



REFERENCES

1. Kaplan, C., G. S. Turner, and D. A. Warrell, " Rabies in Man : Natural History, Pathology, and Illustrative Case Histories, " Rabies : The Facts (Kaplan, C., ed.), pp. 21-48, Oxford University Press. Oxford, 2nd ed., 1986.
2. อมรค์ วิจารณ์กรม, " สถิติจำนวนผู้เสียชีวิตด้วยโรคพิษสุนัขบ้าในประเทศไทย ของกระทรวงสาธารณสุขระหว่างปี พศ. 2472-2521, " พิมพ์ใน ความจำเป็นของสัตว์แพทย์สาธารณสุขกับโรคสัตว์ติดคนในประเทศไทย , หน้า 62, 2522.
3. Kaplan, C., G. S. Turner, and D. A. Warrell. " The Virus " Rabies : The Facts (Kaplan, C., ed.), pp. 1-7, Oxford University Press. Oxford, 2nd ed., 1986.
4. Bouiger. L. R., and J. S. Porterfield, " Isolation of a Virus from Nigerian Fruit Bats, " Trans. R. Soc. Trop. Med. Hyg. , 52, 421-424, 1958.
5. Shope, R. E., F. A. Murphy, A. K. Harrison, D. R. Causey, G. E. Kemp, D. I. H. Simpson, and D. L. Moore, " Two African Viruses Serologically and Morphologically Related to Rabies Virus, " J. Virol. 6, 690-692, 1970.
6. Meredith, C. D., A. P. Roussouw, and H. van Praag Kock, " An Unusual Case of Human Rabies Thought to be of Chiropteran Origin, " S. Afr. Med. J. . 45, 767-769, 1971.
7. Schmidt, J. R., M. C. Williams, M. Lule, A. Mivule, and E. Mujomba, " Viruses Isolated from Mosquitoes. Collected in the Southern Sudan and Ethiopia, " E. Afr. Res. Inst. Rep. , 15, 24-26, 1965.

8. Kemp, G. E., V. H. Lee, D. L. Moore, R. E. Shope, O. R. Causey, and F. A. Murphy, "Kotonkan, A New Rhabdovirus Related to Mokola Virus of the Rabies Serogroup, " A. J. Epidemiol. , 98, 43-49, 1973.
9. Porterfield, J. S., D. H. Hill, and A. D. Morris, " Isolation of a Virus from the Brain of a Horse with " Staggers " in Nigeria, " Br. Vet. J. , 114, 425-433, 1958.
10. Wiktor, T. J, " Is a Special Vaccine Required Against Rabies-Related Viruses and Variants of Rabies?, " Improvements in Rabies Post-Exposure Treatments (Vodopija, I., K. G. Nicholson, S. Smerdel and U. Bijok, eds.) pp. 9-14, Pub. Zagreb Inst. of Public Health ,1985.
11. Houff, S. A., R. C. Burton, R. W. Wilson, T. E. Henson, W. T. London, G. M. Baer. L. J. Anderson, W. G. Winkler, D. L. Madden, and J. L. Sever, " Human to Human Transmission of Rabies Virus by Corneal Transplant, " N. Eng. J. Med. , 300, 603-604, 1979.
12. Kaplan, C., G. S. Turner and D. A. Warrell, " Rabies in Animals. " Rabies : The Facts (Kaplan C., ed.), pp. 68-70, Oxford University Press. Oxford, 2nd ed., 1986.
13. Iwasaki, Y., W. Gerhard, and H. F. Clark, " Role of Host Immune Response in the Development of either Encephalitic or Paralytic Disease after Experimental Rabies Infection in Mice, " Infect. Immun. , 18, 220-225, 1977.
14. Smith, J. S., C. L. McClelland, F. L. Reid, et al., " Dual Role of the Immune Response in Street Rabies Infection of Mice, " Infect. Immun. . 35, 213-221, 1982.

15. Tignor, G. H., R. E. Shope, R. K. Gershon, et al., " Immunopathologic Aspects of Infection with Lagos Bat Virus of the Rabies Serogroup, " J. Immunol. 112, 260-265, 1974.
16. Held, J. R., E. J. Tierkel, and J. H. Steele, " Rabies in Man and Animals in the United States, 1946-1965, " Publ. Hlth. Rep. , 82, 1009-1018, 1967.
17. Chopra, J. S., A. K., Banerjee, J. M. K. Murthy, and S. R. Pal, " Paralytic Rabies. A Clinico-Pathological Study, " Brain. , 103, 789-802, 1980.
18. Sheahan, B. J., P. N. Barrett, and G. J. Atkins, " Demyelination in Mice Resulting from Infection with a Mutant of Semliki Forest Virus, " Acta. Neuropathol. , 53, 129-136, 1981.
19. Murphy, F. A., " Rabies Pathogenesis. Brief review, " Arch. Virol. . 54, 279-297, 1977.
20. Johnson, R. T., " The Pathogenesis of Experimental Rabies, " Rabies (Nogano, Y., and F. M. Davenport, eds.), pp. 59-75, University Park Press, Baltimore, 1971.
21. Tangchai, P., D. Yenbutr, and A. Vejjajiva, " Central Nervous System Lesions in Human Rabies. A Study of 24 Autopsy Cases, " J. Med. Ass. Thailand. . 53, 471-488, 1970.
22. Sokol, F., E. Kuwert, T. J. Wiktor, K. Hummeler, and H. Koprowski, " Purification of Rabies Virus Grown in Tissue Culture, " J. Virol. . 2, 836-849, 1968.
23. Emerson, S. U., " Rhabdovirus, " Virology (Fields, B. N., et al., eds.), pp. 1119-1132, Raven Press, New York, 1985.

24. Wiktor T. J., E. Gyorgy, H. D. Schlumberger, et al., " Antigenic Properties of Rabies Virus Components, " J. Immunol. , 110, 269-276, 1973.
25. Cox, J. H., B. Dietzschold, and L. G. Schneider, " Rabies Virus Glycoprotein. II. Biological and Serological Characterization, " Infect. Immun. , 16, 754-759, 1977.
26. Dietzschold, B., T. J. Wiktor, R. Macfarland, et al., " Antigenic Structure of Rabies Virus Glycoprotein: Ordering and Immunological Characterization of The Large CNBr Cleavage Fragments, " J. Virol. . 44, 595-602, 1982.
27. Lafon, M., and T. J. Wiktor, " Antigenic Sites on the ERA Rabies Virus Nucleoprotein and Non-structural Protein, " J. Gen. Virol. , 66, 2125-2133, 1985.
28. Dietzschold, B., M. Lafon, H. Wang, et al., " Localization and Immunological Characterization of Antigenic Domains of the Rabies Virus Internal N and NS Protein, " Virus Research. . 8, 103-125, 1987.
29. Perrin, P., P. Versmissi, J. F. Delangneau, et al., " The Influence of the Type Immunosorbent on Rabies Antibody EIA; Advantages of Purified Glycoprotein over whole Virus, " J. Biol. Stand. . 14, 995-1020, 1986.
30. Negri, A., " Beitrag zum Stadium der Aetiologie der Tollwuth, Z. Hyg. Infektionskr. 43, 507-528, 1903.
31. Matsumoto, S., " Electron Microscopy of Nerve Cells Infected with Street Rabies Virus, " Virology. 17, 198, 1962.
32. Miyamoto, K., and S. Matsumoto, " Comparative Studies between Pathogenesis of Street and Fixed Rabies Infection, " J. Exp. Med. . 125, 447-456, 1967.

33. Gonzalez-Angulo, Al, H. Marquez-Monter, A. Feria-Velasco, and B. J. Zavala, " The Ultrastructure of Negri Bodies Purkinje Neurons in Human Rabies, " Neurology, 20, 323-328, 1970.
34. Constantine, D. G., " An Update List of Rabies Infected Bats in North America, " J. Wildlife Dis. 15, 347-349, 1979.
35. Winkler, W. G., T. R. Fashinell, L. Leffingwell, et al., " Airborne Rabies Transmission in a Laboratory Worker, " JAMA, 226, 1219-1221, 1973.
36. Hattwick, M. A. W., and M. B. Gregg. " The Disease in Man, " The Natural History of Rabies (Baer, G. M., ed.), Vol. I, pp. 281-303, Academic Press, New York, 1975.
37. Martell, M. A., F. Ceron Montes, and B. Raul Alcocer, " Transplacental Transmission of Bovine Rabies after Natural Infection, " J. Infect. Dis. 127, 291-293, 1973.
38. Ginsberg, H. S., " Rhabdoviruses, " Microbiology (Davis, B. D., R. Dulbecco, H. N. Eisen, and H. S. Ginsberg, eds.), pp. 1168-1175, Harper & Row, Publishers, Inc., 3rd ed., 1980.
39. Hurst, E. W., and J. L. Pawan, " An Outbreak of Rabies in Trinidad without History of Bites and with the Symptoms of Acute Ascending Myelitis, " Lancet. ii, 622-628, 1931.
40. Knutti, R. E., " Acute Ascending Paralysis and Myelitis due to the Virus of Rabies, " JAMA, 93, 754-758, 1929.

41. Hemachudha T., K. Phanthumchinda, P. Phanuphak, et al.,
" Myoedema as a Clinical Sign in Paralytic Rabies, "
Lancet. i, 1210, 1987.
42. Hattwick, M. A. W., T. T. Weiss, J. Stechshulte, et al., " Recovery
from Rabies. A Case Report, " Ann. Int. Med., 76,
931-942, 1972.
43. Porras, C., J. J. Barboza, E. Fenzalida, et al., " Recovery
from Rabies in Man, " Ann. Int. Med., 85, 44-48,
1976.
44. " Rabies in a Laboratory Worker, " Morbidity and Mortality
Weekly Report. 26, 183, 1977.
45. Beran, G. W., " Rabies and Infections by Rabies-Related
Viruses, " Handbook Series in Zoonoses (Steele, J. H.,
ed.), Vol. II, pp. 57-121, CRC Press, 1979.
46. Vaughn, J. B., P. Gerhardt, and K. W. Newell, " Excretion of
Street Rabies Virus in Saliva of Dogs, " JAMA, 193,
363-368, 1965.
47. Murphy, F. A., S. P. Bauer, A. K. Harrison, et al., " Comparative
Pathogenesis of Rabies and Rabies-like Viruses, Viral
Infection and Transit from Inoculation Site to the
Central Nervous System, " Lab. Invest., 28, 361-376,
1973.
48. Murphy, F. A., A. K. Harrison, W. C. Winn, et al., " Comparative
Pathogenesis of Rabies and Rabies-like Viruses,
Infection of the Central Nervous System and
Centrifugal Spread of Virus to Peripheral Tissues, "
Lab. Invest., 29, 1-16, 1973.

49. Murphy, F. A., and S. P. Bauer, " Early Street Virus Infection in Striated Muscle and Later Progression to the Central Nervous System, " Intervirology, 3, 256-268, 1974.
50. Harrison, A. K., and F. A. Murphy, " Lyssavirus Infection of Muscle Spindles and Motor End Plates in Striated Muscles of Hamster, " Arch. Virol. , 57, 167-175, 1978.
51. Lentz, T. L., and T. G. Burrage, " Is the Acetylcholine Receptor a Rabies Virus Receptor? " Science, 215 , 182-184, 1982.
52. Watson, H. D., G. H. Tignor, and A. L. Smith, " Entry of Rabies Virus into Peripheral Nerve of Mice, " J. Gen. Virol., 50, 371-381, 1981.
53. Tignor, G. H., A. L. Smith, and R. E. Shope, " Utilization of Host Proteins as Virus Receptor, " Concepts in Viral Pathogenesis. (Notkins, A. L., and M. B. A. Oldstone, eds.), pp. 109-116, Springer-Verlag, New York, 1984.
54. Burrage, T. C., G. H. Tignor, and A. L. Smith , " Rabies Virus Binding at Neuromuscular Junctions, " Virus Research, 2, 273-279, 1985.
55. Lentz, T. L., P. L. Wilson, E. Hawrot, et al., " Amino Acid Sequence Similarity between Rabies Virus Glycoprotein and Snake Venom Curaremimetic Neurotoxins, " Science, 226, 847-848, 1984.
56. Baer, G. M., and W. F. Cleary, " A Model in Mice for the Pathogenesis and Treatment of Rabies, " J. Infect. Dis. , 125, 520-527, 1972.

57. Smith, J. S., C. L. McClelland, F. L. Reid, et al., " Dual Role of the Immune Response in Street Rabies Infection of Mice, " Infect. Immun. . 35, 213-221, 1982.
58. Bijlenga, G., and T. Heaney, " Postexposure Local Treatment of Mice Infected with Rabies with Two Axonal Inhibitors, Colchicine and Vinblastine, " J. Gen. Virol. , 39, 381-385, 1978.
59. Tsiang, H., " Evidence for an Intraxonal Transport of Fixed and Street Rabies Virus, " J. Neuropathol. Exp. Neurol. , 38, 286-297, 1979.
60. Baer, G. M, T. R. Shanthaveerappa , and G. Bourne, " Studies on the Pathogenesis of Fixed Rabies Virus in Rats," Bull. W. H. O. , 33, 783. 794, 1965.
61. Schneider, L. G., " Spread of Virus from the Central Nervous System, " The Natural History of Rabies. (Baer. G. M., ed.), Vol. I, pp. 273-301, Academic Press, New York, 1975.
62. Perl, D. P., " The Pathology of Rabies in the Central Nervous System, " The Natural History of Rabies (Baer, G. M., ed.), Vol. I, pp. 236-272, Academic Press, New York, 1975.
63. Iwasaki, Y., and H. F. Clark, " Cell to Cell Transmission of Virus in the Central Nervous System: II. Experimental Rabies in the Mouse. Lab. Invest. , 33, 391-399, 1975.
64. Iwasaki, Y., S. Ohtani, and H. F. Clark, " Maturation of Rabies Virus by Budding from Neuronal Cell Membrane in Suckling Mouse Brain, " J. Virol. , 15 , 1020-1023, 1975.

65. Charlton, K. M., and G. A. Casey, " Experimental Rabies in Skunks. Immunofluorescence, Light and Electron Microscopic Studies, " Lab. Invest., 41, 36-44, 1979.
66. Gillet, J. P., P. Derer, and H. Tsiang, " Axonal Transport of Rabies Virus in the Central Nervous System of the Rat, " J. Neuropathol. Exp. Neurol., 45, 619-634, 1986.
67. Johnson, R. T., " Experimental Rabies : Studies of Cellular Vulnerability and Pathogenesis using Fluorescent Antibody Staining, " J. Neuropathol. Exp. Neurol., 24, 662-674, 1965.
68. Johnson, R. T., " Viral Infections of the Nervous System, " Raven Press, New York, 1982.
69. Matsumoto, S., " Electron Microscopy of Central Nervous System Infections, " The Natural History of Rabies. (Bear, G. M., ed.), Vol. I, pp. 217-233, Academic Press, New York, 1975.
70. Sung, J. H., M. Hayano, A. R. Mastri, et al., " A Case of Human Rabies and Ultrastructure of the Negri Body, " J. Neuropathol. Exp. Neurol., 35, 541-559, 1976.
71. Tsiang, H., A. Koulakoff, B. Bizzini, et al., " Neurotropism of Rabies Virus, J. Neuropathol. Exp. Neurol., 42, 439-452, 1983.
72. Superti, F., M. Derer, and H. Tsiang, " Mechanism of Rabies Virus Entry into CER Cells, " J. Gen. Virol., 65, 781-789, 1981.

73. Superti, F., B. Hautecoeur, M. J. Morelec, et al.,
" Involvement Gangliosides in Rabies Virus Infection, "
J. Gen. Virol., 67, 47-56, 1986.
74. Munzel, P., and K. Koschel, " Rabies Virus Decreases Agonist
Binding to Opiate Receptors of Mouse Neuroblastoma-
Rat Glioma Hybrid Cells 108-cc-15, " Biochem.
Biophys. Res. Comm., 10, 1241-1250, 1981.
75. Koschel, K., and P. Munzel, " Inhibition of Opiate Receptor
Mediated Signal Transmission by Rabies Virus in
Persistently Infected NG-108-15 Mouse Neuroblastoma
-Rat Glioma Hybrid Cells, " Proc. Natl. Acad. Sci.
USA., 81, 950-954, 1984.
76. Tsiang, H., " Neuronal Function Impairment in Rabies Infected
Rat Brain, " J. Gen. Virol., 61, 277-281, 1982.
77. Tsiang, H., " An in vitro Study of Rabies Pathogenesis, "
Bull. Inst. Pasteur., 83, 41-56, 1985.
78. Gourmelon, P., D. Briet , L. Court, and H, Tsiang,
" Electrophysiological and Sleep Alterations in
Experimental Mouse Rabies, " Brain Res., 398, 128-
140, 1986.
79. Baer , G. M., T. R. Shantha, and G. H. Bourne, " The Pathogenesis
of Street Rabies Virus in Rats, " Bull. W. H. O., 38,
119-125, 1968.
80. Yasmuth, C., K. E. Nelson, T. Laima, et al., " Prevalence of
Abortive Canine Rabies in Chiang Mai, Thailand, "
J. Med. Ass. Thailand., 66, 169-174, 1983.
81. Starr, L. E., T. F. Sellers, and E. J. Sunkes, " Apparent
Recovery of Dog from Rabies, " J. Amer. Vet. Med. Ass.,
121, 296, 1952.

82. Stamm, D. D., R. E. Kissling, and M. E. Eidson, " Experimental Rabies Infection in Insectivorous Bats, " J. Infect. Dis., 98, 10-14, 1956.
83. Bell, J. F., " Abortive Rabies Infection. I. Experiment Production in White Mice and General Discussion, " J. Infect. Dis. .114 , 249-257, 1964.
84. Doege, T. C., and R. L. Northop, " Evidence for Inapparent Rabies Infection, " Lancet. ii, 826-829, 1974.
85. Bell, J. F., " Latency and Abortive Rabies, " The Natural History of Rabies. (Baer. G. M., ed.), Vol. I, pp. 331-354, Academic Press, New York, 1975.
86. Fekadu, M., and G. M. Baer, " Recovery from Clinical Rabies of 2 dogs Inoculated with a Rabies Virus Strain from Ethiopia, " Am. J. Vet. Res. , 41, 1632-1634, 1980.
87. Lodmell, D. L., and L. C. Ewalt, " Pathogenesis of Street Rabies Virus Infections in Resistant and Susceptible Strains of Mice, J. Virol., 55, 788-795, 1985.
88. Templeton, J. W., C. Holmberg, T. Garber, et al., : Genetic Control of Serum Neutralizing Antibody Response to Rabies Vaccination and Survival after a Rabies Challenge Infection in Mice " , J. Virol., 59, 98-102, 1986.
89. Prabhakar, B. S., N. F. Parkes, and H. F. Clark, " Altered Expression of Rabies Virus Antigenic Determinants Associated with Chronic Infection and Virulence, " J. Gen. Virol., 64, 251-254, 1982.

90. Dietzschold, B., W. H. Wunner, T. J. Wiktor, A. D. Lopes, M. Lafon, C. Smith, and H. Koprowski, " Characterization of an Antigenic Determinant of the Glycoprotein which Correlates with Pathogenicity of Rabies Virus, " Proc. Natl. Acad. sci. U. S. A. , 80, 70-74, 1983.
91. Coulon, P., P. E. Rollin, M. Aubert, et al., " Molecular Basis of Rabies Virus Virulence. I. Selection of Avirulent Mutants of the CVS Strain with Anti-G Monoclonal Antibodies, " J. Gen. Virol. , 61, 97-100, 1982.
92. Coulon, P., P. E. Rollin, and A. Flamand, " Molecular Basis of Rabies Virulence. II. Identification of a Site on the CVS Glycoprotein Associated with Virulence, " J. Gen. Virol. , 64, 693-696, 1983.
93. Wunner, W. H., B. Dietzschold, and T. J. Wiktor, " Antigenic Structure of Rhabdovirus, " Immunochemistry of Viruses: The Basis for Serodiagnosis and Vaccines. (Van Regenmortel M. H. V., and R. Neurath, eds.), pp. 367-388, Elsevier, New York, 1985.
94. Seif, I., P. Coulon, P. E. Rollin, et al., " Rabies Virulence: Effect on Pathogenicity and Sequence Characterization of Rabies Virus Mutations Affecting Antigenic Site III of the Glycoprotein, " J. Virol. 53, 926-934, 1985.
95. Dietzschold, B., T. J. Wiktor, J. Q. Trojanowski, R. I. Macfarlan, W. H. Wunner, M. J. Torres-Anjel, and H. Koprowski, Differences in Cell-to-Cell Spread of Pathogenic and Apathogenic Rabies Virus in vivo and in vitro, " J. Virol. 56, 12-18, 1985.

96. Smith, J. S., " Mouse Model for Abortive Rabies Infection of the Central Nervous System, " Infect. Immun., 31, 297-308, 1981.
97. Kawai, A., and S. Matsumoto, " Interfering and Noninterfering Defective Particles Generated by Rabies Small Plaque Variant Virus, " Virology. 76, 60-71, 1977.
98. Wiktor, T. J., B. Dietzschold, R. N. Leamnson, et al., " Induction and Biological Properties of Defective Interfering Particles of Rabies Virus, " J. Virol., 21, 626-635, 1977.
99. Marcovistz, R., A. G. Hovanessian, and H. Tsiang, " Distribution of Rabies Virus, Interferon and Interferon-Mediated Enzymes in the Brain of Virus Infected Rats, " J. Gen. Virol., 65, 995-997, 1984.
100. Miller, A., H. C. Morse III, J. Winkelstein. et al., " The Role of Antibody in Recovery from Experimental Rabies. I. Effect of Depletion of B and T Cells, " J. Immunol., 21, 321-326, 1978.
101. Mifune, K., E. Takeuchi, P. A. Napiorkowaki, et al., " Essential Role of T Cells in the Postexposure Prophylaxis of Rabies in Mice, " Microbiol. Immunol., 25, 895-902, 1981.
102. Wiktor, T. J., " Cell Mediated Immunity and Post-exposure Protection from Rabies by Inactivated Vaccines of Tissue Culture Origin, " Develop. Biol. Std., 40, 255-264, 1987.
103. Wiktor, T. J., P. C. Doherty, and H. Koprowski, " Suppression of Cell Mediated Immunity by Street Rabies Virus, " J. Exp. Med., 145, 1617-1622, 1977.

104. Prabhakar, B. J., H. R. Fischman, and N. Nathanson, " Recovery from Experimental Rabies by Adoptive Transfer of Immune Cells, " J. Gen. Virol., 56, 25-31, 1981.
105. Shope, R. E., G. M. Bear, and W. P. Allen, " Summary of Workshop on the Immunopathology of Rabies, " J. Infect. Dis., 140, 431-435, 1979.
106. Prabhakar, B. S., and N. Nathanson, " Acute Rabies Death Mediated by Antibody, " Nature, 290, 590-591, 1981.
107. Sikes R. K., W. F. Cleary, H. Koprowski, et al. : Effective Protection of Monkeys against Death from Street Virus by Post-Exposure Administration of Tissue Culture Rabies Vaccine, " Bull. W. H. O., 45, 1-11, 1971.
108. Blancou, J., B. Andral, and L. Andral, " A Model in Mice for the Study of the Early Death Phenomenon after Vaccination and Challenge with Rabies Virus, " J. Gen. Virol., 50, 433-435, 1980.
109. Hemachudha, T., P. Phanuphak, B. Sriwanthana, et al., " Immunologic Study of Human Encephalitic and Paralytic Rabies. A Preliminary Study of 16 Patients, " Am. J. Med. 84, 673-677, 1988.
110. Tsiang, H., and J. C. Guillon, " Presence of Specific Antigens in Neuronal Cells Infected with Fixed and Street Rabies Virus Strain, " Acta Neuropathologica (Berlin), 55, 263-267, 1981.
111. Johnson, R. T., D. E. Griffin, R. L. Hirsch, et al., " Measles Encephalomyelitis-Clinical and Immunologic Studies, New Eng. J. Med ; 310, 137-141, 1984.

112. Hemachudha, T., D. E. Griffin, J. J. Giffels, et al., " Myelin Basic Protein as an Encephalitogen in Encephalomyelitis and Polyneuritis following Rabies Vaccination, " New Eng. J. Med. , 316, 369-374, 1987.
113. Hemachudha, T., P. Phanuphak, R. T. Johnson, et al., " Neurologic Complications of Semple Type Rabies Vaccine: Clinical and Immunologic studies, " Neurology, 37, 550-556, 1987.
114. Griffin, D. E., T. Hemachudha, and R. T. Johnson, " Postinfections and Postvaccinal Encephalomyelitis, " Clinical and Molecular Aspects of Viral Illnesses of the Nervous System. (Gilden D. H., H. Lipton, eds.) Boston, Martinus Nijhoff, In Press, 1988.
115. Fekadu , M., J. H. Shaddock, and G. M. Baer, " Excretion of Rabies Virus in the Saliva of Dogs, " J. Infect. Dis. , 145, 715-719, 1982.
116. Fekadu, M., J. H. Shaddock, and G. M. Baer, " Intermittent Excretion of Rabies Virus in the Saliva of a Dog Two and Six Months after It Had Recovered from Experimental Rabies, " Am. J. Trop. Med. & Hyg. . 30, 1113-1115, 1981.
117. Fekadu, M., J. H. Shaddock, F. W. Chandler, et. : " Rabies Virus in the Tonsils of a Carrier Dog, " Arch. Neurol. , 78, 37-47, 1983.
118. Dupont, J. R., and K. M. Earle. " Human Rabies Encephalitis. A Study of Forty-Nine Fatal Cases With a Review of the Literature, " Neurology, 15, 1023-1034, 1965.

119. Tangchai, P., and A. Vejajiva, " Pathology of the Peripheral Nervous System in Human Rabies. A Study of Nine Autopsy Cases, " Brain, 94, 299-306, 1971.
120. Dolman, C. L., and K. M. Charlton, , " Massive Necrosis of the Brain in Rabies, " Can. J. Neurol. Sci. , 14, 162-165, 1987.
121. Derakhshan, I., " Is the Negri Body Specific for Rabies?, " Arch. Neurol. 32, 75-79, 1975.
122. Derakhshan, I., M. Bahmanyar, S. Noorsalehi, et al., " Light Microscopical Diagnosis of Rabies. A Reappraisal, " Lancet. i, 302-303, 1978.
123. Johnson, K. P., P. T. Swoveland, and R. W. Emmons, " Diagnosis of Rabies by Immunofluorescence in Trypsin-Treated Histological Sections, " JAMA. 244, 41-43, 1980.
124. Warrell, D. A., " The Clinical Picture of Rabies in Man, " Trans. Roy. Soc. Trop. Med. Hyg., 701, 188-195, 1976.
125. Schneider, L. G., " Die Pathogenes der Tollwut bei der Maus. I. Die Virusausbreitung vom Infektionsort zum zentralnervensystem, " Zentralbl. Bakteriol. Parasitenkd. Infektionskr., Hyg. Abt. 1 : Orig., 211, 281, 1969.
126. Ito, F. H., S. A. Vasconcellos, E. B. Erbolato, R. Macruz, and J. A. Cortes, " Rabies Virus in Different Segments of Brain and Spinal Cord of Naturally and Experimentally Infected Dogs, " Int. J. Zoon. , 12, 98-104, 1985.

127. Umoh, J. U., and D. C. Blendon, " Immunofluorescent Staining of Rabies Virus Antigen in Formalin-Fixed Tissue After Treatment with Trypsin, " Bull. W. H. O. , 59, 737-744, 1981.
128. Silva, R. A., and N. M. Silva, " Infecção rabica em cão com presença de vírus virulento nas glândulas salivares e avirulência no encefalo, " Pseq. Agropec. Bras., Ser. Vet. , 8, 89-90, 1973.
129. Silva, R. A., N. M. Silva, and P. R. V. Menezes, " Ocorrência do vírus da raiva na medula e no bulbo de equinos na doença natural e sua ausência nas diferentes regiões do sistema nervoso central e outros tecidos. " Pseq. Agropec. Bras., Ser. Vet. , 9 : 29-31, 1974.
130. Smith, P. C., K. Lawhaswasdi, W. E. Vick, et al., " Enzootic Rabies in Rodent in Thailand, " Nature, 217, 954-955, 1968.
131. Anderson, L. J., K. G. Nicholson, R. V. Tauxe, et al., " Human Rabies in the United States, 1960 to 1979: Epidemiology, Diagnosis, and Prevention, " Ann. Int. Med. , 100, 728-735, 1984.
132. Koch, F. J., J. W. Sagartz, D. E. Davidson, et al., " Diagnosis of Human Rabies by the Cornea Test, " Am. J. Clin. Path. , 16, 509-515, 1975.
133. Bryceson, A. D. M., B. M. Greenwood, D. A. Warrell et al. " Demonstration During life of Rabies Antigen in Humans, " J. Infect. Dis. , 131, 71-74, 1975.

134. Blendon, D. C., W. Creech and M. J. Torres-Anjel, " Use of Immunofluorescence Examination to Detect Rabies Virus Antigen in the Skin of Human with Clinical Encephalitis, " J. Infect. Dis. , 154, 698-701, 1986.
135. Perrin P., P. Versmisse, J. F. Delangneau, et al., " The Influence of the Type Immunosorbent on Rabies Antibody EIA; Advantages of Purified Glycoprotein Over Whole Virus, " J. Biol. Std. . 14, 995-1020, 1980.
136. Sellers, T. F., " A New Method for Staining Negri Bodies of Rabies, " Am. J. Publ. Hlth. , 17, 1080, 1927.
137. Tierkel, E. S., " Rapid Microscopic Examination for Negri Bodies and Preparation of Specimens for Biological Test, " Laboratory Techniques in Rabies (Kaplan, M. M., and H. Koprowski, eds.), pp. 41, 3rd ed., World Health Organization, Geneva, 1973.
138. Veeraraghavan, N., A. Balasubramanian, and R. Rangaswami, " Virus Content of Brains and Submaxillary Glands and Occurrence of Negri Bodies in Animals Suspected of Having Died of Natural Rabies Infection, " Bull. W. H. O. , 18, 469, 1958.
139. Atanasiu, P., " Animal Inoculation and the Negri Body, " The Natural History of Rabies (Baer, G. M., ed.), Vol. I, pp. 373-400, Academic Press, New York, 1975.
140. Webster, L. T., and J. R. Dawson, " Early Diagnosis of Rabies by Mouse Inoculation. Measurement of Humoral Immunity to Rabies by Mouse Protection test, " Proc. Soc. Exp. Biol. Med. . 32, 570-573, 1935.

141. Koprowski, H., " The Mouse Inoculation Test, " Laboratory Techniques in Rabies (Kapian, M. M., and H. Koprowski, eds.), pp. 85-93, 3rd ed., World Health Organization, Geneva, 1973.
142. Jentzsch, K. D., " Reliability and Sensitivity of The Fluorescence-Serological Test for Rabies Virus in Brain, " Zentralbl. Bakteriol. Parasitenk. Infektionskr. Hyg. , 202, 307-327, 1967.
143. Reid, F. L., N. H. Hall, J. S. Smith, and G. M. Baer, " Increased Immunofluorescent Staining of Rabies-Infected, Formalin-Fixed Brain Tissue After Pepsin and Trypsin Digestion, " J. Clin. Microbiol. , 18, 968-971, 1983.
144. Kissling, R. E., " The Fluorescent Antibody Test in Rabies, " The Natural History of Rabies (Baer, G. M., ed.), Vol. I, pp. 401-416, Academic Press, New York, 1975.
145. Heyderman, E., " Immunoperoxidase Technique in Histopathology : Applications, Methods and Controls, " J. Clin Pathol. , 32, 791-798, 1979.
146. Falini, B., and C. R. Taylor, " New Developments in Immunoperoxidase Techniques and Their Application, " Arch. Pathol. Lab. Med.: 107, 105-117, 1983.
147. Levaditi, J. C., P. Atanasiu, A. Gamet, and J. C. Guillon, " Rabies Diagnosis. Problem Raised by Immunofluorescence and Immunoperoxidase Methods, " Arch. de l' Inst. Pasteur d'Algeria. 49, 75-83, 1971.
148. Atanasiu, P., P. Dragonasa, H. Tsiang, and A. Harbi, " Peroxidase Antibody Method : A New Method for Visualization of Intra and Extracellular Rabies Virus, " Ann. Inst. Pasteur. Paris, 121, 247-250, 1971.

149. Avrameas, S., " Enzyme Markers : Their Linkage with Proteins and Use in Immuno-Histochemistry, " J. Histochem., 4, 321-330, 1972.
150. Kotwal, S., and K. G. Narayan, " Direct Immunoperoxidase Test in the Diagnosis of Rabies- An Alternative to Fluorescent Antibody Test, " Int. J. Zoon., 12, 80-85, 1985.
151. Anjaria, J. M., and C. I. Jhala, " Immunoperoxidase Reaction in Diagnosis of Rabies, " Int. J. Zoon. 12, 267-275, 1985.
152. Guesdon, J. L., T. Ternynck, and S. Avrameas, " The Use of Avidin-Biotin Interaction in Immunoenzymatic Techniques, " J. Histochem. Cytochem., 27, 1131-1139, 1979.
153. Hsu, S. M., L. Raine and H. Fanger, " Use of Avidin-Biotin-Peroxidase Complex (ABC) in Immunoperoxidase Techniques: A Comparison between ABC and Unlabeled Antibody (PAP) Procedures, " J. Histochem. Cytochem., 29, 577-580, 1981.
154. Chase, M. W., " Production of Antiserum. B. Immunization Procedures, " Methods in Immunology and Immunochemistry (Williams, C. A., and M. W. Chase, eds.), Vol. I, pp. 209-224, Academic Press, New York, 1967.
155. Seppala, I., H. Sarvas, F. Peterfy, and O. Makela, " The Four Classes of IgG Can Be Isolated from Mouse Serum by using Protein A-Sepharose, " Scand. J. Immunol., 14, 335-342, 1981.
156. Lowry, O. H., " Method of Quantitating of Protein Concentration, " J. Biol. Chem., 193, 265, 1951.

157. Johnson, R. T., D. S. Burke, M. Elwell, C. J. Leake, A. Nisalak, C. H. Hoke and W. Lorsomradee, " Japanese Encephalitis : Immunocytochemical Studies of Viral Antigen and Inflammatory Cells in Fetal Cases, " Ann. Neurol. , 18, 567-573, 1985.
158. Mausner, J. S., and A. K. Bahn, Epidemiologic and Introductory Text, pp. 245, W. B. Saunders Co., Philadelphia, London, Toronto, 1974.
159. Forsgren, A., and J. Sjoquist, " Protein A from Staphylococcus aureus III. Reaction with Rabbit γ -Globulin, " J. Immunol. , 99, 19-24, 1967.
160. Kronvall, G., U. S. Seal, J. Finstad, and R. C. William, Jr., " Phylogenetic Insight into Evolution of Mammalian Fc Fragment of ^{252}G -Globulin Using Staphylococcus Protein A, " J. Immunol. , 104, 140-147, 1970.
161. Love, S. V., " Paralytic Rabies. Review of Literature and Report of a Case, " J. Pediatr. 24, 312-325, 1944.
162. Rupprecht, C. E., and B. Dietzchold, " Editorial : Perspectives on Rabies Virus Pathogenesis, " Lab. Invest. , 57, 603-606, 1987.



APPENDIX I

CHEMICAL AGENTS AND INSTRUMENTS

A. Chemical substances.

Aluminium sulphate ($\text{Al}_2(\text{SO}_4)_3$) (BDH, England)

Avidin-biotinylated horseradish peroxidase complexes
(DAKOPATTS, Glostrup, Denmark)

Complete Freund's Adjuvant (Difco, Detroit, MA, USA)

Coomassie brilliant blue R (Sigma, MO, USA)

Copper sulphate ($\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$) (E. Merck, Darmstadt, W. Germany)

3,3'-Diaminobenzidine (3,3',4,4'-Tetraaminobiphenyl)
(Sigma, MO, USA)

Disodium hydrogen phosphate (Na_2HPO_4) (E. Merck, Darmstadt,
W. Germany)

Ethanol absolute ($\text{C}_2\text{H}_5\text{OH}$) (E. Merck, Darmstadt, W. Germany)

Ethyleneglycolmono-methylether (2-methoxyethanol,
Methylglycol) ($\text{CH}_3\text{OCH}_2\text{CH}_2\text{OH}$) (E. Merck, Darmstadt, W. Germany)

Formaldehyde (E. Merck, Darmstadt, W. Germany)

Gelatin type I, Approx. 300 Bloom (Sigma, MO, USA)

Haematoxylin (BDH, England)

Hydrochloric acid (HCl) (E. Merck, Darmstadt, W. Germany)

Hydrogen peroxide (H_2O_2) (E. Merck, Darmstadt, W. Germany)

Magnesium sulphate ($\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$) (E. Merck, Darmstadt,
W. Germany)

Methanol (CH_3OH) (E. Merck, Darmstadt, W. Germany)

Nobel agar (Difco, Detroit, MA, USA)

Paraplast (Lancer, USA)

Permount (Fisher Scientific, USA)

Potassium chloride (KCl) (E. Merck, Darmstadt, W. Germany)

Polyethylene glycol M.W. 1500 [HO(C₂H₄O)_nH] (E. Merck,
Darmstadt, W. Germany)

Protein A-Sepharose CL-4B (Pharmacia, Uppsala, Sweden)

Sodium acetate (CH₃COONa) (BDH, England)

Sodium azide (NaN₃) (E. Merck, Darmstadt, W. Germany)

Sodium bicarbonate (NaHCO₃) (BDH, England)

Sodium chloride (NaCl) (E. Merck, Darmstadt, W. Germany)

Sodium dihydrogen phosphate (NaH₂PO₄) (E. Merck, Darmstadt,
W. Germany)

Sodium hydroxide (NaOH) (BDH, England)

Sodium iodate (NaIO₄) (BDH, England)

Tris Hydroxymethyl aminomethane (Tris: C₄H₁₁NO₃)
(E. Merck, Darmstadt, W. Germany)

Trypsin (Difco, Detroit, MA, USA)

Xylene (C₆H₄(CH₃)₂) (E. Merck, Darmstadt, W. Germany)

B. Antiserum and serum

Equine anti-rabies globulin, Fluorescein labeled (BBL,
MD, USA)

Goat anti-horse IgG, biotinylated (Vector, CA, USA)

Goat anti-rabbit IgG, biotinylated (Sigma, MO, USA)

Goat serum, normal (Sigma, MO, USA)

Rabbit anti-rabies IgG (Difco, Detroit, MA, USA)

Rabbit serum, normal (DAKOPATTS, Denmark)

Swine anti-rabbit serum (DAKO, Igs., Glastrup, Denmark)

C. Glasswares

Beaker (Pyrex, Corning, NY, USA)

Coplin staining jar (Pyrex, Corning, NY, USA)

Cylinder (Witeg, W. Germany)

Cover glasses (Menzel-Glaser, W. Germany)

Disposable syringe (Nipro, Tokyo, Japan)

Erlenmeyer flask (Pyrex, Corning, NY, USA)

Glass tube (Pyrex, Corning, NY, USA)

Microscopic glass slide (Zhejiang, China)

Tissue embedding ring (Bangkok, Thailand)

D. Instruments

Analytical balance (Precisa, Switzerland)

Automatic pipette (Gilson, Lyon, France)

Centrifuge (Sorvall, Dupont, USA)

Fraction collector, Model alpha 400 (Buchler
Fractometer, USA)

Incubator (Forma Scientific, Ohio, USA)

Microtome (American Optical, NY, USA)

Mixer vortex (Scientific Industries, NY, USA)

pH meter, model 10 (Corning, NY, USA)

Refrigerator (Westinghouse, USA)

Tissue embedding machine (Autotechnicon, NY, USA)

UV-Visible spectrophotometer, model ACTA CIII (Beckman,
CA, USA)



APPENDIX II

REAGENTS AND PREPARATIONS

1. Reagents for Immunoglobulin G Preparation.

1.1 Phosphate buffered saline 0.05 M, pH 7.4

Stock solution A:

$\text{NaH}_2\text{PO}_4 \cdot 2\text{H}_2\text{O}$	15.6	g
Distilled water to	1000	ml

Stock solution B:

Na_2HPO_4	14.2	g
Distilled water to	1000	ml

0.05 M. PBS, pH 7.4

Solution A	250	ml
Solution B	750	ml
NaCl	8.0	g
Distilled water to	2000	ml
Store at 4°C		

1.2 Tris-(hydroxymethyl)aminomethane(Tris)buffer 0.05 M in 0.15 M NaCl, pH 8.6

$\text{C}_4\text{H}_{11}\text{NO}_3$ (Tris)	6.057	g
NaCl	8.766	g
Distilled water to	1000	ml

Adjust the pH to 8.6 with 1 N HCl, and store at 4°C

1.3 Acetate buffer 0.05 M in 0.15 M NaCl, pH 4.3

Stock solution A:

CH ₃ COONa.3H ₂ O	13.6	g
Distilled water to	1000	ml

Stock solution B:

CH ₃ COOH	5.75	ml
Distilled water to	1000	ml

0.05 M Acetate buffer, pH 4.3

Solution A	132	ml
Solution B	368	ml
NaCl	8.766	g
Distilled water to	1000	ml
Store at 4 °C		

1.4 NaOH 1 N

NaOH	40	g
Distilled water to	1000	ml

1.5 HCl 1 N

HCl	36.5	g
Distilled water to	1000	ml

2. Reagent for immunoperoxidase staining, ABC complex Technique

2.1 Phosphate buffered saline (PBS) 0.01 M, pH 7.4

Na ₂ HPO ₄	2.85 g
NaH ₂ PO ₄ .12H ₂ O	7.0 g
NaCl	9.25 g
Distilled water to	1000 ml
Adjust the pH to 7.4 with 1 N NaOH	

2.2 Trypsin 0.1% in PBS, pH 7.8

Stock 2.5% trypsin

Trypsin	2.5 g
Distilled water to	100 ml
Make aliquot and store at -20°C	

0.1% Trypsin, pH 7.8

Stock 2.5% Trypsin	4 ml
PBS, pH 7.4 (freshly prepared)	96 ml
Adjust the pH to 7.8 with 1 N NaOH	

2.3 Hydrogen peroxide 1% in methanol

Add 35% H₂O₂ 0.86 ml into methanol 30 ml

2.4 Avidin-biotin-peroxidase complex (ABC)

Commercially available ABC is prepared by mixing 10 µl of "A" (avidin) and 10 µl of "B" (biotin-peroxidase) in PBS, pH 7.4, 1 ml for 30 minutes at room temperature before use.

3. Reagents for counterstaining.

3.1 Copper sulphate 0.5% in 0.15 M NaCl

CuSO ₄	5.0 g
NaCl	8.766 g
Distilled water to	1000 ml

3.2 Gill's Haematoxylin

Haematoxylin	2.0 g
NaIO ₃ .H ₂ O	0.2 g
Al ₂ (SO ₄) ₃	17.6 g
CH ₃ COOH	20 ml
Ethylene glycol	250 ml
Distilled water	730 ml

Mix ethylene glycol in distilled water, and add haematoxylin, NaIO₃.3H₂O, Al₂(SO₄)₃, and CH₃COOH respectively. Stir for 1 hour at room temperature, and filter before use. The dye solution can be used within 6-8 weeks.

3.3 Tap water substitute

MgSO ₄ .7H ₂ O	2 g
NaHCO ₃	20 g
Distilled water to	1000 ml

4. Reagent for immunodiffusion test

4.1 Sodium barbital buffer (0.05 M), pH 8.2

Barbital sodium	47.6 g
1 N HCl	69 ml
10% NaN ₃	4.2 ml
Distilled water to	4200 ml
Adjust pH to 8.2	

4.2 Protein staining

4.2.1 Protein staining solution

Coomasie brilliant blue R	5.0 g
Distilled water	1000 ml
stir overnight until dissolved.	

4.2.2 Destaining solution

Distilled water	1000 ml
CH ₃ COOH	2000 ml
Methanol	1000 ml
Mix and store at room temperature.	

4.3 Agar gel 1.5%

Special agar Nobel	1.5 g
Distilled water	100 ml

Heat the agar in a double boiling water until dissolved and aliquot into 20 ml test tube, allow to cool and store in 4°C until use.



CURRICULUM VITAE

Mrs. Suranan Tirawatnpong was born on September 11, 1950, Bangkok, Thailand. She graduated with the Bachelor degree of Science in Medical Technology from Mahidol University in 1972. Her academic position is Faculty member of the Immunology Unit, Department of Microbiology, Faculty of Medicine, Chulalongkorn University.