

## References

- Aimone, L.D., and Gebhart, G.F. Stimulation produced spinal inhibition from the midbrain in the rat is mediated by an excitatory amino acid neurotransmitter in the medial medulla. J Neurosci 6(1986):1803-1813.
- \_\_\_\_\_, and Gebhart, G.F. Serotonin and/or an excitatory amino acid in the medulla mediates stimulation-produced antinociception from the lateral hypothalamus in rat. Brain Res 450(1988):170-180.
- Albe-Fessard, D., Berkley, K.J., Kruger, L., Ralston, H.J. III., and Willis, W.D. Jr. Diencephalic mechanisms of pain sensation. Brain Res Rev 9(1985):217-296.
- \_\_\_\_\_, Levante, A., and Lamour, Y. In: Bonica JJ (ed) Advances in Neurology, vol 4, Raven Press: New York, 1974 ,pp 157-216
- Aldes, L.D. Thalamic connectivity of rat somatic motor cortex. Brain Res Bull 20 (1988):333-348.
- Amodei, N. and Paxinos, G. Unilateral knife cuts produce ipsilateral suppression of responsiveness to pain in the formalin test. Brain Res 193(1980):85-94.
- Anden, N.E., Dahlstrom, A., Fuxe, K., Larsson, K., Olson, L., and Ungerstedt, U. Ascending monoamine neurons to the telencephalon and diencephalon. Acta Physiol Scand 67(1966):313-326.
- Andersen, E., and Dafny, N. Microiontophoretically applied 5-HT reduces response to noxious stimuli in the thalamus. Brain Res 241(1982):176-178.
- \_\_\_\_\_, and Dafny, N. An ascending serotonergic pain modulation pathway from the dorsal raphe nucleus to the parafascicularis nucleus of the thalamus. Brain Res 269(1983):57-67.

- Andrezik, J.A., and Beitz, A.J. In: Paxinos G (ed) The Rat Nervous System, Vol 2, Academic Press: Sydney, 1985, pp 1-28.
- Archer, T., Arwestrom, E., Minor, B.G., Persson, M.L., Post, C., Sundstrom, E., and Jonsson, G. (+)-8-OH-DPAT and 5-MeODMT induced analgesia is antagonised by monoamine depletion. Physiol Behav 39(1987):95-102.
- Arvidsson, L.E., Hacksell, U., Nilsson, J.L.G., Hjorth, A., Carlsson, P., Lindberg, D., Sanchez, D. and Wikstrom, H. 8-Hydroxy-2-(di-n-propylamino)tetralin, a new centrally acting 5-hydroxytryptamine receptor agonist. J Med Chem 24(1981):921-923.
- Banks, W.A., Kastin, A.J., Trentman, T.L., Haynes, H.S., Johnson, B.G., and Galina, Z.H. Mediation of serotonin-induced analgesia by 5-HT<sub>2</sub> receptor in the pentobarbital anesthetized mouse model. Brain Res Bull 21(1988):887-891.
- Barasi, S. Responses of substantia nigra neurones to noxious stimulation. Brain Res 171(1979):121-130.
- Barbaresi, P., Conti, F., and Manzoni, T. Axonal branching in the periaqueductal gray projection to the thalamus: a fluorescent retrograde double-labeling study in cat. Brain Res 252(1982):137-141.
- \_\_\_\_\_, Conti, F., and Manzoni, T. Periaqueductal gray projection to the ventrobasal complex in the cat: An horseradish peroxidase study. Neurosci Lett 30(1982): 205-209.
- Barber, A., Harting, J., and Wolf, H.P. Antinociceptive effects of the 5-HT<sub>2</sub> antagonist ritanserine in rats: evidence for an activation of descending monoaminergic pathway in the spinal cord. Neurosci Lett 99(1989): 234-238.
- Barnes, C.D., Fung, S.J., and Adams, W.L. Inhibitory effects of substantia nigra on impulse transmission from nociceptors. Pain 6(1979):207-215.

- Basbaum, A.I. Descending control of pain transmission: possible serotonergic-enkephalinergic interaction. Adv Exp Med Biol 133(1981):177-189.
- \_\_\_\_\_, and Fields, H.L. Endogenous pain control mechanism: brain stem pathways and endorphin circuitry. Ann Rev Neurosci (1984):309-338.
- Battaglia, G., and Rustioni, A. Coexistence of glutamate and substance P in dorsal root ganglion cells of the rat and monkey. J Comp Neurol 277 (1988): 302-312.
- Baumeister, A.A., Anticich, T.G., Hawkins, M.F., Liter, J.C., Thibodeaux, H.F., and Guillory, E.C. Evidence that the substantia nigra is a component of the endogenous pain suppression system in the rat. Brain Res 447 (1988):116-121.
- \_\_\_\_\_, Hawkins, M.F., Anderson-Moore, L.L., Anticich, T.G., Higgins, T.D., and Griffin, P. Effects of bilateral injection of GABA into the substantia nigra on spontaneous behavior and measures of analgesia. Neuropharmacology 27(1988):817-821.
- \_\_\_\_\_, Hawkins, M.F., Anticich, T.G., Moore, L.L., and Higgins, T.D. Bilateral intranigral microinjection of morphine and opioid peptides produce antinociception in rats. Brain Res 411(1987) :183-186.
- Beecher, H.K. Measurement of Subjective Responses: Quantitative effects of drugs, New York: Oxford University Press, 1959.
- Behbehani, M., and Fields, H.L. Evidence that an excitatory connection between the periaqueductal gray and nucleus raphe magnus mediates stimulation produced analgesia. Brain Res 170(1979):85-93.
- Beitz, A.J. The anatomy of ascending serotonergic pathways possibly involved in pain modulation. In: Besson, J.M. (ed) Serotonin and pain , Elsevier Science Publishers B.V., 1990, pp 31-51.
- \_\_\_\_\_. The organization of afferent projections to the midbrain periaqueductal gray of the rat. Neuroscience 7(1982):133-159.

- \_\_\_\_\_, Clements, J.R., Mullett, M.A., and Ecklund, L.J. Differential origin of brain stem serotonergic projections to the midbrain periaqueductal gray and superior colliculus of the rat. J Comp Neurol 250(1986):498-509.
- Berge, O.G., Fasmer, O.B., Jorgensen, H.A., and Hole, K. Test-dependent antinociceptive effect of spinal serotonin release induced by intrathecal p-chloroamphetamine in mice. Acta Physiol Scand 123(1985):35-41.
- Besson, J.M., and Chaouch, A. Peripheral and spinal mechanisms of nociceptive. Physiol Rev 67(1987):67-186.
- \_\_\_\_\_, and Chaouch, A. Descending serotonergic system. Pain Headache 9 (1987):64-100.
- Biegon, A., Rainbow, T.C., and McEwen, B.S. Quantitative autoradiography of serotonin receptors in the rat brain. Brain Res 242(1989):197-204.
- Blair, R.W. Noxious cardiac input onto neurons in medullary reticular formation. Brain Res 326(1985):335-346.
- Bliss, T.V.P., and Lynch, M.A. Long term potentiation of synaptic transmission in hippocampus: properties and mechanisms. In: Long term potentiation: from biophysics to behaviour. A Liss, 1988, pp. 3-72.
- Blue, M.E., Yagaloff, K.A., Mamounas, L.A., Hartig, P.R., and Molliver, M.E. Correspondence between 5-HT<sub>2</sub> receptor and serotonergic axons in rat neocortex. Brain Res 453(1988):315-328.
- Bobillier, P., Seguin, S., Petitjean, F., Salvert, D., Touret, M., and Jouvet, M. The raphe nuclei of the cat brain stem: A topographical atlas of their efferent projections as revealed by autoradiography. Brain Res 113 (1976):449-486.
- Boivie, J. An anatomical reinvestigation of termination of the spinothalamic tract in the monkey. J Comp Neurol 186(1979):343-370.

- Bourgoin, S., Oliveras, J.L., Bruxelle, J., Hamon, M., and Besson, J.M., Electrical stimulation of the nucleus raphe magnus in the rat. Effect on 5-HT metabolism in the spinal cord. Brain Res 194(1980):377-389.
- \_\_\_\_\_, Pohl, M., Hirsch, M., Mauborgne, A., Cesselin, F., and Hamon, M. Direct stimulatory effect of calcitonin on [<sup>3</sup>H]5-hydroxytryptamine release from the rat spinal cord. Eur J Pharmacol 156(1988):13-33.
- Bragin, E.O., Korneev, A.Y., and Vasilenko, G.F. Buspirone effect on the development of antinociceptive reaction. Pain 36(1989):257-261.
- Briggs, I. Excitatory responses of neurones in rat bulbar reticular formation to bulbar raphe stimulation and to iontophoretically applied 5-hydroxytryptamine and their blockade by LSD<sub>25</sub>. J Physiol 265(1977):327-340.
- Bullitt, E., and Light, A.R. Intraspinal course of descending serotonergic pathways innervating the rodent dorsal horn and lamina X. J Comp Neurol 286(1989):231-242.
- Burkill, I.H. A Dictionary of the Economic Products of the Malay Peninsula. Vol. II. Oxford: University Press, 1935.
- Burton, H. Somatic sensory properties of caudal bulbar reticular neurins in the cat (*Felis domestica*). Brain Res 11(1968):357-372.
- Carroll, M.N., and Lim, R.K.S. Observations on the neuropharmacology of morphine and morphine like analgesia. Arch Int Pharmacodyn 125(1960):383-403.
- Carstens, E., Gilly, H., Schreiber, H., and Zimmermann, M. Effects of midbrain stimulation and iontophoretic application of serotonin, noradrenaline, morphine and GABA on electrical threshold of afferent C- and A-fiber terminals in cat spinal cord. Neuroscience 21(1987):395-406.

- Casey, K.L. Somatic stimuli, spinal pathways, and size of cutaneous fibers influencing unit activity in the medial medullary reticular formation. Exp Neurol 25(1969):35-56.
- \_\_\_\_\_. In : Kosterlitz HW, Terenius LY (eds) Pain and Society Verlag Chemie: Weinheim FRG, 1980, pp 183-200.
- Chan, C.W.Y., and Dallaire, M. Subjective pain sensation is linearly correlated with the flexion reflex in man. Brain Res 479(1989):145-150.
- Chan-Palay, V. Indoleamine neurons and their process in the normal rat brain and in chronic diet-induced thiamine deficiency demonstrated by uptake of <sup>3</sup>H-serotonin. J Comp Neurol 176(1977):467-494.
- Chapman, C.R., and Feather, B.W. Effects of diazepam on human pain tolerance and pain sensitivity. Psychosom Med 35(1973):330-340.
- Clementi, G., Amico-Roxas, M., Rapisarda, E., Caruso, A., Prato, A., Trombadore, S., Priolo, G., and Scapagnini, U. The analgesic activity of calcitonin and the central serotonergic system. Eur J Pharmacol 108(1985):71-75.
- Clements, J.R., Beitz, A.J., Fletcher, T.F., and Mullett, M.A. Immunocytochemical localization of serotonin in rat periaqueductal gray: a quantitative light and electron microscopic study. J Comp Neurol 236(1985):60-70.
- Collier, H.O.J., Dinneen, L.C., Johnson, C.A., and Schneider, C. The abdominal constriction response and its suppression by analgesic drugs in the mouse. Br J Pharmac Chemother 32(1968):295-310.
- Collingridge, G. and Lester, R.A.J. Excitatory amino acid receptors in the vertebrate nervous system. Pharmacol Rev 40(1989):143-210.
- Craig, A.D. Jr. In: Besson JM, Guibaud G. and Peschanski M (eds) Thalamus and Pain Elsevier: Amsterdam, 1987, pp 227-243.
- \_\_\_\_\_, and Burton, H. Spinal and Medullary lamina I projection to nucleus submedius in medial thalamus: a possible pain center. J Neurophysiol 45(1981):443-466.

- Cropper, E.C., Eisenman, J.S., and Azmitia, E.C. An immunocytochemical study of the serotonergic innervation of the thalamus of the rat. J Comp Neurol 224(1984):38-50.
- Cudennec, A., Duverger, D., Serrano, A., Scatton, B., and MacKenzie, E.T. Influence of ascending serotonergic pathways on glucose use in the conscious rat brain. II. Effects of electrical stimulation of the rostral raphe nuclei. Brain Res 444(1988):227-246.
- \_\_\_\_\_, Duverger, D., Nishikawa, T., McRae-Dugueurce, A., MacKenzie, E.T., and Scatton, B. Influence of ascending serotonergic pathways on glucose use in the conscious rat brain. I. Effect of electrolyte or neurotoxic lesions of the dorsal and/or median raphe nucleus. Brain Res 444(1988):214-226.
- Cushny, A.R. Pharmacology and Therapeutics or the action of drugs Lea and Febiger: New York, , 1918
- D'Armour, F.E., and Smith, D.L. A method for determining loss of pain sensation. J Pharmacol 72(1941):74-79.
- Dahlstrom, A., and Fuxe, K. Evidence for the existence of monoamine neurons in the central nervous system. Acta Physiol Scand [Suppl 247] 64(1974):1-36.
- Davies, S.N. and Lodge, D. Evidence for involvement of N-methyl-D-aspartate receptors in "wind-up" of class 2 neurones in the dorsal horn of the rat. Brain Res 424(1987):402-406.
- DeFelipe, J., and Jones, E.G. A light and electron microscopy study of serotonin-immunoreactive fibers and terminals in the monkey sensory-motor cortex. Exp Brain Res 71(1988):171-182.
- Dickenson, A.H. A cure for wind-up: NMDA receptor antagonists as potential analgesics. Trends Pharmacol Sci 11(1990):307-309.

- \_\_\_\_\_, and Aydar, E. Antagonism at glycine on the NMDA receptor reduces spinal nociception in the rat Neurosci Lett 121(1991):263-266.
- \_\_\_\_\_, and Goldsmith, G. Evidence for a role of 5-hydroxytryptamine in the responses of rat raphe magnus neurones to peripheral noxious stimuli. Neuropharmacology 25(1986):863-868.
- \_\_\_\_\_, and Sullivan, A.F. Differential effects of excitatory amino-acid antagonists on dorsal horn nociceptive neurones in the rat. Brain Res 506(1990):31-39.
- \_\_\_\_\_, and Sullivan, A.F. Evidence of a role of the NMDA receptor in the frequency dependent potentiation of deep dorsal horn neurones following C-fibre stimulation. Neuropharmacology 26(1987):1235-1238.
- Dray, A. Analgesics of the future. Pain Soc 8(1991): 43-47.
- \_\_\_\_\_, Gonye, T.J., Oakley, N.R., and Tanner, T. Evidence for the existence of a raphe projection to the substantia nigra in rat. Brain Res 113(1976) :45-47.
- Dubner, R. Pain and hyperalgesia following tissue injury: new mechanisms and new treatments. Pain 44(1991): 213-214.
- Dubuisson, D., and Dennis, S.G. The formalin test: A quantitative study of the analgesic effects of morphine, meperidine and brain stem stimulation in rats and cats. Pain 4(1977):161-174.
- Eddy, N.B., and Leimbach, J.E. Synthetic analgesics. 2) Dithienylbutenyl and dithienylbutylamines. J Pharmacol Exp Ther 107(1953):385-393.
- \_\_\_\_\_, Touchberry, C.E., and Lieberman, J.E. Synthetic analgesics. 1) Methadone isomers and derivatives. J Pharmacol Exp Ther 98(1950):121-137.
- Eide, P.K., and Hole, K. Subsensitivity of serotonin and substance P receptors involved in nociception after repeated administration of serotonin receptor agonist. J Neural Transm 77(1989):1-10.

- \_\_\_\_\_, Hole, K., Berge, O.G., and Broch, O.J. 5-HT depletion with 5,7-DHT, PCPA in mice: differential effects on the sensitivity of 5-MeODMT, 8-OH-DPAT and 5-HTP as measured two nociceptive tests. Brain Res 440(1988):42-52.
- \_\_\_\_\_, and Tjolsen, A. Effects of serotonin receptor antagonists and agonists on the tail flick response in mice involve altered tail skin temperature. Neuropharmacology 27(1988):889-893.
- Emmers, R. Dual alterations of thalamic nociceptive activity by stimulation of periaqueductal gray matter. Exp Neurol 65(1979):186-201.
- Eschalier, A., Kayser, V., and Guilbaud, G. Influence of a specific 5-HT<sub>3</sub> antagonist on carrageenan-induced hyperalgesia in rats. Pain 36(1989):249-255.
- Evans, R.H. The pharmacology of segmental transmission in the spinal cord. Progr Neurobio 33(1989): 255-279.
- Fasmer, O.B., Berge, O.G., Post, C., and Hole, K. Effects of the putative 5-HT<sub>1A</sub> receptor agonist 8-OH-2-(di-n-propylamino)tetralin on nociceptive sensitivity in mice. Pharmacol Biochem Behav 25(1986):883-888.
- Faull, R.L.M., and Mehler, W.R.. In: Paxinos G (ed) The Rat Nervous System, Vol 1, Academic Press: Sydney, 1985, pp 129-168.
- Field, E. Mitragynine and mitraversine, two new alkaloids from species of mitragyna. J Chem Soc 119 (1921):887-891.
- Fields, H.L., and Besson, J.M. Pain Modulation, Prog Brain Res vol 77, Elsevier: Amsterdam, 1988.
- \_\_\_\_\_, Clanton, C.H., and Anderson, S.D. Somatosensory properties of spinoreticular neurons in the cat. Brain Res 120(1975):49-66.
- Franklin, K.B.J., Abbott, F.V., English, M.J.M. Jeans M.E., Tasker, R.A.R. and Young, S.N. Tryptophan-morphine interactions and postoperative pain. Pharmacol Biochem Behav 35(1990):157-163.

- Fujimiya, M., Kimura, H., and Maeda, T. Postnatal development of serotonin nerve fibers in somatosensory cortex of mice studied by immunohistochemistry. J Comp Neurol 246(1986):191-201.
- Giordano, J., and Dyche, J. Differential analgesic actions of serotonin 5-HT<sub>3</sub> receptor antagonists in the mouse. Neuropharmacology 28(1989):423-427.
- Glaum, S.R., Proudfoot, H.K., and Anderson, E.G. Reversal of the antinociceptive effects of intrathecally administered serotonin in rat by a selective 5-HT<sub>3</sub> receptor antagonist. Neurosci Lett 95(1988):313-317.
- Glazer, E.J., and Basbaum, A.I. Axon which take up [<sup>3</sup>H]serotonin are presynaptic to enkephalin immunoreactive neurons in cat dorsal horn. Brain Res 298(1984):386-391.
- Gracely, R.H., McGrath, P., and Dubner, R. Validity and sensibility of sensory and affective verbal pain descriptors: Manipulation of affect by diazepam. Pain (1978):19-29.
- Graeff, F.G., Branda, M.L., Audi, E.A., and Schiitz, M.T.B. Modulation of the brain aversion system by GABAergic and serotonergic mechanism. Behav Brain Res 22(1986):174-180.
- Grahame-Smith, D.G. Inhibitory effects of chlorpromazine on the syndrome of hyperactivity produced by L-tryptophan or 5-methoxy-N,N-dimethyltryptamine in rats treated with a monoamine oxidase inhibitor. Br J Pharmacol 43(1971):856-864
- Green, A.R., and Heal, D.J. The effects of drugs on serotonin-mediated behavioural models. In: Neuropharmacology of Serotonin. Green, A.R ed., Oxford: Oxford University Press, 1985, pp. 326-365
- \_\_\_\_\_, and Kelly, P.H. Evidence concerning the involvement of 5-hydroxytryptamine in locomotor activity produced by amphetamine or tranylcypromine plus L-dopa Br J Pharmacol 57(1976):141-147.

- Grewal, K.S. Observation on the pharmacology of mitragynine. J Pharmacol Exp Ther 46 (1932):251-271.
- Grubb, B.D., McQueen, D.S., Iggo, A., Birrell, G.J., and Dutia, M.B. A study of 5-HT-receptors associated with afferent nerves located in the normal and inflamed rat ankle joint. Agents Actions 25(1988):216-218.
- Gudelsky, G.A., Koenig, J.I., and Meltzer, H.Y. Thermoregulatory responses to serotonin (5-HT) receptor stimulation in the rat: Evidence for opposing roles of 5-HT<sub>2</sub> and 5-HT<sub>1A</sub> receptors Neuropharmacology 25(1986):1307-1313.
- Guilbaud, G., Peschanski, M., Gautron, M., and Binder, D. Neurones responding to noxious stimulation in VB complex and caudal adjacent regions in the thalamus of the rat. Pain 8(1980):303-318.
- Haley, J.E., Schachter, M., and Dickenson, A.H. Electrophysiological evidence for a role of bradykinin in chemical nociception in rat. Neurosci Lett 97 (1989):198-202.
- Hamon, M., Bourgoin, S., Le Bars, D., and Cesselin, F. In vivo and in vitro release of enteral neurotransmitters in relation to pain and analgesia. Prog Brain Res 77(1988):431-444.
- \_\_\_\_\_, Collin, E., Chantrel, D., Daval, G., Verge, D., Bourgoin, S., and Cesselin, F. Serotonin receptors and the modulation of pain In: Besson, J.M.(ed) Serotonin and pain Elsevier Science Publishers B.V.,1990, pp53-72.
- \_\_\_\_\_, Gallissot, M.C., Menard, F., Gozlan, H., Bourgoin, S., and Verge, D. 5-HT<sub>3</sub> receptor binding sites are on capsaicin-sensitive fibers in the rat spinal cord. Eur J Pharmacol 164(1989):315-322.
- \_\_\_\_\_, Gozlan, H., El Mestikawy, S., Emerit, M.B., Cossery, J.M., and Lutz, O. In: Osborne NN, Hamon M (eds) Neuronal Serotonin, John Wiley & Sons Ltd: Chichester, 1988, pp 393-422.

- Headley, P.M., Duggan, A.W., and Griersmith, B.T. Selective reduction by noradrenalin and 5-hydroxytryptamine of nociceptive responses of cat dorsal horn neurones. Brain Res 145(1978):185-189.
- \_\_\_\_\_, and Grillner, S. Excitatory amino-acids and synaptic transmission: the evidence for a physiological function. Trends Pharmacol Sci 11(1990) :205-211.
- Hill, H.E., Kornetsky, C.H., Flanery, H.G., and Wikler, A. Studies of anxiety associated with anticipation of pain I: Effects of morphine. Arch Neurol Psychiat 67:(1952),612-619.
- Hoffmeister, F., and Kroneberg, G. Experimental studies in animals on the differentiation of analgesic activity. In: Mantegazza, P. and Piccinini, F., (eds), Methods in drug evaluation Amsterdam: North Holland, 1966, pp. 270-277.
- Hoyer, D., Waeber, C., Pazos, A., Probst, A., and Palacios, J.M. Identification of 5-HT<sub>1</sub> recognition site in human brain membranes different from 5-HT<sub>1A</sub>, 5-HT<sub>1B</sub> and 5-HT<sub>1C</sub> site. Neurosci Lett 85(1988):357-362.
- Hunskaar, S., Berge, O.G., Broch, O.J., and Hole, K. Lesions of ascending serotonergic pathway and antinociceptive effect after systemic administration of p-chloroamphetamine in mice. Pharmacol Biochem Behav 24(1986):709-714.
- \_\_\_\_\_, Fasmer, O.B., and Hole, K., Formalin test in mice, a useful technique for evaluating mild analgesics J Neurosci Meth 14(1985):69-76.
- \_\_\_\_\_, and Hole, K. The formalin test in mice: dissociation between inflammatory and non-inflammatory pain. Pain 30(1987):103-14
- Irwin, S., Houde, R.W., Bennett, D.R., Hendershot, L.C. and Seavers, M.H. The effects of morphine, methadone and meperidine on some reflex responses of spinal animals to nociceptive stimulation. J Pharmacol Exp Ther 101(1951):132-143.

- Ishijima, B., Yoshimasu, N., Fukushima, T., Hori, T., Sekino, H., and Sano, K. Nociceptive neurons in the human thalamus. Confin Neurol (Basel) 37 (1975):99-106.
- Isselbacher, K.J., Braunwald, E., Wilson, J.D., Martin, J.B., Fauci, A.S., and Kasper, D.L. Harrison's Principle of Internal Medicine 13th edi., McGrawhill, Inc., 1994.
- Jaffe, J.H. and Martin, W.R. Opioid analgesics and antagonists. In : Gilman, A.G., Goodman, L.S., Wall, T.W. and Murad, F.,(eds), Goodman and Gilman's the Pharmacological Basis of Therapeutics Macmillan: New york, 1985, pp. 491-531.
- Jansen, K.L.R., and Prast, C.J. Ethanopharmacology of Kratom and the Mitragyna alkaloids. J Ethnopharmacol 23 (1988): 115-119.
- Jessell, T.M., and Iversen, L.L. Opiate analgesics inhibit substance P release from rat trigeminal nucleus. Nature 268(1977):549-551.
- Jones, R.S.G. Response of cortical neurones to stimulation of the nucleus raphe medianus: a pharmacological analysis of the role of indoleamines. Neuropharmacology 21(1982):511-520.
- Jurna, I., Heinz, G., Blinn, G., and Nell, T. The effect of substantia nigra stimulation on  $\alpha$ -motoneurones and tail-flick response. Eur J Pharmacol 51(1978):239-250.
- Keawpradub, N. Alkaloids from the fresh leaves of Mitragyna speciosa (Korth.) Havil. Master's Thesis, Department of Pharmacognosy, Graduate School, Chulalongkorn University, 1990.
- Kevetter, G.A., and Willis, W.D. Spinothalamic cells in the rat lumbar cord with collaterals to the medullary reticular formation. Brain Res 238(1982):181-185.
- Kishore-Kumar, R., Schafer, S.C., Lawlor, B.A., Murphy, D.L., and Max, M.B. Single dose of the serotonin agonist buspirone and m-

- chlorophenylpiperazine do not relieve neuropathic pain. Pain 37(1989):223-227.
- Kosterlitz, H.W. The Wellcome Foundation lecture, 1982. Opioid peptides and their receptors. Proc R Soc Lond 225(1985):27-40.
- Kuraishi, Y., Hirota, N., Saton, M., and Takagi, H. Antinociceptive effects of intrathecal opioids noradrenaline and serotonin in rat: mechanical and thermal algesic test. Brain Res 326(1985):168-171.
- Levine, J.D., Feldmesser, M. Tecott, L. Gordon, N.C. and Izdebski, K. Pain-induced vocalization in rat and its modification by pharmacological agents. Brain Res 296(1984):121-127.
- Lidov, H.G.W., Grzanna, R., and Molliver, M.E. The serotonin innervation of the cerebral cortex in the rat - an immunohistochemical analysis. Neuroscience 5(1980):207-227.
- Livingstone, W.K. What is pain?. Scientific American 88(1953):59-66.
- Llewelyn, M.B., Azami, J., and Roberts, M.H.T. Effects of 5-hydroxytryptamine applied into nucleus raphe magnus on nociceptive thresholds and neuronal firing rate. Brain Res 258(1983):59-68.
- \_\_\_\_\_, Azami, J., and Roberts, M.H.T. The effect of modification of 5-hydroxytryptamine function in nucleus raphe magnus on nociceptive threshold. Brain Res 306(1984):165-170.
- Lodge, D., and Johnson, K.M. Noncompetitive excitatory amino acid receptor antagonists. Trends Pharmacol Sci 11(1990):81-86.
- Lowry, O.H. Rosebrough, N.J., Farr, A.W., and Randall, R.J. Protein measurement with the Folin-Phenol reagent. J Biol Chem 193(1951):265-272.
- Lund, R.D., and Webster, K.E. Thalamic afferents from the spinal cord and trigeminal nuclei: an experimental anatomical study in the rat. J Comp Neurol 130(1967):313-328.

- Macko, E., Weisbach, J.A., and Douglas, B. Pharmacology of mitragynine. Arch Int Pharmacodyn Ther 198(1972):145-161.
- Mantyh, P.W. The terminations of the spinothalamic tract in the cat. Neurosci Lett 38(1983):119-124.
- Marcan, A. Report of the Goverment Laboratory of Siam: Kratom eating. Analyst 54 (1929):475.
- Matsumoto, K., Bing, C., Saaki, K., and Watanabe, H. Methamphetamine- and Apomorphine-induced changes in spontaneous motor activity using a new system to detect and analyze motor activity in mice. J Pharmacol Meth 24(1990):111-119.
- McKearney, J.W. Apparent antinociceptive properties of piperazine type serotonin agonists: trifluoromethylphenylpiperazine, chlorophenylpiperazine and MK-212. Pharmacol Biochem Behav 32(1989):657-660.
- McQuay, H., and Dickenson,A.H. Implication of central nervous system plasticity for pain management. Anaesthesia 45(1990):101-102.
- Melzack, R. The perception of pain. Scientific American 204(1961):41-49.  
 \_\_\_\_\_, and Casey, K.L. Sensory, motivational, and central control determinants of pain. In Kenshalo, D. and Thomas, C.C.,(eds.), The Skin Senses Springfield III, 1968, pp. 423-439.
- Mendell, L.M. Physiological properties of unmyelinated fiber projection to the spinal cord. Exp Neurol 16(1966):316-332.
- Menetrey, D., Chaouch, A., and Besson, J.M. Location and properties of dorsal horn neurons at spinoreticular tract in lumbar enlargement of rat. J Neurophysiol 44(1980):862-877.
- Millan, M.J., Bervoets, K., and Colpaet, F.C. Int Symp Serotonin- From cell biology to pharmacology and therapeutics Florence, Abst,1989, p. 120.

- Mohrland, J.S., and Gebhart, G.F. Effect of selective destruction of serotonergic neurons in nucleus raphe magnus on morphine-induced antinociception. *Life Sci* 27(1980):2627-2632.
- Monroe, P.J., and Smith, D.J. Characterization of multiple [<sup>3</sup>H]5-hydroxytryptamine binding sites in rat spinal cord tissue. *J Neurochem* 41(1983):349-355.
- Murphy, R.M., and Zemlan, F.P. Selective serotonin 1A/1B agonists differentially affect spinal nociceptive reflexes. *Neuropharmacology* 29(1990):463-468.
- Murray, C.W., Porreca, F., and Cowan, A. Methodological refinements to the mouse paw formalin test. An animal model of tonic pain. *J Pharmacol Meth* 20(1988):175-186.
- Nahin, R.L., and Micevych, P.E. A long ascending pathway of enkephalin-like immunoreactive spinoreticular neurons in the rat. *Neurosci Lett* 65 (1986): 271-276.
- Nakamura, S. Two types of inhibitory effects upon brain stem reticular neurons by low frequency stimulation of raphe nucleus in the rat. *Brain Res* 93 (1975):140-144.
- Nazarali, A.J., McKenna, D.J., Saavedra, J.M. Autoradiographic localization of 5 HT<sub>2</sub> receptors in the rat brain using [125I]-DOI, a selective psychotomimetic radioligand. *Prog NeuroPsychopharmacol Biol Psychiat* 13(1989):573-581.
- Nencini, P., Woolverton, W.L., and Seiden, L.S. Enhancement of morphine-induced analgesia after repeated injections of methylenedioxymethamphetamine. *Brain Res* 457(1988):136-142.
- Nichols, D.S., Thorn, B.E., and Berntson, G.G. Opiate and serotonergic mechanisms of stimulation-produced angesia within the periaqueductal gray. *Brain Res Bull* 22(1989):717-724.

- Olpe, H.R., Ortmann, R., Fehr, B., and Waldmeier, P.C. Experimentally induced supersensitivity of neocortical neurons to microiontophoretically administered serotonin. *Brain Res* 224(1981):367-374.
- Paalzow, G. and Paalzow, L. Morphine-induced inhibition of different pain responses in relation to the regional turnover of rat brain noradrenaline and dopamine. *Psychopharmacology*, 45(1975):9-20.
- Palacios, J.M., and Dietl, M.M. In: Sandersh-Bush E (ed) *The Serotonin Receptors*, The Humana Press: Clifton NJ, 1988, pp 89-138.
- Pang, I.H., and Vasko, M.R. Morphine and norepinephrine but not 5-hydroxytryptamine and gamma-aminobutyric acid inhibit the potassium-stimulated release of substance P from rat spinal cord slices. *Brain Res* 376(1986):268-279.
- Parent, A., Descarries, L., and Beaudet, A. Organization of ascending serotonin systems in the adult rat brain. A radioautographic study after intraventricular administration of [<sup>3</sup>H]5-hydroxytryptamine. *Neuroscience* 6(1981):115-138.
- Parolaro, D., Sala, M.V., Patrini, G., Massi, P., Giagnoni, G., and Gori, E. Supraspinal cerebral areas involved in morphine's intestinal inhibition and analgesia. *Pharmacol Biochem Behav* 30(1988):319-324.
- Paul, D., Mana, M.J., Pfau, J.G., and Pinel, J.P.J. Attenuation of morphine analgesia by S2 antagonists, pirenperone and ketanserin. *Pharmacol Biochem Behav* 31(1989):641-647.
- Pavlasek, J., Gokin, A.P., and Duda, P. Visceral pain: responses of the reticular formation neurons to the gall bladder distension. *J Physiol (Paris)* 73 (1977):335-346.
- Paxinos, G. and Watson, C. *The Rat Brain in Stereotaxic Coordinates* 2nd ed, Academic Press: San Diego, 1986.

- Pazos, A., and Palacios, J.M. Quantitative autoradiographic mapping of serotonin receptors in the rat brain. I. Serotonin-1 receptors. *Brain Res* 346(1985):205-230.
- Perl, E.R., and Whitlock, D.G. Somatic stimuli exciting spinothalamic projections to thalamic neurons in cat and monkey. *Exp Neurol* 3(1961):256-296.
- Peroutka, S.J. 5-Hydroxytryptamine receptor subtypes: molecular, biochemical and physiological characterization. *TINS* 11(1988):496-500.
- Peschanski, M., and Besson, J.M. A spino-reticulo-thalamic pathway in the rat: an anatomical study with reference to pain transmission. *Neuroscience* 12(1984):165-178.
- \_\_\_\_\_, and Besson, J.M. Diencephalic connections of the raphe nuclei of the rat brain stem: an anatomical study with reference to the somatosensory system. *J Comp Neurol* 224(1984):509-534.
- \_\_\_\_\_, Guilbaud, G., Gautron, M., and Besson, J.M. Encoding of noxious heat messages in neurons of the ventrobasal thalamic complex of the rat. *Brain Res* 197(1980):401-413.
- \_\_\_\_\_, and Ralston, H.J. III. Light and electron microscope evidence of transneuronal labeling with WGA-HRP to trace somatosensory pathways to the thalamus. *J Comp Neurol* 236(1985):29-41.
- Pickel, V.M., Joh, T.H., and Reis, D.J. A serotonergic innervation of noradrenergic neurons in nucleus locus coeruleus: demonstration by immunocytochemical localization of the transmitter specific enzymes tyrosine and tryptophan hydroxylase. *Brain Res* 131(1977):197-214.
- Poggio, G.F., and Mountcastle, V.B. A study of the functional contributions of the lemniscal and spinothalamic systems to somatic sensibility. Central nervous mechanism in pain. *Bull Johns Hopk Hosp* 106(1960):266-316.
- Pohl, M., Lombard, M.C., Bourgoin, S., Benoliel, J.J., Mauborgne, A., Carayon, A., Besson, J.M., Hamon, M., and Cesselin, F. Opioid control of the in vitro

- release of calcitonin gene-related peptide from primary afferent fibres projecting in the rat cervical cord. Neuropeptides 14(1989):151-159.
- Post, C., Minor, B.G., Davies, M., and Archer, T. Analgesia induced by 5-hydroxytryptamine receptor agonist is blocked or reversed by noradrenaline-depletion in rats. Brain Res 363(1986):18-27.
- Proudfit, H.K., and Hammond, D.L. Alterations in nociceptive threshold and morphine-induced analgesia produced by intrathecally administered amine antagonist. Brain Res 218(1981):393-399.
- Qiao, J.T., and Dafny, N. Dorsal raphe stimulation modulates nociceptive responses in thalamic parafascicular neurons via an ascending pathway: further studies on ascending pain modulation pathways. Pain 34(1988):65-74.
- Quisumbing, E. Medicinal Plants of the Philippines. Manila: Manila Bureau of Printing, 1951.
- Reader, T.A., Ferron, A., Descarries, L., and Jasper, H.H. Modulation role for biogenic amines in the cerebral cortex. Microiontophoretic studies. Brain Res 160(1979):217-229.
- Richardson, B.P., Engel, G., Donatsch, P., and Stadler, P.A. Identification of serotonin M-receptor subtypes and their specific blockade by a new class of drugs. Nature 316(1985):126-131.
- Rivot, J.P., Chaouch, A., and Besson, J.M. Nucleus raphe magnus modulation of response of rat dorsal horn neurons to unmyelinated fiber inputs: partial involvement of serotonergic pathways. J Neurophysiol 44(1980):1039-1057.
- 
- \_\_\_\_\_, Lamour, Y., Ory-Lavollee, L., and Pointis, D. In vivo electrochemical detection of 5-hydroxyindoles in rat somatosensory cortex: effect of stimulations of the serotonergic pathways in normal and pCPA-pretreated animals. Brain Res 275(1983):164-168.

- \_\_\_\_\_, Pointis, D., and Besson, J.M. Morphine increases 5-HT metabolism in the nucleus raphe magnus: an in vivo study in freely moving rats using 5-hydroxyindole electrochemical detection. *Brain Res* 446(1988):333-342.
- Rodgers, R.J., and Shepherd, J.K. 8-hydroxy-2-(di-n-propylamino)tetralin (8-OH-DPAT), inhibits non-opioid analgesia in defeated mice: influence of route of administration. *Psychopharmacology* 97(1989):163-165.
- Samanin, R., Valzelli, L., and Gumulka, W. Inhibitory effect of midbrain raphe stimulation on cortical evoked potentials in rats. *Psychopharmacologia* (Berl) 24(1972):373-379.
- Sanders-Bush, E. (ed) *The Serotonin Receptors*, The Humana Press: Clifton NJ, 1988.
- Sandrini, G., Alfonsi, E., De Rysky, C., Marini, S., Facchinetto, F., and Nappi, G. Evidence for serotonin-S<sub>2</sub> receptor involvement in analgesia in humans. *Eur J Pharmacol* 130(1986):311-314.
- Schmauss, C., Hammond, D.L., Ochi, J.W., and Yaksh, T.L. Pharmacological antagonism of the antinociceptive effects of serotonin in the rat spinal cord. *Eur J Pharmacol* 90(1983):349-357.
- Schouenborg, J. and Dickenson, A.H. The effects of a distant noxious stimulation on A- and C-fibre evoked flexion reflexes and neuronal activity in the dorsal horn of the rat. *Brain Res* 328(1985):56-63.
- \_\_\_\_\_, and Sjolund, B.H. Activity evoked by A- and C-afferent fibers in rat dorsal horn and its relation to flexion reflex. *J. Neurophysiol.* 50(1983):1108-1121.
- Schutz, M.T., deAquiari, J.C., and Graeff, F.G. Anti-aversive role of serotonin in the dorsal periaqueductal gray matter. *Psychopharmacology* 85(1985):340-345.
- Segal, M. Serotonin innervation of the locus coeruleus from the dorsal raphe and its action on responses to noxious stimuli. *J Physiol* 286(1979):401-415.

- \_\_\_\_\_, and Sandberg, D. Analgesia induced by electrical stimulation of catecholamine nuclei in the rat brain. Brain Res 123(1977):369-372.
- Shaw, P.J., Ince, P.G., Johnson, M., Perry, E.K., and Candy, J. The quantitative autoradiographic distribution of [<sup>3</sup>H]MK-801 binding sites in the normal human spinal cord. Brain Res 539(1991):164-168.
- Solomon, R.E., and Gebhart, G.F. Mechanisms of effects of intrathecal serotonin on nociception and blood pressure in rat. J Pharmacol Exp Ther 245 (1988):905-912.
- Spampinato, S., Candeletti, S., Cavicchini, E., Romualdi, P., Speroni, E., and Ferri, S. Antinociceptive activity of salmon calcitonin injected intrathecally in the rat. Neurosci Lett 45(1984):135-139.
- Spreafico, R., Barbaresi, P., Weinberg, R.J., and Rustioni, A. S11-projecting neurons in the rat thalamus: a single- and double-retrograde-tracing study. Somatosens Res 4 (1987):359-375.
- Steinbusch, H.W.M. Distribution of serotonin-immunoreactivity in the central nervous system of the rat-cell bodies and terminals. Neuroscience 6 (1981):557-618.
- \_\_\_\_\_, and Nieuwenhuys, R. In: Emson PC (ed) Chemical Neuroanatomy. Raven Press: New York, 1983, pp 131-207.
- Stevens, R.T., Hodge, C.J. Jr., and Apkarian, A.V. Medial, intralaminar, and lateral termination of lumbar spinothalamic tract neurons: a fluorescent double-label study. Somatosens Motor Res 6(1989):285-308.
- Suwanlert, S. A study of Kratom eaters in Thailand. Bulletin on Narcotics XXVII (1975):21-27.
- Ungerstedt, J. Use of intracerebral injection of 6-hydroxydopamine as a tool for morphological and functional studies on central catecholamine neurons. In: Malmfors, T. and Thoenen, H. (eds) 6-Hydroxydopamine and Catecholamine North-Holland Publ: Amsterdam, 1971, 315-332

- Verge, D., Daval, G., Marcinkiewicz, M., Patey, S., Mestikawy, E., Gozlan, H., and Hamon, M. Quantitative autoradiography of multiple 5-HT<sub>1</sub> receptor subtypes in the brain of control or 5,7-dihydroxytryptamine treated rats. *J Neurosci* 6 (1986):3474-3480.
- Vertes, R.P., Martin, G.F., and Waltzer, R. An autoradiographic analysis of ascending projections from the medullary reticular formation in the rat. *Neuroscience* 19(1986):873-898.
- Woolf, C.J. Evidence for a central component of post injury pain hypersensitivity. *Nature* 221(1983):313-328.
- Woolfe, G. and McDonald, A.D. The evaluation of the analgesic action of pethidine hydrochloride (Demerol). *J Pharmacol Exp Ther* 80(1944):300-307.
- Yaksh, T.L. Direct evidence that spinal serotonin and noradrenaline terminal mediate the spinal antinociceptive effect of morphine in the periaqueductal gray. *Brain Res* 160(1979):180-185.
- \_\_\_\_\_, and Stevens CW In: Dubner R, Gebhart GF, Bond MR (eds) *Proceed Vth World Congress on Pain* Elsevier Sci Publ BV: Amsterdam, 1988, pp 417-435.
- Zaremba, J.E., Douglas, B., Valenta, J., and Weisbach, J.A. Metabolites of mitragynine. *J Pharm Sci* 63 (1974):1407-1414.

### Curiculum Vitae

Mr. Vichien Leelasangaluk was born on July 22<sup>nd</sup>, 1957 in Bangkok, Thailand. He was graduated in Bachelor of Science in Pharmacy in 1981 from the Faculty of Pharmaceutical Sciences, Chulalongkorn University, Master of Science (Pharmacology) in 1984 from the Faculty of Sciences, Mahidol University. Now, he is working as a lecturer in the Department of Pharmacology and Toxicology, Faculty of Pharmacy, Silpakorn University, Nakorn Pathom, Thailand.



ศูนย์วิทยทรัพยากร  
จุฬาลงกรณ์มหาวิทยาลัย