14 November 2019

EFSA whole genome sequence activities for food safety

Beatriz Guerra

EFSA info-session on applications for feed additives - Technical meeting with stakeholders 2019

Trusted science for safe food

European Food Safety Authority

EFSA INTEREST …

…use the data generated by new Sequencing technologies (WGS, Metagenomics, other OMICs) for Food Safety and Public Health Protection

- Outbreak detection and investigation
- Detection, characterization and surveillance of emerging pathogens
- Monitoring of antimicrobial resistance
- …
- **For regulated products:**
  - GMOs
  - Feed aditives
  - Food enzymes
  - Food aditives
  - Novel foods
  - Pesticides

Molecular studies in EFSA

Outbreak investigation (ROAs)

GMOs

AMR surveillance (EUSR)

Feed aditives

Guidelines applications regulatory products

Pesticides

Technical notes

Novel food

Health claims

Detection of emerging «high risk» clones

Characterization/prediction resistance/virulence

Enzyme characterization

Genetic polymorphisms

Biomarkers

Novel molecular biology methods

Novel computational approaches to predict drug metabolism and toxicity

Effects chemical components on living organisms

Source attribution

OMICs

WGS

Metagenomics

Proteomics

Big data

Metabolomics

Transcriptomics

Cloud

...in EFSA

Foodborne pathogens and zoonotic bacteria

Rapid outbreak assessment

SCIENTIFIC REPORT OF EFSA AND ECDC

EU Summary Report on antimicrobial resistance in zoonotic and indicator bacteria from humans, animals and food in 2013[1]

Reference testing supporting EUSR-AMR

WP2 Joint ECDC-EFSA WGS Database

"Technical support to collect and analyse whole genome sequencing (WGS) data in the joint ECDC-EFSA molecular typing database"

at least *L. monocytogenes*, *Salmonella*, *E.coli*

Published May 2019

https://efsa.onlinelibrary.wiley.com/doi/epdf/10.2903/sp.efsa.2019.EN-1337

Request for scientific and technical assistance on harmonised monitoring of antimicrobial resistance (AMR) in bacteria transmitted through food

Published June 2019

https://efsa.onlinelibrary.wiley.com/doi/epdf/10.2903/j.efsa.2019.5709

BIOHAZ PANEL
"Self-tasking mandate for scientific opinion on the application and use of next generation sequencing (including whole genome sequencing) for risk assessment of foodborne microorganisms"

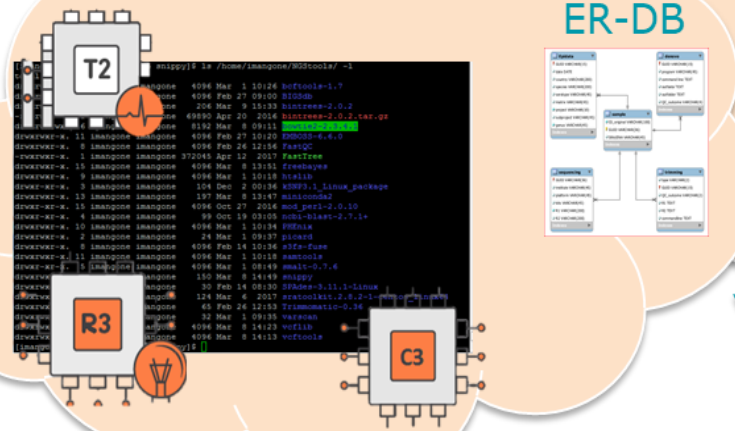
To be published
November/December 2019

EFSA WGS Capacity building

EFSA WGS Capacity building

European Food Safety Authority

Linux AWS servers



ER-DB

Free license key

ridom BIOINFORMATICS

LISEQ
Procurement
Listeria

GENCAMP
EFSA-MS agreement
Campylobacter

INNUENDO
(Thematic grant)
Salmonella
E. coli
Campylobacter
Yersinia

ENGAGE
(Thematic grant)
Salmonella
E. coli
AMR

Generated Sequences, information, analyses, tools, pipelines

ROA ECDC-EFSA
Salmonella, Listeria

EUSR-AMR Ref. testing
(EURL-AR, EC)
Salmonella, E. coli

S3 storage
~ 6TB – >6,000 isolates

GUIDs

Online tools and existing platforms: e.g. ENTEROBASE, BIGSdb, CGE, INNUENDO, COMPARE, PATRIC, etc.

Analysis

Scientist + Bioinformatician

EFSA

Regulated products

EFSA JOURNAL
Open Access

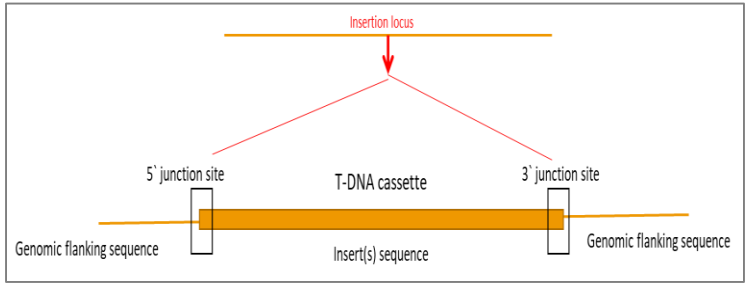
Scientific Opinion | Open Access

Technical Note on the quality of DNA sequencing for the molecular characterisation of genetically modified plants

EFSA Panel on Genetically Modified Organisms (EFSA GMO Panel), Josep Casacuberta, Fabien Nogué, Hanspeter Naegeli, Andrew Nicholas Birch, Adinda De Schrijver ... See all authors

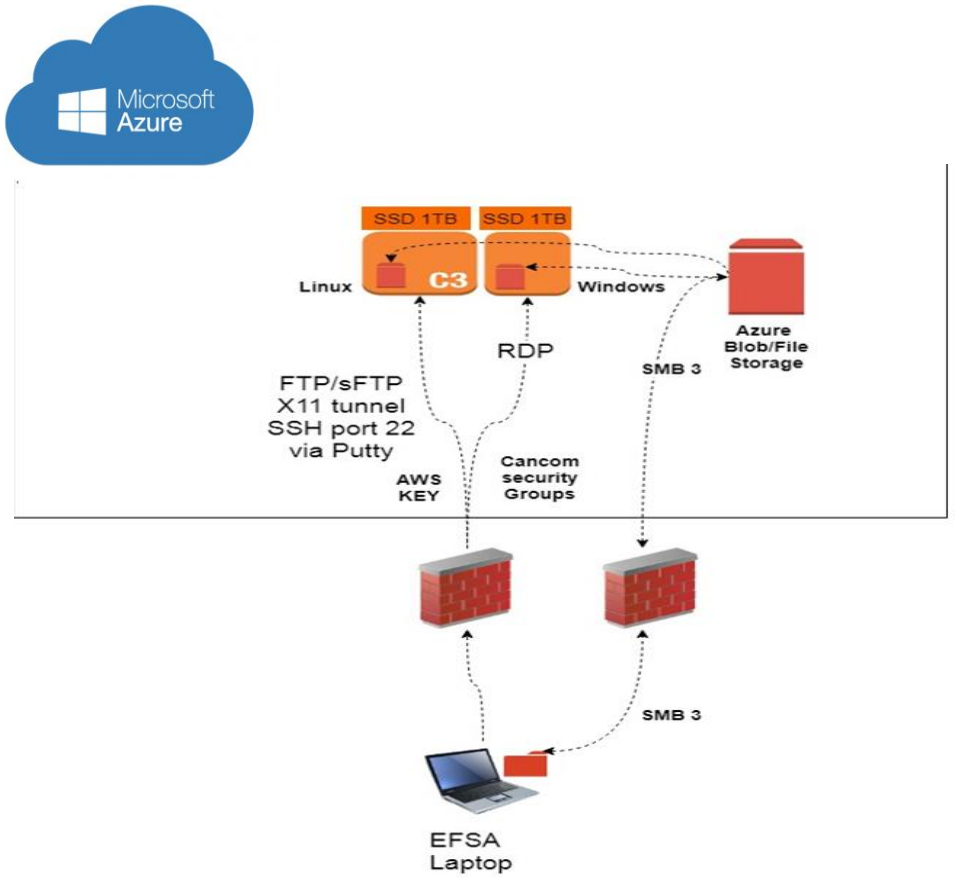
10

https://efsa.onlinelibrary.wiley.com/doi/epdf/10.2903/j.efsa.2018.5345



GMO: Current use and infrastructure

Junction site analysis for detection of all insertion sites
Sequencing to demonstrate Genetic stability



Current infrastructure and tools

GMO AZURE (microsoft) cloud for secure storage and sharing Tools to visualise data (FASTQ), view/perform alignments of SAM, BAM or CRAM files (e.g. UGENE)

Quality check: Coverage, Bioinformatics, Annotation (NCBI Sequin, EMBL GenBank), Quality statistics (FASTQC)

Feedap Guidance

GUIDANCE

ADOPTED: 21 February 2018

doi: 10.2903/j.efsa.2018.5206

Guidance on the characterisation of microorganisms used as feed additives or as production organisms

Abstract

This guidance document is intended to assist the applicant in the preparation and the presentation of an application, as foreseen in Article 7.6 of Regulation (EC) No 1831/2003, for the authorisation of additives for use in animal nutrition. It specifically covers the characterisation of microorganisms used as feed additives or as production organisms.

https://efsa.onlinelibrary.wiley.com/doi/epdf/10.2903/j.efsa.2018.5206

CEP statement

EFSA JOURNAL Open Access

Volume 17, Issue 6
June 2019
e05741

https://efsa.onlinelibrary.wiley.com/doi/full/10.2903/j.efsa.2019.5741

Statement | Open Access

Characterisation of microorganisms used for the production of food enzymes

EFSA Panel on Food Contact Materials, Enzymes and Processing Aids (CEP), Vittorio Silano, José Manuel Barat Baviera, Claudia Bolognesi, Beat Johannes Brüschweiler ... See all authors

First published: 11 June 2019 | https://doi.org/10.2903/j.efsa.2019.5741

Figures References Related Information

Metrics

Abstract

This document is intended to assist the applicant in the preparation and the presentation of an application, as foreseen in Article 17.3 of Regulation (EC) No 1332/2008, for the authorisation of food enzymes. It specifically covers the characterisation of microorganisms used as production organisms.

Conclusion

Conclusion…

EFSA is moving on in the area of WGS for food safety

- Different aims, similar/different bioinformatic tools needed.
- Technology developments make it adequate to use WGS for risk assessment.
- For characterization of microorganisms/genes, the use of curated and updated databases is crucial.
- Very important to harmonize the type of data required and assessment.
- Detailed information on analysis done, tools versions, parameters, etc. needed.
- Challenge: rapid and constant evolution of the techniques, tools, etc.

and preparing to collect and deal with WGS data and WGS-based information.

Thanks for your attention!

Beatriz Guerra
EFSA Lead Expert Molecular Epidemiology
Senior Scientific Officer
Unit on Biological Hazards and Contaminants (BIOCONTAM)
Department of Risk Assessment and Scientific Assistance (RASA)
beatriz.guerra@efsa.europa.eu;