

# Science Policy and Management

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Director

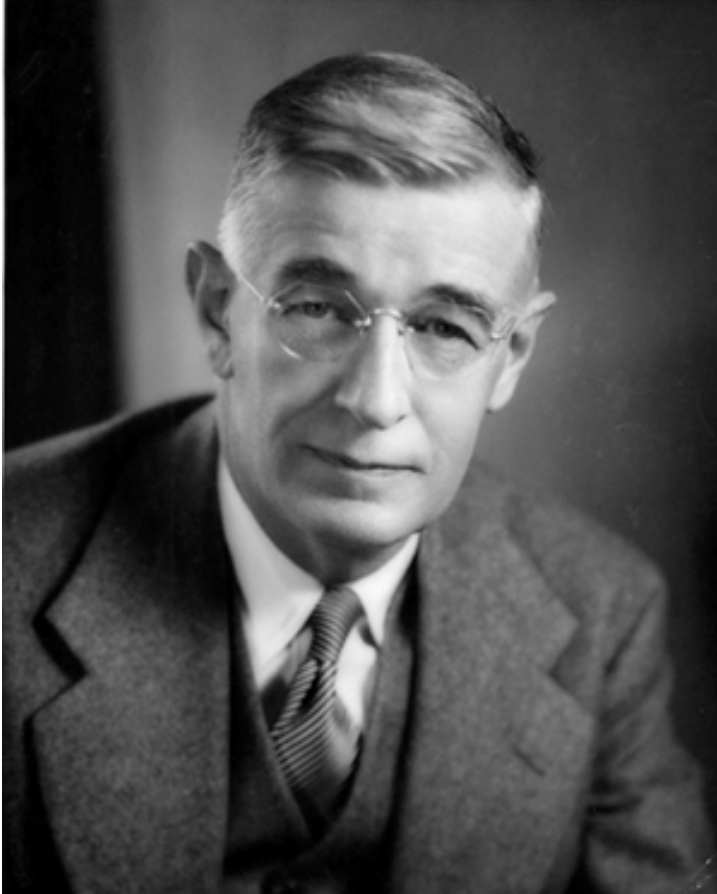
The Wellcome Trust

**welcome**trust

# Outline

- How to give out money to support research?
- How to establish whether this has been done well?
- Key issues for the UK research base

# Science – the endless frontier



"Progress in the war against disease depends on a flow of new scientific knowledge. New products, new industries, and more jobs require continuous additions to knowledge of the laws of nature, and the application of that knowledge to practical purposes. This essential, new knowledge can be obtained only through basic scientific research."

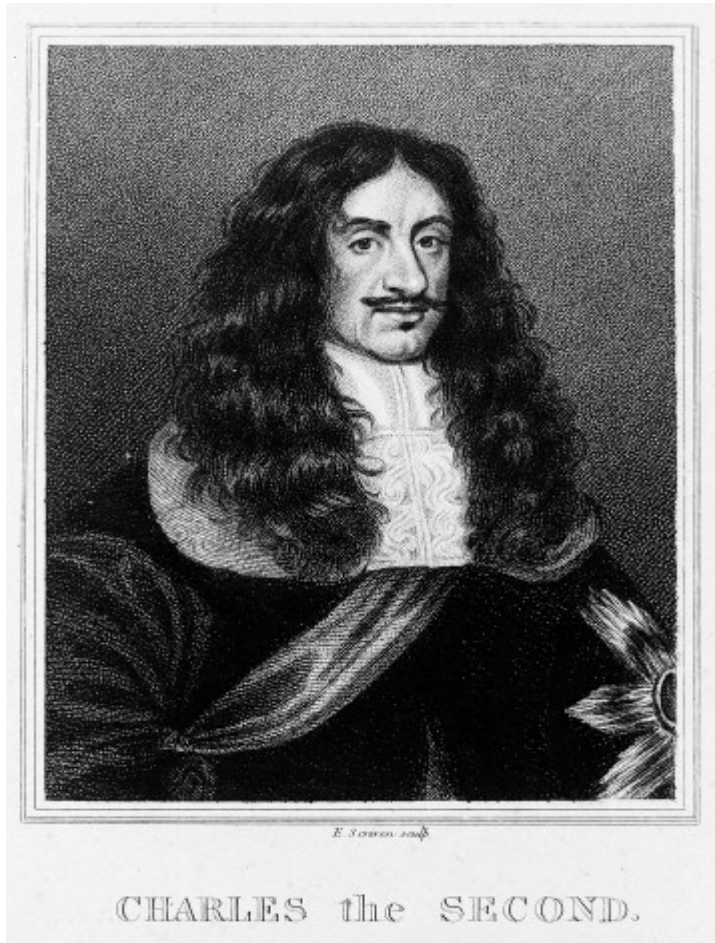
*Science The Endless Frontier: A Report to the President by Vannevar Bush, Director of the Office of Scientific Research and Development, July 1945.* (US Government Printing Office, Washington DC, 1945). Image courtesy of the Massachusetts Institute of Technology Museum © 2005.

# Science & Innovation Investment Framework

"For the UK economy to succeed in generating growth through productivity and employment in the coming decade, it must invest more strongly than in the past in its knowledge base, and translate this knowledge more effectively into business and public service innovation."



# Who asks the questions: the King



*“...Whereas, in order to the finding out of the longitude of places for perfecting navigation and astronomy, we have resolved to build a small observatory within Our Park at Greenwich...”*

*Charles II*  
*(r. 1660-85)*

# Who asks the questions: the President



President Richard Nixon signing the  
National Cancer Act on Dec. 23, 1971

*"The time has come in America when the same kind of concentrated effort that split the atom and took man to the moon should be turned toward curing this dread disease. Let us make a total national commitment to achieve this goal."*

*Nixon - State of the Union message on  
January 22, 1971*

# Who asks the questions: the scientist



*"I remember looking under the microscope and seeing these yeast cells that couldn't divide at all. They would get bigger and bigger, but they didn't split into two, as they were supposed to. Then I picked up a yeast clone that was the complete opposite: it was dividing when the cell was at a smaller size than normal. I looked at it and thought, What does this mean?"*

*Paul Nurse - The New York Times, May 13, 2003*

# Who asks the question: a hybrid approach or.....meeting unmet need

World's scientific community asked to identify specific scientific or technological innovation that would remove a critical barrier to solving an important health problems

14 'Grand Challenges' were then selected by expert committee

for example:

- prepare vaccines that do not require refrigeration
- discover drugs and delivery systems that minimize the likelihood of drug resistant micro-organisms
- develop technologies that allow assessment of individuals for multiple conditions or pathogens at point-of-care



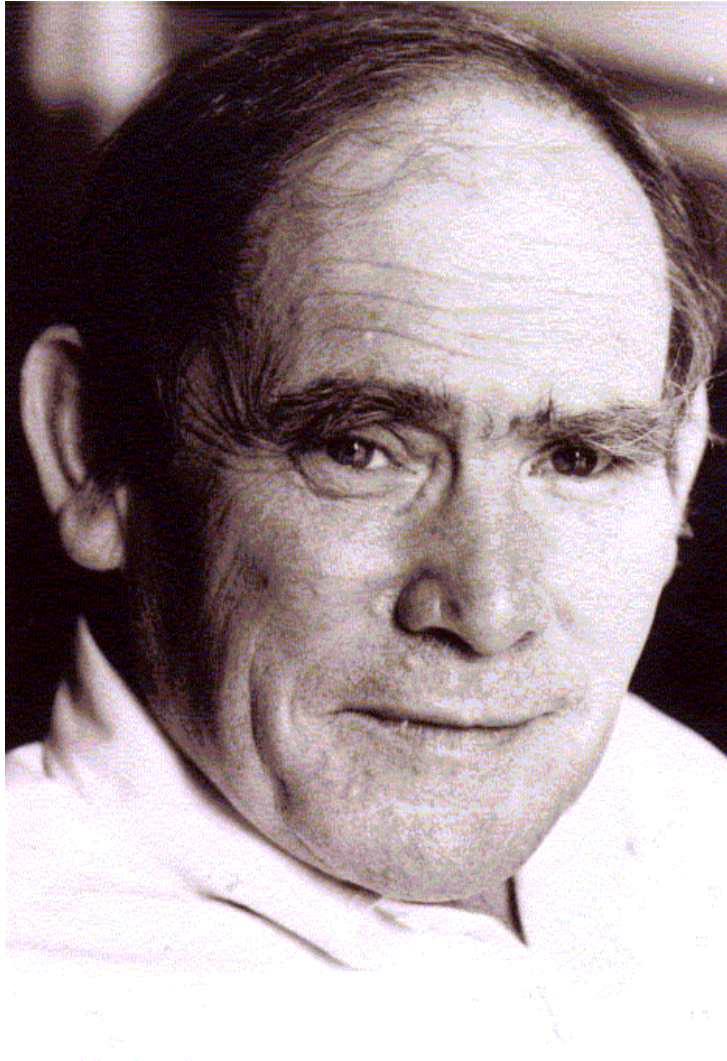
# Who answers the questions - picking winners



*“....simply put, the best way to administer a creative research environment is to find people of great talent and reasonable ambition – whatever their specific disciplines – and leave them to their own devices”*

Joshua Lederberg, *The Scientist*, 1991

# Flexible awards



*“It is only through the use of subterfuge such as applying for money for work already done that innovative research can be freely pursued.”*

Sydney Brenner, *Science* 1998, 282, 1411

*“Set aside 1% of the money of a funding agency to give to the best gamblers.”*

Sydney Brenner, Speaking at LSE, June 2003

# The correct questions by funding agencies?

- Are you a good scientist?
  - ♦ What have you discovered?
  - ♦ Who have you trained?
  - ♦ Submit two or three of your best papers
- What is your question?
- Why is it important?
- How will you approach the question?
- What resources do you need?

# A mixed approach to giving out the money

- Limits to planning science - science sets its own priorities
- Cannot predict discoveries or anticipate the opportunities fresh discoveries produce
- Support a balance of the best ideas and people with flexible mechanisms
- Try to understand unmet need
- Use a mixture of bottom-up & top-down approaches to priority setting

# Measuring success – the issues

- Adoption of true/realistic measures/indicators:
  - recognition of the incremental & unpredictability of research
  - challenge of identifying 'impact' from basic research
- Avoiding perverse incentives
  - weighing papers
  - citation/impact factors
- Managerial vs professional targets
  - quantitative vs qualitative indicators
- Focus on national indicators for an increasingly global pursuit
- Attribution - multiple funding partners, international collaboration

# UK PSA target: the right drivers?

<b>indicator theme</b>	<b>example performance indicator</b>
<b>INPUTS</b>	<ul style="list-style-type: none"><li>- gross expenditure on R&amp;D (GERD): GDP</li><li>- publicly performed R&amp;D as proportion of GDP</li></ul>
<b>OUTPUTS</b>	<ul style="list-style-type: none"><li>- no. &amp; share of OECD PhD awards</li><li>- no. &amp; share of world publications</li></ul>
<b>PRODUCTIVITY – FINANCIAL</b>	<ul style="list-style-type: none"><li>- PhDs awarded: higher education R&amp;D (HERD)</li><li>- citations relative to GDP HERD</li></ul>
<b>PRODUCTIVITY – LABOUR</b>	<ul style="list-style-type: none"><li>- PhDs awarded per researcher</li><li>- publications per researcher</li></ul>
<b>PEOPLE</b>	<ul style="list-style-type: none"><li>- researcher per 1000 population</li><li>- researcher per 1000 workforce</li></ul>
<b>BUSINESS EXPENDITURE</b>	<ul style="list-style-type: none"><li>- business R&amp;D investment in HERD as proportion of HERD</li></ul>

# Persuading the politicians?

## 1966 Project Hindsight – US Dept Defence

- 20 military weapons: Polaris and Minuteman missiles, nuclear warheads, Mark 46 torpedo, M102 Howitzer
- Contributions from university research minimal
- ‘Mission-orientated’ science most successful
- Lag between discovery and application shortest when scientist worked in area targeted by sponsor

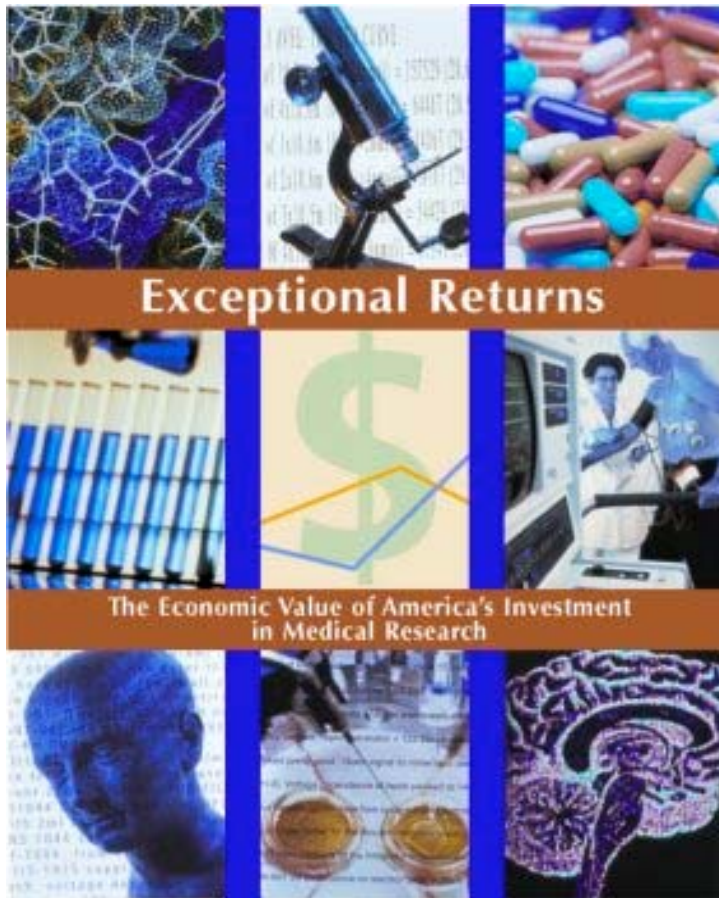


# A bibliometric approach (1): Comroe and Dripps (1976)

- systematic analysis of top 10 clinical advances in cardiovascular and pulmonary medicine
- 529 key articles – 41% reported the results of basic science
- ammunition to argue:  
"...that a generous portion of the nation's biomedical research dollars should be used to identify and then to provide long-term support for creative scientists whose main goal is to learn how living organisms function, without regard to the immediate relation of their research to specific human diseases."
- widely used as an advocacy tool to promote basic research



# Persuading the politicians? An econometric approach: 'Exceptional Returns'



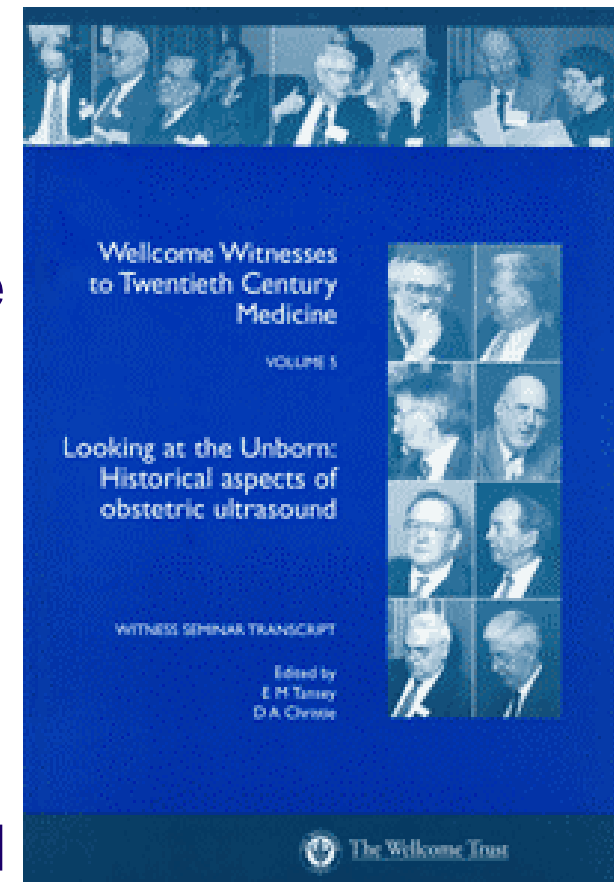
- examination of the economic impact of research – 9 distinguished economists commissioned
- gains from prevention and treatment of cardiovascular disease alone totalled \$31 trillion
- increases in life expectancy in 1970s & 1980s worth \$57 trillion to Americans
- widely used as an advocacy tool to promote investment in research

# A bibliometric approach (2): Comroe and Dripps revisited

- attempt to replicate methods of Comroe and Dripps with respect to 5 advance in neonatal intensive care
- found methods were “not repeatable, reliable or valid”
- a revised bibliometric method developed
- demonstrated that after a 17 year time lag between 2-21% of research underpinning clinical advances was basic
- however, two advances with lowest percentage of basic precursors (parental nutrition and ultrasound) unlikely to cite basic papers

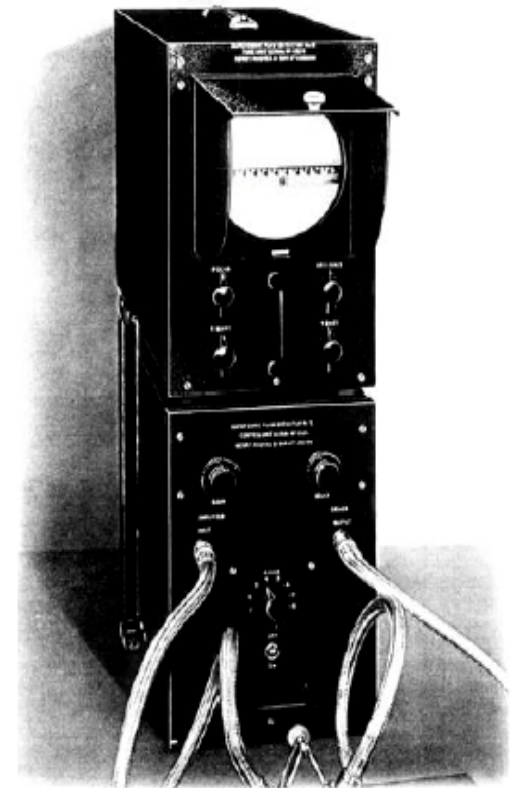
# A narrative approach: Witness Seminars

- organised by the Wellcome Trust Centre for the History of Medicine
- 40 seminars since 1992
- significant figures in 20th-century medicine discuss specific discoveries or events
- researchers, policy makers, patients, carers
- communal eye witness testimonies and open peer review
- open discussion of the hidden realities and evolution of medical practice and research



# Witness Seminars – obstetric ultrasound

- leadership of Professor Ian Donald 1950-60s
- remarkable collaboration between engineers and clinicians
- resistance from doctors who had spent years ‘training their hands to see’
- demonstration, refinement and results led to huge change in clinical practice



# A mixed approach

A need for performance management information:

- inputs
- activities
- outputs

.....but also methods for capturing outcomes:

- case studies
- narratives

# Key questions ...

- What are the correct drivers for the research environment we want to foster?
- Do current management approaches stifle the scientific process (e.g. peer review)?
- How can we best capture the outcomes of research?
- How do we persuade politicians and the public that fundamental research matters?