

Screening and identification of potential anti-borreliae phytochemicals

Summary

This PhD research focuses on finding novel lead compounds from plants used in Estonian folk-medicine with anti-borreliae activity. This will be achieved through developing extraction and isolation techniques for discovering bioactive compounds from biomass and subsequent in vivo testing against Borrelia burgdorferi.

Research field:	Chemistry and Biotechnology
Supervisor:	Merike Vaher
Availability:	This position is available.
Offered by:	School of Science Department of Chemistry and Biotechnology
Application deadline:	Applications are accepted between May 03, 2021 00:00 and May 31, 2021 23:59 (Europe/Zurich)

Description

Lyme borreliosis is a multi-system bacterial disease that is widespread in the world. It is caused by a spirochaete, *Borrelia burgdorferi*, which is spread to humans from ticks. Antibiotics are used to treat Lyme disease in modern medicine, but they are only effective in acute cases, and not in chronic forms, where they may even facilitate the disease. As a result, this project will focus on a new approach to characterize the antibacterial properties of plant extracts used in folk-medicine by multi-instrumental measurements, and by an evaluation of their effects on different morphological forms of *Borrelia*.

The use of various extraction methods (SLE, MAE, UAE, SFE, SWE) and solvents (alcohols, acetone, hexane, ethyl acetate, DES etc.) will add selectivity for improved extraction. The extracts will be analyzed and characterized by separation techniques, including column chromatography, TLC, CE-DAD, HPLC-MS. The crude extracts will be fractionated to substance classes and purified to specific compounds. The fractionated and/or purified lead compounds will be tested for anti-borreliae activity and for cytotoxicity in mammalian cell cultures. Moreover, the active fractions and compounds will be tested in combinations to determine possible synergistic effects.

The main objective of this project will be creating a database of plant extracts, natural compound classes, and isolated compounds with anti-borrelia effects, which includes the following steps:

- Determine effective extraction techniques for the isolation of compounds of interest from the plant biomass
- Development of reliable methods for the whole extract characterization as well as fractionation, isolation, and the identification of substances
- In vitro screening of the isolated phytochemicals for their antibacterial activities against *B. burgdorferi* sp. and cytotoxicity testing in the mammalian cell cultures
- Structural elucidation of the lead compounds obtained from the plant extracts (using HPLC-MS, NMR)

Applicants should fulfil the following requirements:

- Master's degree in a relevant scientific discipline (natural sciences)
- Experience in methods for extraction, characterization, and identification of natural compounds
- Deep interest in separation, phytochemical sciences and microbiology

- Highly motivated and with good communication skills



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