

A close-up photograph of a cow's face, showing its eyes, nose, and mouth. The cow has a white face with black patches. The background is a blurred green field.

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Knowledge, Technology and Innovation Group

Just Editing: A responsible innovation approach to animal gene editing



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For quality of life



The challenge of responsibility

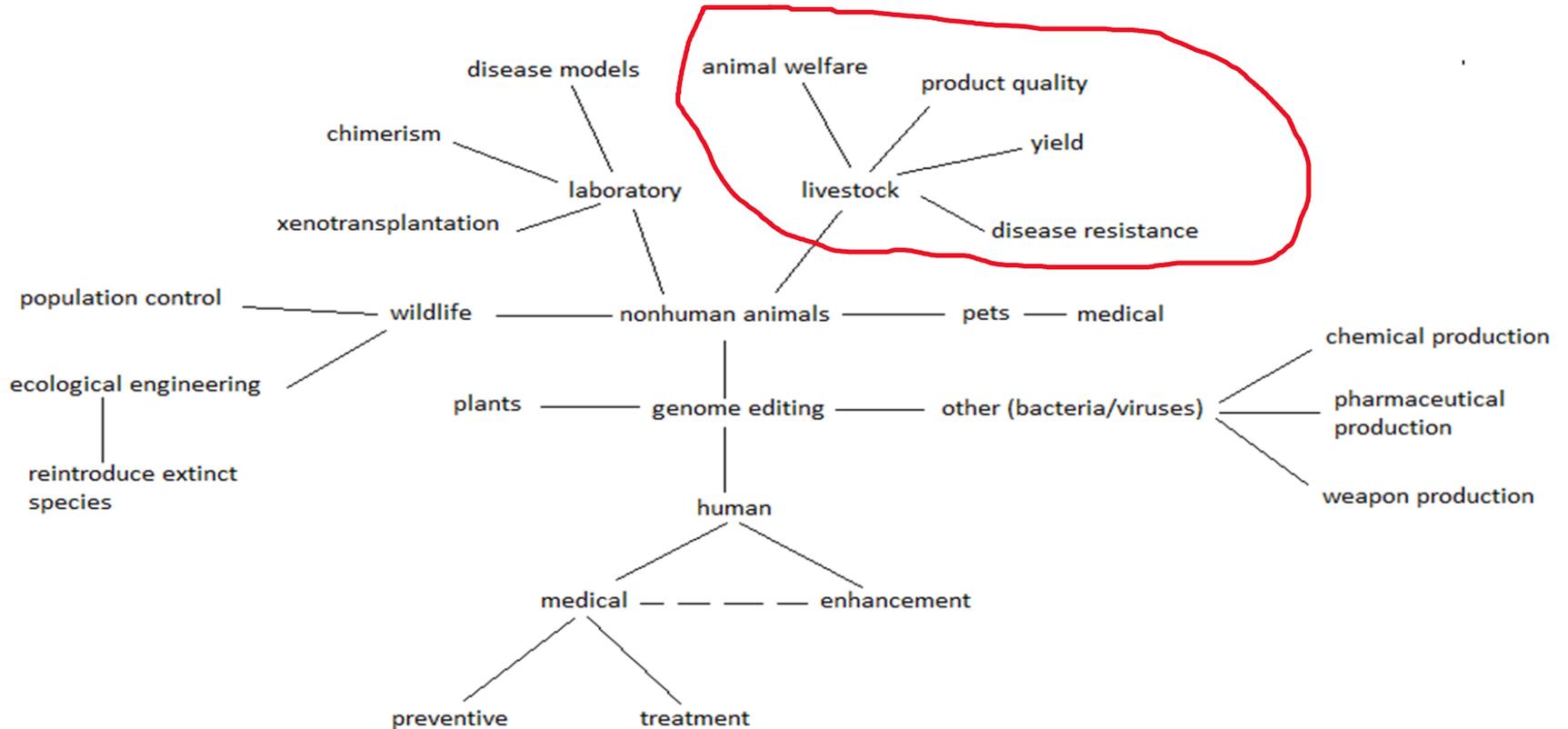
How to align innovation with and for
society in pursuit of sustainability

CRISPR



The CRISPR-Cas system – “has made editing of the genome much more precise, efficient, flexible, and less expensive relative to previous strategies” (National Academy of Sciences 2017: 1)

Potential applications of CRISPR



Our research

“to examine the conditions (if any) under which the the technique of genome editing can and should be applied to animal breeding applications to guide responsive decision-making for scientists, breeders and government”

Technology ←————→ Social order

A science and technology studies perspective on socio-technical interactions



Science and innovation have the power to create futures and vulnerabilities in transformative ways (futures in-the-making)



Science and innovation are, unintentionally or by design, often socially, environmentally, politically and ethically entangled



Science and innovation are always uncertain and often unpredictable in terms of their impacts, as they diffuse and become naturalised in a complex world



Science and innovation fall at least in part into a substantial governance void

A (radical) rationale for RRI

“unless we find ways to shape science and innovation in tune with widely shared social values, future changes will occur without explicit societal shaping, commonly driven by the power of incumbent interests and the delegation of ‘the good’ to market forces”

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Responsible research and innovation: A methodology to to align innovation with and for society

“Responsible Research and Innovation is a transparent, interactive process by which societal actors and innovators become mutually responsive to each other with a view on the (ethical) acceptability, sustainability and societal desirability of the innovation process and its marketable products (in order to allow a proper embedding of scientific and technological advances in our society)”

(von Schomberg, 2011)

“taking care of the future through collective stewardship of science and innovation in the present”

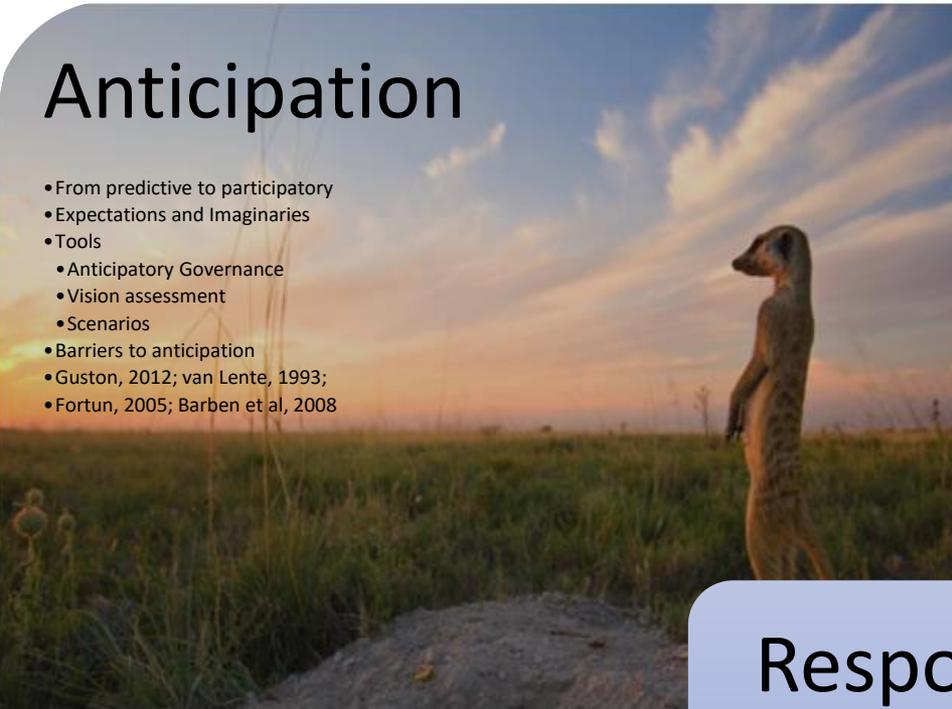
(Stilgoe, Owen and Macnaghten 2012)

New lines of questioning on responsibility aligned with public concerns

<i>Product questions</i>	<i>Process questions</i>	<i>Purpose questions</i>
What are the likely risks and benefits ?	How should research and innovation take place?	Why should this research be undertaken?
How will the risks and benefits be distributed ?	How should standards be drawn up and applied?	Why are researchers doing it?
What other impacts can we anticipate?	How should risks and benefits be defined and measured?	Are these motivations transparent and in the public interest?
How might these change in the future?	Who is in control?	Who will benefit?
What don't we know about?	Who is taking part?	What are they going to gain?
What might we never know about?	Who will take responsibility if things go wrong?	What are the alternatives?
	How do we know we are right?	

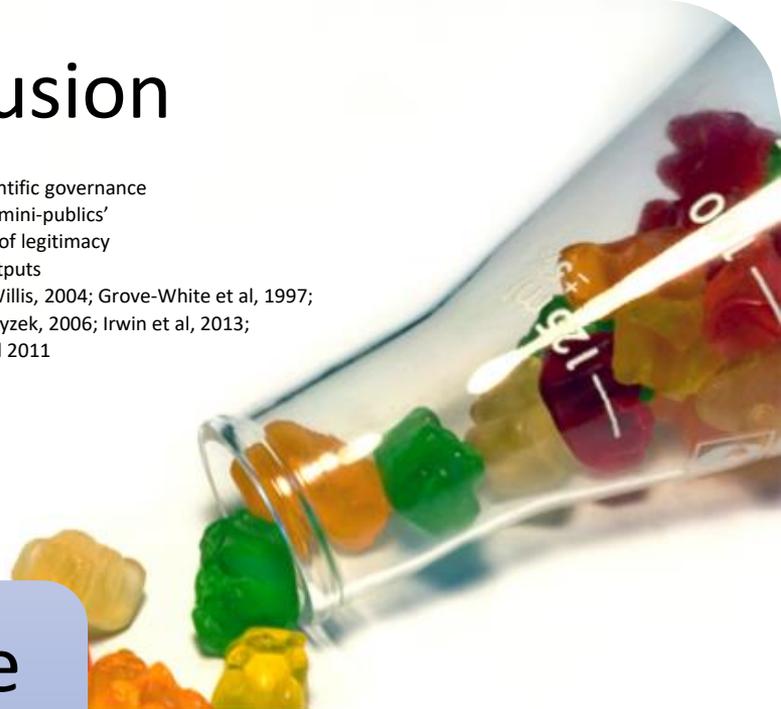
Anticipation

- From predictive to participatory
- Expectations and Imaginaries
- Tools
 - Anticipatory Governance
 - Vision assessment
 - Scenarios
- Barriers to anticipation
- Guston, 2012; van Lente, 1993;
- Fortun, 2005; Barben et al, 2008



Inclusion

- The 'new' scientific governance
- Dialogue and 'mini-publics'
- The challenge of legitimacy
 - Input and outputs
- Wilsdon and Willis, 2004; Grove-White et al, 1997;
- Goodin and Dryzek, 2006; Irwin et al, 2013;
- Lovbrand et al 2011



Responsible innovation

Reflexivity

- From 1st to 2nd order
- Tools
 - Codes of conduct
 - Midstream Modulation
- Wynne, 1993; Schuurbiens, 2011;
- Swiestra, 2009; Fisher et al, 2006



Responsiveness

- Answering and reacting
- Diversity and resilience
- Value-sensitive design
- De facto governance
- Political economy of innovation
- Responsibility as metagovernance
- Pellizoni, 2004; Collingridge, 1980; Friedman, 1996; Stirling, 2007; Kearnes and Rip, 2009



3 workpackages

Understanding current debates and frames

- What are the expectations associated with the technology?
- How do you understand debates on governance?
- How to formulate an adequate ethical framework?

Conducting a public dialogue

- How do you design a public dialogue
- Performing an ethical analysis

Integrating ethical and societal concerns

- Academic practice
- Corporate research and decision-making

RQ1: Visions and promises

- Efficiency / improvements in yield,
 - gains in reproductive efficiency (e.g. chickens that produce only female offspring for egg laying)
 - edited animals that make more efficient conversion of inputs into outputs (e.g. pigs that can be fattened with less food through improved gut function)
- Health / welfare of animals
 - adaption of livestock to the demands of intensive rearing practices (e.g. 'hornless' edited cows that can be kept in close proximity in confined spaces with less risk of injury)
- Disease resistance
 - through breeding resistance to viral pathogens (e.g. to breed pigs with resistance to African swine fever virus) or to engineer disease resistance to reduce the use of prophylactic antimicrobials in farming



RQ2: Current debates on governance

The EU (supported by civil society)

- A cautious approach
- Govern the process, not the products
 - Genome editing falls under GMO legislation (2018)
 - GMO legislation set up mainly for plants/crops
- Important aspects of GMO legislation:
 - Edit does not leave toxic/allergenic components
 - Apart from inserted transgene composition of GMO equals non-GMO
 - Requires genetic marks on modified organism
 - Sequence + method to detect edited sequence
 - Ensure GMO does not threaten endangered/beneficial species

Industry and natural scientists

- GMO regulation should not apply
- The technology need not involve transgenesis (inserting genes from another species)
- Most genome editing only involves minimal genetic changes, which can also occur in natural mutations

RQ3: How to move beyond the impasse? Innovations in governance

Move to soft (de facto) governance

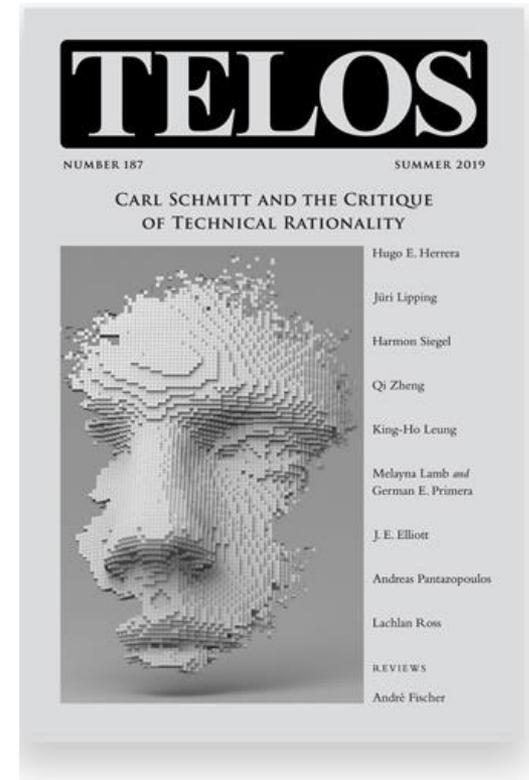
- Transparency
- Accountability
- Societal acceptance

Innovations in governance

- Ethics first framework (Rathenau Institute)
 - Following the Norwegian model
 - Possibility of accelerated assessment procedure
 - No unnecessary government spending
 - Sufficient attention for the broader criteria
 - Active assessment of benefits
- Regulatory workshop in September 2019 to test plausibility



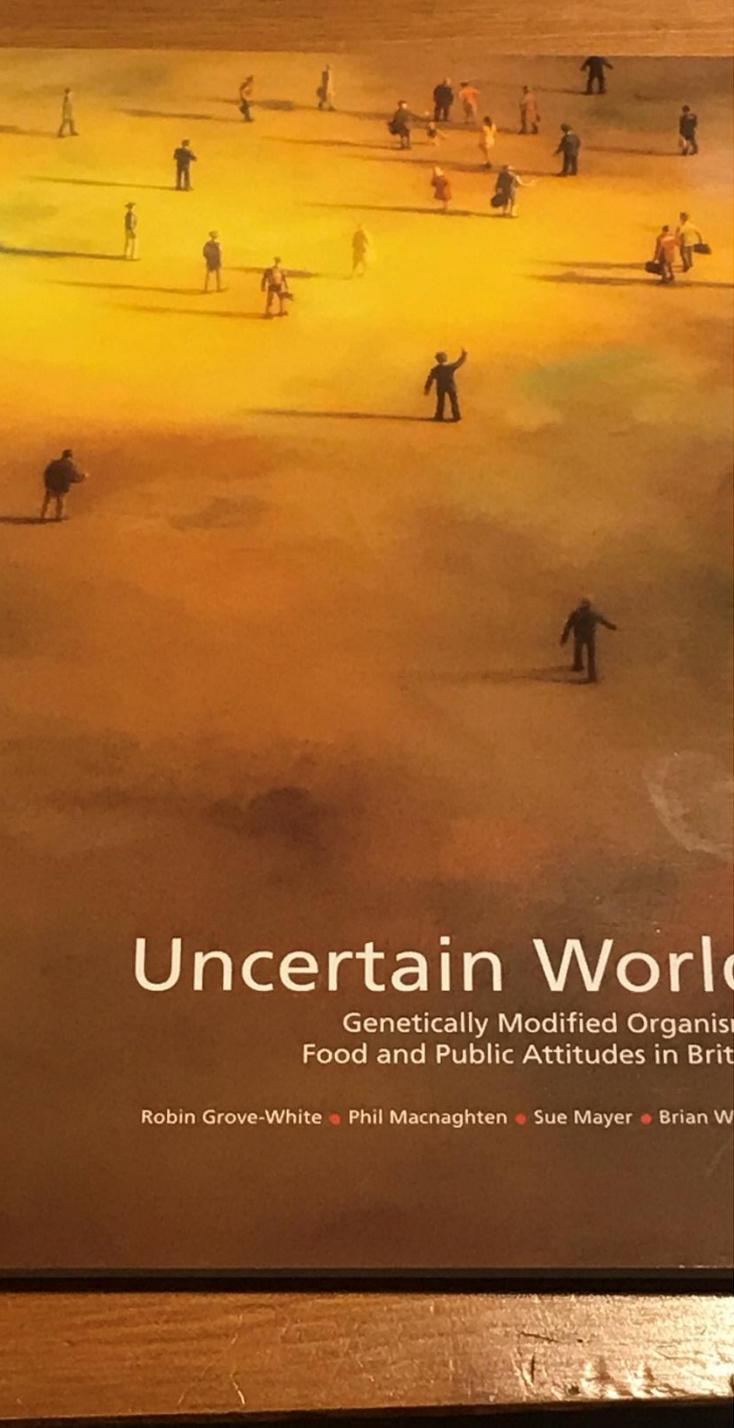
naturalness



RQ 4: How to built a robust ethical framework?

RQ5: How to
built a robust
anticipatory
public
engagement
methodology?

- The assembly of emergent collectives and identities that are constituted to negotiate endogenously public meanings, concerns and priorities
- Design criteria
 - context: technology in food and animals
 - framing: civil society, industry, government
 - moderation: facilitating group dynamic and identity
 - sampling: topic specific strategy
 - analysis: thematic concerns and wider societal narratives
 - interpretation: framework of theoretical and policy concerns



1996–97: Uncertain World research on GMOs

- A dialogue methodology
- How to elicit clues about factors shaping public attitudes and likely responses in a field where few people have ‘settled’ views?
- Qualitative focus group discussion methods (Nine 2-hour groups across a spectrum of demographics)
 - Focus on changes in food as key context
 - Located within people’s broader sense of biotechnology as a whole and different classes of product
 - Scenarios of risk dynamic
 - Questions of responsibility and trust

Uncertain World

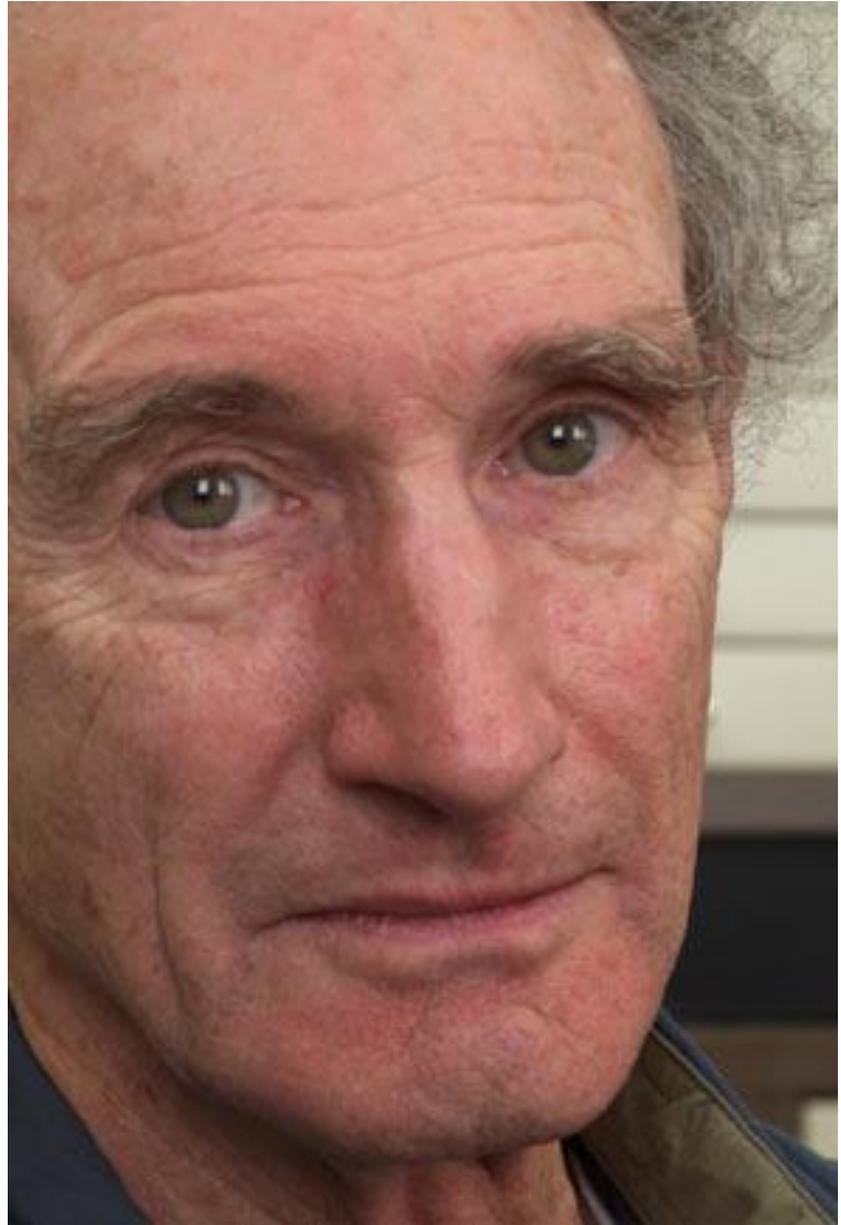
Genetically Modified Organisms
Food and Public Attitudes in Britain

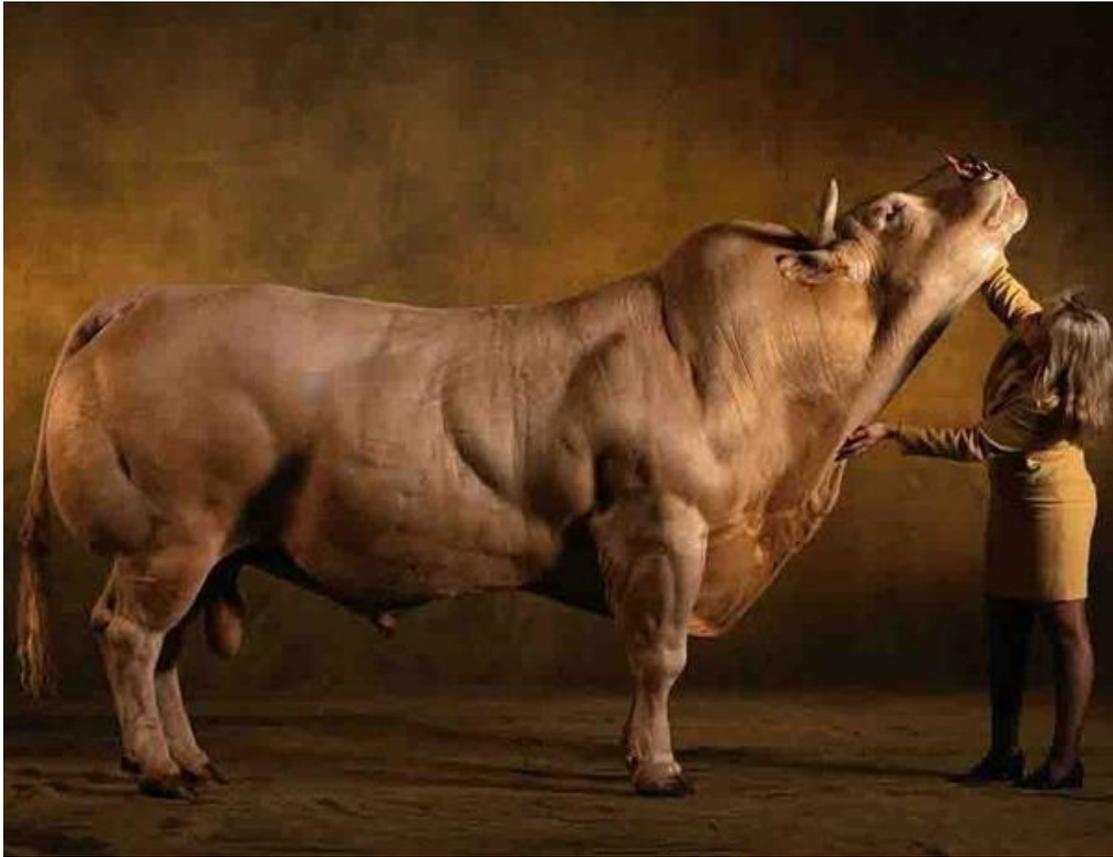
Robin Grove-White • Phil Macnaghten • Sue Mayer • Brian W

Who is driving these developments and why?	Scepticism over claimed social benefits of GM Implied future model of agriculture
Boundary issues	Escalating 'tampering' with nature (likelihood of retribution) Transgression of moral boundaries - the 'integrity' of life Qualitatively different from conventional selective breeding re. speed and precision of intervention
Mistrust over 'scientific' reassurances	BSE as heuristic - dispelling 'innocence'
Organised 'irresponsibility'	Who will be responsible if and when things go wrong Regulatory frameworks seen as compromised by prior commitment to expansion of biotechnology overall
Lack of overall sense of ownership of the technology	Feelings of inevitability and fatalism; technology seen as imposed, pervasive

Sources of Public Unease

'I now have had a chance to read "Uncertain World", which I wish I had indeed read earlier. It is in many ways a remarkably prescient document.'
(UK Chief Scientific Officer Sir Robert May, March 1999)





Focus group example 2: GM animals (2000)

- GM foods and crops have been controversial. What are prospects for GM animals (context)
- Question of clear policy importance for UK Government (motivation)
- How do people identify with GM animals? (topic)
- In what ways is that mediated by existing relationships with animals? (scope)
- Tensions with treating animals instrumentally (as machines, or units of production) and treating animals empathetically (as fellow beings, as pets)? (theoretical context)

Some questions



Are there conditions in which (any) application of gene editing for animal breeding could be embedded in society?



Is our responsible innovation approach (possibly) complicit in promoting gene editing?



How should we engage with top sector companies that are developing a position?



Should we be engaging more directly in the current (European) regulatory debate on gene editing/ CRISPR?



How to ensure that universities (such as Wageningen) play the role of honest broker rather than as promoters of the technology?