

## Author index

- Aghion-Prat, D., 190, 200  
 Aksenova, N. P., 192, 201  
 Alberi, P., 257, 284  
 Albersheim, P., 366, 368  
 Allsopp, A., 164, 165, 174  
 Aloni, R., 305, 309  
 Ammirato, P. L., 354, 368  
 Anderson, R., 291  
 Armstrong, J. E., 235, 252  
 Arney, S. E., 212, 226  
 Arnold, B. C., 177, 200  
 Arzee, T., 178, 200  
 Avers, C. J., 232, 253  
 Avery, A. G., 77, 79, 84  
 Avery, G. S., 151, 153
- Backs-Hüseemann, D., 354, 368  
 Bailey, I. W., 314, 315, 316, 317, 320, 331, 336, 346  
 Balducci, C., 257, 284  
 Ball, E., 69, 70, 79, 83, 84, 87, 88, 90, 92, 93, 94, 98, 183, 195, 201, 241, 252, 279, 283  
 Balls, M., 4  
 Bannan, M. W., 321, 322, 327, 328, 330  
 Barghoorn, E. S., Jr., 311, 323, 324, 331  
 Barlow, P. W., 4, 82, 83, 238, 252  
 Bavrina, T. V., 192, 201  
 Beck, C. B., 268, 283  
 Becking, J. H., 248, 252  
 Berlyn, G. P., 325, 331  
 Bernier, G., 4, 186, 200  
 Berquam, D. L., 349, 368  
 Bewley, J. D., 4  
 Bieniek, M. E., 177, 178, 200  
 Bierhorst, D. W., 57, 58, 60, 68, 83  
 Billett, F. S., 4  
 Black, M., 4  
 Blakely, L. M., 246  
 Blakely, R. M., 246  
 Blakeslee, A. F., 34, 35, 44, 45, 77, 79, 84, 179, 201  
 Blaser, H. W., 177, 200  
 Bonnett, N. T., Jr., 366, 368
- Borchert, R., 216, 226  
 Brady, T., 36, 38, 45  
 Breekland, A. E., 41, 44  
 Bretz, C. F., 211, 212, 227  
 Briggs, W. R., 104, 105, 123, 162, 175  
 Brink, R. A., 35, 45  
 Brinkhorst-van der Swan, D. L. C., 41, 44  
 Brown, C. L., 222, 226, 228, 337, 339, 346  
 Bruck, D. K., 306, 307, 308  
 Brumfield, R. T., 240, 252  
 Bryant, J. A., 4  
 Buchholz, J. T., 16  
 Bullwinkel, B., 211, 227  
 Burgess, J., 4  
 Butterfield, B. G., 4  
 Buvat, R., 66, 83
- Caponetti, J. D., 130, 145, 160, 161, 162, 167, 174  
 Carr, D. J., 4  
 Cateisson, A. M., 67, 83, 328, 331  
 Chailakhyan, M. K., 194, 201  
 Chakravarti, S. C., 51, 60  
 Champagnat, P., 224, 226  
 Chiang, S., 247, 253  
 Cheng, P. C., 184  
 Church, A. H., 110, 112, 122  
 Clarkson, D. T., 5  
 Clausen, J. J., 210, 226  
 Clowes, F. A. L., 67, 83, 235, 236, 237, 238, 239, 242, 244, 252  
 Clutter, M. E., 36, 45, 166, 167, 175, 304, 309  
 Coe, E. H., 13, 25, 225, 226  
 Cohen, L., 178, 200  
 Conklin, M. E., 34, 45  
 Corson, G. E., 51, 56, 60  
 Coupland, R. T., 230, 364  
 Craig, W. R., 196, 201  
 Critchfield, W. B., 210, 226  
 Cronshaw, J., 291  
 Crotty, W. J., 164, 174  
 Crouch, M. L., 40, 41, 44, 356, 368  
 Cullis, C., 256, 283

- Cumbie, B. G., 323, 331  
 Curtis, O. F., 341, 347  
 Cusick, F., 138, 145, 192, 200  
 Cutter, E. G., 4, 128, 131, 143, 144, 145, 146, 172, 174, 247, 253, 256, 283
- Dale, J. E., 4  
 D'Amato, F., 22, 25, 68, 83, 239, 252  
 Dart, P. J., 250, 252  
 Darvill, A. G., 366, 368  
 Davidson, D., 240, 253  
 Davis, E. L., 55, 60, 63, 64, 83, 96, 98, 238, 253  
 DeMaggio, A. E., 19, 25, 32, 44  
 Dengler, N. G., 158, 169, 170, 175  
 Dengler, R. E., 158  
 Dermen, H., 68, 80, 83, 85  
 Dore, J., 365, 368  
 Dubuc-Lebreux, M. A., 151, 174  
 Dudley, M. E., 249  
 Durham, M., 246
- Eames, A. J., 287, 319  
 Eckland, P. R., 212, 227  
 Eggers, V., 363, 368  
 Emanuel, M. E., 297  
 Erickson, R. O., 114, 122, 232, 253  
 Esau, K., 4, 269, 270, 271, 283, 288, 296, 298, 299, 309, 328, 331  
 Evans, L. T., 190, 201  
 Evans, T. A., 246  
 Evert, R. F., 290, 309
- Fahn, A., 342, 347  
 Falconer, M. M., 305, 306, 309  
 Farrar, J. L., 342, 347  
 Feldman, L. J., 172, 174, 241, 242, 244, 253, 256, 283
- ti Finkelstein, R. R., 40, 41, 44  
 Fisher, J. B., 219, 222, 227  
 Fishman, T. N., 245, 247, 253  
 Foard, D. E., 107, 122, 245, 247, 253  
 Fosket, D. E., 75, 83, 289, 302, 305, 309, 310  
 Foster, A. S., 52, 54, 60, 74, 83, 168, 169, 174  
 Franck, D. H., 168, 174  
 Freeberg, J. A., 275, 283, 301, 309  
 Frisch, B., 256, 283  
 Francis, D., 4  
 Fukuda, H., 305, 307, 309
- Gabriel, H. P., 126  
 Galun, E., 197, 200  
 Garrison, R., 140, 145, 204, 205, 206, 207, 209, 228  
 Gautheret, R. J., 336, 347
- George, L., 33, 44  
 Gifford, E. M., Jr., 51, 56, 60, 68, 72, 73, 75, 76, 83, 84, 85, 182, 189, 202, 239, 247, 253  
 Giles, K. L., 356, 368  
 Gill, A. M., 214, 227, 230, 253  
 Goebel, K., 164, 168, 174  
 Golub, S. J., 58, 301, 309  
 Goodwin, R. H., 232, 253  
 Gottlieb, J. E., 139, 145  
 Graf, L. H., 35, 45  
 Green, M. C., 72, 85, 182, 189, 202  
 Green, P. B., 106, 122  
 Greyson, R. I., 184, 196, 197, 198, 200, 201  
 Gulline, H. F., 94, 98  
 Gunckel, J. E., 71, 85, 120, 122, 213, 222, 227, 300, 309  
 Gunning, B. E. S., 38, 44, 239, 253, 264, 283  
 von Guttenberg, H., 235, 239, 253
- Haber, A. N., 245, 247, 253  
 Hagemann, W., 277, 283  
 Haight, T. H., 127, 145  
 Hallé, F., 4, 214, 215, 220, 221, 223, 224, 227  
 Halperin, W., 353, 354, 355, 368  
 Hanawa, J., 134, 135, 145  
 Hara, N., 51, 60  
 Hardham, A. R., 239, 253  
 Harvey, W. H., 167, 174  
 Heimsch, C., 235, 252  
 Hejnowicz, Z., 325, 326, 331, 337, 347  
 Hepler, P. K., 289, 310  
 Heslop-Harrison, J., 193, 196, 200  
 Hibbs, D. E., 222, 227  
 Hicks, G. S., 94, 98, 131, 145, 189, 193, 194, 195, 198, 200  
 Hicks, M. A., 64, 71, 72, 84, 187  
 Higgins, T. J. V., 40, 44  
 Hildebrandt, A. C., 349, 350, 351, 352, 368, 369  
 Hindman, J. L., 196, 201  
 Holsten, R. D., 351, 354, 369  
 Hughes, J. E., 239, 253
- Imaichi, R., 276, 283
- Jacob, F., 257, 283  
 Jacobs, T. W., 249  
 Jacobs, W. P., 211, 227, 300, 301, 303, 307, 309  
 Jensen, L. C. W., 193, 201  
 Jensen, W. A., 20, 21, 22, 23, 25, 235, 253, 262, 263, 283  
 Johansen, D. A., 15, 16  
 Johri, B. M., 4

- Johri, M. M., 13, 25  
 Jones, L. E., 330, 368  
 Jones, R. L., 211, 227  
 Jung, Y., 197, 200  
 Juniper, B. E., 236, 252
- Kao, K. N., 357  
 Kaplan, D. R., 158, 160, 174  
 Kaplan, R., 277, 283  
 Karssen, C. M., 41, 44  
 Kavaljian, L. G., 235, 253, 262, 263, 283  
 Kent, A. E., 351, 354, 369  
 Kinet, J. M., 4, 186, 200  
 King, R. W., 38, 44, 186, 190, 201  
 Kirschner, H., 342, 347  
 Klekowski, E. J., 80, 84  
 Kohlenbach, H. W., 356, 359, 368  
 Komamine, A., 305, 307, 309  
 Konar, R. N., 358, 359, 368  
 Konstantinova, T. N., 192, 201  
 Koornneef, M., 41, 44  
 Kormanik, P. P., 226  
 Kozłowski, T. T., 210, 226, 248, 253  
 Krikorian, A. D., 349, 368  
 Krishnamoorthy, H. N., 190, 191, 201  
 Kuehnert, C. C., 127, 132, 145, 146  
 Kumazawa, M., 300, 309
- LaMotte, C. E., 303, 309  
 Lang, A., 197, 200, 211, 212, 227  
 Langenauer, H. D., 238, 253  
 Larson, P. R., 120, 122, 308, 309  
 Lin, J., 73, 84  
 Link, G. K. K., 363, 368  
 Lintilhac, P. M., 143, 146, 340, 347  
 Little, C. H. A., 343, 347  
 Lloyd, F. E., 37  
 Loiseau, J. E., 94, 95, 96, 99  
 Long, S. R., 249  
 Lord, E. M., 185, 201  
 Lyndon, R. F., 62, 64, 65, 72, 73, 84, 105, 106, 122  
 Lyon, H. G., 15
- MacDaniels, L. H., 287, 319, 341, 347  
 Maheshwari, P., 10, 25, 38, 44  
 Mahmood, A., 327, 331  
 Maier, U., 132, 134, 146  
 Majumdar, G. P., 51, 55, 60, 140, 146  
 Maksymowych, R., 150, 153, 174  
 Mallory, T. E., 247, 253  
 Mancinelli, P., 212, 226  
 Mapes, M. O., 350, 351, 354, 369  
 Marc, J., 181, 201  
 Marcotrigiano, M., 367, 368  
 Marks, G. C., 248, 253  
 Marotta, R., 257, 284
- Marsden, M. P. F., 42  
 Mauseth, J. D., 73, 75, 76, 84  
 Maze, J., 237, 254  
 McAlpin, B. W., 57, 60, 277, 283  
 McAlpine, R. G., 226  
 McArthur, I. C. S., 231, 272, 273, 280, 281, 283, 307, 310  
 McClintock, B., 258, 283  
 McCully, M. E., 4, 247, 253  
 McDaniel, C. N., 225, 227  
 McHughen, A., 193, 196, 201  
 Mears, K., 350, 369  
 Meichenheimer, R. D., 118, 122  
 Meinke, D. W., 41, 42, 44  
 Michyluck, M. R., 357  
 Miksche, J. P., 75, 83  
 Miller, C. O., 365, 368  
 Miller, H. A., 7, 8, 9, 25  
 Millington, W. F., 170, 171, 175, 177, 178, 200  
 Milthorpe, F. L., 4  
 Minter, T. C., 185, 201  
 Mitchison, G. J., 121, 122  
 Monod, J., 257, 283  
 Moore, T. C., 212, 227  
 Morrow, I. B., 300, 303, 309  
 Mueller, P. A., 169, 170, 175  
 Muir, W. H., 349, 368  
 Murashige, T., 88, 89, 90, 99  
 Murfet, I. C., 212, 227  
 Murmanis, L., 327, 332
- Nagl, W., 256, 283  
 Nanda, K. K., 190, 191, 201  
 Narayanaswamy, S., 33, 44  
 Nataraja, K., 358, 359, 368  
 Naylor, E., 361, 368  
 Naylor, J. M., 64, 71, 72, 84, 187, 233, 237, 254  
 Neal, B. R., 223, 224, 227  
 Neuffer, M. G., 41, 44, 225, 226  
 Newman, I. V., 82, 84, 327, 328, 330, 332  
 Niklas, K. J., 76, 84  
 Nougarede, A., 71, 76, 84
- O'Brien, T. P., 4  
 Oldeman, R. A. A., 4, 214, 215, 220, 221, 223, 224, 227  
 Olson, A. R., 39, 44
- Palmer, J. H., 181, 201  
 Paolillo, D. J., Jr., 306, 307, 309  
 Partanen, C. R., 256, 283  
 Pate, J. S., 38, 44  
 Patel, J. D., 140, 146  
 Pellegrini, O., 128, 146, 242, 253  
 Peterson, C. A., 297

- Peterson, R. L., 236, 253, 295, 310  
 Pharis, R. P., 38, 44  
 Philipson, W. R., 4, 63, 84  
 Phillips, H. L., Jr., 236, 238, 253  
 Phillips, I. D. J., 5, 211, 216, 227, 312, 332  
 Pilkington, M., 91, 92, 95, 99  
 Plantefol, L., 119, 122  
 Poethig, R. S., 13, 25, 48, 50, 106, 122,  
 152, 154, 155, 156, 157, 175  
 Pollock, E. G., 20, 22, 25  
 Popham, R. A., 48, 60, 234, 253  
 Posluszny, U., 139, 146  
 Potts, W. C., 212, 227  
 Priestly, J. H., 363, 368
- Raghavan, V., 4, 34, 36, 38, 44  
 Raju, M. V. S., 230, 233, 237, 254, 364  
 Randolph, L. F., 12, 25  
 Reeve, R. M., 274  
 Reid, J. B., 212, 227  
 Reinert, J., 354, 368  
 Remphrey, W. R., 143, 146, 223, 224, 227  
 Rennie, P., 55, 60, 63, 64, 71, 72, 74, 83,  
 84, 187  
 Richards, F. J., 112, 117, 122  
 Richter, P. H., 120, 123  
 Riding, R. T., 73, 75, 84  
 Rier, J. P., 303, 304, 310  
 Rietsema, J., 35, 44  
 Rijven, A. H. G. C., 35, 44  
 Riker, A. J., 349, 350, 368  
 Riopel, J. L., 247, 254  
 Roach, J., 212, 227  
 Roberts, L. W., 5, 289, 302, 305, 308, 310  
 Robertson, E. S., 73, 84  
 Romberger, J. A., 325, 326, 331  
 Rondet, P., 76, 84  
 Rosenthal, D., 94, 96, 99  
 Rothwell, G. W., 268, 283  
 Ruth, J., 80, 84
- Sachs, R. M., 4, 186, 200, 211, 212, 227  
 Sachs, T., 129, 130, 146, 306, 307, 308,  
 310, 342, 347  
 Saint-Côme, R., 75, 84  
 Sala, E., 257, 284  
 Satina, S., 35, 44, 77, 79, 84, 179, 201  
 Sattler, R., 132, 134, 146, 151, 174, 183,  
 201  
 Savidge, R. A., 342, 347  
 Sawhney, V. K., 74, 197, 198, 200, 201  
 Sax, K. B., 232, 253, 337, 347  
 Schmid, R., 268, 283  
 Schmidt, A., 49, 60  
 Schmidt, B. L., 170, 171, 175  
 Schoute, J. C., 117, 123  
 Schraner, R., 120, 123
- Schüepp, O., 108, 123  
 Schulz, R., 20, 21, 23, 25  
 Schwabe, W. W., 112, 118, 122, 123, 189,  
 201  
 Seagull, R. W., 305, 306, 309  
 Shabde, M., 90, 99  
 Shah, J. J., 140, 146  
 Shanks, R., 256, 283  
 Sharman, B. C., 158  
 Sheridan, W. F., 41, 44  
 Shumway, J. E., 40, 41, 44  
 Siebers, A. M., 334, 335, 347  
 Sinnott, E. W., 5  
 Skoog, F., 365, 368  
 Smith, J. G., 35, 44  
 Smith, R. H., 88, 89, 99  
 Snow, M., 114, 115, 123, 134, 142, 146  
 Snow, R., 114, 115, 123, 134, 142, 146  
 Soave, C., 257, 284  
 Soe, K., 278, 279, 284  
 Soetiarto, S. R., 183, 193, 201  
 Soma, K., 79, 84  
 Sorokin, S., 303, 304, 310  
 Spurr, A. R., 16, 17, 25  
 Stahmann, M. A., 35, 45  
 Steeves, M. W., 126  
 Steeves, T. A., 55, 57, 58, 59, 60, 61, 63,  
 64, 71, 72, 74, 83, 84, 94, 96, 98, 104,  
 105, 110, 123, 124, 125, 126, 127, 129,  
 131, 134, 136, 139, 143, 145, 146, 147,  
 160, 161, 162, 167, 168, 174, 175, 187,  
 223, 224, 227, 230, 231, 233, 237, 254,  
 272, 273, 275, 276, 280, 281, 283, 284,  
 307, 310, 343, 344, 347, 364  
 Stein, O. L., 80, 84  
 Sterling, C., 120, 123  
 Steward, F. C., 350, 351, 354, 369  
 Stewart, H. E., 237, 252  
 Stewart, K. D., 73, 83  
 Stewart, R. N., 68, 77, 80, 84, 85, 108,  
 123, 185, 201  
 Strasburger, E., 314, 317  
 Sussex, I. M., 36, 38, 39, 40, 44, 45, 48, 50,  
 59, 61, 93, 94, 95, 96, 99, 101, 103,  
 123, 124, 125, 132, 134, 141, 146, 152,  
 154, 155, 156, 163, 166, 167, 175, 189,  
 193, 194, 195, 200  
 Sweeney, P. R., 94, 98  
 Swingle, C. F., 363, 369
- Taylor, R. L., 360, 361, 369  
 Tenbarge, K. M., 40, 41, 44  
 Tepfer, S. S., 196, 201  
 Thair, B. W., 343, 344, 347  
 Thimann, K. V., 213, 222, 227  
 Thornely, J. H. M., 121, 123  
 Tilney-Bassett, R. A. E., 5, 77, 85

- Titman, P. W., 213, 227  
 Tomlinson, P. B., 4, 139, 146, 214, 215, 220, 221, 223, 224, 227, 230, 253  
 Torrey, J. G., 5, 36, 38, 44, 236, 238, 241, 242, 244, 253, 254, 261, 284, 289, 291, 310, 366, 368  
 Tran Thanh Van, K. M., 190, 192, 201, 365, 369  
 Tsui, C., 365, 368  
 Tucker, S. C., 183, 201  
  
 Vanden Born, W. H., 73, 85  
 Van Overbeek, J., 34, 45  
 Vasil, I. K., 5  
 Vasil, V., 350, 351, 352, 369  
 Vermeer, J., 236, 253  
 Vesecky, T. B., 143, 146, 340, 347  
 Vieth, J., 196, 201  
 Viotti, A., 257, 284  
  
 Walbot, V., 36, 45  
 Walden, D. B., 184  
 Walker, R., 94, 98  
 Walthall, E. D., 38, 45  
 Wangermann, E., 303, 310  
 Ward, J. M., 4  
 Ward, M., 17, 18, 25, 30, 31, 45  
 Wardlaw, C. W., 5, 7, 14, 25, 68, 85, 87, 96, 99, 104, 114, 116, 117, 123, 128, 131, 134, 139, 142, 146, 190, 202, 277, 278, 279, 284  
  
 Wareing, P. F., 5, 216, 227  
 Warren Wilson, J., 335, 347  
 Webster, P. L., 238, 253, 264, 284  
 West, W. C., 71, 85  
 Wetherell, D. R., 354, 368  
 Wetmore, R. H., 7, 8, 9, 25, 30, 31, 32, 44, 45, 58, 72, 85, 88, 99, 120, 122, 164, 168, 175, 182, 189, 202, 205, 206, 207, 209, 213, 222, 227, 228, 275, 283, 300, 301, 303, 304, 309, 310  
 White, R. A., 57, 60, 277, 283, 301, 310  
 Whittier, D. P., 132, 134, 146  
 Williams, R. F., 5, 103, 122, 123  
 Williams, W. T., 365, 368  
 Wilson, B. F., 327, 332  
 Wilson, C., 297  
 Wu, J. H., 350, 368  
  
 Yang, H. Y., 33, 45  
 Yeoman, M. M., 5  
 Yeung, E. C., 38, 39, 45  
 Young, B. S., 280, 284  
 Young, D. A., 121, 123  
  
 Zagórska-Marek, B., 342, 343, 347  
 Ziebur, N. K., 35, 45  
 Zimmerman, M. H., 222, 228  
 Zirkle, C., 336, 346  
 Zhou, C., 33, 45

## Subject index

- Abscisic acid, in embryos, 40–1  
*Acer*, cambium initials, 328  
*Adiantum*:  
   leaf development, 164  
   shoot apex, 89  
*Allium*:  
   differentiation in the root, 262, 264  
   quiescent center, 235  
 Alternation of generations, 6  
 Anneau initial, 66–7, 94  
   cytological characteristics, 70–1  
   leaf initiation and, 119  
 Apical cell:  
   in the fern leaf, 104, 147  
   in the root, 234–5, 239  
   in the shoot, 57, 68, 82  
 Apical control: 226  
 Apical initials:  
   in the root, 235, 238–40  
   in the shoot, 52, 54, 59, 68–70, 79–83  
 Apical meristem (*see* Root apex and Shoot apex)  
 Apical zonation:  
   changes in flowering, 179–82, 198–9  
   cytohistological studies, 70–4, 80–1  
   and development, 75–6  
   and enzyme distribution, 72–3  
   in the shoot, 49–56, 70–6, 80–2, 94, 96–8  
 Apogamy, 132, 134  
*Aquilegia formosa*, floral development, 193  
*Arabidopsis*:  
   embryos, mutations in, 41–3  
 Archegonium, 27–8  
   and embryo development, 27  
 Architectural models, 220–4  
*Arctostaphylos uva-ursi*, shoot ontogeny, 223  
 Autoradiography:  
   of the flowering apex, 186–7  
   of the root apex, 235  
   of the shoot apex, 64–5, 67, 96  
 Auxin:  
   and fern leaf development, 162  
   and internode growth, 211–12  
   in long and short shoots, 213  
   and regeneration, 364–5  
   and shoot apex culture, 88–91  
   and somatic embryogenesis, 358–9  
   and vascular differentiation, 280–1, 302–9  
 Axillary bud, development, 136–7, 139–44  
*Azolla*, cell lineages in roots, 239, 264–6  
  
 Basal cell, 7  
 Branching:  
   lateral branching, 136, 139–44  
   in the root, 245–8  
   in the shoot, 124, 135–44  
   terminal branching, 135–9  
*Brassica campestris*, shoot apex, 51  
*Brassica napus*, storage proteins in embryos, 40–1  
*Bryophyllum calycium*, regeneration, 361  
 Buds:  
   development, 139–41  
   experimental studies on development, 141–3  
   relationship to leaves, 128, 139–44  
   on roots, 363  
 Bud scales, development of, 168–9  
  
 Cambial domains, 325  
 Cambium (*see* Vascular cambium)  
*Capsella*, embryo, 10, 20–1, 35–6  
 Casparian bands, 297–8  
 Cell culture, 349–58  
   and vascular differentiation, 305  
 Cell cycle, 65  
   in the flowering apex, 186  
   in the root apex, 238  
 Cell division:  
   in angiosperm leaves, 150–3  
   in cambium culture, 335–6  
   in the fern leaf, 149, 160  
   in the floral apex, 179, 186–7  
   and leaf initiation, 101, 104, 106–7  
   pressure and the orientation of, 336–40

- in the root apex, 235–40
- in root differentiation, 261–6
- in root growth, 232
- in the shoot apex, 62–70, 81
- and shoot expansion, 203, 205–7, 212
- in thorn development, 178
- in the vascular cambium, 316–22, 328–9
- in vascular differentiation, 270–2
- Cell enlargement:
  - in angiosperm leaves, 152–4
  - in determinate roots, 239
  - and differentiation of xylem elements, 286
  - in the fern leaf, 149, 160–1
  - in root growth, 232
  - in shoot expansion, 203, 205–7, 212
- Central mother cells, 52–4
- Central zone, 54–6, 63–6, 71–4, 80–1, 199
- Chenopodium album*, flowering, 182, 188–9
- Chimeras:
  - and leaf initiation, 108
  - mericlinal, 77–8
  - periclinal, 77–9
  - polyploid, 77
  - in the root apex, 239–40
  - sectorial, 77–8
  - in the shoot apex, 76–82
- Chrysanthemum*:
  - effect of AMO-1618 on *C. morifolium*, 212
  - flowering, 189
- Clonal analysis:
  - in the embryo, 13, 225
  - in the floral axis, 185–6
  - in the leaf, 152, 154–7
  - in the root, 239–40
  - in the shoot apex, 76–82
- Coconut milk:
  - and cellular totipotency, 358–9
  - and embryo culture, 34–5
- Colchicine:
  - and the induction of chimeras, 77
  - and microfibril orientation, 289
- Coleus*:
  - shoot expansion, 211
  - vascular differentiation, 300–3, 305–7
- Cork cambium, 1, 311
  - and the pericycle, 297
- Corpus, 49–51
  - initials, 51
- Cucumis sativus*, flower development, 196–7
- Culture:
  - of cell suspensions, 350–6
  - of embryos, 34–6, 38–9
  - of leaf primordia, 124–32
  - of protoplasts, 356–8
  - of roots, 237, 241
  - of the shoot apex, 88–91
  - of single cells, 349–50
  - and studies of flowering, 189–98
  - and studies of leaf development, 160–7, 172
  - and studies of vascular differentiation, 303–5
  - of thin tissue slices, 190–2, 365–6
  - of vascular cambium, 335–6
- Cytohological zonation (*see* Apical zonation)
- Cytokinins, and cell culture, 359
  - and vascular differentiation, 305
- Datura*:
  - chimeras, 77
  - embryo culture, 34–5
  - floral development, 179–81
- Daucus carota*, cell culture, 350–5
- Dermal system, 7
- Detached meristems, 139–41
- Determination, 128
  - and cambium initiation, 334
  - of the floral meristem, 185, 188–95
  - of leaves, 124–35, 144–5, 173–4
- Determinate growth:
  - of flowers and inflorescences, 181–3, 199–200
  - of leaves, 102, 106, 149, 154
  - of roots, 237, 239
  - of thorns, 176–8
- Development, definition of, 1–3
- Differentiation, 3–4, 7–20, 59–60, 255–83, 285–309, 348–58
  - cell culture and vascular differentiation, 305
  - cellular changes, 285–90
  - and controlling elements, 257–9
  - definition of, 3–4
  - differential gene expression in, 257–9
  - and DNA amplification, 256
  - in the embryo, 7–20
  - experimental studies, 277–82, 301–9
  - methods of study, 259–60
  - potentialities of differentiated cells, 348–58
  - and the promeristem, 59–60
  - and quantitative chromosomal changes, 255–7
  - in roots, 260–6, 290–8
  - in shoots, 66–82, 298–301
  - of xylem, 285–301
- DNA:
  - and differentiation, 256–7, 305
  - in endosperm, 29

- DNA (*cont.*)  
 in the flowering apex, 186  
 in the root apex, 235, 239  
 in the shoot apex, 64–5, 67, 71
- Dorsiventrality, in the leaf, 100, 103, 106, 134–6
- Double fertilization, 29
- Dryopteris*:  
 bud formation, 142  
 leaf determination, 128  
 leaf initiation, 104  
 phyllotaxy, 111, 114, 116–18  
 shoot apex, 87  
 vascular development, 277–8
- Embryo, 6–25, 26–44  
 in angiosperms, 7–13  
 cellular changes, 20–4  
 completion of development, 39–41  
 culture, 32, 34–6  
 definition, 6  
 environment, 26–36  
 in gymnosperms, 14–17  
 in lower vascular plants, 17–20  
 nutrition, 34–6  
 osmolarity and development, 35–6  
 and physical restraint, 30–4  
 role of suspensor, 36–9  
 somatic, 33, 353–60
- Embryo factor, 35
- Embryo proper, 7, 22–4
- Embryogenesis, (*see* Embryo)
- Embryo sac, 27–8  
 isolation of, 33
- Embryo-specific proteins, 40–1, 356
- Endodermis, 297
- Endosperm, 29–30, 39
- Equisetum*:  
 shoot apex, 57–8  
 vascular differentiation, 301
- Euphorbia esula*:  
 root apex, 233, 237  
 root system, 230
- Female gametophyte:  
 of angiosperms, 27–9  
 of gymnosperms, 27–8
- Fertilization, 27–9
- Filiform apparatus, 29
- Floral development, 66, 76, 179–200  
 cytochemical studies, 187  
 determination, 185, 188–94  
 dimorphism, 183–5  
 experimental studies, 188–98  
 floral apex, 179  
 flowering stimulus, 188–9  
 and hormones, 189, 196–8
- lateral appendages, 181
- organ determination, 197–8
- organ initiation, 179–81, 192–5
- organ interaction, 196–7
- photoperiodic studies, 186, 188–91  
 reversion, 190–1  
 ultrastructural changes in, 187–8
- Flowering:  
 and determinate growth of the shoot, 179–83, 217, 225  
 and shoot elongation, 208, 211–12
- Foliar buttress, 102
- Foliar helices, 119–20
- Field theory of phyllotaxy, 117–18, 120–2, 144
- Foot, in embryo, 17–19
- Fundamental system, 7
- Fusiform initials, 315  
 anticlinal divisions, 320–3  
 in conifers, 315–22  
 in dicotyledons, 322–3  
 ontogenetic changes in, 319–23  
 pseudotransverse divisions in, 320
- Generative spiral, 109
- Geum chiloense*, vascular differentiation, 272–73, 280–81
- Gibberellin:  
 in embryos, 38  
 and shoot expansion, 211–12  
 and vascular differentiation, 305
- Ginkgo*:  
 embryo, 14–15  
 growth form, 222  
 root apex, 241–2  
 shoot apex, 52–3, 55  
 shoot expansion, 208, 210, 213  
 vascular differentiation, 300
- Gossypium* embryo, 20, 22
- Grafting:  
 and the cambium, 343–5  
 of leaf primordia, 94  
 of shoot apices, 94
- Grain of wood, 325
- Growth:  
 definition of, 3–4  
 of internodes, 203–214  
 of the leaf, 147–60  
 of the root, 231–2, 260–6  
 of the shoot, 203–28
- Helianthus annuus*:  
 inflorescence development, 181–2  
 initiation of cambium, 313  
 leaf culture, 126  
 shoot apex, 55–6, 63–4, 72–4, 96  
 shoot expansion, 205–9



- vascular system, 266  
 xylem differentiation, 286  
 Heteroblastic development of fern leaves, 163–7  
 Heterophylly, 163–72, 210  
*Hordeum*, embryo culture, 35
- Impatiens*:  
 floral meristem in *I. balsamina*, 190–1  
 shoot apex, 95  
 Incipient vascular tissue, 275–7  
 Inflorescence development, 181–2  
 Intercalary meristem, 207  
 Internode (*see* Shoot expansion)
- Kalanchoe daigremontiana*, regeneration, 362
- Lateral meristems, 311  
 Lateral roots, 245–50  
 initiation, 245–8  
 and microorganisms, 248–50  
 and the pericycle, 245–7  
 spacing, 245–8  
 Leaf, 100–35, 147–74  
 apical growth, 102, 104–6, 147, 149, 156  
 autonomy of primordium, 125–34  
 bilateral symmetry (*see* Leaf, dorsiventrality)  
 clonal analysis of development, 108, 152, 154–7  
 coiling-uncoiling in ferns, 148–9  
 culture studies, 124–32, 160–7, 172  
 determination, 124–35, 144–5, 167–74  
 development in monocots, 104, 157–60  
 dorsiventrality, 100, 103, 106, 134–6  
 heteroblastic development in ferns, 163–7  
 heterophylly, 163–72, 210  
 initiation, 101–8, 119–20  
 and internodal elongation, 208–14  
 marginal growth, 104, 150–1  
 petiole development in angiosperms, 154  
 plate meristem, 153  
 position, 109–21  
 regeneration phenomena, 361–2  
 relation to bud development, 139–44  
 Leaf gap, 268, 278–9  
 Leaf trace, 266
- Linum*:  
 DNA amplification in, 256–7  
 regeneration in, 363  
 vascular differentiation, 269–71, 298–300  
 vascular system, 266–7  
 Long root, 229, 237
- Long shoot, 207–8, 213–14  
*Lupinus*:  
 phyllotaxy, 114–16, 118  
 shoot apex, 70, 88, 91–5  
 vascular development, 279–80
- Lycopodium*:  
 embryo, 19  
 shoot apex, 57  
 vascular differentiation, 275, 301  
 vascular system, 267–8
- Malaxis paludosa*, foliar embryos, 360–1  
 Marginal growth, 150–1  
*Marsilea*, leaf development, 164–5  
 Méristème d'attente, 66–7, 70–1, 81, 94, 119  
 cytological characteristics, 70–1  
 and flowering, 182  
 Méristème médullaire, 66  
 Meristem layers, in the root, 233–4  
*Michelia fuscata*, floral development, 183  
 Microorganisms associated with roots, 248–50
- Mitosis (*see* Cell division)  
 Mitotic index, in the shoot apex, 63
- Musa*:  
 lateral roots, 247–8  
 leaf development, 157–8  
 shoot expansion, 208
- Mutants, and developmentally arrested embryos, 41–3
- Neoformed leaves, 210  
*Nicotiana tabacum*:  
 floral apex experiments, 189, 190, 193–5, 198  
 leaf culture, 127  
 leaf development, 150–6  
 shoot apex, 48–50, 89–90  
 single cell culture, 349–50, 352
- Orthostichies, 109  
 Osmolarity and embryo development, 35–6
- Osmunda cinnamomea*:  
 branching, 138  
 bud scales, 168  
 grafting of leaf primordia, 94  
 leaf development, 104–5, 109–10, 124–32, 136, 147–50, 160–3, 166  
 shoot apex, 57–8, 96  
 sporangia, induction of, 167  
 vascular differentiation, 275–7, 301
- Papaver nudicaule*, endosperm digestion, 39  
 Parastichies, 110–11

- Pericycle, 245, 261, 295, 297  
 Peripheral zone, 52–6, 63, 71–2, 94  
*Petasites hybridus*, flowering apex, 190  
*Pharbitis nil*, floral meristem, 190  
*Phaseolus*:  
   leaf determination in, 128  
   role of suspensor in *P. coccineus*, 38–9  
 Phellogen (*see* Cork cambium)  
*Phlebodium (Polypodium) aureum*, embryo,  
   18–19, 30–2  
 Phloem differentiation:  
   acropetal maturation, 298–301  
   and auxin, 303, 305  
   cellular changes, 289–91  
   metaphloem, 294, 298  
   protophloem, 294, 298  
   in the root, 294  
   in the shoot, 298–301  
*Phlox drummondii*, embryo, 7–9  
 Phyllotaxy, 109–22, 267  
   and available space, 118  
   divergence angle, 111–15, 120–1  
   experimental studies, 114–21  
   the Fibonacci series, 111, 120  
   field theory, 117–18, 120–2  
   and foliar helices, 119–20  
   growth regulators, effect of, 118  
   and leaf trace differentiation, 120  
   and procambial differentiation, 120  
   and the shoot vascular system, 267  
 Physical factors in development, 30–3,  
   143, 336–40  
*Pinus*:  
   cambium in *P. radiata*, 327–8  
   cambium in *P. strobus*, 314–18, 327  
   embryo, 14–17  
   shoot apex, 54  
*Pisum*:  
   differentiation in the root, 261–2, 264,  
     291–4  
   grafting of buds, 94  
   leaf determination, 129–30  
   leaf initiation, 105–6  
   root apex, 234  
   root apex culture, 241  
   shoot apex, 62, 72–3  
   shoot expansion, 212  
 Pith mother cells, 275  
 Pits, 286  
 Plasmodesmata, 24, 286  
 Plastochron, 62, 73, 106  
   plastochron ratio and phyllotaxy, 112–  
   13  
 Plate meristem, 153  
 Pollen, embryo development from, 33  
 Polyembryony in gymnosperms, 14–16  
 Polyploidy and differentiation, 256  
*Populus*:  
   *P. deltoides*, cambial explants, 339–40  
   *P. trichocarpa*, cambium, 337–9  
*Portulaca grandiflora*, floral development,  
   183, 193  
 Preformed leaves, 210  
 Primary body, 1  
 Primary pit fields, 286  
*Primula bulleyana*, floral experiments, 192  
 Procambium (*see* Vascular differentiation)  
 Promeristem, 59–60, 238  
 Proteins, embryo-specific, 40–1  
 Protoderm, 7  
 Provascular tissue, 272–82  
 Psilopsida, embryos, 20  
*Pteridium aquilinum*:  
   apogamy, 132  
   branching, 139  
   root apex, 234  
 Quiescent center, in the root apex, 235–  
   45, 250–51  
*Ranunculus sceleratus*, embryoids, 358–9  
*Raphanus sativus*, root apex, 233  
 Ray initials, 315, 318, 323–5, 327  
 Rays, ontogenetic changes in, 323–5  
 Regeneration: 91–7, 241–5, 360–7  
   and growth regulators, 364–6  
   of the root apex, 241–5  
   of the shoot apex, 91–7  
   of stem segments in culture, 365  
   and wounding, 362–3  
 Reiteration, 223  
 Residual meristem, 273–4, 277  
 Reversion of floral meristem, 190–1  
 Rib meristem, 52–6  
 RNA:  
   in the flowering apex, 186–7  
   in the root apex, 235  
   in the shoot apex, 71–2, 75  
   synthesis in the embryo, 40–1, 43  
*Robinia pseudoacacia*, cambium, 318–19  
 Root (*see also* Root apex)  
   associations with microorganisms, 248–  
     50  
   branching, 245–8  
   buds, 363  
   cap, 231  
   differentiation, 260–6, 290–8  
   formation, in suspension cultures, 350–  
     2  
   haustorium, 230–1  
   horizontal, 229–30  
   long roots, 229, 237  
   and regeneration, 363–4  
   short roots, 229, 237

- vascular system, 261  
 thorns, 230–1
- Root apex, 8–9, 12, 17–20, 229–45, 250–2  
 apical cell, 235, 239  
 apical initials, 234–5, 238–40, 250–1  
 autonomy, 241, 251  
 autoradiography, 235, 237  
 comparison with shoot apex, 231–2, 238, 250–2  
 cytochemical studies, 235–6  
 experimental studies, 240–5  
 meristem layers, 233–4  
 mitotic activity, 235–9  
 origin in the embryo, 8–9, 12, 17–20, 229  
 quiescent center, 235–45, 250–1  
 regeneration, 241–5  
 structure, 232–5  
 surgical experiments, 241–5
- Rosette plants, 208, 211–12
- Saintpaulia ionantha*, regeneration, 362
- Secondary body, 1, 311–31, 333–46
- Secondary wall, of tracheary elements, 286–7
- Selaginella*:  
 branching in *S. willdenovii*, 138  
 embryo, 19–20
- Sequential gene expression in embryos, 40–1
- Sequoia*, zygote, 14
- Shell zone, 140–1
- Shoot (*see also* Shoot apex):  
 architectural models, 220–4  
 branching, 124, 135–44, 217–18  
 differentiation, 266–82, 298–301  
 expansion, (*see* Shoot expansion)  
 formation in suspension cultures, 350–2  
 growth, 203–6  
 growth, control of, 208–14  
 growth, periodicity of, 214–17  
 ontogeny, 218–24  
 ontogeny of trees, shrubs and herbs, 224–25  
 vascular system (*see also* Vascular differentiation), 266–68
- Shoot apex (*see also* Apical zonation), 7, 46–60, 62–83, 86–98, 128–34, 139–44, 179–88, 250–2, 268–77  
 autonomy, 86–91  
 and branching, 136, 139–44  
 cell divisions in living apices, 69–70  
 chimeras, 77–80  
 clonal analysis, 76–82  
 comparison with root apex, 231–32, 238, 250–2  
 cytohistological studies, 70–4, 80–1  
 cytological characteristics and mitotic activity, 70–2, 80–1  
 developmental changes in zonation, 75–6  
 enzyme distribution, 72–3  
 experimental investigations, 86–98  
 and flowering, 76, 179–88  
 integration, 91–7  
 and leaf determination, 128–34  
 mitotic frequency in, 62–70, 80–1  
 morphology, 47–8  
 regeneration, 91–7  
 structural patterns, 47–59  
 ultrastructure, 73–4  
 and vascular differentiation, 268–77
- Shoot expansion, 203–17  
 cell division in, 203, 205–7, 212  
 cell enlargement in, 203, 205–7, 212  
 in dwarf mutants, 212  
 experimental investigations of, 208–14  
 hormonal control of, 211–14  
 leaf influence on, 208–11  
 in long shoots, 207–8, 213–14  
 in rosette plants, 208, 211–12  
 in short shoots, 208
- Short root, 229, 237
- Short shoot, 208
- Sieve elements, 289–91, 303
- Sieve plates, 290–91
- Sinapis alba*:  
 differentiation in the root, 295  
 flowering, 186
- Solanum tuberosum*:  
 leaf initiation and early development, 101–3, 132–4  
 phyllotaxy, 111  
 shoot apex, 93, 95
- Sporophyll induction in fern leaves, 167
- Stem cells, 82
- Storied cambium, 318–19
- Subapical initials, 54
- Suspension culture, 305, 350–6
- Suspensor, 7, 16, 19, 22–3, 36–9  
 differences from embryo proper, 22–3  
 and embryo nutrition, 36–9  
 haustoria, 36–8
- Symplastic growth, 207
- Syringa vulgaris*:  
 shoot expansion, 205, 207  
 vascular differentiation in callus, 303–4
- Terminal cell, 7
- Terminalia catappa*, shoot ontogeny, 218–22
- Thorns, 176–8  
 in roots, 230–1

- Thuja occidentalis*:  
 vascular cambium, 321–2, 328–9
- Todea*:  
 embryo, 17, 19, 32  
 sporophyll induction, 167
- Totipotency:  
 of differentiated cells, 348–60, 367  
 and regeneration, 360–4
- Tunica, 49–51  
 initials, 51
- Vascular cambium, 1, 311–31, 333–46  
 cell division, 316–22, 328–9  
 in conifers, 314–18  
 culture, 335–6, 339–40  
 cytology, 315  
 in dicotyledons, 318–19  
 experimental studies, 333–45  
 fascicular cambium, 317  
 fusiform initials, 315–23  
 increase in girth, 319–23  
 influence of pressure, 336–40  
 initial cells, 326–30  
 initiation in the root, 312–13  
 initiation in the stem, 312–13  
 interfascicular cambium, 312–13, 333–5  
 in monocotyledons, 312, 318  
 organization, 313–18  
 orientation of cambial initials, 340–45  
 and the pericycle, 297  
 of *Pinus strobus*, 314–18, 327, 338–9  
 and the primary meristems, 311, 329–30  
 ray initials, 315, 323, 327  
 terminology, 327, 329
- Vascular differentiation:  
 and auxin, 280–1, 302–9  
 and cell culture, 305  
 cellular changes in, 285–91  
 in culture, 303–5  
 in the embryo, 7–8  
 experimental studies, 277–82, 301–7  
 incipient vascular tissue, 275  
 influence of leaves, 268–82, 301–3, 306–7
- phloem, 289–90, 294, 296, 298–301  
 procambium, 7–8, 261, 270–7, 285–6, 291–5, 298, 307, 311  
 provascular tissue, 272–82  
 residual meristem, 273–4, 277  
 in roots, 261–2, 290–8  
 xylem, 285–309
- Vascular system (see also Vascular differentiation):  
 in the root, 261  
 in the shoot, 266–8
- Vegetative reproduction, 360–4
- Vicia faba*:  
 clonal analysis in root apices, 240  
 shoot apex, 91–2, 95
- Vivipary, 40–2
- Wound-vessel elements, 301–3
- Xanthium*:  
 flowering, 182  
 and leaf development, 150
- Xylem, differentiation:  
 acropetal and basipetal maturation, 299–301  
 cellular changes in, 285–9  
 control of, 301–9  
 cytological studies, 286–7  
 influence of auxin, 302–9  
 lignin deposition, 286  
 metaxylem, 294–5, 299–300  
 protoxylem, 294–5, 299–300  
 in the root, 290–6  
 secondary wall, 286–7  
 ultrastructure, 287–9
- Zea mays*:  
 clonal analysis in embryo, 13, 225  
 controlling elements in differentiation, 257–9  
 embryo development, 11–13  
 embryo mutants in, 41–2  
 root apex, 232–8, 241–4
- Zinnia*, isolated cell cultures and vascular differentiation, 305–6
- Zygote, culture, 32