



BIO FY'10 Experiments in Innovation

A Presentation to the BIO Advisory Committee
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Joanne Tornow, Jane Silverthorne,
Parag Chitnis, Bette Loiselle



*“If you always do
what you always did,
you’ll always get
what you always got.”*

Unknown author



Experiments in Innovation

- ▶ Ideas Labs
- ▶ “Craig’s List” wiki for facilitating new collaborations between tool builders and end users
- ▶ “Big Pitch” blind review
- ▶ “Grade-free” panel review
- ▶ Total FY’10 BIO investment: ~\$18.5 million



What is the Ideas Lab Concept?

Inputs: Grand Challenge Topic, Creative People, Money



Creative Environment: "Ideas Lab"



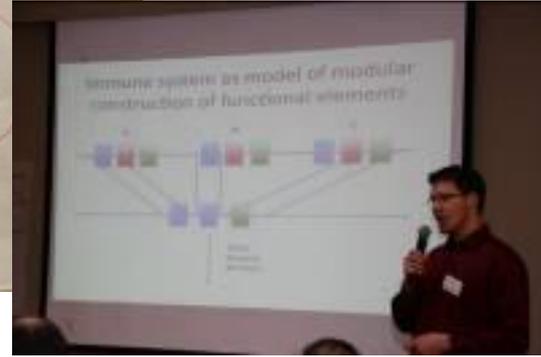
Outputs: Potentially Transformative, Novel,
Adventurous, Innovative, Interdisciplinary Ideas
"Wow Factor"



Interact



Clarify



Ideate

Develop

Implement

Five day facilitated residential sandpit

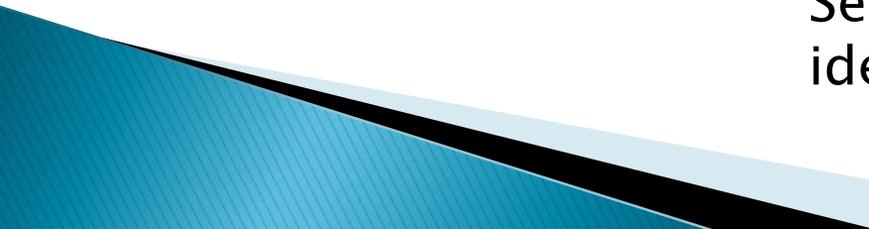


2 months

Submit full proposals

Real time peer review

Select project ideas





Innovations in Biological Imaging and Visualization Ideas Lab

- ▶ Collaboration between DBI, MCB, and DEB
- ▶ Goal: Advance the state-of-the-art in biological image analysis, data visualization, archiving, and dissemination
- ▶ 25 participants selected from ~160 applicants
- ▶ Ideas Lab held at Airlie House (VA) in late May
- ▶ Seven project ideas generated, five invited back as full proposals (received July 15)
- ▶ Three projects recommended for funding



IBIV Awards

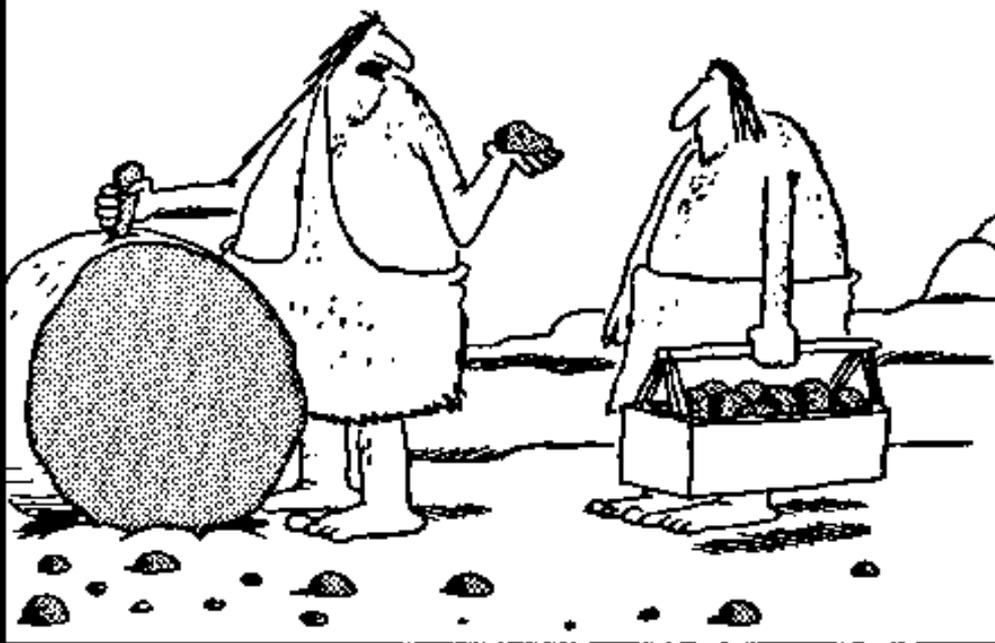
- ▶ Biological Shape Spaces: Transforming Shape into Knowledge
- ▶ Q-STORM: Switchable Quantum Dots and Adaptive Optics for Super-Resolution Imaging
- ▶ ImageQuest: Citizens Advancing Biology with Calibrated Imaging and Validated Analysis



Surpassing Evolution: Transformative Approaches to Enhance the Efficiency of Photosynthesis Ideas Lab

- ▶ Collaboration between MCB, IOS, and the BBSRC (UK)
- ▶ Goal: Engender fresh thinking and approaches that can be brought to bear on the long-standing problem of increasing efficiency of photosynthesis.
- ▶ 28 participants selected from ~120 applicants
- ▶ Ideas Lab held at Asilomar (CA) in mid-September
- ▶ Eight project ideas developed, four invited back as full proposals (due November 1)
- ▶ Solicitation also invited regular proposals from community; offers an opportunity for qualitative comparison of project ideas developed within and outside of Ideas Lab

Lawson



**“So what’s this? I asked for a *hammer*!
A hammer! *This* is a crescent wrench! ...
Well, maybe it’s a hammer. ... Damn these stone
tools.”**

“TOOLS” Report

BIO AC Meeting
Boulder, CO
October 2010



What We Did And Why We Did It

▶ What:

- Issued a DCL encouraging collaborations of tools developers with potential end-users in IOS-supported areas of science *via* a wiki
- Encouraged RAPIDS and EAGERS resulting from the wiki-mediated interactions

▶ Why:

- To foster better communication address current IOS gaps and needs
- To stimulate innovative ideas for the future





Wiki Data

- ▶ 552 PIs registered on the wiki
 - 49 users
 - 48 developers
 - 8 both
- ▶ 57 projects were explored in a preliminary way
- ▶ 40 proposal submission inquiries were received
- ▶ 25 proposals were encouraged
 - 19 of the PIs were registered on the wiki
- ▶ 20 proposals were received



Funding

- ▶ Proposals were reviewed by Program Directors in each receiving cluster
- ▶ 17/20 proposals received were in the funding range
- ▶ \$1 million each initially allocated by IOS and EF
- ▶ 9 projects (all EAGERs) were recommended for funding
- ▶ Total funding: \$2,621,421



Funded Projects

Proposal ID	PI Name	Institution	Title	Recommended Budget	Cluster
1035960 1035975	Albers Young	Georgia State University Emory University	Collaborative Research: Neurogenetics of Social Behavior	\$299,716	NSC
1045243 1045257	Crandall Oakley	Brigham-Young University UC Santa Barbara	Collaborative Research: Developing genomic tools for integrative biology research	\$300,000	NSC
1046863	Mahaffey	North Carolina State University	Targeting protein function <i>in vivo</i> using Small Interfering Proteins (SIPs)	\$298,054	DSC
1045226	Rosenthal	Texas A&M Research Foundation	Enabling Partnerships to Enable Science (TOOLS): anyFish: a user-friendly software package for creating realistic animations for animal behavior	\$300,000	BSC
1045256	Chory	Salk Institute	Quantifying Small Molecules in Cells of Live Organisms	\$300,000	PSS
1045185	Frommer	Carnegie Institution Stanford	EAGER: A microfluidic platform for accelerated construction of nanosensors for high-resolution analysis of hormone levels in vivo	\$299,651	PSS
1048133	Buie	MIT	Culturing the Uncultured: Custom Microfluidic Systems for Growth and Isolation of Environmental Microbes	\$299,999	PSS
1045314	Palanivelu	University of Arizona	Interdisciplinary Collaborative Research: A high throughput, quantitative analysis of Arabidopsis pollen tube guidance using a novel microsystem-based assay	\$299,997	DSC
1045239	Shin	University of North Carolina Charlotte	Collaborative Research: Towards Real-time, High throughput Insect Behavior Analysis	\$223,825	BSC



What Worked



- ▶ The wiki was a useful forum for community discussion and consensus building
- ▶ The wiki facilitated new collaborations
- ▶ A significant need for new tools was expressed
- ▶ Program Directors could cherry pick novel project ideas from the discussions and encourage those proposals that would address portfolio needs



What Didn't Work



- ▶ Policy restrictions did not allow us to capture the collaborations that were directed to happen off-line
- ▶ The wiki needs to be more structured:
 - The lack of topic headings made it difficult to extract information without having to scroll through a lot of comments
 - Users *versus* developers were not identified and addition of a button for this would greatly assist analysis
 - Additional plug-ins would assist with data analysis





Context: Current NSF Merit Review

- ▶ Proposal length
 - 15 page project description
 - 1 page of summary
 - Up to 5+3 pages (budget + budget justification)
 - 2 X n pages biographical sketches
 - n pages of references
- ▶ Results
 - Increased workload on the PIs and reviewers
 - Big picture often left out from the proposal
 - Reliance on details
 - Preliminary data
 - Experimental plan
 - Implicit bias
 - PI
 - Institution





THE BIG PITCH

Why?

- ▶ Does a framework addressing big questions of societal importance, such as climate change, help the PI in the merit review process?
- ▶ Will panels be more receptive to transformative ideas if they are presented with 2-page 'big pitch' summaries that do not include preliminary results, budget, and PI/institution information?



How?

Experiment Outline

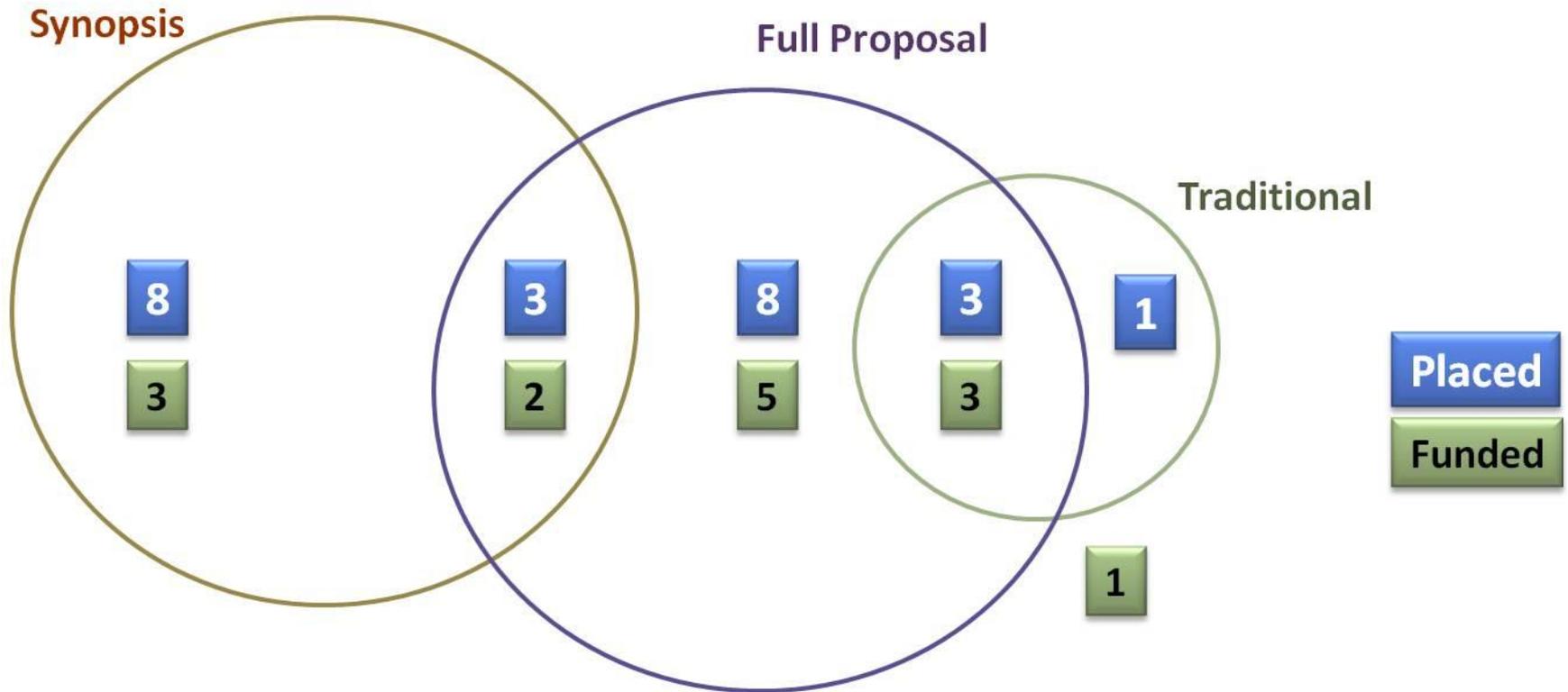
- ▶ 50 proposals relevant to Climate Change
- ▶ Three reviews –
 - CORE Disciplinary Panels
 - Experimental Review Panels
 - FULL proposal
 - 2–page SYNOPSIS proposal
- ▶ Outside influences minimized for the experimental panels
 - No *ad hoc* reviews
 - Firewall
 - Independent decisions – core vs. experimental



Funding Outcomes

- ▶ Program Decisions based on Traditional Panels
 - 7 projects funded
- ▶ Experiment Decisions
 - Primarily based on the input by the synopsis panel
 - 7 projects funded
- ▶ Overall
 - 14 projects (19 proposals funded)
 - 30% funding rate
 - 4.6M from innovation funds

High Priority Proposals



Different sets of proposals were considered 'high priority' by the panels.



Quantitative Conclusions

- ▶ Weak correlation between:
 - Panel ratings for the Synopsis and Full proposals ($r^2 = 0.2$)
 - Rankings by panelists from the Synopsis and Full Proposal panels ($r^2 = 0.1$)
- ▶ Detailed analysis needed
 - What is the variance for the rating of a proposal?
 - How did PI and institution characteristics influence the panel decisions?



Qualitative Conclusions

▶ Panel discussions

- The panel reviewing the SYNOPSIS proposals focused on the significance and potential impact
- The SYNOPSIS panelists were familiar with a greater number of the proposals and thus participated in most discussions
- The SYNOPSIS panelists felt that more detail (1–2 pages) was needed in some (but not all) cases.

▶ Panel Outcomes

- Synopsis panelists were equally confident in the outcomes as the full proposal panelists
- There was some overlap between the two panels when marking the proposals as transformative or high priority or both.



What is next?

- ▶ Analysis will be completed
 - Impact of other factors in the proposals
- ▶ Experiment needs to be repeated
 - Additional data needed
- ▶ Award outcomes need to be evaluated after a few years to examine the effectiveness of the synopsis as the sole source of information

Synopsis panel mechanism could be expanded in a modified format for improving the review process and for reducing workload on PIs, reviewers, and NSF staff



Grade-free Panel: Innovation activity run by DBI & DEB

Premise: NSF Merit Review Process fosters conservatism in funding decisions



Grade-free Panel

- ▶ What aspects of the peer review system might foster conservatism in decisions?
 - Requiring reviews to give a single score to a proposal
 - Requiring panelists to reach consensus in recommending a proposal

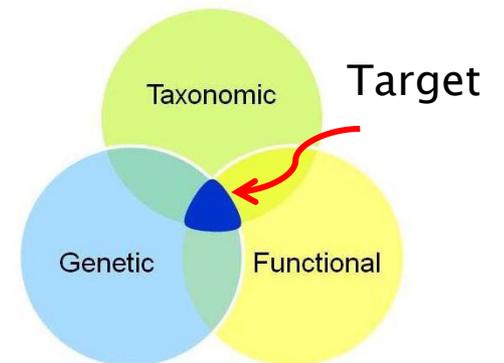


Grade-free Panel

Question: Does the use of scores and panel recommendation categories by panelists influence the perceived intrinsic worth (intellectual merit + broader impacts) of a proposal and subsequent funding recommendations?

Experimental design: A random subset of 30 proposals submitted to the Dimensions of Biodiversity solicitation reviewed by a second panel where:

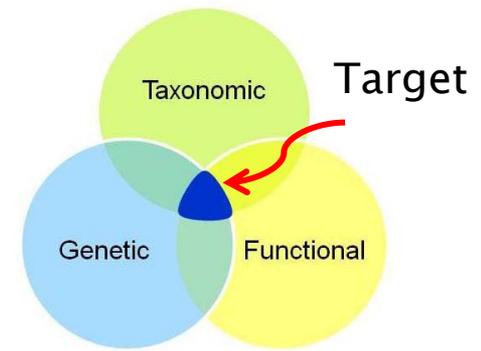
1. Panelists give no scores, but simply review strengths and weaknesses of each proposal
2. No consensus recommendation from panelists



Dimensions of Biodiversity



Grade-free Panel: Innovation Box



Dimensions of Biodiversity

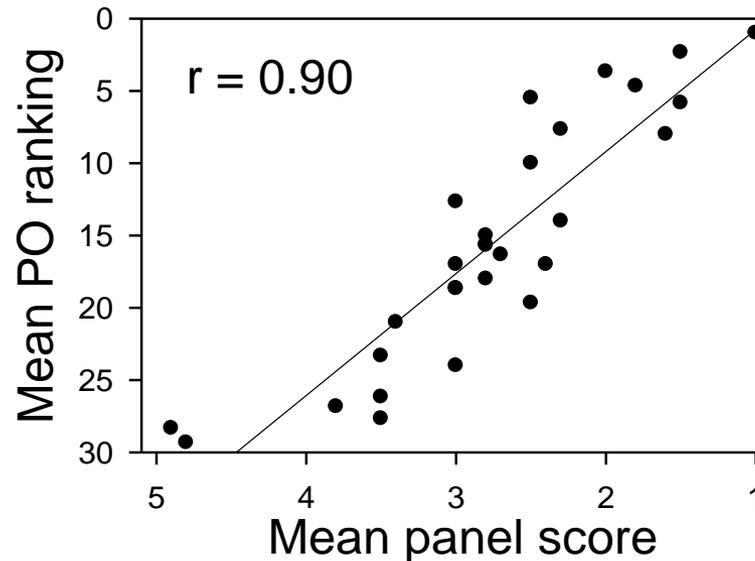
	Grade-Free Panel Fund	Grade-Free Panel Do Not Fund
Regular Panel Fund	A	C
Regular Panel Do Not Fund	B (innovation box)	D



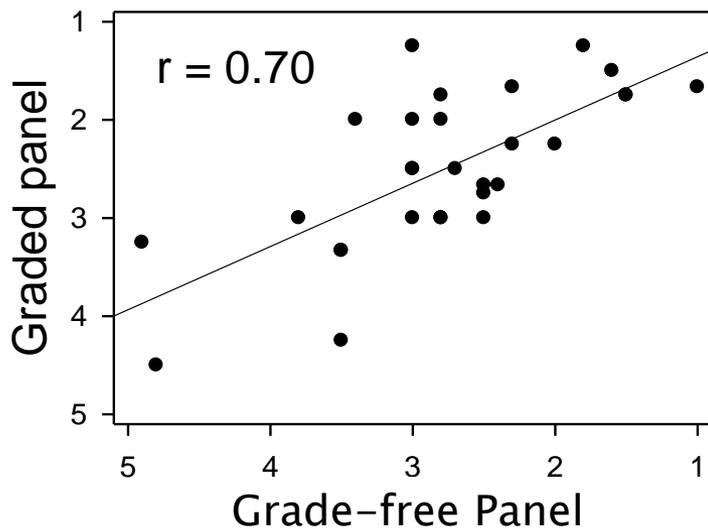
Grade-free Panel: Results

Program officers' rankings closely matched panelists' rankings

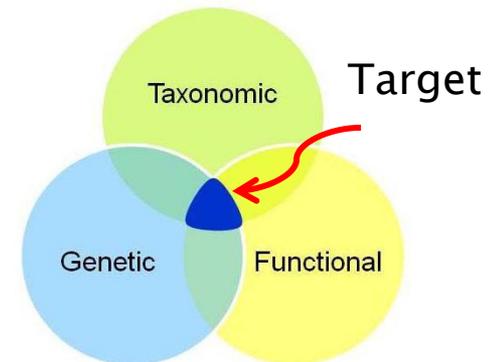
Grade-free Panel



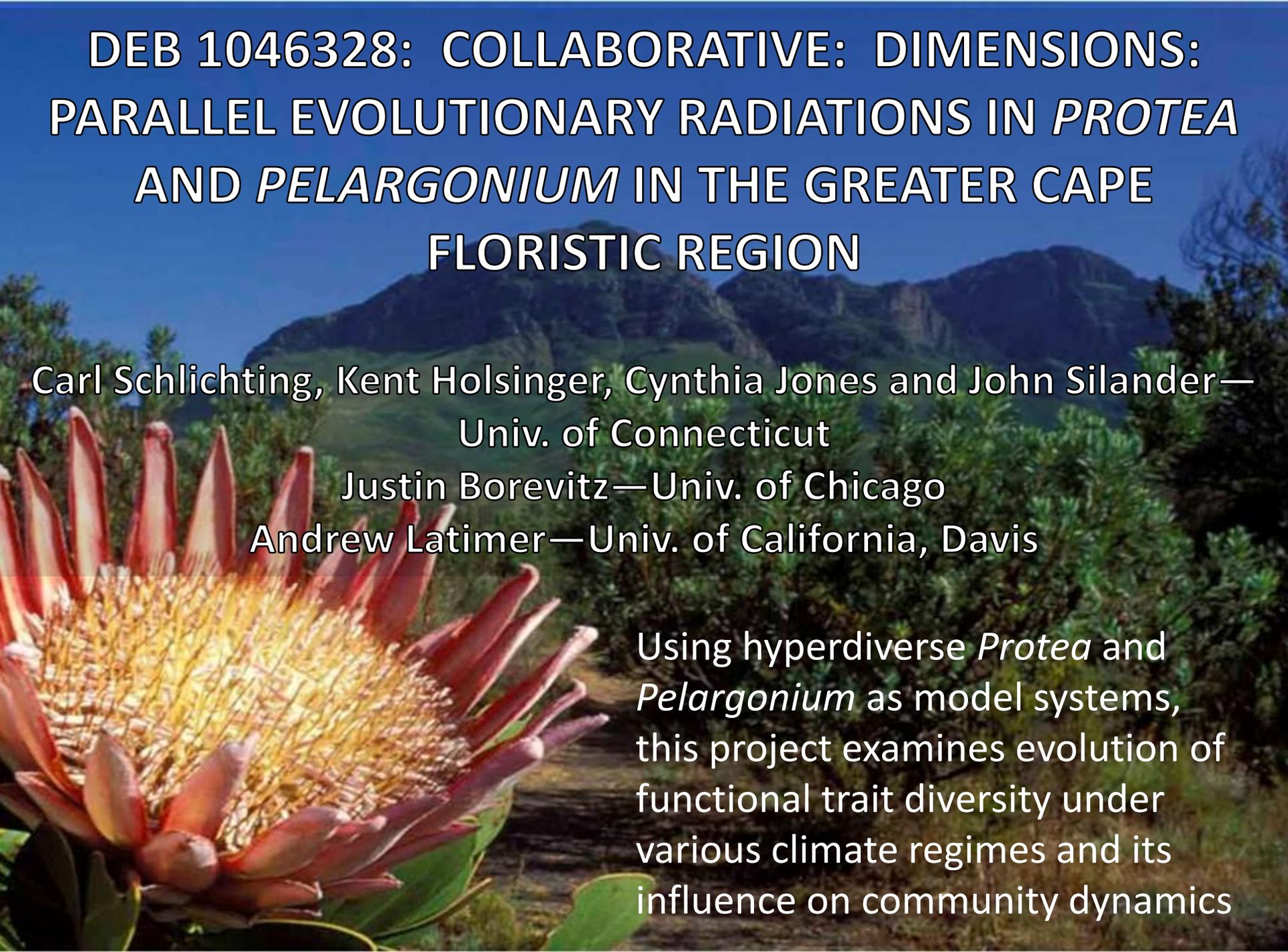
Panel score comparison



Two panels largely agreed on top-ranked and bottom-ranked proposals



Dimensions of Biodiversity

A large, vibrant Protea flower with a dense, golden-yellow center and reddish-pink, pointed bracts is in the foreground. The background shows a scenic view of green mountains under a clear blue sky.

DEB 1046328: COLLABORATIVE: DIMENSIONS: PARALLEL EVOLUTIONARY RADIATIONS IN *PROTEA* AND *PELARGONIUM* IN THE GREATER CAPE FLORISTIC REGION

Carl Schlichting, Kent Holsinger, Cynthia Jones and John Silander—
Univ. of Connecticut

Justin Borevitz—Univ. of Chicago

Andrew Latimer—Univ. of California, Davis

Using hyperdiverse *Protea* and *Pelargonium* as model systems, this project examines evolution of functional trait diversity under various climate regimes and its influence on community dynamics

DEB 1046115: COLLABORATIVE: DIMENSIONS: DECONSTRUCTING DIVERSITY AND ECOSYSTEM FUNCTION AT MULTIPLE SPATIAL AND GENETIC SCALES IN A KEY PLANT-MICROBE SYMBIOSIS

Thomas Bruns and John Taylor—Univ. of California-Berkeley
Kabir Peay—Univ. of Minnesota
Rytas Vilgalys—Duke University

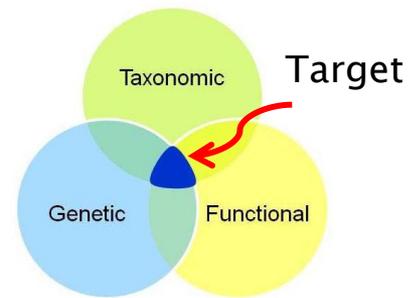
Project will fill major gaps in our understanding of a critical plant-fungal symbiosis by providing the first continental-scale examination of taxonomic, genetic and functional diversity of ectomycorrhizal fungi in pine forest ecosystems



Russula amoenolens
mycorrhizae



Grade-free Panel: What did we learn?



Dimensions of Biodiversity

- ▶ Scores did not affect the ability to identify best proposals: Program Directors' funding recommendations closely matched panelists in the grade-free panel based on post-panel comparison of panelist rankings
- ▶ Panelists were more engaged and many more participated in discussions of the proposals (e.g., “... listened more closely than I did in the past by not knowing the rankings”)
- ▶ Some panelists felt relieved that they did not have to argue about where the proposal goes on the board
- ▶ BIO may not be the right directorate for this review innovation as PDs are empowered when making funding recommendations

Questions

