INSTITUTE OF FOOD SAFETY, ANIMAL HEALTH AND ENVIRONMENT "BIOR" IS A CORNERSTONE TO STRENGTHEN SUSTAINABLE AND SAFE FOOD SYSTEMS

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On 30 January 2020, the Institute of Food Safety, Animal Health and Environment "BIOR" marked its 10th anniversary at the International Scientific Symposium "Science to Strengthen Sustainable and Safe Food Systems", with participation of around 250 participants from 15 countries (Figs. 1, 2). This was also an occasion where we acknowledged our scientific collaborators, colleagues from governmental agencies, industry and NGO's for cooperation and our common contribution to make safer and more sustainable food systems and environment in Europe.

Although the Institute has a long-accumulated professional experience over several decades in some areas, starting even in the 1920s, the last ten years can be characterised by a dynamic development to become one of the leading research institutes in the region. In 2010, the Institute of Food Safety, Animal Health and Environment "BIOR" was established by merging the existing National Diagnostic Centre (National Reference Laboratory in the areas of animal health and food safety) with Latvian Fish Resource Agency and National Aquaculture infrastructure. This was a significant step forward to establish the National Research Institute with a new strategy, clear vision and ambitious goals. Alongside significant scientific achievements, the Institute has built-up as a centre of best available research infrastructure in the respective fields of science in Latvia. Implementation of the ERDF project No.1.1.1.4/17/I/006, "Concentration and Strengthening of Institutional Capacity of Institute "BIOR"", played an important role there, thus opening new horizons for the local and international scientific staff.

Research in food safety, veterinary medicine, fisheries, public and environmental health has been in the focus of the Institute's strategy to create a comprehensive platform within One Health framework. The goal is to achieve better public health outcomes as well as to strengthen sustainable food systems in the future. Currently the Institute carries out research of international significance and quality as well as implements risk assessment projects and provides scientific advice to various governmental agencies under the Ministry of Agriculture, Ministry of Health, Ministry of Environmental Protection and Regional Development, and others. All departments, including laboratories, fishery and aquaculture research units, have long-accumulated professional experience over several decades with international recognition.

Fig. 1.
International Scientific Symposium "Science to Strengthen Sustainable and Safe Food Systems" in Rīga, National Library of Latvia, 30 January 2020, celebrating the 10th Anniversary of the Institute of Food Safety, Animal Health and Environment "BIOR"

From the left: Dr. Bernhard Url, Executive Director of the European Food Safety Authority (EFSA); Mr. Kaspars Gerhards, Minister of Agriculture of the Republic of Latvia; *Dr. med. vet.* Aivars Bērziņš, Director of the Institute of Food Safety, Animal Health and Environment and Vice-chair of the Management Board of the European Food Safety Authority (EFSA)

Fisheries and aquaculture are important fields within the food system in the Baltic region, including the Baltic Sea and inland waters of Latvia. Research activities of the Institute provide scientific support and advice for sustainable use of fish resources in the waters of Latvia, including the Baltic Sea, the Gulf of Riga, and inland waters. Resources of internationally regulated fish species are accounted and assessed on a regular basis, and also unregulated fish stock and its condition in natural sea and inland waters are examined annually. An important role of the Institute is to evaluate the influence of fishing, angling and the environmental conditions of fish stock and biological diversity. It also ensures the monitoring of fishing fleet, fish processing and aquaculture operations and provides economic assessment. Scientific results of research in fisheries are regularly published in prominent international peer-reviewed research journals and widely used as scientific advice to national and international organisations, such as ICES (International Council for the Exploration of the Sea) and HELCOM (Baltic Marine Environment Protection Commission).

One of the main animal health research areas of the Institute was the start of Horizon 2020 project VACDIVA, funded by the European Commission, "A Safe DIVA Vaccine for African Swine Fever Control and Eradication". The main objective of VACDIVA is to solve the African Swine Fever (ASF) problem in

Fig. 2.
Opening of the International Scientific Symposium "Science to Strengthen Sustainable and Safe Food Systems" in Rīga, National Library of Latvia, 30 January 2020. Mr. Kaspars Gerhards, Minister of Agriculture of the Republic of Latvia

Europe and affected countries, by developing three safe and effective vaccines for domestic pigs and wild boars, their companion DIVA tests and effective tools for control and eradication strategies in Europe. In addition to design improved ASF control strategies in different epidemiological scenarios worldwide, tests of the pilot vaccines are foreseen in real environments during the project. Oral immunisation of wild boar with a non-hemadsorbing, attenuated ASF virus of genotype II isolated in Latvia in 2017 by the Institute of Food Safety, Animal Health and Environment "BIOR" (Lv17/WB/Rie1), conferred 92% protection against challenge with a virulent ASF virus isolate (Arm07). Thus, this was a first report on a promising vaccine against ASF virus in wild boar by oral administration. This work is continued during VACDIVA project (Fig. 3).

Research on the epidemiology of food and waterborne diseases as well as molecular characterisation of associated pathogens and their antimicrobial resistance provides an important scientific

Fig. 3.
EC Horizon 2020 VACDIVA project kick-off meeting in Madrid, Spain. *Dr. med. vet.* Edvīns Oļševskis introducing the Institute of Food Safety, Animal Health and Environment "BIOR" and its tasks in the project

information to the National Centre for Disease Prevention and Control, Food and Veterinary service and other stakeholders. It is important to emphasise that Institute has developed comprehensive microbial collections, including a wide range of bacterial pathogens of environment, animal, food chain and human origin. This provides valuable data sets to trace back major food or waterborne pathogens in the food chain "from farm to fork". Novel technologies, including next generation sequencing (NGS) and other pathogen subtyping methodologies were successfully implemented and used over recent years to provide timely scientific support and advice to public health authorities.

The importance of scientific expertise and support from the Institute to combat COVID-19 was acknowledged widely during 2020. Alongside an extensive involvement in SARS-CoV-2 testing in humans in Latvia during the pandemic, the Institute was involved in the recently launched project "Multidisciplinary Approach to Monitor, Mitigate and Contain COVID-19 and Prevent Other Future Epidemics in Latvia". During the project, cost- and time-efficient monitoring tools, using a wastewater-based epidemiology approach for monitoring COVID-19, were developed for the first time in Latvia and knowledge of the occurrence and diversity of coronaviruses including SARS-CoV-2 in susceptible pet population in Latvia was assessed providing evidence-based recommendations to the pet owners and veterinary practitioners. For the first time, SARS-CoV-2 positive domestic cat was found in COVID-19-affected household in Latvia at the end of 2020 and beginning of 2021. This highlighted the possibility and importance of the possible zoonotic transmission of SARS-CoV-2 virus from humans to animals, as a sign of reverse zoonotic transmission. SARS-CoV-2 highlighted also the importance of One Health, where the human, animal, and environmental health are interconnected and creates one ecosystem to understand epidemiology of the disease, particularly during the pandemic situation. Thus, transdisciplinary approach is essential to understand better viral transmission patterns and the epidemiological process of the disease.

In 2020, the researchers of the Institute continued their scientific activities related to the application of high-resolution mass spectrometry for the analysis of chemical contaminants in food products. For example, the analytical methodology based on Fourier transformation ion cyclotron resonance mass spectrometry was used to achieve the quantification of residues of pharmaceuticals in food products and environmental objects without time-consuming sample preparation procedures. Another study significantly extended the number of analysed mycotoxins by the implementation of two-dimensional liquid chromatography. Those newly proposed methodologies proved their reliability and accuracy within several occurrence studies of contaminants in a broad range of food samples. In addition, the proposed sensitive determination procedures facilitated the research in the area of food technological processes aimed at diminishing the content of harmful chemical compounds.

L'ORÉAL Baltic "For Women in Science"' programme, in cooperation with the National Academies of the Baltic States and UNESCO National Commissions, has awarded Dr. Iveta Pugajeva for her scientific work "Elaboration of New Methodology Using Ultra High-resolution Mass Spectrometry for Assessing Public Health via Wastewater-Based Epidemiology". Over the last years, wastewater-based epidemiology (WBE) is used at the Institute as a novel approach of sampling and analysing chemical substances in wastewater samples to estimate a population's exposure to chemicals. This methodology was proposed for the first time as a potential tool to assess the use of illicit drugs and misused therapeutic drugs within a community. Nowadays the application area of WBE has extended to pharmaceuticals and personal care products, population markers, industrial chemical exposure markers, stress, food and diet markers, and biological markers. Despite the latest development, a number of open scientific issues remain, such as insufficient sensitivity of analytical methods, a lack of data on the occurrence of several biomarkers, and the suitability of proposed biomarkers as a characterisation tool in WBE, which need to be solved in order to successfully apply WBE in new areas.

Scientific advice and risk assessment are essential parts of the work of our Institute providing timely support to government institutions working in the

area of veterinary public health. Moreover, the Institute has an important role to provide scientific advice to the public health authorities in the area of nutrition. In 2020, extensive work on the national study on salt and iodine consumption in Latvia has been concluded, for the first time combining nutritional data with biological samples, i.e. sodium and iodine concentrations in urine. The results of the survey have provided long-awaited data for policy makers and the public as iodine deficiency has been on the discussion table for a long time. The Institute has provided not only an evaluation of the situation, but also possible scenarios for solution and future steps.

The safety of environmental, animal and human health is in focus of the One Health concept, thus helping to design and implement programmes, policies, legislation and research in which multiple sectors communicate and work together to achieve better public health outcomes. A wide range of environmental resources and ecosystems are influenced by various factors, including the anthropogenic impact, industrial pollution, climate change, and others. Therefore, there is a worldwide continuous need for new knowledge and research to ensure and improve healthy and sustainable ecosystems and rich biodiversity keeping in mind economical needs of countries.

Since the establishment of the Institute "BIOR", a new generation of scientists have joined our team, cross-appointments of our research staff with universities established, novel laboratory technologies and infrastructure have been introduced and international partnership networks have been significantly broadened (Fig. 4). We can be proud of our goals reached so far with our reputation towards scientific excellence, support in decision making, policy impact and independence.

Fig. 4.
Dr. chem. Iveta Pugajeva, laureate of L'ORÉAL Baltic "For Women in Science" programme, for her scientific work "Elaboration of New Methodology Using Ultra High-resolution Mass Spectrometry for Assessing Public Health via Wastewater-Based Epidemiology"