EUROPEAN COMMISSION
DIRECTORATE-GENERAL
JOINT RESEARCH CENTRE
Directorate A – Strategy and Work Programme Coordination

CDP Theme

Genomics and Bioinformatics

Background on the JRC research

With the aim of protecting general interests and health of European citizens, the JRC provides scientific and technical support to EU policies on food, consumer products, chemicals and public health. This activity is conducted in the JRC Directorate F - *Health, Consumers and Reference Materials*.

Ongoing key projects and research

The JRC has been conducting research in Genomics and Bioinformatics since 2004. Currently, many activities of Directorate F in support to public health policies are strictly linked to these research fields, like:

- Development of a harmonised cancer information system for Europe, to generate a dynamic European cancer monitoring tool which will steer and support effective policies on cancer.
- Development of a the European Platform on Rare Diseases Registration, to provide a central access point for information on rare diseases, improve access to patient registries, harmonise data and promote interoperability between registries.
- Implementation and application of European rules on Nanomedicine, medical devices and *in-vitro* diagnostics, to strengthen consumer safety and protection, especially in the light of the 2012 EC adoption of a package of measures on innovation in health[1].
- Development and test of new animal-free methods, alternatives to animal-based tests, to be applied in an integrated safety assessment of chemicals, and development of informatics tools and databases to support this approach[2].
- Development of new DNA based detection methods to fight food fraud and protect food authenticity, and development of databases and software to support this approach[3].

[1] Safe, effective and innovative medical devices and in vitro diagnostic medical devices for the benefit of patients, consumers and healthcare professionals, COM/2012/540 final
[2] Directive 2010/63/EU, Regulation (EC) No 1223/2009
[3] Regulation (EC) No 882/2004

- Use of next-generation sequencing (NGS) for the detection, identification and quantification of Genetically Modified Organisms (GMOs) in food and feed, and development of databases and software to support this approach[4].
- Development of certified DNA reference material to reliably quantifying nucleic acids in solution, a pre-requisite for many molecular cutting-edge measurements.

Moreover, new projects are ongoing aimed to specifically evaluate direct impact of Genomics and Bioinformatics on policy and finally promote their use to support policy and regulatory science, with particular focus on:

- Fight and monitor of antimicrobial resistance[5] by use of fast and cheap high-throughput DNA sequencing and sequence analysis.
- Inspect Big Data for e-Health[6], to harmonise Life Sciences produced data at European level.
- Use of Open-data to support policy making[7] in health and consumers safety.
- Use of (big) data for policy[8], with particular interest on use of machine learning and data science.
- Use of Genomics to support policy makers in the challenging issue of regulation of new genome editing techniques.
- Use of Genomics to contrast food fraud, like fish substitution.

Selected output for science and policy

Policy reports:

As part of the JRC, Directorate F scientists publish technical reports, technical guidelines, reference reports, policy briefings, contributions to JRC thematic reports and peer-reviewed articles. Some examples in the field of Genomics and Bioinformatics:

- JRC Thematic Report 2015: *Science for Food*[9]
- JRC Technical Report 2016: *Guideline for the submission of DNA sequences and associated annotations within the framework of Directive 2001/18/EC and Regulation (EC) No 1829/2003*[10]
- JRC Technical Report 2016: *Analysis of carcinogenicity testing for regulatory purposes in the European Union*[11]

[4] Regulation (EC) 1829/2003, Regulation (EC) 1830/2003
[5] Action Plan against the rising threats from AMR, COM/2011/748 final
[6] eHealth Action Plan 2012-2020 - Innovative healthcare for the 21st century, COM/2012/0736 final
[7] Open data, An engine for innovation, growth and transparent governance, COM(2011) 882 final
[8] Communication on data-driven economy COM/2014/442 final
[9] https://ec.europa.eu/jrc/sites/default/files/jrc-science-for-food-thematic-report_en.pdf
[10] http://gmo-crl.jrc.ec.europa.eu/doc/Guideline%20for%20the%20submission%20of%20DNA%20sequences.pdf
[11] http://publications.jrc.ec.europa.eu/repository/handle/JRC100609

Peer reviewed papers:

- Angers-Loustau A, Petrillo M, Bonfini L *et al. JRC GMO-Matrix: a web application to support Genetically Modified Organisms detection strategies.* BMC Bioinformatics. 2014. doi:10.1186/s12859-014-0417-8.
- Petrillo M, Angers-Loustau A, Henriksson P *et al. JRC GMO-Amplicons: a collection of nucleic acid sequences related to genetically modified organisms.* Database (Oxford). 2015. doi:10.1093/database/bav101.
- Lievens A, Petrillo M, Querci M, Patak A. *Genetically modified animals: Options and issues for traceability and enforcement.* Trends in Food Science&Technology. 2015. doi:10.1016/j.tifs.2015.05.001.
- Healy MJ, Tong W, Ostroff S *et al. Regulatory bioinformatics for food and drug safety. Regulatory Toxicology and Pharmacology.* 2016. doi:10.1016/j.yrtph.2016.05.021
- Angers-Loustau A, Petrillo M, Paracchini V *et al. Towards Plant Species Identification in Complex Samples: A Bioinformatics Pipeline for the Identification of Novel Nuclear Barcode Candidates.* PLoS One. 2016. doi: 10.1371/journal.pone.0147692
- Petrillo M, Angers-Loustau A, Kreysa J. *Possible genetic events producing colistin resistance gene mcr-1.* Lancet Infect Dis. 2016. doi:10.1016/S1473-3099(16)00005-0.
- Totaro S, Cotogno G, Rasmussen K, et al. *The JRC Nanomaterials Repository: A unique facility providing representative test materials for nanoEHS research.* Regul Toxicol Pharmacol. 2016. doi: 10.1016/j.yrtph.2016.08.008.
- Herwig R, Gmuender H, Corvi R et al. *Inter-laboratory study of human in vitro toxicogenomics-based tests as alternative methods for evaluating chemical carcinogenicity: a bioinformatics perspective.* Arch Toxicol. 2016 doi: 10.1007/s00204-015-1617-3

A complete list is available here:

- https://bookshop.europa.eu/en/home/
- https://ec.europa.eu/jrc/en/publications

Hosting Directorate

Directorate: Health Consumer and Reference Materials (DIR F)