



“What is excellence in agricultural research facing the plurality of the challenges?”

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Outline



- The scope of the challenge
- The plurality of the challenge
- What is excellent research?
- Can we assess it well?

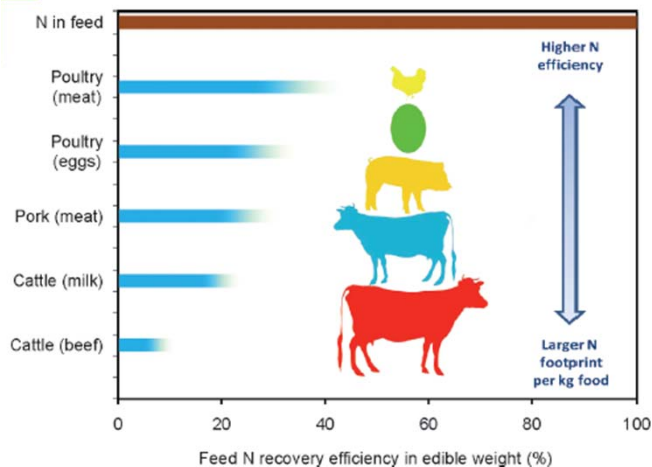


Growth in global food demand



This is a good thing!

Animal protein expensive in resources to produce (ENA)



- 35% more mouths by 2050
 - Mainly in Asia, Africa and S. Am
- Richer people eat more:
 - ~5bn people in middle class by 2030 (cf 1.8bn now), with associated higher consumption (meat, dairy and total volumes)
 - Mainly in Asia
- 70% urbanised
 - Understanding of food systems
- All add up to increased global food demand (FAO estimate 70% more)



Supply-side challenges are severe...



- No more land
- More regulation
- More competition for resources...

- And climate change...

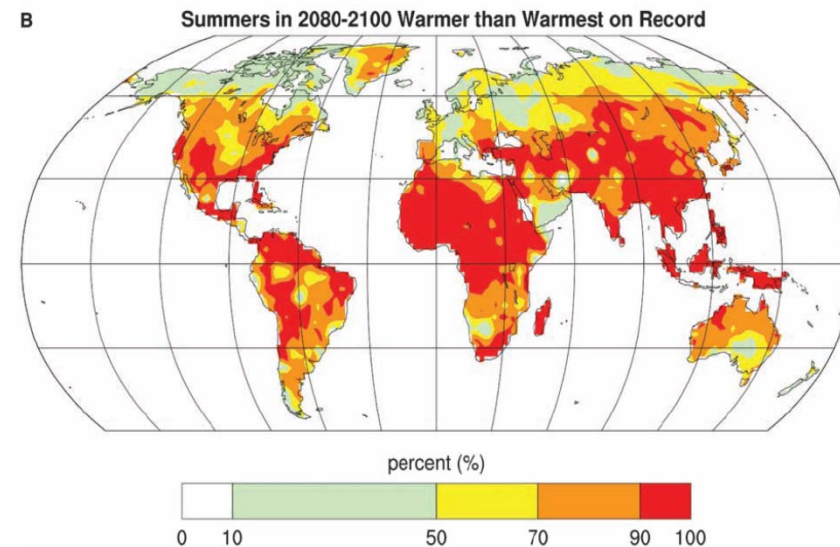
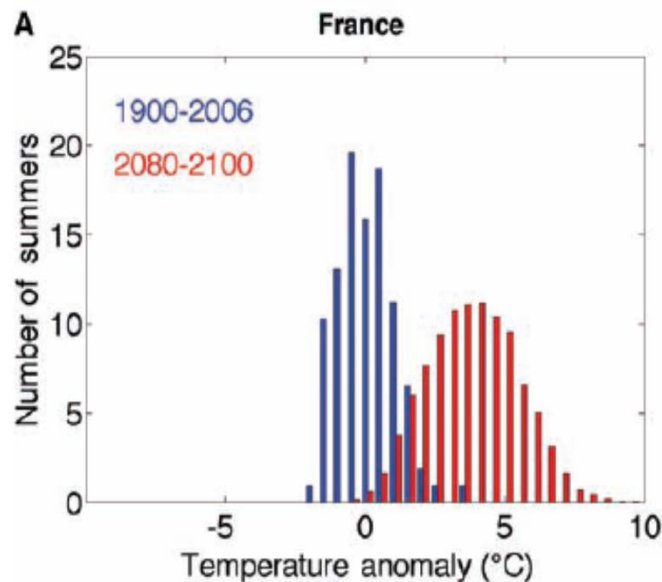




Climate change is impacting on yields now



“...in France and northern Italy, where over 30,000 people perished from heat-related causes..... Italy experienced a record drop in maize yields of 36% from a year earlier, whereas in France maize and fodder production fell by 30%, fruit harvests declined by 25%, and wheat harvests (which had nearly reached maturity by the time the heat set in) declined by 21%”





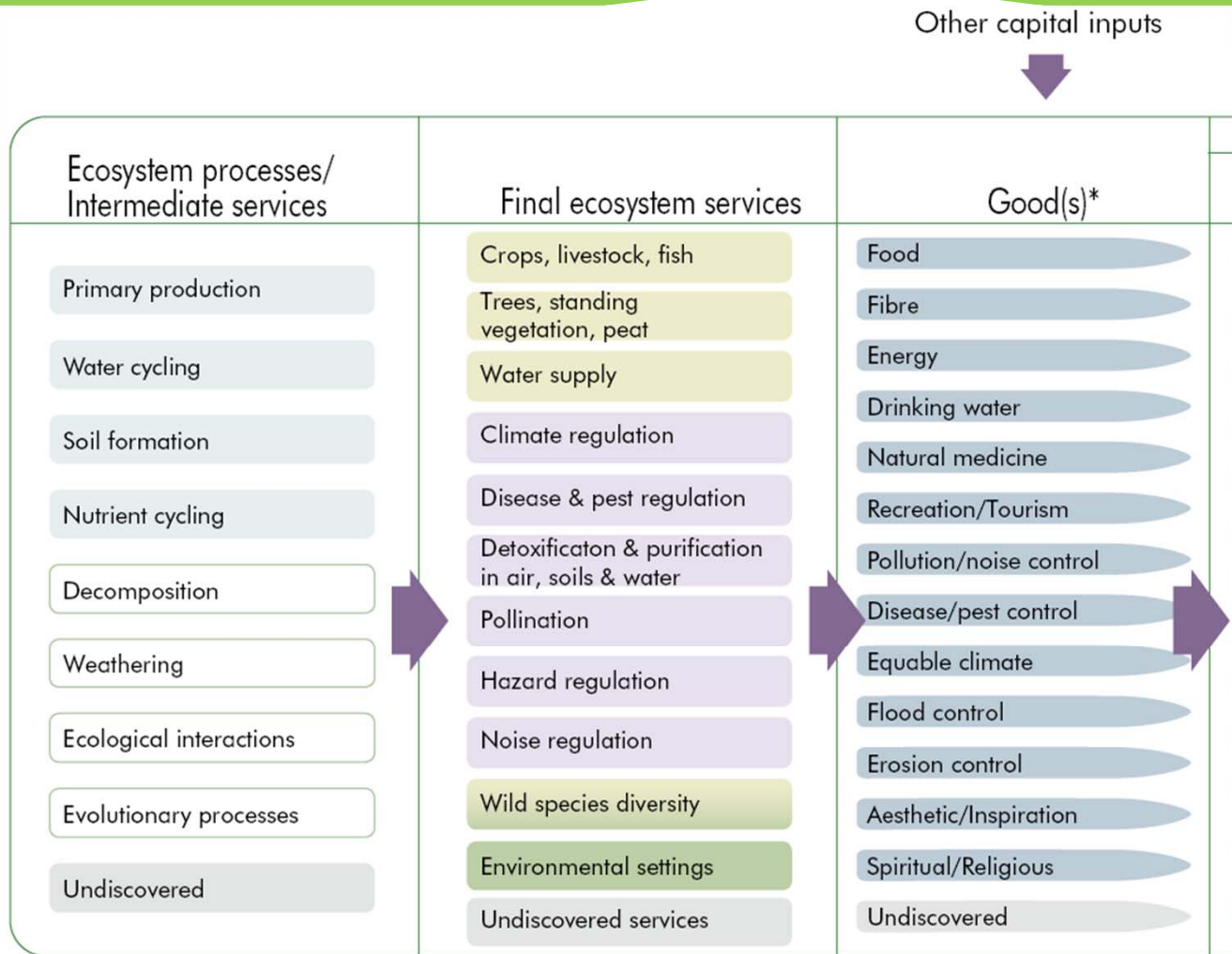
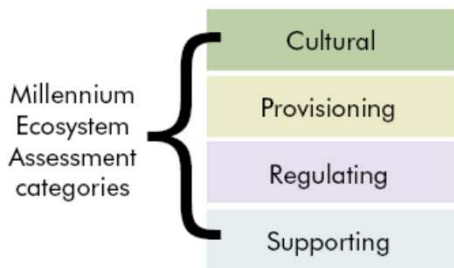
The supply-side food security challenge



Changing diets, reducing waste and other interventions reduce – but do not abolish – the need to increase food globally

- **Increase food production**
 - in the face of climate change
 - whilst resources getting scarcer
 - Without taking more land
- **Therefore:**
 - *Farm same area and produce more per unit area*

But "Ecology" is important



UK National ecosystem assessment 2011



The *sustainability challenge*:



- to produce more AND minimise impact on environment
- “*SUSTAINABLE intensification*”
 - Growing (or maintaining) production, whilst minimising inputs, and enhancing ecosystem services

15-20% of global food production comes from insect pollinated crops (Klein et al 2008)





“Sustainable Agriculture” needs...



- Management of impacts within plots/fields
 - Resource use efficiency, good soil management, precision agriculture etc
- **AND** management of land to maintain other services
 - Water, carbon storage, cultural value, pollination, natural enemy services, biodiversity, recreation, wild food etc
 - Network of non-cropped land at landscape scale

Integrated management at landscape scale



Agriculture cannot exist alone

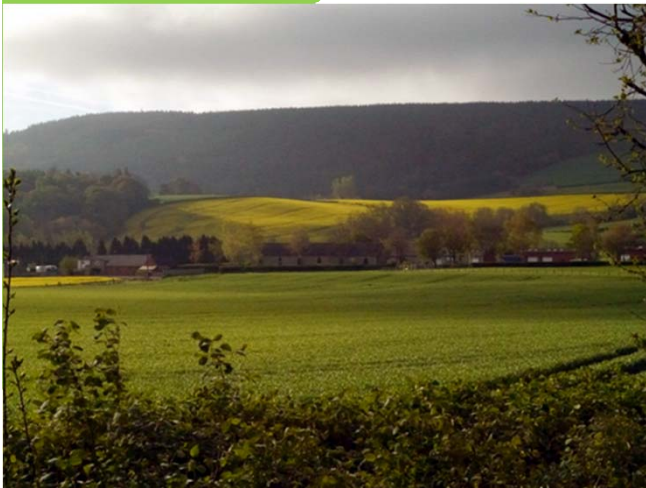


- Agriculture is *one* land use
- Multiple land uses are required to ensure services important to society are maintained – tailored to place
- We need to think *jointly* about agriculture, environment and society (needs, governance, instruments)





The “new agriculture”



- Needs to integrate agricultural production with environmental enhancement to deliver society’s needs
- “sustainable agricultural landscapes” do not need to be e.g. organic but do need to provide a range of goods
- Agricultural thinking needs to be *interdisciplinary*, and move from the field- or farm- scale to larger scales

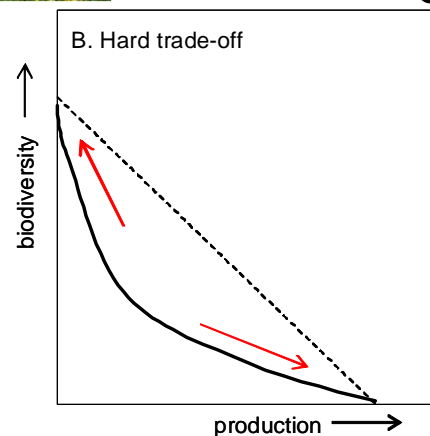
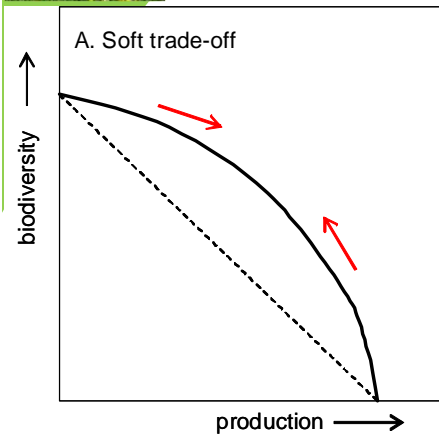


A word on terminology



- Mono-disciplinary research/framing
 - E.g. how to maximise yields
- Multi-disciplinary research
 - E.g. how to maximise yields **and** how to maximise services
- Inter-disciplinary research
 - E.g. how to optimise production **and** services to get the **best of both**
- Trans-disciplinary research
 - How to undertake and translate research into farm-level **actions**

Strategic research requires systems' approaches



- Strategic research – that to produce a specific outcome – requires systems approaches to avoid trade-offs
- In the “new agriculture” the system includes:
 - Society
 - Environment
 - Farmers
 - farming



So, within a systems' framework we need a mixture of:



- disciplinary research (to understand detailed mechanisms),
- Inter-disciplinary research (to optimise between variables) *and*
- Trans-disciplinary research (to create impact)

To deliver the *strategic* research delivering food security

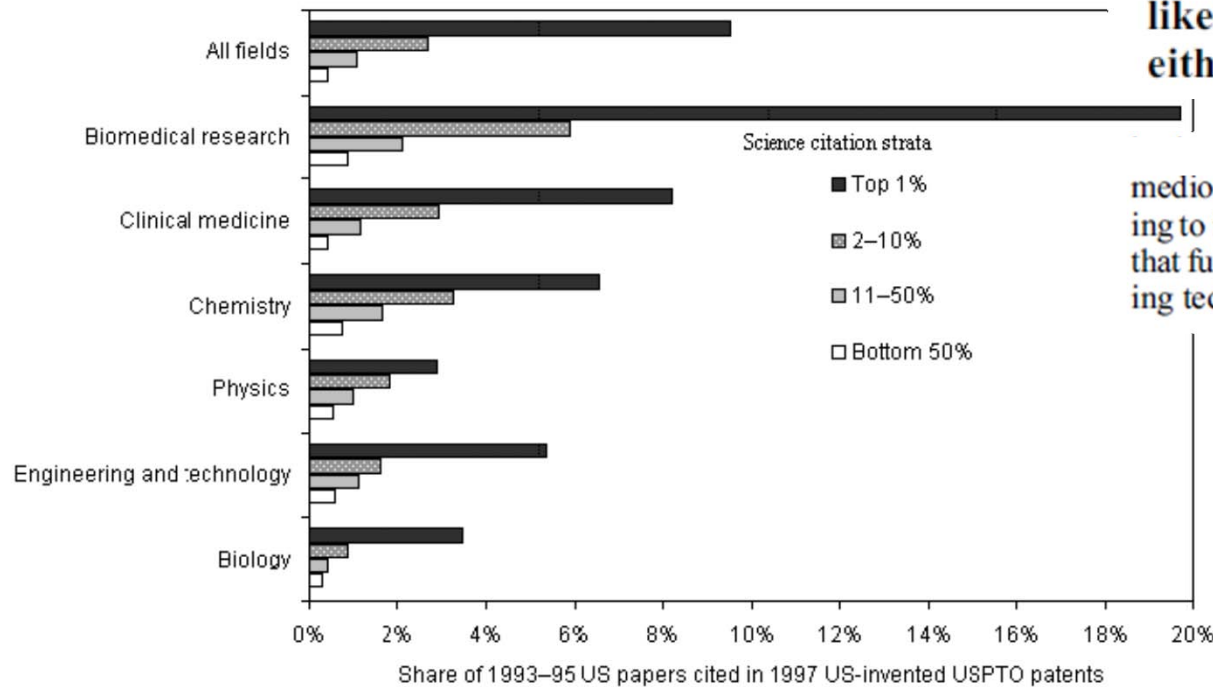




Excellent science pays off in applied spheres



Mission-oriented agencies supporting research should not forget the importance of scientific excellence to the successful completion of their mission: mediocre research is not likely to give much direct benefit to either science or innovation



There is no field in which mediocre research stands much chance of contributing to innovation. The results imply that governments that fund the best science have the best chance of reaping technological benefit.

Hicks et al 2000

Science and Public Policy, volume 27, number 5, October 2000, pages 310-320.

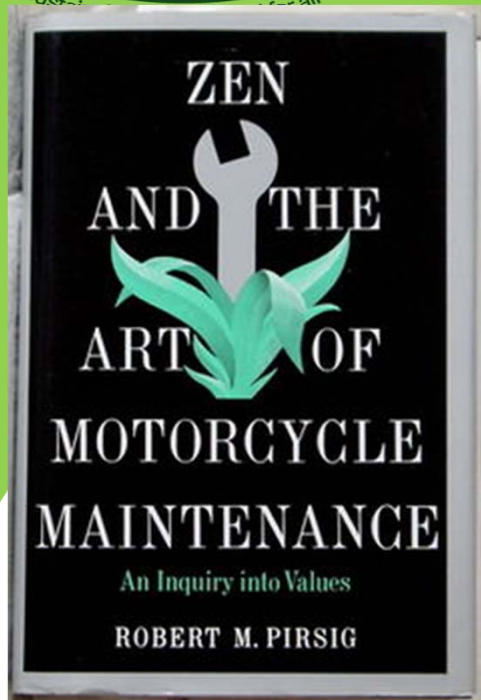


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ASSESSING AND FUNDING *EXCELLENCE*



Scholarly definitions of excellence



Research excellence is often taken to be simply a synonym of good quality science. As such, the pursuit of research excellence is uncontroversial within the scientific communities; achieving excellence in the sense of contributing to pushing back knowledge frontiers and creating breakthroughs has always been a key objective of leading researchers and research institutions.



Global
Food Security



REF 2014: Assessment framework and guidance on submissions

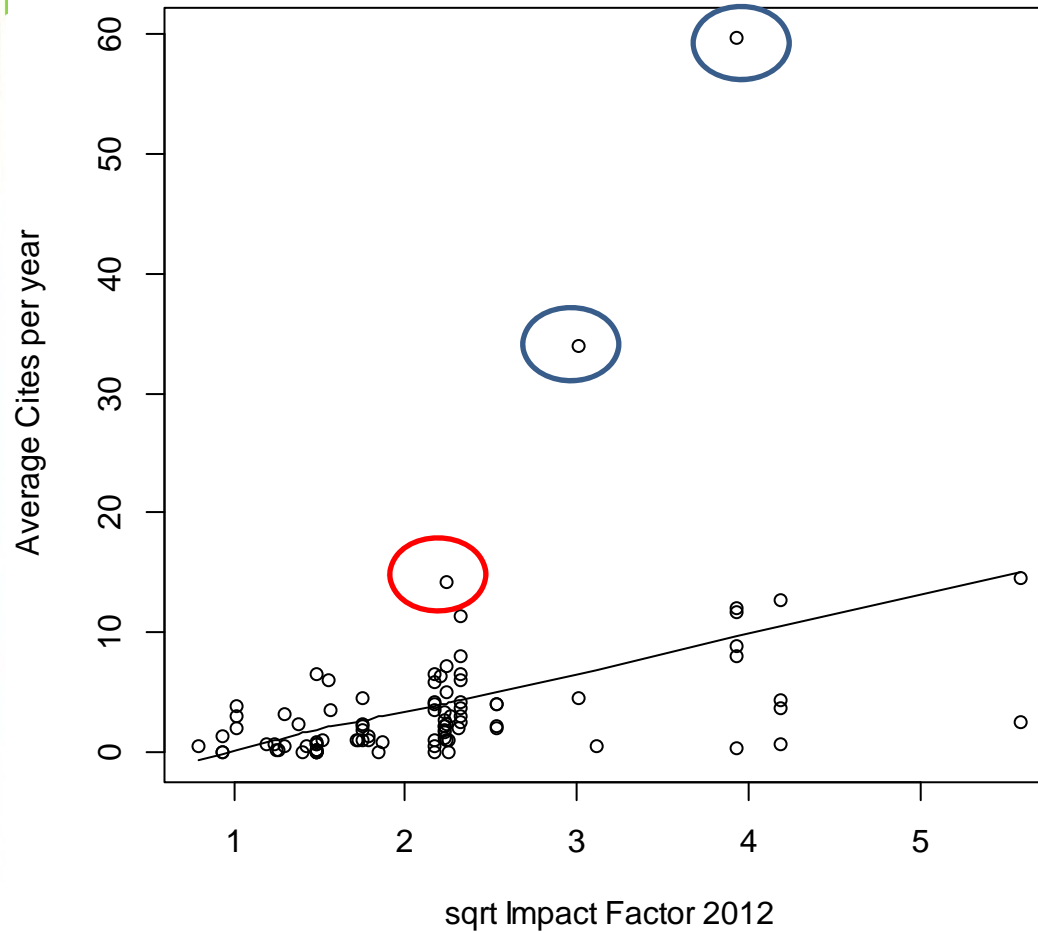
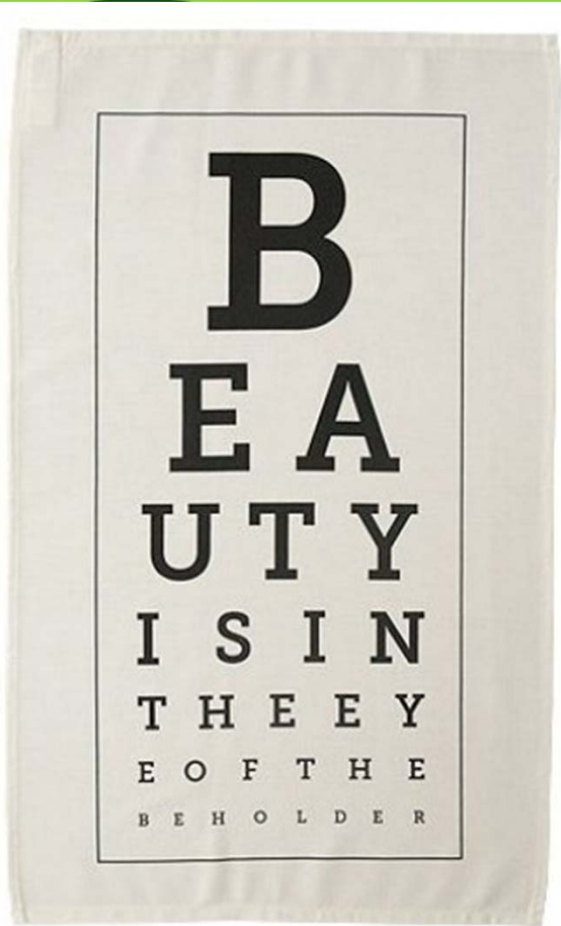
Table A1: Overall quality profile: Definitions of starred levels

Four star	Quality that is world-leading in terms of originality, significance and rigour.
Three star	Quality that is internationally excellent in terms of originality, significance and rigour but which falls short of the highest standards of excellence.
Two star	Quality that is recognised internationally in terms of originality, significance and rigour.
One star	Quality that is recognised nationally in terms of originality, significance and rigour.
Unclassified	Quality that falls below the standard of nationally recognised work. Or work which does not meet the published definition of research for the purposes of this assessment.

1. For the purposes of the REF, research is defined as a process of investigation leading to new insights, effectively shared.
2. It **includes** work of direct relevance to the needs of commerce, industry, and to the public and voluntary sectors; scholarship⁸; the invention and generation of ideas, images, performances, artefacts including design, where these lead to new or substantially improved insights; and the use of existing knowledge in experimental development to produce new or substantially improved materials, devices, products and processes, including design and construction. It **excludes** routine testing and routine analysis of materials, components and processes such as for the maintenance of national standards, as distinct from the development of new analytical techniques. It also **excludes** the development of teaching materials that do not embody original research.



The sociology of disciplinary assessment of excellence



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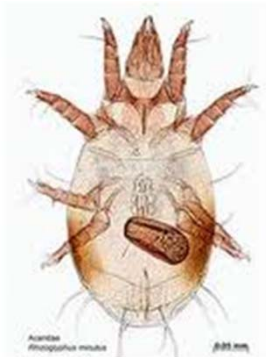
Tackle the “sacred cow” of peer review!



Sacred cow!

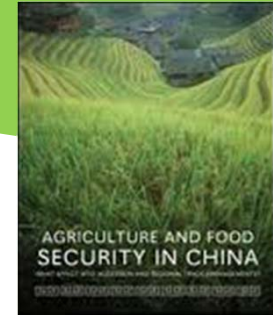


- Peer review often very conservative
- Review often based on indirect norms of “quality”
- Review often biased against inter-disciplinarity
- Review often based on flawed philosophies
 - E.g. simple models, “acceptable” models





Assessing interdisciplinary excellence ("novelty, significance, rigour")



- Mono-disciplinary expertise base for reviewers leads to double jeopardy (or worse)
- Peer review is compromised by mono-disciplinary norms of excellence (e.g. "will it be a *Nature* paper?")
- mono-disciplinarians may resist change



An anecdotal example



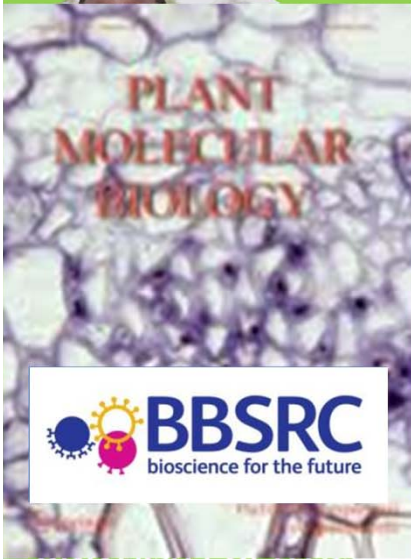
ELIZABETH THE SECOND
by the Grace of God of the United Kingdom of Great Britain and
Northern Ireland and of Our other Realms and Territories Queen,
Head of the Commonwealth, Defender of the Faith:

TO ALL TO WHOM THESE PRESENTS SHALL COME, GREETING!

- (a) to promote and support, by any means, high-quality basic, strategic and applied research and related post-graduate training relating to the understanding and exploitation of biological systems;
- (b) to advance knowledge and technology, and provide trained scientists and engineers, which meet the needs of users and beneficiaries (including the agriculture, bioprocessing, chemical, food, health-care, pharmaceutical and other biotechnological-related industries),

thereby contributing to the economic competitiveness of Our United Kingdom and the quality of life;

to provide and support



VICIOUS CIRCLE



HUGGER

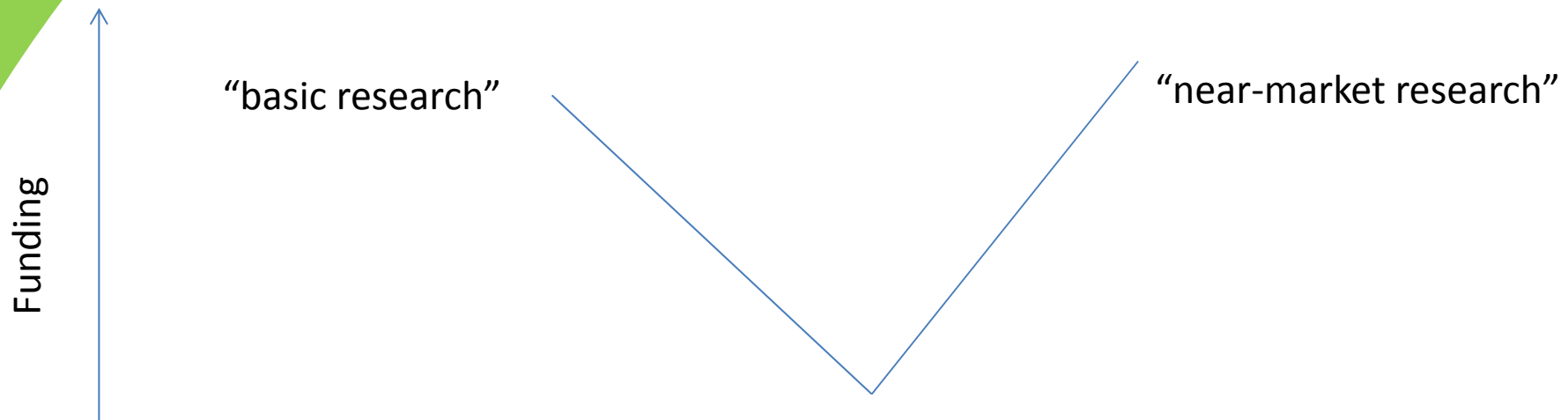




The vicious circle



- Creates makes the “valley of death” deeper





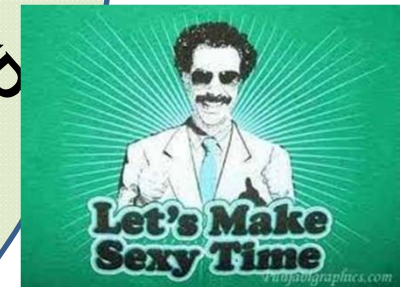
Culture change needed



Practical utility

APPLIED RESEARCH

**INSPIRED USE
BASIC RESEARCH:
PASTEUR'S PATCH**



PURE RESEARCH

Fundamental knowledge

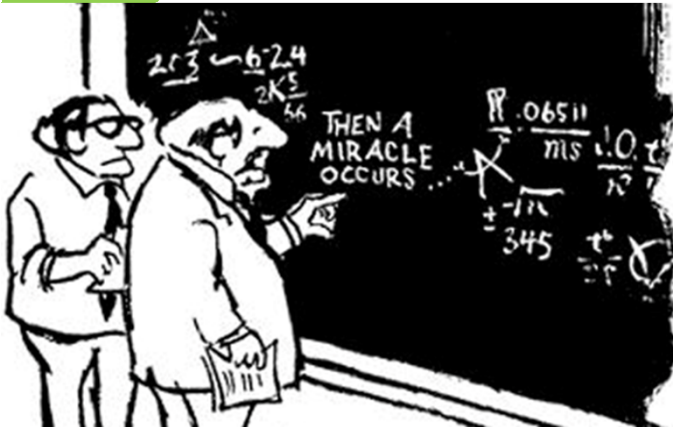
Donald Stokes (1997), *Pasteur's Quadrant: Basic Science and Technological Innovation* (Brookings Institution Press, Washington DC).



Multiple approaches to excellence



- Encourage “use inspired basic research” – melding pure and applied
 - Promotions
 - Panel processes
 - Training
 - Stakeholder involvement
- Reward multiple excellences:
 - *Nature* papers should not be THE gold standard but A gold standard
 - Tjissen’s “scorecard”
- Ensure inter-disciplinary training and respect
- Recognise the flaws in the process





Thank you!

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ROUTES TO SOLUTIONS FOR SUSTAINABLE PRODUCTION...?



Global Food Security Programme



“Food security, nutrition and sustainable agriculture must remain a priority on the political agenda, to be addressed through a cross-cutting and inclusive approach, relevant to all stakeholders at global, regional and national level.” [G8 statement July 2009]

- multi-funder, multidisciplinary, long-term
- Devise, implement and monitor a UK research strategy
- Enhance engagement & understanding

