

## Index

### **a**

acceptor–acceptor–donor pattern 512  
 accumulator 221  
 acetoate dehydrogenase 642  
 acetolactate decarboxylase 641  
 acetolactate synthase 641  
 acetyl-CoA 639  
 acetyl CoA carboxylase 685  
 acoustic plate mode 377  
 acoustic waves 377  
 acrolein 631  
 actinomycetes 707  
 actinorhodin 716  
 activator RNA 90  
 activators 709  
 acyl homoserine lactone 254  
 adaptation 452  
 adaptor-ligated genomic fragments 165  
 adenosylcobyrinic acid 405  
 adenylyl cyclase 82  
 adhesion protein 575  
 adhesives 631  
 aerial microbial community 159  
 African yellow fever 592  
 AIDS 312  
 aldo-keto reductase 630  
 Alfalfa 673  
 algal biofuel 667, 689  
 algal biofuels 667  
 alginate 679  
 algorithm 231, 307  
 alkaloids 707  
 alkanes 669  
 alkenes 669  
 allelic replacement mutagenesis 452  
 allogeneic graft 563  
 allolactose 75  
 alternate splicing 106  
 alternative RNA splicing 99  
 Alzheimer's disease 109

$\gamma$ -amidotriphosphates 509  
 amino acids 38  
 amino acid biosynthesis 682  
 amino acid sequence 126  
 aminoacyl-tRNA 605  
 aminoacyl-tRNA synthases 464  
 aminocoumarin 706  
 2-aminopurine 514  
 5-aminolevulinic acid 400  
 Amperometric biosensors 362  
 anabolic pathways 469  
 anaerobic metabolism 629  
 anaerobic pathway 408  
 anaerobiosis 653  
 analog adder 277  
 analog cascade 280  
 analog circuits 280  
 analog computation 277  
 analog signals 570  
 animal feeds 687  
 anoxic conditions 638  
 anoxic environment 50  
 anthropomorphism 52  
 antibiotic resistance 495  
 antibiotic resistant infections 702  
 antibiotic resistant bacteria 292  
 antibiotics 254, 291, 701  
 antibiotics resistance 702  
 antibody responses 591  
 anticodon 465  
 antifreeze 622  
 antigen presentation 322  
 antigen-expressing transgene 348  
 antigen-presenting cell 348  
 antigenic drift 600  
 antimarial 709  
 antimicrobial drugs 452  
 antiretroviral response 549  
 antisense RNA 451  
 antisense strand 344

- apoenzyme 382  
 apoptosis 276, 343, 485, 544  
 apoptosis attractor 206  
 aptamer 45, 310, 344  
 aptazymes 261, 263  
 ara operon 78  
 arabinose 254, 636  
 arabinose isomerase 78  
 archaea 38, 407  
 archival storage 171  
 argonaute 336  
 artemisinin 715  
 artemisinin pathway 709  
 artificial gene clusters 707  
 artificial intelligence 307  
 artificial miRNAs 341  
 artificial proteins 517  
 assembly 165  
 assembly algorithms 169  
 association method 129  
 ATP phosphoribosyl transferase 69  
 ATP synthase 54, 470  
 ATP-binding cassette 471  
 ATPase 97  
 attenuation 79, 604  
 attenuator 80  
 attractors 185  
 AU-rich elements 606  
 autobreak 317  
 autocatalytic splicing 104  
 autoimmune diseases 326  
 autoimmune response 348  
 autoinducers 574  
 autonegative feedback 279  
 autoregulatory feedback loops 270  
 autostaple 317  
 avian flu 600  
 5-azacytidine 110
- b**
- B-cell acute lymphoblastic leukemia 565  
 BAC clones 490, 497  
 BAC inserts 492  
 BAC libraries 490  
 BAC vector 490  
 BAC/BGM library 499  
 bacteria 38, 157, 626  
 bacterial artificial chromosome (BAC) 10, 482  
 bacterial chromosome 92  
 bacterial core genome 450  
 bacterial edge detection circuit 284  
 bacterial locomotion 312  
 bacterial microcompartment (BMC) 20, 420  
 bacterial phospholipases 707  
 bacteriochlorophyll 415  
 bacteriophage 53, 283, 567  
 bacteriophage lambda 485  
 baculoviral vectors 347  
 band pass 545  
 band pass filter 256, 268, 526  
 base-pair structures 512  
 base-pairing 81  
 basic-region leucine zipper 116  
 basin of attraction 185  
 Bayesian networks 132  
 bead array 383  
 $\beta$ -galactosidase 68  
 $\beta$ -galactoside permease 68  
 $\beta$ -thiogalactoside transacetylase 68  
 beta-oxidation 682  
 betweenness centrality 132  
 BGM system 482  
 BGM vector 488  
 bilayer membrane 51  
 binary interactions 125  
 binding sites 373  
 bioactive scaffolds 706  
 bioassays 705  
 BioBricks 38, 232, 688  
 BioBrick repository 711  
 biochemical mechanism 197  
 biochemical reaction 231, 380  
 biocomplexes 359  
 biodiesel 428, 634, 667  
 biofilm formation 267  
 biofuels 253, 667  
 bioinert layer 373  
 bioinformatic infrastructure 170  
 bioinformatic tools 157  
 bioinformatics 543  
 bioinformatics techniques 192  
 biological actuation 349  
 biological interaction networks 308  
 biological nanofactory 567  
 biological networks 184  
 biological organization 445  
 biological signaling pathways 561  
 biological systems 308  
 biomanufacturing 290  
 biomass 622, 675  
 biomass formation 634  
 biomass harvest 689  
 biomaterials 231  
 biomedicine 336  
 biomolecular interactions 123  
 biomolecular processes 192  
 biomolecules 372, 578  
 biopolymers 446

- bioprocess 395  
 bioreactors 689  
 bioreceptors 360  
 biorecognition element 381  
 bioremediation 253, 269  
 biosafety engineering 551  
 biosecurity 23  
 biosensor 16, 290, 359, 716  
 biosynthetic enzymes 702  
 biosynthetic machinery 708  
 biosynthetic operon 408  
 biosynthetic pathways 701  
 biotechnology 336, 669  
 biotin 637  
 bipartite structure 96  
 bisabolene 687  
 bisabolene synthase 687  
 bistable switch 201, 230, 338, 568  
 blastocyst 525  
 blood glucose 382, 561  
 blood glucose homeostasis 534  
 bone marrow transplant 563  
 Boolean functions 183  
 Boolean logic 344  
 Boolean logic computations 273  
 Boolean logic gates 272  
 Boolean network 185  
 bottlenecks 133  
 bottom-up strategies 446  
 branch site 102  
 branched-chain alkanes 686  
 2,3-butandiol 622  
 2,3-butanediol dehydrogenase 641
- C**  
<sup>13</sup>C-labeled substrates 672  
 C-cluster coxsackie viruses 593  
 C-terminal domain 84, 412  
 CAAT box 93  
 canalizing functions 188  
 cancer 112, 231, 260, 312, 338, 418, 563  
 cancer cells 266, 575  
 cancer therapy 428  
 canonical translation 465  
 capping 113  
 capsid coding region 606  
 carbapenem-resistant enterobacteriaceae 703  
 carbon chemistry 43  
 carbon flux 633, 639, 671  
 carbon nanowire sensors 384  
 carbon source 81, 628  
 carbon-fixing protein organelle 426  
 carbonic anhydrase 420  
 carboxysome genomic locus 426
- carboxysomes 420  
 carcinoids 348  
 cascades 252  
 cascade effect 86  
 cassava powder 650  
 catabolite repression 81, 686  
 catalytic center 46  
 catalytic efficiency 676  
 catalytic function 311  
 celera assembler 167  
 cell behavior 263  
 cell cycle 252, 532  
 cell differentiation 91, 544  
 cell division 87, 91, 454, 546  
 cell envelopes 471  
 cell fate 269  
 cell immobilization 646  
 cell lysis 163  
 cell membrane 470, 528, 567  
 cell morphology 252  
 cell motility 284  
 cell recycling 646  
 cell signaling 485  
 cell sorting 544  
 cell therapy 231, 563, 575  
 cell volume 288  
 cell wall 673  
 cell-based therapies 524, 525  
 cell-cycle progression 467  
 cell-surface adhesion receptors 533  
 cell-to-cell communication 230  
 cell-type classifier 532  
 cell-cycle network 189  
 cell-cycle regulation 205  
 cell-density 293  
 cell-surface receptors 112  
 cellobiohydrolase hybrids 676  
 cellobiohydrolases 676  
 cellobiose 678  
 cellular automata 310  
 cellular database 215–217  
 cellular engineering 565, 568  
 cellular genome 546  
 cellular heterogeneity modules 535  
 cellular interactions 561  
 cellular metabolism 454, 672  
 cellular pathway 215–217  
 cellular reprogramming 549  
 cellular senescence 550  
 cellular signaling 276  
 cellular survival 447  
 cellulose 672

- cellulosic biomass 629  
 cenome 52  
 central dogma 507  
 central metallo-oxen semiconductor 379  
 central nervous system 593  
 centromeres 109  
 cephamycin C 713  
 cerebrospinal fluid 565  
 chain elongation 704  
 chain length 684  
 chaos-order transition 186  
 chaperone 276  
 chaperone protease 469  
 chaperone protein 414  
 chaperone-like complex 404  
 chaperones 468  
 charge-coupled device 164  
 charge-transfer complexes 374  
 chassis 712  
 cheese 643  
 chemical kinetics 191  
 chemical vapor deposition 384  
 chemically guided gene expression 533  
 chemically inducible chromosomal evolution (CIChe) 14  
 chemoautotrophic bacteria 420  
 chemoinformatics 703  
 chemoorganoheterotrophic 469  
 chemotaxis 263  
 chemotherapy 563  
 chimeras 124  
 chimeric antigen receptor 563  
 chimeric promoters 274  
 chimeric protein 677  
 chiral carbon 642  
 chloroplast 96, 52  
 chloroplast DNA 92  
 cholera 574  
 chromatin 92, 288  
 chromatin remodeling 336  
 chromatin structure 110  
 chromatin-based synthetic circuits 270  
 chromatin-mediated silencing 258  
 chromatin-modifying proteins 256  
 chromodomain 111  
 chromosomal integration 336  
 chromosomal mosaicism 549  
 chromosome 53, 75, 481  
 chromosome replication 454  
 chromosome segregation 467  
 chromosome variations 531  
 chronic disorders 703  
 circuit 2, 4, 15–18, 18  
 circuit behavior 287  
 circuit dynamics 345  
 circuit–host interactions 286  
 circuit topology 253, 279  
 circular dichroism 72  
 circular mtDNA 487  
 circular polymerase extension cloning 547  
 cis-acting elements 69  
 cis replication element 599  
 cis-repressed RNA 262  
 classifier circuits 292  
 clocks 201  
 cloning 525  
 cloning host 484  
 cloud computing 171  
 CO<sub>2</sub> assimilation 675  
 cobalamin (*cob*) operon 422  
 cobalamin biosynthetic operon 406  
 cobalamin conjugates 419  
 cobalamin-dependent enzymes 429  
 cobalt–carbon bond 404  
 cobalt insertion 399  
 cobalt-early pathway 402  
 cobalt-late pathway 402  
 cobaltochelatases 402  
 cobyric acid 403  
 cobyric acid *a,c*-diamide 403  
 coding region 233, 241  
 codon 80  
 codon pairs 594  
 codon pair deoptimization 598  
 codon pair score 596  
 codon usage 594  
 codon-specific release factors 467  
 coelicolor polyketide 706  
 coenzyme 38, 42, 637  
 cofactor 400, 406  
 Coffin–Lowry syndrome 111  
 co-localization 18  
 colon cancer 575  
 combinatorial biosynthesis 710  
 commensal bacteria 574  
 commodity chemicals 622  
 communication networks 545  
 communities 52  
 comparative genomics 447  
 compartmentalization 2, 18, 20, 42, 420  
 compartmentalized cells 38  
 competitive binding 200  
 complementarity 46, 508  
 complementary mutation 129  
 complementary strand 322  
 complex biological logic circuits 273  
 compromised immune system 591  
 computational modeling 716

computational tools 231, 243  
 computer-aided design 314  
 computers 307  
 conductometric biosensors 366  
 conductometric techniques 366  
 conductometry 362  
 coniferyl 674  
 conjugated polyelectrolyte 367  
 conjugated polymer 366  
 conjugation 52  
 conjunctive normal form 344  
 constitutive promoter 279  
 continuous cultures 647  
 control circuits 716  
 control panel 220  
 control systems 79  
 controlled pore glass 382  
 cooperativity 278  
 coordinate induction 89  
 coordinate repression 69  
 copy number variation 139  
 core biosynthesis genes 704  
 core microbiome 160  
 core of the minimal genome 446  
 core proteins 99  
 core proteome 453  
 core region 73  
 corepressor 69  
 corn fiber 645  
 corn steep liquor 637  
 corn stover 676  
 Corncob 644  
 Corncob molasses 643  
 corrin biosynthesis 409  
 corrin reductase 425  
 cosmetics 631  
 cosmid library 704  
 cosubstrates 635  
 cotranslational folding 606  
*p*-coumaryl alcohol 674  
 counterelectrode 362  
 counters 325  
 covalent binding 361  
 CpG dinucleotide 110  
 crosslinking 360  
 crossover 317  
 crosstalk 255, 261  
 CRP dimer 83  
 cryptic clusters 711  
 cryptic metabolome 708  
 cryptic splice site 102  
 cryptochrome 2 260  
 crystal structure 418  
 culture systems 689

cultured cells 593  
 cyanobacteria 254, 420, 687  
 cyanobacterium 683  
 cyanocobalamin 397  
 cybernetics 307  
 cyclic AMP 82  
 cyclic AMP receptor protein 78  
 cyclin-dependent kinase 194  
 cyclin E 340  
 cytokine 527, 543  
 cytokine release 565  
 cytokine-mediated toxicity 565  
 cytoplasm 48, 51, 484  
 cytoplasmic membrane 468  
 cytoplasmic/nucleoplasmic proteins 525  
 cytoplasmic repressor 71  
 cytoplasmic ribosomes 114  
 cytosine 47  
 cytoskeleton 528  
 cytotoxic effector protein 292

**d**

damping behavior 286  
 daptomycin 713  
 data management 169  
 data storage 170  
 database of interacting proteins 137  
 dechelatase activity 415  
 decoding 465  
 degree centrality 132  
 delayed fluorescence 368  
 dendritic cells 326  
 deoptimized encodings 594  
 deoptimized virus 602  
 6-deoxyerythronolide B 714  
 deoxyribonuclease 74  
 derepressor RNA 90  
 descobaltocorrinoids 415  
 design-build-test cycle 264  
 designer 232  
 detergents 631  
 Dexter energy transfer 369  
 diabetes 567  
 diacetyl reductase 642  
 diastereoisomeric forms 624  
 Dicer 336  
 Dicer 1 109  
 dielectric constant 376  
 diet 160  
 differential algebraic equation (DAE) 214  
 differentiation 485, 525, 530  
 difluorotoluene 507  
 digital adder 277  
 digital logic computation 273

- digital logic gate 273  
 dihydrosirohydrochlorin 402  
 dihydroxyacetone 632  
 dimethylbenzimidazole 405  
 dinucleotide pair frequencies 606  
 dinucleotides 607  
 direct annotation 138  
 directed evolution 256  
 disease-perturbed networks 139  
 disjunctive normal form 344  
 dissolved oxygen 645  
 distance matrices 128  
 diverse interaction networks 139  
 DNA 671  
 DNA assembly 2, 5–15, 16  
 DNA base pair 260  
 DNA-based sensors 324  
 DNA-based intercellular communication 283  
 DNA-binding 199, 241, 256, 335  
 DNA-binding domain 87, 258  
 DNA-binding proteins 84  
 DNA-binding region 73  
 DNA cloning 4  
 DNA delivery 254  
 DNA–DNA interactions 310  
 DNA fragments 485  
 DNA-genome world 47  
 DNA helicase 94  
 DNA inversion 288  
 DNA invertase cascade 271  
 DNA isolation 708  
 DNA ligase 4, 459  
 DNA looping 78  
 DNA methylation 89, 110, 710  
 DNA methyltransferase 110, 710  
 DNA microarray technology 88  
 DNA microarrays 383  
 DNA modification 5–15  
 DNA nanorobot 321  
 DNA nanostructures 311  
 DNA origami 313  
 DNA polyhedron 324  
 DNA polymerase 473, 510  
 DNA polymers 47  
 DNA probes 383  
 DNA–protein interactions 570  
 DNA recombinases 271  
 DNA recombination 462  
 DNA replication 47, 445, 455  
 DNA search 233  
 DNA segments 53  
 DNA template 516, 568  
 DNA template amplification 164  
 DNA transcription 47  
 DNA vaccines 326  
 DNA viruses 53  
 DNase degradation 92  
 DNase I 326  
 DNAzymes 276  
 domain–domain interactions 129  
 domain interactions 138  
 domain pair 130  
 dominos 485  
 donor genome 53  
 double crossover 311  
 double helix 84  
 double stranded DNA 321, 484  
 double stranded RNA 336  
 double stranded scaffold 314  
 downstream processing 651  
 doxycycline 259  
 drug design 309  
 drug development 291  
 drug release 309  
 drug therapy 309  
 drug-delivery vehicles 567  
 drugs 231  
 dual regulation 200  
 duplex DNA 509  
 dyad symmetry 76  
 dynamic light-scattering 322  
 dynamic regulation 293  
 dynamic sensor-regulator system 293  
 dynamic signaling 531  
 dynamical circuits 264  
 dynamical equations 183  
 dynamical model 196  
 dynamical modeling 201  
 dynamical systems 186  
 dynamical transitions 189  
 dynamical variables 193
- e**
- ecdysone 259  
 e-cell (electronic cell) 211–228  
 e-cell system 218–227  
 echinomycin 705  
 ecological modeling 715  
 edges 123  
 editing panel grid 317  
 “edge of chaos” hypothesis 188  
 effector molecules 235  
 effector proteins 578  
 ehub node 134  
 eIF2-eIF2B complex 115  
 electrochemical biosensor 361  
 electrochemical gradient 48  
 electrode potential 363

- electron microscopy 72  
 electron transfer 43  
 electron transport 97  
 electron transport chain 407  
 electrostatic approximation 374  
 electrostatic interactions 73  
 embryo 525  
 embryonic stem 348  
 embryonic stem cell 525, 565  
 emission wavelength 368  
 emulsion-based PCR 164  
 encapsulins 423  
 end-product repression 69  
 endemic reservoirs 608  
 endoglucanase 677  
 endonuclease 99, 467, 484, 495  
 endosymbionts 449  
 endosymbiosis 52  
 endosymbiotic processes 449  
 energetic metabolism 455  
 energy homeostasis 450  
 energy-rich bonds 43  
 enteric viruses 162  
 enthalpy 380  
 environment 669  
 enzymatic hydrolysis 676  
 enzyme-catalyzed reaction 380  
 enzyme cofactors 626  
 enzyme electrodes 359  
 enzyme IIA 82  
 enzyme induction 68  
 enzyme-linked immunosorbent assay 378  
 enzyme–product complex 415  
 enzyme repression 69  
 enzyme thermistors 382  
 enzymes 42, 359, 381  
 epigenetic 75  
 epigenetic networks 571  
 epigenetic regulation 545  
 epigenetic switches 527  
 epigenotype 111  
 episomal plasmid 547  
 Epstein–Barr nuclear antigen 547  
 eradication 607  
 erythrocyte 224–227  
 erythrocyte model 225  
 erythromycin 276  
 erythromycin A 714  
 erythromycin biosynthesis 712  
*Escherichia coli* 566  
 ethanol 626, 667  
 ethanologenic fermentation 679  
 ethanologenic host 678  
 ethical and legal complications 536  
 ethylene diamine bridge 513  
 euchromatin 93  
 eukarya 38  
 eukaryotes 67, 157, 253, 528  
 eukaryotic cells 48  
 eukaryotic genes 453  
 eukaryotic genome 92  
 eukaryotic initiation factor 2 115  
 eukaryotic virus 607  
 evanescent field 371  
 evolution 289  
 evolution of life 51  
 evolutionary constraints 128  
 evolutionary patterns 126  
 evolutionary trees 137  
 executive protein 194  
 exon 67  
 exon number 107  
 explosives 623  
 export 321  
 expression data 133  
 expression patterns 349  
 extant life 37  
 extended bacterial core genome 450  
 extracellular matrix 543, 565  
 extractive fermentation 649  
 extremophiles 708  
 extrinsic noise 288
- f**
- factor A 417  
 factor II 402  
 false-negative assembly 166  
 false-positive assembly 166  
 farnesene 687  
 fatty acid metabolism 682  
 fatty acid pool 687  
 fed-batch culture 644  
 fed-batch system 648  
 feed-back mechanisms 688  
 feed-forward loop 335  
 feedback 187  
 feedback inhibition 705  
 feedback loops 279, 338, 571  
 feedforward loop 198, 289  
 feedstock engineering 674  
 feedstocks 672  
 fermentable sugars 667  
 fermentation 399, 623, 645, 683, 714  
 fermentation broth 650  
 fermentation mash 650  
 fermenter design 645  
 ferredoxins 43  
 ferritin-like protein 423

- fertilization 485  
 fertilizers 679  
 fibroblasts 545  
 field intensity enhancement factor 375  
 filtering 268  
 filters 545  
 firmicutes 160  
 FK506 714  
 flavin destructase 405  
 flavodoxin 404  
 flavoprotein 408  
 flexibility 187  
 flipping 271  
 flow cytometry 544  
 flow injection analysis enzyme  
     thermistor 381  
 flu pandemics 600  
 fluorescence quenching 369  
 fluorescence resonance energy transfer 370  
 fluorescence spectrum 74  
 fluorescence wavelength 368  
 fluorescent dye terminator bases 165  
 fluorescent protein 276, 340  
 fluorescent reporter proteins 254  
 flux balance analysis (FBA) 214  
 food processing 628  
 food supplements 546  
 forced pH fluctuation 644  
 formate dehydrogenase 681  
 formation stage 195  
 fossil fuels 667  
 fragment recruitment 168  
 friend leukemia 115  
 fructose 636  
 fuels 231  
 functional annotation 138  
 functional bricks 192  
 functional flow algorithm 139  
 functional module 134  
 fungi 54  
 fusions 423  
 fusion protein 19, 292
- g**  
 gamma lactone 406  
 galactocerebrosidase 348  
 gas electrode 364  
 gastrointestinal tract 593  
 gated pores 424  
 GC content 606  
 gel electrophoresis 497  
 gene analysis 156  
 gene chip technology 88  
 gene circuits 183, 334  
 gene cluster 705  
 gene deletion 705  
 gene duplication 402  
 gene expression 87, 236, 252, 254, 258, 283, 293,  
     526, 544, 571  
 gene expression dynamics 243  
 gene expression profiles 131, 139  
 gene fabrication 669  
 gene knockout 672  
 gene length 596  
 gene networks 338, 534  
 gene network motifs 289  
 gene order method 126  
 gene persistence 39  
 gene products 445  
 gene regulation 67, 340  
 gene regulatory networks 184, 205  
 gene repertoire 469  
 gene silencing 336  
 gene structure 39  
 gene synthesis 594  
 gene therapy 326  
 gene-specific clusters 166  
 gene-silencing mechanism 109  
 gene–gene interactions 90  
 generally regarded as safe 641  
 genetic alphabet 507  
 genetic cascades 268  
 genetic circuitry 191  
 genetic circuits 192, 252, 335  
 genetic code 46, 98  
 genetic codon table 516  
 genetic engineering 481, 629, 688  
 genetic information 507  
 genetic loci 717  
 genetic machinery 455  
 genetic modification 681  
 genetic networks 526  
 genetic operons 568  
 genetic redundancy 652  
 genetic regulatory processes 191  
 genetic switch 230, 335  
 genetic timer 267, 570  
 genetic transformation 484  
 genetic variations 139  
 genome 37, 253, 399, 405, 484, 681  
 genome dissection 497  
 genome engineering 22, 260  
 genome manipulation 481  
 genome minimization 713  
 genome mining 704  
 genome organization 126  
 genome projects 39  
 genome-scale interactome 139

- genome-scale reconstruction 134  
 genome sequences 671, 710  
 genome sequence information 500  
 genome sequencing 155, 407, 447  
 genome structure 600  
 genome synthesis 9  
 genome transplantation 22  
 genome-wide topological patterns 191  
 genomes 336  
 1000 Genomes Project 171  
 genomics 39  
 genomic analyses 447  
 genomic fluidity 167  
 genomic integration 682  
 GFP-coding region 272  
 giant DNA 481  
 glass electrode 364  
 glioblastoma 347  
 Global Ocean Sampling 155  
 Global Polio Eradication Initiative 608  
 globoid cell leukodystrophy 348  
 glucose 636, 676  
 glucose catabolism 635, 636  
 glucose oxidase 362  
 glucose:glycerol ratio 636  
 glucose-6-phosphate dehydrogenase (G6PD) 224, 226  
 glucosyltransferase 652  
 glutathione 224, 226  
 glycerol 632  
 glycerol dehydratase 632  
 glycerol dissimilation 639  
 glycerol flux 639  
 glycerol perturbation spectra 74  
 glycolysis 454, 641  
 glycolytic pathway 624  
 glycosyltransferase 706  
 graded positive feedback loops 280  
 graft-versus-host disease 563  
 graft-versus-tumor effect 563  
 graph theory 132  
 graphs 123  
 gratuitous inducer 68  
 “green” chemistry 622  
 green fluorescent protein (GFP) 14, 267, 313, 425, 550, 641, 670  
 greenhouse gas 670  
 green monster 14  
 grid size 317  
 growth factors 91, 543  
 growth kinetics 603  
 growth regulators 675  
 GTPases 467  
 GTPase protein binding domain (GBD domain) 19  
 GU-rich elements 606  
 guanosine triphosphate 43  
 guide RNA 260  
 gut microbiome 161, 567  
 gyrase 459
- h***
- hairpin structure 324  
 haplotypes 485  
 heart disease 567  
 heat capacity 380  
 heat shock conditions 467  
 heat shock protein 85  
 heat shock regulon 86  
 heat shock response 86  
 HeLa cancer cell 275  
 HeLa cells 343, 345  
 HeLa-high miRNAs 276  
 HeLa-low miRNAs 276  
 helix–turn–helix domain 84  
 helper modules 707  
 hemagglutinin 601  
 hematopoietic stem cell 563  
 hematopoietic stem cell transplantation 563  
 heme synthesis 411  
 heme-copper protein 408  
 hemicellulose 644, 672  
 hemin controlled repressor 115  
 hepatitis C 608  
 heterochromatin 93  
 heterogeneous nuclear ribonucleoprotein A1 343  
 heterogeneous RNA 93  
 heterologous system 640  
 heterotrophic metabolism 471  
 hexaminecobalt 313  
 high-copy plasmid 279  
 high-density transposon mutagenesis 452  
 high-energy nucleotides 45  
 high-throughput analysis 349  
 high-throughput method 384  
 high-throughput sequencing 165  
 high-throughput studies 710  
 high-throughput protein–protein interaction detection 124  
 Hill exponent 199  
 Hill function 193  
 histidine operon 75  
 histidine protein 82  
 histone 92  
 histone acetylase 110  
 histone deacetylase 710

- histone demethylation 260  
 histone-modifying enzymes 260  
 histone 52  
 HIV infection 574  
 homeostasis 186, 187, 530, 534  
 homolactic fermentation 653  
 homologous recombination 6, 397, 497  
 horizontal gene transfer 39  
 horizontal transfer 701  
 hormone–receptor protein complexes 112  
 hormones 378  
 host–circuit interactions 253  
 host defense system 423  
 host–microbial symbiotic state 161  
 host–microbiome studies 159  
 host–pathogen interaction 162  
 host–pathway combinations 706  
 housekeeping genes 93  
 hubs 133  
 human chromosome 108  
 human diseases 139  
 human food chain 667  
 human genome project 166  
 human genome sequence 88  
 human microbiome 566  
 hybrid analog–digital designs 282  
 hybrid oscillators 265  
 hybridization 88, 382  
 hydrocarbon chains 50  
 hydrocarbons 669, 686  
 hydrogen-bonding 507  
 hydrogenobyrinic *a,c*-diamide 404  
 hydrogenolysis 624  
 hydrophobic base pairs 508  
 hydroxymethylbilane 400  
 hypersaturation transposon mutagenesis 452  
 hypersensitive sites 92  
 hysteresis 545
- i*  
 Illumina sequencing platform 157  
 “insulator” elements 716  
*I-PpoI* digestion 496  
 immobilization 360  
 immobilized ligand 372  
 immune memory 260  
 immune response 326, 344, 591, 598  
 immunity 591  
 immunogenic responses 580  
 immunogenicity 608  
 immunology 592  
 immunosuppressants 563  
 immunosystems 359  
 immunotherapy 564, 575
- impedance spectroscopy 362  
 inactivated polio vaccine 600  
 incoherent feed-forward 340  
 induced pluripotent stem cell 525, 578  
 inducer molecules 546  
 induction 68  
 influenza 599  
 inherited gene expression 89  
 inhibitor 69  
 initiation complex 93  
 initiation factor 93  
 innate tolerance 636  
 input–output response 278  
 input–output transfer functions 280  
 insects 708  
 insertional mutagenesis 531  
*in silico* modeling 212, 218, 224, 227  
 insulators 263  
 insulin 534  
 integration 491  
 integration locus 491  
 integrator gene 89  
 inteins 274  
 interaction kinetics 373  
 interactome 472  
 intercellular communication 283, 533  
 interdigital transducer 377  
 intergenic regions 336  
 internalization 49  
 International Human Microbiome Consortium 161  
 intracellular flux 672  
 intragenic regions 336  
 intramolecular packing 369  
 intrinsic biocontainment mechanisms 717  
 intron 67, 265  
 intron splicing 97  
 intronic sequences 262  
 invasin 575  
 3-iodotyrosine 516  
 ion-selective electrode 364  
 ion-selective field effect transistor 365  
 iron–sulfur clusters 41  
 isobutanol 683  
 iso C nucleoside 507  
 isocytosine 507  
 isoenzyme 683  
 isoguanine 507  
 isomerization 400  
 isoprene 687  
 isoprene side chains 49  
 isoprenoids 687  
 isopropyl- $\beta$ -D-thiogalactopyranoside 254

isopropyl- $\beta$ -thiogalactoside 70  
isotope feeding 705

**j**

Jabnolski diagram 367  
jatropha 635  
Jerusalem artichoke 643  
jojoba 685

**k**

kanamycin 706  
kinetic constants 236  
kinetic lability 415  
kinetic parameters 232  
knock-out 640

**l**

lab-on-a-chip 365  
lac operator 73  
lac operon 70  
lac promoter 84  
lac repressor 71  
lactaldehyde 630  
lactate dehydrogenase 638  
lactic acid bacteria 626  
lactose operon 242  
L-alpha-amino adipate 50  
laminates 631  
lariat 99  
lattice panel 316  
layer-guided acoustic plate mode 379  
lentivirus 348  
lethal gene 582  
leucine zippers 571  
leukemia 563  
level matching 287  
life cycle assessment 689  
ligand-binding 256  
ligand-binding domain 259  
ligand-inducible systems 258  
ligase 99  
ligation 484  
light-activated gene expression 533  
lignin 674  
lignin backbone 674  
lignocellulosic biomass 643, 672  
linseed 635  
lipids 38  
lipid bilayer 41, 48  
lipid membrane 580  
lipopolysaccharide 652  
liposomal constructs 579  
liposomes 326, 567  
live attenuated vaccine 591

locus control region 497  
logic circuit 253, 262, 335  
logic functions 335  
logic gate 202, 527, 532, 545, 570  
long-chain fatty alcohols 686  
loop sequence 343  
love wave 379  
low-copy plasmid 279  
low-density lipoprotein 326  
lower loop variation 417  
lumazine synthase 422  
lycopen 293  
lysteriolysin O 575

**m**

machine 307  
macrolides 259  
macromolecular crowding 580  
macrophages 326  
magnetite nanoparticles 323  
magnetosomes 420  
maintenance methylase 110  
malaria 591  
maltose 636  
mammalian cells 345  
mated model 90  
mathematical modeling 287  
matrix correlation 129  
matrix entrapment 360  
maximum likelihood approach 130  
medical diagnostics 269, 359  
megalomicin 714  
megaplasmid 708  
mellibiose 70  
membrane entrapment 360  
membrane fusion 49  
membrane proteins 468  
membrane-associated protein 408  
memory circuit 269  
memory devices 252  
mesenchymal stem cell 544  
messenger RNA 568  
*meso*-L-diaminopimelate 50  
meta-analysis 159  
metabolic burden 271, 274  
metabolic disease traits 139  
metabolic engineering 609, 630, 670  
metabolic enzymes 262  
metabolic homeostasis 469  
metabolic load 288  
metabolic modeling 713  
metabolic pathways 450, 626  
metabolic profiling 710  
metabolic reconstruction 671

- metabolic switch 716  
 metabolism 308  
 metabolite pools 265  
 metabolite profiles 626  
 metabolites 445, 702  
 metabolome 472  
 metabolomics 717  
 metabolosome 420  
 metagenomes 47  
 metagenomic sequencing 162  
 metagenomics 155  
 metal nanoparticles 428  
 metal oxide semiconductor field effect transistor 365  
 metal/dielectric interface 373  
 metallic catalysts 631  
 metastable phosphate bond 45  
*methicillin-resistant Staphylococcus aureus* 702  
 methionyl-tRNA 464  
 4-methylbenzimidazole 507  
 6-methylsalicylic acid 714  
 methyl CP binding protein 2 110  
 methyl group transfer 400  
 methyl ketones 686  
 methyl-2-pyrimidinone 507  
 methyl- $\beta$ -thiogalactoside 70  
 methylation 399, 709  
 methylation of cytidine residues 109  
 methylerythritol-phosphate (MEP) 18  
 methylethyl ketone 623  
 methylglyoxal 629  
 methylglyoxal synthase 625  
 methylmutase 399  
 methyltransferase 399, 465  
 micro-total-analysis-systems 365  
 microaerated cultures 638  
 microalgae 687  
 microarray 88, 189, 382  
 microbial cells 703  
 microbial ecosystems 566  
 microbial engineering 679  
 microbial sensors 290  
 microbial symbionts 708  
 microbiome 155, 291  
 microbiome assembly 167  
 microcompartments 715  
 microelectrochemical system 384  
 microencapsulation 291, 573  
 microorganism culture 626  
 microorganisms 360, 626  
 microRNA 108, 261, 334, 549  
 miltiradiene 714  
 minimal cell 454  
 minimal cell model 454  
 minimal gene-set 447  
 minimal genome 445  
 miRNA sensors 341  
 mirror tree method 127  
 misincorporation 514  
 mismatches 322  
 mitochondria 481  
 mitochondrial DNA 92, 485  
 mitochondrial genome 488  
 mitochondrial intron 104  
 mitochondrion 52  
 mixed cultures 632  
 modeling 212  
 modern pathway 402  
 modular part 2, 15, 18, 25  
 modularity 255  
 module-finding algorithms 134  
 molasses 643  
 molecular assemblies 308  
 molecular biology 543  
 molecular chaperones 468  
 molecular cloning 481, 500, 547  
 molecular cloning system 481  
 molecular components 232  
 molecular crowding 580  
 molecular diversity 702  
 molecular logic evaluator 344  
 molecular payloads 321  
 molecular self-assembly 310  
 molecular signals 335  
 molecularly imprinted polymer 360  
 monocistronic mRNA 90  
 monolignols 673  
 monooxygenase 399, 403  
 monosaccharides 641  
 Monte Carlo Markov clustering 134  
 morphogenesis 255  
 morphology 528  
 mouse embryonic fibroblast 548  
 mRNA 67  
 mRNA stability 606  
 mRNA transcripts 579  
 mRNA translation 606  
 multicellular computation 285  
 multicellular systems 252, 282, 284  
 multicistronic gene clusters 716  
 multienzyme complex 420  
 MultiGeneBlast 709  
 multilayered logic gates 284  
 multimeric complex 404  
 multiple displacement amplification 162  
 multiplex automated genome engineering (MAGE) 14, 711  
 mutagenesis 397

mutants 652  
 mutasynthesis 710  
 mutation 71, 490, 592, 684  
 mutually repressive interactions 269  
*Mycoplasma genitalium* 10, 223  
 mycoplasmas 451  
 myocardium 565

**n**

n-Butanol 681  
 N-terminal domain 84, 412  
 NAN codons 46  
 nanofabrication 311  
 nanoparticles 548, 567  
 nanorobot 322, 344  
 napsamycin 704  
 napsamycin biosynthesis 704  
 nasal spray 600  
 natural product 709  
 negative control 79  
 network centrality 132  
 network motifs 135, 201  
 neural networks 310  
 neuraminidase 602  
 neuroendocrine tumors 348  
 neuronal complications 593  
 neutral lipids 685  
 "Next Generation" (NextGen) sequencing 163  
 nicotinic acid 637  
 nitrogen fixation 43, 707  
 nitrogen source 637  
 NK-model 186  
 node 190  
 nodules 52  
 noncoding RNAs 263, 334, 499  
 nonhistone chromosomal proteins 112  
 nonlinear differential equations 183  
 non-orthologous gene displacement 447  
 non-ribosomal peptide synthetase 42, 703  
 nonribosomal synthesis 45  
 nonvolatile memory 271  
 NOR-gate 570  
 ntrinsic factor 418  
 nuclear hormone receptors 259  
 nuclear transformation 675  
 nucleases 326  
 nucleic acids 37, 310, 378  
 nucleoprotein 601  
 nucleotides 38, 42, 288  
 nucleoside composition analysis 513  
 nucleotide loops 417  
 nucleotide loop synthesis 399  
 nucleotide rearrangement 596  
 NUN codons 46

nutraceuticals 687  
 nutrient availability 293

**o**

obesity 567  
 object-oriented modeling 214  
 Occam's razor 37  
 Oct4 116  
 oil refinery 689  
 Okazaki RNA fragments 47  
 oligo U sequence 80  
 oligonucleotides 45  
 omics 688  
 oncogenic mutation 529, 575  
 oncolytic viruses 292  
 open reading frame 80, 408, 465, 599, 639, 704  
 operational taxonomic unit 159  
 operator RNA 90  
 operator sites 241  
 operon 69, 397, 639  
 opportunistic pathogens 639  
 optical biosensors 372  
 optical field 373  
 optimum pH 648  
 optogenetics 254, 571  
 oral polio vaccine 600, 609  
 ordinary differential equation (ODE) 184, 214  
 organelle 359, 450, 715  
 organic acids 647  
 origin of life 37  
 orthogonality 255  
 orthology 39  
 oscillator 201, 264, 252, 325, 561  
 overlapping BACs 495  
 overmethylated products 414  
 overprescription 703  
 oxidative phosphorylation 485  
 oxygen level 293  
 oxygen-sensitive intermediates 429  
 oxygen supply rate 645  
 oxygen transfer coefficient 646  
 oxygen transfer rate 646  
 oxygen uptake rate 646  
 oxytetracycline 714

**p**

paleome 52  
 parasites 449  
 Parsimonious explanation 130  
 parts mining 256  
 parts registry 234  
 party hub 134  
 paryphoplasm 51  
 pathogen detection system 290

- pathogenic virus 592  
 pathogens 703  
 pathway-specific regulator 709  
 PCR amplification 509  
 PCR-mediated amplification 484  
*pdu* operon 422  
*pdu* organelle 426  
 Pearson correlation coefficient 131  
 P-endosymbiont 449  
 pentatricopeptide repeat 97  
 pentose sugar 678  
 peptide hormones 112  
 peptides 42  
 peptide-morpholino oligonucleotide conjugate 707  
 peptidoglycan structure 51  
 peptidyl carrier protein 43  
 peptidyl-tRNA 605  
 peripheral amidations 404  
 pesticides 378  
 pH 637  
 pH electrode 364  
 phage-derived serine recombinases 271  
 phages 162  
 phagocytes 48  
 phagocytosis 48  
 pharmaceuticals 253, 293, 624  
 pharmacology 309  
 phenotype 397, 565  
 phenotypic reversion 598  
 phenyl ammonia lyase 674  
 pheromone 285  
 phiX polymerase 163  
 phloretin 276  
 phosphate-limiting conditions 628  
 phosphatidylethanolamine 707  
 phospho-*N*-acetyl-muramylpentapeptide translocase I 704  
 phosphoenolpyruvate mutase 705  
 phosphofructokinase 713  
 phospholipid biosynthesis 454  
 phospholipids 52  
 phosphorescence 368  
 phosphorolysis 47  
 phosphorus 676  
 phosphorylation 202  
 phosphorylation mechanism 201  
 phosphorylation-dephosphorylation reactions 194  
 photolithography 384  
 photosynthesis 38, 715  
 photosynthetic organism 679  
 phylogenetic analysis 708  
 phylogenetic tree 408, 445  
 phylogenetic profiling 126  
 physical vapor deposition 384  
 piecewise-linear differential equation 197  
 piezoelectric biosensors 375  
 piezoelectric crystals 376  
 piezoelectric effect 375  
 piezoelectric quartz crystal 378  
 piezoelectric transducers 376  
 "planktonic" fraction 158  
 plant biomass 672  
 plants 708  
 plaque assay 592  
 plaque phenotype 601  
 plaques 599  
 plasmid 162, 253, 314, 340, 397, 640  
 plasmid DNA 484, 546  
 plasmid vector 482, 485  
 plasticizers 623  
 Plexor system 515  
 pluripotency 580  
 pluripotent stem cells 349, 529  
 pneumolysin 605  
 pneumonia 605  
 point mutation 83, 101  
 poliomyelitis 593  
 poliovirus vaccines 591  
 pollen granules 159  
 polyA binding protein 113  
 polyadenylation 98  
 polyadenylation sites 262  
 polycistronic mRNA 69  
 polycistronic RNA 97  
 polyelectrolytes 42  
 polyesters 622  
 polyester resins 622  
 polyethers 622  
 polyketides 42  
 polyketide synthase 703  
 polymer structure 368  
 polymerase chain reaction (PCR) 4, 10, 89, 310, 508, 713  
 polymerase subunit B1 601  
 polymeric gel matrix 361  
 polymerization 42  
 polymorphism 12, 169  
 polynomial calculations 307  
 polynucleotide phosphorylase 47  
 polyphosphate kinase 427  
 polyphosphates 42  
 polyprotein 600  
 polypyrimidine tract 101  
 polyribonucleotides 47  
 polysaccharide 674  
 polythiophene 369

- polytrimethylene terephthalate 622  
 polyurethanes 622  
 population homeostasis 534  
 pores 424  
 positive control 79  
 positive control factor 79  
 positive feedback loop 535  
 positive loop 187  
 post-transcriptional change 100  
 post-transcriptional gene expression 97  
 post-transcriptional modification 516  
 post-transcriptional regulation 274, 336  
 post-translational modifications 467  
 post-translational modifications 194  
 post-translational regulation 116, 264  
 potency 525  
 potentiometric biosensors 364  
 potentiometry 362  
 poxvirus species 592  
 pre-RNA processing protein 102  
 prebiotic life 48  
 prebiotic metabolism 38, 41  
 precorrin-2 397  
 precorrin-*n* 402  
 precursor molecules 688  
 preinitiation complex 459  
 preuroporphyrinogen 400  
 primary attenuating mutation 592  
 primary microRNA transcript 336  
 primer-mediated base incorporation 165  
 printing inks 623  
 pro-apoptotic protein 345  
 pro-apoptotic genes 532  
 probabilistic boolean network 190  
 processor 323  
 processor cells 529  
 progeny 39  
 progesterone 259  
 program 307  
 prokaryotes 67  
 prokaryotic proteins 129  
 promoter 83, 255, 272, 568  
 propanediol 405  
 1,2-propanediol 622  
 1,3-propanediol 622  
 prophages 53  
 prostate cancer 348  
 protease 86  
 protecting strand 344  
 protein-coding genes 453  
 protein complex 124, 241  
 protein degradation 469  
 protein dimer 234  
 protein expression 256  
 protein folding 606  
 protein-folding system 54  
 protein function 138  
 protein interactions 235  
 protein microarray 384  
 protein phosphorylation 82, 264  
 protein–protein interaction 19, 110, 125, 335, 528, 568, 671  
 protein–protein signaling 570  
 protein ratios 426  
 protein secretion 252, 468  
 protein sequestration 426  
 protein signaling cascades 253  
 protein–substrate complex 684  
 protein synthesis 69, 527  
 protein topologies 411  
 protein transduction domain 548  
 protein translation 592  
 $\gamma$ -proteobacteria 449  
 proteome 472  
 proteomics 453  
 proteorhodopsins 157  
 protobiotic life 48  
 protokarya 53  
 proton pump 471  
 prototrophic rearrangement 411  
 proximal sequence element 96  
 pseudocobalamin 417  
 pT181 attenuator 262  
 pteridine triphosphate 43  
 purine–Ds–purine sequences 510  
 push-on-off switch 267  
 PV-Max virus 597  
 pyrosequencing 160  
 pyrosequencing technology 164  
 pyruvate dehydrogenase 681  
 pyruvate kinase (PK) 227
- q**
- quantitative models 183  
 quantum dots 383  
 quantum mechanical modeling 684  
 quartz crystal microbalance 377  
 quinones 707  
 quorum sensing 283, 535, 545, 574
- r**
- radiofrequency 323  
 radioisotope tagging 384  
 Raman scattering 374  
 Raman signal 374  
 random codon re-encoding 596  
 random nodes 133  
 rapalogs 714

- rapamycin 712  
 rate laws 236  
 ratio-meter 281  
 rational design 256  
 reaction networks 236  
 reactive extraction 651  
 reactive oxygen species 534  
 receiver module 535  
 receptors 53  
 recognition sequences 496  
 recombinant 641  
 recombinant DNA 4, 25, 543  
 recombinant DNA technology 517  
 recombinant fusion protein 546  
 recombinant genomes 497  
 recombinase-based circuits 277  
 recombinases 568  
 recombineering 13  
 recruitment plots 168  
 red fluorescent protein 273  
 redox balance 640  
 redox mediators 363  
 reductase 399  
 redundant genes 451  
 reference electrode 362  
 regeneration 544  
 regenerative medicine 231, 524, 543  
 regionspecific binding 411  
 regulator gene 69  
 regulatory cascades 264  
 regulatory circuitry 707  
 regulatory components 445  
 regulatory domains 256  
 regulatory issues 536  
 regulatory mechanisms 183  
 regulatory networks 276, 340  
 regulatory pathways 252  
 regulon 85, 640  
 renewable energy 667  
 renewable feedstock 622, 634  
 replication 447, 507  
 replication fork 459  
 reporter coding regions 272  
 reporter gene 347, 497  
 reporter phages 291  
 repressor 230, 264, 568  
 repressor system 203  
 repression 68  
 repressor 526, 709  
 repressor gene 345  
 repressor-operator complex 74  
 reproducing metabolism 37  
 resins 631  
 resistance 702  
 resonance angle 370  
 resonant frequency 376  
 respiration 645  
 restriction endonuclease 4  
 reticulocytes 115  
 retroactivity 265  
 retrosynthesis 717  
 retrotranscription 604  
 retroviruses 604  
 Rett syndrome 110  
 reverse genetics 481  
 reverse genetics system 601  
 reverse transcriptase 53  
 reversion 593  
 riboflavin 637  
 ribonuclease P 105  
 ribonucleoprotein 99  
 ribonucleoprotein particle 115  
 ribonucleotides 45, 47  
 riboplasm 51  
 riboregulator 262, 270  
 ribosomal binding sites 335  
 ribosomal proteins 466  
 ribosomal protein gene 97  
 ribosomal RNA 95  
 ribosome 39, 46, 288, 568, 605  
 ribosome assembly 466, 467  
 ribosome binding site 80, 233, 255, 570, 716  
 ribosome stalling 80  
 ribostamycin 714  
 riboswitch 85, 47, 312, 716  
 ribozyme 47, 104, 263, 311, 527  
 ribozyme-mediated cleavage 263  
 ribulose kinase 78  
 ribulose-5-phosphate epimerase 78  
 rice straw 676  
 rifampicin resistance 710  
 rinderpest virus 607  
 ring biosynthesis 399  
 ring-contraction process 406  
 ring vaccination campaigns 607  
 RNA-binding proteins 276  
 RNA cleavage 97  
 RNA degradation 336  
 RNA/DNA-genome compartment 51  
 RNA editing 97  
 RNA fragments 516  
 RNA-genome world 47  
 RNAi-based circuits 350  
 RNAi inverter 343  
 RNAi mediator 341  
 RNA-IN-RNA-OUT system 262  
 RNA-induced silencing complex 336  
 RNA-induced transcriptional silencing 111

RNA interference 109, 261, 334, 571  
 RNA ligase 104  
 RNA metabolism 39, 462  
 RNA polymerase (RNAP) 76, 193, 223, 258, 464, 568, 716  
 RNA silencer 716  
 RNA splicing 98, 104  
 RNA switches 335  
 RNA transcription 46  
 RNA viruses 53, 600  
 robot 306  
 robustness 286  
 Rosetta Stone approach 131  
 rRNA maturation 466  
 RuBisCO 420  
 run-off transcription 88

**s**

<sup>16</sup>S rDNA gene 156  
 S-adenosyl methionine 114, 685  
 salting-out extraction 651  
 sanitation 607  
 Sargasso sea 157  
 scaffold strand path 317  
 scaffolded DNA origami 313  
 scaffolds 165  
 Schilling test 417  
 scrambled design 598  
 screening 397  
 seasonal epidemics 600  
 second regulator 200  
 secondary metabolites 706  
 secreted alkaline phosphatase 578  
 selection markers 484  
 SELEX 515  
 self-assembled monolayer 361  
 self-complementarity 46  
 self-splicing 102  
 self-supporting cell 212, 223  
 semiconductors 277  
 sendai virus 548  
 sender cells 285  
 sense–antisense transcription control 265  
 sense strand 344  
 sensory aptamer 344  
 sensory systems 278  
 sequence alignment 137  
 severe acute respiratory syndrome 609  
 shear horizontal acoustic plate mode 379  
 shear horizontal surface acoustic wave 379  
 shear modulus 376  
 shell proteins 423  
 Shine–Dalgarno 97  
 Shine–Dalgarno sequence 113

short hairpin RNA 265, 571  
 short interfering RNA 261  
 short-chain alcohols 669  
 shuffling 598  
 shunt plasmid 280  
 sigma factor 86, 464  
 sigma-like transcription factor 97  
 sigmatropic rearrangement 412  
 signal filtering 570  
 signal mode 545  
 signal recognition particle 468  
 signal-to-noise ratio 282, 372  
 signal transduction pathways 264, 287  
 signaling 308  
 signaling biomolecules 533  
 signaling cascades 568  
 signaling pathways 264  
 signaling proteins 283  
 signaling sequences 426  
 simulation 212  
 simultaneous saccharification and fermentation 643  
 sinapyl alcohol 674  
 single-cell genomics 162  
 single-domain enzymes 704  
 single-gene inactivation strategies 451  
 single input module 198  
 single nucleotide polymorphism 384  
 single output gene 345  
 single output module 198  
 single phosphorylation signals 571  
 single-strand DNA 359  
 single-stranded DNA 87, 283, 321  
 single-stranded oligonucleotide 6, 9  
 siroheme 406  
 sirohydrochlorin 402  
 site-directed mutagenesis 573  
 site-specific recombinase 546  
 site-specific recombination 652  
 six-electron reduction 406  
 skin 565  
 small cytoplasmic RNA 102  
 small hairpin RNA 527  
 small interfering RNA 109, 334  
 small molecule 254, 395  
 small-molecule input 270  
 small-molecule sensors 343  
 small nuclear ribonucleoprotein particle 98  
 small nuclear RNA 96, 102  
 small regulatory RNAs 716  
 smallpox 592  
 societal challenge 23  
 solid-state array 383  
 solid-state electrode 365

- solvents 631  
 SOS box 87  
 SOS regulon 87  
 spatial distribution 545  
 spatial patterning 282  
 spatiotemporal control 254, 533  
 spectroscopic transition 374  
 splice site sequence 98  
 spliced leader 96  
 spliceosomal introns 101  
 spliceosomal protein 343  
 spliceosome 99  
 splicing factors 102  
 spores 159, 500  
 SPR angle 370  
 stabilization 97  
 staple strands 313  
 starch 636  
 stem cell differentiation 531  
 stem cell homing 533  
 stem cell therapy 532  
 stem cells 524, 529, 543, 560  
 stem-loop structures 276  
 stereoisomers 642  
 steroid hormones 95, 112, 259  
 steroid-responsive genes 95  
 stochastic biochemical noise 190  
 stop codon 98  
 streptogramins 259  
 streptomycin 713  
 structural genes 69  
 structure-based protein engineering 684  
 substance-reactor model (SRM) 220  
 substrate-binding pocket 411  
 substrate channeling 412, 419  
 subtelomeric sequence 713  
<sup>30</sup>S subunits 466  
 sucrose 636  
 superhost 713  
 supporting matrix 381  
 surface plasmon resonance 370  
 surface polarity 384  
 surface transverse wave 379  
 surface-enhanced Raman spectroscopy 374  
 SV40 virus 90  
 switch 264  
 symbionts 50  
 symbiotic associations 50  
 222 symmetry 72  
 SynBioSS 231  
 synonymous nucleotide changes 597  
 synthetic biological circuit 670  
 synthetic biological constructs 231  
 synthetic biological systems 243  
 synthetic biology 1–25, 37, 231, 252, 347, 507,  
     525, 543, 561, 609, 701  
 – implications 1–25  
 – resources 17  
 – use 1–25  
 synthetic cell 2, 21–23, 25  
 synthetic chemistry 396  
 synthetic chromosome technology 689  
 synthetic circuits 325, 561, 565  
 synthetic DNA 481, 500  
 synthetic gene circuits 252, 544  
 synthetic kill-switch 582  
 Synthetic memory 270  
 synthetic memory circuit 536  
 synthetic mRNA 549  
 synthetic networks 561  
 synthetic pathways 561  
 synthetic regulatory circuits 261  
 synthetic rubber 641  
 synthetic systems 230  
 synthetic transcription factor 256  
 systemic lupus erythematosus 326  
 systems biology markup language 231
- t**
- T cells 322, 561  
 T-cell grafts 577  
 T-cell proliferation 576  
 T-cell response 578  
 T lymphocytes 531  
 T7 transcription 512  
 tandem array 259  
 tandem proteins 423  
 targeted killing 291  
 taste receptor 338  
 TATA box 93  
 tautomerism 507  
 taxonomic classification 158  
 telomerase 92  
 telomere 92  
 temperature factor 411  
 temperature-dependence 649  
 template 69  
 teratomas 531, 544  
 termination codon 107  
 terminators 233  
 terpenoid biosynthesis 710  
 TetR 233  
 tetracenomycin 705  
 tetracycline 259  
 tetracycline-dependent transactivator 258  
 tetrahydrofuran 651  
 tetramerization region 73  
 tetrapyrroles 402

- theophylline 263  
 therapeutic applications 325  
 therapeutics 290, 687  
 thermal biosensors 379  
 thermal transducer 381  
 thermistor 381  
 thermometric enzyme-linked immunosorbent assay 382  
 thiamine pyrophosphate 642  
 thickness shear mode 377  
 thioesterase 684  
 6-thioguanine 507  
 tiling 310  
 timer circuits 265  
 tissues 359  
 tissue culture 592  
 tissue damage 323  
 tissue engineering 253, 269, 565  
 tissue patterning 282  
 toggle switch 266, 325, 545, 561  
 toggles 252  
 toll-like receptor 9 326  
 top-down strategies 446  
 topoisomerase 461  
 toxic intermediates 715  
 toxicity 703  
 toxin–antitoxin systems 717  
 trans-acting RNA molecules 262  
 trans-activating RNA 262  
 transactivating response RNA-binding protein 336  
 transactivator 529  
 transceiver cells 529  
 transcription 39, 67, 445, 507  
 transcription activator-like effector 527  
 transcription export 115  
 transcription factors 525, 568  
 transcription factor 94, 255  
 transcriptional activation domain 124  
 transcriptional biosensors 427  
 transcriptional coactivator 261  
 transcriptional control 253  
 transcriptional regulatory 187  
 transcriptional repressors 260, 276  
 transcriptome 472  
 transcriptome analysis 89  
 transcriptomics 453  
 transducer 360  
 transfection 547  
 transformant cells 499  
 transformation 7, 11  
 transformation-associated recombination 670  
 transfusion 544  
 transgenes 258, 276, 347, 527  
 transgene expression 578  
 transgenic mice 491, 497, 578  
 transient phase 195  
 transient stimulus 269  
 transition region 186  
 translation 39, 67, 445, 507  
 translation machinery 46  
 translational repression 336  
 translatome 465  
 translocon 468  
 transmembrane domains 407  
 transplantation 544  
 transport mechanisms 418  
 transposase genes 713  
 transposon integration 547  
 transposon mutagenesis 451  
 trans-splicing 106  
 trans-translation 467  
 triacylglycerol 685  
 tricarboxylate utilization 407  
 tricarbon alcohol 631  
 trigger factor 468  
 triose-phosphates 42  
 triplet–triplet annihilation 368  
 tRNA 45  
 tRNA diffusion 605  
 tRNA gene product 104  
 tropomyosin genes 108  
 tryptophan operon 75  
 tumor 324  
 tumor growth 418  
 tumor imaging 428  
 tumor targeting 562  
 tumor tissue 575  
 tumorigenesis 525, 530  
 tunability 255  
 tunable oscillator 265  
 two-electron oxidation 406  
 type I diabetic 534
- u**
- ubiquitin 111  
 ubiquitin-dependent degradation 263  
 ultraviolet radiation 254  
 unnatural base pair 507, 512  
 untranslated region 262, 338  
 upstream activating sequence 93, 258  
 upstream control element 95  
 uracil 47  
 uracyl-DNA glycosylase 461  
 urate oxidase 578  
 uric acid homeostasis 578  
 uro'gen III 400  
 UV photons 323

**v**

vaccines 563, 591  
 valine biosynthetic pathway 684  
 vegetable oils 685  
 vertex degree distribution 135  
 vertex degree information 133  
 vertices 123  
 viral attenuation 596  
 viral vectors 543, 580  
 virtual erythrocyte 212  
 virulence 452, 593  
 virulence factors 652  
 viruses 157, 579  
 vitamin B<sub>12</sub> 395, 637  
 vitamin conjugates 418  
 vitellogenin gene 113  
 Volatile memory 270  
 VP16 transcription activation domain 258

**w**

watermark sequence 12, 21  
 Watson–Crick pairing 310  
 wax esters 685  
 wax formation 685  
 Weber’s law 278  
 whey permeate 643  
 whole-cell model 287, 454  
 whole cells 359  
 whole-genome sequencing 126

whole-genome shotgun 155  
 whole-mitochondria genomes 482  
 whole viral genomes 594  
 wobble base 465

**x**

X-ray crystallographic analyses 512  
 X-ray crystallography 73  
 X-ray diffraction 72  
 xylanase 677  
 xylitol dehydrogenase 678  
 xylose 636  
 xylose assimilation 678  
 xylose-fermenting yeast 678  
 xylose reductase 678  
 xylulose kinase 678

**y**

yeast 573, 626  
 yeast artificial chromosome 669  
 yeast episomal plasmid 669  
 yeast integrative plasmid 669  
 yeast two-hybrid 124

**z**

“zero-order ultra-sensitivity” 196  
 zinc finger 527, 547, 580  
 Zinc Finger Database 259  
 Zinc Finger Targeter 259  
 zinc finger transcription factor 259