

STudent REsearch Mobility Programme (STREAM) Research Project proposal

Host University : Leiden University

Main Research Field (drop-down list): 15. Natural Sciences

Specified field, subject:

Inorganic Chemistry, Medicine, Life Science, Chemical Biology, Photo-Chemistry

Research project title:

Light-activated anticancer compounds

Possible starting month(s):

Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>									

Exact starting and end dates will be discussed between the supervisor and the student

Possible duration in months:

- Minimum: 3 months
- Maximum: 2 semesters

Suitable for students in: Bachelor level Master level

Prerequisites:

- Minimum GPA 3.2 out of 4
- Basic knowledge (sophomore level) in general chemistry, inorganic chemistry, organic chemistry and basic spectroscopy.

Description:

Chemotherapy is, after surgery, the second most efficient therapy against cancer. However, it has many side effects for cancer patients because anticancer drugs kill cancer cells but also healthy ones. Phototherapy consists in treating a cancer patient with a light-sensitive prodrug that is poorly active in the dark. After the compound has distributed in the patient and the tumour, light irradiation of the tumour only ensures that the light-induced toxicity of the compound is only released at the place of irradiation, i.e., in the tumour. As demonstrated in photodynamic therapy (PDT), a clinically approved version of anticancer phototherapy, this new type of treatments lowers side-effects for the cancer patient. However, PDT sometimes fails; also, it is often associated with pain and/or extended photosensitivity of the patient after the treatment.

This project aims at synthesizing new metal-containing compounds to solve the problems of currently available technologies. Like in PDT, these new compounds are poorly toxic in the dark, and can be activated upon visible light irradiation, i.e., become toxic and kill cancer cells only at the time and place where light is shone. However, they are activated by light in a completely different manner, as they contain ruthenium, a heavy metal combining photochemical and anticancer properties. Upon replacing the weakly bound chloride ligands of known cytotoxic ruthenium compounds by strongly bound sulphur ligands, the DNA- and protein-binding ability of the ruthenium compounds is lowered, which will lower their toxicity in the dark. By shining light onto the ruthenium-enriched cancer cells photochemical cleavage of the Ru-S bond will take place, thus detaching the metal complex from the sulphur ligand and allowing it for binding to biological molecules. Thus, the ruthenium prodrug will be



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transformed inside cancer cells into a highly toxic molecule that will kill the cells. The projects consist in synthesizing new ruthenium-containing molecules and studying their photochemical properties. For 2-semester research training projects biological studies can also be included.

Faculty and/or Department:

[Faculty of Science](#) / [Leiden Institute of Chemistry \(LIC\)](#)

Deadline for nomination to reach Leiden University:

- 1 April (for Fall semester intake) / 1 October (for Spring semester intake).
- Please note: Due to the COVID-19 situation and measures taken, the project might be cancelled if empirical research in the institute is impeded by COVID-19.

Additional information:

- Number of places available per semester: 1.

Notification of admission given by the end of:

Approximately 6 weeks after receipt of the application.

Contact person:

Ms. Usha Mohunlol, Coordinator STREAM Programme

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