ANIMALS WITHOUT DISEASE: THE FUTURE OF THE ANIMAL PRODUCTION CHAIN?

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SciCom

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Editors
Lieve Herman, Chair Scientific Committee
Xavier Van Huffel, Director Staff Direction for risk assessment FASFC

Federal Agency for the Safety of the Food Chain (FASFC)
CA-Botanique
Food Safety Center
Boulevard du Jardin botanique 55
B-1000 Brussels

Lay-out
Pieter Depoorter, Expert Staff Direction for risk assessment FASFC
Jan Germonpré, Communication service FASFC
Gert Van Kerckhove, Communication service FASFC

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Welcome address

Lieve Herman
Flanders Research Institute for Agriculture, Fisheries and Food
Chairwoman SciCom

Dr. Lieve Herman graduated as doctor in sciences, specialization genetics - molecular biology, at Ghent University in 1988. Since 1989 she has been working at the Flanders research institute for agriculture, fisheries and food (ILVO), where she is head of the Technology and Food Sciences unit since 2007. Her research has been focused on food safety, food microbiology, food hygiene, food quality and risk evaluation of genetically modified organisms and molecular processes. Since 2001 she is a member, and currently chairwoman, of the Scientific Committee established at the FASFC. She is also a member of the EFSA BIOHAZ panel and of several EFSA working groups from the BIOHAZ, the FEEDAP, the CEF and the APP Panel and from the EFSA Scientific Committee.

"Animals without disease: the future of the animal production chain" is the topic of this 16th annual symposium of the Scientific Committee established at the Belgian Food Safety Agency.

Recent efforts by the various actors in animal production have led to significant progress in the control and prevention of animal diseases. However, intensive animal production systems are prone to the accumulation of many pathogens that pose a variable risk to both animals and humans. Moreover, the COVID-19 pandemic has shown that a human pathogen can also have an impact on animal production systems.

The aim of the symposium is not so much to focus on the classical themes of prevention and control of animal diseases, but rather to try to give an image of the challenges facing animal food production. Themes such as food safety, sustainability, economy and the digital revolution are all addressed. This symposium is challenging and future-oriented and fits within the broad context of preserving and safeguarding the health of food producing animals and thus of the consumer (One Health) while taking into account the societal challenges faced by operators, sectors and government. The theme creates both the opportunity to draw lessons from past (animal) health crises and to present new insights into animal production methods and the challenges associated with them.

The organisation of this symposium took place under the chairmanship and with the contribution of Etienne Thiry and with special input from Thierry van den Bergh, but had to be postponed because of the COVID pandemic. I would like to express my gratitude for their active contribution in the organisation of this symposium, even though they are no longer a member of the Scientific Committee.

I express very special thanks to my fellow members of the Scientific Committee, Dr. Philippe Delahaut, vice-chairman, Prof. Jeroen Dewulf, Dr. Nick De Regge, Prof. Lieven De Zutter, Dr. Nicolas Korsak, Prof. Louis Maes, Dr. Marcella Mori and Prof. Claude Saegerman and to Dr. Xavier Van Huffel (Director) and Dr. Pieter Depoorter (expert) both from the Staff direction for risk assessment, for their invaluable contributions in the working group in charge of the scientific organisation of this symposium. Furthermore, we acknowledge the strong support of the Agency through its Chief Executive Officer, the General Director of the Directorate General Control policy and the Staff direction for risk assessment for providing the needed human and financial resources.

The very high scientific quality of the symposium is supported by prominent speakers coming from Belgian and foreign universities and scientific institutes. They are warmly acknowledged.

Your numerous presence as participants reveals that the topic of the symposium is a pressing issue and meets the concerns of scientists, industry and risk assessors involved in the improvement of animal health and the safety of the food chain.

I wish you a very fruitful symposium.

Setting the Scene

Thierry van den Berg
Sciensano
Former SciCom member

Thierry van den Berg is retired since 01/05/2021. Before he was Scientific Director Animal Infectious Diseases, in charge of 105 persons, since 30 years in position at the former CODA-CERVA, now Sciensano. He was External Professor at the University of Liège in Gembloux, AgroBiotech (Course on Animal Pathology & Hygiene) from 2009 to 2018. Thierry was member of several professional bodies: Member of the Scientific Committee of AFSCA/FAVV from 2012 to 2020. Head of the National Reference Laboratory for Avian Influenza & Newcastle Disease for Belgium and Luxemburg (2003-2009); Chairman of European COST Action 839 (1999-2005); Member of several National and International committees on Avian Diseases; member of the board of the ESVV (European Society for Veterinary Virology) 2006-2012; member of the advisory board of ESV (European Society of Virology), member of a microbiology & immunology commission of the FNRS; member of a FRIA commission; member of the Belgian Influenza Scientific Committee; member of the FAO-OIE OFFLU consortium (subgroup on vaccination); member of EFSA experts groups related to AI & NDV …

Thierry is regular referee for about 25 international peer-reviewed journals, member of the Editorial Board of Avian Pathology & of the Euroreferences journal. He is author or co-author of more than 120 peer reviewed publications

His key domains of expertise are: Virology, Immunology, Biotechnology, Diagnosis, Vaccination.

Animals without disease: the future of the animal production chain?

An introduction to the Symposium

The deep crisis that our society is going through is obvious. Ecological degradation, galloping demographics, social exclusion, unlimited exploitation of natural resources, the relentless pursuit of profit and growing inequalities are at the heart of contemporary problems and make a paradigm shift increasingly imperative. The Covid-19 crisis has, in this respect, been a powerful eye-opener and it is to be hoped that it will serve as a framework for global reflection to explore the world beyond (as said by Sir W. Churchill, "never let a good crisis go to waste"). Among others, this crisis has opened the door to more digital solutions (like telemedicine), new vaccine breakthroughs, improved biosecurity measures (“bioconfinement”), increased (big) data sharing or better collaborative research but, above all, it has confirmed what one-health advocates have been saying for years: multidisciplinary collaborations among veterinarians, physicians, and public health professionals are necessary to address the growing public health threat associated with zoonotic diseases. SARS-CoV-2 is just the latest in a growing list of viruses that have spilled over from animal hosts into human populations.

In this context, veterinary medicine has an important role to play. By 2050, the world’s population is projected to grow by one-third, reaching between 9 billion and 10 billion people and a substantial increase in meat, dairy, and fish consumption is expected. This increasing demand for animal products will require a significant research and development investment but the challenges to be met go beyond research into enhanced animal productivity. Research will be required into how to anticipate and meet significant changes in the global environment impacting on animal production, how to ensure sustainable production and how to improve equitable distribution of animal products today and in the future, and how to improve communication between those engaged in animal production and the public. According to the Food and Agriculture Organization of the United Nations (FAO), “in 2010, the food animal sector contributed 40 percent of the global value of agricultural output and supported the livelihoods and food security of almost a billion people”. The rapid growth of this sector represents many challenges, including increasing pressure on the availability of land, water, and energy to sustainably increase animal productivity, and

the potential adverse impacts of global climate change on agricultural productivity. A further challenge is the overuse of antibiotics leading to an increased risk of resistant infectious disease in humans and in animals.

Healthy animals are critical for a healthy planet, whether caring for pets, looking after livestock or protecting our wildlife for ultimately safeguarding human health. The title of the symposium is deliberately provocative: is it realistic to imagine a disease-free animal world, especially if we consider that currently up to 20 percent of livestock are lost to disease each year ? Interesting questions will be addressed like: Is health just the absence of disease ? Is it possible to anticipate most animal diseases by a better and faster identification of drivers of emergence ? Is it possible to eradicate all animal diseases or do we have to settle for controlling some of them ? Is intensive farming compatible with disease-free farming? What is the future of the One Health concept ? To what extent can we rely on hygiene and biosecurity ? What is the cost-benefit of preventing animal diseases ? Can digital technologies reconfigure animal healthcare in farming ? Can genomics help improving sustainability of animal production ? How can the healthy microbiome protect against disease ? What is the future role of veterinary policy makers and official bodies in the new paradigm ?

16th Symposium of the Scientific Committee established at the Belgian Food Safety Agency

Programme

Animals without disease: the future of the animal production chain?

Tuesday, 2th December 2021

Pacheco auditorium
Finance Tower
Pachecolaan/Boulevard Pachéco 13
1000 Brussels
Belgium

9:00	**Registration**
9:30	**Welcome** **Lieve HERMAN *(ILVO, Chairwoman SciCom)***
9:40	**Setting the scene: context and objectives of the symposium** **Thierry VAN DEN BERG** *(ex-Sciensano, ex-SciCom member)*
Session 1:	***Towards a sustainable and healthy animal production chain*** Chair: Lieven De Zutter (UGent, SciCom member) and Marcella Mori (Sciensano, SciCom member)
09:50	**Drivers of emergence of infectious animal diseases: what are the challenges?** **Claude SAEGERMAN** *(ULiège, SciCom member)*
10:20	**When (re)emerging diseases become endemic** **Jacques GODFROID** *(The Arctic University of Norway)*
10:50	Coffee break
11:10	**COVID pandemic: lessons learnt for animal health** **Etienne THIRY** *(ULiège)*

11:40	**Sustainable animal production: how can we better produce healthy food producing animals?** **Jeroen DEWULF** *(UGent, SciCom member)*
12:10	**The economics of disease prevention in animal production (in a Green Deal context)** **Erwin WAUTERS** *(ILVO)*
12:40	**Lunch**
Session 2:	***The future is now: digits and omics*** Chair: Nick De Regge (Sciensano, SciCom member) and Axel Mauroy (FASFC)
13:40	**The digital revolution in animal production technologies** **Miel HOSTENS** *(UGent – Universiteit Utrecht)*
14:10	**Harnessing genomic information for livestock improvement** **Michel GEORGES** *(ULiège)*
14:40	**The healthy gut microbiome: new insights to promote animal health and protect from zoonotic diseases** **Richard DUCATELLE** *(UGent)*
15:10	Coffee break
Session 3:	***Are we well-enough prepared to tackle future challenges?*** Chair: L. Maes (UAntwerpen, SciCom member) and N. Korsak (Uliège, SciCom member)
15:30	**Animal health and safety of the food chain: lessons from the past, reflections for the future in a One Health context** **Xavier VAN HUFFEL** *(FASFC)*
16:00	**The future role of the veterinarian in the light of the Animal Health Law.** **Wiebke JANSEN** *(FVE)*
16:30	**Conclusions of the symposium** **Philippe DELAHAUT** *(CER - vice-Chairman SciCom)*

Session 1

Towards a sustainable and healthy animal production chain

Drivers of emergence of infectious animal diseases: what are the challenges?

Claude Saegerman
University of Liège
SciCom member

Until September 2005, Claude Saegerman was the Director of the scientific secretariat of the Scientific Committee of the Federal Agency for the Safety of the Food Chain (FASFC). Currently, he is a full professor and head of Research Unit of Epidemiology and Risk Analysis applied to Veterinary Sciences (UREAR-ULg). From October 2007 until October 2009, he was vice-head of the Department of Infectious and Parasitic Diseases and from October 2009 until September 2013, he was the head of the same Department. Currently he is the head of the biosecurity unit at the Faculty of Veterinary Medicine, University of Liege, Belgium.

Claude Saegerman was graduated as doctor in veterinary medicine in 1986. He got a master of sciences in epidemiology in 1992 and a PhD in veterinary sciences in 2004. He was recognized in 2005 as diplomate of the European College for Veterinary Public Health. He received several (inter)national scientific awards, the most recent being granted by the Belgian Royal Academy of Medicine for an original contribution to the knowledge of the emerging Bluetongue virus in Europe.

Claude Saegerman is a member of several scientific committees like the scientific committee of the Federal Agency for the Safety of the Food Chain since 2008, the expert committee specialized in animal health of the French Agency for Food, Environmental and Occupational Health and Safety (Anses) since 2006 (vice-chairman since 2018), the expert committee specialized in vectors of Anses (vice-chairman since 2019) and the ASF Emergency collective expert assessment group of Anses (Chairman since 2018), the Veterinary Ad Hoc Scientific Advisory Group on an inactivated Bluetongue vaccine at the European Medicines Agency since 2010, also member of several working groups of the European Food Safety Authority since 2010 concerning the Bluetongue virus, the Schmallenberg virus, epidemiological indicators of the meat inspection, EBOLA and food fraud. He is also member of the Emerging Risks Exchange Network form the European Food Safety Authority since 2010 and was member of the Scientific Advisory Board of the United States Animal Health Association Committee (USDA) on Validating refining and encouraging the implementation of honey bee Best Management Practices to improve colony health Grant (2016-2018). He is the president of the Belgian Association of Animal Health and Epidemiology since 2007 and titular member of the The Royal Academy of Medicine of Belgium since 2016 (Chairman of the 6th section of veterinary medicine since 2020). He is independent expert of the scientific and technical committee Review of the World Organization for Animal Health (OIE) since 2008. He serve as guest or topic editor for several international journals.

Current research is mainly conducted on quantitative epidemiology, risk analysis and biosecurity, the development of methods for early clinical detection and understanding dynamics of infection of emerging (vector-borne and/or zoonotic) diseases, bee diseases and management practices and rare events, also for prioritizing animal diseases and drivers of diseases, based on an interdisciplinary approach and use of evidence-based medicine, and evaluation of disease control measures (including cost-benefit analysis). Recently he develop new project on cattle biosecurity, COVID-19 and bee diseases in Belgium and new projects in Latin America and Sub-Sahara Africa on the antimicrobial resistance, on the discovery of pathogens in non-primate humans, on the ticks and tick-borne diseases including haemorrhagic fevers, to construct a new original platform on zoonoses and vector-borne diseases.

The UREAR-ULg has a scientific output following an upward trend since its inception with more of 280 publications referenced in the US National Library of Medicine since 2010.

ABSTRACT

The emergence of a disease is related to the combined presence of several factors, named ‘drivers’. The latter may create an environment suitable for infectious disease to emerge, spread and be maintained in animal and/or human and/or environmental compartment [1,2]. Indeed, the knowledge of these drivers and their links is of prime importance to properly understand the interactions between hosts, pathogens and their environments in a One

Health but even more so in a Global Health perspective [3,4] and as such to improve our capacity for prevention, detection and response to emerging diseases [5].

Recent event (e.g. SARS-CoV-2) claims for more proactivity and anticipation by the authorities in terms of disease emergence. Prioritization of human [6] and animal diseases [3,7,8] based on drivers of emergence is rare but it is an approach to change the corresponding authorities (i.e. animal health, public health, environmental health, governmental) to these new goals.

A methodology for prioritizing drivers of emergence of diseases was recently proposed [3]. The development of this methodology was supported by the Belgian Federal Public Service of Health, Food Chain and Environment as part of the EPIDIACAP (Risk-based increase of diagnostic capacities for epizootic diseases in Belgium) research project RT13/3 implemented by Liege University and Sciensano.

Indeed, ranking methods and multicriteria approaches are cost-effective tools for such purpose and were applied to prioritize a list of selected diseases (N = 29 including 6 zoonoses) based on the opinion of 62 experts in accordance with 50 drivers-related criteria, grouped in 8 domains of criteria: (A) pathogen/disease characteristics (N 9 criteria); (B) distance to Belgium (N = 3 criteria); (C) ability to monitor, treat and control the disease (N = 7 criteria); (D) farm/production characteristics (N = 7 criteria); (E) changes in climate conditions (N = 3) criteria; (F) wildlife interface (N = 6 criteria); (G) human activity (N = 6 criteria); and (H) economic and trade activity (N = 9 criteria). Diseases appearing in the upper ranking were porcine epidemic diarrhea (a coronavirus), foot-and-mouth disease, low pathogenic avian influenza, African horse sickness and highly pathogenic avian influenza [3] (Figure 1). The tool proposed uses a multi-criteria decision analysis (MCDA) approach to prioritize pathogens according to their drivers of emergence and can be applied to other countries, contexts or diseases. As an example, the methodology was recently used to find the main drivers of emergence of the SARS-CoV-2 in companion animals [7] or to find main drivers of Influenza D in ruminants [8].

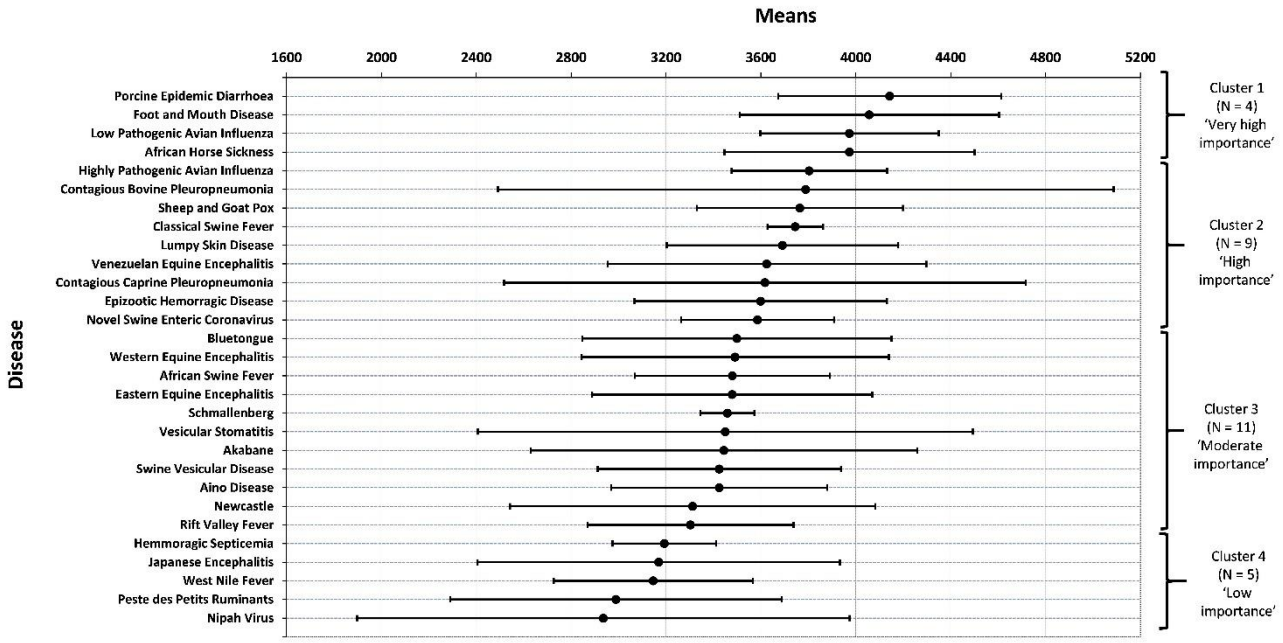
In addition, we need to explore how natural, economic and social sciences can find synergies in systemic analysis of emerging issues providing better identification, description, monitoring and management of their drivers [9].

However, by definition, drivers evolve in time and space, and prioritizing diseases based on drivers of emergence needs regular update. To perform this refining several challenges exist, such as:

- Need for more studies on drivers of disease emergence;
- Development of a sustainable system for elicitation of experts;
- Stimulation of transdisciplinarity: not just an addition of disciplines, but the linkage of a wide range of interconnected disciplines;
- Stimulation of Global Health as no frontiers exist for disease emergence;
- Need for study on relation between criteria and its possible effect in the propagation of the scoring;
- Capture of uncertainty using sensitivity analysis on the domains of criteria, on criteria, and on experts;
- Need for more prospective scenario analysis based on drivers when a new (food) technology is proposed before its local and scaling use in order to anticipate emergence of diseases or undesirable event.

Dealing with these challenges requires further research projects enabling sound proposition and innovative way to work, in real-time, at global scale (with a strong collaboration between developing and developed countries) and using digital epidemiology.

Figure 1. (Re-)emerging livestock diseases prioritized. Mean scores and standard deviations are mentioned. Four clusters were identified by regression tree analysis marked by brackets (Source: [3])



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When (re)emerging diseases become endemic

Jacques GODFROID
The Arctic University of Norway

Jacques Godfroid got a Doctor in Veterinary Medicine degree from the Faculty of Veterinary Medicine at the University of Liège, Belgium in 1981. He further got a Master degree in Molecular Biology at the University of Brussels, Belgium and a PhD in Veterinary Science at the University of Namur, Belgium.

After having worked for 4 years in West Africa at the International School of Veterinary Medicine in Dakar, Senegal (1986-1989), he went back to Belgium and worked at the Veterinary Institute in Brussels on brucellosis and mycobacterial infections in livestock and wildlife for 14 years. He was elected member of the task force of the European Union on bovine brucellosis (expert) and sheep and goat brucellosis (chairman) from 2000 to 2004.

In 2004, he moved to South Africa where he was appointed Professor of Microbiology to fill the Alexander Forbes Chair in Wildlife Diseases of at the Department of Veterinary Tropical Diseases (DVTD), Faculty of Veterinary Science, University of Pretoria. he worked mainly on bovine tuberculosis in South African Conservation Areas as well as on brucellosis in terrestrial and marine mammals.

In January 2008, he moved to Norway, where he was appointed Professor of Microbiology and Head of the Section for Arctic Veterinary Medicine at the Norwegian School of Veterinary Science, Tromsø. In January 2014, the section was transferred to UiT - the Arctic University of Norway. Since 2009, he is an extraordinary Professor at the DVTD, Faculty of Veterinary Science, University of Pretoria, South Africa.

Jacques Godfroid has been supervisor/co-supervisor of 9 PhD and 10 MSc students and has collaborated in 11 international funded projects. He is author or co-author of 152 peer reviewed publications in international scientific journals and wrote 9 chapters on brucellosis in veterinary, wildlife and ecology textbooks. He participated and presented oral communications to more than 60 international conferences.

ABSTRACT

"Today, tomorrow, together" is a slogan used by businesses to strengthen the loyalty of their clients. In the context of animal and human diseases, this slogan is the hallmark of endemicity. In addition, for livestock, the relationship between disease classification and social response is made explicit: diseases are defined as either "exotic," a legal status requiring government action to eradicate them, or endemic (including "production diseases") i.e., permitted to remain present.

Many pathogenic agents circulate silently within farmed and wild host populations and may infect several host species, influencing the epidemiology of diseases, the dynamics of microparasites (those that replicate within the host, such as viruses or bacteria) or macroparasites (those that do not replicate within the host, such as parasitic helminths), and the health of the host. Considering that over 70% of human diseases have a zoonotic origin and that a substantially higher percentage of livestock diseases are most likely shared with other wild-ranging hosts, research on parasite-parasite interactions in wild populations is needed.

Since the pioneering work of Anderson and May some 40 years ago, mathematical models to study the population dynamics and epidemiology of host-parasite interactions have been developed. The original models were based on simplified 1-host-1-parasite systems, describing systems involving either microparasites or macroparasites. These models have been modified, including additional host species, acquired immunity and abiotic factors like seasonality. Importantly, a microparasite-macroparasite co-infection model has been developed to explore how this type of co-infection affects the predictions of the standard single-parasite models. This has led to a good understanding of the key factors that affect parasite transmission, the incidence and the prevalence of disease, and the stability and dynamics of host-parasite systems in general.

Unfortunately, the disciplines of epidemiology and community ecology have developed to a large extend independently of one another. Nonetheless, the multispecies nature of many contemporary disease threats demands a community-scale approach to complement more traditional biomedical and disease control approaches. Examples taken from brucellosis and bovine tuberculosis, two important livestock and wildlife diseases, will be presented to highlight the importance of understanding and predicting the outcome of multiple infections in multiple host species.

For many (re)emerging diseases, eradication is unlikely to be successful and endemicity will be the rule. Translating a broader understanding of ecological communities into practical disease management will require the integration of surveillance, community ecology analysis, and (veterinary) public health implementation. The biggest challenge may very well be to convince livestock diseases managers and fellow veterinarian scientists that parasites are a natural part of healthy ecosystems.

COVID pandemic: lessons learnt for animal health

Etienne Thiry
University of Liège
Former chairman SciCom

Etienne Thiry was born on the 4th of April 1957 in Etterbeek (Brussels). He was graduated as doctor in veterinary medicine in 1980 and in veterinary sciences (PhD) in 1985. He was recognized in 2001 as diplomate of the European College for Veterinary Public Health. He is full professor and head of veterinary virology and viral diseases laboratory, faculty of veterinary medicine, Liège University, Belgium. He is also part time professor of veterinary virology at the free university of Brussels. He won the International Pfizer award by the international committee of the World Buiatrics Society in 1996. He won the Gaston Ramon award by the French Academy of Veterinary Medicine in 2008. He was recognized by the European Society for Veterinary virology as honorary member in 2009. He received the award Prix de la Francophonie by the Fédération des Associations francophones des vétérinaires d'Animaux de Compagnie (FAFVAC) in 2011.

Etienne Thiry is member of several scientific committees: associated member of the Royal Academy of Medicine of Belgium; member of the National Committee for Microbiology of the Belgian Royal Academy; chairman of the scientific committee at the Belgian Food Safety Agency (Afsca) (2014-2021); chairman of the Risk Assessment Group Covid Animals (2020-2021); chairman of the expert committee for animal health and welfare at the French Agency for Food, Environmental and Occupational Health and Safety (Anses) (2012-2018); vice-chairman of the board of directors of the federal scientific institute Sciensano. He is also chairman of the board of directors of the non-profit association Formavet active in the veterinary continuing education. He is member, previously acting- and vice-chairman, of the European Advisory Board on Cat Diseases. He was also coordinator of the European Union "Better Training for Safer Food" project on "Animal Health Prevention and Control of Emerging Animal Diseases" (2012-2013).

His research interests cover several aspects of animal virology, especially the study of animal virus-host interactions and the evolution of viral populations in noroviruses and hepeviruses. In applied research, virucidic activity and the quality of personal protective equipments, especially in the context of the Covid-19 pandemic. These scientific activities generated more than 500 papers in specialised scientific journals (h-index 41).

ABSTRACT

There is no more doubt about the zoonotic origin of most of the human emerging diseases. As early as in 2001, Mark Woolhouse and his team (Taylor et al., 2001) identified not less than 75% of emerging pathogens as zoonotic agents. The current Covid-19 pandemic did contribute to increase the number of zoonotic viruses. The drivers of such emerging zoonotic viruses are mainly from anthropogenic activities leading to biodiversity loss, disturbance of ecosystems and spillover to human population (Lawler et al., 2021). SARS-CoV-2, the agent of Covid-19, is the last example of such zoonotic virus spillover after Ebola virus and influenza A virus H1N1 pdm09. A further driver of spread is the increased transport around the world. It is therefore urgent to implement a mitigation policy able of reducing the negative effects of such anthropogenic activities. This is the only attitude allowing the reduction of the risk of new zoonotic pathogen emergence.

However the main lesson learnt from the Covid-19 pandemic from an animal health point of view is how to control the risks associated with a reverse zoonosis. In 2009, the previous human pandemic caused by influenza A virus H1N1 pdm09 was a first alert regarding the potential effects of the transmission of a human virus to animals, i.e. reverse zoonosis, and the zoonotic risk that can be associated. This virus is now a common influenza A virus circulating in pigs, together with "classical" swine influenza A viruses H1N1, H1N2 and H3N2 (Chauhan and Gordon, 2020). We observe now the same phenomenon of animal infection with SARS-CoV-2: this human virus was identified in not less than 12 animal species causing 584 outbreaks in 30 different countries (situation at 30th September 2021; OIE, 2021). The consequences of such animal infection with a human virus must be very cautiously analysed both for human and animal health. Fortunately, up till now, except the massive SARS-CoV-2

infection of farmed minks, the reverse zoonotic events are rare and have a small contribution to the human pandemic and animal diseases. However it is essential to develop the tools for a precise monitoring of such events. SARS-CoV-2 is a variable virus and the installation of variant delta could be associated with more animal infections with potential negative effects in humans and animals.

A good preparedness of a new pandemic must assess the risk of possible human to animal infection as early as possible. Reverse zoonosis is a key part of the One Health approach for the control of any pandemic and should be studied by multiple approaches: virus receptor usage, experimental infections and recording of natural infections in production and companion animals as well as in wildlife.

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Sustainable animal production: how can we better produce healthy food producing animals?

Jeroen Dewulf
Ghent University
SciCom member

Jeroen Dewulf graduated in 1998 as a veterinarian from the Faculty of Veterinary Medicine of the Ghent University, Belgium. In 2002 he finished his PhD on the epidemiology and control of classical swine fever. In that same year he received a master of science degree in veterinary epidemiology from the University of Utrecht, the Netherlands (Cum Laude). He became diplomat in the European College of Veterinary Public Health in 2005.

Currently he is full professor in Veterinary Epidemiology at the Faculty of Veterinary Medicine of the Ghent University. His main research interests are quantitative epidemiology and control of zoonoses with a specific emphasis on antimicrobial use and resistance in animals as well as the prevention of epidemic and endemic diseases with a focus on the application of biosecurity measures.

He is the head of the Veterinary Epidemiology Unit and is supervising over 10 PhD students who are doing research in the field of veterinary epidemiology. He is (co-)author of over 300 A1 publications in the field of veterinary epidemiology with a H-index of 45.

He is the principal author of the annual Belgian report on antimicrobial consumption in animals (BelVetSac) and chair of the JPI-AMR network on quantification of antimicrobial consumption in animals at herd level. Since 2009 he is member of the scientific committee established at the Belgian federal food Agency and is the founder and chair of board of the center of expertise on antimicrobial use and resistance in animals (AMCRA) in Belgium. He is also the author of the book “biosecurity in animal production and veterinary medicine” as well as the book “8 myths on antimicrobial resistance disproved, practical guide for reducing antibiotic use in animal husbandry”.

Abstract

In this presentation I will argue that in the animal health policy of the past we have focused too much on animal diseases whereas we should focus more on animal health. When focusing on diseases through monitoring and surveillance and eventually through treatment or eradication we are typically searching for problems (in an early stage) and then try to solve them. In the future we should focus more on keeping animals healthy.

One of the most important tools to do so is by improved infection prevention or biosecurity in animal production. This biosecurity should be the fundament of any disease control program and combined with good preventive measures to enhance the resilience of animals (eg. vaccination, improved feeding, feed and water additives, genetic improvements,…) we should be able to avoid most of the problems. Good biosecurity is based on a limited number of basic principles. These state that: 1) we should try to separate susceptible animals and potential sources of infection as much as possible, 2) we have to focus first on the most high risk transmission routes, 3) we need to try to reduce the infection pressure of those endemic pathogens we cannot eradicate, 4) we need to realize that the larger farms become, the more at risk they are and finally 5) we have to be aware that even small risks can become important if we repeat them frequently. With these principles in mind we can develop good biosecurity programs that protect both against endemic and epidemic diseases, that are generic so you are investing in the prevention of multiple diseases at once, that are relatively cheap and adapted to the local situation, and that can protect us against the unknown treats of the future.

Besides this I will argue that we should include much more other animal species (eg. companion animals, wildlife,…) into the animal health policy as they interact heavily with the environment, humans and food producing animals. In this we need to explore more the opportunities provided through risk based surveillance, citizen

science and smart syndromic surveillance. The latter has huge possibilities as more and more digital databases become available and sensoring technology is applied in animal production.

All of these measures, combined with expected further improvements in vaccine developments will allow to focus more on animal health and prevention rather than on animal diseases and treatment.

Session 2

The future is now: digits and omics

The digital revolution in animal production technologies

Miel Hostens
Utrecht University
Ghent University

Miel Hostens received his MSc in Veterinary Medicine at the Ghent University (Belgium) in 2006 and was granted a PhD entitled “Health and Fertility Challenges in High Yielding Dairy Cows during the Transition Period and the Use of Dietary Fatty Acids as an Optimization Strategy” in 2012 at the department of Reproduction, Obstetrics and Herd Health. After his PhD appointment (2007-2010), he was working as teaching assistant (2007-2012) and post-doc assistant (2012-2018) in clinical and theoretical MSc courses in Ruminant Herd Health Medicine. His profound interest in the dairy science is strongly supported by attendance on more than 50 national and international trainings between 2007 and 2020. In 2019, he started as Assistant Professor at the Department of Population Health Sciences of the Faculty of Veterinary Medicine at Utrecht University (UU, 0.9 FTE) with focus on the interdisciplinary field of dairy and data science. Due to ongoing data-driven research projects at Ghent University, he still has a 0.1 FTE position at Ghent University. He’s currently coordinating courses on data-driven precision agriculture at both universities. He has guided over 70 MSc students in Veterinary Medicine and is a member of the steering committee to revise the MSc in Veterinary Medicine and new post-graduate in animal health sciences at the UU.

Driven by a strong personal interest in the data science domain, he successfully finished over 15 post-graduate educations in the epidemiological, statistical and data science domain, finished a professional certificate in Epidemiology (Prince Edward Island, 2009) and Bio-informatics (Dublin, 2016), and started guiding students in BSc (6) and MSc (4) in Applied Internet, Communication and Technology and MSc in Business Informatics. He is involved in several (European) research projects on subjects as the use of agricultural data to exploit genomic data and develop novel phenotyping approaches, monitoring of dairy cows using machine learning techniques, the possibilities of machine learning techniques in monitoring sustainable agriculture practices and prediction of health indicators using common sensor technology. He is promotor and co-promotor of several Ph.D. theses on these subjects.

Due to an extensive international network following active project participation in both dairy and data science, he became an experienced keynote speaker at different congresses. In 2019, he became a member of the “Dairy Cattle Milk Recording Working Group” of the International Committee for Animal Recording.

Abstract

Europe is regarded as one of the leading role models for smart, sustainable, and circular agriculture worldwide. When moving towards sustainable agriculture we need to vigorously monitor and safeguard all aspects of agriculture including animal health and welfare. Precision livestock farming (PLF) is a set of advanced technologies aimed at automatic, real-time monitoring of animal welfare, health, environmental impact, and production.

Due to rapid development of these technologies, a massive amount of data has become available. However, accessibility, confidentiality, security, and the complexity of heterogenous data analysis are limiting full exploitation of agricultural data at this moment. Federated learning is a new paradigm which focusses on training such decentralized heterogenous data residing in different locations or institutions. It aims at a multi-actor approach building common models allowing to simultaneously address critical issues such as data privacy, data security, data access and access to heterogeneous data. Within the data science community, the approach is often referenced by ‘bringing the code to the data instead of the data to the code’, but never applied to agriculture. This presentation will show both non-federated and federated methodologies to illustrate the power of combining existing scientific data to accelerate research-to-research collaborations and illustrate the potential of analytical models that scale across multiple organization while protecting business sensitive data to accelerate research-to-industry collaborations.

This digital revolution will hopefully accelerate the transition towards sustainable agriculture by integrating heterogeneous agricultural data ultimately increasing the carrying capacity of the earth.

Harnessing genomic information for livestock improvement

Michel Georges
University of Liège

Michel Georges, DVM PhD, has devoted most of his career to the development and use of genomic tools for the forward genetic dissection of economically important traits in livestock. His team performed the first genome-wide QTL scans in animals, identified the double-muscling myostatin gene, discovered polar overdominance, discovered a mutation perturbing miRNA-mediated regulation of the myostatin gene as well as other regulatory mutations affecting growth and muscle mass, and uncovered a novel CNV-generating mechanisms involving circular intermediates. More recently, Michel Georges' team has moved in human genetics and contributed to the identification and analysis of risk loci for inflammatory bowel disease. Michel Georges received the Wolf price in agriculture in 2007 and the Francqui Prize in biomedical sciences in 2008.

Summary

The world demand for animal-based food products is anticipated to increase by 70% by 2050. Meeting this demand in a way that has a minimal impact on the environment will require the implementation of advanced technologies, and methods to improve the genetic quality of livestock are expected to play a large part. Over the past 10 years, genomic selection has been introduced in several major livestock species and has more than doubled genetic progress in some. However, additional improvements are required. Genomic information of increasing complexity (including genomic, epigenomic, transcriptomic and microbiome data), combined with technological advances for its cost-effective collection and use, will make a major contribution.

The healthy gut microbiome: new insights to promote animal health and protect from zoonotic diseases

Richard Ducatelle
Ghent University

Richard Ducatelle is a veterinarian, who graduated from Ghent University in Belgium in 1978. He obtained a PhD in veterinary pathology from Ghent University in 1983. He was scientific advisor for the Belgian government from 1985 till 1989. He is professor in veterinary pathology at Ghent University since 1989, emeritus since 01-10-2020. He is a Diplomate of the European College of Veterinary Pathologists and a diplomate of the European College of Poultry Veterinary Science. He is president of WVPA Belgian branch since 1991 and past-president of the European Society of Veterinary Pathology.

Prof. Ducatelle is author or co-author of more than 700 scientific publications listed in the Web of Science (h-index = 57) and more than 400 abstracts in proceedings of international congresses. He was an invited speaker at more than 200 national and international congresses.

His research interest is mainly in gastro-intestinal health, with a focus on poultry, calves and pigs. He was mentor of 34 PhD theses in this field of research.

ABSTRACT

The caeca of poultry and the caecum and colon of pigs are true fermentation vessels, with around 10^{11} bacteria per gram of content. This bacterial soup is characterized by complex interactions of the bacteria among each other and with the host. Thanks to the huge advancement in bioinformatics and biotechnology of the last two decades, we are beginning to understand the role of the gut microbiome in the protection of human and animal health. For an increasing number of bacterial families and genera, their metabolic role in the intestinal ecosystem has been characterized. We have now come to the point that one can start speculating on what would be the ideal gut microbiome, with a dominant population of microbes that would promote animal health and help to protect from zoonotic diseases. These beneficial effects are associated with a myriad of underlying mechanisms. Fortunately, there are a few dominant patterns that seem to be critically important for intestinal health. These can serve as biomarkers of the health status. One such pattern that stands out is butyrate production. This short chain fatty acid is one of the major end products of the metabolic network of the gut microbiome. It serves as the major energy source for the epithelial cells lining the lower intestinal tract. Even more importantly, butyrate is sensed by the host mucosa through the presence of 3 receptors. The host response to high butyrate production by the gut microbiome is characterized by a wide range of beneficial effects, including better absorption of nutrients in the small intestine, less inflammation, elongation of the small intestinal villi, reduced virulence of Salmonella, and many more. Next to butyrate, the number of identified beneficial patterns and signals is increasing rapidly.

The next question, however, is how to steer the microbiome in that direction. Recent research efforts have pointed out that an important fraction of the microbiota appear to be 'heritable', meaning that the genetics of the host determines their presence and abundance to some extent. The heritability is roughly estimated at $h^2 = 0.15$. This opens new opportunities for improving gut health through genetic selection. Another major determinant of the gut microbiota is the composition of the feed in general and the undigestible fraction of the feed in particular. Unfortunately the analytical tools for the characterization of the undigestible, predominantly non-starch polysaccharide (NSP), fraction of the feed are underdeveloped. There is still a long way to go before this approach can be fully exploited to improve gut health. For the time being, feed additives, including enzymes (NSPases), prebiotics and probiotics are being used to correct for a poorly adapted NSP fraction of the feed.

The lumen of the lower intestinal tract is a very specific habitat, characterized by strict anaerobiosis, a relatively poor nutrient supply, and support from the host through abundant mucus secretion. Ad libitum feeding of a nutrient

dense diet puts considerable stress on the digestive system. The incomplete digestion and absorption of nutrients in the small intestine leads to an undesirable expansion of the microbial population in the prececal gut segments, known as ‘small intestinal bacterial overgrowth’, and to a shift in the microbiome of the caecum and colon, commonly referred to as ‘dysbiosis’. A close follow-up of the gut microbiome using -omics tools can allow to anticipate on the deterioration of the microbiome and thus allow time for correction through management and feed formulation, reducing the need for medication and moving one step further towards animals without disease.

Session 3

Are we well-enough prepared to tackle future challenges?

Animal health and safety of the food chain: lessons from the past, reflections for the future in a One Health context

Xavier Van Huffel
Belgian Federal Agency for the Safety of the Food Chain
Director of the staff direction for risk assessment

Xavier Van Huffel (DVM, PhD) graduated in 1980 from the University of Ghent as doctor in veterinary medicine. He obtained his PhD in veterinary sciences from the same university.

In the beginning of his career X. Van Huffel was mostly interested in the clinical aspects of large animal medicine. After having spent an internship at the University of California, Davis (USA) and at the New Bolton Center of the University of Pennsylvania (USA) he worked for several years as a research assistant in the clinic of surgery and anaesthesiology of the Faculty of Veterinary Medicine at the University of Ghent. In addition to clinical practice his research dealt with the study of the pathogenesis of bovine arthrogryposis and infectious arthritis. He got recognized at that time as a diplomate of the European College of Veterinary Surgeons.

In 1990 he changed career and became a scientific advisor successively at the IWONL – IRSIA (Institute for the encouragement of scientific research in industry and agriculture), at the Federal Ministry of Agriculture and at the Federal Public Service Health, Food Chain Safety and Environment where he was involved in encouraging and financing scientific research in animal health and production, animal welfare and food safety.

In 2006 he joined the Belgian Food Safety Agency as Director of the Staff Direction for Risk Assessment and coordinator of the scientific secretariat of the Scientific Committee. He is mainly responsible for a team of experts preparing the scientific opinions of the Scientific Committee on risk assessment and risk management in the food chain. He has participated in several European projects on food safety and animal health research and is actually involved in the FOODSAFETY4EU project. In recent years he has mainly published on risk assessment, risk prevention, risk ranking and measuring the safety of the food chain. X. Van Huffel is member of the Scientific Committee of ANSES and the Advisory Forum of EFSA.

ABSTRACT

Animal health and safety of the food chain are closely related topics well-regulated at the European and national level. The foundation is the EU Animal Health Policy which is the result of decades long development in the fight against transmissible animal diseases. The EU Animal Health Policy protects human and animal health and welfare as well as food safety as it is working towards high animal health status of livestock, poultry and fish by controlling animal disease outbreaks and by surveillance and eradication programmes. Despite the EU Animal Health Policy operates under the motto “prevention is better than cure” incidents and crises do happen in the food chain. They have shown the vulnerability of the food safety system and the need for permanent vigilance for emerging threats and for decisive implementation of efficient measures by all actors.

The disease threats to livestock have increased steadily over the past decades due to globalisation, farming intensification with changed husbandry and management structure, climate changes, changes in the weather conditions and changes in wild life population density, dynamics and management. These factors contribute to the increased risk of spread and evolution of pathogens.

Food producing animals are frequently implicated in the emergence of zoonotic diseases. These diseases pose a particular risk to the safety of the food chain and thus to public health. Outbreaks of zoonotic diseases involving livestock can have catastrophic economic and public health impacts. By reviewing a number of past food-borne crises an attempt is made to draw lessons for the future. Particular attention is paid to the One Health concept which has long been put forward as the most appropriate approach to address multispecies health risks but which encounters still barriers for effective implementation.

The future role of the veterinarian in the light of the Animal Health Law

Wiebke Jansen
Federation of Veterinarians of Europe

Wiebke Jansen graduated from the University of Veterinary Medicine Hannover (Germany) in 2010 and worked there on several research projects focusing on zoonotic food-borne diseases. She became an EBVS specialist in veterinary public health in 2017 and finished her PhD at the University of Namur in 2019 with a special emphasis on Brucella before turning to Sciensanos Veterinary Bacteriology. She now works as Policy Officer at the Federation of Veterinarians of Europe (FVE).

Abstract

The Animal Health Law (Regulation (EU) 2016/429) on transmissible animal diseases has become applicable across the EU as of the 21 April 2021. Article 25 of the Animal Health Law requires operators to make sure that establishments receive regular animal health visits from a veterinarian. These animal health visits aim to strengthen animal health by improving disease prevention, in particular biosecurity, early detection and control of diseases. However, no Act lays down to date the minimum requirements necessary for the uniform application of Article 25, which jeopardizes the consistent and sufficient implementation in the Member States. FVE encourages to implement harmonised regular health visits on Community level to tackle the major challenges for livestock farming today: keeping disease out (e.g. ASF, AI), reducing the climate footprint of farming to become climate-neutral by 2050, reducing the use of antibiotics of 50% by 2030, to make animal farming more welfare-friendly, sustainable and upscale organic production to 25% by 2030. Regular veterinary visits have the great potential to improve animal welfare and economic efficiency, as well as to reduce use of antibiotics and enhance sustainability. FVE is convinced that there is a need to define animal health visits sufficiently to formulate a meaningful tool that has added value for farmers, veterinarians and consumers alike. After wide consultation, FVE developed guidance to get maximum value out of animal health visits: https://fve.org/animal-health-visits-add-value/. Harmonised, regular animal health visits will enable veterinarians to ultimately act in favour of animal welfare, food safety, public health, reduced production costs, more effective use of resources and reduced climate/environmental impact, consumer perception and consumer reassurance and deliver upon the imperative of the One Health approach.

SciCom

Federal Agency for the Safety of the Food Chain

CA-Botanique
Food Safety Center
Bd du Jardin Botanique 55
B-1000 Brussels