References

Thai

บดินทร์ ติวสุวรรณ. การศึกษาฤทธิ์ต้านการชักของอนุพันธ์ Valproic acid. ปริญญานิพนธ์, คณะเภสัชศาสตร์ , จุฬาลงกรณ์มหาวิทยาลัย, 2540.

English

Albus, H., and Williamson, R. Electrophysiologic analysis of the actions of valproate on pyramidal neurons in the rat hippocampal slice. Epilepsia. 39(1998): 124-139.

Anderson, G.D. A mechanistic approach to antiepileptic drug interactions. Ann. Pharmacol. 32(1998): 554-561.

Anlezark, G., Horton, R.W., Meldrum, B.S., and Sawaya, M.C.B. Anticonvulsant action of ethanolamine-o-sulphate and di-n-propylacetate and the metabulism at γ-aminobutyric acid GABA in mice with audiogenic seizure. Biochem. Phamacol. 25 (1976): 413-417.

Avoli, M. Molecular mechanisms of antiepiieptic drugs. Science & Medicine. August (1997): 54-63.

Barnard, E.A., Skolnick, P., Olsen, R.W., Mohler, H., Sieghart, W., Biggio, G., and Braestrup, C. International Union of Pharmacology. XV. Subtypes of γ - aminobutyric $acid_A$ receptors: Classification on the basis of subunit structure and receptor function. Pharmacol. Rev. 50 (2) (1998): 291-313.

Benveniste, H., and Huttemeier, P.C. Microdialysis: Theory and application. Prog. Neurobiol. 35 (1990): 195-215.

Berg, A.T., and Shinna, S. Risk factors for a first febrile seizure a matched case control study. Epilepsia. 36 (1995): 334-341.

Berkovic, S.F., and Scheffer, I.E. Febrile seizures: genetics and relationship to other epilepsy syndromes. Curr. Opin. Neurol. 11 (1998): 129-134.

Boling, W. and Oliver, A. The current state of epilepsy surgery. Curr. Opin. Neurol. 11 (1998):155-161.

Brodie, M.J., and Dichter, M.A. Antiepileptic drugs. N. Engl. J. Med. 18(1996): 168-175.

Browning, R.A. The electroshock model, neuronal networks and antiepiletic drugs. In, C.L. Faingold and G.H. Fromm (eds.), Drugs for control of epilepsy, pp. 195-211. London: CRC Press, 1992.

Buchhalter, J.R. Animal models of inherited epilepsy. Epilepsia. 34 (suppl. 3) (1993): S31-S41.

Cereghino, J.J. and Kupferberg, H.J. Preclinical testing. In, J.A. French, M.A. Dichter, and I.E. Leppik (eds.), New antiepileptic drug development: Preclinical and clinical aspects, pp. 19-30. Netherlands: Elsevier Science Publishers B.V., 1993.

Chapman, A.G. Glutamate receptors in epilepsy. Prog. Brain Res. 116(1998):371-383.

Cooper, J.R., Bloom, F.E., and Roth, R.H. The biochemical basis of neuropharmacology, 7th ed., pp.126-183. New York: Oxford University Press,1996.

Crowder,J.M. and Bradford, H.F. Common anticonvulsant inhibits Ca^{2+} uptake and amino acid neurotransmitter release *in vitro*. Epilepsia. 28 (1987): 579-585

Davis, R., Peter, D.H., and McTavish, D. Valproic acid: A reappraisal of its pharmacological properties and clinical efficacy in Epilepsy. Drugs. 47 (2) (1994): 332-372.

Deckers, C.L.P., Hekster, Y.A., Keyser, A., Lammers, M.V., Meinardi, H., and Renier, W.O. Address effects in epilepsy therapy. Acta. Neurol. Scand. 95 (1997): 248-252.

Dichter, M.A. Emerging insights into mechanisms of epilepsy: Implications for new antiepileptic drug development. Epilepsia. 35 (suppl. 4) (1994): S51-S57.

Dichter, M.A. Basic mechanisms of epilepsy: Targets for therapeutic intervention. Epilepsy. 38 (suppl. 9) (1997): S2-S6.

Dichter, M.A. and Wilcox. K.S. Excitatory synaptic transmission. In, J. Engel, Jr. and T.A. Pedley (eds.), Epilepsy: A Comprehensive Textbook. pp.251-265. New York: Lippincott-Raven Publishers, 1997.

Diem, K. and Lentner, C. Scientific tables (7 th ed), pp.54-55. Germany: Ciba Geigy Limited, 1972.

Dodd, P.R., Beckmann, A.M., Davidson, M.S., and Wilce, P.A. Glutamate-mediated transmission, alcohol, and alcoholism. Neurochem. Int. 37 (2000): 509-533.

Dreifuss, F.E. Classification of epileptic seizures. In, J. Engel, Jr. and T.A. Pedley (eds.), Epilepsy: A Comprehensive Textbook, pp. 525-532. New York: Lippincott-Raven Publishers, 1997.

Dunham, N.W., and Miya, T.S. A note on a simple apparatus for detecting neurological deficit in rats and mice. J. Am. Pharm. Assoc. 46 (1957): 208-209.

Ferrendelli, J.A., Holland, K.D., and Covey, D.F. Comparison of the anticonvulsant activities of ethsuximide, valproate, and new anticonvulsant, thiobutyrolactone. Epilesia. 30 (1989): 617-633.

File, S.E.., and Aranko,N. Sodium valproate decrease exploratory behaviour in mice: development of tolerance and cross-tolerance with chlordiazepoxide. Eur. J. Pharmacol. 151(1988): 293-299.

Godin, Y., Heiner, L., Mark, J., and Mandel, P. Effect of di-n-propylacetate, an anticonvulsive compound, on GABA metabolism. J. Neurochem. 16 (1969): 869-873.

Hevers, W., and Lüddens, H. The diversity of $GABA_A$ receptors. Mol. Neurobiol. 18 (1998): 35-86.

Holmes, G.L. Epilepsy in the developing brain: Lessons from the laboratory and clinic. Epilepsia. 38 (1) (1997): 12-30.

Johannessen, C.U. Mechanisms of action of valproate: A commentatory. Neurochem. Int. 37 (2000): 103-110.

Kaupman, K., Huggel, K. Heid, J., Flor, P.J., Bischoff. S., Michel, S.J., McMaster, G., Angst, C., Bittiger, H., Froestl, W., and Better, B. Expression cloning $GABA_B$ receptor uncovers similarity to metabotropic glutamate receptor. Nature. 386 (1997): 239-246.

Kemp J.A., and Leeson P.D. The glycine site of the NMDA receptor- five years on. Trends Pharmaco. Sci. 14 (1993): 20-25.

Kuriyama, K., Hirouchi, M., and Nakayasu, H. Structure and function of cerebral $GABA_A$ and $GABA_B$ receptors. Neurosci. Res. 17 (1993): 91-99.

Lindroth, P., and Mopper, K. High performance liquid chromatographic determination of subpicromole amounts of amino acids by precolumn fluorescence derivatization o-phthaldialdehyde. Ann . Chem. 51 (1979): 1667-1674.

Lipton, S.A., and Rosenberg, M. Excitatory amino acids as a final common pathway for neurologic disorder. N. Engl. J. Med. 330 (9) (1994): 613-621.

Litchfield, J.T., and Wilcoxon, F.W. A Simplified method of evaluating dose effect experiments. J Phamacol. Exp. Ther. 96 (1949) : 99-109.

Löscher, W. Basic aspects of epilepsy. Curr. Opin. Neurol. Neurosur. 6 (1993a): 223-232.

Löscher, W. Effects of the antiepileptic drug valproate on metabolism and function of inhibitory and excitatory amino acids in the brain. Neurochem Res. 18 (1993b): 485-502.

Löscher, W. New visions in the pharmacology of anticonvulsion. Eur. J. Pharmacol. 342 (1998): 1-13.

Löscher, W., Honack, D., Fassbenber, C.P., and Nolting, B. The role of technical, biological and pharmacological factors in the laboratory evaluation anticonvulsant drugs, III: Pentylenetetrazole seizure models. Epilepsy Res. 8 (1991): 171-189.

Löscher, W., Nolting, B. The role of technical, biological and pharmacological factor in the laboratory evaluation anticonvulsant drugs, IV: Protective indices. Epilepsy Res. 9 (1991): 1-10.

Löscher, W., Nolting, B., and Fassbender, C. The role if technical biological and pharmacological factors in the laboratory evaluation of anticonvulsant drugs, I: The influence of administration vehicles. Epilepsy Res. 7 (1990): 173-181.

Macdonald, R.L., and Kelly, K.M. Antiepileptic drug mechanism of action. Epilepsia. 34 (suppl. 5) (1993): S1-S8.

MacNamara, J.O. Drugs effective in the therapy of the epilepsies. In, A.G. Gilman, R.W. Ruddon, P.B. Molinoff, L.E limbird and J.G. Hardman (eds.), Goodman and Gilman's the pharmacological basis of therapeutics. 9th ed., pp.461-485. New York: Raven Press, 1996.

Mclean, M.J., and Macdonald, R.L. Sodium valproate, but not ethosuximide, produces use and voltage dependent limitation of high frequency repetitive firing of action potentials of mouse central neurons in cell culture. J. Pharmacol. Exp. Ther. 237 (3) (1986): 1001-1011.

Meldrum, B.S. Neurotransmission in epilepsy. Epilepsia. 36 (suppl. 1) (1995): S30-S35.

Meldrum, B.S. Update on the mechanism of action of antiepileptic drugs. Epilepsia. 37 (suppl. 6) (1996): S4-S11.

Meldrum, B.S. Identification and preclinical testing of novel antiepileptic compounds. Epilepsia. 38 (suppl. 9) (1997): S7-S15.

Nau, H., and Löscher. Valpraic acid: Brain and plasma levels of the drug and its metabolites, anticonvulsant effects and γ–aminobutyric acid (GABA) metabolism in the mouse. J. Pharmco Exp. Ther. 220 (1982): 654-659.

Olsen, R.W., and Avoli, M. GABA and epileptogenesis. Epilepsia. 38 (1997): 399-407.

Ortells, M.O., and Lunt, G.G. Evolutionary history of the ligand-gated ion-channel superfamily of receptors. Trends Neurosci. 18 (1995): 121-127.

Pellegerino, J.L., Pelligrino, A.S., and Cushman, A.J. A Steriotoxic atlas of the rat brain. New York: Plenum Press, 1979.

Phillips, N.I., and Fowler, L.J. The effects of sodium valproate on γ–aminobutyrate metabolism and behavior in naïve and ethanolamine-o-sulphate pretreated rats and mice. Biochem. Pharmacol. 31(13) (1982): 2257-2261.

Pornchulee Supatchaipisit. Anticonvulsant activity and effects of (N-hydroxymethyl)-2-propylpentamide on the central nervous system. Master's Thesis, Chulalongkorn University, 1995.

Porter, R.J. Classification of epileptic seizures and epileptic syndromes. In, J. Laidlaw A., Richens and D. Chadwick (eds.), Textbook of epilepsy, 4 th ed., pp. 1-19. London: Churchil Livingstone, 1993.

Rho, J.M., and Sankar, R. The Pharmacologic basis of antiepileptic drug action. Epilepsia. 40 (1999): 1471-1483.

Rogawski, M.A., and Porter, R.J. Antiepileptic drugs: Pharmacological mechanism and clinical efficiency with consideration of promising developmental stage compounds. Pharmacol. Rev. 42 (1990): 223-286.

Scheuer, M.L., and Pedley, T.A. The evaluation and treament of seizures. N. Engl. J. Med. 20 (1990): 1468-1474.

Schwartzkroin, P.A. Origin of the epileptic state. Epilepsia. 38 (8) (1997): 853-858.

Scott, R.C., and Neville, B.G.R. Developmental perspectives on epilepsy. Curr. Opin. Neurol. 11 (1998): 115-118.

Sieghart, W. Structure and pharmacology of γ-aminobutyric $acid_A$ receptor subtypes. Pharmacol. Rev. 47 (2) (1995): 181-234.

Thomson, E.B. Drug Bioscreening: Drug evaluation in pharmacology, pp.1-15, New York: VCH Publisher,1990.

Thongchai Sooksawate. Anticonvulsant effects of N- (2-Propylpentanoyl) urea. Master's Thesis, Chulalongkorn University, 1995.

Taylor, C.P. and Meldrum, B.S. Na^+ channels at targets for neuroprotective drugs. Trends. Pharmaco. Sci. 16 (1995): 309-316.

Upton, N. Mechanisms of action of new antiepileptic drugs: Rational design and seredipitous findings. Trends. Pharmaco Sci. 15 (1994): 456-463.

Ure, J.A., and Perassolo, M. Update on the pathophysiology of the epilepsies. J. Neurosci. 177 (2000):1-17.

Van der Laan, J. W., De Boer, T., and Bruinvels, J. Di-n-propylacetate and GABA degradation, Preferential inhibition of succinic semialdehyde dehydrogenase and indirect inhibition of GABA-transminase. J. Neurochem. 32 (1979): 1769-1780.

White, H.S. Clinical significance of animal seizure models and mechanism of action studies of potential antiepileptic drug. Epilepsia. 38 (suppl.1) (1997): S9 – S17.

White, H.S., Wolf, H.H., Woodhead, J.H., and Kupferberg, H.J. The National institutes of health anticonvulsant drug development program: screening for efficacy. In, J. French, I leppik, and M.A. Dichter(eds.), Antiepileptic drug development, pp.29-39. New York: Lippincott-Raven Publishers, 1998a.

White, J.H., Wise, A., Main, M.J., Green, A., Fraser, N.J., Disney, G.H., Barnes, A.A., Emson, P., Foord, S.M., and Marshall, F.H. Heterodimerization is requried for the formation of a function $GABA_B$ receptor. Nature. 396 (1998b): 679-682.

Zeise, M.I., Kasparo, S., Ziele, G. and Berger, W. Valproate supresses N-metyl-D-asparate-evoked, transeint depolarizations in the rat neocortex in vitro. Brain Res. 544(1991): 345-348.

ศูนย์วิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย

Appendices

ศูนย์วิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย

Anticonvulsant activity

Table 1 Anticonvulsant activity of VPA (i.p.) in MES test

Dose (mg/kg)	Pretreated time (min)	No. of animals	
		no protection	protection
50	15	8	0
	30	8	0
	60	8	0
100	15	7	1
	30	7	1
	60	7	1
200	15	6	2
	30	5	3
	60	5	3
300	15	3	5
	30	2	6
	60	3	5
400	15	1	7
	30	1	7
	60	1	7

ศูนย์วิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย

Table 2 Anticonvulsant activity of VPM (i.p.) in MES test

Dose (mg/kg)	Pretreated time (min)	No. of animals	
		no protection	protection
75	15	7	1
	30	7	1
	60	6	2
100	15	6	2
	30	5	3
	60	5	3
125	15	5	3
	30	4	4
	60	3	5
150	15	4	4
	30	3	5
	60	2	6
175	15	2	6
	30	1	7
	60	1	7

ศูนย์วิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย

Table 3 Anticonvulsant activity of VPA(i.p.) in PTZ test

Dose (mg/kg)	Pretreated time (min)	No. of animals	
		no protection	protection
50	30	7	3
75	30	6	4
100	30	4	6
150	30	1	9
120	30	1	9

Toxicity

Table 4 Acute toxicity(lethality) of VPA and VPM within 72 hours

substance	Dose (mg/kg)	No. of animals	
		dead	survival
VPA	500	1	7
	600	2	6
	700	4	4
	800	6	2
	900	7	1
VPM	500	2	6
	600	4	4
	700	5	3
	800	6	2
	900	7	1

Table 5 Neurotoxicity of VPA and VPM (i.p.) by Rotorod test

substance	Dose mg/kg	No. of animals	
		inable to maintain on rotating rod	able to maintain on rotating rod
VPA	200	2	6
	300	4	4
	400	5	3
	500	6	2
	600	7	1
VPM	100	1	7
	125	2	6
	150	3	5
	175	5	3
	200	7	1

Table 6 Barbiturate sleeping times of VPM and VPA(i.p.)

Animal No.	Sleeping time(min)					
	NSS 0.1ml/25g	PEG400 0.1ml/25g	VPA100 mg/kg B.W.	VPA250 mg/kg B.W.	VPM100 mg/kg B.W.	VPM200 mg/kg B.W.
1	45.14	55.35	107.27	132.52	233	771.45
2	45.51	54.41	93.4	118.5	338.5	757.34
3	42.28	54.2	98.5	132.5	219.5	734.23
4	57.11	55.31	92.55	149	278.3	650.23
5	51.07	53.12	91.1	115.3	279.05	646.42
6	42.58	54.09	80.3	142	337.25	707.33
7	46.07	53.36	54	114.5	221.3	705.42
8	41.52	58.03	63.02	160.2	226.3	749.13

Table 7 Hypnotic effect of VPM (i.p.)

Dose(mg/kg)	No. of animals	onset(min)	duration(min)
200	8	10(n=1)	25
225	8	4.5(n=2)	35
250	8	2(n=3)	55
275	8	<1(n=2),2(n=2)	>60
300	8	<1(n=4)	>60

ศูนย์วิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย

Locomotor activity

Table 8 Horizontal counts of locomotor activity of NSS (0.1ml/25g B.W.)- treated mice

Times / No. mice	horizontal counts									
	1	2	3	4	5	6	7	8	9	10
Pre15	862	1058	1102	1001	855	949	926	1144	371	1045
Pre30	485	738	714	601	455	426	433	766	354	708
Pre45	339	488	584	509	308	372	299	643	254	581
Po15	122	172	149	123	74	44	284	47	33	14
Po30	72	88	152	31	3	0	51	65	0	0
Fo45	127	237	53	0	0	0	24	66	0	11
po60	0	27	17	109	0	160	58	127	0	91
Po75	161	0	0	99	0	38	0	2	0	0
Po90	139	41	0	0	0	1	0	11	166	0
Po105	11	0	89	0	0	0	1	27	101	0
Po120	1	54	1	101	285	148	27	0	0	0
Po135	0	0	5	12	0	132	25	0	12	230
Po150	0	2	62	0	108	1	1	0	0	52
Po165	0	6	0	0	65	0	0	328	27	0
Po180	33	61	0	0	0	99	0	28	92	0

Pre=pretreatment

Po= post-treatment

ศูนย์วิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย

Table 9 Horizontal counts of locomotor activity of PEG400 (0.1ml/kg B.W.) - treated mice

Times / No. mice	horizontal counts									
	1	2	3	4	5	6	7	8	9	10
Pre15	1045	1050	1005	912	643	921	501	1264	1074	977
Pre30	608	729	677	694	111	358	354	933	765	644
Pre45	468	650	383	514	92	173	423	609	681	543
Po15	0	1	36	80	18	152	5	0	1	1
Po30	0	0	94	9	0	12	26	0	0	1
Po45	0	8	29	7	0	2	19	0	4	4
po60	0	0	34	60	0	3	0	0	0	0
Po75	1	0	27	0	0	3	0	0	7	17
Po90	1	0	4	0	0	0	0	59	0	1
Po105	0	9	15	58	0	4	0	0	0	5
Po120	0	12	2	2	134	5	0	0	21	57
Po135	0	0	0	37	12	8	0	32	8	0
Po150	0	0	0	48	0	0	0	53	0	0
Po165	0	0	0	0	0	1	0	0	5	12
Po180	0	4	1	0	0	0	0	63	19	20

Pre=pretreatment

Po= post-treatment

ศูนย์วิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย

Table 10 Horizontal counts of locomotor activity of VPA (100mg/kg B.W.) - treated mice

Times / No. mice	horizontal counts									
	1	2	3	4	5	6	7	8	9	10
Pre15	1054	990	1091	1031	1050	793	1233	1193	1144	862
Pre30	602	647	608	788	920	572	736	881	891	684
Pre45	538	448	368	735	878	372	745	810	757	539
Po15	0	0	0	0	0	0	13	26	5	0
Po30	0	1	0	0	0	0	0	30	0	0
Po45	0	0	0	0	0	0	35	0	0	0
po60	5	0	0	0	0	1	0	0	0	0
Po75	0	14	0	0	0	0	0	3	14	3
Po90	0	11	0	0	10	1	17	24	0	0
Po105	0	0	1	54	1	0	0	0	0	0
Po120	31	32	0	8	0	0	0	0	0	11
Po135	0	0	0	0	0	0	0	0	54	1
Po150	4	0	7	0	0	20	0	48	4	0
Po165	0	0	3	1	8	0	0	0	0	2
Po180	12	4	0	3	15	41	36	0	0	0

Pre=pretreatment

Po= post-treatment

ศูนย์วิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย

Table 11 Horizontal counts of locomotor activity of VPA (250mg/kg B.W.) - treated mice

Times / No. mice	horizontal counts									
	1	2	3	4	5	6	7	8	9	10
Pre15	958	1344	1020	1036	446	948	1427	1119	706	1074
Pre30	560	782	852	798	369	692	1042	579	259	580
Pre45	430	769	529	754	119	387	836	384	137	579
Po15	0	10	0	0	0	1	3	0	0	0
Po30	0	0	0	0	0	2	0	0	0	1
Po45	5	5	0	0	0	1	0	0	0	0
po60	0	0	0	1	0	1	0	0	0	0
Po75	0	1	0	0	0	2	6	1	8	0
Po90	2	0	0	0	1	0	0	0	7	0
Po105	0	10	0	0	0	0	0	0	0	0
Po120	0	0	0	0	0	0	0	8	0	1
Po135	0	0	0	46	0	0	31	0	0	0
Po150	45	34	0	8	0	1	10	0	0	0
Po165	1	0	0	0	0	0	33	0	2	0
Po180	0	0	0	0	0	0	71	9	0	1

Pre=pretreatment

Po= post-treatment

ศูนย์วิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย

Table 12 Horizontal counts of locomotor activity of VPM (100mg/kg B.W.) - treated mice

Times / No. mice	horizontal counts									
	1	2	3	4	5	6	7	8	9	10
Pre15	1146	1015	897	1148	903	1155	906	521	980	1149
Pre30	942	806	647	693	762	697	660	250	624	786
Pre45	648	741	577	625	655	615	344	196	505	663
Po15	2	0	0	1	0	2	1	0	0	0
Po30	0	0	0	0	4	0	0	0	0	0
Po45	0	0	0	9	11	3	0	3	12	0
po60	6	0	0	0	0	1	0	0	7	2
Po75	0	0	0	0	2	0	0	0	0	7
Po90	0	0	0	0	3	0	0	0	0	0
Po105	0	0	0	0	0	12	5	0	0	14
Po120	6	27	1	0	6	13	0	22	0	0
Po135	8	0	0	0	0	0	0	1	2	0
Po150	2	0	31	1	0	0	0	0	0	0
Po165	0	82	9	15	0	0	0	0	0	0
Po180	0	2	0	0	3	0	0	0	1	77

Pre=pretreatment

Po= post-treatment

ศูนย์วิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย

Table 13 Horizontal counts of locomotor activity of VPM (200mg/kg B.W.) - treated mice

Times / No. mice	horizontal counts									
	1	2	3	4	5	6	7	8	9	10
Pre15	1048	983	932	884	1125	928	789	1079	800	716
Pre30	282	718	654	726	618	570	408	834	603	392
Pre45	200	392	563	390	433	383	400	506	621	263
Po15	1	1	1	1	0	0	0	1	0	0
Po30	1	0	0	4	0	0	0	0	0	0
Po45	0	0	4	4	0	0	0	0	0	0
po60	0	3	2	1	4	8	2	0	0	0
Po75	0	0	0	10	0	0	0	0	0	0
Po90	0	2	10	0	6	9	9	0	0	1
Po105	0	5	0	0	0	11	1	0	0	0
Po120	16	0	5	9	0	6	0	0	0	0
Po135	0	0	29	1	0	0	6	0	0	0
Po150	2	0	8	0	8	12	0	0	0	0
Po165	0	0	7	0	9	5	10	0	0	2
Po180	0	2	0	1	0	0	7	0	5	0

Pre=pretreatment

Po= post-treatment

ศูนย์วิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย

Effect of VPA and VPM on the release of cortical amino acid neurotransmitters

Table 14 Total amount of aspartate within 180 min after injection

Group	count	The Mean	Standard deviation	Standard Error of the Mean
NSS	5	100.35	4.94	2.21
PEG400	5	73.97	20.5	9.17
VPA100	5	79.56	28.42	12.7
VPA250[a]	5	53.32	33.58	15.02
VPM100[a]	5	54.01	12.17	5.44
VPM200[a]	5	51.09	11.3	5.06

Table 15 Total amount of glutamate within 180 min after injection

Group	count	The Mean	Standard deviation	Standard Error of the Mean
NSS	5	99.814	3.15	1.41
PEG400	5	73.19	10.98	4.91
VPA100[a]	5	61.3	27.2	12.16
VPA250[a,b]	5	33.226	28.91	12.93
VPM100[a]	5	49.64	30.02	13.42
VPM200[a,b]	5	42.17	8.99	4.02

[a] $p < 0.05$ denote statistically significant from NSS

[b] $p < 0.05$ denote statistically significant from PEG400

Table 16 Total amount of glycine within 180 min after injection

Group	count	The Mean	Standard deviation	Standard Error of the Mean
NSS	5	99.51	4.06	1.81
PEG400	5	91.9	19.33	8.64
VPA100	5	70.26	28.2	12.61
VPA250	5	80.79	32.37	14.47
VPM100[a,b,c,d]	5	44.23	15.95	7.13
VPM200	5	87.15	15.95	16.57

Table 17 Total amount of GABA within 180 min after injection

Group	count	The Mean	Standard deviation	Standard Error of the Mean
NSS	5	99.59	11.46	5.13
PEG400	5	81.71	14.15	6.33
VPA100	5	71.09	32.53	14.54
VPA250	5	69.48	28.19	12.61
VPM100[a,d]	5	61.04	12.87	5.6
VPM200	5	95.73	25.44	11.37

[a] $p < 0.05$ denote statistically significant from NSS

[b] $p < 0.05$ denote statistically significant from PEG400

[c] $p < 0.05$ denote statistically significant from VPA250mg

[d] $p < 0.05$ denote statistically significant from VPM200mg

Amount of aspartate at various times

Table 18 (20min after injection)

Group	count	The Mean	Standard deviation	Standard Error of the Mean
NSS	5	101.2	11.77	5.26
PEG400	5	65.23	22.98	10.27
VPA100	5	80.83	35.54	15.89
VPA250[a]	5	49.99	41.97	18.76
VPM100[a]	5	58.04	21.82	9.76
VPM200[a]	5	60.23	17.67	7.9

Table 19 (40min after injection)

Group	count	The Mean	Standard deviation	Standard Error of the Mean
NSS	5	100.09	9.43	4.22
PEG400	5	68.42	37.51	16.77
VPA100	5	80.36	39.35	17.599
VPA250[a]	5	52055	42.95	19.21
VPM100[a]	5	49.91	20.34	9.09
VPM200[a]	5	49.94	20.52	9.17

Table 20 (60min after injection)

Group	count	The Mean	Standard deviation	Standard Error of the Mean
NSS	5	98.19	14.39	6.44
PEG400	5	69.02	39.03	17.46
VPA100	5	68.14	26.89	12.03
VPA250[a]	5	44.03	25.2	11.27
VPM100[a]	5	50.05	21.45	9.59
VPM200[a]	5	56.69	31.26	13.98

[a] $p < 0.05$ denote statistically significant from NSS

Table 21 (80 min after injection)

Group	count	The Mean	Standard deviation	Standard Error of the Mean
NSS	5	97.62	10.67	4.7
PEG400	5	71.08	28.76	12.85
VPA100	5	78.95	43.36	19.39
VPA250[a]	5	39.26	30.21	13.51
VPM100[a]	5	55	28.67	12.82
VPM200[a]	5	45.99	19.21	8.59

Table 22 (100min after injection)

Group	count	The Mean	Standard deviation	Standard Error of the Mean
NSS	5	100.05	12.29	5.5
PEG400	5	74.22	31.91	14.27
VPA100	5	86.8	38.14	17.06
VPA250	5	57.91	42.05	18.81
VPM100	5	68.42	9.45	4.22
VPM200[a]	5	55.46	27.4	12.25

Table 23 (120min after injection)

Group	count	The Mean	Standard deviation	Standard Error of the Mean
NSS	5	101.63	6.13	2.74
PEG400	5	83.78	31.38	14.04
VPA100	5	81.38	30.7	13.73
VPA250[a]	5	55.89	39.47	17.65
VPM100[a]	5	54.84	14.47	6.47
VPM200[a]	5	43.75	30.2	13.5

[a] $p < 0.05$ denote statistically significant from NSS

Table 24 (140min after injection)

Group	count	The Mean	Standard deviation	Standard Error of the Mean
NSS	5	101.37	2.71	1.21
PEG400	5	83.47	27.59	12.34
VPA100	5	75.29	23.31	10.42
VPA250[a]	5	60.6	37.87	16.94
VPM100[a,b,c]	5	41.37	8.11	3.63
VPM200[a,b,c]	5	32.7	17.58	7.86

Table 25 (160min after injection)

Group	count	The Mean	Standard deviation	Standard Error of the Mean
NSS	5	101.36	3.04	1.36
PEG400	5	74.79	27.49	12.29
VPA100	5	84.98	32.52	14.54
VPA250[a]	5	60.05	36.83	16.47
VPM100[a,c]	5	49.14	11.45	5.12
VPM2000[a,c]	5	45.34	12.65	5.66

Table 26 (180min after injection)

Group	count	The Mean	Standard deviation	Standard Error of the Mean
NSS	5	101.70	12.94	5.79
PEG400	5	75.77	27.77	12.42
VPA100	5	79.34	23.56	10.34
VPA250[a]	5	59.55	36.04	16.11
VPM100[a]	5	59.32	29.21	13.06
VPM200	5	69.74	18.08	8.09

[a] $p < 0.05$ denote statistically significant from NSS

[b] $p < 0.05$ denote statistically significant from PEG400

[c] $p < 0.05$ denote statistically significant from VPA100mg

Amount of glutamate at various times

Table 27 (20min after injection)

Group	count	The Mean	Standard deviation	Standard Error of the Mean
NSS	5	101.86	21.19	9.48
PEG400[a]	5	59.61	32.74	14.64
VPA100[a]	5	55.46	31.86	14.25
VPA250[a]	5	41.27	39.23	17.54
VPM100[a]	5	40.53	31.61	14.14
VPM200[a]	5	45.43	24.76	11.07

Table 28 (40min after injection)

Group	count	The Mean	Standard deviation	Standard Error of the Mean
NSS	5	100.76	3.54	1.5
PEG400[a]	5	65.01	30.54	13.66
VPA100[a]	5	50.4	24.66	11.03
VPA250[a]	5	35.8	32.58	14.57
VPM100[a]	5	44.89	30.51	13.65
VPM200[a]	5	55.53	14.47	6.47

Table 29 (60min after injection)

Group	count	The Mean	Standard deviation	Standard Error of the Mean
NSS	5	96.73	5.72	2.55
PEG400[a]	5	63.4	19.01	8.5
VPA100[a]	5	54.19	26.26	11.74
VPA250[a]	5	32.58	29.99	13.41
VPM100[a]	5	36.97	29.93	13.39
VPM200[a]	5	44.31	25.26	11.29

[a] $p < 0.05$ denote statistically significant from NSS

Table 30 (80min after injection)

Group	count	The Mean	Standard deviation	Standard Error of the Mean
NSS	5	98.47	5.22	2.33
PEG400	5	74.71	8.8	3.94
VPA100[a]	5	52.39	22.56	10.09
VPA250[a,b]	5	28.04	25.07	11.3
VPM100[a,b]	5	36.28	27.06	12.10
VPM200[a,b]	5	37.39	16.12	7.21

Table 31 (100min after injection)

Group	count	The Mean	Standard deviation	Standard Error of the Mean
NSS	5	101.98	10.01	4.47
PEG400[a]	5	70.29	6.04	2.7
VPA100[a]	5	62.71	26.63	11.91
VPA250[a,b]	5	35.92	32.99	14.75
VPM100[a]	5	48.37	32.98	14.75
VPM200[a]	5	47.26	10.42	4.66

Table 32 (120min after injection)

Group	count	The Mean	Standard deviation	Standard Error of the Mean
NSS	5	98.58	6.76	3.02
PEG400	5	86.01	18.11	8.10
VPA100[a]	5	63.09	28.93	12.93
VPA250[a,b]	5	31.07	26.53	11.86
VPM100[a]	5	55.51	31.45	14.07
VPM200[a,b]	5	38.31	13.09	5.85

[a] $p < 0.05$ denote statistically significant from NSS

[b] $p < 0.05$ denote statistically significant from PEG400

Table 33 (140min after injection)

Group	count	The Mean	Standard deviation	Standard Error of the Mean
NSS	5	96.81	5	2.24
PEG400	5	81.46	18.09	8.09
VPA100	5	66.99	36.88	16.49
VPA250[a,b]	5	32.04	31.88	14.26
VPM100	5	62.07	39.41	17.62
VPM200[a,b]	5	34.75	14.29	6.39

Table 34 (160min after injection)

Group	count	The Mean	Standard deviation	Standard Error of the Mean
NSS	5	100.15	6.48	2.89
PEG400	5	75.16	21.95	9.81
VPA100	5	75.14	36.15	16.16
VPA250[a,b,c]	5	28.88	23.99	10.73
VPM100[a]	5	59.72	34.63	15.48
VPM200[a]	5	39.23	27.1	12.12

Table 35 (180min after injection)

Group	count	The Mean	Standard deviation	Standard Error of the Mean
NSS	5	100.25	16.43	7.35
PEG400	5	83.09	12.88	5.76
VPA100	5	71.31	43.47	19.44
VPA250[a,b]	5	33.42	31.26	13.98
VPM100	5	62.43	38.04	17.01
VPM200[a,b]	5	37.31	30.63	13.7

[a] $p < 0.05$ denote statistically significant from NSS

[b] $p < 0.05$ denote statistically significant from PEG400

[c] $p < 0.05$ denote statistically significant from VPA100mg

Amount of glycine at various time

Table 36 (20min after injection)

Group	count	The Mean	Standard deviation	Standard Error of the Mean
NSS	5	100.49	4.64	2.07
PEG400	5	86.62	23.91	10.69
VPA100	5	75.25	35.55	15.89
VPA250	5	93.95	36.08	16.14
VPM100[a,b,d]	5	47.06	22.28	9.96
VPM200	5	78.87	29.71	13.29

Table 37 (40min after injection)

Group	count	The Mean	Standard deviation	Standard Error of the Mean
NSS	5	95.14	4.84	2.15
PEG400	5	98.48	42.72	19.11
VPA100	5	69.74	25.22	11.28
VPA250	5	87.97	30.94	13.84
VPM100[a,b,c]	5	42.23	13.71	6.13
VPM200	5	86.53	35.29	15.78

[a] $p < 0.05$ denote statistically significant from NSS

[b] $p < 0.05$ denote statistically significant from PEG400

[b] $p < 0.05$ denote statistically significant from VPA250mg

[c] $p < 0.05$ denote statistically significant from VPM200mg

Table 38 (60min after injection)

Group	count	The Mean	Standard deviation	Standard Error of the Mean
NSS	5	99.23	13.96	6.2
PEG400	5	78.64	32.79	14.66
VPA100	5	67.61	34.48	15.42
VPA250	5	87.32	33.83	15.12
VPM100[a,b,c,d]	5	47.31	27.11	12.13
VPM200	5	82.84	31.43	14.0

Table 39 (80min after injection)

Group	count	The Mean	Standard deviation	Standard Error of the Mean
NSS	5	100	5.89	2.6
PEG400	5	86.32	26.85	12.01
VPA100	5	67.08	22.36	10
VPA250	5	71.2	26.47	11.84
VPM100[a,b]	5	46.76	24.6	11.0
VPM200	5	72.62	41.27	18.45

[a] $p < 0.05$ denote statistically significant from NSS

[b] $p < 0.05$ denote statistically significant from PEG400

[c] $p < 0.05$ denote statistically significant from VPA250mg

[d] $p < 0.05$ denote statistically significant from VPM200mg

Table 40 (100min after injection)

Group	count	The Mean	Standard deviation	Standard Error of the Mean
NSS	5	98.77	8.86	3.96
PEG400	5	96.57	31.23	13.96
VPA100	5	77.06	32.72	14.63
VPA250	5	86.97	39.84	17.82
VPM100[a]	5	49	33.03	14.77
VPM200	5	93.63	43.15	19.29

Table 41 (120min after injection)

Group	count	The Mean	Standard deviation	Standard Error of the Mean
NSS	5	100.52	8.6	3.88
PEG400	5	99.39	30.63	13.7
VPA100	5	64.07	28.51	12.75
VPA250	5	80.06	35.7	15.96
VPM100[a,b,c,d]	5	42.15	8.43	3.77
VPM200	5	94.36	30.59	13.68

[a] $p < 0.05$ denote statistically significant from NSS

[b] $p < 0.05$ denote statistically significant from PEG400

[c] $p < 0.05$ denote statistically significant from VPA250mg

[d] $p < 0.05$ denote statistically significant from VPM200mg

Table 42 (140min after injection)

Group	count	The Mean	Standard deviation	Standard Error of the Mean
NSS	5	98.95	13.84	6.19
PEG400	5	94.23	16.31	7.29
VPA100	5	66.63	42.39	18.96
VPA250	5	78.74	43.04	19.24
VPM100[a,b,d]	5	36.1	7.82	2
VPM200	5	90.1	43.23	19.33

Table 43 (160min after injection)

Group	count	The Mean	Standard deviation	Standard Error of the Mean
NSS	5	100.02	9.59	4.29
PEG400	5	92.48	22.92	10.25
VPA100	5	693.92	41.03	18.35
VPA250	5	69.95	39.95	17.87
VPM100[a,b,c]	5	40.67	17.72	7.9
VPM200	5	94.05	42.47	18.99

[a] $p < 0.05$ denote statistically significant from NSS

[b] $p < 0.05$ denote statistically significant from PEG400

[c] $p < 0.05$ denote statistically significant from VPA250mg

[d] $p < 0.05$ denote statistically significant from VPM200mg

Table 44 (180min after injection)

Group	count	The Mean	Standard deviation	Standard Error of the Mean
NSS	5	102.42	20.02	8.95
PEG400	5	92.36	12.43	5.55
VPA100	5	74.93	42.47	18.99
VPA250	5	70.92	41.42	18.52
VPM100[a]	5	46.75	33.2	14.85
VPM200	5	91.35	46.96	21

[a] $p < 0.05$ denote statistically significant from NSS

Amount of GABA at various times

Table 45 (20min after injection)

Group	count	The Mean	Standard deviation	Standard Error of the Mean
NSS	5	101.77	20.60	9.21
PEG400	5	80.21	24.48	10.95
VPA100	5	71.63	36.93	16.53
VPA250	5	100.40	40.78	18.24
VPM100	5	68.22	32.80	14.67
VPM200	5	91.09	13.86	6.20

Table 46 (40min after injection)

Group	count	The Mean	Standard deviation	Standard Error of the Mean
NSS	5	98.59	10.52	4.71
PEG400	5	87.25	33.62	15.04
VPA100	5	83.66	52.09	23.29
VPA250	5	94.22	46.75	20.90
VPM100	5	60.32	19.05	8.52
VPM200	5	111.92	34.35	15.36

Table 47 (60min after injection)

Group	count	The Mean	Standard deviation	Standard Error of the Mean
NSS	5	98.59	22.54	10.08
PEG400	5	82.91	20.69	9.25
VPA100	5	89.91	64.79	28.98
VPA250	5	90.57	46.42	31.83
VPM100	5	58.68	15.76	7.05
VPM200	5	93.80	26.69	11.94

Table 48 (80min after injection)

Group	count	The Mean	Standard deviation	Standard Error of the Mean
NSS	5	101.66	4.40	1.97
PEG400	5	81.63	41.36	18.50
VPA100	5	83.49	41.58	18.59
VPA250	5	74.71	31.83	14.24
VPM100	5	61.02	14.84	6.64
VPM200	5	79.42	29.03	12.98

Table 49 (100min after injection)

Group	count	The Mean	Standard deviation	Standard Error of the Mean
NSS	5	96.94	5.74	2.56
PEG400	5	69.85	11.63	5.20
VPA100	5	94.11	50.19	22.45
VPA250	5	81.69	42.56	19.04
VPM100	5	67.09	16.26	7.27
VPM200	5	91.43	18.80	8.41

Table 50 (120min after injection)

Group	count	The Mean	Standard deviation	Standard Error of the Mean
NSS	5	99.69	8.03	3.59
PEG400	5	83.67	16.84	7.53
VPA100	5	68.37	38.47	17.21
VPA250	5	90.78	70.122	31.36
VPM100	5	53.75	23.63	10.57
VPM200	5	107.19	30.20	13.51

Table 51 (140min after injection)

Group	count	The Mean	Standard deviation	Standard Error of the Mean
NSS	5	101.43	19.01	8.50
PEG400	5	82.99	20.24	9.05
VPA100	5	66.73	66.81	29.88
VPA250	5	96.72	71.98	32.19
VPM100	5	50.74	9.85	4.40
VPM200	5	95.58	46.97	21.00

Table 52 (160min after injection)

Group	count	The Mean	Standard deviation	Standard Error of the Mean
NSS	5	100.85	19.24	8.60
PEG400	5	79.71	11.50	5.14
VPA100	5	64.25	55.73	24.92
VPA250	5	77.98	50.15	53.89
VPM100	5	61.59	21.45	9.59
VPM200	5	93.04	29.72	13.29

Table 53 (180min after injection)

Group	count	The Mean	Standard deviation	Standard Error of the Mean
NSS	5	97.37	18.54	8.29
PEG400	5	87.12	23.59	10.55
VPA100	5	70.16	35.60	15.92
VPA250	5	79.34	53.89	24.10
VPM100	5	54.19	26.46	11.83
VPM200	5	98.07	27.16	12.15

ศูนย์วิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย

Curriculum vitae

Miss Taunjai Numthongsakun was born on 23 rd April 1969, in Rayong, Thailand. She had graduated with Bachelor in Nursing from Faculty of Nurse, Mahidol University in 1996. After graduation, she had worked as a nurse at Siriraj Hospital.

ศูนย์วิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย