

ACKNOWLEDGEMENTS

In The Name of Allah, the Most Gracious, the Most Merciful

Foremost, I would like to express my special appreciation and thanks to my advisor Prof. Tawfiq Arafat and my co-advisor Dr. Wael Abu Dayyih, you have been a tremendous mentor for me. I would like to thank you for your patience, motivation, enthusiasm, and immense knowledge. your guidance helped me in my research, allowing me to grow as a research scientist. Your advice on both research as well as on my career have been priceless. your influence on my life will continue through my entire life, as one of my role models.

I would also like to thank my committee members, Prof. Zuhair Muhi-Eldeen, Dr. Eyad Al-Mallah and Dr. Naseer Hashim Ahmed for serving as my committee members even at hardship. I also want to thank you for letting my defense be an enjoyable moment, and for your brilliant comments and suggestions, thanks to you.

To my family, Words cannot express how grateful I am to my mother Dr.Intisar, my father Dr.Issam my brothers Anas and Zaid who spent sleepless nights with me and was always my support in the moments when there was no one to answer my queries, Your prayer for me was what sustained me thus far.

My sincere thanks to Prof. Tawfiq Alhussainy for his support and continuous advices

My sincere thanks also goes to Dr Nidal Qinna, for his support, advices and his help by allowing using his laboratory, and to Mohammad Albayed, for his great technical assistance in animal handling.

Special thanks to Hamza Al-Hurob from JCPR who have been very helpful and supportive many thanks for the staff of JCPR who also helped me in this work.

For my dear friends, Marwa nasir, Mustafa nawzad, Noor Taqi, Rawnaq Jalal, Hagop, Raghda Tobchi and Yaser Ahmed, I would like to specially thanking you for the help you gave me, and your continuous spiritual support until the finish of this research.