



Government
Office for Science

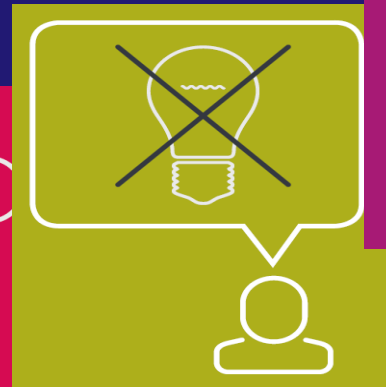
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Innovation: managing risk, not avoiding it

Health Risks, Precaution and Innovation

24 June 2015



Dr Claire Craig, Director,
Government Office for Science, UK

- **Innovation is essential, but always carries risk**
- **Framing risk rigorously makes decisions more robust**
- **Context matters: science is not the only lens**
- **Shaping regulation and decision-making: it can be done!**

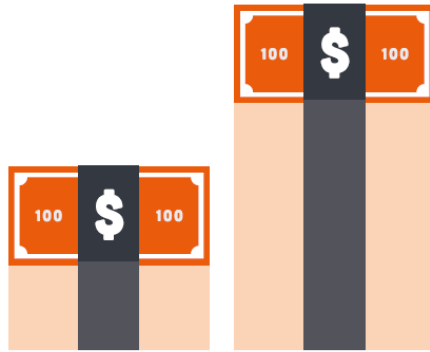


Innovation is essential to growth and wellbeing

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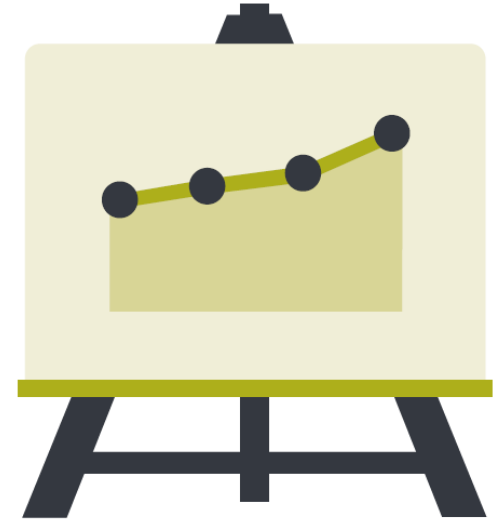


- **Increases in life expectancy (and reductions in infant mortality)**
- **Global gdp increases**



Technological improvements will increase productivity by as much as 25% and will generate a predicted \$3.7 to \$10.8 trillion for the world economy by 2025.

Technological advances have helped to bring unprecedented improvements in health over the past 150 years, with life expectancy in the United Kingdom steadily increasing by two to three years each decade. From a starting point of about 40 years, it has doubled to 80 years.



Twenty years ago, there were fewer than 3 million people with internet access; now there are nearly 2.5 billion.



Innovation has always been contested

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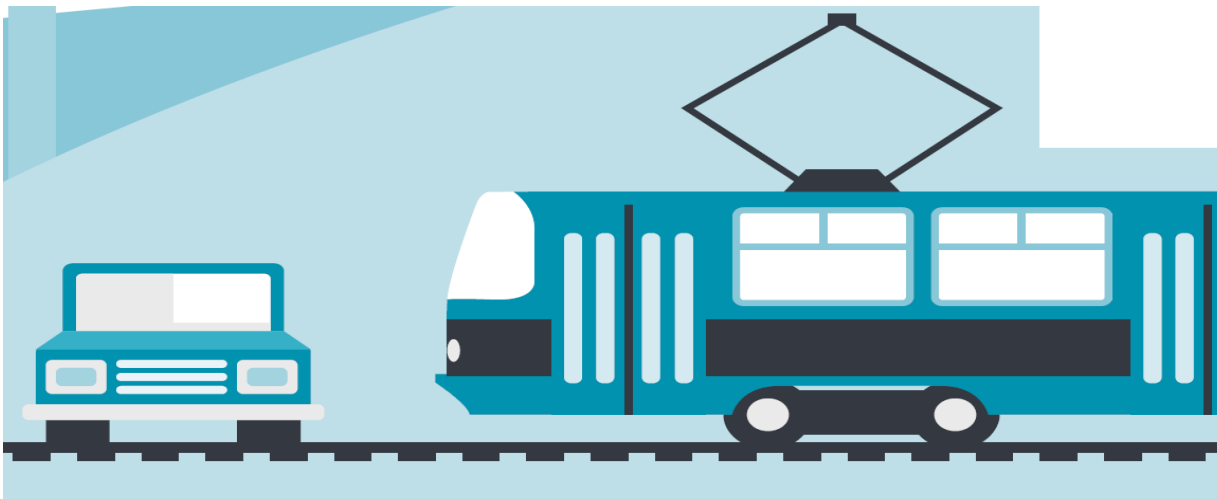
- **Cars and trains**
- **Contraception**

Societies respond by a mix of changing behaviours, regulation and legislation

Combined oral contraceptive pill - first used in USA in 1960. Currently used by over 100 million women worldwide

Has been called “greatest scientific invention,” of 20th century by some commentators

Impacts for women include: choice as to whether to have children, further education and a career

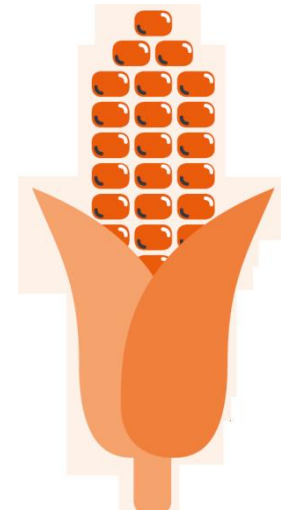
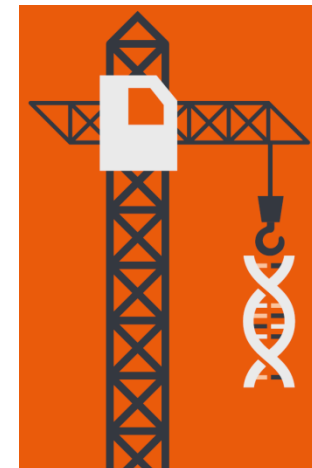
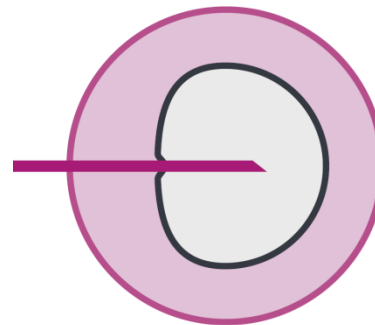
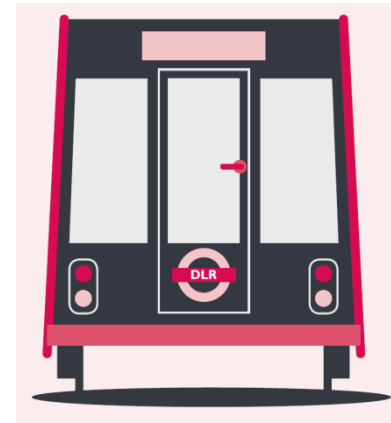
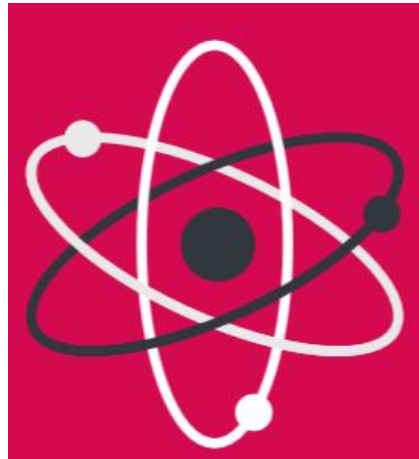


Future wellbeing depends on effective exploitation of emerging technologies

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- **Big data**
- **Satellites**
- **Robotics and autonomous systems**
- **Synthetic biology**
- **Regenerative medicine**
- **Agri-science**
- **Advanced materials**
- **Energy storage**
- **Quantum**
- **Internet of things**



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Apply the “science” of risk and risk communication

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Review the evidence.....

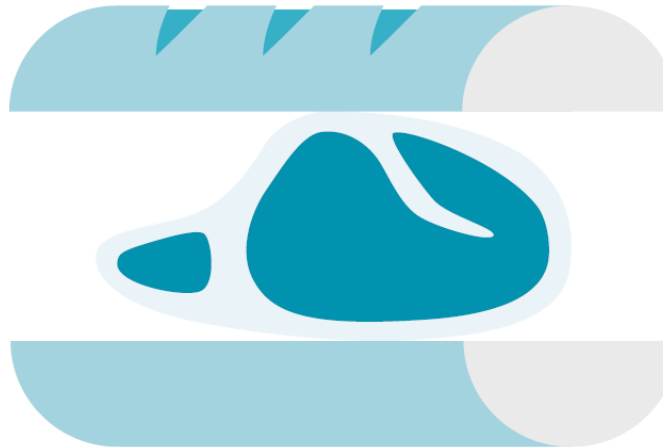
...and acknowledge that all evidence is

- Contingent
- Uncertain

Remember that the numbers you choose are not neutral



Framing quantitative information in the negative ('4 people will die') or positive ('saves 2 lives') can lead to dramatic differences in people's perceptions.



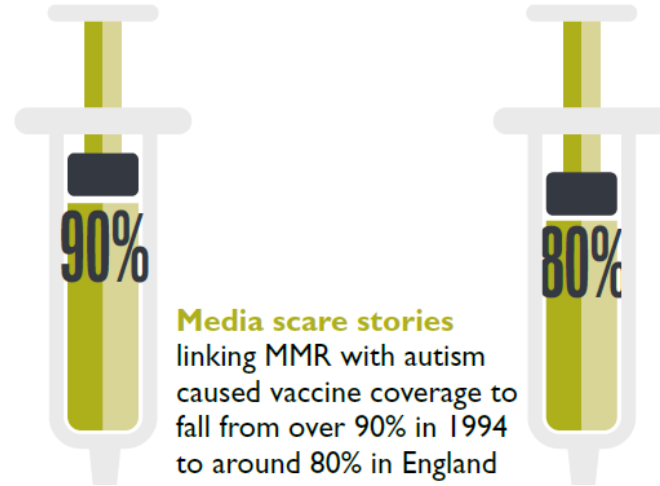
Relative measures of risk can be misleading: being told that regularly eating a bacon sandwich increases your lifetime risk of pancreatic cancer by 20% may be somewhat unconvincing if the baseline is extremely low and the bacon sandwich is rather pleasant.

**We place trust for specific purposes.
We expect the trustworthy institution
or individual to:**

- Take account of our interests
- Be competent
- Not be self-serving

**Critical Trust is especially important
if cause and effect are difficult for the
layperson to determine.**

- Invisible, pervasive
- Long term
- Highly technical



In 2012, measles cases rose
to levels that had not been
seen in England and Wales since
1989, reaching a peak of 1912
confirmed cases.

UK has a systematic approach to managing top national risks

top national risks

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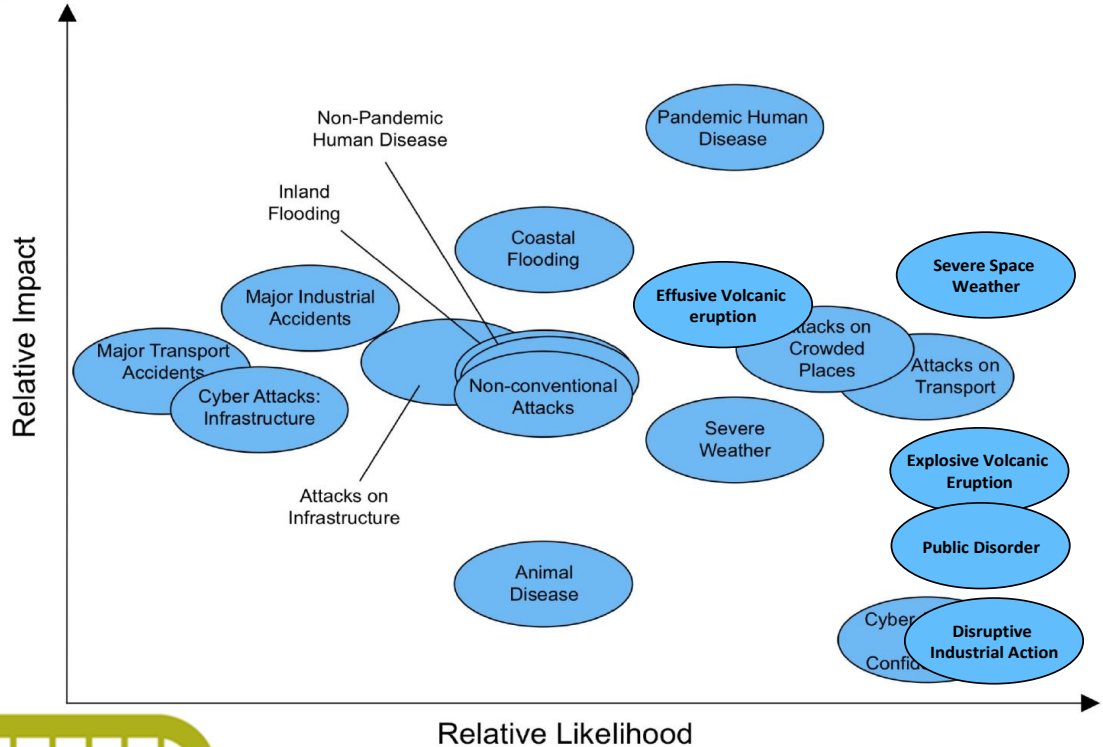
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The system

- Systematic and cross-Departmental
- Rapid response
- Independent verification
- Credibility

Recent emergencies

- Ebola
- Flooding



300 MILLION DEATHS

Smallpox was responsible for more than 300 million deaths in the first half of the twentieth century. As the ongoing Ebola epidemic reminds us, disease outbreaks remain a potent threat today.

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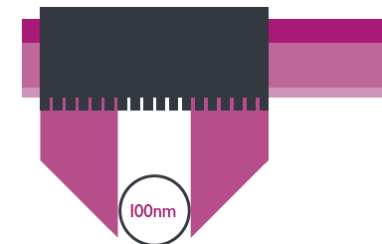
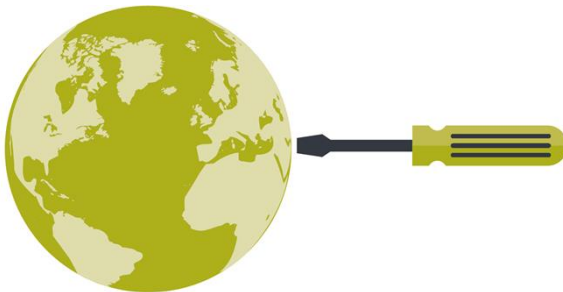
If you can't stand the heat get out of the kitchen

- **Hazards:** bleach
- **Exposure:** bleach in the stew
- **Risk = hazard x exposure:** poisoning
- **Vulnerability:** children have greater sensitivity and greater likelihood of exposure
- **Uncertainty:** degree of confidence in hazard, exposure and vulnerability



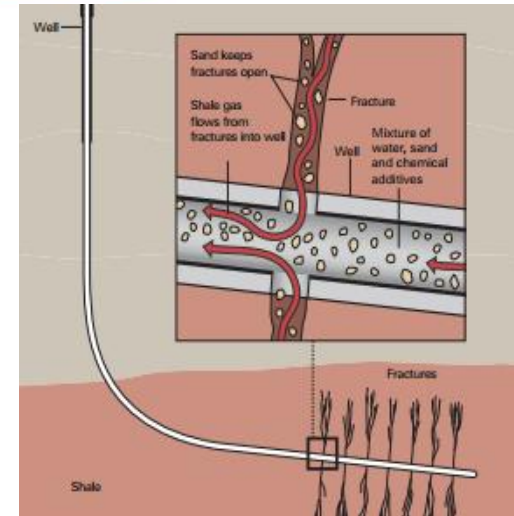
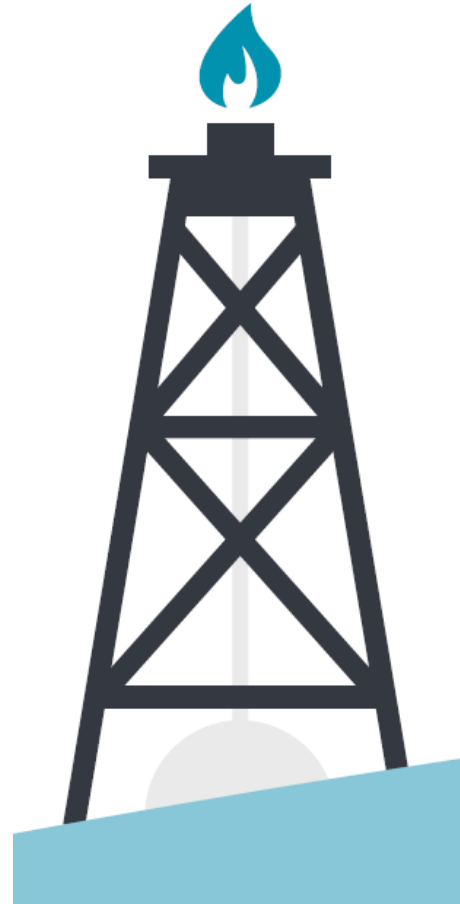
Anticipating types of innovation

Five Broad Categories	Examples	Responses
1. Who pays?	Some medical drugs	NICE
2. My pain, your gain	Nuclear waste	Public engagement Decisions at multiple levels
3. Science meets values	Early GM, geo-engineering	Strengthen science base. Public engagement. Don't confuse science with values.
4. Unanticipated consequences	Internet	Monitor, debate, trial and learn
5. New challenges	Some nanotechnologies	Monitor, adapt, regulate



Can view 'fracking' in terms of:-

- Suite of technical risks e.g. seismological or well engineering ('hydraulic fracturing')
- Impact on global energy and carbon policy ('growth' and 'greenhouses gases')
- Impact on local amenity ('not in my backyard')



Cultural factors - precautionary by default?

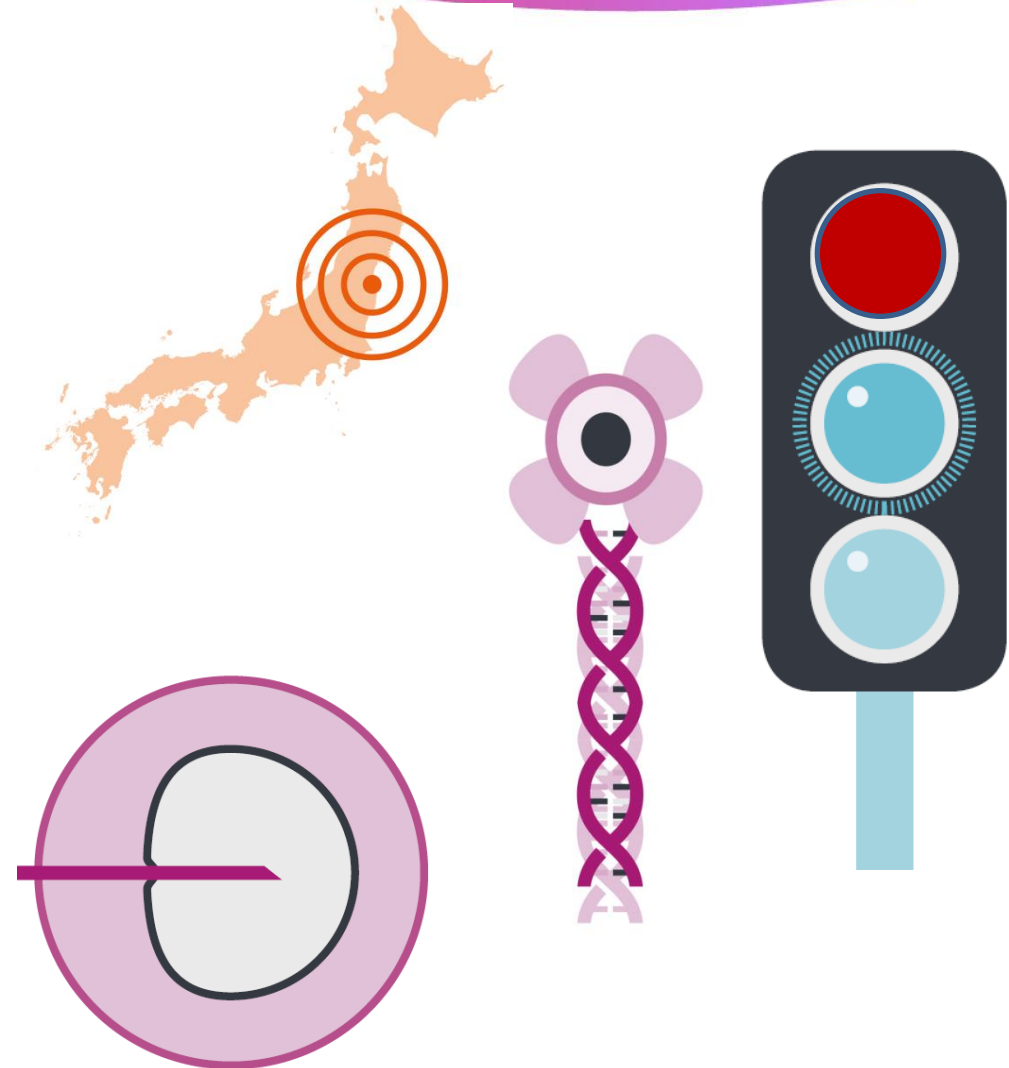
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National identity and values

- Stem cells
- Nuclear power
- GM
- Handguns

Leading to large variations
in approaches to
innovation and risk and on
different issues in different
countries



GM crops: practical working guidelines

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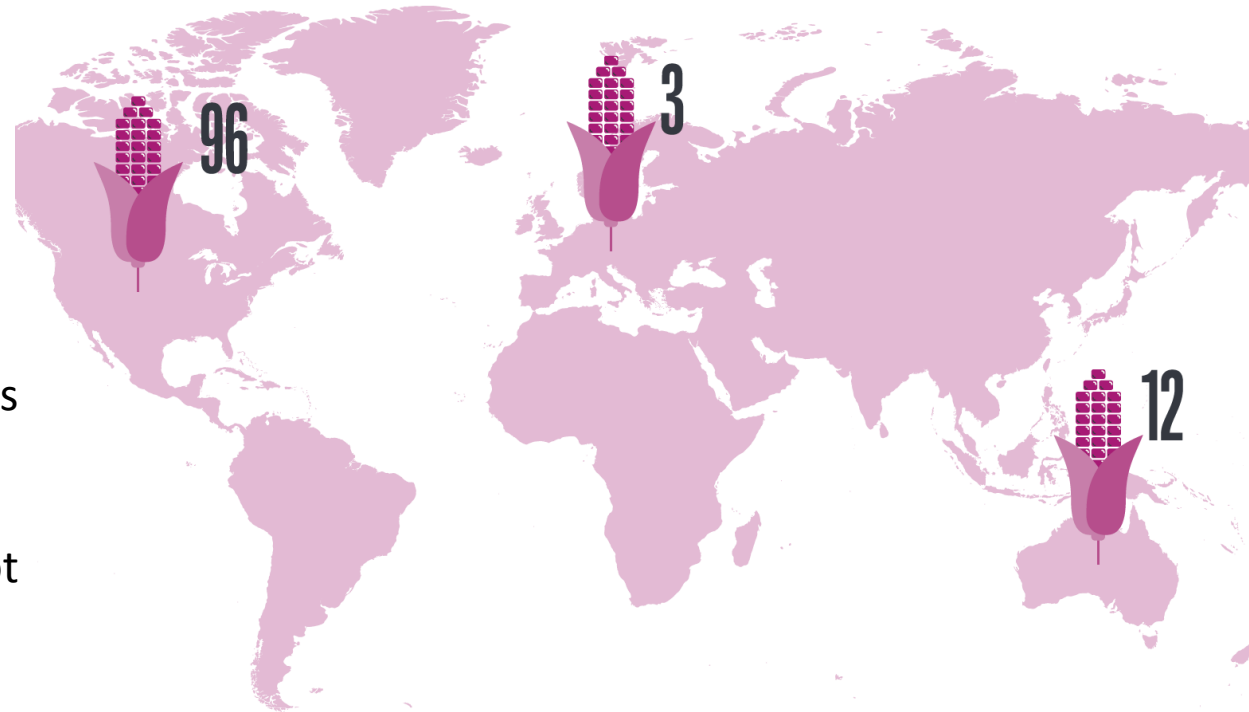
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Be specific

- What gene?
- In what organism?
- For what purpose?

Have a broad view

- Consider inaction as well as action
- Look at multiple pathways
- Science is essential, but not the only lens

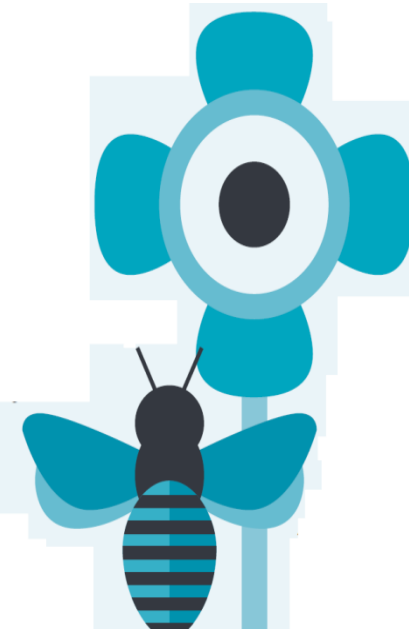
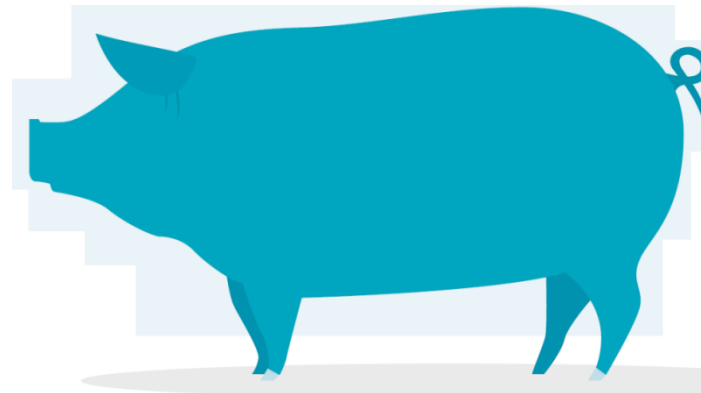


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Challenges

- **Systemic pressures**
 - Economic regulators (and price)
- **Asymmetric incentives**
 - Neonicotinoids (unintended consequences)
- **Lack of proportion**
 - Pig inspection (what you can't see for looking)



HFEA and mitochondria replacement therapy

HFEA: Extended consultation

Multiple strategies

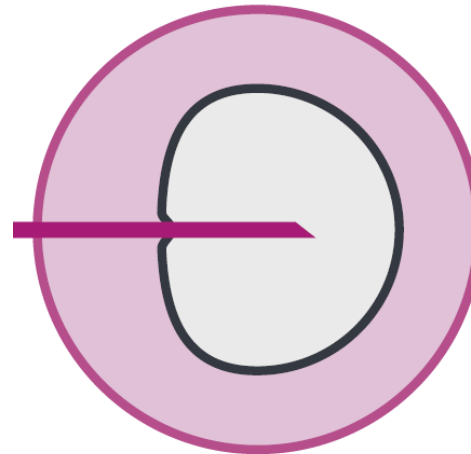
Outcome: Shift in public and expert opinion

Advised Secretary of State: clear public support for clinical use of mitochondria replacement treatment.



The HFEA consultation consisted of:
Deliberative workshops; a public representative survey; open consultation meetings; a patient focus group; an open consultation questionnaire.

Between 2011 and 2014, the Human Fertilisation and Embryology Authority led an extended consultation process on the use of mitochondrial replacement procedures to eliminate faulty genetic material.



Towards the end of the twentieth century, the governance of technology has shifted from top-down regulation to include greater participation by non-governmental actors.

Key areas where we can build on existing approaches:

- o **Investment:** Aligning national priorities for investment on resilience, infrastructure and innovation with an evidence and risk-based approach;
- o **Coordination:** Ensuring a more coherent and structured approach to assessing impact of risk in policy, regulation and crisis management;
- o **Regulators:** Putting in place the right governance structures and incentives in relation to our regulators and regulated industries;
- o **Science-based EU:** Rooting the approach to policy and decision-making in EU in robust scientific evidence.

