

Genomics & Transcriptomics of Plant-Prokaryotes Interactions

Objectives

- Decipher **epidemic processes** involved in **disease emergence**
- Understand **bacterial pathogenicity** mechanisms
- Comprehend **plant resistance** mechanisms
- Propose **durably resistant** plant material for breeding

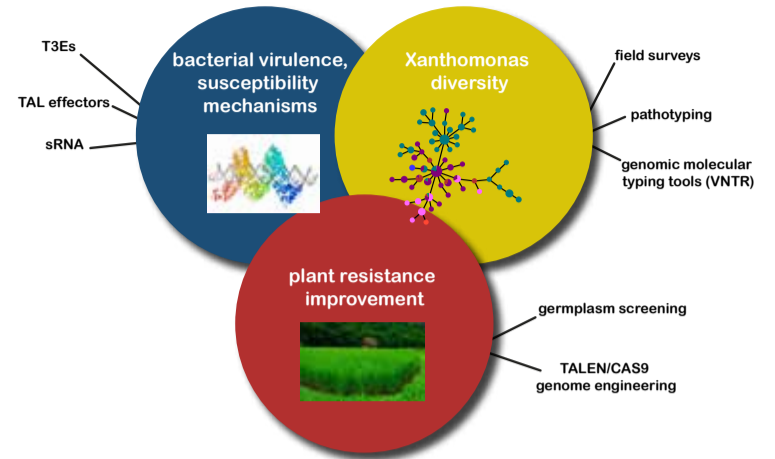
Models

One major bacterial model: *Xanthomonas*

- **pathogenic on more than 140 plants**, high host and tissue specialization
- a unique and complex **pathogenicity process**: specific proteins are injected inside the plant cell, where they hijack the plant metabolism to the benefit of the bacteria

Different complementary economically important pathosystems

- *Xanthomonas oryzae* pv. *oryzae* & pv. *oryzicola* on rice
- *Xanthomonas citri* pv. *citri* on citrus
- *Xanthomonas phaseoli* pv. *manihotis* on cassava
- *Xanthomonas vasicola* pv. *musacearum* on banana
- pathovars of *Xanthomonas translucens* on cereals



Ralf Koebnik



Lionel Gagnevin



Valérie Verdier



Florence Auguy



Sandrine Fabre



Sébastien Cunnac



Boris Szurek



Emmanuel Wicker

<b>Molecular epidemiology, population genetics, pathotyping, diagnostics</b> <i>X. musacearum</i> , <i>X. oryzae</i> , <i>X. manihotis</i> , <i>X. translucens</i>	<b>Diversity &amp; evolution of T3SS &amp; T3E</b> <i>X. citri</i> , <i>X. oryzae</i> , <i>X. translucens</i>	<b>Diversity &amp; evolution of TAL effectors</b> <i>X. citri</i> , <i>X. oryzae</i> , <i>X. translucens</i> , <i>X. manihotis</i>
<b>Functions &amp; targets of TAL effectors</b> <i>X. oryzae</i> , <i>X. manihotis</i> , <i>X. citri</i> , <i>X. translucens</i>	<b>Roles of sRNA in rice susceptibility</b> <i>X. oryzae</i>	<b>Resistance engineering: germplasm screening, genome editing</b> rice, cassava

Major results

- Involvement in several *Xanthomonas* **sequencing projects** (FNX consortium): more than 100 genomes, which provide indispensable data for our research
- Development of **MLVA typing** tools for population analysis and epidemiological monitoring
- Development of a WEB platform for automatic **classification & annotation** of TALE, and for **plant target prediction**
- Identification of plant small RNAs induced by bacteria (TE3) that may **suppress rice immunity**
- Identification of **loss of susceptibility resistance gene** in rice (*xa41*)
- Characterization of SWEET sugar transporters as **major susceptibility targets** of *Xoo* in rice
- Identification of UPTAL2, an ERF transcription factor, as a **new susceptibility gene** specific of African *Xoo* strains
- Design of new resistance alleles of rice to BLB (*X. o. pv. oryzicola*) by **genome editing**
- Design of **artificial TALEs** for the analysis of TALE plant targets



TALEN editing of the rice genome in the promoter of SWEET 14 leading to loss of susceptibility to *Xoo*

Projects & funding

- ANR (XANTHracing, Xanthomix, CROpTAL, PIXIES)
- Bill & Melinda Gates Foundation (TALEnted\_Rice)
- Agropolis (Plant Epidemiosurveillance, PAIX, MUSEOVIR, MIC-CERES)
- Rice Agri-Food system (MENERGEP)
- PEERS (YUCATAL)
- Région Languedoc-Roussillon (Projet Chercheur d'avenir)
- Post-doctoral & doctoral fellowships (NSF, ERASMUS, Beachell-Borlaug, MESR)
- EU (Marie Curie IOF : RXomics)



Publications & tools

- Databases & bioinformatic tools:
  - www.xanthomonas.org
  - QueTAL, TALVEZ
- 18 publications in 2015 in journals with IF>3 with more than 60% in partnership with collaborators in the South



Teaching & training

- Master courses (~20h/year SupAgro Montpellier and U. Montpellier)
- Coorganization of the course 'Biologie Intégrative des Systèmes Microbiens Parasitaires' (25h) Master DIPHE and DEMPI (UM)
- Teaching 'Biotechnologies Végétales et Microbiennes', 'Phytopharmacie et Protection des Végétaux' at U. Cheikh-Anta-Diop (Sénégal)
- in 2015: 3 PhD defenses, 3 post-docs, 4 visiting scientists, 7 PhD students



Our team is deeply involved in the FNX network started in 2008 (INRA SPE). This network is a major tool for cooperation, project management and for the international visibility of the French *Xanthomonas* community

- LIPM (INRA, CNRS, UPS), Toulouse
- IPME (IRD, CIRAD, UM), Montpellier
- BGPI (INRA, CIRAD, SupAgro), Montpellier
- EMERSYS (INRA, AgroCampus Ouest, U. Angers), Angers
- PVBMT (CIRAD, U. Réunion), La Réunion