LERU STudent REseArch Mobility Programme (STREAM)
Project proposal

Host University: Leiden University

Main Research Field (drop-down list): 13.3 Chemistry

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
☒	☐	☐	☐	☐	☒	☐	☐	☐	☐	☐	☐

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 tumor, light irradiation of the tumor only insures that the light-induced toxicity of the compound is only released at the place of irradiation, ie, in the tumor. 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 sulfur 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 sulfur ligand and allowing it for binding to biological molecules. Thus, the ruthenium prodrug will be transformed inside cancer cells into a highly toxic molecule that will kill the cells. The projects consists in synthetizing new ruthenium-containing molecules, and studying their photochemical properties. For 2-semester research training projects biological studies can also be included.

Faculty: Science

Faculty Department: Leiden Institute of Chemistry

Deadline for nomination to reach host university:
1 April or else 1 October.

Notification of admission given by the end of:
Approximately 6 weeks after receipt of the application.

Additional information:
Number of placements available: 1 per semester
The exact duration needs to be determined in consultation with the Research Project Supervisor

Contact person:
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