

REFERENCES

- Alfermann, A. W., Spieler, E. and Reinhard, E. 1985. Primary and secondary metabolism of plant cell cultures. Berlin Heidelberg : Springer.
- Anderson, L. A., et al. 1982. Alkaloid production by leaf organ, root organ and cell suspension cultures of *Cinchona ledgeriana*. Planta Medica 46: 25-27.
- Anderson, L. A., et al. 1983. Production of cytotoxic canthin-6-one alkaloids by *Ailanthus altissima* plant cell cultures. Journal of Natural Products 46 : 374-378.
- Arens, H., Borbe, H. O., Ulbrich, B. and Stockigt, J. 1982. Detection of pericine, a new CNS-active indole alkaloid from *Picralima nitida* cell suspension culture by opiate receptor binding studies. Planta Medica 46 : 210-214.
- Arens, H., et al. 1985. Antiinflammatory compounds from *Plagiorhegma dubium* cell culture. Planta Medica 50 :52-56.
- Arens, H., et al. 1986. Novel antiinflammatory flavonoides from *Podophyllum versipelle* cell cultures. Planta Medica : 468-473.
- Bailey, L. H. 1963. The standard cyclopedia of horticulture. Vol. 2. New York : The Macmillan Company.
- Balandrin, M. F. and Klocke, J. A. 1988. Biotechnology in agriculture and forestry 4 : Medicinal and aromatic plants I. Berlin : Springer-Verlag.
- Bantherp, D. V. 1994. Secondary metabolism in plant tissue culture: Scope and limitations. Natural Product Reports 11 : 303-328.
- Bantherp, D. V. and Brown, G. D. 1989. Two unexpected coumarin derivatives from tissue cultures of *Compositae* species. Phytochemistry 28 : 3003.
- Barthe, G. A., et al. 1987. Naringin and limonin production in callus cultures and regenerated shoots from *Citrus* sp. Journal of Plant Physiology 127 : 55-65.
- Bauch, H. J. and Leistner, E. 1978. Aromatic compounds in cell suspension of *Galium mollugo*. Planta Medica 33 : 115-123.

- Becker, H., et al. 1984. The structure of new valepotriates from tissue cultures of *Valerianace wallichii*. Planta Medica 50 : 245-248.
- Benjamin, B. D., et al. 1987. Multiple shoot cultures of *Atropa belladonna*: Effect of physicochemical factors on growth and alkaloid formation. Journal of Plant Physiology 129 : 129-135.
- Berlin, J. and Sasse, F. 1988. Cell culture and somatic cell genetics of plants vol. 5 Phytochemicals in cell cultures. Orlando : Academic Press.
- Berlin, J., et al. 1988. On the podophyllotoxins of root cultures of *Linum flavum*. Planta Medica 54 : 204-206.
- Bhatt, P. N., et al. 1983. Studies on some factors affecting solasodine contents in tissue cultures of *Solanum nigrum*. Physiologia Plantarum 57 : 159-162.
- Bohm, B. A. and Towers, G. H. N. 1962. A study of phenolic compounds in *Impatiens*. Canadian Journal of Botany 40 : 677-683.
- Bolkart, K. H. and Zenk, M. H. 1968. Tyrosine, a precursor of the quinone ring of 2, 7-dimethyl-naphthoquinone (chimaphilin). Naturwissenschaften 9 : 444.
- Bolkart, K. H. and Zenk, M. H. 1969. Homogentisate pathway in the biosynthesis of 2, 7-dimethyl-naphthoquinone (chimaphilin). Zeitschrift fur Pflanzenphysiologie, 61 : 356.
- Bolkart, K. H., Knobloch, M. and Zenk, M. H. 1968. Mevalonic acid, the precursor of the substituted benzenoid ring of chimaphilin. Naturwissenschaften 9 : 445.
- Borris, R. P., Cordell, G. A. and Farnsworth, N. R. 1980. Isofraxidin, a cytotoxic coumarin from *Micrandra elata* (euphorbiaceae). Journal of Natural Products 43 : 641-643.
- Boylen, C. W., et al. 1969. Differentiation of pigmentation of flower parts. V. Partial purification and characterization of a flavonoid-3- β -glucosidase from petal of *Impatiens balsamina*. Phytochemistry 8 : 2311-2315.
- Bradford, M. 1976. A rapid and sensitive method for the quantitation of microorganism quantities of protein utilizing the principle of protein-dye binding. Analytical Biochemistry 72 : 248-254.
- Brodelius, P. 1986. Handbook of plant cell culture. London : Macmillan.

- Burnett, A. R. and Thomson, R. H. 1968. Naturally occurring quinones. XV. Biogenesis of the anthraquinones in *Rubia tinctorium* (madder). Journal of the Chemical Society 19 : 2437-2441.
- Butcher, D. N. and Street, H. E. 1964. Excised root culture. Botanical Reviews 30 : 513-586.
- Campbell, I. M., Robin, D. J., Kelsey, M. and Bentley, R. 1971. Biosynthesis of bacterial menaquinone (vitamin K₂). Biochemistry 10 : 3069-3078.
- Chapelle, J. 1974. 2-Methoxy-1,4-naphthoquinone in *Impatiens glandulifera* and related species. Phytochemistry 13 : 662.
- Charlwood, B. V. and Moustou, C. 1988. Manipulating secondary metabolism in culture. Cambridge : Cambridge University Press.
- Charlwood, K. A., et al. 1988. Manipulating secondary metabolism in culture. Cambridge : Cambridge University Press.
- Chen, D. and Bohm, B. A. 1966. Naphthoquinone biosynthesis in higher plants. Canadian Journal of Biochemistry 44 : 1966.
- Chung, C. A. and Staba, E. J. 1987. Effect of age and growth regulators on growth and alkaloid production in *Cinchona ledgeriana* leaf-shoot organ cultures. Planta Medica 53 : 206-210.
- Clevenger, S. 1958. The flavonoids of *Impatiens balsamina* L. Archives of Biochemistry and Biophysics 76 : 131-138.
- Dansette, P. and Azerad, R. 1970. A new intermediate in naphthoquinone and menaquinone biosynthesis. Biochemical and Biophysical Research Communications 40 : 1090-1095.
- Datta, S. K. and Datta, K. 1984. Chemodifferentiation of diosgenin in *Dioscorea composita*. Phytochemistry 23 : 2684-2685.
- Dikshit, S. P. 1973. β-Sitosterol from the seeds of *Impatiens balsamina*. J. Oil Technol. Ass. India 5 : 10.

- Durand, R. and Zenk, M. H. 1971. Biosynthesis of plumbagin (5-hydroxy-2-methyl-1,4-naphthoquinone) via the acetate pathway in higher plants. Tetrahedron Letter 32 : 3009-3012.
- Eilert, U., et al. 1985. Stimulation of sanguinarine accumulation in *Papaver somniferum* cell cultures and semicontinuous sanguinarine production by re-elicitation . Planta Medica 52 : 417-418.
- Ellis, B. E. 1988. Natural products from plant tissue culture. Natural Product Reports 5 : 581-612.
- Emmons, G. T., Campbell, I. M. and Bentley, R. 1985. Vitamin K (menaquinone) biosynthesis in bacteria : Purification and probable structure of an intermediate prior to *o*-succinylbenzoate. Biochemistry and Biophysical Research Communications 131 : 956-960.
- Endo, T. and Yamada, Y. 1985. Alkaloid production in cultured roots of three species of *Duboisia*. Phytochemistry 24 : 1233-1236.
- Endo, T., et al. 1987. Alkaloid production in root and shoot cultures of *Catharanthus roseus*. Planta Medica 53 : 479-482.
- Farnsworth, N. R. and Cordell, G. A. 1976. A review of some biologically active compounds isolated from plants as reported in 1974-1975 literature. Lloydia 39 : 420.
- Farnsworth, N. R. and Nuntavan Bunyapraphatsara. 1992. Thai medicinal plant: Recommended for primary health care system. Bangkok : Medicinal Plant Information Center.
- Flores, H. E., Hoy, M. W. and Pickard, J. J. 1987. Secondary metabolites from root cultures. Trends in Biotechnology 5 : 64-69.
- Fujita, Y. and Tabata, M. 1987. Plant cell and tissue culture. New York : Liss.
- Fujita, Y., et al. 1985. Selection of cell lines with high productivity of shikonin derivatives by protoplast culture of *Lithospermum erythrorhizon* cells. Agricultural and Biological Chemistry 49 : 1755-1759.

- Furuya, T. 1988. Production of useful compounds by plant cell cultures-de novo synthesis and biotransformation. Yagugaku Zasshi 108 : 675-695.
- Gaisser, S. and Heide, L. 1996. Inhibition and regulation of shikonin biosynthesis in suspension cultures of *Lithospermum*. Phytochemistry 41 : 1065-1072.
- Grotzinger, E. and Campbell, I. M. 1974. 4-(2'-Carboxyphenyl)-4-oxobutyrate:an obligatory intermediate in lawsone biosynthesis. Phytochemistry 13 : 923-926.
- Grotzinger, E. and Campbell, I. M. 1972. The role of 2-ketoglutarate in lawsone biosynthesis in *Impatiens balsamina*. Tetrahedron Letters 46 : 4685-4686.
- Hagimori, M., et al. 1980. Studies on the production of *Digitalis* cardenolides by plant tissue culture I. Determination of digitoxin contents in first and second passage calli and organ redifferentiating calli of several *Digitalis* species by radioimmunoassay. Plant and Cell Physiology 21 : 1391-1404.
- Hagimori, M., Matsumoto, T. and Mikami, Y. 1984. Photoautotrophic culture of undifferentiated cells and shoot forming cultures of *Digitalis purpurea*. Plant Cell Physiology 25 : 1099-1102.
- Hahlbrock, K. and Grisebach, H. 1979. Enzymic controls in the biosynthesis of lignin and flavonoids. Annu Rev Pl. Physiol. 30 : 105-130.
- Hartmann, T., et al. 1986. Reinvestigation of the alkaloid composition of *Atropa belladonna* plants, root cultures, and cell suspension culture cultures. Planta Medica 52 : 390-395.
- Hashimoto, T., et al. 1982. Large scale production of tobacco cells by continuous cultivation. Plant Tissue Culture, Proceedings of the 5th International Congress of Plant Tissue and Cell Culture, pp 403-404. Japanese Association for Plant Tissue Culture, Tokyo.
- Hashimoto, T., et al. 1986. Tropane alkaloid production in *Hyoscyamus* root cultures. Journal of Plant Physiology 124 : 61-75.
- Hay, C. A., et al. 1986. In vitro cultures of *Cinchona* species Part II. Time-course studies on the uptake of radio-labelled alkaloid precursors and alkaloids by *C. ledgeriana* root suspension cultures. Plant Cell Tissue and Organ Cultures 9 : 197-206.

- Heble, M. R. 1985. Primary and secondary metabolism of plant cell cultures. Heidelberg : Springer-Verlag.
- Heide, L. and Leistner, E. 1981. Enzymatic synthesis of the coenzyme A ester of o-succinylbenzoic acid, an intermediate in menaquinone (vitamin K₂) biosynthesis. FEBS Letters 128 : 201-204.
- Heide, L. and Tabata, M. 1987a. Enzyme activity in cell-free extracts of shikonin-producing *Lithospermum erythrorhizon* cell suspension cultures. Phytochemistry 26 : 1645-1650.
- Heide, L. and Tabata, M. 1987b. Geranylpyrophosphate:p-hydroxybenzoate geranyl-transferase activity in extracts of *Lithospermum erythrorhizon* cell cultures. Phytochemistry 26 : 1651-1655.
- Heide, L., Arendt, S. and Leistner, E. 1982. Enzymatic synthesis, characterization, and metabolism of the coenzyme A ester of o-succinylbenzoic acid, an intermediate in menaquinone (vitamin K₂) biosynthesis. Journal of Biological Chemistry 257 : 7396-7400.
- Heide, L., Floss, H. G. and Tabata, M. 1989. Incorporation of shikimic acid into p-hydroxybenzoic acid in *Lithospermum erythrorhizon* cell cultures. Phytochemistry 28 : 2643-2645.
- Heide, L., Nishioka, N., Fukui, H. and Tabata, M. 1989. Enzymatic reaction of shikonin biosynthesis in *Lithospermum erythrorhizon* cell cultures. Phytochemistry 28 : 1873-1877.
- Heinstein, P. F. 1985. Future approaches to the formation of secondary natural products in plant cell suspension cultures. Journal of Natural Products 48 : 1-9.
- Henry, M. and Chantalat-Dublanche, I. 1985. Isolation of spinasterol and its glucoside from cell suspension cultures of *Saponaria officinalis* : ¹³C-NMR spectral data and batch culture production. Planta Medica 51 : 322-325.
- Herbert, R. B. 1989. The biosynthesis of secondary metabolites. London : Chapman and Hall.

- Hiraoka, N. and Tabata, M. 1974. Alkaloid production by plants regenerated from cultured cells of *Datura innoxia*. Phytochemistry 13 : 1671-1675.
- Hirata, K., et al. 1987. Production of indole alkaloids in multiple shoot culture of *Catharanthus roseus* (L.) G. Don. Agricultural and Biological Chemistry 51 : 1311-1317.
- Inouye, H., Ueda, S., Inoue, K. and Matsumara, H. 1979. Biosynthesis of shikonin in callus cultures of *Lithospermum erythrorhizon*. Phytochemistry 18 : 1301-1308.
- Ishimaru, K., et al. 1992. Growth and lobeline production of *Lobelia inflata* hairy roots. Shoyakugaku Zasshi 46 : 265-267.
- Jung, G. and Tepfer, D. 1987. Use of genetic transformation by the Ri T-DNA of *Agrobacterium rhizogenes* to stimulate biomass and tropane alkaloid production in *Atropa belladonna* and *Calystegia sepium* root grown *in vitro*. Plant Science 50 : 145-151.
- Kamada, H., et al. 1986. Alkaloid production by hairy root cultures in *Atropa belladonna*. Plant Cell Reports 5 : 239-242.
- Kamo, K. K., et al. 1982. Morphinan alkaloids in cultured tissue and redifferentiated organs of *Papaver somniferum*. Phytochemistry 21 : 219-222.
- Kaneda, N., et al. 1987. Steroidal constituents of *Yucca schidigera* plants and tissue cultures. Phytochemistry 26 : 1425-1429.
- Kang, S. C. and Moon, Y. H. 1992. Isolation and antimicrobial activity of a naphthoquinone, from *Impatiens balsamina*. Saengyak Hakhoechi 23 : 240-247.
- Kelkar, D. V. et al. 1986. 3-Substituted lawsone and their calcium and zinc chelates as antimicrobials. Indian Journal of Pharmaceutical Sciences Nov.-Dec. : 198-200.
- Kitacka, M., et al. 1989. Accumulation of geranylgeraniol in cell suspension culture of *Croton sublyratus* Kurz (Euphorbiaceae). Annu. Rep. Sankyo Res. Lab. 41 : 169-173.
- Kolkmann, R. and Leistner, E. 1987a. 4-(2'-Carboxyphenyl)-4-oxobutyryl coenzyme A ester, an intermediate in vitamin K₂ (menaquinone) biosynthesis. Z. Naturforsch., C; Biosci. 42 : 1207-1214.

- Kolkmann, R. and Leistner, E. 1987b. Synthesis, analysis and characterization of coenzyme-A esters *o*-Succinylbenzoic acid, an intermediate in vitamin K₂ (menaquinone) biosynthesis. Z. Naturforsch., C; Biosci. 42 : 542-552.
- Kolkmann, R., Knauel, G., Arendt, S. and Leistner, E. 1982. Site of activation of *o*-Succinylbenzoic acid during conversion to menaquinones (vitamin K₂). FEBS Letters 137 : 53-56.
- Kulkarni, B. A., et al. 1983. 3-Chlorohydroxy-1,4-naphthoquinones and their chelates as antimicrobials. Indian Journal of Pharmaceutical Sciences Jan.-Feb. : 21-23.
- Leduc, C., Petra, R. and Leistner, E. 1991. Isochorismate hydroxymutase from Rubiaceae cell suspension cultures. Plant Cell Reports 10 : 334-337.
- Lily, M. P. and Metzger, J. 1980. Medicinal plants of east and southeast asia : Attributed properties and used. London : The MIT Press.
- Lindsey, K. and Yeoman M. M. 1983. The relationship between rate, differentiation and alkaloid accumulation in cell cultures. Journal of Experimental Botany 34 : 1055-1065.
- Little J. E., et al. 1948. The isolation and antifungal action of naturally occurring 2-methoxy-1,4-naphthoquinone. Journal of Biological Chemistry 174 : 335-342.
- Luckner, M. 1990. Secondary metabolism in microorganisms plants and animals. 3 rd ed. German Democratic Republic : Interdrunk Graphischer Großbetrieb Leipzig.
- Lui, J. H. C. and Staba, E. J. 1979. Effects of precursors on serially propagated *Digitalis lanata* leaf and root cultures. Phytochemistry 18 : 1913-1916.
- Manitto, P. and Sammes, P. G. 1981. Biosynthesis of natural products. New York : Halsted Press.
- Mansell, L. R. and Seder, A. J. 1971. O-methyltransferase activity from young flowers of *Impatiens balsamina*. Phytochemistry 10 : 2043.
- Mansell, L. R., et al. 1970. Differentiation of pigmentation of flower parts. VI. Qualitative and quantitative comparisons of hydroxycinnamic acid derivatives in petals of the red, white and purple genotypes of *Impatiens balsamina*. Phytochemistry 9 : 1751-1755.

- Margarethe, P., Schaaf, M., Heide, L. and Leistner, E. 1993. Properties of isochorismate hydroxymutase from *Flavobacterium K₃₋₁₅*. Journal of Natural Products 56 : 1294-1303.
- Marley, M. G., Meganathan, R. and Bentley, R. 1986. Menaquinone (vitamin K₂) biosynthesis in *Escherichia coli* : Synthesis of o-succinylbenzoate does require the decarboxylase activity of the ketoglutarate dehydrogenase complex. Biochemistry 25 : 1304-1307.
- Meganathan, R. 1981. Enzymes from *Escherichia coli* synthesize o-succinylbenzoic acid, an intermediate in menaquinone (vitamin K₂) biosynthesis. Journal of Biological Chemistry 256 : 9386-9388.
- Meganathan, R. and Bentley, R. 1979. Menaquinone (vitamin K₂) biosynthesis : Conversion of o-succinylbenzoic acid to 1,4-dihydro-2-naphthoic acid by *Mycobacterium phlei* enzymes. Journal of Bacteriology Oct. : 92-98.
- Meganathan, R. and Bentley, R. 1983. Thiamine pyrophosphate requirement for o-succinylbenzoic acid synthesis in *Escherichia coli* and evidence for an intermediate. Journal of Bacteriology Feb. : 739-746.
- Miura, Y., et al. 1987. Isolation of vinblastine in callus culture with differentiated roots of *Catharanthus roseus* (L.) G. Don. Agricultural and Biological Chemistry 51 : 611-614.
- Miura, Y., et al. 1988. Formation of vinblastine in multiple shoot culture of *Catharanthus roseus*. Planta Medica 54 : 18-20.
- Mukherjee, B. and Roy, S. 1956. Plant sterols from seeds of *Impatiens balsamina*. Sci. Cult. 21 : 616.
- Neumann, K. H., Barz, W. and Reinhard, E. 1985. Primary and secondary metabolism of plant cell cultures. New York : Springer.
- Ohlsson, A. B., et al. 1983. Effect of light on cardenolide production by *Digitalis lanata* tissue cultures. Phytochemistry 22 : 2447-2450.

- Okamoto, T., Yazaki, K. and Tabata, M. 1995. Biosynthesis of shikonin derivatives from L-phenylalanine via deoxyshikonin in *Lithospermum erythrorhizon* cell cultures and cell free extracts. Phytochemistry 38 : 83-88.
- Overton, K. H. 1977. Plant tissue culture and its bio-technological application. Berlin : Springer.
- Patra, A. and Chaudhuri, S. K. 1988. Chemical constituents of *Impatiens balsamina* Linn. Journal of Indian Chemical Society LXV : 367-368.
- Pharkphoom Panichayupakaranant and Wanchai De-Eknamkul. 1992. Study on naphthoquinone formation in *in vitro* cultures of *Impatiens balsamina* L. The Thai Journal of Pharmaceutical Sciences 16 : 29-37.
- Popp, J. L., Berliner, C. and Bentley, R. 1989. Vitamin K (menaquinone) biosynthesis in bacteria : High performance liquid chromatographic assay of the overall synthesis of o-succinylbenzoic acid and 2-succinyl-6-hydroxy-2,4-cyclohexadiene-1-carboxylic acid synthase. Analytical Biochemistry 178 : 306-310.
- Quisumbing, E. 1951. Medicinal plants of the Philippines. Manila : Bureau of Printing.
- Reichling, J., et al. 1988. Production and accumulation of phenylpropanoids in tissue and organ cultures of *Pimpinella anisum*. Zeitschrift fur Naturforschung 43c : 42-46.
- Reinhard, E. and Alfermann, A. W. 1980. Biotransformation by plant cell cultures. Adv. Biochem Eng. 16 : 49-83.
- Rhodes, M. J. C. 1985. Immobilized plant cell cultures. Topics in Enzyme and Fermentation Biotechnology 10 : 51-57.
- Roja, P. C., et al., 1987. Multiple shoot cultures of *Rauwolfia serpentina*: Growth and alkaloid production. Journal of Natural Products 50 : 872-875.
- Roser, W. 1984. Ueber phtalylderivate. II. Chemische Berichte 17 : 2770-2775.
- Rucker, W., et al. 1983. Untersuchungen über wachstum, morphogenese und glykosidbildung and wurzelorgankulturen von *Digitaria purpurea* L. Biochemie and Physiologie der Pflanzen 178 : 91-100.

- Rueffer, M. and Zenk, M. H. 1986. Columbamine, the central intermediate in the late stages of protoberberine biosynthesis. Tetrahedron Letters 27 : 923.
- Santi Thungsuwan, et al. 1985. Report on *Impatiens balsamina* Research. Bangkok : Chulalongkorn University.
- Sastri, B. N. S., et al. 1959. The wealth of India: A dictionary of India raw material and industrial product. Vol. 5. New Delhi : Council of Scientific and Industrial Research.
- Sauerwein, M., et al. 1992. Further approaches in the production of secondary metabolites by plant tissue cultures. Plant Tissue Culture Letters 9 : 1-9.
- Schmid, H. V. and Zenk, M. H. 1971. ρ -Hydroxybenzoic acid and mevalonic acid as precursors of the plant naphthoquinone alkannin. Tetrahedron Letter 14: 4151-4155.
- Seidel, S. and Reinhard, E. 1987. Major cardenolide glycosides in embryogenic suspension cultures of *Digitalis lanata*. Planta Medica 53 : 308-309.
- Shoji, N, et al. 1983. Chemical structure of hosenkol-A, the first example of the natural baccharane triterpenoid of the missing intermediate to shionane and lupane. Journal of the Chemical Society. Chemical Communication : 871-873.
- Shoji, N, et al. 1994a. Hosenkosides A, B, C, D and E, novel baccharane glycosides from the seeds of *Impatiens balsamina*. Tetrahedron 50 : 4973-4986.
- Shoji, N, et al. 1994b. Hosenkosides F, G, H, I, J and K, novel baccharane glycosides from the seeds of *Impatiens balsamina*. Chemical and Pharmaceutical Bulletin 42 : 1422-1426.
- Sieweke, H. and Leistner, E. 1991. α -Succinylbenzoate:coenzyme A ligase, an enzyme involved in menaquinone (vitamin K₂) biosynthesis, displays broad specificity. Z. Naturforsch. 46c : 585-590.
- Sieweke, H. and Leistner, E. 1992. α -Succinylbenzoate:coenzyme A ligase from anthraquinone producing cell suspension cultures of *Galium mollugo*. Phytochemistry 31 : 2329-2335.

- Simantiras, M. and Leistner, E. 1989. Formation of o-succinylbenzoic acid from isochorismic acid in protein extracts from anthraquinone producing plant cell suspension cultures. Phytochemistry 28 : 1381-1382.
- Simantiras, M. and Leistner, E. 1991. Cell free synthesis of o-succinylbenzoic acid in protein extracts from anthraquinone and phylloquinone (vitamin K₁) producing plant cell suspension cultures. Occurrence of intermediates between isochorismic and o-succinylbenzoic acid. Z. Naturforsch. 46c : 364-370.
- Simantiras, M. Schmidt, K and Leistner, E. 1991. 4-(2'-Carboxyphenyl)-4-oxobutyrate: preparative isolation from anthraquinone producing cell suspension cultures of *Galium mollugo*. Phytochemistry 30 : 823-824.
- Staba, E. J., et al., 1982. Alkaloid production from *Papaver* tissue cultures. Journal of Natural Products 45 : 256-262.
- Steffen, von K. and Peschel, H. 1975. Chemical constitution and antifungal activity of 1,4-naphthoquinones, their biosynthetic intermediary products and chemical related compounds. Planta Medica 27 : 201-212.
- Stockigt, J., et al. 1983. Voafrine A and voafrine B, new dimeric indole alkaloids from cell suspension cultures of *Voacanga africana* Stapf. Helvetica Chimica Acta 66 : 2525-2533.
- Stockigt, J., et al. 1992. Plant Tissue Culture and Gene Manipulation for Breeding and Formation of Phytochemicals. Proceedings for the German-Japanese Joint Meeting on Plant Tissue Culture, pp. 277-292. Tsukuba, Tokyo.
- Sugimoto, Y. et al. 1988. Production of bisbenzylisoquinoline alkaloids in cultured roots of *Stephania cepharantha*. Phytochemistry 27 : 1379-1381.
- Teshima, D., et al. 1988. Production of emetine alkaloid by *in vitro* culture of *Cephaelis ipecacuanha* A. Richard. Plant Cell Reports 7 : 278-280.
- Thatree Phadungcharoen, et al. 1988. Antifungal compound from *Impatiens balsamina* leaves. The Thai Journal of Pharmaceutical Sciences 13 : 117-126.

- Toppel, G., et al. 1987. Alkaloid patterns and biosynthetic capacity of root cultures from some pyrrolizidine alkaloid producing *Senecio* species. Plant Cell Reports 6 : 466-469.
- Toshihiro, A., Thakur, S., Rosenstein, F. U. and Matsumoto, T. 1986. Sterols of Cucurbitaceae: The configurations at C-24 of 24-alkyl- Δ^5 -, Δ^7 -and Δ^8 -sterols. Lipid 21 : 39-47.
- Tripathi, R. D., Srivastava, H. S. and Dixit, S. N. 1978. A fungitoxic principle from leaves of *Lawsonia inermis* Lam. Experientia 34 : 51-52.
- Tsukada, M. and Tabata, M. 1984. Intracellular localization and secretion of naphthoquinone pigments in cell cultures of *Lithospermum erythrorhizon*. Planta Medica 50 : 338-341.
- Van-Uden, W. 1993. Biotechnological production of podophyllotoxin and related cytotoxic lignans by plant cell cultures. Pharmacy World & Science 15 : 41-43.
- Veliky, I. A. and Barber, K. M. 1975. Biotransformation of tryptophan by *Phaseolus vulgaris* suspension culture. Lloydia 38 : 125.
- Violon, C., et al. 1984. Relation between valepotriate content and differentiation level in various tissue from Valerianaceae. Journal of Natural Products 47 : 934-940.
- Wanchai De-Eknamkul and Ellis, B. E. 1984. Rosmarinic acid production and growth characteristics of *Anchusa officinalis* cell suspension cultures. Planta Medica 51 : 346-350.
- Weische, A. and Leistner, E. 1985. Cell free synthesis of o-succinylbenzoic acid from isochorismic acid, the key reaction in vitamin K₂ (menaquinone) biosynthesis. Tetrahedron Letter 26 : 1487-1490.
- Weische, A. Johann, M. and Leistner, E. 1987a. Biosynthesis of o-succinylbenzoic acid I : Cell free synthesis of o-succinylbenzoic acid from isochorismic acid in enzyme preparations from vitamin K producing bacteria. Archives of Biochemistry and Biophysics 256 : 212-222.

- Weische, A., Garvert, W. and Leistner, E. 1987b. Biosynthesis of o-succinylbenzoic acid II : Properties of o-succinylbenzoic acid synthase , an enzyme involved in Vitamin K₂ biosynthesis. Archives of Biochemistry and Biophysics 256 : 223-2231.
- Weissenboeck *et al.* 1971. Occurrence of flavonoids in chloroplasts of *Impatiens balsamina*. Zeitschrift fur Pflanzenphysiologie 64 : 274-277.
- Wellmann, E. 1975. Quantitative analysis of the light effect on flavonoid synthesis in plant cell and tissue cultures. Planta Medica (Supplement) : 107-111.
- Windholz, M. 1983. The Merck Index 10th ed. Rahway : Merck & Co., Inc.
- Wink, M. 1987. Cell culture and somatic cell genetics of plants Volume 4 Cell culture in phytochemistry. San Diego : Clarendon Press.
- Wink, M. 1990. Secondary products from plant tissue culture. Oxford : Clarendon Press.
- Yamaga, Y., Nakanishi, K., Fukui, H. and Tabata, M. 1993. Intracellular localization of p-hydroxybenzoate geranyltransferase, a key enzyme involved in shikonin biosynthesis. Phytochemistry 32 :633-636.
- Yamamoto, O. and Yamada, Y. 1986. Production of reserpine and its optimization in cultured *Rauwolfia serpentina* Benth cell. Plant Cell Reports 5 : 50-53.
- Yazaki, K., Fukui, H. and Tabata, M. 1986. Isolation of the intermediates and related metabolites of shikonin biosynthesis from *Lithospermum erythrorhizon* cell cultures. Chemical and Pharmaceutical Bulletin 34 : 2290.
- Yazaki, K., Fukui, H. and Tabata, M. 1986. Isolation of the intermediates and related metabolites of shikonin biosynthesis from *Lithospermum erythrorhizon* cell cultures. Chemical and Pharmaceutical Bulletin 34 : 2290-2293.
- Yazaki, K., Heide, L. and Tabata, M. 1991. Formation of p-hydroxybenzoic acid from p-coumaric acid by cell free extract of *Lithospermum erythrorhizon* cell cultures. Phytochemistry 30 : 2233-2236.
- Yeoman, M. M. 1986. Plant cell culture technology. Oxford : Blackwell.
- Yoshikawa, T. and Furuya, T. 1985. Morphinan alkaloid production by tissue differentiated from cultured cell of *Papaver somniferum*. Planta Medica : 110-113.

- Zacharius, R. M. and Osman, S. F. 1987. Glycoalkaloids in tissue culture of *Solanum* species. Dehydrocommersonine from cultured root of *Solanum chacoense*. Plant Science Letters 10 : 283-287.
- Zenk, M. H. 1980. Enzymatic synthesis of ajmalicine and related indole alkaloids. Journal of Natural Products 43 : 438-451.
- Zenk, M. H., Rueffer, M., Amann, M. and Deus-Neumann, B. 1985. Benzylisoquinoline biosynthesis by cultivated plant cell and isolated enzymes. Journal of Natural Products 48 : 725-738.
- Zenk, M.H., et al. 1975. Anthraquinone production by cell suspension cultures of *Morinda citrifolia*. Planta Medica (Supplement) : 79-101.
- Zieg, R. G., et al. 1983. Selection of high pyrethrin producing tissue cultures. Planta Medica 48 : 88-91.

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Publications

1. Pharkphoom Panichayupakaranant and Wanchai De-Eknakul. 1992. Study on naphthoquinone formation in in vitro cultures of *Impatiens balsamina* L. Thai J. Pharm. Sci., 16 : 29-37.
2. Pharkphoom Panichayupakaranant and Wanchai De-Eknakul. 1992. Enzymatic methylation of lawsone to 2-methoxy-1,4-naphthoquinone in *Impatiens balsamina* leaves. Thai J. Pharm. Sci. 16 : 287-289.
3. Pharkphoom Panichayupakaranant, Noguchi, H., Wanchai De-Eknakul and Sankawa, U. 1995. Naphthoquinones and coumarins from root cultures of *Impatiens balsamina*. Phytochemistry 40 : 1141-1143.
4. Pharkphoom Panichayupakaranant, Noguchi, H., Wanchai De-Eknakul and Ebizuka, Y. A novel Biscoumarin from *Impatiens balsamina* root cultures. Planta Medica. submitted.
5. Pharkphoom Panichayupakaranant, Noguchi, H., Wanchai De-Eknakul and Ebizuka, Y. Production of naphthoquinones and coumarins by *Impatiens balsamina* root cultures. in preparation.
6. Pharkphoom Panichayupakaranant and Wanchai De-Eknakul. Multienzyme complex of lawsone biosynthesis in *Impatiens balsamina* root cultures. in preparation.