ACKNOWLEDGEMENTS

For the successful completion of this work, I would like to express my deepest gratitude and appreciation to who I am indebted.

To Professor Dr. Wanpen Chaicumpa, my advisor, for her kindness, teaching, supervision and encouragement. Without her virtues, this study would not have been accomplished.

I would like to express my sincere gratitude to my co-advisors, Associate Professor Dr. Pramuan Tapchaisri and Assistant Professor Dr. Pongsri Tongtawe, Faculty of Allied Health Sciences, Thammasat University, for their kind and valuable suggestion.

I would like to thank my co-advisors, Associate Professor Dr. Manas Chongsanguan and Assistant Professor Dr. Pongrama Ramasoota, Faculty of Tropical Medicine, Mahidol University for their kindness, suggestion, and innumerable help throughout this study.

My gratitude also goes to Professor Sou-ichi Makino, Obihiro University of Agriculture and Veterinary Medicine, for his kind acceptance to be my thesis examination chairperson.

I would like to thank Dr. Suwanna Cowawintawewat, Assistant Professor Dr. Potjanee Srimanote and the members of Molecular Immunology and Molecular Microbiology Laboratories (Dr. Sunee, Dr. Jub, Dr. Toon, Dr. Poom, Karn, Kung, Kob, Keng, Mam, J, Yulee, Art, Noom, Naun, Golf) for their friendship, helps and cheerfulness.

Thanks are due to the Commission on Higher Education, Ministry of Education and the Faculty of Allied health Sciences, Thammasat University, for the financial supports.

I would like to thank Jakkom family for their helps, support and warmness.

To my beloved parents, sister, brother and nephews, for all they have done to bring me here.

Anek Pootong