Preface

This work was established during my practice as researcher in the workgroup '*Nanomaterials*' at the Laser Zentrum Hannover e.V. (LZH) where I focused on various national and international cooperations and two main research projects:

(I) '*Functionalized nanoparticles for the sex-specific selection of bovine spermatozoa*' (Masterrind, NBank), aiming for the development of a biocompatible and specific gold nanomarker for the bovine Y-chromosome in cooperation with the Friedrich-Loeffler-Institut (FLI) Mariensee (duration: 02/10–02/11).

(II) The DFG Excellence Cluster REBIRTH (from **RE**generating **BI**ology to **R**econstructive **TH**erapy) within the Research Unit (RU) 7.3. '*Nanoparticles*', where researchers from the LZH, the Hannover Medical School (MHH), the Leibniz University of Hannover (LUH), the University of Veterinary Medicine Hannover (TiHo), the FLI and other institutions worked on the establishment of novel regenerative technologies and tools. Therein, the RU 7.3 used the technique of pulsed laser ablation in liquids for the fabrication of ultrapure mono- and multi-material nanobioconjugates. These constructs were applied e.g. as vectors for directed ion- drug- and gene-delivery purposes with stimulus-induced release or as medical nanomarkers for advanced immunolabeling, high-resolution bio-imaging and sensitive nanosensory applications (duration: since 02/10).

The process of *in situ* bioconjugation during pulsed laser ablation in liquids was established at LZH in 2007 and various gold-DNA and gold-protein conjugates have been successfully fabricated since that time. However, there remains a deficiency of knowledge regarding the optimal conjugation conditions and the controlled functionalization of gold nanoparticles with two or more different bio-ligands. With my combined educational background as an engineer and a biomedical scientist, I concentrated on this deficiency and tried to understand the interplay and implications of the various process parameters. I also worked to establish guidelines for the customized bioconjugation. This thesis presents a condensed summary of my findings and offers general instruction for the individual configuration of novel and functional gold nanoparticle bioconjugates for biological applications.
All research results were collected from my own lab experiments and from 17 national and international student internships as well as two Bachelor theses, which I mentored. Parts of the results and contributions to the work of collaborative research partners were published in international, peer-reviewed research journals, which are summarized as a *list of own publications* at the end of this thesis and labeled in Roman numerals at the beginning of the results chapters.

http://www.springer.com/978-3-658-13514-0

Laser-Generated Functional Nanoparticle Bioconjugates
Design for Application in Biomedical Science and Reproductive Biology
Barchanski, A.
2016, XIII, 310 p. 134 illus., Softcover
ISBN: 978-3-658-13514-0