Funding Early-Career Scientists: Best Practices and Research Questions

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Why should we care about funding early career (EC) scientists?

- Growing interest in early careers = PhD, post-doc, and early tenure track stages

- “Graying” of the scientific workforce
  - decline in birth rates and the end of mandatory retirement
  - burden of knowledge and increasing age at first RO1

- Impact on the future of knowledge production
  - Funding for EC could change age distribution of researchers

Why should we care about funding early career (EC) scientists?

- EC stage may be more fragile
  - May be the most effective time to encourage people to remain in science
- EC scientists' research interests and methodologies may be most malleable
  - funding might be a particularly effective way to promote research on new ideas and new fields.
- Possibly less concern about crowd-out
  - If we are currently below optimal funding levels at EC stage

Why should private foundations care about funding EC scientists?

- Increasingly important source of funding for science

- Private funding organizations are relatively free to experiment with different approaches to grant making
  - Funders have data on both applicants and recipients – making it possible to analyze success of grants

- Unique opportunity for researchers and funders to evaluate foundation grant programs
  - Which approaches have been most successful in furthering funders' objectives and contributing to the progress of science?

Tradeoffs associated with funding EC scientists: early vs. late selection

- May improve scientific outcomes by providing early career researchers potentially at the peak of their creativity with more autonomy

- Alternatively, allow competitive environment of EC to sort out best researchers

- Predictors of success at EC stage are noisy
  - it may take many years before it is clear which researchers and which research programs are most and least likely to produce important results.
  - aspects of scientific pedigree that are unrelated to the fundamental quality of the researchers or research programs themselves will matter more during early careers than they will after information revelation has occurred.

Why evaluate? Why consider design tradeoffs?

- Programs may have unintended effects that are unseen unless measures are defined to evaluate progress towards objectives

- Fields medal awarded by International Congress of Mathematicians (ICM) to mathematicians under 40:
  - Fields wanted to encourage further contributions in pure math
  - It instead increases recipients' propensity to explore applied fields

- How might Fields have avoided this outcome?
  - Defining objective measure of success, e.g. publications in pure math as opposed to applied fields
  - Evaluation of progress towards this goal would have alerted ICM to divergence of program's impact from its goals at an earlier stage
  - Post-award management of grants could have brought straying mathematicians back into the fold
  - Evaluation of the program would have allowed them to re-engineer it to better meet its goals

There are many design choices and relatively little empirical evidence…most are open questions

- Application process
  - Breadth: Targeted vs Broad
  - Competition from other funders: Crowded vs. “White Space”
  - Career stage: undergraduate, grad school, postdoc, young faculty?
  - Minimum fundable unit: EC scientist vs mentor-mentee pairs
  - Talent search: Solicited vs open application
- Selection process
  - Selection of evaluators: traditional vs non-traditional criteria
  - Aggregation of opinion: average vs. variance
  - Deliberation: face to face or decentralized
  - Cutoffs: rigid vs. soft
- Post-award management
  - Renewal: pure prize vs. incentive program
  - Depth of ongoing feedback; individual vs. community
  - Autonomy: Active vs. passive management

Application Phase Tradeoffs: Breadth vs. Depth

- No obviously correct choice
- When broad scope makes sense
  - Role of uncertainty & scale
  - Piggyback on evaluation done elsewhere (e.g. NSF)
  - Nomination (e.g. MacArthur)
- Challenges of breadth most acute at evaluation phase
  - But comparisons across fields are challenging, especially at the EC stage
  - Mobilizing evaluator expertise is challenging with broad spectrum funding programs
- Targeted approaches
  - Set program goals
  - Select “best” applicants

Application Phase Tradeoffs

- Minimum fundable unit
  - One could fund the EC scientist, or her mentor, of the mentor/mentee pair

- Focusing on the EC scientist:
  - autonomy and bargaining power
  - reduced investments from the mentor?
  - No evidence to date on the impact of funding “portability”
- Funding the mentor (as in a training grant):
  - Holds mentors accountable for the quality of the training
  - Loss of EC autonomy

Selection Phase Tradeoffs: metrics for summarizing evaluators' opinions

- Aggregating evaluator sentiment
  - The traditional metric is an average
  - Does not incorporate the intensity of sentiment and how it varies across evaluators
  - Might diversity of opinion be itself a marker of creative potential?

- Gates foundation issues reviewers a limited supply of "gold stars."
  - In theory, all proposals with one gold star get funded
  - One could also issue evaluators a limited number of "rotten tomatoes"

- What discretion to give program administrators to overrule evaluators' opinions?
  - Are they better informed ("see the whole deck"?)
  - How to hold them accountable for the exercise of discretion?

Selection Phase Tradeoffs: Using numeric scores with cut-offs for funding

- Where do evaluators add value?
  - Distinguishing meritorious applicants from those with little or no potential?
  - Distinguishing between fine gradations among applicants with high potential?

- If the former, then it would make sense to use evaluators to determine the pool of finalists, and then decide on the winners by lottery
  - Additional benefit of introducing randomization: makes robust evaluation possible

- If the latter, then a single score in the context of a fixed award pool can provide a path to evaluation

Post-award management Tradeoffs: renewals

- Pure prize or incentive program?
  - Obviously depends on the funder's objective
  - In practice: is there a renewal? Or are the awards phased?
- Incentive programs (e.g., HHMI) are costlier to manage, but provide a lever for the funder to influence the direction of scientific effort
- Also can enable funders to deepen their financial commitment for the more "successful" grantees
  - But can backfire if the funder only has noisy proxy for success
  - Works better if "success" is clearly defined and observable

Post-award management Tradeoffs

- Active vs. Passive management
  - Pertains to funder involvement in scientific choices of the awardee
  - Hands-off vs. hands-on regarding choice of collaborators' choice of topics, milestones, with appropriate ongoing monitoring and possible early termination
  - How relevant for EC funding (where mentors may be the active managers)?

- Link to evaluation: what to measure to allow funders to evaluate progress toward their objectives?
  - Publications? Citations? Patents? Commercialization?
  - Choose carefully because "you get what you measure"

Evaluation

- The grant process itself generates data about applications, grants and outcomes that, if collected and managed appropriately, can provide insights to help improve the performance of the grants.

- Grant applications should be designed with future evaluation in mind, so that the information supplied by applicants can be used for data analysis.
  - Measuring outcomes
  - Tracking non-recipients
  - Randomization