Acknowledgment

First and foremost I would like to thank my Almighty Allah for His immense benevolence, for answering my prayers for giving me the strength to hang on despite my constitution wanting to give up and throw in the towel and providing me a purpose to be in this world. Because of Him I am here and able to write this for a reason and responsibility towards this biosphere.

Next my acknowledgment can’t begin without naming my parents to whom I owe my life. I feel immensely pleased and deeply satisfied to dedicate this thesis to them who inspired, supported and showed confidence in me and encouraged me to take up research and provided all the support right through this work. I know they have lost a lot with my absence which is very hard for me to compensate. All the other family members have been exceptionally supportive during this time and I am deeply indebted to all of them.

I express my deepest and sincere gratitude to my mentor Dr. Sangita Mukhopadhyay who personally supervised, supported and encouraged me all through this work. She has been a great inspiration and a constant morale booster. She has not only personally guided me and provided me with all the needed help in the most professional manner but also has been very kind, loving, caring and friendly whilst allowing me the room to work in my own way. Because of her I have developed in me a deep love for science and never to be defeated attitude to stand fast, hang on and work hard to solve a problem. I am deeply indebted to her and owe her more than just an acknowledgment for her quality supervision and guidance. Her patience at the time of this thesis writing and editing has been admirably remarkable. Besides being an excellent supervisor she has been a very nice human being. Her hospitable, gracious, soft spoken and kind attitude has left an unforgettable and everlasting impact on my personality.

I owe my sincere gratitude to the previous director of CDFD Prof. S. E. Hassnain for showing confidence in me and encouraging me at the initial phase of this work and for being a constant source of inspiration all through. Thanks to the present Director of CDFD Dr. J. Gowrishankar for providing an excellent academic environment for growth as a competitive researcher. A sense of gratitude towards previous Dean academics at CDFD Dr. Shekhar C. Mande and present coordinator academic affairs Dr. Sanjeev Kholas for being very friendly and always helpful. I am thankful to the Vice Chancellor and Registrar at Manipal University for permitting me to register as a PhD graduate student.

I thank all my teachers from my school days till M. Sc for teaching me the basic principles of science to which I was a complete novice. At M. Sc level Prof. K. I. Andrabi, Dr. M. A. Zargar, Dr. K. M. Fazili, Dr. Rabia Hameed and Dr. Shajur-ul-amin have been a real inspiration. A final spark to ignite in me the passion towards research was provided by Prof. K. I. Andrabi. I owe more than acknowledgement to him.

This thesis would not have been possible without the help from Krishna Chaitanya, Akhilesh Datt Pandey, Rajavarman, Nazia Parveen and Arghya Das at CDFD and Imran Siddiqui and Santosh Kumar at ICGEB New Delhi. I am thankful to all the previous members of LMCB Nooruddin Khan, Shiny Nair, Kaiser Alam, Chandra Shekhar, Sheikh Ghousunnissa, Tabrez Hussain, Krishnaveni Mohareer, Sheeba Rasheed, Aisha Farhana, Senthil Kumar, Nasreena Bashir, Smanla Tundup, Sandeep Kumar, Yusuf Akhtar and present members G. Sreekrit, Nazia Parveen, Atul Udgata, Arghya Das, Gouranga Pradhan, Krishna Chaitanya, Parul Singh, Dr. R. Nagender Rao, Dr. Philip Raj Abraham and Dr. Asma Ahmad all of whom have been great companions and have provided a cheerful environment around
that made some stressful times a pleasurable memory besides creating a real good scientific atmosphere. During my stay at CDFD I have earned some very good friends Dr. Javid Ahmad Dar, Dr. Mohammad Jamal Dar, Dr. Janny Shahjahan, Mr. Shaffiqu T. S., Nooruddin khan, G. Sreejit, Arghya Das, Nazia Parveen and Imtiyaz Yaseen have been on my side through thick and thin and their constructive criticism has helped me stay ahead. The sweetly irritating moments provided by Nazia, Arghya and chaitanya have worked as salt and pepper. I owe them more than just an acknowledgement. Special thanks to Arghya for the help during thesis printing and critical review and suggestions before printing this work. Thanks to all my batch mates and other contemporaries at CDFD.

I share the credit of this work with the technical staff of our lab without whose assistance this work would have been difficult to achieve. All the previous technical staff members N. Sudheer, Waseem Ahmed and Krishna Murthy deserve acknowledgement for their dedicated efforts. I am thankful to Sheikh Zamir for not only providing the technical assistance but also being a very good friend. My sincere thanks to our technical officer Nitin Pathak and Polepaka Swetha who have helped me in handling official formalities during the work and at the time of thesis submission. Special thanks to Nitin for enthusiastically helping in every issue related to reagent procurement. Without his presence it would have been tough to get materials in time.

I also wish to thank Mrs. N. Punitha, Mr. Santhosh, Mr. V. Kasipathy and all other staff members from EMPC and administration department of CDFD who helped with all official work and maintained a cordial atmosphere around.

I warmly thank Dr. Pawan Sharma for his friendly help and assistance to carry out in vivo experiments at ICGEB New Delhi. I also thank Prof. Mushtaq A. Siddiqui and Prof. Abdul Rehman Rather for encouragement and critical suggestions.

My sincere thanks to CSIR, ICMR, Immunology Foundation and CDFD for financing my research, various national and international travels and other expenses. This research would have been impossible without their generous support.

Last but not the least and the most important mention is of my best and most precious discovery during this time; my better half and companion for life Shayista Abdullah who also deserves my loving thanks for being patient and understanding my commitments. She has been a constant moral and emotional support and has helped with her valuable suggestions besides making the home environment lovingly soothing when I was going through hell and high water. Shayista thanks for being patient and for always being there. Your mere presence in my life means everything to me. I also wish to thank my entire extended family for providing a loving and caring environment for me.

There have been many other people more than worth mention in these two pages. My sincere apologies to all of you who deserved to be talked about in this acknowledgement but could not be because of time and space constraint.

It is an honor for me and I feel immensely pleased to thank all of you who made this thesis possible. I am more than humbled by your generosity and your support and blessings are duly acknowledged. I thank you all.

Khalid Hussain Bhat