

An Indian-Australian research partnership

**Project Title:** **Structural studies on lanthanide complexes with amino acids and peptides**
**Project Number** **IMURA0478**
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**Monash Co-supervisor(s)**  
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**Monash Department:** School of Chemistry

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**IITB Co-supervisor(s)**  
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**IITB Department:** Department of Chemistry

## Research Academy Themes:

**Highlight which of the Academy's Theme(s) this project will address?**
*(Feel free to nominate more than one. For more information, see [www.iitbmonash.org](http://www.iitbmonash.org))*

1. Advanced computational engineering, simulation and manufacture
2. Infrastructure Engineering
3. Clean Energy
4. Water
5. Nanotechnology
6. Biotechnology and Stem Cell Research

## The research problem

*We have an ongoing project on "Low-coordinate monomeric lanthanoid chalcogenolates". These complexes could prove to be suitable precursors for nano-sized lanthanoid chalcogenides which have applications in optical and magnetic devices. In this regard we wish to extend the work to prepare "Lanthanoid complexes with amino acids and peptides containing selenocystein and tellurocystein." The use of small peptides<sup>1</sup> containing selenocystein and tellurocystein may lead to the isolation of desired chalcogenolates. The complexes, in addition to be used as precursors for chalcogenides, can also be evaluated for the imaging applications.<sup>2</sup>*

1. (a) S. Yoshida, F. Kumakura, I. Komatsu, K. Arai, Y. Onuma, H. Hojo, B. G. Singh, I. Priyadarshini, and M. Iwaoka, *Angew. Chem. Int. Ed.* **2011**,50,2125-2128.  
 (b) T. Takei, Y. Urabe, Y. Asahina, H. Hojo, T. Nomura, K. Dedachi, K. Arai, and M. Iwaoka, *J. Phys. Chem. B* **2014**,118,492-500.

2. (a) C. Kremer, J. Torres, S. Dominguez and A. Mederos, *Coord. Chem. Rev.*, **2005**, 249, 567-590.
- (b) T. Terai, K. Kikuchi, S. Iwasawa, T. Kawabe, Y. Hirata, Y. Urano, and T. Nagamno, *J. Am. Chem. Soc.*, **2006**, 128, 6938-6946.

### Project aims

*The main aim of the project is to synthesize and structurally characterise monomeric complexes of lanthanoids with selenocystein and tellurocystein containing small peptides.*

*The work in the initial stages will focus on preparing the desired peptides and subsequently preparing their complexes. There are no studies reported in the literature on the interaction of these acids and peptides with lanthanoids.*

### Expected outcomes

*Highlight the expected outcomes of the project*

The project work should lead to development of new chemistry on the interaction of lanthanoids with selenocystein/ tellurocystein / peptides containing these acids.

The structural characterisation may reveal interesting modes of binding of the ligands with lanthanoids.

The monomeric complexes should prove to be good precursors for preparing lanthanoid chalcogenides.

Also the complexes should prove to be good magnetic resonance contrast agents.

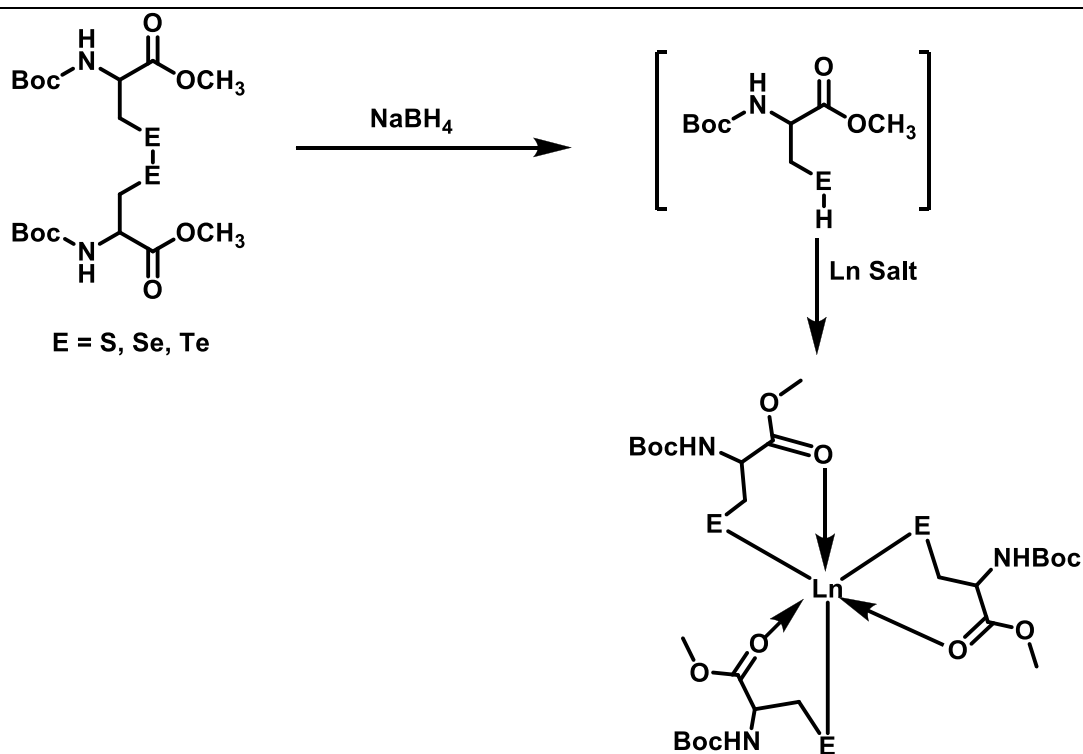
### How will the project address the Goals of the above Themes?

*Describe how the project will address the goals of one or more of the 6 Themes listed above.*

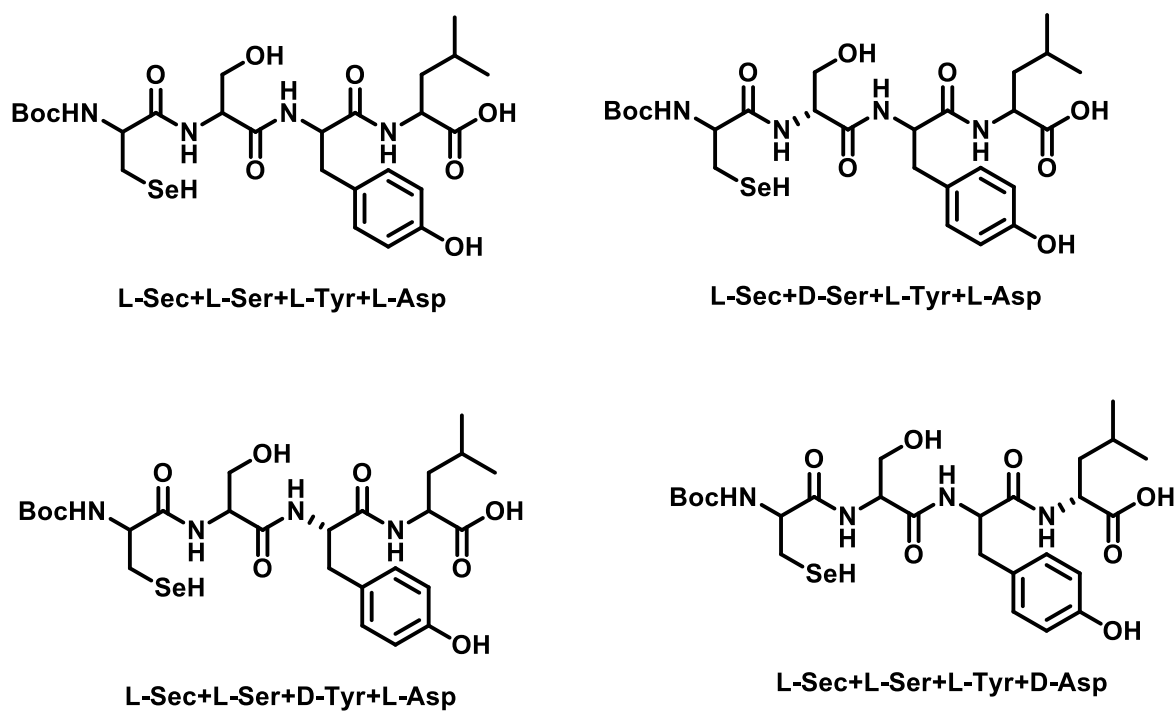
1. The following reaction schemes will be pursued to prepare the desired complexes.
2. The incorporation of amino acids with "hard" donor atoms such as tyrosine, aspartic acid, serine along with selenocystein/tellurocystein can provide the desired ligating environment.
3. Also inclusion of D-amino acids in a chain of L-amino acids can provide desired folds to ligate lanthanoid ions.<sup>3</sup>

3. S. Durani, *Acc. Chem. Res.* **2008**, 41, 1301-1308.

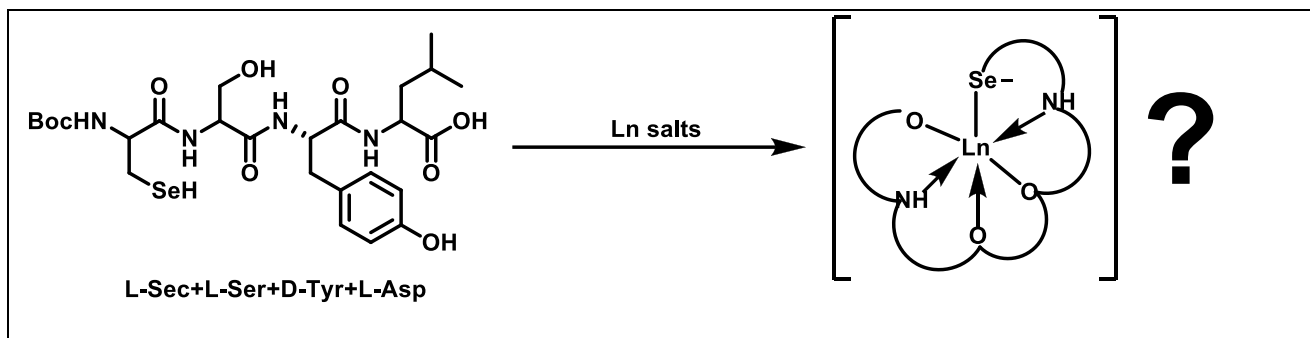
**Scheme 1:** Synthesis of L-Cys, Sec, Tec and D-Cys, Sec, Tec Amino acid containing Lanthanoid complexes



**Scheme 2:** Synthesis of small peptides



**Scheme 3:** Synthesis of peptide containing Lanthanoid complexes



## Capabilities and Degrees Required

*The candidate should have M Sc in General,/Inorganic/Organic specialisation. The candidates with some experience in synthetic chemistry will be given preference.*

## Potential Collaborators

*Please visit the IITB website [www.iitb.ac.in](http://www.iitb.ac.in) OR Monash Website [www.monash.edu](http://www.monash.edu) to highlight some potential collaborators that would be best suited for the area of research you are intending to float.*

Please provide a few key words relating to this project to make it easier for the students to apply.

**Lanthanoids, Amino Acids, Selenocystein, Tellurocystein, Peptides**