

## DOCTORAL THESIS

### Oligonucleotide-based luminescent detection platform utilizing iridium (III) complexes

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**Oligonucleotide-Based Luminescent Detection  
Platform Utilizing Iridium(III) Complexes**

**LEUNG Ka Ho**

**A thesis submitted in partial fulfillment of the requirements  
for the degree of Doctor of Philosophy**

**Principal Supervisor: Dr. MA Dik-Lung**

**Hong Kong Baptist University**

**December 2014**

# Declaration

I hereby declare that this thesis represents my own work which has been done after registration for the degree of PhD at Hong Kong Baptist University, and has not been previously included in a thesis, dissertation submitted to this or other institution for a degree, diploma or other qualification.

Signature:

Date:

# Abstract

Luminescent transition metal complexes have arisen as viable alternatives to organic dyes for sensory applications due to their notable advantages. This thesis aimed to synthesize different kinds of Ir(III) complexes, explore their interactions with DNAs and investigate their application for the construction of label-free oligonucleotide-based sensing platforms. A series of Ir(III) complexes incorporating a variety of  $C^N$  and  $N^N$  donor ligands were synthesized and were shown to exhibit G-quadruplex-selective binding properties *via* emission titration, UV/vis titration, fluorescence resonance energy transfer melting and G-quadruplex fluorescent intercalator displacement experiments. These G-quadruplex-selective Ir(III) complexes were utilized as signal transducers to monitor the conformational changes of oligonucleotides in label-free oligonucleotide-based luminescent detection platforms for metal ion ( $Sr^{2+}$ ), small molecules (GSH and ATP), protein (human neutrophil elastase) and enzyme activities (polymerase, hepatitis C virus NS3 helicase).

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# Table of Contents

Declaration	i
Abstract	ii
Acknowledgements	iii
Table of Contents	iv-vii
Illustrations	viii-xxvi
List of Abbreviations	xxvii-xxx
<b>Chapter 1</b> Introduction	
1.1 Introduction	1–3
1.2 Oligonucleotide-based sensing platforms	4–8
1.3 Label-free oligonucleotide-based sensing using luminescent molecules	8–10
1.4 Luminescent transition metal complexes as DNA probe	10–12
1.5 Objectives	13
1.6 Reference	13–15
<b>Chapter 2</b> Utilization of iridium(III) complex in G-quadruplex-based luminescent switch-on probe for the detection of strontium(II) ion	
2.1 Introduction	16–20
2.2 Result and Discussion	20–29
2.3 Experimental section	30
2.3.1 Materials	30
2.3.2 General experiment	30–31
2.3.3 Synthesis of [Ir(ppy) <sub>2</sub> (biq)]PF <sub>6</sub>	31
2.3.4 Complex <b>2.1</b> as molecular probe for oligonucleotide- based Sr <sup>2+</sup> detection	31–32
2.3.5 Assay selectivity	32

2.3.6 Real sample analysis	32–33
2.4 Conclusion	33–34
2.5 Reference	35–38
<b>Chapter 3</b> Exploration of the luminescence response of <b>2.1</b> like iridium(III) complexes towards DNA and the application in G-quadruplex-based luminescent detection of protein, small molecule and enzyme activity	39
3.1 Introduction	39–46
3.2 Result and Discussion	47
3.2.1 A G-quadruplex-selective luminescent switch-on probe for the detection of sub-nanomolar human neutrophil elastase	47–59
3.2.2 A luminescent G-quadruplex switch-on probe for the highly selective and tunable detection of cysteine and glutathione	60–76
3.2.3 A highly sensitive G-quadruplex-based luminescent switch-on probe for the detection of polymerase 3' to 5' proofreading activity	77–88
3.3 Experimental section	89
3.3.1 Materials	89
3.3.2 Synthesis	89–91
3.3.3 Emission response of <b>3.1</b> , <b>3.2</b> and <b>3.3</b> towards different forms of DNA	91
3.3.4 Emission measurement for the detection of HNE in buffered solution	91–92
3.3.5 Emission titration for the detection of cysteine and glutathione in buffered solution	92–93
3.3.6 DNA polymerization assay procedures	93
3.3.7 Polymerase proofreading activity detection in aqueous buffered solution	93–94
3.4 Conclusion	95–96
3.5 Reference	96–100

<b>Chapter 4</b>	Investigation of G-quadruplex selectivity of Ir(III) complexes and application in G-quadruplex-based luminescent detection of ATP and base excision repair enzyme activity	101
	4.1 Introduction	101–106
	4.2 Result and Discussion	107
	4.2.1 A label-free luminescent switch-on assay for ATP using a G-quadruplex-selective iridium(III) complex	107–121
	4.2.2 Detection of base excision repair enzyme activity using a luminescent G-quadruplex selective switch-on probe	122–140
	4.2.3 Label-free luminescent switch-on detection of endonuclease IV activity using a G-quadruplex-selective iridium(III) complex	141–154
	4.3 Experimental section	155
	4.3.1 Materials	155–156
	4.3.2 Synthesis	156–157
	4.3.3 Luminescence response of complexes towards different forms of DNA	158
	4.3.4 Complex <b>4.1</b> as a G-quadruplex probe for oligonucleotide-based ATP detection	158
	4.3.5 Total cell extract preparation	159
	4.3.6 FRET melting assay	159
	4.3.7 G4-FID assay	160
	4.3.8 Gel electrophoresis to investigate the dissociation of the duplex substrate	161
	4.3.9 Detection of UDG activity	161
	4.3.10 Detection of Endo IV activity	163
	4.4 Conclusion	163–166
	4.5 Reference	167–172



<b>Chapter 5</b>	Exploring larger libraries of iridium(III) complexes and the label-free luminescence switch-on detection of hepatitis C virus NS3 helicase activity using a G-quadruplex-selective probe	173
5.1	Introduction	173–178
5.2	Result and Discussion	179–196
5.3	Experimental section	197
5.3.1	Detection of helicase activities	197
5.3.2	Detection of helicase activity in cell extract	198
5.3.3	Synthesis	198–205
5.4	Conclusion	206–207
5.5	Reference	208–213