LETTER FROM AMERICA: A MEMO TO SIR MARK WALPORT

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Congratulations Dr Walport on your appointment as the UK government's Chief Scientific Adviser. You join a select group. Since the position of chief science adviser was established in the US in 1957 (see Table 1) and in the UK in 1964, less than 30 men (yes, all men) have occupied the position. Today across Europe, only Ireland, the Czech Republic and the European Commission have formal equivalents, which also exist in Australia, New Zealand, and soon perhaps in Japan and at the United Nations.

Table 1: US presidential science advisers, 1957 to the present day.

Shaded names are those who participated in a series of visits hosted by the University of Colorado's Center for Science and Technology Policy Research from 2005 to 2013. Dates in parentheses are the year of death.

Eisenhower	James R. Killian, Jr. (1988)	1957 - 1959
Eisenhower	George B. Kistiakowsky (1982)	1959 - 1961
Kennedy	Jerome B. Wiesner (1994)	1961 - 1963
Johnson	Jerome B. Wiesner (1994)	1963 - 1964
Johnson	Donald F. Hornig (2013)	1964 - 1969
Nixon	Lee A. Dubridge (1994)	1969 - 1970
Nixon	Edward E. David, Jr.	1970 - 1973
Nixon	H. Guyford Stever (2010)	1973 - 1974
Ford	H. Guyford Stever (2010)	1974 - 1977
Carter	Frank Press	1977 - 1981
Reagan	George A. Keyworth II	1981 - 1985
Reagan	William R. Graham, Jr.	1986 - 1989
G. H. W. Bush	D. Allan Bromley (2005)	1989 - 1993
Clinton	John H. Gibbons	1993 - 1998
Clinton	Neal Lane	1998 - 2001
G. W. Bush	John H. Marburger III (2011)	2001 - 2009
Obama	John Holdren	2009 - present

In the United States, the science adviser is an assistant to the President with the formal title of Director of the Office of Science and Technology Policy, one of the many groups that sit in the Executive Office of the President. The OSTP was created in 1976, but the formal designation of science adviser dates from 1957, and informally from even earlier. All US science advisers (except notably the first, James Killian, who had a background in public administration) have been trained in some area of physics, reflecting the Cold War origins of the position and its historical connection to defence issues.

Since 2005, the Center for Science and Technology Policy Research at the University of Colorado has brought to our campus six former science advisers, spanning the administrations of John F. Kennedy to Bill Clinton, as well as the sitting advisers under Presidents George W. Bush and Barack Obama.

In this note, I distill what I consider to be the most relevant insights from their experiences, viewed through the lens of academic research on science and technology policy, to suggest five important lessons for any prospective chief scientific adviser.

Lesson 1. Science advisers are not superheroes

The US science adviser carries the weight of a mythology of extraordinary access to the President and of a portfolio which spans government. A 2013 profile of Anne Glover, science adviser to the European Commission, looked with envy across the Atlantic:

> *"John Holdren [is] the latest in a long list of éminence grises tapped to advise US presidents. At the annual meeting of [the American Association for the Advancement of Science] in Boston last month, Glover says that Holdren told her that he was in and out of Barack Obama's office up to four times a day in the run-up to important decisions."* [1]

The reality of the position is more prosaic and less glamorous than this (perhaps apocryphal) anecdote would suggest. The science adviser has never been all that central to presidential decision making. The position was created as part of President Eisenhower's response to the Soviet launch of Sputnik, with the appointment of James Killian. One historian of the

period commented that President Eisenhower *"saw more scientists in the two weeks following Sputnik than he had seen in the year before."*[2] Eisenhower contributed to the creation of a mythology when he said that Killian *"would enjoy wide latitude in action and guaranteed access to information in every corner of government."*[3]

But actions can speak louder than words. Eisenhower rushed Killian's swearing in ceremony to depart for a golf vacation in Augusta, Georgia. He also left office with a warning that *"public policy could itself become the captive of a scientific-technological elite."*[4] Yet as the realities of politics became apparent, Killian's successors began to look back at what they perceived to be a golden age of science advice. Jerome Weiser, who followed as President Kennedy's science adviser, characterised Killian as an adviser who *"rapidly became involved in matters of the greatest national importance involving education, defense, disarmament, space, and international cooperation."*[5] Recalling his term a decade later under President Nixon, Ed David observed that *"The old style science adviser, the distinguished person whom the president looked upon as his house intellectual, to be listened to on the complex and new issues… is not likely to recur soon."*[6]

The idea that science advisers can carry the authority of science as a counterbalance to the messiness of politics runs deep in the expectations of many for the position. Such expectations come from politicians (reflected, for example, in the recent UK House of Lords report on chief scientific advisers[7]) as well as from the science community (reflected, for example, in the recent book *The Geek Manifesto*, which calls for a greater authority of scientists in decision making.[8])

Despite such expectations, the science adviser is an adviser just like any other in government, with a limited portfolio of responsibilities and expectations for accountability. An experience of the EU's Anne Glover that is instructive occurred after she claimed in public that genetically modified foods were no riskier than their conventional counterparts. The ensuing controversy resulted in a soft rebuke from José Manuel Barroso, president of the European Commission, to whom she reports:

> *"The CSA reports directly to the President of the Commission and has the task to provide independent expert advice to the President on any aspect of science, technology and innovation…The CSA has a purely advisory function and no role in defining Commission policies. Therefore, her views do not necessarily represent the views of the Commission."*[9]

Science advisers are not superheroes with special access and supra-political authority. Making effective use of the position within government requires the scientific community to realistically calibrate their expectations for the role.

Lesson 2. 'Science advice' is a misnomer

These days, science advice and science communication are all the rage. Unfortunately, such discussions often fall prey to the so-called 'deficit model' of the relationship between science and decision making.[10] In its most basic form, the deficit model recommends the following logic to a would-be science communicator: once you come to understand the facts as I understand them, then you will come to share my policy preferences, if not my values.

Under such a model of interaction the emphasis is on sharing (or more commonly, arguing about) scientific facts or understanding outside of any political context. We have learned, repeatedly and sometimes at a high price, that efforts to separate science and politics in such a manner may diminish the role of evidence in policymaking, and can contribute to the pathological politicisation of science. Fortunately, many in the science policy community, both academics and practitioners, now recognise the pitfalls of the deficit model and have moved beyond it.

For instance, we asked Donald Hornig, who was science adviser to Presidents John F. Kennedy and Lyndon Johnson, to describe an instance when he was asked by the President to *"arbitrate on some scientific question or to provide some scientific advice on an issue that he was handling."* Hornig replied that he knew *"of no example of being called to arbitrate a scientific question."*[11]

The actual (as opposed to mythologised) history of the US science adviser position helps to place the role in a more realistic perspective. James Killian, often held up as the most successful postholder, was not even a trained scientist, having earned a Bachelor's degree in public administration. So if the science adviser is not actually advising on science what is he doing? The science adviser is part of government, and in the US is a presidential appointee, and as such is a political adviser. It just happens that the portfolio of responsibilities of the science adviser includes matters of policy for science, including government-wide R&D budgets, and science for policy, on topics as varied as food safety and terrorism.

Lesson 3. Political advice from a science adviser can take multiple forms

The science adviser is not unique in government in having specialised expertise or post-secondary education. Almost by definition, governing in the 21st century requires sophisticated expertise. Energy, food, conflict, economics, crime, education, environment, terrorism - the list of complex issues dealt with by governments that require the input and advice of experts knows no bound. In one sense, the phrase 'science advice' may already be redundant.

The idea of a science adviser serving as a 'house intellectual' is no longer a realistic expectation, if it ever was. Compare the perspective of William T. Golden, writing of the federal government in 1950: *"As to how many top echelon or key scientists there are...it would be difficult to decide where to draw the line. However, it appears that the number is probably somewhere between 20 and 200."*[12] In 2004, the US Governmental Accountability Office found that across government there were 948 advisory committees with 62,497 members. President Obama famously stacked his first term Cabinet with a science 'dream team', prompting the head of the American Association for the Advancement of Science to comment, *"We have never had quite this array of scientists in federal government leadership positions."*[13]

The rise of expertise in government means that the role of the science adviser has been constrained to a few areas, simply because governments are chock full of experts, agencies and advisory mechanisms. In our review, we characterised a set of specialised roles unique to the position of science adviser as follows:[14]

Budget champion. The science adviser is a co-ordinator, and at times, a champion for research and development funding across the federal government. The scientific community may look to the science adviser as its 'chief lobbyist' for greater public support. All of the science advisers that we spoke with expressed caution about taking on this role, as it risks eroding the adviser's authority in government. Nonetheless, it seems clear that many in the scientific community view the position in exactly this fashion, particularly when the size of the federal R&D budget is commonly invoked as a metric of science policy success.

Issue expert. The science adviser has a unique ability to assemble expertise to address specialised or cross-cutting policy issues. When a top scientist in academia or industry receives a call from the President's science adviser, it is certain to be returned. This power to convene can quickly bring together top experts to consider issues of national importance. For example, John Marburger, President George W. Bush's science adviser, described how his office was asked at short notice to prepare a briefing for the President on earthquakes and tsunamis after the 2005 Sumatran earthquake that killed almost 300,000 people.

Options Czar. The science adviser may also serve as what I have called an *"honest broker of policy options"*, helping the President or Prime Minister to understand the scope of available choice on a particular topic. Given the practical realities of high-level decision making, it might be difficult to imagine a President like George W. Bush, who relied on a close circle of political advisers, using a science adviser in this manner, but it is less difficult to envision a President like Bill Clinton doing so.

Institution builder. A fourth role is to oversee the institutionalisation of scientific advice across government. The provision of useful advice requires a commitment from policymakers to the use of evidence, but also to the creation and maintenance of strong institutions. The science adviser has a crucial role to ensure institutional integrity by providing advice on advice.

Lesson 4. Institutions matter

Professor David Nutt, chair of the UK's Advisory Committee on the Misuse of Drugs (ACMD) was famously relieved of his duties by the Home Secretary to whom he reported, following public comments that were

perceived to be at odds with government policy. What was rather lost in the fierce debate that followed was the importance of the underlying institutional arrangement for advice.[15] Independence is not enough. The specific work of the advisory body matters a great deal as well. Consider the following three recent situations:

Earlier this year, the Greek government brought charges against Andreas Georgiou, the head of its independent statistical agency Elstat, and two of his colleagues for allegedly overstating the country's debt in 2009. The debt calculations were a critical input to characterising the magnitude of the nation's financial crisis and the subsequent responses by the EU and the IMF. For his part, Mr Georgiou complained: *"I am being prosecuted for not cooking the books."* By contrast, Greek politicians argued that the statistical agency was *"too focused on the numbers and not enough on serving the country and the government."*[16]

Last year in L'Aquila, Italy, six scientists and one government member of the Italian National Commission for the Forecast and Prevention of Major Risks were sentenced to six years in prison for misleading the public about earthquake risks. At an ill-timed press conference held prior to the devastating 2009 earthquake, which killed 297 people, local residents were reassured by the experts that they should enjoy a glass of Montepulciano instead of worrying about earthquakes.[17]

In the United States, in the immediate aftermath of Hurricane Sandy, New Jersey Governor Chris Christie issued an executive order classifying the storm as a 'post-tropical cyclone' rather than a hurricane, preempting the scientific evaluation of the National Weather Service. Whether Sandy was judged a hurricane or not makes a big difference in insurance payouts to individual homeowners. If a hurricane, the payouts would be much smaller. In a letter to the Weather Service, New York Senator Chuck Schumer reminded the agency that its scientific judgments could cost his constituents a lot of money.[18]

Each of these seemingly different cases has a common characteristic, which they share in turn with the sacking of David Nutt. An institution - Elstat in Greece, the Major Risks Commission in Italy, the US National Weather Service and the UK's ACMD - was tasked with rendering expert judgment as an input to policymaking. In each case, that input was thwarted in some way.

Ironically, Elstat was created in 2010 to improve the provision of statistical data to Greek politicians. Prior to that, *"the practice was for the finance ministry's general accounts office to collude with the Bank of Greece to come up with deficit and debt figures ignoring surveys carried out by the statistical service,"* as one economist told the *Financial Times*.

In Italy, the earthquake experts stand accused of colluding with politicians to convey a message of complacency to the public via a 'media operation.' The message being sent was motivated, at least in part, by the experts' desire to discredit an amateur earthquake forecaster who had heightened public alarm by predicting a forthcoming big earthquake.

Dozens of US states have defined a tiered 'hurricane deductible' for insurance payouts, several of which rely on scientific judgments of the National Weather Service, an agency that was never established for such a purpose. Given the political pressure, it was no surprise that Sandy was ultimately not classified as a hurricane in the agency's final storm characterisation.

The challenges of utilising expertise in politics know no national boundaries and can be found across the political spectrum. Calls to cleanly separate science and politics fail to recognise that the challenge actually lies in their integration via institutions. If an advisory body exists to answer narrow technical questions put forward by policymakers, then this needs to be made clear via its terms of reference, and a formal process needs to be created to elicit questions from policymakers. An example of such a committee is the UK Migration Advisory Committee (MAC), which is mandated to answer only specific questions, according to a well-established set of methods and protocols.[19] It provides non-binding recommendations which government can adopt or ignore as it chooses. While the MAC's advice has been hotly debated in recent years, there have been no challenges to its legitimacy of the sort that plagued the ACMD.

A different type of advice focuses on policy options. Sometimes decision makers want to know what options for action are available to them. As Lord May, former UK government chief scientific adviser, explains: *"The role of the scientist is not to determine which risks are worth taking, or deciding what choices we should take, but the scientist must be involved in indicating what the possible choices, constraints and possibilities are … The role of the scientist is not to decide between the possibilities but to determine what the possibilities are."*[20]

Such honest brokering of policy options is sorely needed in a world where experts readily self-segregate themselves according to their political preferences, leaving few options for comparative policy advice. An expert body that clarifies, or even expands, the scope of choice will necessarily be comprised of a wider range of expertise than a panel of scientists who arbitrate scientific questions. Economists and other social scientists will almost certainly be necessary, as, in many cases, will broader forms of public engagement.

Rather than answering specific technical questions, or recommending a specific course of action to meet a narrow goal, an 'honest broker' provides multiple possible options to meet a specified goal, or options conditional on goals. One example of an honest broker is the US Office of Technology Assessment, terminated in the early 1990s, which would often produce reports with options for action rather than advocating specific policies. Other examples include the red team/blue team adversarial model used by the military, the German Federal Institute for Risk Assessment and some of the projects of the UK Foresight Programme. A key role for government science advisers in future will be to set up and evaluate such institutions, which are able to provide more systematic advice about how to provide useful advice.

Lesson 5. Politics is more difficult than physics

When Albert Einstein was asked why it was that we could discover how to split the atom but had difficulty in overseeing atomic technology, he famously replied, *"That is simple my friend: because politics is more difficult than physics."*

I was reminded of this phrase when we interviewed Ed David, President Nixon's science adviser. Not only did Nixon demand that David terminate all federal funding to MIT as retribution for campus protests against the Vietnam War, but he eventually terminated the science adviser position altogether, prompting its resurrection via Congressional legislation. Before that however, Nixon had another interaction with experts which reveals that while the laws of physics are unbendable, politics can be even less accommodating. David explained that in 1972, Nixon's White House was considering cancelling the Apollo 17 mission to the moon.

> *"That reason was essentially political…Apollo 17 was slated to launch about a month before the election day, early in November 1972. The big worry by the political forces in the White House was that if there was an accident on Apollo 17, it would bear heavily on the election outcome negatively. I suggested that Apollo be postponed, however, until December after the election…This shows you how science hangs by a string in such situations."*[21]

David explained to us that NASA at first resisted the schedule change, claiming that they would have difficulty keeping their staff in peak form during the delay. Based on the President's unyielding political agenda, David gave them a choice that they could not refuse: launch in December, or not at all. NASA quickly saw the merits of his perspective and adapted its mission planning.

Despite such political realities, scientists at times argue that science should carry overriding political authority and legitimacy. Of course, science does carry authority, which is one reason why it is so often invoked in political debates. However, care must be taken not to place science or scientific institutions in a situation of direct confrontation with political forces, as politics will almost always win out.

For instance, the 2012 House of Lords report on chief scientific advisers at times leans too heavily on the capacity of science's 'essential characteristics' to check the excesses of politics.[22] The report recommends that scientific advisers sit outside the Civil Service, but have direct access to ministers at the prompting of the adviser; have a reserved seat on departmental boards; be allocated their own 'ring-fenced' budget; and have a say in how departmental funds for science are allocated.

However, the notion of a completely independent scientific adviser proved problematic when the Lords' report sought to grapple with situations when a science adviser disagreed with a ministerial policy decision. The proper answer to this question is the same as for any government employee - either quietly accept the decision, seek change from within, speak out and suffer the consequences, or perhaps resign. When science advisers see their role change from providing advice to playing a formal role in the making of decisions, the science adviser is no longer an independent adviser, but has entered the democratic process as an unaccountable decision maker. Following the Lords' advice would lead to more cases like that of David Nutt, rather than fewer.

Einstein was right: politics is more difficult than physics. Securing effective science advice depends upon creating effective institutions with clear mandates that integrate expertise into decision making. Democracy is best served by recognising that advisers advise and decision makers decide.

Parting thoughts

Writing in 1963, the philosopher Stephen Toulmin warned that, *"Unless decisions about science policy are to be left to be made by éminences grises, we shall need a corresponding body of independent informed opinions about the natural history of science…research on the intellectual foundation of scientific policy."*[23] The good news for science advisers in the 21st century is that there exists a rich and growing field of research on practical questions that lie at the intersection of expertise and decision making.

The UK has more than its fair share of this expertise, which I encourage you to take full advantage of during your tenure. These experts can provide you with much useful advice on advice. Just as there are calls for policymaking across government to be more evidence-based, so too should science and technology policy.

Good luck!

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Endnotes

1. Kupferschmidt, K. (2013) Europe's Science Superwoman Struggles to Get Off the Ground. 'Science.' 8 March 2013: Vol. 339 no. 6124 pp.1144-1147.
2. As quoted in Pielke, Jr., R. and Klein, R.A. (Eds.) (2010) 'Presidential Science Advisors.' New York: Springer.
3. Ibid.
4. See: http://www.presidency.ucsb.edu/ws/index.php?pid=12086
5. Weisner quoted in Pielke and Klein (2010).
6. See http://sciencepolicy.colorado.edu/scienceadvisers/david_transcript.html
7. House of Lords Select Committee on Science and Technology (2012) 'The Role And Functions Of Departmental Chief Scientific Advisers.' London: TSO.
8. Henderson, M. (2012) 'The Geek Manifesto: why science matters.' London: Bantam Press.
9. See: http://www.europarl.europa.eu/.../P7_RE(2012)007606_EN.doc
10. See for instance http://www.esajournals.org/doi/pdf/10.1890/090160
11. See: http://sciencepolicy.colorado.edu/scienceadvisers/hornig_transcript.html
12. As quoted in Pielke, Jr., R. and Klein, R.A. (Eds.) (2010) 'Presidential Science Advisors.' New York: Springer.
13. See: http://www.rsc.org/chemistryworld/News/2009/January/20010902.asp
14. See: http://sciencepolicy.colorado.edu/publications/special/psa/index.html
15. Writing in the 'Financial Times', Robert Shirmsley drew a different lesson, 'Killer equestrianism is obviously the new scourge of our society.' See http://www.ft.com/cms/s/0/3fe7434a-c9ab-11de-a071-00144feabdc0.html
16. As discussed here: http://rogerpielkejr.blogspot.com/2013/01/greek-tragedy.html
17. As discussed here: http://www.ostina.org/content/view/5928/1534/
18. As discussed here: http://rogerpielkejr.blogspot.com/2012/12/science-politics-and-hurricane.html
19. See http://www.compas.ox.ac.uk/publications/working-papers/wp-10-81/
20. As quoted in Pielke, Jr., R. (2007) 'The Honest Broker: Making Sense of Science in Policy and Politics.' Cambridge: Cambridge University Press.
21. As quoted in Pielke, Jr., R. and Klein, R.A. (Eds.) (2010) 'Presidential Science Advisors.' New York: Springer.
22. House of Lords Select Committee on Science and Technology (2012) 'The Role And Functions Of Departmental Chief Scientific Advisers.' London: TSO.
23. Toulmin, S. (1963) Towards a natural history of science. 'New Scientist.' 20(364):315-316.