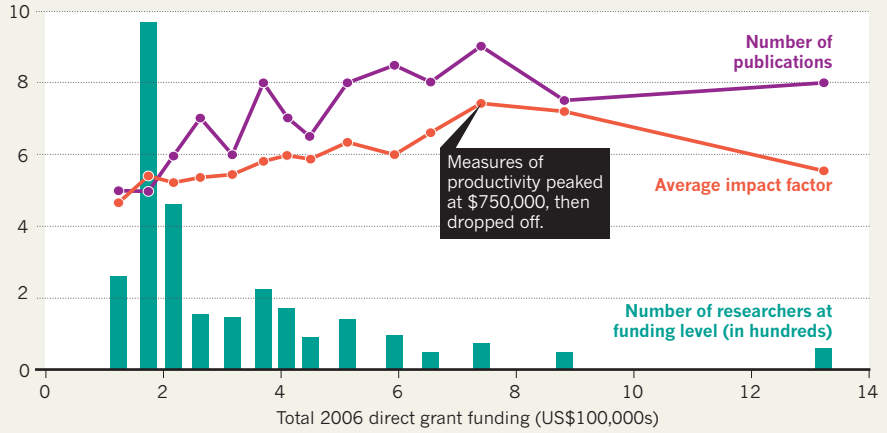
SOURCE: NIH

MERIT IN THE MIDDLE?

Plotting the median number of grant-linked publications (2007 to mid-2010) and median average journal impact factors against total US National Institutes of Health funding to investigators in 2006 shows the highest performance at medium funding levels.



METRICS

Study says middle sized labs do best

A comparison of funding level and output has captured attention at the US National Institutes of Health.

BY MEREDITH WADMAN

The director of one of the biggest institutes at the US National Institutes of Health (NIH) posted a blog entry that got tongues wagging this autumn. Jeremy Berg, who heads the National Institute of General Medical Sciences (NIGMS) in Bethesda, Maryland, had analysed the scientific productivity of nearly 3,000 researchers who were funded by grants from his institute in 2006. With the help of NIH data-mining experts, who have developed powerful tools for such studies, Berg was able to show, in hard numbers, what scientists could once only speculate about: the relationship between grant size and scientific productivity.

"Everything had come together so that it seemed possible to ask the questions I asked without it being a two-year project," says Berg.

His analysis plots the median number of publications between 2007 and mid-2010, and the median average impact factor of those publications, against total direct NIH funding in 2006. It covers 2,938 investigators, who were divided into 14 groups on the basis of their funding level.

The resulting plot (see chart) shows that both measures peaked at around US$750,000 in annual funding; at higher funding levels, the median publication number and average impact factor were both discernibly lower.

Berg says conventional wisdom has long held that, once a lab reaches a certain size, it becomes harder to manage and the average number of publications per dollar falls. But until now, he says, "no one actually had the data to put that in more quantitative terms". He hastens to add that the variation within funding levels is large. "Some people with $800,000 or $900,000 are publishing 40 or 50 papers over this time. It's important not to forget that the average behaviour is not the behaviour of everybody."

Berg's analysis comes at a time of increasing austerity for the US government, driven by a struggling economy and ballooning deficits. The push to trim costs is likely to gain strength come January, when spending-conscious Republicans will take control of the US House of Representatives, where funding bills are born. And political cost-cutters may increasingly turn to analyses such as Berg's to inform their decisions.

"Science is not an obvious first choice for the public. It could be regarded as a luxury during a time of recession. So there is a call for greater accountability and greater documentation of the impact and expenditure of public funds," says John Marburger, vice-president for research at the State University of New York, Stony Brook. As director of the White House Office of Science and Technology Policy under former president George W. Bush, Marburger pushed for more rational systems of developing and evaluating science policy. "Congress and the administration want to see something more than just our anecdotal success stories," adds John McGowan, deputy director for science management at the NIH's National Institute of Allergy and Infectious Diseases in Bethesda.

Analyses similar to Berg's are under way, but on a larger scale. The STAR METRICS (Science and Technology in America's Reinvestment — Measuring the Effects of Research on Innovation, Competitiveness and Science) project was launched in May and, led by the NIH and the US National Science Foundation, aims to develop measurements of the economic and social impacts of US research spending by linking data on federal grant recipients to outcomes such as publications, patents, citations and employment (see *Nature* **464,** 488–489; 2010). Meanwhile, McGowan and his team have developed e-SPA (electronic Scientific Portfolio Assistant), a computer tool for gauging productivity by linking NIH-funded investigators to measures including impact factor, citation number and patents applied for and published. e-SPA is now in use by about 1,000 NIH staff as they plan and evaluate their research portfolios and make close-call funding decisions on individual grants. And in 2006, the National Institute of Environmental Health Sciences in Research Triangle Park, North Carolina, launched SPIRES (Scientific Publication Information Retrieval and Evaluation System), an NIH-wide system that matches 275,000 NIH grants with publications going back to 1980.

Some are sceptical of such efforts. "There's no reason to think that just because there is productivity in an area of science it would be a predictor of social value," says Daniel Sarewitz, Washington DC-based co-director of the Consortium for Science, Policy and Outcomes at Arizona State University. "You can be productive on a question that's of great interest to scientists, but of no particular value in terms of application."

NIH

"It's important not to forget that the average behaviour is not the behaviour of everybody."
Jeremy Berg

Nonetheless, such analyses focus the attention of scientists competing for increasingly scarce dollars. For Dorothy Erie, an NIGMS-funded biochemist at the University of North Carolina in Chapel Hill, Berg's analysis tells an important story. "There's a very clear difference in productivity between those who are above

$225,000 and those who are below it," she says. "If you can only afford to hire two people, it's hard to be productive."

Berg stresses that the analysis is a conversation-starter, not a judgement to be applied mechanically. "If you just say, 'Based on your funding level, you should be publishing seven papers and you are only publishing four,' and one of those four is the discovery of RNA interference, that clearly would be the wrong way to think about things," he says.

Raphael Kopan, a developmental biologist and NIGMS grantee who this year ran his lab at Washington University in St Louis on $800,000, says that Berg should be applauded for trying to scientifically analyse what his institute gets for its investment. But without segregating the data — comparing, for instance, investigator-initiated grants with projects instigated by the NIGMS, or intramural with extramural investigators — "it may lead to the wrong conclusion — that scientists do best if their funds are limited and their labs are small. I don't think this is necessarily correct," says Kopan.

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Still, Berg's analysis has served a purpose: validating a 20-year-old NIGMS policy of generally denying new grants to well funded labs. Since 1999, that has meant labs with more than $750,000 in direct support from all sources, including the award being applied for.

Marburger says that Berg's analysis provides a "reality check" of that policy. The results, he says, are "an indication that they aren't making a big mistake".

Berg's next project will be to tackle the impact of the abbreviated grant-application forms that came into effect at the NIH in January. Among other things, he will be asking whether and how the slimmed-down form for the agency's mainstay grants is affecting the scores that applicants receive.

Whatever happens, the future is likely to bring more austerity, making it important for defenders of science agencies to arm themselves with the best quantitative ammunition they can generate. In this environment, questions such as Berg's "are very good to ask", says Kopan, who argues that Congress is already effectively cutting the NIH by failing to keep its budget growing as quickly as the costs of doing biomedical research. If cuts have to be made, he says, "we might as well go ahead and do it correctly". ■

FUNDING

UK science will be judged on impact

Pilot scheme paves way for university research to be awarded on the basis of society benefits.

BY NATASHA GILBERT

Research funding agencies have long dreamed of favouring scientists who have a track record of turning their work into tangible benefits for society and the economy. Attempts to judge 'impact' have been controversial, but the UK government thinks it has hit on a workable scheme. Last week, the Higher Education Funding Council for England (HEFCE) unveiled the results of a year-long pilot study that showed that using peer-review panels to assess the impact of research in UK universities is "workable" and "robust".

The idea of getting tangible returns from research funding aligns with the current coalition government's demands that researchers "do more for less", in the words of business secretary Vince Cable. With the success of the pilot study, the method looks set to become a key part of the nation's research audit system by 2014. This Research Excellence Framework (REF) will replace the Research Assessment Exercise (RAE), which did not factor research impact into its calculations, and will be used to apportion more than £1.5 billion (US$2.4 billion) per year. Research impact is expected to contribute up to 25% to the overall rating of a university department's research quality.

In the pilot study, university departments submitted case studies describing the impact of the work done by one in ten of their researchers over the past 17 years. Other academics and industry scientists on subject-specific panels reviewed the case studies, and awarded rankings from 4* (the best) to unclassified. Eleven physics departments and ten departments of clinical medicine and of Earth systems and environmental science took part in the exercise. 'Impacts' included the establishment of spin-out companies, influence on policy relating to the environment, or the development of products such as computer software or technology.

University projects with clear advantages for society, such as bumblebee conservation, will be cited to win funding.

IMAGEBROKER/FLPA

Many academics are concerned that the added focus on research impact would skew funding towards applied research. Jonathan Grant, president of RAND Europe, a research consultancy based in Cambridge, UK, wrote a report last year criticizing the REF, and argues that impact should determine only 10–20% of universities' funding to avoid channelling funds away from blue-skies research. However, the pilot's successful use of peer-review panels has convinced him that "if you are going to measure impact, this is the way to do it".

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HEFCE will unveil a final plan for the REF in February 2011, but universities say there are still some problems to be ironed out. Anna Grey, research manager at the University of York, UK, says that some of her university's industry partners were not happy to release the details it needed to demonstrate impact, such as financial savings made as a result of products developed by the university. "Unless we can prove to the companies that the information will remain confidential, we will struggle to get hard evidence of impact," she says.

And Peter Main, director of education and science at the Institute of Physics in London, worries that universities could pressure departments to continue research in fields that have generated impact in the past, "even when more future impact might be generated from new directions". ■