Acknowledgement

At the very early stage of my PhD, I was informed a term named the Valley of PhD. This is the period when you lose perspective and therefore confidence and belief in yourself. At that deep and dark valley, nothing works, and no one knows why. Quit seems is the only way out. What I was not told is that still there is moment of climax, although fleeting and followed by endless valleys. You regain everything back and even believe you have power to change the world till you go quickly down to the next valley by a failure experiment. The magic cycle of valley and climax has been with me for the past years of my PhD, till closing moment of this thesis. While I could not possible have written this thesis without the invaluable help by many people.

I would like to express my eternal gratitude and appreciation to my supervisor Prof. Andreas Herrmann. I still remember the details when you interviewed me and how joyful I was when I received your invitation as a Phd student in your group. This invitation has changed both of my personal life and career path afterwards. There was a darkest moment of my PhD period, your encouragement, warm words and support really brightened me and helped me out of there. You are knowledgeable, clarity at explanations, details oriented and always energetic. I am pretty sure years of training from you would be beneficial for the rest of my carrier.

I also would like to thank the members of my reading committee: Dr. Romana Schirhagl, Prof. Tim Liedl and Prof. Marc Spehr for the time and the evaluation on my thesis.

I also would like to say a very big thank you to Dr. Robert Göstl for all the supervision and support he gave me. Our weekly meeting really motivated me a lot to be more productive. Thank you for being so patient and efficient when working with my manuscript. Thank you also for your time and effort for showing me how to
prepare a perfect scientific presentation.

The first chapter of this work would not have been possible without the corporation and support from Dr. Arnold Boersma. I am sorry for making your life tough when you had to work hard on a reviewer manuscript that was not perfect. Thank you for more than five versions of our manuscript.

The project of last chapter would not have been possible without the committed collaboration with Prof. Minseok Kwak from Pukyong National University (South Korea) and Dr. Jun-O Jin from Yeungnam University (South Korea). Our first collaboration had to be cancelled as we did not have the wish to reinvent the wheel. Two years later, our new collaboration came out and fortunately it was quite successful.

A special thanks go to my first daily supervisor Dr. Bart J. Crielaard. Thank you for all the support from you during the early stage of my PhD. It was you who opened doors of research for me and guided me through. I sincerely wish you all the best.

In particular, I would like to acknowledge the talent and commitment of Mark Loznik for taking care of all my shopping lists, oligonucleotides synthesis and especially Dutch translation of the summary part of this thesis.

I also want to take this opportunity to thank Ursula and Lydia for the help with all my paper work.

I am also indebted to Alexander Jans from other group of DWI for his help of showing me how to use microfluidic device and also for our collaboration on microgel project which although stopped for time limit.

Providing me with support and accompany through the years have been other colleagues from the group: Jan Willem de Vries, Agnieszka, Avishek Paul, Eliza Warszawik, Gurudas Chakraborty, Konstantin Balinin, Nicola Pontillo, Deniz Yildiz, Kai-Oliver Brenske and Saradaprasan Muduli. My deepest special thanks to the following people from the group: 在此特别感谢郑立飞师兄。无论是我在科研还是生活中遇到困难，你总是能够及时提出宝贵的建议。你对科研和生活的全方位见解，经常让我受益匪浅。特别感谢刘凯师兄的帮助。你对科研的
热忱，严谨的治学态度是我学习和工作的榜样。特别感谢岳军师兄，秋艳师姐和陈威师兄对我的就业指导。特别感谢卓君刘庆夫妇，婧祎夫妇，孙静夫妇，马超夫妇，帅东，罗明，玄明君对我的无私帮助。特别感谢鹏坤，周雨，绵成，心童对我的帮助。

I am also very grateful to all those friends from Groningen. Life was much easier and enjoyable with you all! 感谢我的好朋友亚楠，忠洪夫妇，义飞夫妇，振辰，小明，华堂，冯帅，庆凯夫妇和李靖。Also my friends from Aachen. 和霖，祥洋，崔青，李鑫和超磊。衷心地祝愿我的朋友们事业有成，家庭美满。

My special thanks to my ladybros: 王菲和周丹 (alphabetically order). How wonderful you two are still around for more than 15 years and how lucky I have been! We shared secrets when we were teens; I knew it when you found your Mr.right, when you started your family and when your adorable little boys came into your life. Our story continues and I see three grandmas are playing poker. That is us

My deepest appreciation goes out to my husband 孙斌 for all his supports and love.

Finally, I would like to thank my family. Without their unlimited kindness and overwhelming support, there would by no means for me to stand on where I am now.

Sincere apologies to those I have forgotten to thank.
List of Publications


3. Hongyan Li, Mark Loznik, Robert Göstl and Andreas Herrmann: DNA Hybridization as a general method to enhance nanoparticle cellular uptake, Nanoscale, in peer review.

4. Hongyan Li, Jun-O, Shuaidong Huo, Minseok Kwak and Andreas Herrmann: Core of immunostimulatory nanoparticles makes a difference, to be submitted.

5. Zhuojun Meng, Qing Liu, Hongyan Li, Jing Sun, Mark Loznik, Dong Chen, Robert Göstl, Kai Liu, Andreas Herrmann: Highly stiff, tough, and stretchable DNA liquid crystalline organogels with fast self-healing and magnetic response behaviors, PNAS, in peer review.

6. Qing Liu, Huahong Fang, Zhuojun Meng, Hongyan Li, Kai Liu and Andreas Herrmann: Fluorescence properties of lipid-DNA in liquid and liquid crystal states, to be submitted.