

---

# Index

---

- Abbott, S. J. 229  
abbreviations 2–3  
absolute reaction rates, theory of 18  
abzyme 78  
Acerenza, L. 376  
acetate kinase 196  
acetic anhydride 173  
acetylcholinesterase 156, 173  
*N*-acetylglucosamine kinase 97  
acid–base properties of proteins 255–257  
acid, Brønsted definition 255–256  
activated complex 18  
activation 152–157  
activation energy 17, 274, 277  
active site 31  
    titration 390–391  
activity 255  
Adair, G. S. 292, 318  
Adair equation 291–297  
    relationship to models of cooperativity 319  
“Adair–Koshland model” (*see also* sequential model) 318  
adenylate kinase 366–368  
ADH (*see* alcohol dehydrogenase) 147, 157, 190, 196, 199, 408  
Ainslie, G. R. 323  
Ainsworth, S. 153  
Alberty, R. A. 264  
    biographical notes 199  
    multiple substrates 198  
    thermodynamics 105, 255, 455  
    time courses 71  
Albery, W. J. 238, 246  
alcohol dehydrogenase 147, 157, 190, 196, 199, 408  
aldehyde dehydrogenase 65  
alkaline phosphatase 451  
Allen, D. W. 302  
Allende, C. C., and J. E. 220  
all-or-none assay 391  
allosteric interactions 285–286  
allosteric model (*see also* symmetry model) 305  
“alternative enzymes” 77–83  
alternative routes of reaction 123–124  
Altman, C. 107, 117, 401  
D-amino acid oxidase 277  
aminoacyl-tRNA synthetases 40, 218, 220  
 $\gamma$ -aminobutyrate 176  
 $\gamma$ -aminobutyrate aminotransferase 176, 185  
aminotripeptidase, intestinal 166  
amplitude of relaxation 381–382, 402  
amylase 224  
analysis of variance 440  
analyzing mechanisms by inspection 122–126  
Anderson, R. S. 137  
Anderson, S. R. 121, 319  
Anderton, B. H. 175  
ANOVA, *see* analysis of variance 440  
antagonistic inhibition 146  
antibody, catalytic 78, 83  
anticompetitive inhibition 140  
apparent order 335  
apparent parameters

- experimental design and 99
  - inhibition 62–63, 133–141, 158
  - integrated rate equations 67
  - pH-independent parameters and 264–265
  - two-substrate reactions 207–208
- Apweiler, R. 452
- arginase 137
- arginine, ionization 256
- Arnold, F. H. 80
- Arrhenius, S. A.
  - activation energy 17, 274
  - biographical notes 15
  - equation 15–17, 20, 274, 276–279
  - plot 17, 20, 277–279
- arsenate reductase 94
- artificial enzymes 78–81
- aryl sulfatase 79
- ascorbate oxidase 205
- asparagine synthetase 233
- aspartate
  - ionization 256
  - metabolism 372–373
- aspartate kinase (aspartokinase) 61, 373
- aspartate transaminase 71, 194, 205, 407
- aspirin 184, 185
- assays 85–93
- Aßmus, H. 373, 377
- association-dissociation models of cooperativity 319–320
- assumptions implicit in least-squares analysis 425
- Atkins, G. L. 439
- Atkinson, D. E. 57, 339, 358
- ATP-regenerating systems 92
- Azzi, A. 29
  
- Bakker, B. M. 372, 373, 377
- Balny, C. 21
- Balzarini, J. 147
- Bardsley, W. G. 98
- Barendrecht, H. P. 15
- Barker, H. A. 193
- base, Brønsted definition 255–256
- Bastian, J. 80
- Beard, D. A. 240
- Beavo, J. A. 365
- Beilstein-Institut 452
- Bell, R. P. 242
- bell-shaped curves 260–262
  
- Belleau, B. 186
- Bender, M. L.
  - biographical notes 206
  - enzyme titration 390
  - single-turnover experiment 407
  - specificity constant 42
  - substituted-enzyme mechanism 206
  - temperature dependence 277
  - thiol-subtilisin 78
- Benesch, R., and R. E. 286
- Benkovic, S. J. 80
- Berger, A. 160
- Berthelot, M. 27
- Berzelius, J. J. 14
- best-fit parameters 420–432
- bias, in initial rate estimate 87
- bimolecular reaction 3, 5
- binding experiments, analysis 297–301
- Binet, A. 28
- biochemical systems theory 335
- biographical notes
  - Alberty, R. A. 199
  - Arrhenius, S. A. 15
  - Bender, M. L. 206
  - Buchner, E. 25
  - Burk, D. 47
  - Chance, B. 394
  - Changeux, J.-P. 306
  - Cleland, W. W. 197
  - Dixon, M. 142
  - Eigen, M. 399
  - Eyring, H. 17
  - Fischer, H. E. 303
  - Fulhame, E. 14
  - Haldane, J. B. S. 59
  - Heinrich, R. 330
  - Henri, V. 28
  - Hill, A. V. 286
  - Kacser, H. 333
  - Knowles, J. R. 242
  - Laidler, K. J. 20
  - Lineweaver, H. 47
  - Menten, M. L. 30
  - Michaelis, L. 29
  - Monod, J. 285
  - Norrish, R. G. W. 396
  - Porter, G. 397
  - Rapoport, S. M. 333
  - Roughton, F. J. W. 393

- Sørensen, S. P. L. 254  
Sumner, J. B. 30  
Tsou, C. 181  
Woolf, B. 49  
Wyman, J. 306  
biotechnology, implications of control  
  analysis 373–377  
Blangy, D. 312  
blank rate 98  
block elasticity 360  
Bodenstein, M. 14  
Boeker, E. A. 70–71  
Boltzmann distribution 17  
bond vibration 242  
Boocock, M. R. 341  
Botts, J. 156  
Boyde, T. R. C. 28  
Boyer, P. D. 198, 228  
Brandt, R. B. 148  
Briggs, G. E. 28, 32, 45  
Briggs–Haldane treatment 32–33, 173–174  
Brinkman, R. 394  
Britton, H. G. 234, 237, 241  
Brocklehurst, K. 86, 121, 182, 188, 269, 406  
Brode, P. F., III 68  
Brønsted, J. N. 256  
Brot, F. E. 42  
Brown, A. J. 27–28, 30  
Brüschweiler, R. 323  
Bruylants, A. 24  
BST (*see* biochemical systems theory) 335  
Buc, J. 151, 400  
Buchner, E. 25, 27, 28  
Bunting, P. S. 21, 22, 71, 140  
Burk, D. 31, 47–48, 51, 52  
Burke, J. J. 400  
Burns, J. A. 331, 342, 343, 345, 349, 351, 359,  
  360, 384  
“burst” kinetics 388–391, 408  
caged ATP 397  
calorimetry 278  
calpain 269  
Calvin cycle 373  
Campbell, M. K. 55  
carbonic anhydrase 38  
Cárdenas, M. L.  
  *N*-acetylglucosamine kinase 97  
  biotechnology 375  
  competition between substrates 150–152  
  cooperativity 289, 321, 323  
  hexokinases 46, 217, 289, 321, 323  
  inhibition 148, 217  
  interconvertible enzymes 365, 366  
  metabolic control analysis 331, 360  
  metabolic modeling 373  
  metabolite channeling 364  
  residual plots 446  
  reversibility 333, 372  
  rounding error 86  
  silent genes 377  
  specificity 46, 289, 321  
cascades 365–366  
Cascante, M. 148  
catalysis 14–15  
  catalytic antibody 78, 83  
  catalytic constant 33, 37, 59  
  isotope effects 247–248  
  two-substrate reaction 199, 206–207  
catalytic inhibition (*see also* uncompetitive  
  inhibition) 140  
catalytic poisons 172  
catalytic proficiency 38  
catalytic RNA 77, 78, 81–83  
cathepsin C 154  
Cech, T. R. 82  
Cedar, H. 233  
central complexes 113, 125–126, 386  
Cerami, A. 185  
Cha, S. 120  
Cha’s method 120–122  
Chan, W. W.-C. 145  
Chance, B. 199, 393  
Changeux, J.-P. 285, 305, 306, 309, 310  
channeling 362–364  
Chapman, D. L. 14  
Chassagnole, C. 373  
C—H bond breaking 19, 242–244  
chemical and kinetic classifications of  
  mechanisms 195–197  
chemical kinetics 3–23  
chemical mimics 81  
chemical modification 179–183  
chemiflux ratios 234–238  
Chen, Y.-D. 352  
Cheng, Y.-C. 148  
Chevallard, C. 150, 151  
Chittock, R. S. 92

- Chou, K. 117
- Chou, T.-C. 146–147
- $\alpha$ -chymotrypsin
- burst of product release 388, 390
  - nonproductive binding 159–162
  - specificity constant 42
  - substituted-enzyme mechanism 193, 206
  - temperature dependence 277
- $\alpha$ -chymotrypsin, nonproductive binding 161
- Cigić, B. 154
- citrate synthase 363
- Clarke, J. B. 241
- classic papers, modern reprints 27
- classification of enzyme-catalyzed reactions 189
- classification of mechanisms 190–198
- clavulanic acid 185
- Clegg, J. S. 330
- Cleland, W. W.
- biographical notes 197
  - classification of rate constants 199
  - dithiothreitol 197
  - experimental design 96
  - isotope effects 246
  - net rate constant method 128
  - parameter estimation 423, 424
  - symbolism 197
  - two-substrate reactions 122, 192, 196, 203, 465
- CO<sub>2</sub>, reducing emissions 81
- coefficient form of rate equation 115–116, 198
- coefficient of variation
- constant 418, 419, 424, 429, 432, 434, 441–443, 449
  - definition 435
  - Michaelis–Menten parameters 437
- coenzymes 190
- Coggins, J. R. 182, 341
- collision theory 17
- Colman, R. F. 320
- combination plots 144–145
- commercial software 440–443
- comparing models 439–440
- compensation relationship 279
- competing substrates 40, 149–152
- competition plot 151–152
- “competitive activation” (misnomer) 154
- competitive inhibition 41, 63, 134–136, 143, 158, 160
- compared with essential activation 154
  - in vivo* 339–341
  - pharmacological use 184
- complete inhibition 133
- compulsory activation 154
- compulsory-order ternary-complex mechanism 193–200
- isotope exchange 229–233
  - product inhibition 213–217
  - rate equation 198–200
    - derivation 113–116
  - substrate inhibition 211–212
- computer programs
- derivation of rate equations 128–131
  - experimental design and 144
  - metabolic modeling 368–373
  - parameter estimation 417
- concentration control coefficient 343, 345, 346, 350, 352, 376
- concerted model (*see* symmetry model) 304–313
- confidence limits 435
- conformational change, rate 400
- connectivity relationship
- matrix form 354
- connectivity relationships 350–352, 355
- conservation equation 401
- constant of integration 5
- continuous assay 85–87
- continuous-flow method 392–393
- control analysis (*see* metabolic control analysis) 330–377
- control coefficient
- constrained enzyme concentrations 349–350
  - definition 341–344
  - large perturbations 347–349
  - perturbing parameter 344
  - relationship with elasticity 350–354
  - summation relationships 344–349
- control strength 342
- control, compared with regulation 359–362
- Cook, P. F. 246
- Cook, R. A. 296
- cooperativity 98
- Adair equation 291–297, 319
  - association-dissociation models 319–320
  - compared with interconvertible enzymes 365–366

- definitions 295–297
- effect on multienzyme system 336–337, 361–362
- general model 312, 314
- Hill equation 286–289, 318
- kinetic 320–323
- mnemonical model 321
- models 286–297
- monomeric enzyme 320
- negative 288, 290, 295, 301, 312, 318
- pH behavior 261
- physiological function 281–283
- sequential (KNF) model 312–319
- spurious 103
- symmetry (MWC) model 304–313
- cooperativity index 289–290, 295
- Copeland, R. A. 178, 179
- Cordeiro, C. A. A. 330, 445
- Cortés, A. 148
- coupled assay 66, 86, 89–93
- covalent bond 274
- covariance 437
- CP12 304
- Croll, R. P. 300
- Cullen, G. E. 30–31, 126, 384
- cumulative inhibition 145–147
- Curien, G. 373, 377
- cyanate 185
- cyclodextrins 79
- cyclooxygenase 185
- cyclophilin 80
- cyclosporin synthetase 223
- cysteine, ionization 256
  
- Dalziel, K. 198, 222, 225
- Daniel, R. M. 276
- Danson, M. J. 43, 85, 276
- Davidsohn, H. 28, 93, 253
- dead-end complex 124–125, 135, 155, 184, 212, 214, 261
- dead time 397
- decay, first-order 11
- Degn, H. 224
- degrees of freedom 433
- dehydrogenases 193, 196
- dehydroquinase 182
- De Jong, R. M. 168
- demand block 360
- Deming, W. E. 48
  
- denaturation 185, 273–275
- dependent variable 426
- derivation of rate equations 107–132
- design of experiments 95–105
  - inhibition 157–159
  - ion concentrations 102–105
  - pH 98–99, 266–267
  - substrate concentration 53, 95–98
  - temperature 98–99
  - two-substrate reactions 217–218
  - use of replicates 99–102
- detailed balance 121
- detecting enzyme inactivation 93–95
- determinant 110
- deuterium isotope effect (*see also*  $^2\text{H}$  isotope effect) 243–250
- Deutscher, M. P. 93
- de Vienne, D. 349
- dialysis 169, 172
  - equilibrium 297–298
- dibasic acid, ionization 257–261
- Dickenson, C. J. 157
- Dickinson, F. M. 157
- diffusion limit 169
- digitonin 330
- di Mari, S. J. 194
- dimensional analysis 9–10, 200, 287
- 2,2'-dipyridyl disulfide 188
- direct linear plot 51–53
  - effect of inhibition 141
  - negative parameter estimates 430–432
  - progress curve 69
  - statistical aspects 425–432
- discontinuous assay 85–87
- discrimination between mixed substrates 39–42
- disequilibrium 334
- dissociation, slow 169–170
- distribution-free statistics 425–427
- 5,5'-dithiobis-(2-nitrobenzoate) 173
- Dixon plot
  - inhibition 155
- Dixon, H. B. F. 260, 269
- Dixon, M.
  - biographical notes 142
  - Enzyme Commission 452
  - inhibition 141
  - isotope exchange 222
  - pH 265

- tight binding 171
- Dixon plot
  - inhibition 141–143, 148
  - pH 265–266
- Dobson, P. D. 187
- dominant gene 349
- double-displacement reaction 195
- double-reciprocal plot 47–48, 414
  - weighted fit 432
- Doudna, J. A. 82
- Doudoroff, M. 193, 233
- Doumeng, C. 166
- Dowd, J. E. 48
- Downs, C. E. 137, 144
- drug design 183–187
  - implications of control analysis 373–377
- DTNB, *see* 5,5'-dithiobis-(2-nitrobenzoate) 173
- Duggleby, R. G. 71
- Dunford, H. B. 396
- dynamic channeling 362–364
  
- Eadie, G. S. 52
- Eadie–Hofstee plot (*see also* plot of  $v$  against  $v/a$ ) 50
- Eady, R. R. 395
- Easterby, J. S. 92
- EC number 189, 452
- EDTA (*see* ethylenediamine tetraacetate) 172
- Efrat, S. 83
- Eigen, M. 399
- Eisenthal, R. 43, 52, 85, 276, 372, 428, 430
- elasticity
  - definition 332–336
  - properties 336–337
  - relationship with control coefficient 350–354
- elementary step 7
- Elliott, K. R. F. 223
- end product 360
- enthalpy of activation 20
- enthalpy–entropy compensation 278–279
- entropy of activation 20
- enzyme activity, units 34–35
- enzyme assays 85–93
- enzyme cascades 365–366
- enzyme classification 189
- Enzyme Commission 452–453
- enzyme isomerization 238–241
- enzyme memory 206, 321
- enzyme molarity 34
- Enzyme Nomenclature* 189–190, 453
- enzyme regulation 281–324
- enzyme–substrate complex 4, 25–27
- epilepsy 176, 186
- epimerases 238
- equilibria, ionic 102–105
- equilibrium assumption 28, 29, 31, 58, 192, 201, 290–291
- equilibrium dialysis 297–298
- equilibrium isotope effects 246
- equilibrium isotope exchange 231–234
- equilibrium perturbation 246
- equilibrium, quasi- 19
- Erales, J. 304
- erectile dysfunction 186
- error, experimental 98
- essential activation 153–155
- essential groups 172, 179–183, 188
- estimation of initial rates 67–71
- estimation of kinetic constants
  - effect of experimental error 414–419
  - graphical methods 45–53, 414–418
- ethylenediamine tetraacetate 172
- Eunen, K. van 372
- exclusive binding 311
- Exner, O. 278
- expected parameters 161
- experimental design 95–105
  - inhibition 157–159
  - ion concentrations 102–105
  - pH 98–99, 266–267
  - residual plots 446
  - substrate concentration 53, 95–98
  - temperature 98–99
  - two-substrate reactions 217–218
  - use of replicates 99–102
- experimental error 98
  - diagnosis with residual plots 443–448
  - effect on kinetic analysis 414–418
  - transformation 415
- experimental techniques, fast reactions 391–400
- experimental variance 432–433, 440
- exponential functions, ill-conditioned
  - character 386–387
- Eyring, H. 17, 18