Summary

The PIGWEB project organised a discussion on the future of animal experimentation at the EAAP Conference in Lyon. The discussion included early career scientists only, as they will be part of the future of animal research. A summary of the discussion is provided below.

The panellists briefly introduced themselves and their research. Michelle Stafford is a PhD student at TEAGASC in Ireland who is working on developing the microbiome in dairy and beef calves cows from birth to lactation. Kevin Jerez Bogota is a PhD student at Aarhus University in Denmark working on alternatives to antibiotics to treat bacterial infections in pigs and chickens Anouschka Middelkoop is a swine researcher at Schothorst Feed research with a focus on gut health and early life effects; besides she is also member of the ethical committee.

Susanna Raisanen is a postdoc at ETH Zurich in Switzerland working on dairy nutrition, protein metabolism, methane mitigation, and nitrogen metabolism. Francis Eugenio is a scientist at Adisseo who works on amino acid metabolism in pigs. Clement Garcon is a PhD student at INRAE and Adisseo working on metabolism in the intestine using modelling approaches and in vitro cell cultures. The panellists all have different expertise, but they are all working towards the same goal of reducing welfare and health problems in animals.

The first question from the audience is about alternatives to invasive sampling techniques. It is acknowledged that there are some alternatives available but that they cannot always be used. For example, you need to be able to select specific animals for your research, and some methods are not suitable for this. The panellists are hopeful that sensor technologies will eventually help to reduce the need for invasive sampling.

Some examples of alternatives to invasive sampling techniques that are currently being developed or used are explained. One example is the use of exhalomics, which involves taking samples of the exhaled breath of the cow. This is a non-invasive technique that can be used to identify the primary volatile fatty acids (VFAs) in the rumen. Another example is bolus samples, which are taken from the cow's mouth while it is ruminating. This method is less invasive than tubing, but it is still more invasive than exhalomics.

The panel follows to discuss the challenges of developing and using in vitro methods to study animal gut health. It is noted that while in vitro methods can help screen potential feed ingredients and additives, they cannot fully replicate the complex processes of digestion and microbiota interactions in live animals. As a result, it is believed that animal experimentation will remain a crucial step in gut health research for the foreseeable future.

Another discussion point is the balance between precision and scale in gut health research. It is noted that animal experiments are generally more precise than in vitro methods, but they are also more expensive and time-consuming. As a result, the panellist believes that it is essential to carefully consider the specific research question when choosing between animal and in vitro methods.

Experiences are shared from working in industry, where it was noted that companies were more interested in using less refined methods that could produce good results at scale. This suggests a growing demand for in vitro methods that can be used to screen feed ingredients and additives more quickly and efficiently.

They also discuss the importance of carefully considering the specific research question when choosing between animal and in vitro methods. For example, if the research aims to screen potential feed

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ingredients and additives, then an in vitro method may be sufficient. However, if the research aims to study the complex effects of a diet on gut health, then an animal experiment may be necessary.

There is a need for new technologies that can be used to develop more accurate and scalable in vitro methods. They believe that such technologies have the potential to revolutionise gut health research and reduce the need for animal experimentation.

The potential of digital twins is considered. They agree that digital twins can potentially reduce the need for animal experimentation. Still, they also acknowledge that they cannot fully replicate the complex processes of digestion and microbiota interactions in live animals. They discuss the need for more computer scientists and modellers to develop and improve digital twins. They also discuss the importance of accepting that digital twins may not always be able to provide perfect explanations for their results. However, they believe that digital twins can still be valuable for understanding gut health and developing new treatments and interventions.

Data and sampling protocols are mentioned. They agree that there is a need to standardise sampling protocols so that samples can be reused and shared between researchers. They also discuss the importance of open data and open science. It is emphasized that samples should be documented. In order to do this properly, good data management and a data management plan is required.

Collaboration between researchers from different fields is put forward as an important action towards new treatments and interventions. Still, it is mentioned that there is a need for increased storage space and researchers should receive training on how to share samples and data.

One of the panellists shares their experience of trying to perform a meta-analysis of the use of arginine during gestation in sows. They found that they could only use 19 studies because data were incomplete and diets were not shared. This highlights the importance of sharing data completely and transparently.

The acquiring of funding for research is mentioned. They note that research bodies are often reluctant to fund experiments designed to improve methods, even though this research is essential for making progress in the field. Communication and collaboration is essential/ They agree that funding agencies should work together and that researchers should share samples and data more effectively. They also believe that technology can help to bring researchers together and to facilitate the sharing of samples and data.

They believe that more training in modelling is needed for researchers working on alternatives to animal experimentation. It is argued that data analysis is more challenging than acquisition, and that we need to make our research more reproducible so that the data we use in the future can be trusted. Ultimately it is agreed that we need to invest in training and tools to improve data analysis skills, and that we need to make our research more reproducible and ethical.

The panellists discuss what components would be included in a future-proof animal facility. They agree that the facility should be able to measure as much as possible about the animals, including their welfare and environmental impact. They also discuss the possibility of making the facility publicly accessible so that people can see how the animals are treated. However, they acknowledge that this may be difficult to implement due to cost and privacy concerns. They point out that regulations and public expectations can change quickly, making it difficult to invest in long-term solutions.

Finally, the panellists discuss the challenges of communicating about animal production research with the general public, including preconceived notions and potential backlash. They suggest training researchers on how to communicate in an accessible and engaging way, being proactive in communication, and engaging with a wide range of stakeholders. Despite the challenges, they believe

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it is important to continue communicating to build public trust and support for animal production research and inform the public about its benefits. They also note the importance of transparency and the challenges of communicating with a sceptical public influenced by unfair representations of animal research.

In summary, the panellists express hope for the future of gut health research, believing that new technologies and methods will enable more precise and humane studies. Specifically, they are optimistic about the potential of digital twins to contribute significantly to our understanding of gut health and improve the lives of both animals and humans.

They also emphasised the importance of open science and collaboration in advancing research in this field. Sharing samples and data is considered essential for making progress, and the panellists are working to develop better ways to facilitate this.

Finally, the discussion concluded with the recognition of the need to continue exploring tools, methods, and alternatives to animal research in the future.

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