1. Summary
One Health is an important emerging framework which emphasizes the connection between the wellbeing of the environment, animals and humans. Most One Health initiatives focus on zoonoses and antibiotic resistance. Within this Interfaculty Research Cooperation (IRC), we propose to address a new, potentially highly relevant aspect of One Health: cascading, microbiome-mediated health. By investigating this topic in a single defined multitrophic model system including soils, plants, ruminants and mice as model organisms for human health, our project will add an important new dimension to the concept of One Health and will serve as a nucleus to develop a competitive NCRR on microbiome-mediated health.

The overall objectives of our project are to study the cascading impact of three types of common environmental chemicals on the health of soils, plants and animals and to assess the relative contribution of microbial communities at the interfaces between these trophic levels. By developing and investigating a multitrophic model system, we plan to address the following key questions:

1. How do plant secondary metabolites, heavy metals and pesticides structure the microbiomes at the interfaces between soils, maize plants, cattle and the mouse model?
2. How do the microbiome changes affect the health of the different host organisms/habitats?
3. Do the health effects on the individual hosts change the health of the other hosts (“cascading health”)?

These key questions of the project will be answered by integrating the expertise of 9 different groups which specialize on microbiomes, environmental chemicals, plant, animal and human health and bioinformatics.

The added value of our collaborative project is four-fold:

1. By integrating the different groups and uniting their expertise within a common model framework, we will be able to capture cascading health effects across trophic levels which none of the involved groups could measure on its own.
2. By assessing the impact of common environmental chemicals on microbiome-dependent health across different trophic levels, we will be able to document microbiome patterns that would remain invisible otherwise.
3. The resulting interdisciplinary structure will provide a nucleus from which our newly developed concepts can be expanded to encompass other systems, with the final aim to capture the multitrophic dynamics elicited by environmental change and describe as well as remedy impacts on the integrity of anthropogenic and natural ecosystems.
4. By supporting the training and integration of several young investigators with proven track-records of scientific excellence, our project will significantly contribute to capacity building in interdisciplinary research at the University of Bern.

In summary, we expect our proposal to play a pioneering role in the scientific analysis, integration and expansion of the One Health concept and to provide a strong basis for a future NCCR.