



# Recent and ongoing WGS initiatives and activities of EFSA

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Basic course on bioinformatics tools for Next Generation Sequencing data mining

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## OUTLINE

- **Ongoing WGS procurement activities**
- **Conclusions from EFSA's Scientific Colloquium on the Use of Whole Genome Sequencing (WGS) of food-borne pathogens for public health protection (June 2014)**

**Discussion group 1: WGS of foodborne pathogens in action**

**Discussion group 2: Curation and analysis of WGS data: bioinformatics solutions**

**Discussion group 3: Cross-sectorial coordination and international cooperation**

## ONGOING WGS PROCUREMENT ACTIVITIES

### ■ October 2014 – October 2016:

*‘Closing data gaps for performing RA on ***L. monocytogenes*** in RTE foods’*

**Activity 3: molecular characterisation employing WGS of strains from different compartments along the food chain and from humans.**

(Contractor consortium: SSI/ANSES/PHE/ UA)

### ➤ Objectives:

- 1. to carry out the **molecular characterisation of a selection of *Lm* isolates from different sources**, i.e. RTE foods, compartments along the food chain and humans **employing WGS analysis**
- 2. to **analyse the WGS typing data** of the selected *Lm* isolates with three goals:
  - i. to explore the genetic diversity of *Lm* within and between the different sources and human origin;

## ONGOING WGS PROCUREMENT ACTIVITIES


- ii. to assess the epidemiological relationship of *Lm* from the different sources and of human origin considering the genomic information and the metadata available for each isolate;
- iii. to identify the presence of putative markers conferring the potential to survive/multiply in the food chain and/or cause disease in humans.

- 3. to **perform a retrospective analysis of outbreak strains** to investigate the suitability of WGS as a tool in outbreak investigations.


- **Call for proposals ended 30 April 2015:** New grants **Molecular approaches for identifying and characterising microbial foodborne pathogens, specifically using whole genome sequence (WGS) analysis**

- <http://www.efsa.europa.eu/en/press/news/141112.htm>
- [http://www.efsa.europa.eu/en/art36grants/article36/gpefsaa\\_fSCO201501.htm](http://www.efsa.europa.eu/en/art36grants/article36/gpefsaa_fSCO201501.htm)

## CONCLUSIONS DISCUSSION GROUP 1


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- **Q1. WGS Methods available**
    - WGS techniques are continuously evolving
    - Setting up sequencing pipeline vs. outsourcing sequencing and data analysis to commercial/PH laboratories
    - Need to define appropriate quality metrics (including data analysis): EQA programs, role of EURLs
    - Need to establish guidelines for use of WGS in detection of foodborne pathogens

## CONCLUSIONS DISCUSSION GROUP 1


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- **Q2. Interpretation of WGS data for different applications**
    - SNP calling vs. comparisons of allelic variants (gene-by-gene comparison)
    - Plurality of approaches; depends on precise question
    - Not clear yet which method most suitable in food safety
    - Need for outcome reported in plain language widely understandable and interpretable
    - Need for communication with policy makers
    - Harmonisation across sectors



## CONCLUSIONS DISCUSSION GROUP 1


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- **Q3. WGS data curation and storage of data**
    - Uncurated approach (e.g. GenBank) not suitable for food safety and public health purposes
    - WGS data should be publically available in real-time together with some metadata
    - Interoperability of databases and backward and forward compatibility to other sequence based datasets
    - Ensure continuity of existing and future databases

## CONCLUSIONS DISCUSSION GROUP 2


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- **Q1. Quality evaluation, annotation, interpretation and storage of WGS data**
    - Need for standard protocols and quality metrics
    - Quality assessment metrics may depend on technology
    - Currently no gold standard for analysis
    - Storage and management of large FASTQ files
    - Multi-disciplinary forums, case studies, ring trials
    - For public health purposes: SOPs for accreditation purposes




## CONCLUSIONS DISCUSSION GROUP 2

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- **Q2. Harmonisation of approaches for WGS data analysis**
    - Effective international surveillance depends on common nomenclature
    - Harder to define nomenclature based on K-mer/SNP approaches
    - Open source freely available vs. closed source commercial software
    - Commercial software should not be “black boxes”
    - Workflow managers/schedulers, e.g. Galaxy: web-based access to individual tools
    - Ever-growing need for computing power


## CONCLUSIONS DISCUSSION GROUP 2

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- **Q3. Online genomic databases, data sharing and real-time data analysis and visualisation**
    - Single global database vs. federated distributed multi-level databases
    - Encryption is needed for secure data transfer of data and metadata
    - Sharing of microbial data and analysis driven by One Health perspective vs. differing rules for data ownership and release within different sectors
    - Any database or resource is only as good as the data that it contains, and how easy it is to access that data


## CONCLUSIONS DISCUSSION GROUP 3

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- **Q1. Integrate WGS into routine monitoring and surveillance, and outbreak preparedness within and across sectors**
    - Concerns related to sharing related epidemiological data
    - Food and veterinary sector handle sensitive data: misuse can have adverse economic impact
    - First attempt: new molecular typing database of foodborne pathogens to enhance outbreak preparedness at EU level
    - Many international and national initiatives: difficult to have overview of applicability to routine monitoring and surveillance

## CONCLUSIONS DISCUSSION GROUP 3

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- **Q2. Coordination of efforts between the food, veterinary and human health sectors**
    - EC's Vision paper: starting point to develop vision on data sharing across sectors, communities and professional disciplines
    - Reporting sequence data alone useless for surveillance and scientific purposes
    - Ongoing discussions at ECDC/EFSA level in the context of common joint molecular typing database for PFGE/MLVA
    - Minimum dataset to be shared

## CONCLUSIONS DISCUSSION GROUP 3

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- **Q3. Development and validation of WGS applications across sectors; transition management challenges**
    - Proof of concept studies needed to demonstrate added PH value, e.g. international FB outbreak/epidemic situations
    - Replacement of old techniques requires comparative analytical and epidemiological validation studies
    - EURLs play a crucial role in supporting the transition from old to WGS methods in the food sector
    - Close collaboration of EURLs with PH laboratory networks. Cooperative network around EFSA and ECDC
    - Start now the investments in national capacities and don't underestimate training needs
    - Open a discussion with policy makers on the potential impact of WGS development on EU legislation



## Full WGS Scientific Colloquium report available:

<http://www.efsa.europa.eu/en/press/news/150216.htm>

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# Questions?

