I dedicate this work to

my family,

for their endless love and support...

Acknowledgements

A journey of years of hard work, filled with moments of extensive learning, along with teaching me perseverance and resilience beyond science, was possible with the support of many people, to whom I want to extend my thanks to—

I express my heartfelt gratitude to my Ph.D. supervisor, *Dr. Ratika Srivastava*, for providing me the opportunity to pursue this research under her guidance and for supervising this research work. I thank her for introducing me to the wonderful and extensive space of immuno-oncology, helping me in pursuing my passion for the research. I am extremely grateful for the knowledge of immunology and the research skills that I have learned from her during this tenure. Her zeal for immunology and meticulous eye in research has been an inspiration to me.

It's hard to envision the success of this journey without the support and affection of the faculty members of the department. Foremost, I express my deep sense of reverence to *Prof. G. Archana*, head of the department, and my M.Sc. dissertation guide, for all kinds of academic, institutional and moral support. I also express my deep gratitude to DAC members *Prof. Anuradha Nerurkar* and *Prof. Pushpa Robin*, for evaluating the progress of my work and for providing helpful feedback on the project. I am extremely thankful to *Prof. Devarshi Gajjar*, Coordinator of the Biotechnology Program, for providing all kinds of institutional help and for allowing access to her laboratory instruments, which greatly eased my work. I further extend my thanks to *Dr. Pushpendra Singh*, *Dr. Pranav Vyas*, *Dr. Nandita Baxi*, *Prof. Sanjay Ingle*, *Dr. Rajesh Patkar* and late *Dr. Johannes Manjrekar* for their support and encouragement.

I extend my thanks to my fellowship sources - MSU, GSBTM and SHODH.

I am grateful to *Mr*. *Shirish Nagarkar* and *Mr*. *Nitesh Bhatt* for helping with administrative work, to *Dr*. *Harsukh Tank* for providing necessary lab materials and to all non-academic staff for helping in every way.

I also extend my thanks to the members of *Prof. Rajesh Singh's* lab, *Prof. Rasheedunissa Begum's* lab and *Dr. Sanjeev Upadhyay's* lab for providing cell lines and instrumentation facilities. I thank all members of BC-GRC for assisting with GRC's instruments.

I extend my thanks to my lab mate Ms. Khushboo Rana for helping and sharing the lab work. I also acknowledge my first friends in lab-Ms. Priya

Paithankar, Ms. Purna Dwivedi and Mr. Shomeek Choudhary- the fun times in the lab with them during the initial period of my Ph.D. are enduring memories.

I further extend my thanks to the senior research scholars of the department for their support. I am indebted to *Dr. Hasmat Buchad*, who is like a sister to me, for every kind of help and for understanding the hardships of this journey. A simple thank you is not enough for the support she has lent to me during my work. I thank *Dr. Mihir Sarang* for teaching me new softwares that were of great help in the preparation of posters, presentations and drafts throughout these years. I thank *Dr. Jitendrapuri Gosai*, *Dr. Swati Madhu*, *Dr. Siddhi Vora*, *Dr. Jaswinder Kaur Saini*, *Dr. Ashtaad Vesuna*, *Ms. Khyati Mehta* and *Mr. Anand Paranandi* for scientific and moral support, for helping with the paperwork, for the company over evening refreshments, while working in late evenings, and for badminton matches—making the stay at the department memorable and worthwhile.

The best happiness in life is friendship and the good times shared with friends. A huge thanks to my close friend, *Ms. Anjali Shinde*, with whom I have spent 10 years of my education at MSU. I extend my gratitude to her for her unwavering emotional and moral support throughout the years of Ph.D. and in life, that helped me maintain tranquility in difficult times. I thank my juniors *Mr. Suraj Shukla* and *Ms. Pinal Trivedi* who have been amazing friends and extended every kind of help to me that was possible during the entire period and with whom I spent a happy time in the department. I heartily acknowledge the support of my long-term friends *Dr. Kavya Gupta, Ms. Roshni Patel* and *Ms. Hiral Patel*, in this journey. I also thank *Ms. Chitra Nair*, who worked as an M.Sc. dissertation student in the lab, and became a good friend of mine. I am extremely appreciative of this friendship and of her support to me during the time.

—And above all, I am indebted to my biggest pillars of strength-my family, for everything I have in life.

Thank you to all the people who helped me come this far. Your contributions in this journey are invaluable.