Project Details

**Project Title**
Development of IoT enabled surveillance system for monitoring pollution caused by pharmaceuticals wastes

**Project Summary**

India being a major hub for pharmaceutical manufacturing is associated with high levels of antibacterial antibiotics (ABAs) in effluent linked to antibiotic manufacturing with a significant higher concentrations than raw sewage. Presence of APIs and particularly active ABAs (pharmaceuticals and personal care products; PPCPs) in the environment has resulted in increased levels of resistant bacteria (ARB) cultivated from waste streams and resistant genes in bacteria (ARGs) in total community DNA. Baddi, one of the largest pharmaceutical hubs in India holds around 500 small medium large pharma units accounting for 35% Asia’s total medicine production is . In order to monitor their impact and regulate their activities to stop waste antibiotics entering both aquatic and terrestrial habitats and spreading resistant bacteria and damaging human health, it’s important to identify and quantify the APIs and ARAs in different water streams. High and low level of pharmaceutical manufacturing regions of Baddi and Kangra can be mapped as sites for sample collection where sampling from industrial effluents, waste streams, waste treatment plants and river and sewage outlets to be used to identify and quantify ABAs and APIs by analytical chemistry using LCMS technology. Different water quality parameters will be assessed to understand the impact of the said pollutants on receiving water bodies. Deep sequencing of samples followed by data analysis would help to develop thorough understanding of the problem. The IoT enabled monitoring framework would improve the mapping with minimal human intervention. Human exposure data to these industrial waste streams and river can provide vital information to link source of waste and gene resistance by focused ethnographic studies, interviews and secondary data from patient records at governmental healthcare facilities would complement the findings. One important source for studying the impact of local levels of ABAs and APIs on human faecal resistome and prevalence of resistant E. coli from patients in hospitals, health centers and clinics by faecal resistome analysis of E. coli isolates. In order to establish impacts of antibiotic pollution and consumption on local population at two sites key drivers of ARG can be investigated by via mathematical models via data analysis and statistical modelling. The data and information from these plans can be used to develop recommendations for environmental guidelines to inform a risk assessment protocols across Indian and other relevant countries. All these efforts would help to build an IoT enabled surveillance system for AMR surveillance.

**PhD Supervisors**

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<tr>
<th>Role</th>
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<tbody>
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## Project requirements (Student qualifications, experience required, etc.)

- M.Tech in Chemical Engineering / Nanotechnology / Materials Science / Biochemical Engineering / Electronics & Communication Engineering OR MSc in drug design and discovery/ Biochemistry
- Candidate with hands on experience on LC-MS operation is preferred

## Source of funding (IRD/FITT Project details, if any)

RP03651

## Role of Faculty Members involved

The proposed work is truly an interdisciplinary task where the expertise of the collaborators can be complementary. There are clearly two segments of the entire research work. Different PPCPs, ARB and ARGs will be analyzed under the supervision of Prof. SZA at his lab. Prof. SA will help to develop the sensor framework to monitor different water quality parameters. Prof. BL and Prof. SA will help to develop the IoT enabled surveillance system for mapping the pollutants and developing the mathematical model for assessing the impact of the pollutants on waterbodies and human health.