

## Table of Content

<b>Table of Content .....</b>	<b>- 8 -</b>
<b>LIST OF ABBREVIATIONS .....</b>	<b>- 16 -</b>
<b>AIM &amp; OBJECTIVE.....</b>	<b>- 18 -</b>
<b>INTRODUCTION .....</b>	<b>- 20 -</b>
Photoacoustic imaging and its probes .....	- 20 -
Photoacoustic imaging probes and dark quenchers .....	- 22 -
Indocyanine green in photoacoustic imaging .....	- 22 -
Mechanism of fluorescence quenching and PAI quenchers .....	- 24 -
Stimuli responsive photoacoustic imaging probes .....	- 26 -
Imaging of reactive oxygen species by PAI .....	- 27 -
Super resolution imaging and stimulated emission depletion .....	- 31 -
STED super resolution imaging probes .....	- 32 -
Thermoresponsive probes.....	- 35 -
Thermoresponsive imaging probes .....	- 35 -
BODIPY chromophores – Synthesis, modification and properties.....	- 36 -
<b>PUBLICATIONS.....</b>	<b>- 38 -</b>
<b>RESULTS &amp; DISCUSSION .....</b>	<b>- 40 -</b>
NIR quenching Pyrrolyl-BODIPY dyes .....	- 41 -
General concept .....	- 41 -
Preparation of PyBODIPY .....	- 43 -
Analysis of optical properties .....	- 47 -
Photoacoustic properties of PyBODIPY .....	- 52 -
Reactivity and modification towards water solubility and biocompatibility .....	- 53 -
PAI properties of PyBODIPY in water.....	- 59 -
PyBODIPY in cell and animal studies.....	- 60 -
Summary & Outlook .....	- 63 -
Evaluation of ROS sensitive NIR-BODIPY .....	- 65 -
Synthesis and optical characterization of ROS sensors .....	- 66 -
Optical and PAI examination of ROS sensing properties of BHT-BODIPY .....	- 70 -
Mechanistic investigation of the ROS active species formation.....	- 76 -
ROS imaging in cells by BHT-BODIPY .....	- 80 -
Summary & Outlook .....	- 83 -

<b>Novel chromophore for the 660 nm STED depletion laser .....</b>	<b>- 84 -</b>
Synthesis, characterization and STED properties .....	- 84 -
Actin labeling with 12 and comparison with commercial fluorophore .....	- 98 -
Further imaging properties of ABDP.....	- 102 -
Summary & Outlook .....	- 104 -
<b>Development of a novel time-temperature indicator.....</b>	<b>- 106 -</b>
Temperature induced structural changes .....	- 109 -
TTI behavior of ODB in water.....	- 114 -
Summary & Outlook .....	- 117 -
<b>SUMMARY &amp; OUTLOOK .....</b>	<b>- 119 -</b>
<b>EXPERIMENTAL PROCEDURES .....</b>	<b>- 121 -</b>
<b>General Information.....</b>	<b>- 121 -</b>
<b>Photoacoustic (PA) Imaging.....</b>	<b>- 122 -</b>
<b>Cellexperiments .....</b>	<b>- 122 -</b>
General Procedure XTT cell viability assay .....	- 122 -
Cell-uptake studies for PyBODIPY (Figure 25).....	- 123 -
Imaging of ROS activated A549 cells for fluorescence microscopy (Figure 40).....	- 123 -
Imaging of ROS activated A549 cells for PAI (Figure 41) .....	- 123 -
<b>Superresolution cell imaging by STED.....</b>	<b>- 124 -</b>
Unspecific cell labeling.....	- 124 -
Actin labeling in HeLa cells .....	- 124 -
<b>General Information for <i>in vivo</i> blood circulation experiments .....</b>	<b>- 125 -</b>
<b>Synthesis protocols .....</b>	<b>- 126 -</b>
<b>Synthetic procedures for PyBODIPY NIR QDs .....</b>	<b>- 126 -</b>
Synthesis of 5-methyl-1H-pyrrole-2-carbaldehyde .....	- 126 -
Synthesis of 3,5-dimethyl-1H-pyrrole-2-carbaldehyde.....	- 126 -
Synthesis of 3,4,5-trimethyl-1H-pyrrole-2-carbaldehyde.....	- 127 -
Synthesis of Dimethyl-5-formylisophthalate .....	- 129 -
Synthesis of 1H-2-methylpyrrole .....	- 130 -
Synthesis of tetra methyl-meso-isophthalate BODIPY core .....	- 131 -
- (General Procedure 1) .....	- 131 -
Synthesis of tetra methyl-meso-(3,5-dimethoxyphenyl) BODIPY core .....	- 132 -
Synthesis of tetra methyl-meso-phenyl BODIPY core .....	- 132 -
Synthesis of dimethyl-meso-phenyl BODIPY core .....	- 133 -
Synthesis of dimethyl-meso-(3,5-dimethoxyphenyl) BODIPY core .....	- 133 -
Synthesis of dimethyl-meso-isophthalate BODIPY core .....	- 134 -
Knoevenagel condensation for PyBODIPY - General procedure 2.....	- 134 -
Synthesis of PyBODIPY 4f.....	- 135 -

Synthesis of PyBODIPY 4h .....	- 135 -
Synthesis of PyBODIPY 4g .....	- 136 -
Synthesis of PyBODIPY 4i .....	- 136 -
Synthesis of PyBODIPY 4d .....	- 137 -
Synthesis of PyBODIPY 4b .....	- 137 -
Synthesis of PyBODIPY 4c .....	- 138 -
Synthesis of PyBODIPY 4a .....	- 138 -
Synthesis of PyBODIPY 4e .....	- 139 -
Synthesis of PEGylated BODIPY .....	- 139 -
Synthesis of 3,4,5-Tris(prop-2-yn-1-yloxy)benzaldehyde .....	- 139 -
<b>Synthesis of alpha-N<sub>3</sub>-omega-OH-TEG .....</b>	<b>- 141 -</b>
<b>Synthesis of alpha-N<sub>3</sub>-omega-OH-PEG400 .....</b>	<b>- 141 -</b>
<b>Synthesis of dimethyl-meso-trialkine-BODIPY .....</b>	<b>- 142 -</b>
<b>Synthesis of 3x TEG BODIPY by click-chemistry .....</b>	<b>- 143 -</b>
<b>Synthesis of 3x PEG400 BODIPY by click-chemistry .....</b>	<b>- 144 -</b>
<b>Synthesis of PyBODIPY 8a .....</b>	<b>- 145 -</b>
<b>Synthesis of PyBODIPY 8b .....</b>	<b>- 146 -</b>
<b>Synthesis of PyBODIPY 6 .....</b>	<b>- 147 -</b>
 <b>Synthetic procedures for ROS sensors .....</b>	 <b>- 151 -</b>
Synthesis of 4-hydroxy-3,5-dimethylbenzaldehyde .....	- 151 -
Synthesis of 4-hydroxy-3,5-diisopropylbenzaldehyde .....	- 151 -
Synthesis of 3,5-di-tert-butyl-4-hydroxybenzaldehyde .....	- 152 -
General Procedure 3 for Knoevenagel Condensation ROS sensing BODIPYs .....	- 152 -
Synthesis of ROS sensor 7a .....	- 153 -
Synthesis of ROS sensor 7b .....	- 153 -
Synthesis of ROS sensor 7c .....	- 154 -
Synthesis of ROS sensor 7d .....	- 154 -
Synthesis of ROS sensor 8a .....	- 155 -
Synthesis of ROS sensor 8b .....	- 156 -
Synthesis of ROS sensor 8c .....	- 157 -
Synthesis of ROS sensor 8d .....	- 158 -
 <b>Synthetic procedures for STED imaging probe .....</b>	 <b>- 159 -</b>
Synthesis of ABDP 10 .....	- 159 -
Synthesis of ABDP 11 .....	- 161 -
Synthesis of ABDP 12 .....	- 162 -
Synthesis of ABDP 15 .....	- 163 -
Synthesis of ABDP 14 .....	- 164 -
Synthesis of aza-BODIPY 14 .....	- 168 -
Synthesis of ABDP 16 .....	- 170 -
Synthesis of ABDP 17 .....	- 172 -
Synthesis of HaloTag-ABDP 20 .....	- 175 -
 <b>Development of thermal sensor .....</b>	 <b>- 178 -</b>
Synthesis of Methyl 2-(4-methylphenylsulfonamido)acetate .....	- 178 -
Synthesis of 3-Methyl-1-tosylpyrrolidin-3-ol .....	- 178 -
Synthesis of 3-Methyl-1-tosyl-2,5-dihydro-1H-pyrrole .....	- 179 -
Synthesis of methyl 3-methyl-1H-pyrrole-2-carboxylate .....	- 180 -

Synthesis of 2,3-Dimethyl-1H-pyrrole .....	- 180 -
Synthesis of acetamido-dipyrromethene .....	- 181 -
Synthesis of Oxadiazaborinin and acetyl amino-BODIPY.....	- 181 -
Synthesis of amino-dipyrromethene .....	- 182 -
<b>LIST OF LITERATURE .....</b>	<b>- 184 -</b>