FARE INTO FIGURES

2 INRAE divisions (Transform and AgroEnv) and 1 URCA division (AEBB)
30 researchers, associate-professors and professors, engineers and technical staffs
8 PhD students, trainees and apprentices a year
1200 hours of teaching a year
85 research projects
50 scientific papers and patents a year
2 700 000 € annual budget

FRACTIONATION OF AGRORESOURCES AND ENVIRONMENT

Joint research unit INRAE & URCA

Uncovering the mechanisms and tools shaped by Nature to improve the use of renewable carbon and to contribute to sustainable development is the ambition of the FARE laboratory.

Our mission, inside the network of our INRAE and URCA partner labs, is focused on three key points of the biological & technological transformation of lignocellulosic plant biomass:

Follow the degradation of lignocellulose (culture residues, litters) by soil microorganisms in the field, in order to maintain fertility and to favor ecosystem services necessary for a sustainable agriculture (input management, carbon and nitrogen cycles).

Fractionation of lignocellulose by enzymatic or microbial biotechnological processes, to produce chemicals of interest for chemistry and energy, while respecting the green chemistry concepts.

Using agro-sourced fibers and polymers, to design innovative nanostructured materials with new optical properties (protective films and coatings), or composite materials with high technical and environmental performances.
**Topic 1: Biological Deconstruction of Lignocellulose**

H. Rakotoarivonina - O. Paes

Goal is to identify, characterize and control the features of their interactions which determine the biodegradation of lignocellulosic substrates. Selectates considered are crop residues (wheat straw), co-products from transformation processes (wheat bran) and deboosted crop (short rotation coppices, fibre plants).

First results are related to the hydrolysis of lignocellulosic substrates. Substrates considered are crop residues (wheat straw), co-products from transformation processes (wheat bran) and deboosted crop (short rotation coppices, fibre plants). The aim of the cross-topic animation "Conceptualization and modelling" is to understand and predict the transformation processes of lignocellulosic biomasses identifying the markers of these transformations. In FARE, we develop computational models which involve complementary research:

- the determination process to producino-composites
- the desconstruction of lignocellulosic biomasses
- the enzymolysis of plant litter or soil

The dynamic multi-scale models rely on experimental results and are used as guide to direct and harmonize experimental efforts in FARE.

**Cross Topic: Conceptualisation et Modélisation**

The aim of the cross-topic animation "Conceptualisation et Modélisation" is to understand and predict the transformation processes of lignocellulosic biomasses identifying the markers of these transformations. In FARE, we develop computational models which involve complementary research:

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**Cross Topic: Microscopy and Physico-Chemistry**

A. Habrant

Chemical and microstructural analysis of plant wall fractions, residues and polymers is performed by chromatography, spectrosopy (UV, IR, fluorescence), light diffusion or dynamic vapor sorption (DVS). These techniques allow to characterize physico-chemical properties of the various (hemicellulose, cellulose, lignin) or bioinspired (film, gel) assemblies. Surface properties, such as wettability or solid or liquid interfacial tensions to liquid or solid interfacial tensions are investigated by contact angle measurement of water or oil droplet. This technical activity pole combines the skills of 3 technical domains:

- **Microbiology**: culture of bacterial strains (Thermobacillus xylanilyticus), expression of native and recombinant proteins, protein characterization, molecular biology techniques (DNA/RNA extraction, cloning, PCR).
- **Enzymology**: purification of enzymes and sugars (chromatography, biochemical characterization of enzymes, implement of enzymes on substrates [powder, tissue, lyophilic extract], production of recombinant proteins, protein characterization, molecular biology techniques [DNA/RNA extraction, cloning, PCR]).
- **Biogencochemistry**: measurement of C and N immobilization in soils, use of stable isotopes ([13C, 15N] and isotopic analysis, oxygen uptake, oxygen uptake [13C/15C] chemical characterization of soils and litter).