



**HAL**  
open science

## **ABRomics: A Galaxy-based one health antimicrobial resistance platform**

Pierre Marin, Bérénice Batut, Kenzo-Hugo Hillion, Clea Siguret, Raphael Tackx, Lao Julie, Nadia Goué, Gildas Le Corguillé, Fabien Mareuil, Philippe Glaser, et al.

### ► To cite this version:

Pierre Marin, Bérénice Batut, Kenzo-Hugo Hillion, Clea Siguret, Raphael Tackx, et al.. ABRomics: A Galaxy-based one health antimicrobial resistance platform. GCC 2024 - Galaxy Community Conference 2024, Jun 2024, Brno, Czech Republic. , 10.7490/f1000research.1119762.1 . hal-04619528

**HAL Id: hal-04619528**

**<https://hal.science/hal-04619528v1>**

Submitted on 20 Jun 2024

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



# A Galaxy-based One Health Antimicrobial Resistance Platform

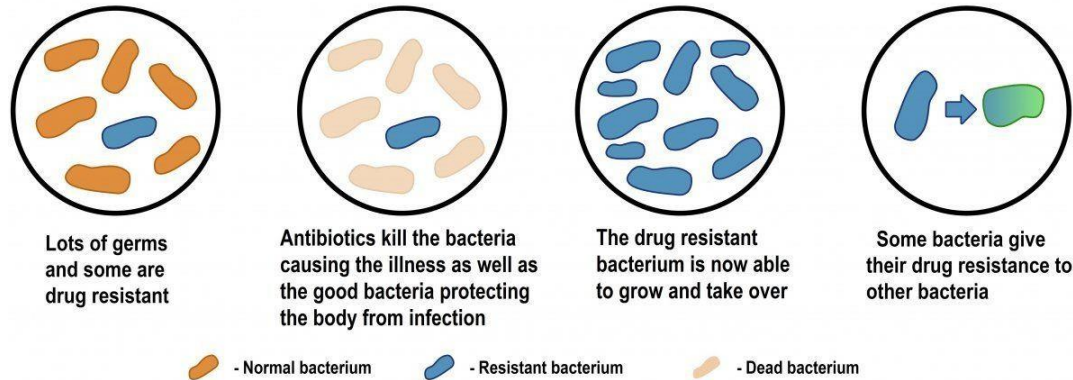
B erence Batut on behalf of the ABRomics consortium

Galaxy Community Conference 2024

# AntiMicrobial Resistance (AMR)

Bacteria, viruses, fungi and parasites no longer respond to antimicrobial medicines

## How antibiotic resistance happens



# One of the Top Global Public Health and Development Threats

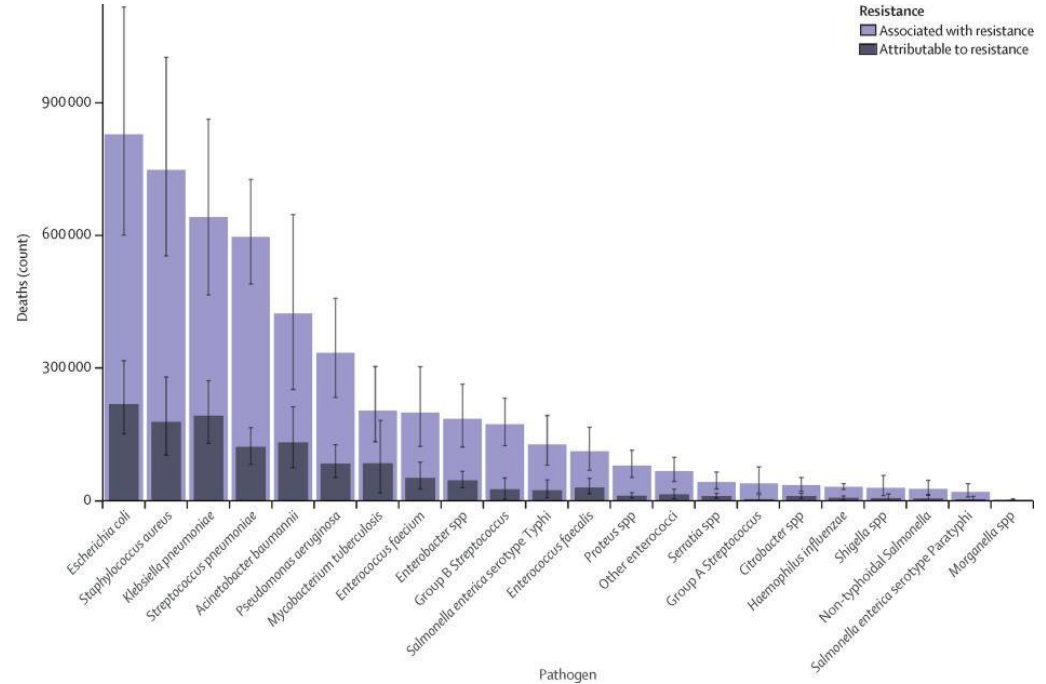


Figure 2 - Antimicrobial Resistance Collaborators et al, The Lancet, 2022.

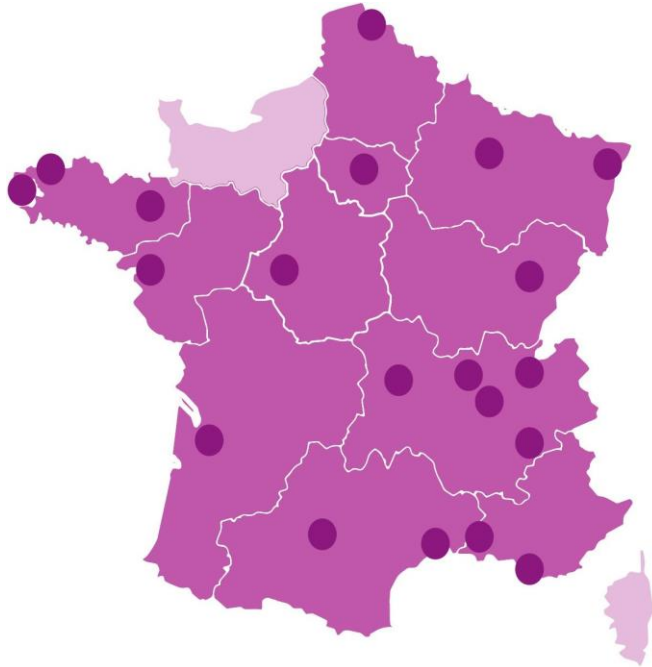
# Rationale for ABRomics

1. Increasing access to **sequencing for clinical laboratories**, including outside university-teaching hospitals
2. Improvement thanks to **genomics** and **metagenomics** of our knowledge about the (complex) circulation of antibiotic-resistant bacteria, mobile genetic elements (MGE) and antibiotic resistance genes (ARG)
3. Mostly siloed investigations, while a **global picture** is needed

To address this gap in the French ecosystem:

**ABRomics (2 M€ for 4 years): a multi-omics One Health platform for collaboration and data sharing between researchers and clinicians for AMR surveillance**

# ABRomics Consortium



## National team effort

- 43 partners
- **Multidisciplinary consortium**
- **National reference centers for antibiotic resistance**

## Coordination

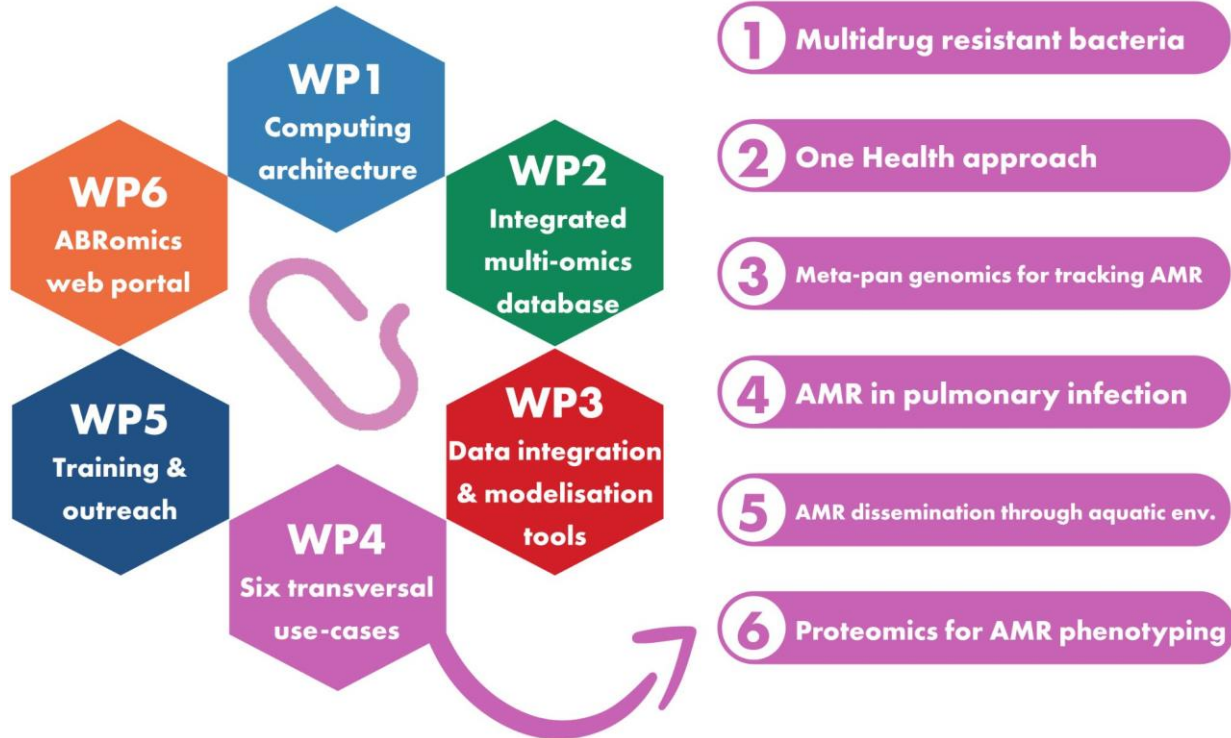
- Claudine Médigue (French Institute of Bioinformatics)
- Philippe Glaser (Institut Pasteur)

# ABRomics Objectives

- Provide an open access to genomic and metagenomic analyses through **standardised and controlled pipelines** and an up-to-date set of **mathematical and bioinformatic tools**
- Build a repository of **structured, interoperable, standardized and well-annotated multi-omics microbiological data** from **human, animal and environmental origins**
- **Be easily usable** by non bio-informaticians and experts in AMR analysis
- Provide a **shared platform** to improve the **surveillance and research on antibiotic resistance across human, animal and environment sectors**

**Online One Health community-driven platform  
to scale up and improve surveillance of antibiotic resistance**

# Work Packages of ABRomics

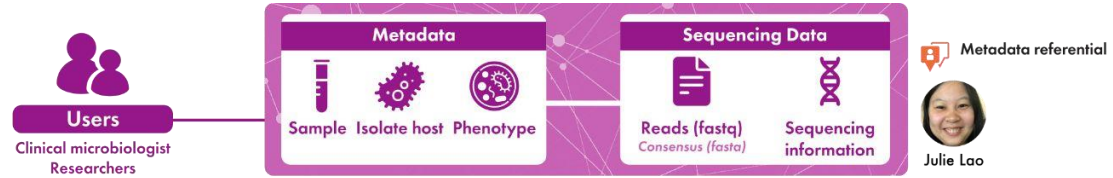




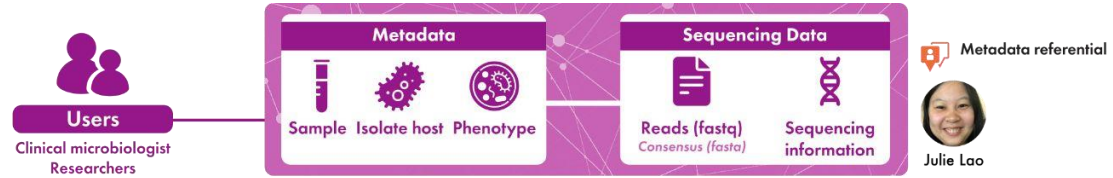
# ABRomics Platform



# ABRomics Platform

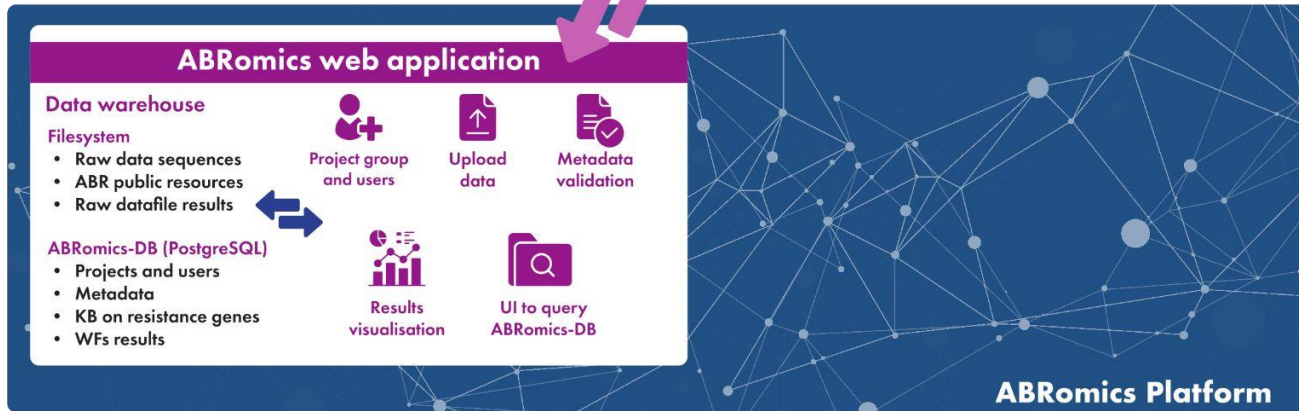


# ABRomics Platform



Web application interface

-  Romain Dallet
-  Raphaël Tackx
-  Amanda Dieuaide
-  Thomas Mignon
-  Fabien Mareuil
- Database structure
-  Julie Lao



## From Omics Workflows ...

Workflows here



## To Analysis reports ...

**Quality metrics**

**Analysis summary**

**Genomic result report**

**Antimicrobial resistance analyses - Acquired resistance genes**

**Sample metadata summary**

## The ABRomics Platform features ...

### 1 Project management

**User list of Projects**

**CREATE PROJECT**

- Add user to project
- Modify project
- Delete project

**1 Projects > Etienne test ABRomics**

**2 IMPORT SAMPLES** **3 CREATE ANALYSIS** **4 DOWNLOAD CSV** **5 DOWNLOAD XLSX** **6 PUBLISH SAMPLE(S)** **7 DELETE SAMPLE(S)**

Sample ID	Strain ID	Instrument model	Sample type	Host species	Microorganism scientific name	Country	Place	Sampling date format	Sampling date	Sample comment	Permission	Created on	Status	Actions
C_freundii_165	CT165	Illumina MiSeq	human	Blood	Homo sapiens	France		dd/mm/yyyy	2023-12-01			mardi 12 décembre 2023 à 18:08:30		

**8 CREATE ANALYSIS FOR CITROBACTER FREUNDII**

**9 RESULTS**

### 2 Upload data & metadata validation

### 3 Run analyses

### 4 Results visualisation

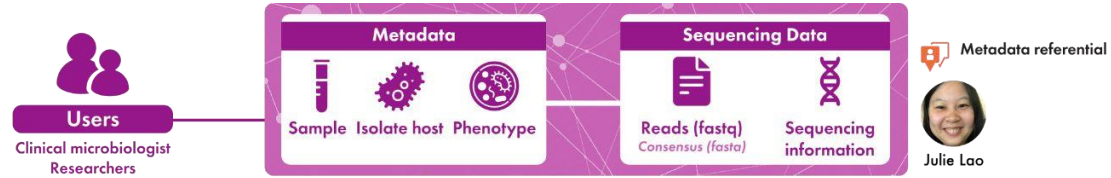
ABRomics database samples location (map visualization)

### 5 Explore results of the community using the ABRomics database

**List of available analysis**

- (fastq) AMR detection
- (fastq paired) Trimming, QC, Assembly, Taxonomy, Annotation, AMR detection
- (fastq paired) Trimming, QC, Assembly, Taxonomy, AMR detection
- (fastq paired) Trimming, QC

# ABRomics Platform



Web application interface

Romain Dallet

Raphaël Tackx

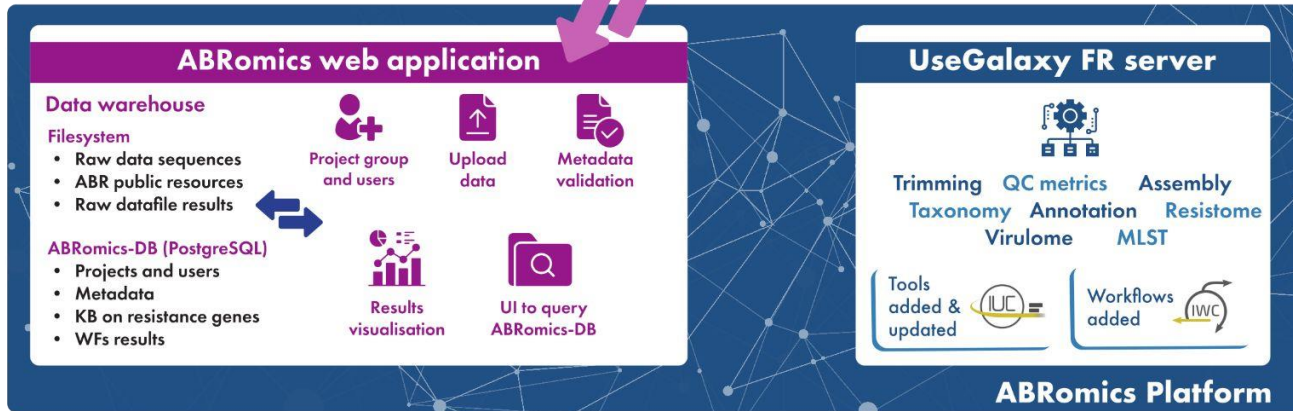
Amanda Dieuaide

Thomas Mignon

Fabien Mareuil

Database structure

Julie Lao



Galaxy workflows

Pierre Marin

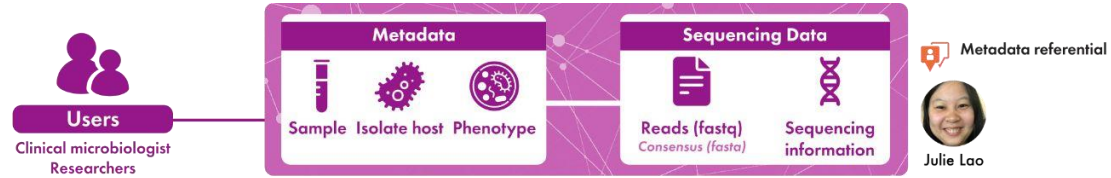
Alix de Thoissy

Cléa Siguret

Bérénice Batut

Hugo Lefevre

# ABRomics Platform



Web application interface

Romain Dallet

Raphaël Tackx

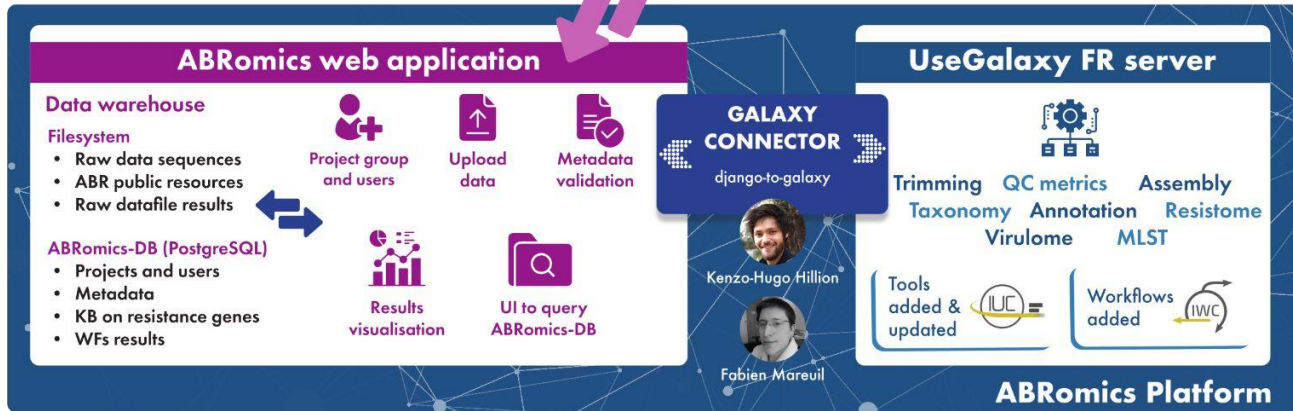
Amanda Dieuaide

Thomas Mignon

Fabien Mareuil

Database structure

Julie Lao



Galaxy workflows

Pierre Marin

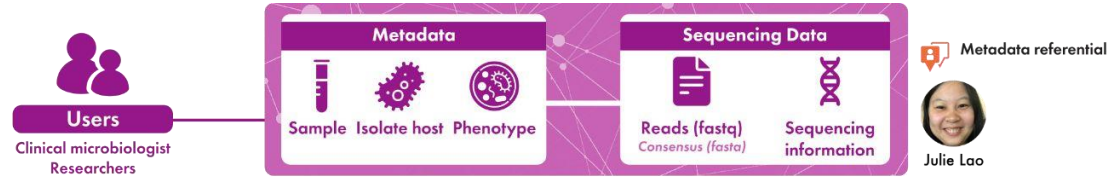
Alix de Thoissy

Cléa Siguret

Hugo Lefevre

Bérénice Batut

# ABRomics Platform

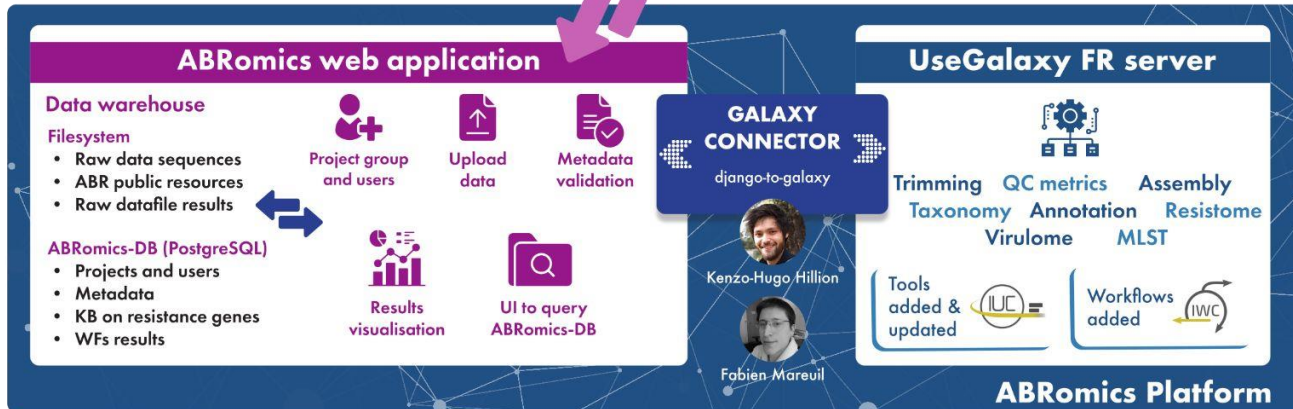


Web application interface

Romain Dallet  
Raphaël Tackx  
Amanda Dieuaide  
Thomas Mignon  
Fabien Mareuil

Database structure

Julie Lao



Galaxy workflows

Pierre Marin  
Alix de Thoissy  
Cléa Siguret  
Bérénice Batut  
Hugo Lefeuvre

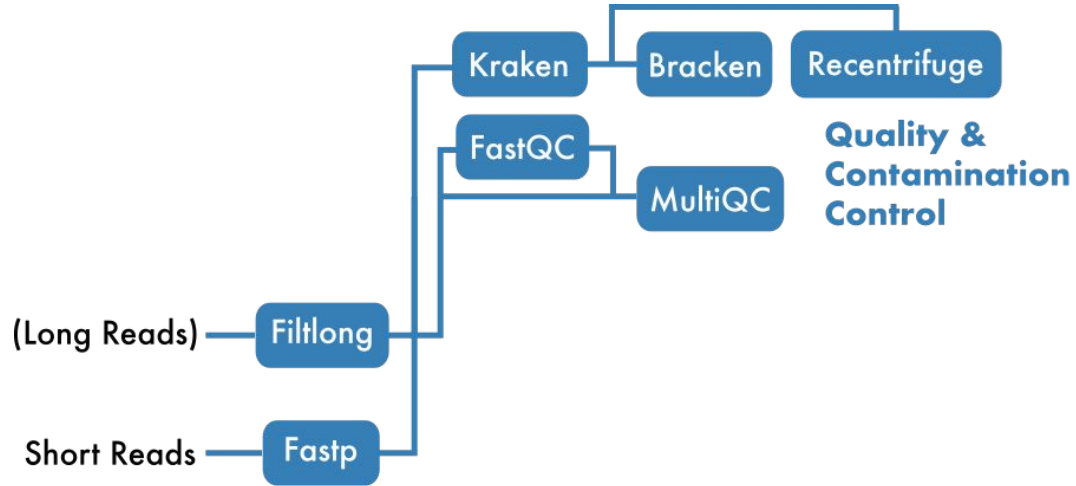
IFB core Cluster

Gildas Le Corguillé

**IFB Core Cluster**  
INSTITUT FRANÇAIS DE BIOINFORMATIQUE

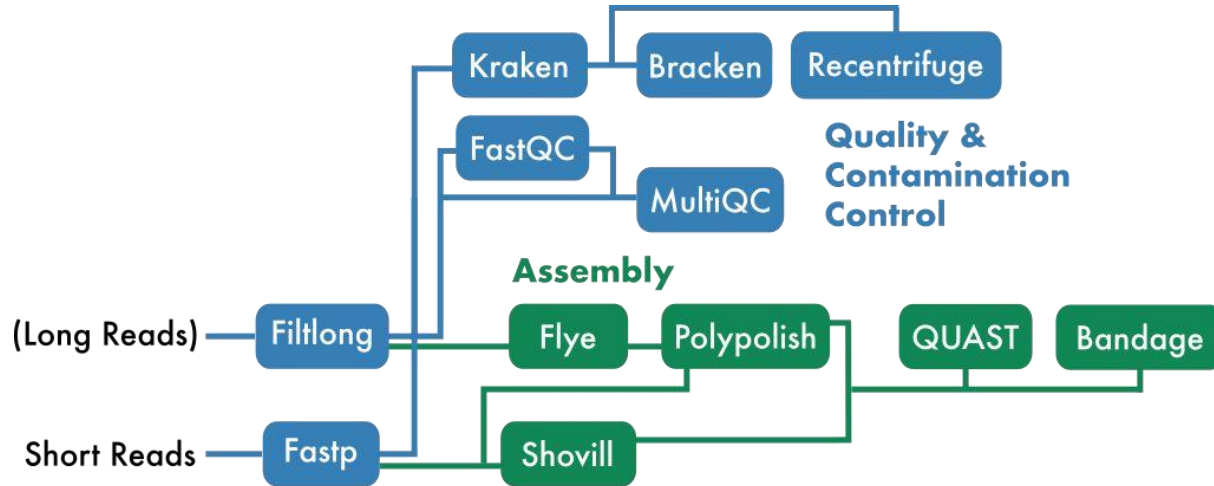
- Shared project space with right access
- Unix access to data/tools

# Genomics Workflows

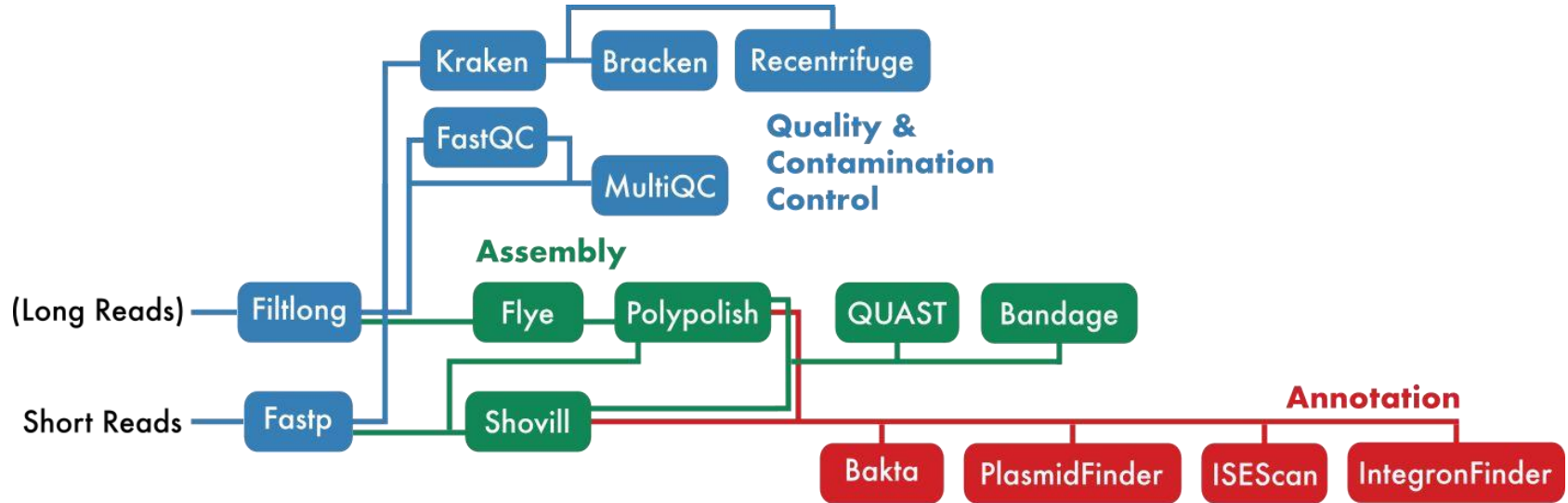




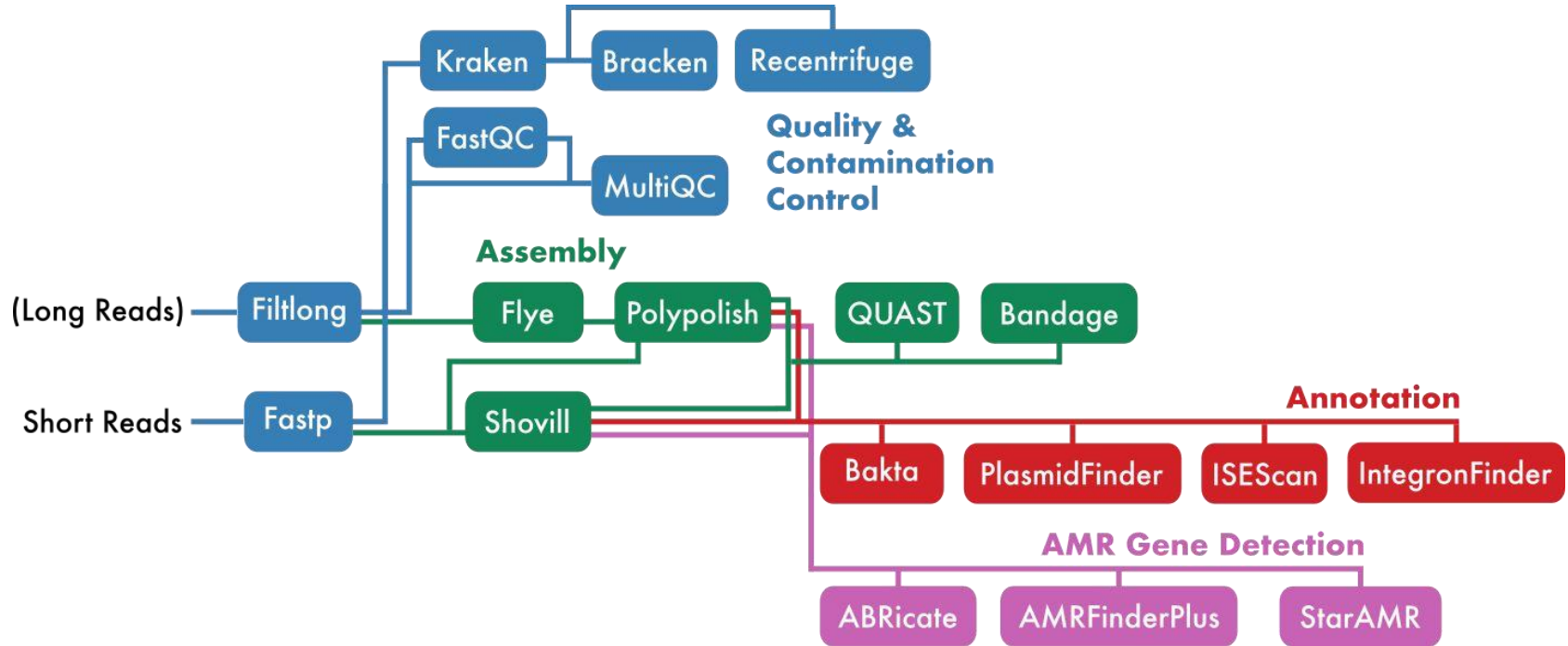
# Genomics Workflows



# Genomics Workflows



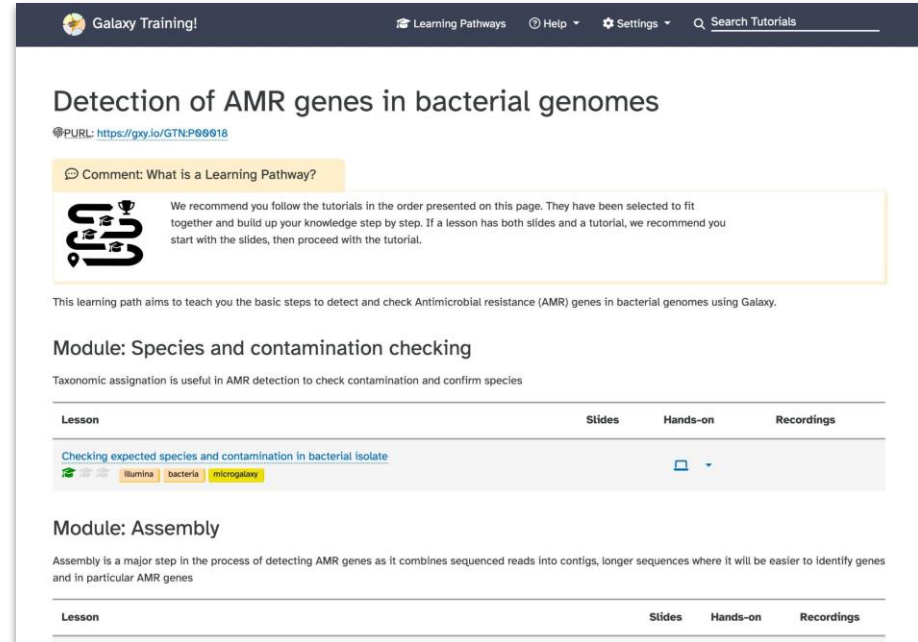
# Genomics Workflows



# Genomics Workflows

## Subworkflows

- Available on WorkflowHub and Dockstore via IWC
- Documented as Learning Pathways on the GTN - <https://gxy.io/GTN:P00018>



The screenshot displays the Galaxy Training! interface. At the top, there is a navigation bar with 'Galaxy Training!', 'Learning Pathways', 'Help', 'Settings', and a search bar for 'Search Tutorials'. The main content area is titled 'Detection of AMR genes in bacterial genomes' with a PURL: <https://gxy.io/GTN:P00018>. Below the title is a comment box asking 'What is a Learning Pathway?' with a response explaining that the recommended tutorials are ordered to build knowledge step-by-step. A paragraph describes the learning path's goal: to teach basic steps for detecting and checking Antimicrobial Resistance (AMR) genes in bacterial genomes using Galaxy. The interface then lists two modules: 'Species and contamination checking' and 'Assembly'. The 'Species and contamination checking' module includes a table of lessons:

Lesson	Slides	Hands-on	Recordings
<a href="#">Checking expected species and contamination in bacterial isolate</a>			

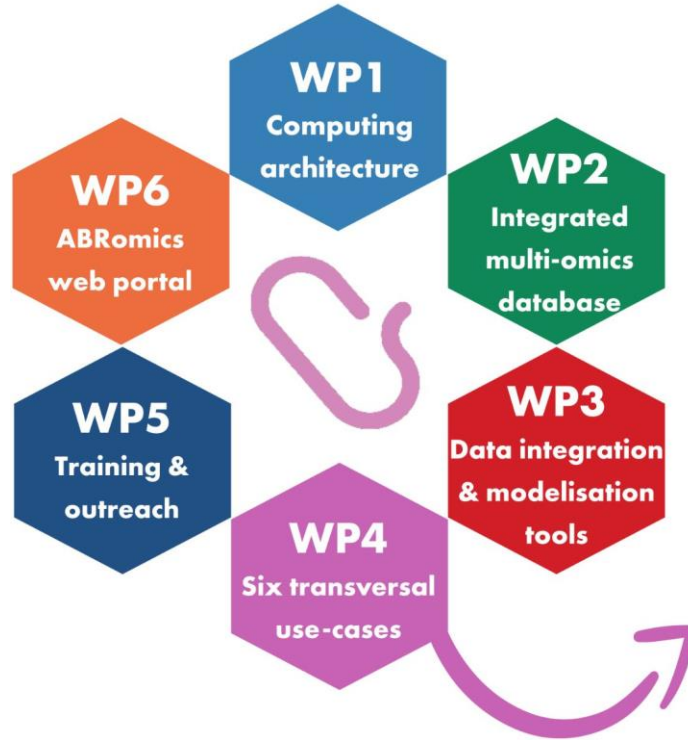
The 'Assembly' module also includes a table of lessons:

Lesson	Slides	Hands-on	Recordings
--------	--------	----------	------------

# Next Steps

## Workflows beyond genomics

- cgMLST
- Metagenomics
- Pangenomics
- Multi-OMICs



- 1** Multidrug resistant bacteria
- 2** One Health approach
- 3** Meta-pan genomics for tracking AMR
- 4** AMR in pulmonary infection
- 5** AMR dissemination through aquatic env.
- 6** Proteomics for AMR phenotyping

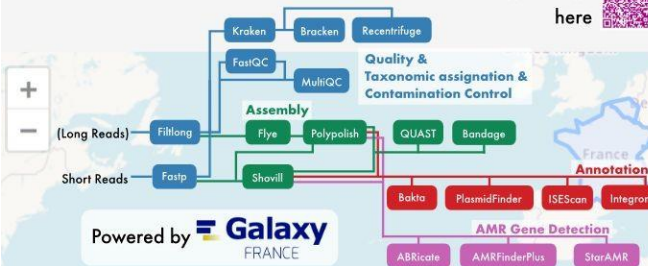
Thank You!



<https://www.abromics.fr/>

## From Omics Workflows ...

Workflows here



## To Analysis reports ...

Quality metrics

Analysis summary

Genomic result report

Antimicrobial resistance analyses - Acquired resistance genes

Sample metadata summary

## The ABRomics Platform features ...

### 1 Project management

User list of Projects

CREATE PROJECT

- Add user to project
- Modify project
- Delete project

1 Projects > Etienne test ABRomics

2 IMPORT SAMPLES 3 CREATE ANALYSIS 4 DOWNLOAD CSV 5 DOWNLOAD XLSX 6 PUBLISH SAMPLE(S) 7 DELETE SAMPLE(S)

Sample ID	Strain ID	Instrument model	Sample type	Host species	Microorganism scientific name	Country	Place	Sampling date format	Sampling date	Sample comment	Permission	Created on	Status	Actions
C_theurdi_165	CT165	Illumina MiSeq	human	Blood	Homo sapiens	France		dd/mm/yyyy	2023-12-01			mardi 12 décembre 2023 à 18:08:30		

8 Results visualisation

9 Explore results of the community using the ABRomics database

### 2 Upload data & metadata validation

Import Samples form

### 3 Run analyses

List of available analysis

### 4 Results visualisation

ABRomics database samples location (map visualization)

### 5 Explore results of the community using the ABRomics database