**Research Scoping Workshop**

**Global topic: One Health Challenges in Food Systems**

Thursday 5th May 2022

The COVID-19 pandemic has demonstrated that zoonotic diseases can present tremendous threats to global health. Recognising how closely connected human health is with that of animals and the land we share, we need to find effective solutions to manage infections, taking the One Health perspective. Moreover, relationships among people, animals, plants and their environment are made even more complex by the changing climate and demographic pressure.

With this in mind, GFS and CID organised a half-day workshop bringing together researchers working on livestock diseases, crop diseases, and farming policy. The discussion focussed on preventing infectious disease-driven problems in a changing climate and managing disease and antimicrobial resistance in the agricultural landscape.

**Post-Event Summary:**

Following introductions by Maria Bargues-Ribera and Prof Howard Griffiths, the meeting began with talks from Harriet Bartlett (Department of Zoology), Dr Nichola Hawkins (NIAB) and Prof Mark Holmes (Department of Veterinary Medicine), on their research and its bearing on the meeting’s key focus: the close connection between human health, animal health and that of the land we share.

Participants then separated into smaller groups to discuss research gaps which could form the basis for [responses to] future funding calls. The discussions were free-flowing and a wide range of possible topics were identified. *[Could summarise here?]*

A final, summary discussion, involving all participants, focussed on aligning academics’ desire to do fundamental science with the need for impact and for research to inform public policy. How to put together interdisciplinary proposals was discussed; combining, for example, fundamental and social science. It was suggested that experts in public policy should join future discussions, as well as stake-holders from industry (at all levels), and academics from other fields, from medical anthropologists, to food lawyers, archeologists to psychologists.

**More detailed notes from the Workshop:**

**Research talks:**

* Harriet Bartlett (Department of Zoology) [Understanding the relative risks of zoonosis emergence under contrasting approaches to meeting livestock product demand | Royal Society Open Science (royalsocietypublishing.org)](https://royalsocietypublishing.org/doi/10.1098/rsos.211573)
* Dr Nichola Hawkins (NIAB) [Dr Nichola Hawkins | NIAB](https://www.niab.com/about/people/dr-nichola-hawkins)
* Prof Mark Holmes (Department of Veterinary Medicine) [Safeguarding the wonder drugs (cam.ac.uk)](https://www.cam.ac.uk/stories/antibiotic-resistance)

**Summary Breakout Discussion A: Identifying research gaps and research questions**

A. Microbiome in the interface of soil-plant-animal-human interactions

* The use of broad-spectrum antibiotics in farming can affect the human microbiome. The application of fungicides affects the soil and crop microbiome; and same for the use of manure as fertilizer.
	+ What bacteria/fungi/resistance (persistence/AMR) is in manure? And what are the impacts of this in people and livestock?
	+ What contributes to the persistence or emergence of resistant strains? E.g. on-going selective pressures; or ‘mechanistically’, plasmids.
	+ How long do common pathogens exist in soil? What has been done in terms of transmission analysis - livestock/soil/people?
	+ There’s lots of work happening at Rothamstead about how (?) use of inorganic compounds on farms affects biodiversity.
	+ We need to understand the soil microbiome better.
	+ Don’t know how antibiotic use is affecting insects or how interaction of fungicides, disinfectants and antibiotics affects them.
	+ Over (and inefficient) use of disinfectant in clinical settings is a huge problem.

B. Emergence of new pathogens in the context of intensive farming

* Wildlife is a source of pathogens, rather than farms.
	+ How much risk (of spread between wildlife and farms) is due to intensive farming? Compared to wild meat, or non-intensive farming.
	+ What counts as a new pathogen?
	+ How do we measure risk? – if we can measure it!
	+ What is the role of the waste from farms in the emergence of new pathogens?
* When focusing on AMR, we can study how some processes occur in different compartments, and their outcomes.
	+ These processes can be the persistence of pathogens; the emergence/spread of resistance genes; the effects of antimicrobial residues
	+ We can compare processes in wild animals vs livestock; wild habitats vs arable land/built environments; and in humans/animals/crops.
	+ Deforestation is relevant in creating new human/animal/interfaces, esp in terms of AMR (rather than novel diseases).
	+ Some of the outcomes to observe are: what acts as a reservoir of resistance; what promotes growth of pathogens; what selects for resistance; what promotes horizontal gene transfer of resistance genes.
	+ In all of these, we can study (a) emergence, (b) selection, (c)persistence, and (d)spread/transmission of AMR.
* Can we infer these processes from sampled snapshots of the microbiome?
	+ There are vectors acting as intermediates between compartments.
* What promotes the flow between compartments? Movement, trading, run-off.

C Global governance of food systems and the associated environmental risks

* Data challenges:
* There are difficulties in model parametrization - importance of sensitivity analyses.
* Data challenges: There are difficulties in getting big datasets/samples/estimations of transmission risk.
* Bridging science and practice:
	+ What evidence is needed to promote a change? And how to change - analysis of cost-effectiveness.
	+ There is need of more collaborations with social scientists, especially those doing quantitative work. Often, there are 'simple' measures that are more effective than outcomes of complex modelling - e.g. implementing sanitation.
	+ Funding agencies play a big role on what is investigated.
	+ New governmental or institutional regulations is what influences/promotes change in practitioners.
	+ Need to understand further the human drivers of behavior and incentives in decision making processes - e.g. from social sciences/psychology
	+ Farmers trust vets. There was uncertainty about who arable farmers would trust, in terms of getting them to change their practice.
	+ E.g. of Denmark taxing use of pesticides, where there is also mandatory testing – non-judgemental. In UK AHDB protects industry and productivity, so less likely to intervene if this might be affected.
	+ Tree planting schemes are a monoculture – this tackles carbon but not loss of biodiversity.
	+ People don’t want to pay more for food – without government subsity they won’t make better choices.
	+ Top-down decisions are problematic e.g. reception of Germany’s organic farming policy.
	+ Agriculture not respected or understood, either at public or governmental levels.
	+ Farming procudures can shift through incentives and subsidies. Should subsidy be based on quality rather than quantity? Should subsidies for biodiversity be linked to productivity?
	+ There should be gov policy on how much of our own food we produce.
	+ Consumption levels and waste are problematic.
	+ Can behaviour be changed by incentivizing more environmentally friendly choices in diet etc?
	+ Perceived desire for pesticide-free food – yet currently impossible to produce enough foods without pesticides.
	+ Public perception often incorrect – e.g. that carbon footprint of flying food is often much less than cost of growing food in sub-optimal conditions. Ideas based on ideology not evidence.
	+ We need evidence led decisions.
	+ Lack of trust in FAO and WHO.
	+ Important to educate youth.
	+ Setting clear targets for antibiotic use has worked well in UK and Demark, for example.
	+ Massive change can be induced using clear messages. E.g. drop in fungicide use.
	+ Huge manipulation of food industry by supermarkets.

Impact and research are almost separate things. Research doesn’t necessarily lead to policy change.

**Summary Breakout Discussion B: Identifying actions/strategies according to Cambridge expertise**

Considering the bridge between scientists and practitioners…

* Who do we need in the discussions?
	+ Social scientists: medical anthropologists, agricultural economists, political scientists, food lawyers, geographers (both from demographics and physics), data scientists, psychologists, historians. Vets working in the sector.
	+ Industry actors: Actors from all parts of the food supply chain: people preparing inputs (animal feed, medicines for animals), farmers, vets, traders, retailers, regulatory agencies.
* How to have fruitful discussions?
	+ Research questions should be formulated by listening to actors in food industry and understanding their perceptions of risk and barriers to change. What incentivizes them?
	+ Organizing discussion groups; appropriately scoped forums/brainstorming excercises.
	+ Making surveys – e.g. asking them who do they get advice from; what are their incentives/barriers?
	+ Formulating the research questions together with these profiles of people (collaborating).
	+ How do you make a cross-discipline project that’s usefully focused?
* Need to revise legislation:
	+ Regulation of practices – what is the evidence that current legislation works – is it fit for purpose? What is the conceptual framework for new evidence?
* How do we bridge the gap in Cambridge?
	+ There is the Centre for Science and Policy. Who is there in terms of food security? Which type of forums/events do they organize?
	+ Need to align academics desire to do fundamental science with need for impact.

**Notes from Harriet’s group in Breakout session 2:**

* Spill-over of zoonosis is a spectrum – pathogens could be studied in different ways, with different systems to measure them.
* How to quantify risks of different farming systems?
* No good transmission model for AMR – longitudinal studies are needed.

**Questions for guided discussion:**

A Microbiome in the interface of soil-plant-animal-human interactions

Keywords: Antimicrobial products, farming products, soil microbiome, disease vectors, pollinators, gut microbiome, antimicrobial resistance.

A1. How does the use of antimicrobials or other farming products affect soil biodiversity? How does this, in turn, affect soil-borne pathogens? A2. How do antimicrobials or other farming products affect disease vectors? And pollinators? – direct and indirect effects, e.g. if they affect microbes (question 1) and these microbes affect vector/pollinator behaviour. A3. How are the gut microbiomes of livestock interconnected with soil or plant microbiomes? A4. Which is the ‘resistome’ (characterisation of genes that provide antimicrobial resistance) of the ecological community in a farm?

B. Emergence of new pathogens in the context of intensive farming

Keywords: intensive farming, emergent pathogens, zoonoses, environmental pollution and AMR, disease surveillance.

B1. How do deforestation and the intensive farming industry contribute to the emergence of new pathogens? B2. How does this apply to livestock practices and crop-growing/harvesting practices? B3. How do different farming practices contribute to zoonoses? B4. Which are the relationships between environmental pollution (e.g. air pollution) caused by intensive farming and AMR? B5. What are the best practices/methods for pathogen and disease surveillance?

C. Global governance of food systems and the associated environmental risks

Keywords: bridging research & practitioners, farmers’ behaviour, policy gaps, governmental systems & environment.

C1. How do we bring the research outputs to the actual practitioners? C2. How can we change the practitioners’ behaviours (e.g. best incentives)? C3. Which are the current gaps in farming policies? C4. How do governmental alternatives (e.g. circular economy) change the environmental risks posed by current farming practices (e.g. biodiversity impact)?