

## NAME INDEX

- Ackerly, D. H., 120  
 Adams, P., 384, 390  
 Aertsen, A., 45, 61, 63, 189  
 Aertsen, A. *et al.*, 202  
 Ahlsén, G., 433  
 Aihara, K., 293  
 Albert, A., 49, 51  
 Allen, J. B., 131  
 Alpern, M., 492  
 Altmann, J., 479  
 Amari, S., 189, 192, 201, 305  
 Amit, D. J. *et al.*, 222, 232  
 an der Heiden, U., 172  
 Anderson, 1  
 Anderson, J. A., 521  
 Anninos, P. A., 303–15, 317, 318, 321,  
   504–12  
 Anninos, P. A. *et al.*, 304, 305, 308, 317,  
   318, 340  
 Anogianakis, G., 303–15, 504–12  
 Apostolakis, M., 504–12  
 Arbib, M. A., 189, 192, 201, 342  
 Arshavskij, Yu J. *et al.*, 378, 382  
 Asanuma, H., 190  
 Ashby, W. R., 342  
  
 Babloyantz, A., 293  
 Babloyantz, A. *et al.*, 357  
 Bach, M., 189, 202, 206  
 Bachevalier, J., 101  
 Baker, A. *et al.*, 49, 51  
 Baker, J., 47  
 Balcar, V. J., 495  
 Ballard, D., 189, 192, 201  
 Banchin, A., 194  
 Barchas, J. D., 293  
 Barker, J., 384  
 Barker, L. A., 296  
 Barlow, H. B., 169  
  
 Barna, G., 293–302  
 Barto, A. G., 164  
 Bastian, J., 165  
 Bear, 9, 10  
 Bennett, M. V. L., 152, 159  
 Benson, M. W., 74, 78, 79, 82  
 Bergman, A., 253, 256, 258  
 Berthoz, A., 56, 58  
 Best, J., 201  
 Bickley, W. G., 45  
 Bienenstock, E., 90  
 Binder, P. M., 336  
 Blackmore, R., 522  
 Blair, B. G., 513  
 Blanks, R. H. I. *et al.*, 47, 49, 55  
 Blasdel, G. C., 189, 190  
 Blasdel, G. G., 426  
 Blass, J., 294  
 Block, N., 434  
 Bloedel, J. R. *et al.*, 54, 63  
 Bloom, M. J., *see* Gerstein, G. L. *et al.*  
 Blozovski, D., 101  
 Borg-Graham, Lyle J., 384–404  
 Bower, J., 61  
 Bower, J. M., 63  
 Bradley, P., 185  
 Braitenberg, V., 16, 250, 251, 426  
 Brandon, J. G., 185  
 Brayton, R. K., 150  
 Brazier, M. A., 308  
 Bree, G. M., 74, 79  
 Brenner, D., 516  
 Brown, D., 384  
 Brown, T. *et al.*, 396  
 Broyles, J. L., 433  
 Buhmann, J., 120  
 Bullock, T. H., 517, 519  
 Buneman, O. P., 378  
 Bunow, B. I. *et al.*, 26

- Burns, B. D., 202  
 Burrows, M., 149  
 Bush, B. M. H., 156, 158  
 Buvel, 241
- Caianiello, E. R., 260–7, 316, 317, 321,  
 342–3, 536  
 Cajal, Ramon y, 28, 29, 433  
 Campbell, D., 101  
 Carman, G. V., 63  
 Carpenter, M. B., 121  
 Chajlakian, L. M., 372–83  
 Chajlakian, L. M. *et al.*, 372, 373  
 Chalife, M. *et al.*, 154, 157  
 Chang, H. T., 30  
 Changeaux, J.-P., 194  
 Changeaux, J. P., 97, 221–31, 250  
 Chay, T. R., 293  
 Chen, H. H. *et al.*, 120  
 Chen, J. W., 359, 362, 363, 364  
 Cheng, K. S., 515  
 Chiu, S. Y. *et al.*, 390  
 Choi, M. Y., 336  
 Chomsky, N., 250  
 Churchland, P. S., 45  
 Clark, J. W., 104–18, 120, 184, 316–44,  
 345–56, 357–71, 467  
 Clark, J. W. *et al.*, 105, 107, 117, 318, 320,  
 321, 326, 328, 347, 348, 354, 476  
 Clements, 26  
 Cohen, B. H., 433  
 Cohen, D., 3–7  
 Comptroller General, 514, 529  
 Conouris, G. A., 39  
 Cooley, J., 385, 402  
 Cooper, L. N., 1–11, 319, 408, 409, 521  
 Cooper, L. N. *et al.*, 232  
 Coss, R. G., 32, 185  
 Cotterill, R. M. J., 164–88, 326  
 Cottrell, M., 21  
 Coulter, J. D., 517  
 Cowan, J. D., 525  
 Creutzfeldt, O. D., 305  
 Crick, F., 184, 185  
 Crick, F. H. C., 443  
 Crick, J., 97  
 Crisanti, A. *et al.*, 222  
 Crofton, H. D., 155  
 Curthoys, I.S., *see* Blanks, R. H. I. *et al.*  
 Cynader, M., 433
- Daley, R. J., 185  
 Dames, W. *et al.*, 499  
 Dammasch, Ingolf E., 495–503  
 Daniels, 8  
 Daniels, P. D., 269  
 Daunicht, W., 55, 60  
 Davis, R. E., 154, 158
- Dayhoff, J. E., 165, 189  
 De Masio, A. R., 177  
 Dehaene, S., 221–31, 250  
 Dekker, H., 515  
 Derrida, B., 241, 242, 243, 244, 247, 327  
 Deubel, H., 493  
 Dev, P., 149  
 DeWitt, B. S., 515  
 Diamond, J. *et al.*, 30, 32, 40  
 Diederich, S., 232–9  
 Dill, R. C., 202  
 Dinse, H. R. O., 201  
 Dodge, F., 385, 402  
 Dodson, J. D., 228  
 Domich, L., 433  
 Dreyfus, G., 249  
 Dunant, F. *et al.*, 294  
 Dunin-Barkowski, W. L., 372–83  
 Durbin, R., 156
- Eastport Study Group, 513  
 Ebbinghaus, H., 228  
 Ebner, 9, 10  
 Eccles, J. C., 269  
 Eckhorn, R., 479–94  
 Eckmiller, R., 45, 55, 59  
 Edelman, G. H., 135  
 Edelman, G. M., 258  
 Efstratiadis, S., 504–12  
 Eibi, H., 177  
 Eichenbaum, H., 165  
 Einstein, A., 46, 69  
 Ekerot, C.-F., 379  
 Elmer-DeWitt, P., 477  
 Elsner, T., 493  
 Elul, R., 305  
 Érdi, P., 293–302  
 Erdős, P., 148–63  
 Erickson, R. P., 522  
 Ericsson, K. A., 522  
 Erulkar, S. D. *et al.*, 27  
 Espinosa, I. E., *see* Gerstein, G. L. *et al.*  
 Evanczuk, S., *see* Gerstein, G. L. *et al.*  
 Ewert, J.-P., 463, 464, 465  
 Ezure, K., 55
- Farber, R. M., 120  
 Fatt, P., 294  
 Feigenbaum, J., 137  
 Feigenbaum, M. J., 357  
 Feinstein, D. I., 184  
 Feldman, M. L., 35  
 Feynman, R. P., 515  
 Fifkova, E., 185  
 Finkel, L. H., 135  
 Fisher, M. E., 191–2  
 Flanagan, O. J. Jr., 434  
 Flyvberg, H., 240–8, 327

- Fogelman-Soulié, S., 241, 242  
 Folstein, S., 177  
 Forth, J. C., 21  
 Freeman, W., 69, 414  
 Freeman, W. J., 61  
 French, C., 384, 390, 392  
 Friesen, W. O., 268  
 Fujita, M., 269  
 Fukaya, M., 210–20  
 Fuster, J. M., 204  
  
 Gabor, J. D., 178  
 Gage, P., 384, 390, 392  
 Gardner, M. R., 342  
 Geisler, C. D., 134  
 Gelatt, C. D., 436  
 Gelatt, C. D. Jr., 527  
 Gelfand, A. E., 241  
 Gelperin, A., 406, 410  
 Georgopoulos, A. P., 60  
 Gerstein, G., 61, 63  
 Gerstein, G. L., 165, 189  
 Gerstein, G. L. *et al.*, 61, 165, 202  
 Gevins, A. S. *et al.*, 165  
 Gibbs, C. M., 433  
 Gibson, G. E., 294  
 Gibson, R. E., 45  
 Gielen, C. C. A. M., 50, 55, 56  
 Gilbert, C., 132  
 Gilbert, C. D., 190, 517  
 Goldberg, J., 47  
 Goldman, P. S., 517  
 Goldman–Rakic, P. S., 189  
 Goldschmidt, R., 152  
 Goles-Chacc, E., 241, 242  
 Gottwald, B. A., 297  
 Grabert, H., 515  
 Graf, W., 46, 54, 55, 56, 60  
 Graham, R., 515  
 Grassberger, P., 367, 368  
 Gray, E. G., 28  
 Gray, J., 154, 159  
 Green, M. B., 46  
 Green, M. S., 515  
 Grefenstette, J., 251  
 Gregory, R. L., 186  
 Griffith, W., 384  
 Grinvald, A. *et al.*, 189  
 Grobelnik, S., 58  
 Grondin, R. O. *et al.*, 324, 325, 336  
 Gruner, J. A., 58  
 Grüsser, O.-J., 455, 456, 461, 463, 467  
 Grüsser-Cornehls, U., 455, 456, 462, 463, 467  
 Guevara, M. *et al.*, 357  
 Guevara, M. R. *et al.*, 370  
 Guiba-Tziampiri, O., 505  
  
 Gustafsson, B. *et al.*, 384  
 Guyon, I., 249  
  
 Haag, G., 519  
 Habbel, C., 490  
 Haken, H., 514, 517  
 Halliwell, J., 384  
 Harris, K. M., 35  
 Harris, K. M. *et al.*, 32  
 Harth, E., 190, 370, 432–54  
 Harth, E. M. *et al.*, 317, 318, 340  
 Hartline, D. K., 184  
 Hassul, M., 269  
 Haydon, P., 293  
 Hebb, D., 4, 15  
 Hebb, D. O., 178, 180  
 Hebb, O., 84, 85, 89, 92  
 Hefti, F., 294  
 Heiden, U. *an der*, 455–68  
 Heidmann, T., 97  
 Heiligenberg, W., 165  
 Helmholtz, 55  
 Hendry, S. H. C., 517  
 Henkel, R. D., 232–9  
 Hertz, J. A. *et al.*, 222  
 Hess, R., 54  
 Hibbs, A. R., 515  
 Hildreth, E. C., 432  
 Hilhorst, H. J., 241  
 Hillis, Daniel, 477  
 Hinton, G., 95  
 Hinton, G. E., 120, 436, 437  
 Hirai, Y., 269  
 Hobbie, R. K., 158  
 Hodgkin, A. L., 150, 167, 385  
 Hoepfner, T. J., 190  
 Hoffmann, G. W., 74–87  
 Hofstadter, D., 119  
 Hogg, T., 120, 249  
 Holden, A. V., 293  
 Holland, J., 250, 251  
 Holmes, M. H., 131  
 Holst, E. V., 433  
 Holzgraefe, M., 502  
 Hopfield, J. J., 75, 84, 85, 89, 105, 106, 120, 167, 180, 184, 221, 222, 225, 226, 232, 239, 249, 319, 324, 363, 405–15, 536  
 Horn, G., 185  
 Hubel, D. H., 3, 8, 169–71, 422, 426, 517  
 Huberman, B. A., 120, 249, 250, 293, 336  
 Hudspeth, A. J., 124  
 Hughes, H. C., 433  
 Humières, D. d', 249  
 Huxley, A. F., 150, 167, 385  
  
 Ichikawa, M., 293

- Imig, T. J., 122, 126, 132, 517  
 Ingber, L., 59, 513–33  
 Ingerson, 241  
 Israel, M. *et al.*, 294  
 Ito, M., 372, 373, 379, 382
- Jack, J. J. B., 387  
 Jack, J. J. B. *et al.*, 26, 27, 30, 32, 38  
 Jacob, F., 251  
 Jasper, H., 305  
 Jenkins, W. M., 126  
 Jensen, R. V., 336  
 Jervey, J. P., 204  
 Johannesma, P., 61, 63, 189  
 John, E. R., 202  
 Johnson, C. D., 154, 158, 160  
 Johnston, D. *et al.*, 384  
 Jones, E. G., 28, 517  
 Jones, R. S., 521  
 Joó, F. *et al.*, 496  
 Jope, R. S., 296  
 Jordon, M., 462  
 Josin, Gary, 534–49  
 Julesz, B., 480, 481
- Kaikis-Astara, A., 505  
 Kaiserman-Abramof, I. R., 28  
 Kandel, E., 99  
 Kano, M., 379  
 Kanter, I., 232  
 Katz, B., 294  
 Kauffman, S. A., 241, 316, 327  
 Kaufman, L., 516  
 Kawato, M., 32  
 Kennedy, M. B., 75, 77–8  
 Keppel, G., 229  
 Kerszberg, Michel, 249–59  
 Kettner, R. E., 60  
 Killackey, H. P., 190  
 Kinahan, P. E., 74, 79  
 King, R., 293  
 Kinzel, W., 232–9  
 Kirkpatrick, A. *et al.*, 448  
 Kirkpatrick, S., 233, 436, 527  
 Kirkpatrick, S. *et al.*, 436  
 Kitagawa, M., 210–20  
 Knox, C. K., 165  
 Koch, C., 32, 390, 548  
 Kohonen, T., 1, 6, 12–25, 179  
 Kokkinidis, M., 507, 511  
 Kolb, B., 132  
 Kosco, B., 132  
 Kosslyn, S. M., 434  
 Kralj, A., 58  
 Krone, G. *et al.*, 201  
 Krone, G. H. *et al.*, 120  
 Kruger, J., 61, 189, 202, 206
- Kuffer, S. W., 167  
 Kühn, R., 226  
 Kuperstein, M., 165  
 Kürten, K. E., 105, 316–44, 357–71
- Lancaster, B., 384  
 Langouche, F., 515, 519  
 Lapedes, A. S., 120  
 Larionova, N. P., 372–83  
 Lashley, K. S., 179  
 Levchenko, E. B., 225  
 Levi-Civita, T., 46  
 Levick, W. R., 169  
 Lindstrom, S., 433  
 Linsker, R., 97, 102, 230, 416–31  
 Lisman, J. E., 75, 76–7  
 Lissmann, H. W., 154, 159  
 Little, W. A., 191, 317, 320  
 Littlewort, G. C., 104–18, 324, 328, 345–56  
 Llinas, M., 382  
 Llinas, R., 45, 50, 51, 61, 184, 387, 390  
 Lo, F. S., 433  
 Loeb, G. E., 58, 59  
 Longuet-Higgins, H. C., 1, 178, 378  
 Lorente de No, R., 39  
 Lorenz, E. N., 357  
 Lund, J. S. *et al.*, 433  
 Lux, H. D., 305
- McClurkin, J. W., 433  
 McCulloch, W. S., 44, 63, 106, 213, 221–4,  
 316, 317, 325, 378, 496  
 McIntire, S. L., 154  
 Mackey, M. C., 172  
 Madison, D. *et al.*, 384  
 Makisara, K., 17  
 Mallinow, R., 33  
 Malsburg, C. von der, 90  
 Mann, R. W., 58  
 Marinaro, M., 260–7, 342–3  
 Markham, C. H., *see* Blanks, R. H. I. *et al.*  
 Marr, D., 100, 120, 269, 372, 432  
 Marroquin, J., 548  
 Martin, O., 262, 263  
 Massaro, D. W., 228, 229  
 Matsumoto, G., 293  
 Matsumoto, H., 268–92  
 Matsuoka, K., 268  
 Matziari, C., 505  
 Mauritz, K. H., 58  
 Mayr, E., 250  
 Melamed, E., 294  
 Merzenich, M. M., 126, 190  
 Merzenich, M. M. *et al.*, 140  
 Metropolis, N. *et al.*, 436, 437  
 Metzler, J., 434  
 Mézard, M., 221–31

- Mézard, M. *et al.*, 221, 225, 229, 244, 247  
 Michalak, R., 434  
 Middlebrooks, J. C., 126  
 Miller, G. A., 228, 522  
 Miller, J. P., 151  
 Miller, J. P. *et al.*, 30, 33  
 Miller, S. G., 75, 77–8  
 Minsky, M., 252  
 Misner, C. W., 519  
 Mitchison, G., 184, 185  
 Mittag, T. W., 296  
 Mittelstaedt, H., 433  
 Mizrahi, M. M., 515  
 Montero, V. M., 433  
 Morel, A., 122, 126, 132  
 Morishita, T., 268  
 Morocco, R. T., 433  
 Morrell, F., 190, 201, 204, 206, 325  
 Morrell, F. *et al.*, 201, 204, 206, 325  
 Mountcastle, V. B., 189, 190, 201, 203, 258, 517  
 Mulliken, W. H., 433  
 Murdock, B. B. Jr, 228, 229, 522
- Nable, D., 387  
 Nadal, J. P., 221–31  
 Nadal, J. P. *et al.*, 91, 97, 221, 224, 225  
 Nadel, L., 101  
 Nashner, L. M., 58  
 National Research Council, 515  
 Nauta, W. J. H., 517  
 Neisser, U., 434  
 Neumann, J. von, *see* von Neumann  
 Nicholls, J. G., 167  
 Nicolis, C., 293  
 Niebur, E., 148–63  
 Niez, J. J., 90, 102  
 Nijmijer, M., 241  
 Nilsson, N. J., 249  
 Nobili, R., 179  
 Norman, D. A., 228  
 Nunez, P. L., 525
- Oakson, G., 433  
 Odiyzko, M., 262, 263  
 Oğuztöreli, M. N., 363  
 Oja, E., 21, 429  
 Okabe, Y., 210–20  
 Oppen, M., 232–9  
 Orr, G. E., 513  
 Oster, G. F., 119
- Pabst, M., 479–94  
 Palm, G., 45  
 Palmer, R. G., 184  
 Pandya, A. S., 432–54  
 Paperi, S., 252
- Parisi, G., 221, 222, 225  
 Parnas, I., 38  
 Pearson, J. C., 189, 190, 201  
 Pearson, J. C. *et al.*, 190, 201, 204  
 Peitgen, H. O., 137  
 Pellionisz, A. J., 44–73, 120, 184, 521  
 Peretto, P., 88–103, 223, 230, 409  
 Perkel, D. H., 32, 33, 151, 165, 189  
 Perkel, D. J., 33, 151  
 Personnaz, L. *et al.*, 232  
 Personnaz, L. E., 249  
 Peters, A., 28, 35  
 Peterson, B. W., 47, 49  
 Peterson, B. W. *et al.*, 55, 56  
 Pickles, J. O., 124, 132  
 Piggott, L. R., 177  
 Pisco, G. V. D., 189, 201  
 Pitts, W., 44, 63, 106, 213, 221–4, 316, 317, 325, 378, 496  
 Poggio, T., 32, 432  
 Pomeau, Y., 241  
 Poppele, R. E., 165  
 Postman, L., 229  
 Powell, T. P. S., 28  
 Pribram, 1  
 Price, O. L., 294  
 Procaccia, I., 367, 368
- Rafelski, J., 104–18, 120, 184, 316–44, 345–56  
*see also* Clark, J. W. *et al.*  
 Rall, W., 26–43, 149, 150, 151, 319, 378, 387  
 Ramachandran, 206  
 Raman, S., 308  
 Rammal, R., 250  
 Raskin, L., 101  
 Rasnow, B., 63  
 Ratliff, R., 164  
 Reale, R. A., 517  
 Redman, C. J., 26, 27  
 Reese, T. S., 149  
 Reitboeck, H. J., 479–94  
 Reitboeck, H. J. P., 61, 165  
 Richmond, F. J. R., 58, 59  
 Richter, P. H., 137  
 Riittinen, H., 21  
 Rinaldi, P. C., 190  
 Rinzel, J., 27, 28, 30, 32, 33, 151  
 Ritter, H., 21  
 Ritz, S. A., 521  
 Roekaerts, D., 515, 519  
 Roney, K. J., 191, 202  
 Rossenber, C., 548  
 Roth, G., 455–68  
 Russell, D. F., 184  
 Rutter, M., 177

- Sachs, M. B., 164  
 Sahley, Cl., 406  
 Salama, G., 189, 190, 426  
 Salazar, J. M., 293  
 Samuel, A. L., 249  
 Saramaki, T., 17  
 Saul, 8  
 Scheible, A. B., 190  
 Schmitt, F. O., 149  
 Schneider, J. *et al.*, 492  
 Schofield, Chris, 8  
 Schofield, C. L., 319  
 Schulman, L. S., 515  
 Schulten, K., 21, 120  
 Schuster, H. G., 357, 362  
 Schwartz, A. B., 60  
 Scott, A. C., 321  
 Seelen, W. von, 465  
 Seelen, W. von *et al.*, 190, 201  
 Segal, M., 384, 387  
 Segev, I., 26–43, 319, 378  
 Segev, I. *et al.*, 26  
 Sejnowski, T., 548  
 Sejnowski, T. J., 120, 436, 437  
 Sejnowski, T., 95  
 Selke, W., 191  
 Shamma, S. A., 131  
 Shannon, C., 44  
 Shaw, G. L., 189–209, 317, 320, 325, 516  
 Shaw, G. L. *et al.*, 194, 201, 202, 203, 206  
 Shelton, D. P., 378, 396  
 Shepard, R. N., 434  
 Shepherd, G. M., 132, 149, 150, 169, 170, 476, 516  
 Shepherd, G. M. *et al.*, 33, 167  
 Sherrington, C., 61  
 Sherrington, D., 233  
 Shiffrin, R. M., 228  
 Shizgal, B., 522  
 Sileto, *et al.*, 10  
 Silverman, D. J., 189–209, 325  
 Silverman, D. J. *et al.*, 194  
 Silverstein, J. W., 521  
 Simon, H. A., 522  
 Simpson, J. I., 46, 50, 54, 56  
 Simpson, J. I. *et al.*, 55, 60  
 Sinex, D. G., 134  
 Singer, 4, 10  
 Singer, W., 433  
 Smith, R. H., 149  
 Sompolinsky, H., 223, 226, 232  
 Soodak, R. E., 54  
 Soroko, L., 179  
 Stauffer, D., 241, 242  
 Stefanis, S., 305  
 Stein, R. B., 358, 359, 360, 361, 362, 363, 364  
 Stein, R. B. *et al.*, 268  
 Stent, G. S., 268  
 Steriade, M. *et al.*, 433  
 Stevens, C. F., 359  
 Storm, J., 389, 390  
 Stretton, A. O. W., 154, 158, 160, 161  
 Stretton, A. O. W. *et al.*, 152, 154, 155  
 Sugimori, M., 382  
 Sullivan, R. C., 177  
 Sutton, R. S., 164  
 Szentagothai, J., 117  
 Tank, D. W., 85, 239  
 Teuchert, G., 502  
 Thomas, R., 241  
 Thompson, 202  
 Thompson, R. S., 268  
 Thorne, K. S., 519  
 Tirapegui, E., 515, 519  
 Toledo-Morrel, L. de, 190  
 Tomita, K., 300  
 Torkkola, K., 21  
 Tóth, J., 294  
 Toulouse, G., 221–31, 250  
 Toulouse, G. *et al.*, 223, 224  
 Traub, R., 387, 390  
 Traub, R. D., 164  
 Träuble, H., 177  
 Travis, Bryan, 119–47  
 Tretter, F., 433  
 Truex, R. C., 121  
 Tsal, Y., 525  
 Tsien, R. W., 387  
 Tsukahara, N., 32  
 Tsutsumi, K., 269–92  
 Tucek, S., 296  
 Tuebner, M., 177  
 Turner, D. A., 32  
 Turner, M. R., *see* Gerstein, G. L. *et al.*  
 Tzanakou, E., 434, 435  
 Tzanakou, E. *et al.*, 435, 436  
 Underwood, J., 229  
 Unnikrishnan, K. P., 432–54  
 Utal, W. R., 117  
 Vallecalle, E., 202  
 van Enter, A. C. D., 237–8  
 van Hemmen, J. L., 226, 237  
 van Kampen, N. G., 514  
 van Zuylen, E. J., 50, 55, 56  
 Varhú, D., 456  
 Vasudevan, R., 191, 516  
 Vavilina, A. Ju., 372–83  
 Vecchi, M. P., 436, 527  
 Vedenov, A. A., 225  
 Verzeano, M., 202

- Vidal, P. P., 56, 58  
 Vinograda, O. S., 101  
 Virasoro, M. A., 250  
 Voigt, H. F., 164  
 von Neumann, J., 44–5
- Wagner, G. P., 495, 496  
 Walker, C. C., 241  
 Walrond, J. P., 154, 160  
 Walrond, J. P. *et al.*, 149, 154  
 Wanner, G. A., 297  
 Watanabe, S., 305  
 Wehner, M. F., 523, 528  
 Weidlich, W., 519  
 Weinberg, S., 519  
 Weisbuch, G., 241, 242  
 Westlake, P. R., 178  
 Wheller, J. A., 519  
 Whishaw, I. Q., 132  
 White, J. G., 156, 157  
 White, J. G. *et al.*, 154  
 Wiener, N., 44  
 Wiesel, T. N., 3, 8, 169–71, 190, 422, 426, 517  
 Wiesendanger, M., 190  
 Wietersheim, A. von, 463, 464
- Williamson, S. J., 516  
 Willshaw, D. J., 378  
 Wilson, C. J., 32  
 Wilson, C. J. *et al.*, 30, 35  
 Wilson, E. O., 119  
 Winlow, W., 293  
 Winston, J. V., 104, 120, 184, 318, 345, 467–78  
   *see also* Clark, J. W. *et al.*  
 Wolf, A. *et al.*, 366–7  
 Wolfer, W. G., 523, 528  
 Wolff, J. R., 495, 496, 498, 499, 502  
 Wolff, J. R. *et al.*, 496  
 Wolfram, S., 192, 201, 241, 262, 263  
 Wong, R. K. S., 164  
 Woolley, P., 177  
 Wurtman, R. J., 294
- Yajima, A., 268  
 Yerkes, R. M., 228  
 Young, E. D., 164  
 Young, R. A., 433  
 Yuille, A., 548
- Zemon, V., 164  
 Zhang, G., 522

## SUBJECT INDEX

*Page numbers in italics indicate references to tables or figures.*

- abstraction, 433–4
- accessibilities, *see* cyclic modes
- acetylcholine, 101  
*see also* Ach synthesis
- Ach synthesis, 293, 294–6, 300  
fine-tuned control system, 300
- actin, 185, 186
- active forgetting, 15–16, 228
- activity, 142, *143–5*  
cortical neurones, 135, *136, 137, 138*  
variation, 510–11
- afferent axons, *see* axons
- afferent process, *see* dendrites
- AID, 268, 272, 274, 284
- allosteric enzyme model, 75–6, 77–8
- Alopex* process  
application of, 442  
functioning of system, 445–6  
model assumptions, 434–5  
neural circuitry, 443–4  
optimization problems, 434, 435–7  
results of computer simulations, 446–51  
sequencing of patterns, 446  
structure of system, 444–5  
visual receptive fields, 435–7
- alpha frequency, 524–5
- Alzheimer's disease, 293–4
- AMP, 268, 272, 274
- amphibians  
mathematical model of retina, 455–7  
retina ganglion cell model, 457–61  
tectum opticum: simple summatory  
model, 461–4; summation and lateral  
inhibition, 464–7  
visual recognition in, 455–68
- AND–OR analogue, 210–20  
computer simulation, 216–17, 218
- elements: connection between, 215;  
functions of, 212–14; individuality of,  
216  
learning principle, 215–16, 219–20  
model structure, 211–16  
weighting factors, 213–14
- annealing, simulated, 436, 448, 527
- aplysia, 2
- ascaris lumbricoides*, 152, 161
- assembly hypothesis, 202
- association fibres, 126, *130*
- associative memory, 320–2, 339, 408, 409
- ataxic performance, 54
- attention  
intensity of, 228  
searchlight, 443
- auditory system  
3-D application, 140–6  
activity of neurones, 142, *143–5*  
association fibres, 126, *130*  
mathematical model of, 131–6  
midbrain nuclei, *129*  
spatial location of sound, 141–2  
structure of, 124–31  
tonotopic mapping, 126, *130*  
*see also* cochlea
- autism  
coherence and, 177–8  
fever effect, 177
- autocatalysis, 75, 76–7, 78
- automata  
cellular, 260–7: additive, 263–6; data  
processing abilities, 249–59; inverse  
problem, 266; notation, 262–3; *see*  
*also* neurons, logical  
competing: machine architecture,  
251–2; population dynamics, 252–3;



- automata: competing—*continued*  
     results, 253–7; translation invariance, 255–7  
     random complex, 240–8  
 average impulse density, *see* AID  
 average membrane potential, *see* AMP  
 axons, 14, 165  
     afferent, 14, 16  
     distribution, 132, 133  
  
 Basket–Stellate–Purkinje networks, 269, 276–82  
     *see also* Purkinje cells  
 bicuculin, 7, 10  
 biological intelligence  
     applications, 521–5: alpha frequency, 524–5; patterned information processing, 521–2; statistical analysis, 521; to C3, 525–30; wave propagation, 524–5  
     meson exchange, 515  
     physiology of neocortex, 514–16  
     theory: macroscopic regions, 518–21; mesoscopic domains, 515, 517–18; microscopic neurons, 516–17  
 boredom, 83  
 brain structure, *see* structure of brain  
*Brain Research*, 33  
 brain theory  
     brain as computer, 44–5  
     reductionalist, 45–6  
     *see also* neuronal networks: tensor network theory *and* individual theories  
 brain waves, 13–14  
 brainwashing, 347, 467  
 burst patterns, 204  
  
 C3  
     application of BI to, 525–30  
     combat simulations, 528–9  
     statistical decision making, 529–30  
 cable theory of dendrites, 149–52  
*caenorhabditis elegans*  
     models for locomotion, 154, 155–6  
     motor nervous system of, 152–61  
     simulation, 156–61: forward motion network, 156–7  
 cellular architecture, 251–2  
 cellular automata, *see* automata, cellular  
 central nervous system, *see* CNS  
 cerebellar circuitry  
     employing rhythmic oscillation, 269–72  
     feedback system GR–GO network, 269, 271–6  
     feedforward system, BA–ST–PU network, 269, 276–82  
     modifiable synapses and neural cells, 269–71  
     total behaviour of, 283–5  
 cerebellar, cortex, *see* cortex, cerebellar cerebellum, 268–9  
     adaptive linear filter model, 269  
     add-on-type network, 52, 54  
     frog, 372, 373  
 CF, *see* climbing fibre  
 chaotic activity  
     biological significance, 369–70  
     non-linear networks, 357–71:  
         continuous-time model, 358–63  
         quasirandom nets, 363–9  
 cholinergic system, activity in, *see* TRC hypothesis  
 climbing fibre, 372  
 clipping model, 226  
 CNS  
     hyperspaces defined, 61, 62, 63–4  
     immune system and 74–87: *see also* hysteresis  
     structure of, *see* structure of brain  
 coarse-graining, 515  
 cochlea, 124  
     cross-section of, 127  
     neural response in, 128  
     neurons in, *see* neurons  
     *see also* auditory system  
 cognition  
     imagery and abstraction, 433–4  
     reafference and, 432–3  
     *see also* Alopex process  
 coherence, 164–88  
     autism and, 177–8  
     computer model, 171–6  
     memory and, 178–82  
     pinch-out, 174, 175–6, 178, 182–3  
 columnar organizing principle, 189  
     in layered self-adaptive network, 416–31  
     mini, macro and mesocolumn, 517–18  
     *see also* feature-analyzing cells: trion model  
 command, *see* C3  
 communications, *see* C3  
 compensation theory, *see* synaptogenesis  
 computer-aided design, 495–503  
 computers, neural, 55, 59–60, 85–6  
 conditioning  
     appetitive, 406  
     backward, 409, 410  
     classical, 164  
     first-order, 406, 409  
     forward, 409, 410  
     Pavlovian, 406, 407  
     second-order, 406  
     *see also* learning

- conductance, 378, 382  
 leak c., *see* membrane resistivity  
 membrane, 382, 388–9, 396  
 synaptic, 159  
 transmembrane, 158
- configuration space, 242
- Connection Machine, 477
- connective strength, 135, 138, 139  
 memory and, 257  
 non-zero-couplings, 327–39: bounded  
 by unity, 336–9; unit magnitudes,  
 329–36
- connectivity, 134, 135, 241, 305–6  
 directed, 12  
 feedback, 12, 17  
 in Josin's system, 545–7, 548  
 input, 17  
 memory and, 223, 228  
 quasirandom network, 364  
 translation invariance and, 256–7
- continuous-time model, 363
- control, *see* C3
- convergence, 80–1
- cooperativity, synaptic, 382
- correlation analysis, 168–9  
 coefficient techniques, 61, 64–8  
 coefficients as metric tensor, 61–9  
 texture discrimination, 490, 491, 492
- cortex, 167  
 auditory, *see* auditory system  
 cerebellar, 269: neural cells in 270–1;  
 Purkinje cell structure, 372–83  
 connectivity, *see* connectivity  
 cortical neurons, 123–4, 125: electrical  
 behaviour, 384–404; inhibitory  
 neurones, 133; neural layers in,  
 121–4; neuron activity, 135, 136, 137,  
 138; *see also* pyramidal cells  
 dynamics and iterated maps, 137–40  
 functional areas of, 122  
 LCM model, 131, 132  
 variations in structure, 124  
 visual, 169–71, 172, 490, 491, 492
- cost function, 437, 438, 514, 527
- Crick–Mitchison theory, 184
- cross-correlation analysis, 64–8, 189  
*see also* correlation analysis
- current clamp, 386–7, 389, 398
- currents  
 muscarinic potassium, 387  
 Na<sup>+</sup>, *see* sodium currents
- cyclic modes  
 accessibilities of cycles, 340–1  
 associative memories, 320–2, 339  
 cycle length, 340, 353  
 distance between accessible cycles,  
 340–1  
 in randomly assembled nets, 326–9:  
 neuronal thresholds, 328, 329–39;  
 stability, 326–7  
 neurobiological relevance, 322–6  
 stability, 316, 342  
 subcycling, 354  
 synchronous finite-state model:  
 autonomous motions, 320–2;  
 specifications, 317–20  
 transition to, 345–56: cutting  
 prescription and, 351–5; rapid, 347–8;  
 simple architecture and, 348–51  
*see also* rhythmic oscillations  
 cytoplasm, resistance of, 158
- data-banks, mapping body coordinates, 55
- delay, synaptic, *see* synapses, delays
- dendrites, 123, 165  
 cable theory of, 149–52  
 diameter of, 158  
 distribution, 132, 133  
 membrane properties, 382:  
 conductance, 382, 388–9, 396  
 passive cable properties, 26–8  
 structure, Purkinje cells, 372–83  
*see also* dendritic spine clusters
- dendritic spine clusters  
 excitable spines, 32–40: different  
 synaptic inputs, 35–6, 37, 38–9; distal  
 branches, 35, 36, 39–40; firing  
 contingencies, 37, 39; head  
 membrane, 32–3; nonlinear stem  
 resistance, 33, 34  
 idealized, 27, 28  
 nonlinear synaptic processing, 26–43  
 spine stem resistance, 28–30: nonlinear  
 dependence on, 33, 34; Ohm's law,  
 30, 31; synaptic efficacy and, 30–2  
*see also* dendrites
- discrete models  
 cyclic modes in, *see* cyclic modes  
*see also* automata, cellular
- distances  
 Hamming, 63, 325, 326, 340–1  
 in neural network, 105–11: fringe  
 effects, 110–11; plateaus, 111  
 interval histograms, 481, 482
- dopamine, 504
- dreaming state, 184
- driven transmitter-recycling model, 296–7
- dynamic behaviour, *see* TRC hypothesis
- early vision, 432
- EEG, 516  
 activity, 305  
 brain structure and, 304, 305–12  
 gross activity, 306

- EEG—*continued*  
 model, 305–12: correlation with MEG data, 307  
 spindling, 307  
 efferent process, *see* axons  
 eigenfunctions, 521–2  
*eigenmannia virescens*, 165  
 electrical behaviour, 384–404  
 electroencephalogram, *see* EEG  
 electronic neural networks, 148–63  
 chemical synapses, 151  
 construction of, 152  
 electrical synapses, 152  
 forward locomotion network, 156–7  
 motor nervous system of *C. elegans*, 152–61  
 nerve processes, 150–1  
 parameter choice, 158  
 simulation, 156–61  
 synaptic conductance, 159  
 transmembrane conductance, 158–9  
 electrophysiology, single cell, 60  
 embedding, 51, 234  
 EMG-motor unit interpretation, 56–9  
 enzymes  
 allosteric enzyme model, 75–6, 77–8  
 kinase, 76–8  
 phosphatase, 76, 77  
 phosphorylating, 77  
*see also* allosteric enzyme model  
 epilepsy, 293, 308  
 error corrections, *see* learning, by error corrections  
 evoked potentials, 13  
 evolutionary tinkering, 251  
 excitable dendritic spine clusters: excitable spines, *see* dendritic spine clusters  
 experience  
 neural network evolution with, 1–11  
*see also* learning  
 eye movements, 492–3  
 feature-analyzing cells, 416–31  
 connection with physical systems, 427–9  
 constrained optimal interference, 429–30  
 energy formulation, 427  
 globally near-optimal states, 427–8  
 Hebb rule and, 429–30  
 modular self-adaptive network, 417–18  
 orientation columns, 424–7  
 orientation-selective, 421–3  
 spatial-opponent cells, 418–21  
 spin lattices, 427–8  
 feedback, 252  
 connectivities, 12, 17  
 global scalar, 434  
 in GR–GO network, 269, 284, 285, 286:  
 learning process, 271–2; period  
 locking process, 272–6  
 internal connections, 14  
 morphogenetic models, 496, 500  
 network structure, 17  
 pathways, 433  
 relaxation of activity due to, 17  
 feedforward system, BA–ST–PU network,  
 269, 276–82, 284, 287  
 filtering rhythmic oscillation, 277–9  
 suppression of large input, 276–7  
 fibre, *see* climbing; mossy; *and* parallel  
 fibre  
 firing, 304–5  
 coherence, *see* coherence  
 correlated, 180  
 excitable spine clusters, 37, 39  
 in trion model, 204  
 Na<sup>+</sup> only repetitive, 393, 394  
 synchronous, 317–26  
 FNS, 58  
 forgetting, 228–9  
 active, 15–16, 228  
 interference effects: proactive, 229;  
 retroactive, 228  
*see also* learning: memory  
 functional neuromuscular stimulation, *see*  
 FNS  
 functionality, 545–7, 548  
 GABA, 499  
 GABG interneuron, 505  
 gating particles, 385–6  
 genetic algorithms, 251–2  
 granular cells (GrCs), 372, 376, 378  
 learned pools, 374  
 Granule–Golgi network, 269, 271–6  
 Gross–Neveu model, 326  
 Hamming distances, 63, 325, 326, 340–1  
 head stabilization, 47, 49, 52–3, 52, 53, 56  
 Hebb's rule, 15, 232  
 feature-analyzing cells and, 429–30  
 hippocampus, 2, 172, 505  
 as comparator, 101  
 histograms, interval, 481  
 Hodgkin and Huxley model, 385  
 holographic processes, 179  
 Hopfield's model, *see* Hopfield in name  
*index*  
 Hubel–Wiesel cells, 2, 3  
 hysteresis  
 allosteric enzyme model, 75–6  
 boring and interesting experiences, 83  
 convergence, 80–1  
 familiar and unfamiliar, 84

- Hebb theory of learning, 84, 85  
 Lisman model, 76–7, 78  
 Miller–Kennedy model, 77–8  
 network dynamics, 78–9  
 neurons with, 74–87  
 pain and joy, 82–3  
 teaching, 79–80
- imagery, 433–4  
 immune system, CNS and, *see* hysteresis  
 impulse frequency, 14–15  
 information  
   capacity, Purkinje cells, 376–8  
   perilous, 190  
 inhibition, 7, 8, 9, 408  
   lateral in amphibian tectum cells, 465–7  
   long-term, 496  
   *see also* thresholds  
 input lines, *see* axons, afferent  
 input signals, *see* signals  
 interference  
   constrained optimal, 429–30  
   effects, *see* forgetting  
 introspective trap, 434  
 Ising models, 326  
 Ising-spin system analogy, 191–2  
 iterated maps, *see* mapping
- Josin's computational system, 534–49  
   biological relevance, 547–8  
   connectivity and functionality, 545–7, 548  
   hierarchical net, 542–5  
   mathematical proof, 539–45  
   results, 539–45  
   training patterns, 538, 539, 540–3  
 joy, interpretation of, 82–3
- Kauffman's model  
   comparison with spin glasses, 240–8  
   partitioning of configuration space, 242–3  
   results, 243–7  
 kinesiology, 56–9
- late vision, *see* *Alopex* process  
 lateral geniculate nucleus, 170, 432  
   dorsal, 433, 437–8, 445  
   learning and, 3, 8–10  
   synapses of, 3  
 lateral inhibition, *see* inhibition  
 LCM model, 131, 132  
 leak conductance, *see* membrane resistivity  
 learning, 15  
   acquisition of new patterns, 223–4  
   additive learning rule, 239  
   basic model for formulation, 221–4  
   by error corrections: in spin glass models, 232–9; learning rule, 233–5; of random patterns, 235–6; retrieval of noisy patterns, 236–7  
   efficacies, 90–5, 99  
   experimental psychology and, 227–9  
   from birth capabilities, 249  
   Hebbian, 84, 85, 180, 232  
   in AND–OR analogue, 215–16, 219–20  
   marginalist scheme, 226–7  
   memorization threshold, 221–4  
   models of, 84, 85  
   nature and nurture, 250, 254, 257  
   olfaction and, 406–9  
   parameters, 91  
   process on Purkinje cells, 279–82  
   recognition tasks, 227–9  
   reinforcement, 229, 254  
   stimulus response behaviour, 79–80  
   task-bound, 249  
   ultrametric structure, 250  
   with bounded synaptic efficacies, 225  
   *see also* conditioning; experience; forgetting; memories; training algorithms
- LGN, *see* lateral geniculate nucleus  
*Limax maximus*, 406–7, 413–14  
 linguistic competence, 250  
 Lipkin model, 326  
 Lisman model, 75, 76–7, 78  
 local emphasis, 348–51  
 locomotion, in nematodes, 154, 155–6  
 long-term memory, *see* memory, long-term  
 Lyapunov exponents, 366–7
- machine architecture, cellular, 251–2  
 magnetoencephalography, *see* MEG  
 mapping  
   body coordinates, 55  
   iterated function maps, 137–40  
   optimal, 6  
   purpose of, 23  
   self-organizing feature maps, 12–25, 18–21: bubbles of activity, 20, 21; feeler mechanism, 23; Mexican hat function, 19, 20; simulations, 21–2  
   tonotopic, 126, 130, 141  
   *see also* models  
 Marburg multielectrode technique, 490  
 Markov process, 21  
 medial geniculate nucleus (MGN), 131  
 MEG, 131, 304, 516  
   EEG correlation with, 307  
   SQUID, 304, 307–12  
 membrane  
   conductance, 382, 388–9  
   resistivity, 388–9, 396

- memory  
 Alzheimer's disease and, 293–4  
 associative, 320–2, 339, 408, 409  
 coding of sensory information, 18  
 coherence and, 178–82  
 connectivity and, 228  
 content addressable, 233, 236  
 experience and, 1–11  
 long-term, 99–101: biological intelligence and, 514; stored eigenfunction, 521–2  
 memorization threshold, 221–4  
 models of, 88–103: equations of motions, 88–90; general framework, 96–7; learning processes, 90–5; long-term, 99–101; short-term, 97–9  
 primacy effect, 229  
 recency effect, 228  
 serial position effect, 228  
 short-term, 97–9, 227–9: biological intelligence and, 514; capacity, 522–4; connection strengths, 257; search eigenfunction, 521; span, 228  
 storage: and retrieval, 18; capability, 232, 234, 235  
 time delays, 223  
*see also* forgetting; learning  
 mesoscopic domains, 515, 517–18  
 Mexican-hat functions, 19, 20, 421–2, 429, 456  
 MF, *see* mossy fibre  
 MGN, *see* medial geniculate nucleus (MGN)  
 Michalis–Menten kinetics, 77  
 microelectrode data, 201–6  
 microscopic theory, *see* Josin's computational system  
 Miller–Kennedy model, 77–8  
 models, *see* mapping; neural networks and individual models  
 monocular deprivation, 7–10  
 Moore–Penrose generalized inverse, 49, 51, 56, 58, 68, 69  
 morphogenetic models, 495–503  
 feedback process, 496, 500  
 logical neurons: closed circuits of, 499–502; network of, 496–9  
 mossy fibre, 374, 377  
 motivation, 228  
 motor systems, *see* sensorimotor systems  
 muscles  
 muscle-space, 58  
 overcomplete musculature, 56, 57, 58  
 stimulation, 56–9  
 myelination, 169  
 myosin, 185, 186  
 nature and nurture, 250, 254, 257  
 nematodes  
 locomotion in, 154, 155–6  
 motor nervous system of, 152  
*see also* *Caenorhabditis elegans*  
 neocortex, 167  
 as pattern-processing computer, 525  
 physiology, *see* biological intelligence  
 nerve processes, 150–1  
 nets, *see* neural networks  
 networks, *see* brain theory; neural networks; tensor network theory  
 neural cells  
 activity of, 14  
 bilobed and trilobed, 422, 423, 426  
 feature-analyzing, *see* feature-analyzing cells  
 in cerebellar cortex, 269–71  
 orientation-selective, 421–3  
 spatial-opponent, 418–21  
 neural networks, 305  
 add-on-type, 52, 54  
 and computing, 85–6  
 AND–OR analogue, *see* AND–OR analogue  
 chaotic activity, *see* chaotic activity  
 coherence in, *see* coherence  
 computing by, 59–60  
 cycling, *see* cyclic modes  
 electronic, *see* electronic neural networks  
 evolution with experience, 1–11  
 immune system comparisons, *see* hysteresis  
 layered: feature-analyzing cells in, *see* feature-analyzing cells of sensory complex, 119–47  
*see also* cortex, neural layers in  
 longer term behaviour, 1  
 matrices, 49  
 microscopic theory, *see* Josin's computational system  
 modifiable, 1: pattern recognition with, 467–78  
 olfaction and, *see* olfaction  
 pain and joy interpretation, 82–3  
 pattern recognition, *see* training algorithms  
 quasirandom, *see* quasirandom networks  
 randomly connected, *see* Kauffman's model; quasirandom networks  
 realism required, 13–16  
 relaxation in, 1, 17  
 short-term behaviour, 1  
 solid state physics applied to, 12–13  
 stability, 362

- structure and function of, 47, 49–54
- travelling salesman problem, 85
- unstructured and structured, 111–15
- weakly interacting netlets, 114
- see also* learning; mapping; memory; synapses; tensor network theory
- neural thron, 519
- neurobiology, cyclic models and, 322–6
- neurobotics, 55, 59
- neurocratic model, 155
- neuromuscular junctions, *see* NMJ
- neuronal networks, *see* neural networks
- neuronal threshold
  - adjustable, 328, 336–9
  - normal, 328, 329–36
- neurones, *see* neurons
- neurons, 123, 165
  - cochlear, 27
  - cortical, *see* cortex, cortical neurons
  - electronic, *see* electrotonic neural networks
  - feature sensitive units, 15
  - firing, synchronous, 317–26
  - input–output behaviour, 2
  - learning, 3–4, 5
  - logical, 496–9: closed circuits of, 499–502
  - microscopic, 516–17
  - pacemaker, 169, 183, 184
  - threshold, quasirandom networks of, 316–44
- neurophilosophy, 45–6
- neurotransmitters, 167
- Newton–Raphson method, 365
- NMDA receptors, 10
- NMJ, 150, 160–1
  - as stretch receptors, 156
- node of Ranvier, 390
- non-NMDA receptors, 10
- non-zero couplings, 327–9
- nurture, *see* nature and nurture
  
- ocular dominance, 10
  - binocular deprivation, 10
  - monocular deprivation, 7–10
  - selectivity and, 7
- oculomotor mechanism, 492–3
- odour stimulus, *see* olfaction
- ohmic resistance, 152
  - spine stem resistance and, 30, 31
- olfaction, 405–15
  - analytic view, 411–12
  - learning, 406–9
  - Limax maximus*, 406–7, 413–14
  - mixture distinction, 413–14
  - weak signal recognition, 410–11
- optimization
  - Alopec* algorithms, 434, 435–7
  - visual perception as, 437–44
- organ of Corti, 124, 127
- oscillations, rhythmic, *see* cerebellar circuitry; cyclic modes; rhythmic oscillations
- output signals, *see* signals
- overcomplete musculature, 56, 57, 58
  
- pacemaker neurons, 169, 183, 184
- pain, interpretation of, 82–3
- Palimpsest schemes, 225–7
  - bounded synaptic efficacies, 225
  - marginalist scheme, 226–7
- parallel fibre, 372
- pattern recognition
  - biological intelligence and, 521–2
  - neocortex as computer, 525
  - texture, 479–94
  - see also* training algorithms
- perceptron, 268
- periodic locking process, 272–6
- periodic oscillations, *see* cyclic modes; rhythmic oscillations
- PF, *see* parallel fibre
- phase locking, 297
  - see also* periodic locking
- phoneme maps, 21, 22
- physiology
  - electro, single cell, 60
  - multi-unit, 61–9
  - of neocortex, *see* biological intelligence
- picrotoxin, 505
- pinch-out, 174, 175–6, 178, 182–3
- polarization parameters, 91, 95
- post synaptic activity, *see* signals, output
- post synaptic variable, 4
- potentials, evoked, 13
- presynaptic activity, *see* signals, input
- primacy effect, 229
- prolactin levels, 504–12
  - activity variation, 510–11
  - dopamine, 504
  - hippocampus and, 505
  - inhibiting factor (PIF), 504
  - model, 507–10
  - notation, 506–7
  - picrotoxin, 505
  - releasing factor (PRF), 504
  - serotonin, 504–5
- proteins, 185, 186
- pseudopregnancy, prolactin levels, *see* prolactin levels
- psychology, experimental, neural networks and, 227–9

- Purkinje cells, 271, 278  
 dendrite structure, 372–83: information capacity, 376–8; RECORD and RECALL, 376  
 learning process on, 279–82  
 membrane resistivity, 382, 396  
*see also* Basket–Stellate–Purkinje networks
- pyramidal cells, 384–404, 476  
 approximation of cell, 387  
 current clamp, 386–7, 389  
 hippocampal, 384–404  
 membrane resistivity, 382, 388–9, 396  
 model algorithm, 402–3  
 model data base, 386–7  
 modeling strategy, 388–9  
 Na<sup>+</sup> currents, 389–98, 399–401  
 single action potential, 399  
 voltage clamp, 386–7, 389
- quasirandom networks, 104–18  
 chaotic activity, *see* chaotic activity  
 cyclic modes in, 316–44: *see also* cyclic modes  
 distances in, 105–11  
 quenched model, 241
- random networks, *see* quasirandom networks
- reafferent simulation  
 cognition and, 432–3  
*see also* Alopex process
- recency effect, 228
- receptors  
 NMDA, 10  
 non-NMDA, 10
- recognition tasks, 23, 227–8
- rectification, 392, 393, 396–8
- rehabilitation medicine, 56–9
- reinforcement, 229, 254
- relaxation  
 approximation, 19–20  
 in neural circuits, 17  
 of activity due to feedback, 17
- resistance, 30, 31, 152  
 membrane, *see* membrane resistivity of cytoplasm in nerve cells, 158
- retina, of amphibians, *see* amphibians
- reverberation, 323–4, 347
- rhythmic oscillations, 269–72, 362, 498  
 hierarchical chemical oscillators, 295  
 synaptic transmission and, *see* TRC hypothesis  
*see also* cerebellar circuitry; cyclic modes
- scylla*, 158
- self-organizing feature maps, *see* mapping
- sensorimotor systems, 54–5
- serial position effect, 228
- serotonin, 504–5
- short-term memory, *see* memory, short-term
- signals  
 impulse frequency, 14–15  
 in neural cell, 14  
 input, 14, 15  
 intensity, 14  
 output, 15  
 transfer function, 14
- simulated annealing, 436, 448, 527
- single-cell electrophysiology, 60
- six-code theory, 434
- smell, *see* olfaction
- sodium currents, 389–98, 399–401  
 estimating parameters, 389–96  
 functional role of, 399–401  
 in hippocampal pyramidal cells, 388, 389–401  
 Na<sup>+</sup> current kinetics determination, 395–6  
 Na<sup>+</sup> only repetitive firing, 393, 394  
 Na<sup>+</sup> only spike, 390, 391, 392, 396–8  
 TTX sensitive inward-rectification, 392, 393, 396–8
- solid state physics, 12–13
- sound, *see* auditory system
- spin glass models, 167, 184  
 error corrections in, 232–9  
 Kauffman's model and, 240–8
- spin lattices, 427–8
- spin variables, 221–2
- spine stem resistance: spines, excitable, *see* dendritic spine clusters
- SQUID, 304, 307–12
- stability, 316, 326–7, 342, 362
- startle response, 446
- statistical analysis, 521  
 C3 statistical decision making, 529–30
- stimuli, weak and strong, 83
- storage capability, 232, 234, 235
- Strategic Defense Initiative (SDI) Program, 513–14
- stretch receptors, 156
- structure of brain  
 functions and, 303–15  
 theoretical methods: EEG model, 305–12; neural net model, 305; unit properties, 304–5
- substrate inhibition, *see* allosteric enzyme model
- Superconducting Quantum Interference Device, *see* SQUID
- synapses, 165–6  
 chemical, 151

- conductive, 159
- delays, 167, 169, 178, 305: autism and, 177–8
- efficacies, 95, 97, 98, 99, 222: averaged cumulant of, 226–7; bounded, 225; spine stem resistance and, 30–2
- electrical, 152
- experience and, 1–11
- inhibitory, 7, 8, 9
- inputs to excitable spines, 35–6, 37, 38–9
- LGN cortical, 3, 8–10
- modifiable, 269–71, 272
- modification rules, 3–5, 409, 499
- optimal mapping, 6
- Purkinje cells, 378–9, 382: cooperativity, 382
- synaptic dynamics, 88–90
- synaptic strength, 270
- synaptic thresholds, 270
- time lag, 410
- transmission, cholinergic, *see* TRC hypothesis
- synaptogenesis
  - compensation theory of, 496, 498, 499, 500
  - see also* morphogenetic models
- synchronous finite-state model, 317–26
- synthetic view, 411, 413
  
- teaching, 79–80
- tectum opticum, *see* amphibians
- tensor network theory, 44–73
  - brain as computer, 44–5
  - computerized maps of body-coordinates, 55
  - computing by neuronal networks, 59–60
  - correlation coefficients as metric tensor, 61–9
  - EMG motor unit interpretation, 56–9
  - functional CNS hyperspace geometry, 61–9
  - functional muscle stimulation, 56–9
  - general theory of neuronal networks, 47, 49–54
  - multi-unit physiology, 61–9
  - neurobotics, 55, 59
  - neurophilosophy, 45–6
  - reductionist brain theory, 45–6
  - rehabilitation medicine and kinesiology, 56–9
  - sensorimotor systems, 54–5
  - single-cell electrophysiology, 60
  - tensor modules, 52, 53
  - tensors: covariant embedding, 51; fundamental, 69; metric, 69; projective, 51; transformation, 46, 51
  - tensor transformations, *see* tensor network theory
  - tetrodotoxin sensitive inward rectification, 392, 393
  - texture, 479–94
    - correlated activity, 490, 491, 492
    - dot textures, 482
    - experiments, 481–90
    - line textures, 480, 482
    - model, 480–1
    - neurophysical plausibility, 490–2
    - oculomotor mechanism, 492–3
    - spatial distribution of intervals, 482
    - via internal histograms, 481
    - via temporal correlations, 479–80
  - thalamocortical relays, 445
  - thresholds, 413
    - adjustable, 328, 336–9
    - logic model, 319
    - normal, 328, 329–36
    - synaptic, 270
    - see also* inhibition
  - timing of impulse, *see* coherence
  - tonotopic mapping, 126, 130, 141
  - training algorithms, 467–78
    - computer applications, 477
    - elements of, 471–2
    - experience with, 472–3
    - physical limitations to, 467–71
    - trained network evaluation, 473–6
  - training patterns, 538, 539, 540–3
  - transfer function, 14
  - transformations, tensor, *see* tensor network theory
  - transitions, *see* cyclic modes, transition to translation invariance, 255–7
  - transmembrane conductance, 158
  - transmitters, *see* driven transmitter-recycling model: synapses; transmission: TRC hypothesis
  - travelling salesman problem (TSP), 85
  - TRC hypothesis, 293–302
    - Ach synthesis, 293, 294–6, 300
    - driven transmitter-recycling model, 296–7
    - neurochemical background, 294, 295, 296
    - results, 297–9
  - triggering frequency, 14
  - trion model, 189–209
    - analysis of multi-microelectrode data, 201–6
    - firing levels, 204
    - Monte-Carlo simulations, 194–5, 196–200, 201
    - spatial and temporal dependence, 201–2
  - TSP, *see* travelling salesman problem



- TTX sensitive inward rectification, 392,  
393, 396–8
- unified-code model, 434
- vesicles, 167
- vestibulo-collic reflex, 47, 48, 50, 52, 53
- vision  
early, 432  
hierarchical model of, 444–6  
in amphibians, *see* amphibians  
late, *see* *Alopex* process  
occulomotor mechanism, 492–3  
perception as optimization process,  
437–44
- receptive fields, 435–7  
texture description, *see* texture  
*see also* *Alopex* process: visual cortex
- visual cortex, 169–71, 172  
monocular deprivation, 7–10  
of cat, 490, 491, 492  
response characteristics, 2–3  
voltage clamp, 386–7, 389
- wave propagation, 524–5  
weak signal recognition, 410–11  
weight vectors, 15
- Yerkes and Dodson law, 228