Socio-economic and scientific context:

There is a risk of cross-contamination of feedingstuffs with antibiotics during manufacture. This risk is linked, in particular, to the use of common production lines for all types of feed, including medicated feed. Surveillance plans put in place by the Directorate General for Food in 2017 and 2018 on feedingstuffs on farms have revealed high frequencies of antibiotic contamination. These results show uncontrolled exposure of animals to concentrations of antibiotics far below the dosage, in a context where the use of antibiotics is tightly controlled to maintain their effectiveness. A new European regulation on the manufacture, placing on the market and use of medicated feedingstuffs has just been adopted and the establishment of maximum levels of cross-contamination based on a scientific risk assessment is requested by EFSA. Similarly, a working group set up by the FAO aimed at answering several questions on the risks related to cross-contamination in feedingstuffs, and in particular the risk of antibiotic residues in food of animal origin.

Assumptions and Questions:

The contamination of feed by antibiotics during manufacture raises various issues such as the possibility of transfer of antibiotics to food of animal origin, potentially leading to a risk of exceeding Maximum Residue Limits that could be harmful to the consumer and the farmer. Indeed, the distribution of food contaminated with antibiotics to farm animals is an uncontrolled risk that does not lead to the regulatory application of a withdrawal period, as recommended by the regulations on veterinary drugs. Finally, the potential selection of resistant strains in the intestinal microbiota of animals in the presence of antibiotic concentrations far below dosage levels is an issue of considerable interest in the current context. There are publications describing the selection of resistant strains at doses far below therapeutic doses. The objective of this project is therefore to assess the risks of residues and emergence of resistance in animals fed contaminated feed at levels corresponding to the levels currently tolerated by good feed manufacturing practices.

Thesis main phases:

The thesis project will be divided into three main phases in order to meet the objective.

1) Development and validation of methods for the assay of selected antibiotics in biological matrices by LC-MS/MS, i.e. muscle, liver, plasma, faeces and possibly fat.

2) Evaluation of the risk of transfer of antibiotics from feed to raw products by an experimental study on 4 groups of pigs: the measurement of antibiotic concentrations in tissues, plasma and faeces from pigs fed with daily rations of contaminated feed will allow to assess the risk of transfer. Each group will be fed an antibiotic or a combination of antibiotics at concentrations corresponding to the currently tolerated levels of contamination. Faeces and plasma will be collected regularly. At the end of the treatment period, livers, muscles and possibly fat will be sampled. All the samples from the different matrices will be measured. Combined with the results in the tissues and the quantities administered, the plasma data will make it possible to model the concentrations expected in the tissues following cross-contamination in food.

3) Estimation of the risk of emergence of antibiotic resistance in the intestinal microbiota of pigs by an experimental study on 2 groups of pigs: Escherichia coli (E. coli) is a commensal bacterium of the digestive tract that can be considered as an indicator bacterium of the evolution of antibiotic resistance phenotypes in the Gram- population of the intestinal microbiota. Each group of pigs will be exposed to a feed contaminated with the antibiotic of interest. Faeces of the animals will be collected several times during the pre-treatment, treatment and post-treatment phase. The total E. coli populations will be enumerated on selective media and their sensitivity to the antibiotic in the feed will be determined on selective media with added inhibitory and sub-inhibitory concentrations of the antibiotic of interest. The impact of the antibiotic present in the feed on the co-selection of resistance to other families of antibiotics of interest in veterinary and human medicine will also be studied. The size of total E. coli populations, the distribution of MICs and associated resistance percentages will be compared over time to assess the impact of daily exposure to low concentrations of antibiotics.

Scientific and technical skills required by the candidate:

The candidate should have knowledge of pharmacology and microbiology and competence in the analytical sciences. Knowledge of statistics and pharmacological modelling will be a plus.
3 publications from the team (5 last years):


National and international Collaborations:

Collaboration interne au laboratoire Anses de Fougères avec deux unités : Unité Antibiotiques, biocides, résidus et résistance (AB2R) et Unité Expérimentation, Modélisation et Analyse de données (EMAD).


Collaboration éventuelle avec l’Interprofession Nationale Porcine.