POSITION PAPER

Role of livestock in the EU Bioeconomy and FOOD2030 Strategy
Stressing the importance of animal health and welfare
A CWG AHW perspective to the EU Bioeconomy and Food 2030 strategies

Hermann Schodesberger | January 2023

SCAR
Standing Committee
on Agricultural Research

European Animal Health
& Welfare Research
COLLABORATIVE WORKING GROUP

Executive Summary

The world is facing two major challenges in this century: to feed and nourish an ever-growing world population, and to successfully steer it through Global Warming and the associated dramatic change of climate[1].

The SCAR Collaborative Working Group Animal Health and Welfare Research (CWG AHW) applauds and supports the ultimate importance and timeliness of both the EU Bioeconomy Strategy[2] and EU Food 2030[3]. It regards both European strategies not just as important milestones in the transition of the world to a more sustainable future, but also as key instruments to surmount these challenges and the risks associated with them.

At the same time, the CWG AHW emphasizes that sufficient focus should be laid on livestock, which represent key factors in both food security and climate change.

Present and future hunger and malnutrition have to be combated not merely by increased supplies of calories or tonnage of biomass but also and most importantly by improved quality of diets and supplied protein. A lack of protein and nutritionally balanced diets affect all people regardless of age or social stratum but have a most deleterious effect on the health and development of children which may last through their entire adulthood. Livestock offers an important supply of high-value protein that cannot be replaced easily. The value of livestock however goes far beyond the mere supply of nutritious protein; it also provides other biogenic raw materials, energy and fertilizer and renders multiple eco-system services.

With this position paper the CWG AHW wants to provide a unique perspective on the EU Bioeconomy Strategy and EU Food 2030 regarding livestock, which plays a perhaps underappreciated yet important and integral part in both.

Particularly in this perspective, the CWG AHW strives to highlight

- The role of livestock as converters of low-value biomass into high-value products, particularly as supreme source of protein
- The risks of circularisation and (re)introduction of epidemiological pathways facilitating the spread of disease
- The importance of maintaining and further improving the high level of health & welfare of livestock
- The importance of maintaining a high level of food safety, particularly in terms of emerging novel forms of diet and protein supply
- The importance of aquaculture and farmed fish and of preventing harmful exploitation of an already critically stressed aquatic biosphere
- The enormous potential of emergent digital technologies including analysis and sharing of data
- The risks of shrinking genetic resources and safeguarding the genetic heritage of disappearing livestock species and breeds
- The importance of livestock health management in a One Health context.

Finally, this CWG AHW perspective concludes with a summary of key messages and a list of important action points to be addressed by research.

[1] Notwithstanding with new urgency: preventing future pandemic threats. These however lie outside the scope of the two strategies discussed.
[2] https://ec.europa.eu/knowledge4policy/publication/updated-bioeconomy-strategy-2018_en
[3] https://ec.europa.eu/research/bioeconomy/index.cfm?pg=policy&lib=food2030

Motivation

The Collaborative Working Group Animal Health and Welfare Research (CWG AHW) of the Standing Committee on Agricultural Research (SCAR)[4] brings together 40plus partners comprising ministries, policy makers, and research funders from 25 EU member states and associated countries. The CWG AHW was established in 2005 with a clear and strong focus on coordinating animal health and welfare research in Europe.

As such, for more than 15 years now, the CWG AHW has been mapping existing research funding programmes, and existing research capacities and infrastructure. It is monitoring research output and analyses research gaps, and from these findings it has distilled a common Strategic Research Agenda, which is permanently updated by foresight studies, expert workshops or internal working groups.

The scope of the CWG AHW lies on research of emerging and major infectious diseases, production associated diseases and animal welfare of production animals in the EU, including research-related infrastructural aspects. Fish and bees are also included, as well as those conditions which pose a threat to human health. Food safety issues relating to the handling of livestock products are excluded, as are diseases of wildlife, except where they act as reservoirs of infection for humans or production animals.

With the challenges of providing an ever increasing world population with sufficient safe and nutritious food and surviving in a changing climate, a number of strategies have appeared on the European and global level with the aim to sketch out possible paths to solving and surmounting the slowly materialising crises. Many of them adopt a holistic or system's view, but cast only a cursory or a skewed glance on the importance and impact of animal health and welfare on food security and climate change.

SCAR has been involved as one of the leading instruments in defining two seminal strategies that govern research policy and funding in the coming years: the EU bioeconomy strategy and the EU Food 2030 strategy.

In the course of Horizon2020 SCAR has re-evaluated and redefined its role and modus operandi. In order to better address the challenges of the future, SCAR Working Groups are called upon to venture beyond organizational barriers, to observe the work of the other groups and seek a greater integration and alignment of their output with what SCAR as a whole is doing.

With this paper the CWG AHW is answering this call, specifically highlighting its view on both the European Bioeconomy and Food2030 Strategies, emphasising the fact that livestock has a key role to play in both, as a major contributor to their respective goals and objectives, while facing many challenges, such as i) a rising demand of animal protein, ii) a need for more sustainable ways of production, iii) emerging animal diseases and a need for breeding for higher genetic disease resistance despite an increasingly eroding genetic base, and last but not least iv) climate change and needed higher tolerance against weather extremes.

The CWG AHW wants to emphasise

1. the role livestock production plays in providing highly nutritional food and high-value biomass,

[4] The overall objective of SCAR is to provide advice and support for shaping, programming and aligning European research in agriculture and the wider bioeconomy. With this purpose, SCAR encourages information exchange, coordination and collaboration between Member States, predominantly through four main activities: i) strategic policy advice; ii) foresight exercises; iii) common strategic research agendas; iv) mapping research capacities relevant for the bioeconomy. These activities are performed by Strategic and Collaborative Working Groups working under the umbrella of SCAR.

2. its intrinsic vulnerability to pathogenic agents and the role of epidemiological pathways, in particular in terms of (zoonotic) threats to public health, food safety and the demand for increased circularisation of material flows, and
3. the delicate balance between productivity and animal welfare, under the demand of enhanced food security to feed the world.

The strategies: an overview

The EU Bioeconomy Strategy – "Innovating for Sustainable Growth: A Bioeconomy for Europe"

Bioeconomy as defined by the European Commission is "the production of renewable biological resources and the conversion of these resources and waste streams into value added products, such as food, feed, bio-based products and bioenergy."[5] Essentially it means utilizing biomass and renewable biological resources to replace fossil- and mineral-based raw materials and fuels as well as developing bio-based or bio-inspired manufacturing processes and catalysts. Furthermore, it propagates a cascading use of biomass and the introduction of circular utilization pathways for more efficient use of raw materials and energy in order to reduce the environmental footprint that an ever-growing population of >7,8 bn people leaves on this planet.

To help to bring about such a bio-based economy the European Commission has published its EU Bioeconomy Strategy "Innovating for Sustainable Growth: A Bioeconomy for Europe" (EC 2012)[5], supplemented further by accompanying documents and comprehensively revising the strategy in 2017[6]. The EU Bioeconomy strategy (EC 2012) action plan pushes along three major lines of action: i) investments in research, innovation and skills; ii) reinforced policy interaction and stakeholder engagement (including a stakeholder panel and the bioeconomy observatory); iii) enhancement of markets and competitiveness in bioeconomy sectors.

The EU Food 2030 Strategy – Future-proofing EU food systems

There is a consensus that our current food systems are far from resilient and not fit for the future, in particular in developed countries: i) food production is not sustainable per se, with intensive production systems also frequently affecting animal well-being; ii) our diet is often unbalanced and unhealthy with 2 bn people on this planet being obese or overweight and 0.8 bn underweight or suffering from malnutrition[7]; iii) our food-related environmental footprint is too large, impacting biodiversity and climate. The outlook into the future is even more dismal: the population growth demands a minimum of 60% increase in protein supply, while food systems now already consume almost 3/4 of planetary water resources, and approx. a third of planetary energy resources while emitting a considerable share of planetary greenhouse gases.

To tackle these challenges, to remove the existing silos and to develop a combined and systemic view of food systems, agriculture, natural resources and the wider bioeconomy, the European Commission launched EU Food2030, a set of R&I policies to future-proof food systems and make them more sustainable, resilient, diverse and competitive. Food2030 identifies 4 prioritized areas of action: i) nutrition for sustainable and healthy diets; ii) climate-smart and environmentally sustainable food systems; iii) circularity and resource efficiency of food systems, and iv) innovation and empowerment of communities.

In the report of the Food2030 Independent Expert Group "*Recipe for Change*" 3 missions are suggested: i) improve dietary patterns and lifestyles for a 50% reduction in the incidence of non-communicable diseases (NCD) by 2030, while reducing the environmental impact of food consumption; ii) create a resource-smart food system with 50% lower greenhouse-gas emissions by 2030; and iii) realise trust and inclusive governance for a resilient and safe food system.

[5] COM (2012) Innovating for Sustainable Growth: A Bioeconomy for Europe.
[6] COM (2017) Review of the 2012 European Bioeconomy Strategy
[7] UN Economic and Social Council (2019) Report of the Secretary General – Progress towards the Sustainable Development Goals (E/2019/68)

Role of livestock in the European Bioeconomy – as seen from the perspective of the CWG AHW

Importance of livestock.

The world is in urgent need of a transition to a "greener" industry and economy and to a more sustainable and efficient food production to nourish the world. Both the Bioeconomy Strategy and Food2030 strategies are important milestones towards these goals. While supporting the ultimate importance and timeliness of both, the CWG AHW wishes to emphasise the important contributions of livestock to these two strategies.

Role of Livestock in Bioeconomy.

The EU bioeconomy strategy advocates the transition from non-renewable, mostly mineral or fossil-based resources to renewable materials and fuels and cascading and circularisation of energy and substance flows. Plants account for the vast majority of biomass on this planet with ~450 Gigatons of carbon (Gt C)[8] and animals only for 2.4 Gt C, of which livestock accounts for less than 0.1 Gt C. The major focus of the EU bioeconomy strategy lies therefore on the production of the necessary renewable raw materials provided by crops and forestry such as fibres and fuels, and on the greenification of industrial processes by using bio-inspired processes and naturally grown bio-resources. Under these circumstances it is totally understandable that in many of the member States' bioeconomy strategies livestock issues appear rather marginally presented, if at all. However, wherever the nutritional need of a reliable (and affordable) supply of high-quality food is concerned, livestock production plays a crucial role, supplying sufficient amounts of high-grade proteins and other essential micro-nutrients[9]. It is also worthy to note that the benefits of livestock farming go beyond providing meat, milk and eggs. Livestock produces many more valuable raw materials for industrial needs, such as leather. Their waste products can be used as biofuels for biorefineries and biogas plants.

Moreover, production animals are a major source of natural fertilizer (N,P,K)[10], which is an important prerequisite of sustainable crop production[11] - a perfect example of circularisation. Without livestock the entire equivalent would have to be replaced by industrially produced chemical fertilizer, which would actually form a reversal of the intentions of EU bioeconomy. (Overproduction of manure in regions with highly intensive livestock farming can be utilised by reclaiming valuable substances such as phosphate and potassium and providing biogenic raw material for chemical industry (e.g. nitrogen compounds)). Livestock farming also provides important ecosystem services like utilizing marginal grassland, helping to maintain special forms of terrain and ecosystems, or providing specialized services like pollination and other forms of gene dispersal. Indirect services are connected to tourism, leisure, educational value, landscape and cultural heritage.

Livestock as biomass converters.

Livestock are the best and most important converters of raw, largely indigestible biomass into high-value nutrient-dense food and other livestock-associated or -derived products, ranging from traditional ones

[8] Yinon M. Bar-On, Rob Phillips, Ron Milo (2018) The biomass distribution on Earth Proceedings of the National Academy of Sciences Jun 2018, 115 (25) 6506-6511
[9] 1/3 of humanity's protein intake. FAO (2016) The contributions of livestock species and breeds to ecosystem services
[10] Annual US Production values exceed 1 bn tons of animal manure per year. Zhang H, Schroder J (2014) Animal Manure Production and Utilization in the US. In *Applied Manure and Nutrient Chem. for Sust. Agri and Env* (pp.1-21)
[11] FAO (2017) *Voluntary Guidelines for* Sustainable *Soil Management*. www.fao.org/3/a-bl813e.pdf

(leather, candles, etc.), to industrially used (chemistry, cosmetics, etc.)[12] or novel products such as *'farmaceuticals'*, medicinal products harvested from transgenic farm animals.

Livelihood.

Livestock contributes considerably to the livelihoods of people, in particular in poor countries[13]. In some low-income countries the livestock sector contributes as much as 40% of agricultural GDP[13]. In Africa and Asia up to 1 bn people directly depend on livestock production and marketing, with 2/3 of the poor livestock keepers being women. In Europe as well, livestock farming is still a most important economic sector. Livestock farming not only contributes by creating revenue by selling the products but also by offering small business opportunities and jobs in livestock keeping, as well as harvesting, processing, transportation and marketing livestock products.

Circularisation and epidemiological pathways.

Circularisation and its systemic manifestation as Circular Economy, featured in the BioEconomy and Food2030 strategies, are important paradigms in order to surmount the environmental and nutritional crisis looming ahead. Circularising energy and substance flows and reusing and recycling abiotic and biotic waste streams are important instruments in lowering the environmental footprint, reducing the exploitation of mineral and fossil natural resources and eventually achieving a carbon-neutral civilization.

However, medical progress in the human and animal domain has repeatedly required the opposite of circularisation, i.e. breaking up epidemiological pathways and toxin and pathogen enrichment cycles, such as restricting the feeding of kitchen refuse and swill (ASF), separating human and animal excreta and only using the latter for fertilizing (tapeworm), pasteurizing raw milk (bovine tuberculosis), or eliminating the usage of meat and bone meal (BSE/Creutzfeld-Jacob Disease - BSE/CJD)[14].

Every introduction of a new circular animal-derived or -associated material flow therefore must be accompanied by appropriate risk assessment and comprehensive research into its safety for humans, animals and the environment.

[12] Marti DL, Johnson RJ, Mathews KH (2011) Where's the (not) meat? Byproducts from beef and pork production. *USDA Livestock, Dairy, and Poultry Outlook Report* LDP-M-209-01

[13] Smith J et al. (2013) Beyond milk, meat and eggs: Role of livestock ind food and nutrition security. *Anim. Front* 3,6-13

[14] BSE/CJD is a salient example of how a new, at first very laudable circularisation, the re-utilisation of an animal by-product as a valuable protein feed additive, can go terribly wrong. The ensuing crisis required the culling of hundreds of thousands of animals, caused numerous deaths of humans and cost billions of Euros [e.g see E.P. Cunningham, After BSE - A future for the European livestock sector, European Association for Animal Production, Scientific series, 108, 2003].

Role of livestock in the EU FOOD 2030 Strategy

Food Security Aspects.

As emphasized in Food2030, the world faces a food security crisis, manifesting itself as a predominant lack of nutritive protein. Lack of access to sufficient quantities of nutritious food affects all strata of global society, but it hits children worst. Undernourished children have an elevated risk of contracting infectious diseases, are more seriously ill, have a delayed recovery, and run a greater risk of dying. If they survive, they run the risk of physical and mental underdevelopment, impaired cognitive ability and reduced performance in school and later on at work.

According to UNICEF[15] nearly half of all deaths in children under 5 are attributable to undernutrition[16], and this is more a question of a lack of nutritive proteins than of insufficient calories.

As mentioned above livestock are supreme converters of low quality biomass into highly concentrated nutritious food. Protein of animal origin plays an enormous role in preventing stunting and wasting because of its inherent exceptional concentration of valuable proteins and essential micronutrients, minerals and vitamins (i.e. Fe, Co/Vit B12, etc.). It is superior to plant-derived protein, which generally exhibits an inferior amino acid spectrum, and doesn't offer the essential elements and vitamins abundant in animal-derived food products. Hence purely plant-based diets have to be carefully balanced to avoid nutrient deficiencies.

On the other hand, excessive livestock production is always at risk of being vilified as a major source of damage to climate, environment and human health in the form of zoonoses, obesity, and malnutrition, resulting in vascular disease, cancer and loss of QALYs[17]. However, it is necessary to also highlight that new studies increasingly show that a balanced mix of plant-derived diets with moderate amounts of meat, milk and eggs and other forms of food of animal origin yields the best nutritional benefit to human health for the smallest environmental footprint[18,19]. Moreover, if animal-derived food products were to be replaced with a purely plant-based diet, the result would be a considerable higher demand of energy, resources and land, in order to guarantee an equivalent concentration of essential and indispensable micronutrients in the diet[21].

It has also been shown that foregoing meat consumption in developed countries does not automatically improve food security in low-income countries, actually it might even worsen it[20]. It is therefore important that livestock is an integral part of the Food 2030 strategy.

Animal infectious diseases.

It is self-evident that healthy food can only come from healthy animals. It is important to note however that livestock is intrinsically and persistently threatened by pathogenic agents like bacteria, viruses, fungi, and parasites, many of them vector-borne, but also by toxic (bio)chemical compounds, many of them able to wreak catastrophic havoc. Also, a large number of animal diseases are zoonotic such as tuberculosis or BSE, some with pandemic potential such as avian influenza or its most salient example SARS-Cov2. In the

[15] UNICEF, WHO, World Bank Group Joint Malnutrition Estimates, March 2020 Edition
[16] In 2019 more than 144 mio children below age 5 were stunted and 47 mio more were seriously malnourished because of a lack of access to sufficient quantities of protein and essential nutrients.
[17] QUALY: quality-adjusted life year
[18] Kim BF, et al. (2019) Country-specific dietary shifts to mitigate climate and water crises. *Global Environmental Change*, in press.
[19] White RR, Hall MB (2017) Nutritional & greenhouse gas impacts of removing animals from US agriculture. PNAS 28, 114 (48)
[20] Stokstad E (2010) Could Less Meat Mean More Food? Science 237, 810-11

past, containing and mitigating their outbreaks has cost billions of Euros[21]. Even if Europe has made significant progress to prevent, control and eradicate animal diseases among her livestock, for many of those hazards, efficacious instruments to control or prevent outbreaks are still lacking (see DISCONTOOLS database[22]). Efforts to develop such tools have to be intensified, research and innovation coordinated and funded, especially in preventive veterinary medicine such as biosecurity and vaccination, risk assessment and preparedness such as improved and scalable rapid diagnostics, surveillance & response infrastructures.

Securing animal health, the responsible use of pharmaceuticals like antimicrobials and guaranteeing the highest possible level of food safety are of utmost importance for human health, for animal welfare and the economic wellbeing of the entire associated value chains. The EU Bioeconomy Strategy and Food2030 are instrumental initiatives to surmount these challenges.

Production associated diseases.

Increased productivity, intensification and stocking density, necessary to satisfy the ever-increasing global protein demand, also brings along an increased risk of production-related disease, frequently multifactorial in nature, associated with biogenic factors as well as farming methods and management factors. Determination of prevalence and risk factors as well as development of mitigation options and prevention strategies is necessary.

Animal Welfare Aspects.

Only animals kept with respect for their well-being are efficient converters of low-value biomass into high-value products. The increasing global protein demand forces livestock production to higher efficiency, higher intensification and integration as well as higher stocking density as the available area is progressively limited. To maintain and improve the desired efficiency and productivity, animal welfare has to be greatly improved and species-adequate conditions need to be created and enhanced, from birth to slaughter.

Food safety aspects.

The CWG AHW also wants to highlight the importance of food safety within the frame of food security. Both strategies, and in particular Food2030, stress the need for reducing food waste. However, a considerable part of food waste comes from the potentially compromised food safety of products kept beyond shelf-life, or have already been offered to consumers, like buffets. Risks also come from the increasing desire of consumers for "natural", unprocessed food such as unpasteurized milk. Alternative protein sources – in the future or already hitting the market – such as insect-based foods or artificially grown meat bring along new challenges to food safety as well as unknown microbiomes and potential allergens. Research is needed in future preservation of the safety of food and prevention of food-borne zoonoses, including bacteria carrying antimicrobial resistance genes, and risks from pharmaceutical residues.

Aquaculture and the marine biosphere.

Although fish and aquaculture are predominantly the domain of SCAR's Strategic Working Group SCARFISH, the CWG AHW's remit also encompasses the health and welfare of farmed fish[23]. The CWG

[21] e.g. Table 7 in FAO. 2016. Economic analysis of animal diseases/FAO Animal Production and Health Guidelines. No. 18.
[22] DISCONTOOLS = DISease CONtrol TOOLS (diagnostics, vaccines and pharmaceuticals), an open access database identifying research gaps for improving infectious disease control in animals, www.discontools.eu
[23] In fact both SCAR Working Groups, CWG AHW and SWG SCARFISH, have been collaborating closely in the past years, e.g. joint foresight on fish welfare, 2018.

applauds the focus on increased efforts to tap the resources of aquaculture and marine fish stock and seafood. Fish and seafood species properly managed show excellent feed conversion rates, which helps protein availability and thus food security.

However, there is a risk to further exploitation of a potentially already stressed biosphere (i.e. due to overfishing and destructive fishing methods such as bottom trawling and cyanide fishing). Also, the increase in number, area and stocking density of littoral and terrestrial fish farms introduces new dimensions of immissions and emissions, such as fertilizer for algae growth, into a sensitive, often still largely untouched biosphere (i.e. coastal regions). The open water application of antimicrobials to combat fish disease in (marine) open water fish farms is a particularly critical issue. Furthermore a large number of widely consumed species of fish (salmon, trout, tuna, etc.) or seafood are basically carnivorous predators in need of protein feed themselves, and therefore have a much less beneficial effect on helping to save the future global food/protein crisis. Industrially manufactured insect proteins might offer a perspective for the future, though.

Opportunities of digital technologies.

The use for ever-growing applications of interconnected digital (sensor) devices at animal and farm level and the large, ever-accumulating volume of collected data provides new opportunities for veterinary science. Specific individual sensor data or sophisticated or complex meta-analysis of large volumes of aggregated multidimensional data ('Big Data') represent both ends of a full spectrum. They enable early identification of newly emerging or re-emerging threats and new risk factors for established diseases, the development of new forms of prevention like vaccines, and facilitate comparison and benchmarking of treatment, prevention, epidemiology and economic burden of diseases.

Digitally measuring and recording the behaviour of farmed animals indoor and outdoor and continuously assessing their movement patterns and body conditions 24hrs a day and 7 days a week will moreover enormously enhance the objective determination of the welfare status of each individual animal.

However, the increasing dependence on digital technologies and automated systems (i.e. smart farming) also creates a risk. Continuous and un-interrupted power supply, network connection and cyber security will become increasingly critical to maintain food security and safety and prevent animal welfare disasters. With food supply chains counting among Critical Infrastructure for society, extensive focus has to be laid on research that makes livestock farming and food supply chains much more crisis resilient.

Erosion of genetic resources and diversity.

Evidence suggests that the genetic base is eroding at a worrying rate[24]. Many breeds have unique characteristics or combinations of characteristics – disease resistance, tolerance of climatic extremes or the ability to supply specialized products – that can contribute to meeting these challenges. Loss of genetic livestock diversity is dangerous because it narrows the manoeuvring room necessary to adapt livestock to future challenges and increase innate resilience against a range of climates and biotic threats (disease vectors, pathogens), as well as increase fertility, conversion rate and nutrition value of the final product. Also, if livestock would possess genetic resistance against certain forms of disease, treatment with antimicrobials would be greatly reduced. Only a sufficiently complex, diverse and comprehensive gene pool makes a successful and sustainable adaptation to these present and future challenges possible.

[24] FAO (2016) The 2nd Report on the State of the World's Animal Genetic Resources for Food and Agriculture
Particularly in poultry, global genetic lines of commercial grandparents flocks are converging and concentrated in a dangerous small number of commercial primary breeders. Basically only 4 multinationals dominate worldwide sales of genetic lines for high performance broilers, only 2 for high performance layers. The same is seen in other livestock species. Globally, only 15 species amount to 90% of total livestock, 5 species to 75%[24]. About 100 livestock species and breeds have disappeared in the years 2000-2014.

Livestock, food and One Health – The current SARS-CoV2 pandemic and future risks

There is a broad scientific consensus that the current pandemic caused by SARS-CoV2 finds its origin in infected bats and an ensuing spillover of SARS-type corona virus into humans[25] – perhaps via an intermediate host species – and flaring up as an epidemic in humans after spreading to customers of a Chinese wet market[26]. Within weeks it grew into a global pandemic.

Not only in Europe, but throughout the world, SARS-CoV2 has caused severe disruption of all aspects of human life, including all economic sectors and also affecting the European food systems. Although at least in Europe society luckily escaped a food supply crisis caused by the pandemic, it could easily have turned out otherwise.

If SARS-CoV2 had been transmissible via food, the supply chains would have collapsed within the hour. The example of African Swine Fever (ASF) demonstrates that viral agents can survive and remain virulent and infectious for several months, even– in this case – in processed meat and other pork products –and thus can play an important epidemiological role in spreading a pandemic disease[27]. Fortunately ASF is not zoonotic.

Measures to combat the current pandemic could have had harmful consequences themselves for the supply chains of food from animal origin. For example closed borders in order to prevent further spread of SARS-CoV2 – fortunately invoked only for limited periods – have also made quite salient the dependence of domestic agriculture and food processors on free travel of foreign skilled labour force (harvesters, distributors, logistics,...) or on free flow of imports of feedstuff and goods in Europe.

In the medium to long term, the reduced demand for animal-derived food products (i.e. resulting from gastronomy shut-downs) has sent ripples through the entire supply chain. For instance. the initial backlog of non-consumed meat was at first absorbed by storage and cooling facilities. However, when those capacities were exceeded, slaughtering at the abattoirs ceased, causing accumulation of non-slaughtered livestock at the farms with rising unproductive feed costs and creating a serious animal welfare problem by livestock outgrowing their pens and transgressing stocking density limits.

ASF and SARS-CoV2 are just two present-day illustrations for the crucial and multi-faced effects microbial pathogens in livestock and humans can exert on European or even global food security. Many more zoonotic or non-zoonotic threats are lurking out there and just waiting for their chance to cross the species border and wreak havoc on public health and global food security[28].

[25] Andersen, K.G., Rambaut, A., Lipkin, W.I. et al. The proximal origin of SARS-CoV-2. Nat Med 26, 450–452 (2020).
[26] Zhou P, Yang XL, Wang XG, Hu B, Zhang L, Zhang W, et al. (2020). "A pneumonia outbreak associated with a new coronavirus of probable bat origin". Nature. 579 (7798): 270–273.
[27] In fact meat and meat scraps fed to pigs have been one of the major pathways ASF has spread throughout eastern Europe and in China. See also Costard, S.; Mur, L.; Lubroth, J.; Sanchez-Vizcaino, J.M.; Pfeiffer, D.U. (2013). "Epidemiology of African swine fever virus". Virus Research. 173 (1): 191–197 (review)
[28] E.g. lurking pathogens with pandemic potential: Swine flu: Honglei Sun, et al. (2020) Prevalent Eurasian avian-like H1N1 swine influenza virus with 2009 pandemic viral genes facilitating human infection. Proceedings of the National Academy of Sciences Jul 2020, 117 (29) 17204-17210; SADS: Caitlin E. Edwards et al. (2020) Swine acute diarrhea syndrome coronavirus replication in primary human cells reveals potential susceptibility to infection, in: PNAS, 12. October 2020. Bat-borne viruses: Letko M. et al. (2020) Bat-borne virus diversity, spillover and emergence. Nature Reviews Microbiology volume 18, pages461–471(2020)

These risks emerge directly at the interface between humans, livestock and wildlife, ecosystems and the general environment. The only rightful way therefore to address, mitigate and prevent these risks is by following a One Health approach, i.e. acting across sectors.

One Health is a collaborative, multi-sectoral, and transdisciplinary approach working at the interconnection between people, animals, plants, and their shared environment, in fact the entire biosphere, and spanning all levels from local to global, with the ultimate goal of achieving the highest possible standard in public, animal, plant and ecosystem health and integrity of the environment, thus preventing in the best possible way upcoming urgencies.

Future prevention of animal infectious diseases in livestock, particularly zoonotic diseases and those with pandemic potential therefore requires comprehensive research –into how to maintain the integrity of ecosystems and habitats and into exploring the pathogen pressure arising from wildlife reservoirs and/or unsafe human behaviour, into improving monitoring, surveillance and early warning systems, into novel forms of biosecurity, animal hygiene and preventive veterinary medicine, into new forms of therapeutics and intervention options as well as their development and production techniques, and last but not least into better forms of risk communication. In the age of Fake News, risk communication becomes increasingly hindered or even impaired despite its being ever more masterfully crafted, meaningful and efficacious, and despite technological progress in public and social media technologies[29].

Future One Health research in livestock and public health therefore has to incorporate a large range of disciplines, vastly transgressing the traditional field of veterinary disciplines, incorporating ecologists, conservation and wildlife experts, field virologists, professionals in human health and epidemiologists, IT developers and specialists, authorities, farmers and food processors, mobility and logistics experts, economists and global development specialists, psychologists, communication experts, and, as SARS-CoV2 has shown, critical infrastructure and disaster management – a non-exhaustive list, just to highlight the diversity required to successfully address the challenges in preserving animal and thus human health in the future.

[29] E.g. Burki T (2020) The online anti-vaccine movement in the age of COVID-19. The Lancet, 2(10), 504-505

Conclusions

Given the elements described above, the CWG AHW is of the opinion that livestock should receive a better focus in future strategies for the following reasons:

- Livestock are an important source of high-value biomass reaching far beyond the provision of mere food and providing valuable ecosystem services.
- Livestock is a source of highly concentrated nutrients, superior to other sources of protein. The superior nutritional quality of protein from livestock should be more emphasized, as well as the higher demand of energy, resources and land required by purely plant-based diets if these need to guarantee an equivalent concentration of essential, indispensable micronutrients in the diet.
- Animal diseases can have a major impact on food systems. As infectious animal diseases, often with epidemic or even pandemic potential and/or zoonotic components, emerge or re-emerge continuously and unexpectedly, society and authorities have to remain vigilant and capable to protect our livestock. Strengthening research in risk identification, prevention, early detection, mitigation, biosecurity, and resilience against (re)emerging risks is of fundamental importance.
- Circularisation, (re)utilisation of waste streams and alternative (protein) feed, although of utmost importance in principle, can introduce unknown risks and open unexpected novel epidemiological pathways for pathogens and toxin enrichment. Corresponding accompanying research into the safety of novel circularities and potentially emergent risks is absolutely mandatory. By-products must be safe for human and animal health.
- Global growth of population and global dietary changes necessitate an increase in global food producing efficiency - to produce more with less. Further intensification and concentration of livestock production are only sustainable if highest standards in animal welfare and in prevention of associated diseases in livestock are achieved.
- The global dietary change, the increasing demand for "natural", unprocessed food and the introduction of new forms of protein supply such as insect food, artificial meat or food reclaimed from waste bring along new risks for the safe consumption of food. Research is needed to address these emergent challenges.
- The tremendously efficient conversion of feed into valuable food make wild and farmed fish as well as other forms of aquaculture an important growing source of protein. Great effort has to be put into researching and innovating safe, sustainable and animal welfare friendly forms and ways of fishing and aquaculture.
- Digital technologies have a great potential to improve animal health and welfare. To utilize their full potential, veterinary/medical/life sciences have to cooperate intensively and much closer than before with technical science and engineering.
- A large and diverse gene pool is an absolute prerequisite to adapt and improve livestock regarding future challenges in health, fertility, productivity and resilience against disease and climate change. The shrinking agrobiodiversity and the disappearance of feed and livestock species and breeds pose a great risk to future adaptability. More emphasis has to be laid on maintaining a broad genetic diversity beyond mere arguments of profitability.
- European food systems, particularly those involving livestock and their products, face great risks from infectious and parasitic pathogens, and from microbial threats affecting either animals or humans or both, both endemic or emergent.
- Other threats arise from the increasing dependence on digital technologies and automated systems (i.e. smart farming). Continuous and un-interrupted power supply , network connection and cyber security will become increasingly critical to maintain food security and safety and prevent animal welfare disasters. With food supply chains counting among Critical Infrastructure

for society, extensive focus has to be laid on research that makes livestock farming and food supply chains much more crisis resilient.

- Present and future challenges have to be addressed following a holistic One Health approach, incorporating a wide range of disciplines outside the traditional (bio)medical and veterinary sciences. Special emphasis has to be laid on researching improved forms of risk communication and efficacious means to counter disinformation and fake news.

What needs to be done

- Better visibility of livestock, better awareness of its importance, benefits and challenges in future Bioeconomy and Food strategies
- Better recognition of the nutritional value of livestock-derived protein.
  Awareness of the increase of the environmental footprint when exchanging animal-based protein for plant-based protein.
- Improved awareness of the inherent risks and threats European and global livestock faces from many sides, most prominently from animal infectious diseases. In particular awareness that ceaselessly invading vectors and pathogens, (re)emerging because of climate change or global flow of goods and people, never stop to put our livestock population at risk.
- Improved awareness that because of the inherent zoonotic nature of many animal infectious diseases, safeguarding livestock health means safeguarding human health, especially in terms of One Health.
- Improved awareness that diseased livestock means loss of efficiency, resources, energy, food and ultimately money. Safeguarding livestock health helps preventing waste and loss and putting unnecessary burden on climate and the environment.
- Increased research regarding risk assessment, prevention, early warning and detection, control and eradication of infectious diseases.
- Increased research on risks and threats arising from circularisation and reopening of interrupted epidemiological pathways.
- Intensified research on animal welfare friendly forms of livestock husbandry and on the prevalence, mitigation and prevention of multifactorial production associated diseases.
- Accompanying research on the safety of altered diets and novel sources of food (new species, food from waste, artificial meat).
- Increased research on fish and seafood health, sustainable ways of open water fishing, farmed fish and aquaculture
-
- Fostering of cross- and interdisciplinary thinking between hard sciences and engineering on the one hand and medical and life sciences on the other hand. More and tighter collaboration between digital sciences and veterinary sciences for developing innovative applications in the field. Intensified sharing of data across disciplines, sectors and territorial borders.
- Safeguarding the genetic resources of old indigenous feed and livestock species and breeds. Intensified research into breeding regimes for improved resilience against disease and climate change.
- Adopting a One Health approach in research addressing existing and future challenges, involving a diversity of comprehensive disciplines outside the traditional veterinary sciences.
- Exploring better forms of risk communication and fighting the rising tide of disinformation, propaganda and fake news.

Draft text, to be circulated the SFU for further review
Please keep confidential