

Running a Research Program

What makes a research lab successful in the eyes of the University?

Running a Research Program

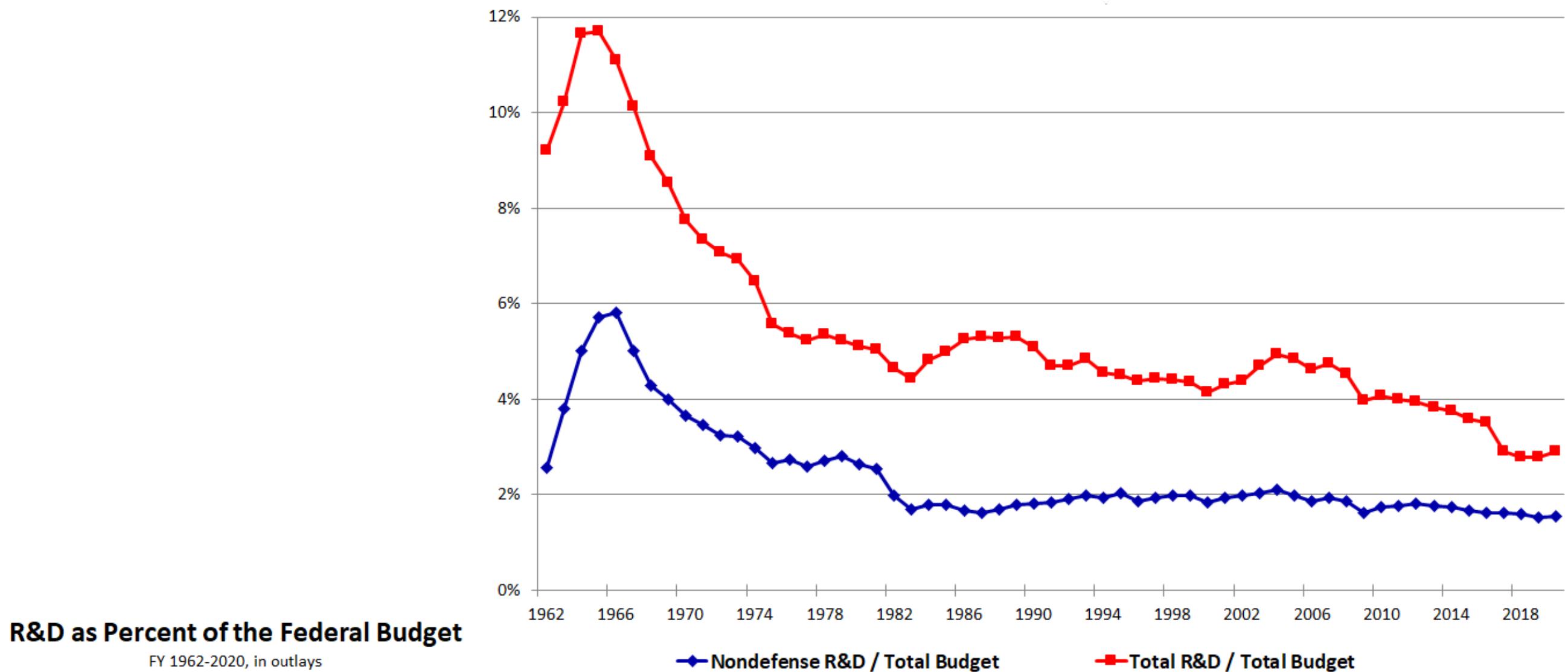
What makes a research lab successful in the eyes of the University?

1. bring money in
2. produce excellent work
3. build a great reputation



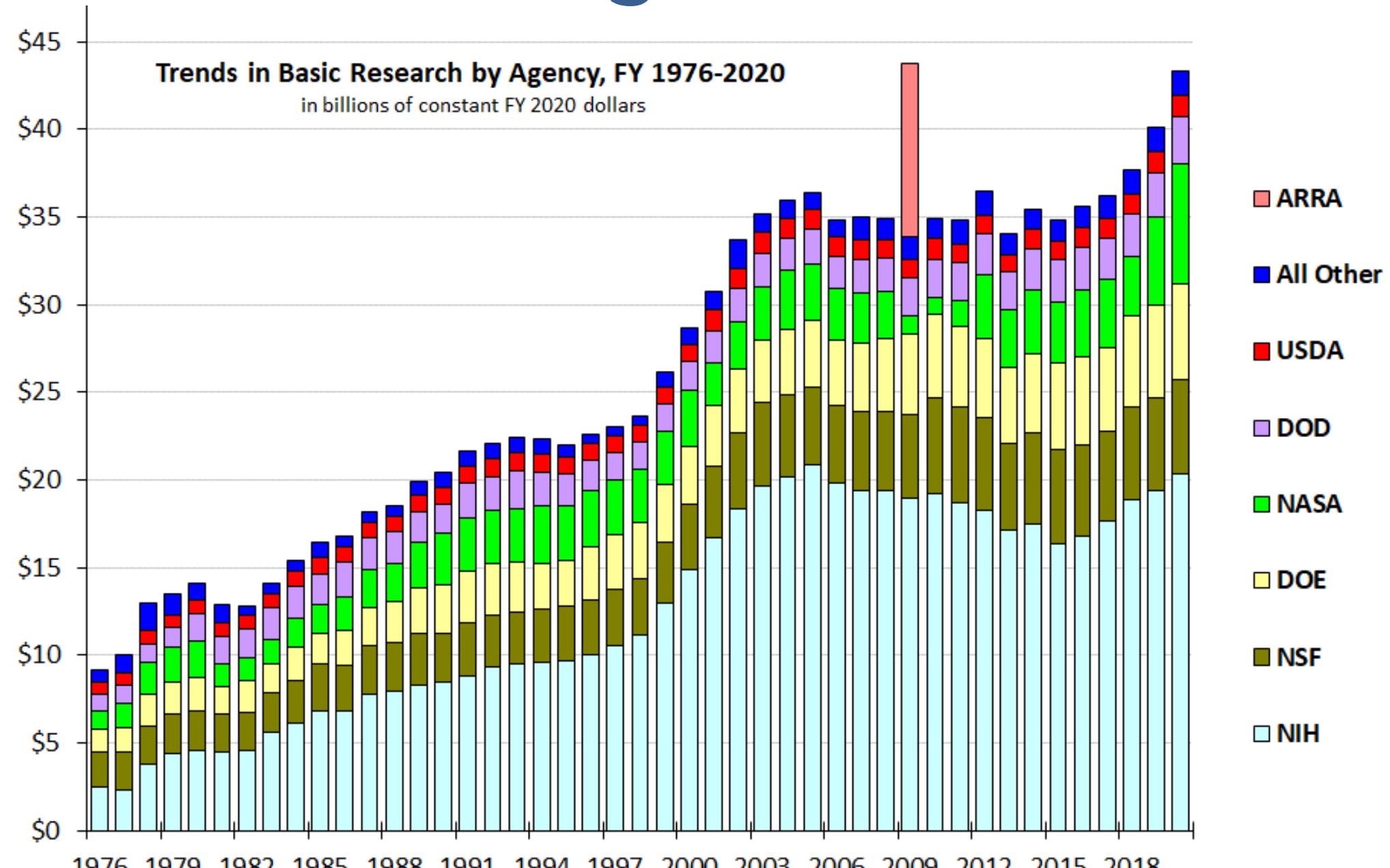
"I think I can make you very happy if I can get funded."

Running a Research Program



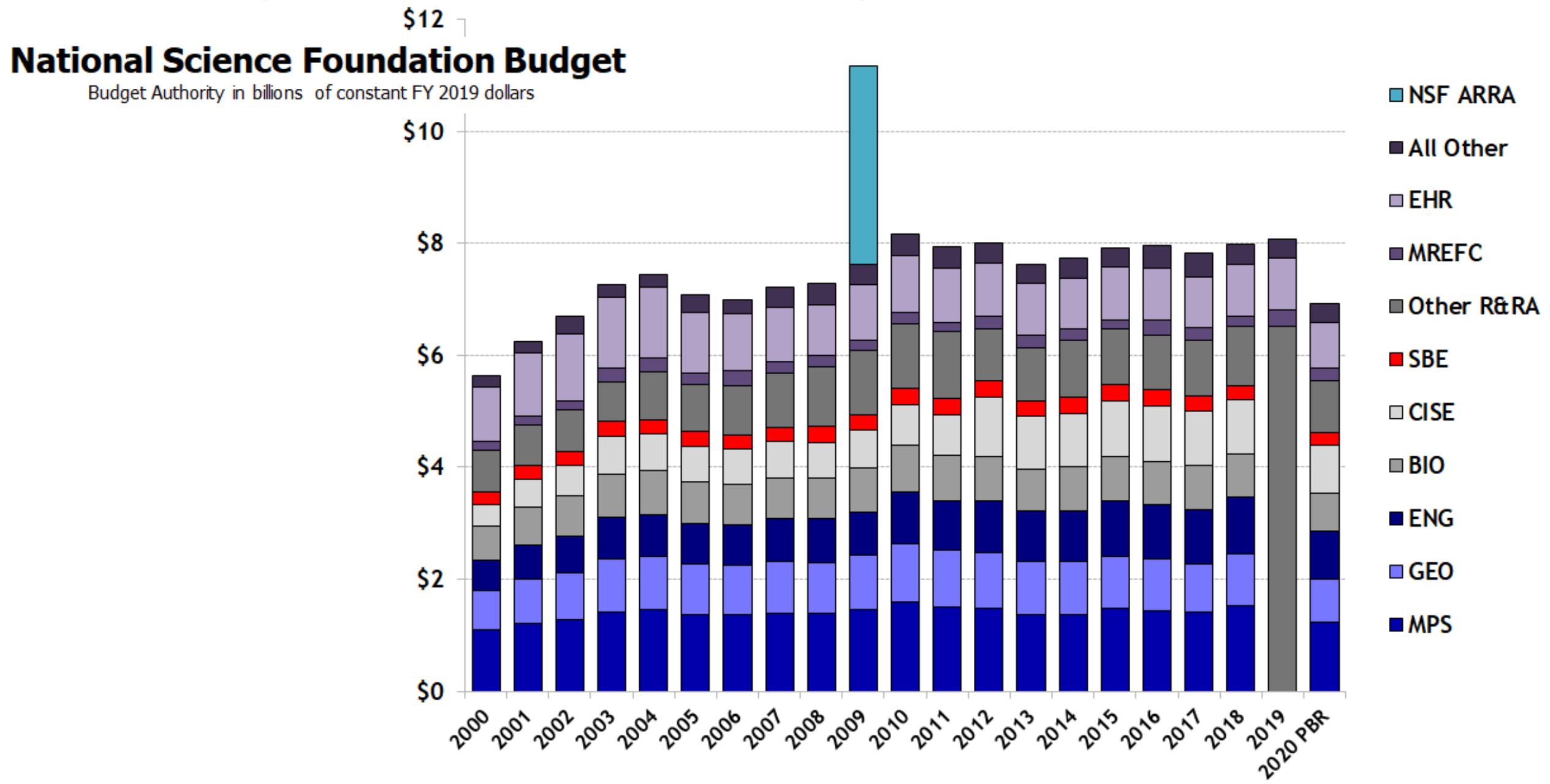
FY 2020 figures do not include emergency COVID-19 appropriations.
Beginning in FY 2017, federal agencies have revised what they consider R&D. Late-stage development, testing, and evaluation programs, primarily within the Defense Department, are no longer counted as R&D.
Based on data from the *Budget of the U.S. Government FY 2021 Historical Tables*. © 2020 AAAS

Running a Research Program



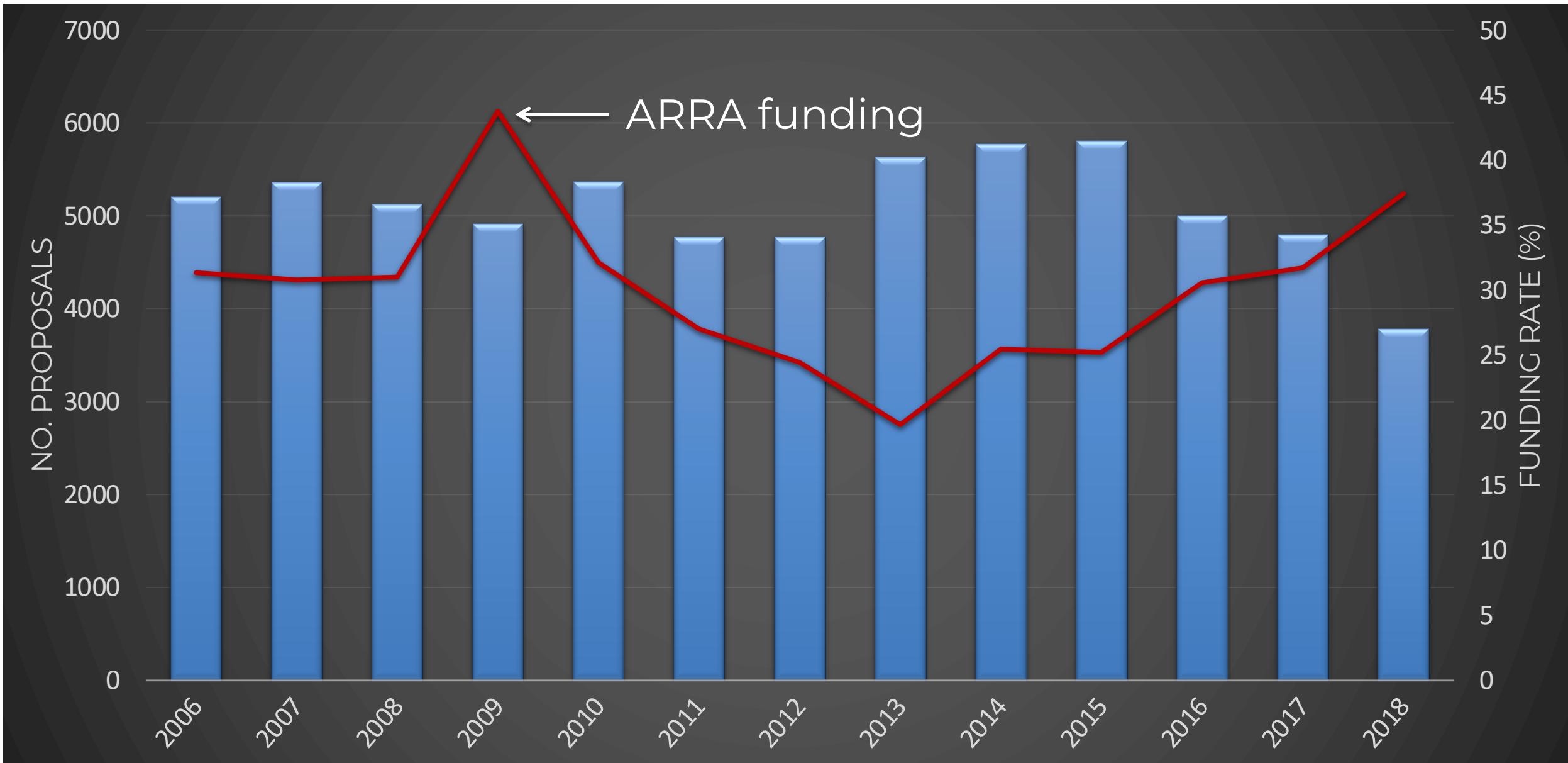
Based on AAAS analyses of OMB and agency budget documents and data. FY 2020 figures do not contain emergency COVID-19 R&D. © 2020 AAAS

Running a Research Program



Note: Directorate-level spending figures for FY 2019 are not yet available. Source: Historical NSF budget data. © 2019 AAAS

NSF's GEO program funding data

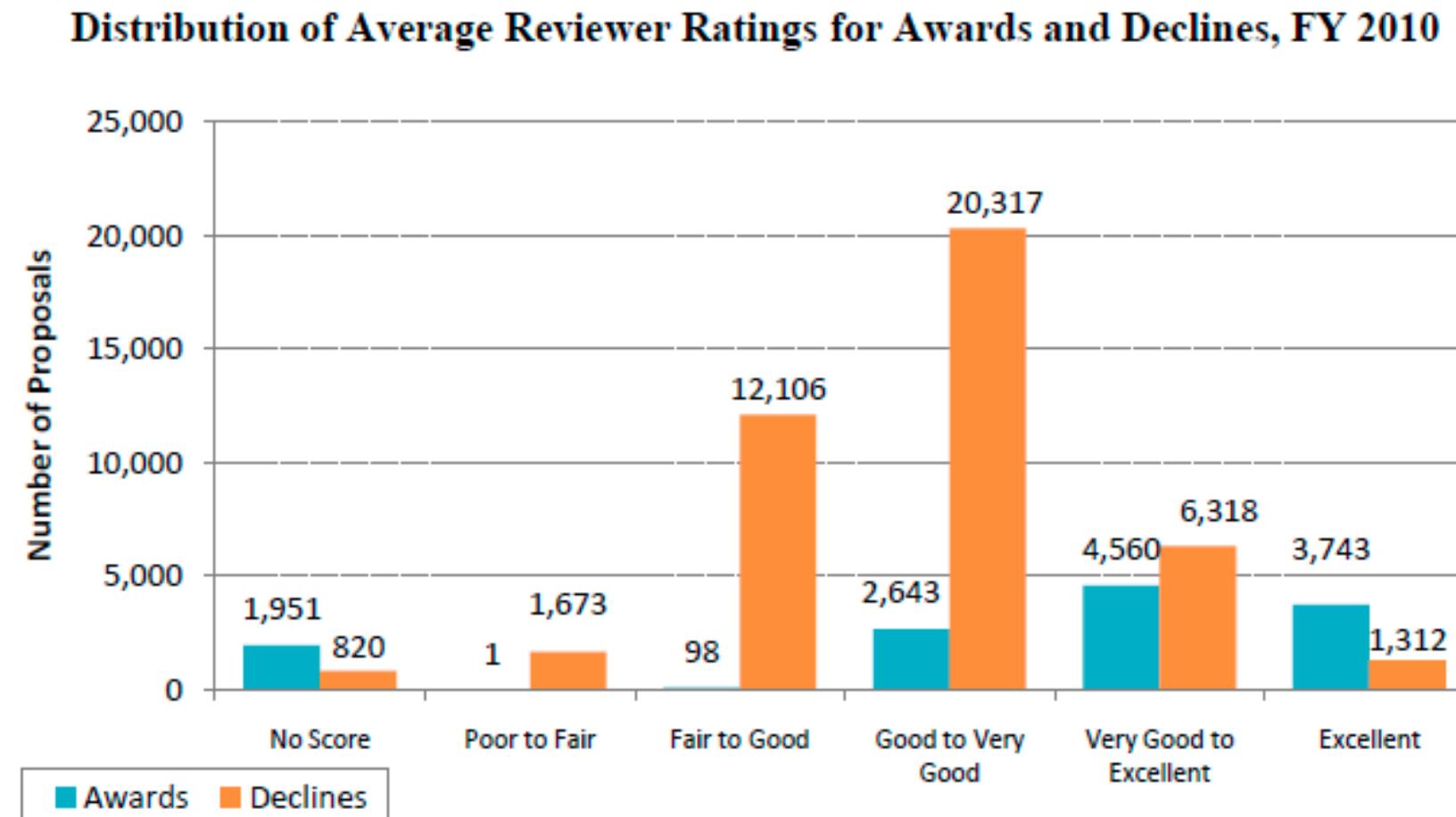


<http://dellweb.bfa.nsf.gov/awdfr3/default.asp>

Writing Winning Proposals

Propose to do less, but better

- it is better to have a well written/justified proposal on a more focused topic than a badly-written proposal on an awesome idea



Source: NSF Enterprise Information System 10/01/10.

Writing Winning Proposals

Get to the point quickly:

- Most panelists will spend maybe one hour reading (re. skimming) your proposal
- Put your hypotheses/questions on page 2/3
- Use bold font or bullets to capture the readers attention

Writing Winning Proposals

Hit the solicitation

- some may be generic, but always try to target exactly what the solicitation is requesting, including budget
- if in doubt, chat with the program officer or ask to serve on a panel to get the experience of seeing what it's like to make decisions

Writing Winning Proposals

Never forget broader impacts

- NSF takes this part of proposals very seriously, leaving it out would be a showstopper
- think beyond the ‘normal’ activities of a professor

Writing Winning Proposals

Take advantage of special opportunities

- Packard Fellowship
- NSF CAREER/NASA and DOE New Investigator
- Internal opportunities
- HHMI Professorships
- Private foundations
- Local state funding?
- National Geographic Society
- student funding opportunities

Running a Research Program

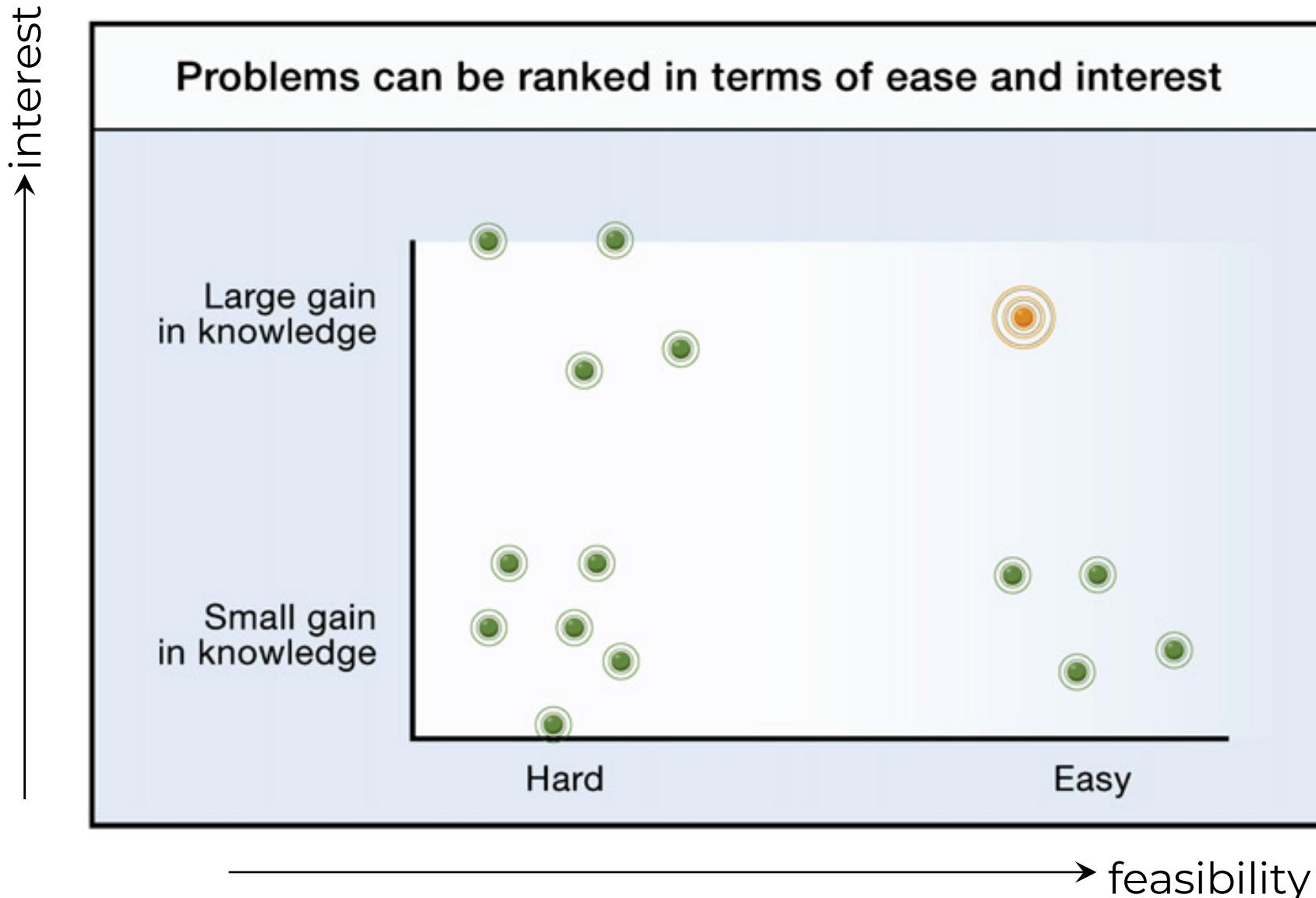
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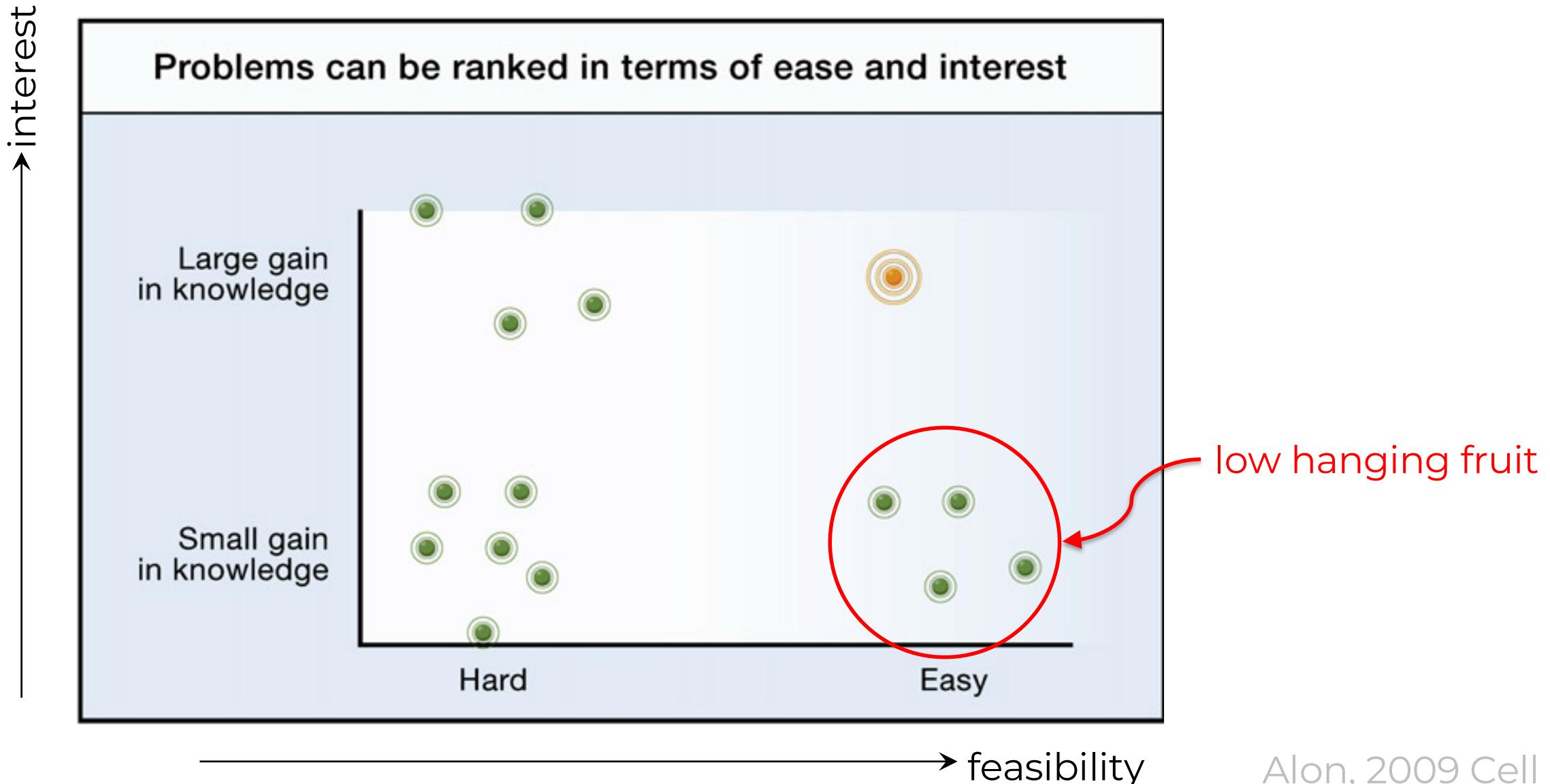
"I think I can make you very happy if I can get funded."

How to have good ideas

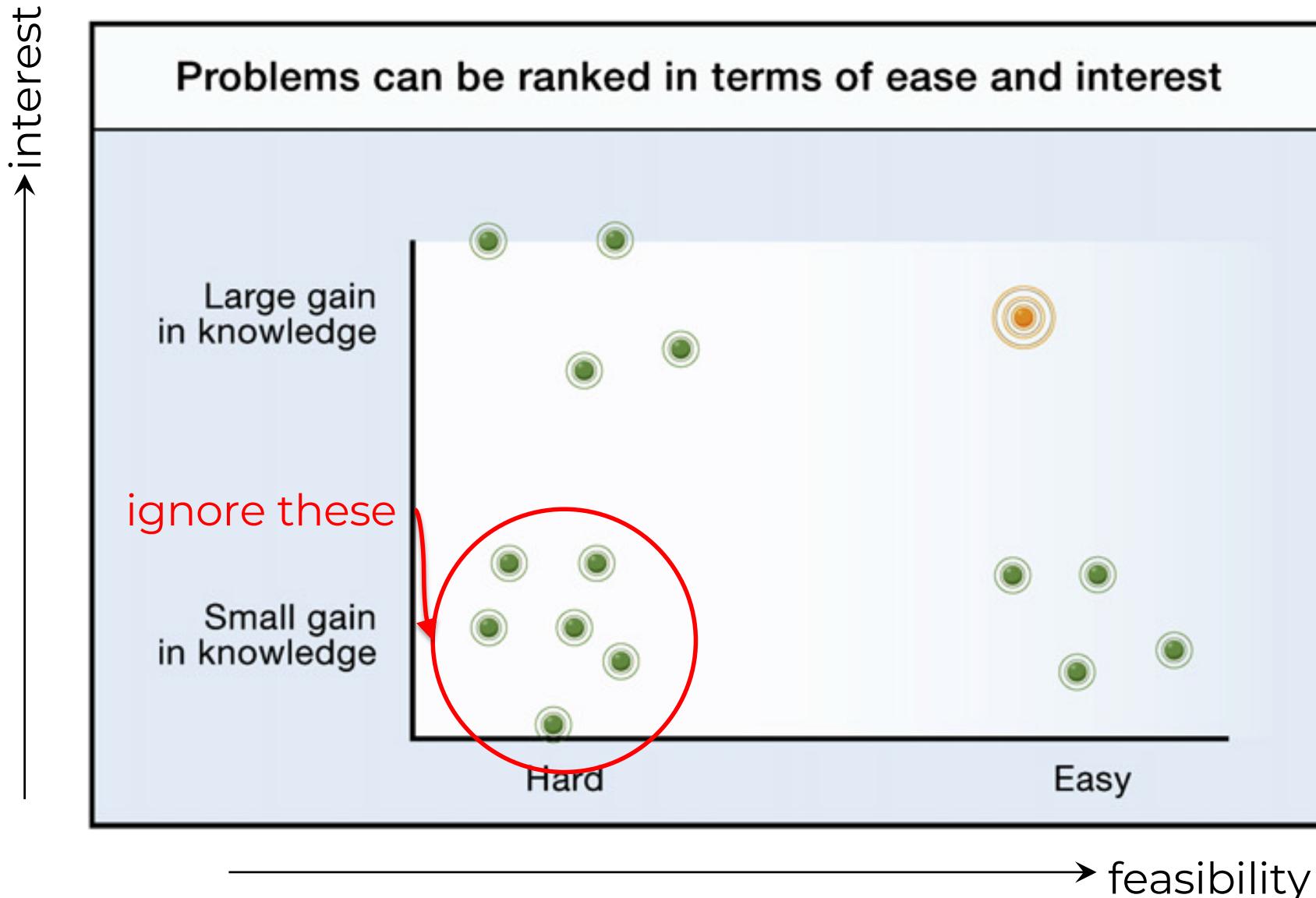


Alon, 2009 Cell

How to have good ideas

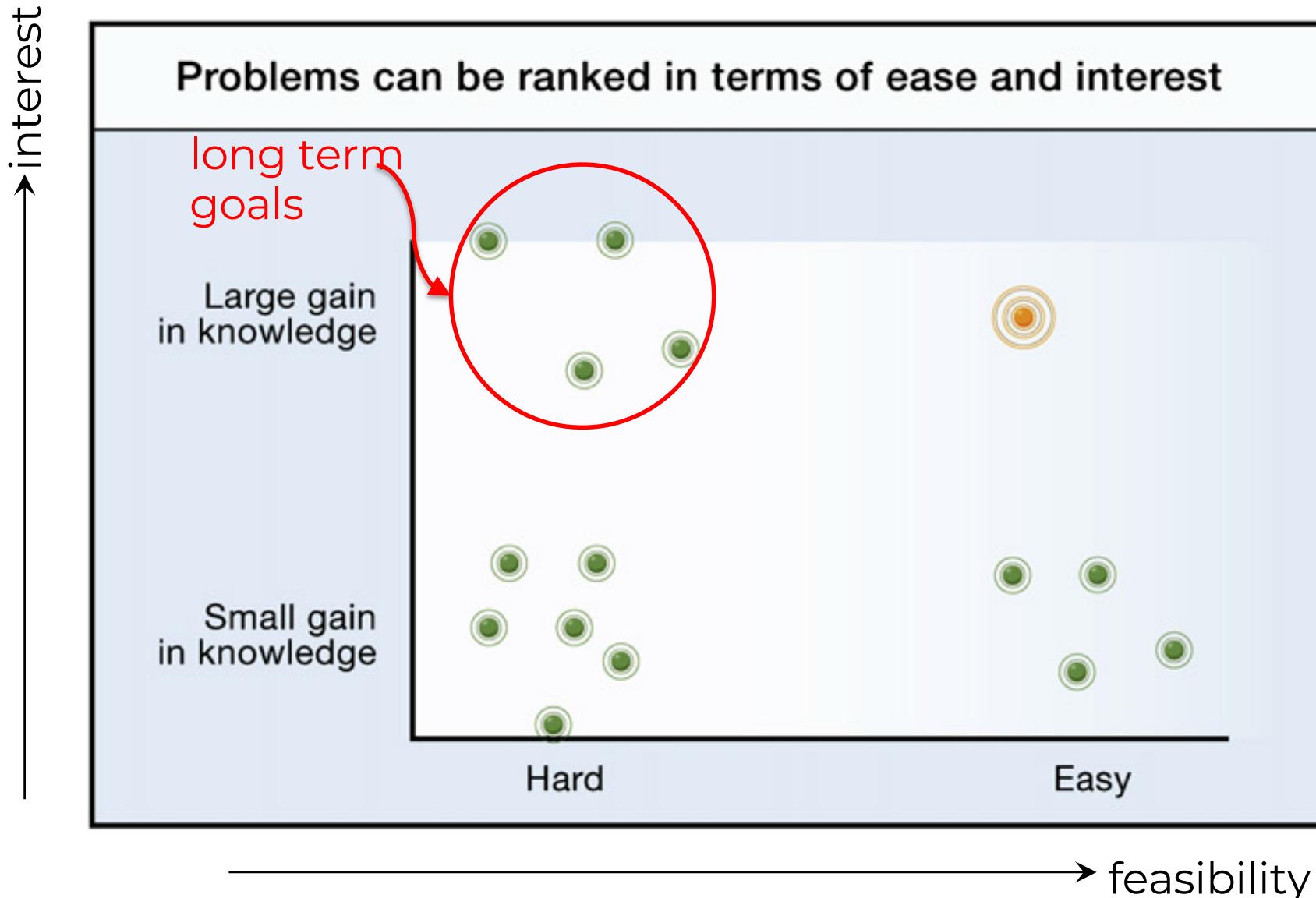


How to have good ideas

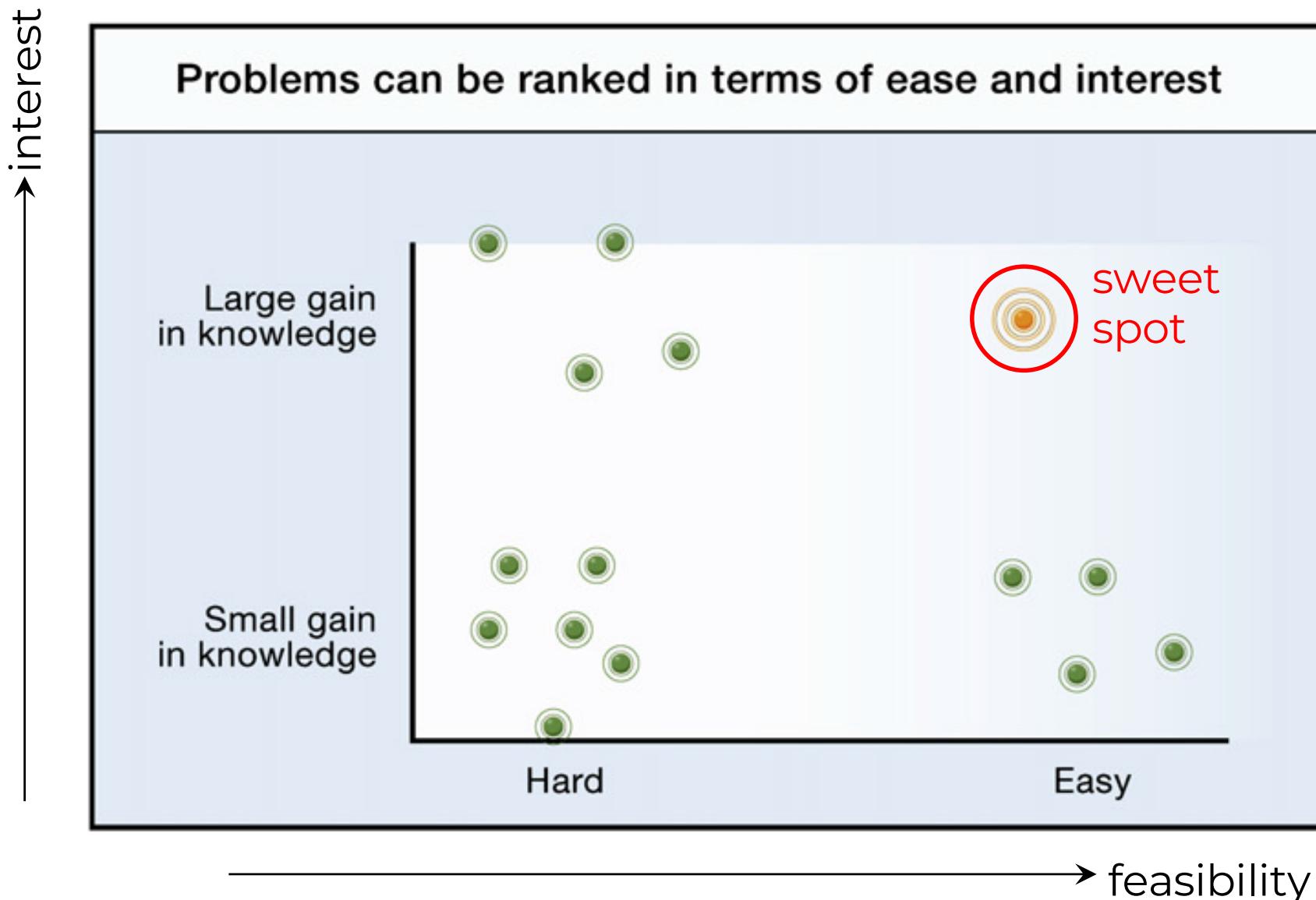


Alon, 2009 Cell

How to have good ideas

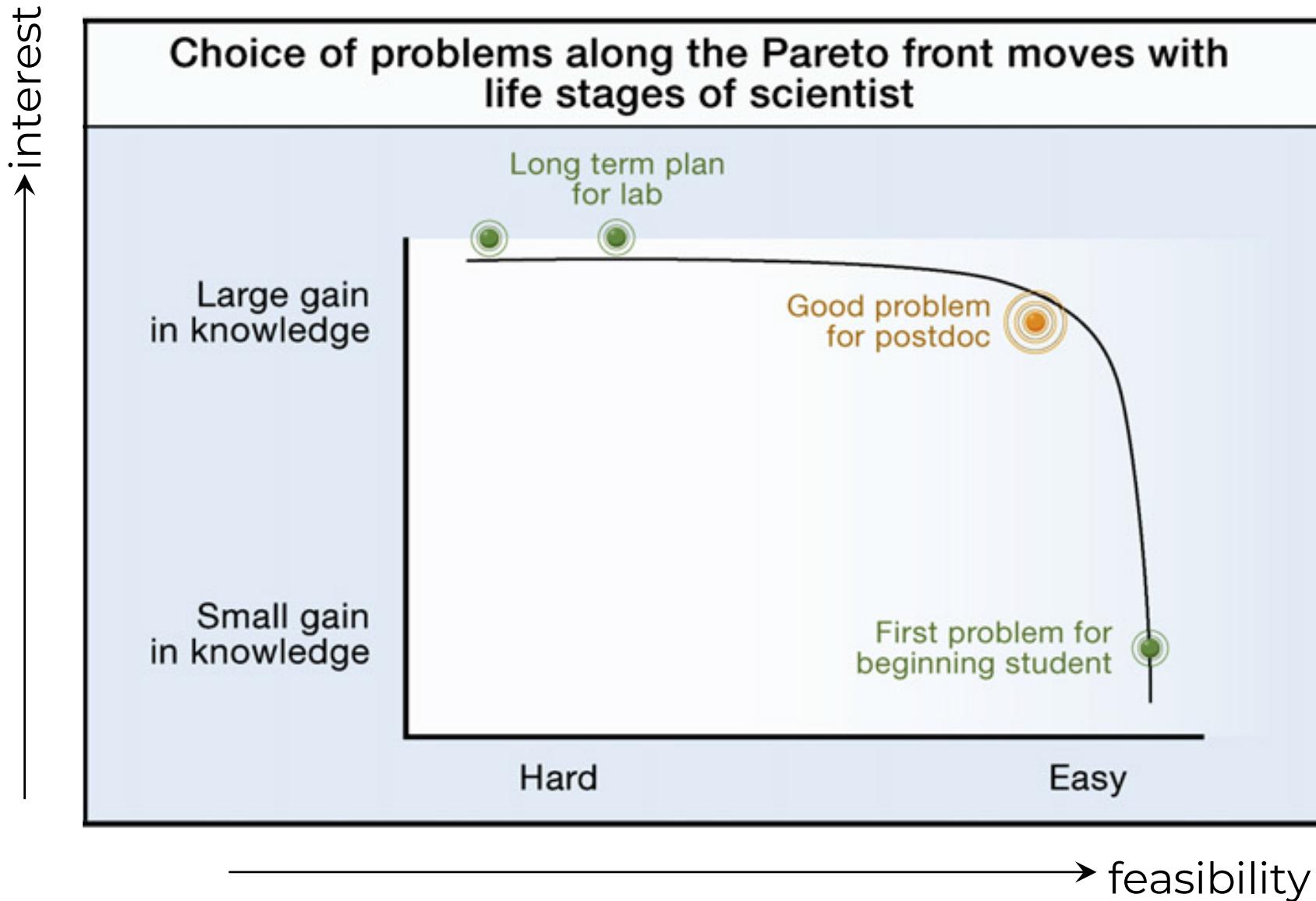


How to have good ideas



Alon, 2009 Cell

How to have good ideas



Alon, 2009 Cell

How to have good ideas

What makes an idea good?

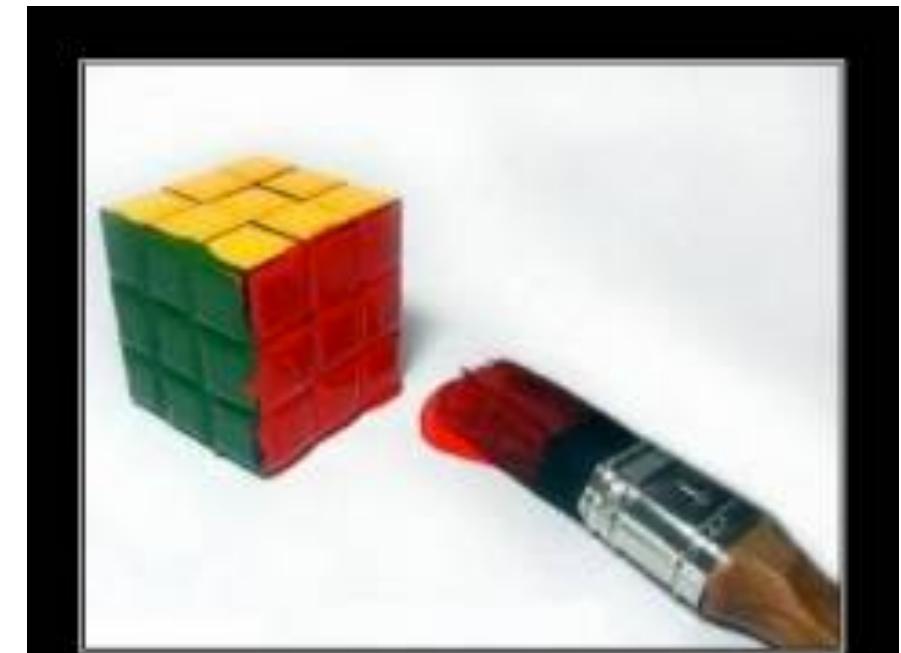
- solves a *longstanding open research problem* or *resolves a controversy*
 - problems can be difficult, but they must have solutions
 - the solution presented in a paper should represent an advance beyond the previous body of knowledge

LETTER

doi:10.1038/nature12534

Recent global-warming hiatus tied to equatorial Pacific surface cooling

Yu Kosaka¹ & Shang-Ping Xie^{1,2,3}



Even The Most Difficult Problems
can have simple solutions

How to have good ideas

What makes an idea good?

- *provides a paradigm shift*
 - defines a new field or direction
 - uncovers an important process or understanding
 - provides fundamental revisions to our framework of understanding

JOURNAL OF GEOPHYSICAL RESEARCH, VOL. 115, F03026, doi:10.1029/2009JF001522, 2010

Ocean regulation hypothesis for glacier dynamics in southeast Greenland and implications for ice sheet mass changes

T. Murray,¹ K. Scharrer,¹ T. D. James,¹ S. R. Dye,² E. Hanna,³ A. D. Booth,¹ N. Selmes,¹ A. Luckman,¹ A. L. C. Hughes,¹ S. Cook,¹ and P. Huybrechts⁴

Received 9 September 2009; revised 31 March 2010; accepted 5 April 2010; published 19 August 2010.

[1] Synchronous acceleration and thinning of southeast (SE) Greenland glaciers during the early 2000s was the main contributor that resulted in the doubling of annual discharge from the ice sheet. We show that this acceleration was followed by a synchronized and

How to have good ideas

What makes an idea good?

- Is a fundamental discovery
 - new data, techniques, process....

nature

Vol 459 | 4 June 2009 | doi:10.1038/nature08024

LETTERS

The Gamburtsev mountains and the origin and early evolution of the Antarctic Ice Sheet

Sun Bo¹, Martin J. Siegert², Simon M. Mudd², David Sugden², Shuji Fujita³, Cui Xiangbin¹, Jiang Yunyun¹, Tang Xueyuan¹ & Li Yuansheng¹

How to have good ideas

What makes an idea good?

- *Is an important quantification*
 - something relevant to a large community of scholars

LETTER

doi:10.1038/nature10847

Recent contributions of glaciers and ice caps to sea level rise

Thomas Jacob^{1†}, John Wahr¹, W. Tad Pfeffer^{2,3} & Sean Swenson⁴

Cultivating your Research Taste

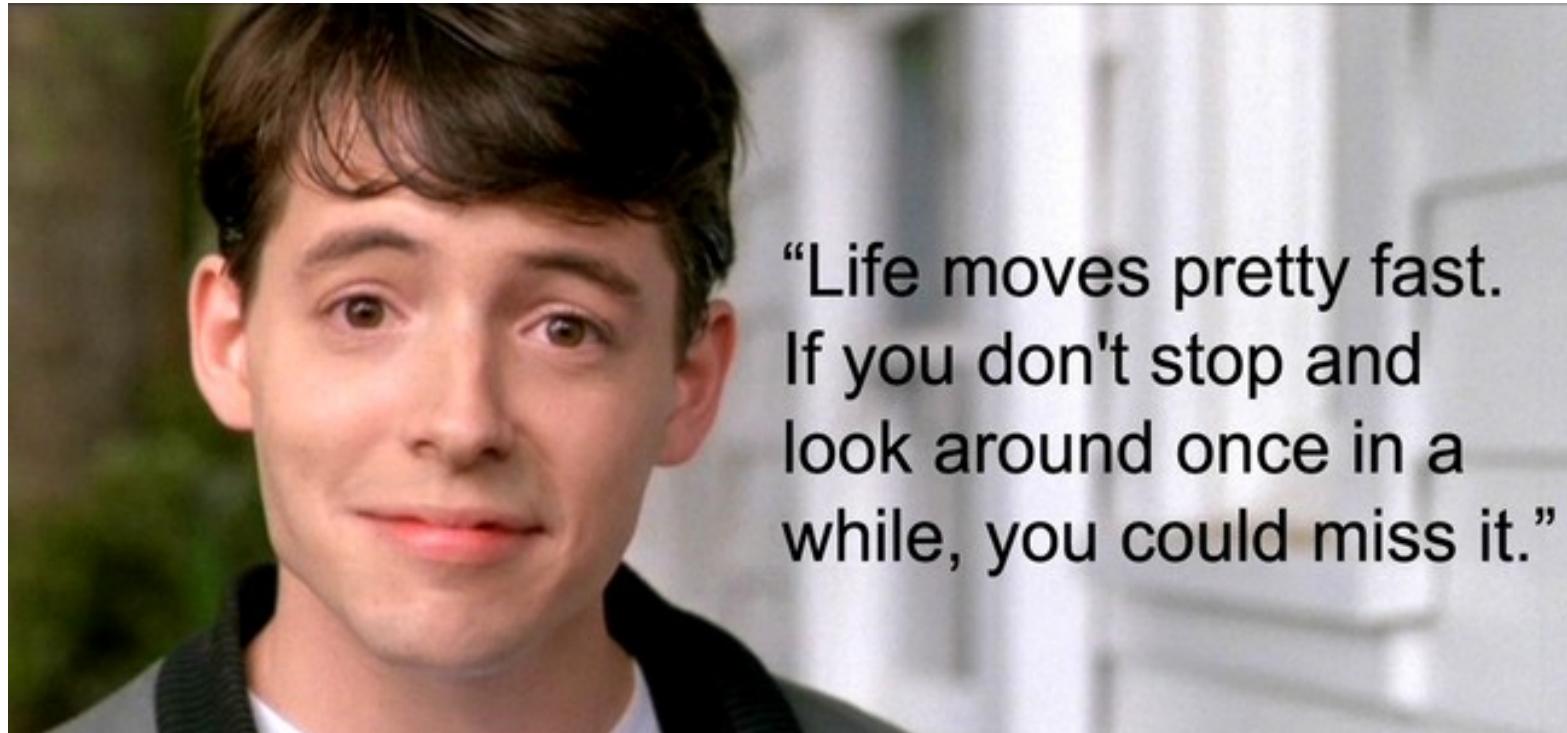
- science is ultimately a creative pursuit
- while some creativity is innate, it can also be cultivated



Cultivating your Research Taste

create downtime

- some ideas come when the conscious mind is busy doing something like cooking, brushing your teeth, meditation or exercise
- create meeting-free Fridays
- spend time each week outside of your office



“Life moves pretty fast.
If you don't stop and
look around once in a
while, you could miss it.”

Cultivating your Research Taste

collaborate with abandon

- just as you have friends with good taste in music, food etc. seek out others with good taste in research
- Invite them to come talk in your dept./collaborate/or just brainstorm
- improvising with others is a good way to turn off the error checking part of your brain and allows ideas to come forward
- allows you to work at the interface between disciplines

Cultivating your Research Taste

collaborate with abandon

- go to meetings to attend talks but also to meet with other researchers – these are often the places where ideas are seeded through conversations with colleagues you don't normally see day-to-day
- you'll find that near the end of your PhD/start of postdoc that conferences shift from being a place "where you gain knowledge of the current understanding of the field" to "where you get ideas"
- seeing what colleagues are doing at other institutions leads to connection to things done at your own institution

Cultivating your Research Taste

tinker with ideas

- Sample and experiment with abandon: just like with food...you don't know if you like something until you try it
- start with an impossible wish for answering a problem and then add reality by coming up with workable, practical substitutes or ways to approach the problem
- question assumptions – list the ones you have about your current work and then choose some to use as a springboard for creating new ideas
- Keep a journal of ideas that you like and exchange your favorites with colleagues

Cultivating your Research Taste

know what's being done

- Read conference proceedings (or session titles) for the most important meetings in your field
- learn about the latest (topical, technical etc.) trends, even if you don't resonate with them – and develop opinions about them
- When you read papers, dig deeper to understand the value that reviewers might have seen in a particular paper (look beyond the flaws)
- review the award abstracts database to see what NSF has funded previously



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US(5845)

Award Amount

Less than or equal \$50,000(358)

Between \$50,001 - \$100,000(566)

Between \$100,001 - \$500,000(3561)

Between \$500,001 - \$1,000,000(953)

More than \$1,000,000(438)

Award Instrument

Standard Grant(3532)

Continuing Grant(2104)

Cooperative Agreement(101)

Interagency Agreement(21)

Contract(3)

Fellowship(91)

Contract Interagency Agreement(24)

Collaborative Research: The Behavior of Sulfur During Magma Mixing and Implications for Magma Degassing and Ore Formation

Award Number:1707615; Principal Investigator:Philipp Ruprecht; Co-Principal Investigator:; Organization:Board of Regents, NSHE, obo University of Nevada, Reno; NSF Organization:EAR Start Date:12/01/2016; Award Amount:\$34,114.00; Relevance:48.0;

CAREER: Drought Predictability and the Role of Land-Atmosphere Interactions in the U.S. Great Plains

Award Number:1056796; Principal Investigator:Steven Quiring; Co-Principal Investigator:; Organization:Texas A&M Research Foundation; NSF Organization:AGS Start Date:03/15/2011; Award Amount:\$570,575.00; Relevance:48.0;

Collaborative Research: Improved Regional and Decadal Predictions of the Carbon Cycle

Award Number:1049033; Principal Investigator:Natalie Mahowald; Co-Principal Investigator:Robert Ross, Peter Hess, Christine Shoemaker; Organization:Cornell University; NSF Organization:AGS Start Date:04/01/2011; Award Amount:\$1,064,047.00; Relevance:48.0;

Collaborative Research: Reactive Chlorine Cycling in Marine Air

Award Number:1347520; Principal Investigator:Saewung Kim; Co-Principal Investigator:; Organization:University of California-Irvine; NSF Organization:AGS Start Date:01/01/2015; Award Amount:\$345,041.00; Relevance:48.0;

COLLABORATIVE RESEARCH - Earth-Life Transitions: Integrated Data-Model Analysis of CO2-Climate-Vegetation Feedbacks in a Dynamic Paleo-Icehouse

Award Number:1338281; Principal Investigator:Isabel Montanez; Co-Principal Investigator:Jenny McElwain, William Dimichele; Organization:University of California-Davis; NSF Organization:EAR Start Date:01/01/2014; Award Amount:\$593,033.00; Relevance:48.0;

Dimensions: Collaborative Research: Bacterial Taxa that Control Sulfur Flux from the Ocean to the Atmosphere

Award Number:1342694; Principal Investigator:Mary Ann Moran; Co-Principal Investigator:William Whitman; Organization:University of Georgia Research Foundation Inc; NSF Organization:OCE Start Date:01/01/2014; Award Amount:\$1,359,955.00; Relevance:48.0;

A Nested Multi-Scale Hydrological Modeling Framework: Assessing Resilience and Vulnerability to Climate Change

Award Number:1316536; Principal Investigator:Amir AghaKouchak; Co-Principal Investigator:; Organization:University of California-Irvine; NSF Organization:EAR Start Date:08/15/2013; Award Amount:\$225,000.00; Relevance:48.0;

CAREER: Quantification of Ionosphere-Thermosphere System Drivers, State Parameters, and Fundamental Coupling Mechanisms

Award Number:1454839; Principal Investigator:Lara Waldrop; Co-Principal Investigator:; Organization:University of Illinois at Urbana-Champaign; NSF Organization:AGS Start Date:09/01/2015; Award Amount:\$195,312.00; Relevance:48.0;

Collaborative Research EaSM-3: Local and Remote Regional Climate Responses to Regional Forcings from Short-Lived Climate Forcers

Award Number:1419398; Principal Investigator:Arlene Fiore; Co-Principal Investigator:Shindell Drew; Organization:Columbia University; NSF Organization:AGS Start Date:10/01/2014; Award Amount:\$870,000.00; Relevance:48.0;

Cultivating your Research Taste

get out of your comfort zone

- expertise is creativity stifling
- look for the blind spots in your discipline or peripheral disciplines
- think about how your approach/knowledge can be applied (with novelty) to other sub-disciplines
- don't become a one-trick-pony with one technique or idea that you defend for life
- find novices – they often have a completely different perspective than more established people
 - this is exactly the point of having a research group – you don't bring in people who will be clones of yourself, but those who will push you to work on new areas that rely on your collective knowledge/expertise
- expose yourself to new experiences: dept. seminars outside of your research; chatting with colleagues outside your discipline

Cultivating your Research Taste

teach

- Teaching forces you to master the existing body of knowledge – the first step needed prior to creating new knowledge
- teaching encourages us to think about the long road, the big picture and what really matters about a field
- provides great justification for exploring how your work intersects with that of others on the edges of your field

Cultivating your Research Taste

Exercise: Write a few sentences that describes the overarching goal of your research in the context of your lab website at your new home institution

- think about what drives you scientifically
- what technique/approach/topic do you want to be defined by?
- think about what is known and unknown in your field
- think about the scientists or results that you admire the most



WHAT DRIVES ICE SHEET CHANGE?
HOW DO WE REDUCE UNCERTAINTY IN PREDICTIONS OF SEA-LEVEL RISE?
WHAT IMPACTS DO CHANGES IN ICE SHEETS HAVE ON OTHER NATURAL SYSTEMS?

Our group works on understanding ice sheet and glacier changes that arise from both natural and forced variability. Our approach is observation-driven and aimed at unravelling the physical processes that control ice motion. We use a suite of techniques to pursue these goals including ground-based geophysical techniques, remote-sensing observations and numerical models.

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"I think I can make you very happy if I can get funded."

Becoming known

Be patient

- fundamentally, you need to put your head down and do good work to be recognized
- everyone famous in your field started off being a student
- when you have a big result, work with your university press folks to publicize the results with a press release

Becoming known

Build your portfolio

- cultivate your research website
- update your GoogleScholar, ResearchGate
- use social media to demonstrate your voice
- apply for awards and fellowships – ask people to nominate you
- ask people to invite you for talks and keynotes

Becoming known

Consider your interactions with others

- be someone people want to work with
- you can be an asshole when you're colossally brilliant, but for now you cannot be a jerk and still have a good reputation
- put in the time to do a good job with reviews of grant applications and manuscripts
- cultivate a positive online presence where you can publicize your own work and your take on other papers