... 336, 345  
 attenuation..... 335–338, 340, 342, 344  
 block..... 337, 341–343  
 start site(s) (TSSs) ..... 70, 78, 79, 446  
 termination ..... 105, 293–310, 313–330, 334–336, 340  
 Transcriptome ..... 70, 77  
 Transfection..... 127–130, 132, 133  
 Translation..... 1, 4, 17–19, 24, 29, 35, 36, 70, 88, 92, 104, 117, 125, 166, 184, 257, 260, 269, 314, 334, 338, 339  
 T7 RNA polymerase ..... 169, 179, 238, 297, 305, 406, 408, 413, 456, 460, 461  
*trp* RNA-binding attenuation protein (TRAP)..... 12, 23, 334–340, 342–344  
 T7 transcription..... 169, 173, 233, 240, 250
- U**  
 Unwinding  
 assay..... 23, 175, 176, 190–194, 203, 298, 304, 307–308  
 rate..... 9, 10, 200, 204, 205, 207  
 reaction ..... 3, 12, 176, 192, 194, 201, 203, 208, 230, 231, 242, 307  
 UV  
 light ..... 36, 37, 39, 42, 44, 46, 324  
 shadowing..... 148, 174, 305, 380, 432, 462  
 transillumination ..... 132
- W**  
 W-band spectrometer..... 140, 143, 149
- Y**  
 Yeast ..... 5, 13, 14, 17–20, 23, 24, 27, 35–46, 49–51, 54, 59, 63, 104, 107, 108, 119, 166, 167, 170, 183, 184, 213, 231, 294, 313, 315–317, 321, 341, 406, 408, 422