To: OSTP

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Re: NSTC Research Business Models Comments, Items A, B., E., and F.

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A. Accountability

The ultimate accountability of the research enterprise is to the society as a whole i.e. to the training of a technically-skilled workforce, the generation of new ideas that will power the economy, and the improvement of quality of life (a concept difficult to quantify). How can one show accountability in the short run, when the goal is long-run? Current practices show accountability that is easy to measure (bidding practices, rationalized decisions on funding), but have no way to show that the decisions are better than alternatives would have been. Here's an experiment to consider: for some NSF or NIH initiative: fund some number of grants by the usual process. Then randomly select the same number of otherwise-to-be-declined grants and fund them. Wait 20 years. Evaluate the impact of each set of grantees and their students. Did peer review work? Only by funding the "losing" proposals can the foresight presumed to work in the current proposal system be demonstrated.

The remainder of my comments in this section might equally well be considered as part of comments in section F, Research Support.

In my field, chemistry, it is presumed that we need to encourage as many students as possible to get Ph.D.s and then for previously under-represented groups to join the professoriate. I have seen several students choose not to go the academic route because of the difficulty they perceive in funding their work. Consider that each year the US grants approximately 2000 chemistry Ph.D.'s (and has for at least the last 20 years). That means that at any time, there are approximately 10,000 graduate students in chemistry departments in this country. To provide a stipend, tuition, and minimal operating funds for every one of them would cost $30,000 per student per year (This year at Illinois, a stipend is about $18,000, tuition waiver is $6,700, and a year's chemicals etc. might cost $5,000, for a total of $30,000, excluding indirect costs. With ICR, the cost would escalate to $43,000 per student per year). That means that an uncritical expenditure of $300,000,000 (without ICR) to $430,000,000 (with ICR) would fund every current student with NO proposals, NO paperwork, NO uncertainty on the ability of a faculty member to support continuing students, and vastly increased intellectual freedom. If one required students to be teaching assistants for two years (common at many schools), the cost would drop by $98,000,000 (direct) or $146,000,000 (including ICR). These figures should be contrasted with the total funds currently finding their way to chemistry students via NSF, NIH, DOE, and DOD. If the situation is similar to what it was when I was a "rotator" at NSF in 1990-

1991, it will turn out that at NO extra cost to the taxpayers, all these students could be funded. Where's the accountability?

1) Faculty time previously spent writing dozens of proposals in the hope a few get funded would instead be focused on teaching students.
2) People previously scared away from academia due to the uncertainty obtaining operating funds would no longer face this uncertainty.
3) Freedom of inquiry for highly risky projects would increase, together with the likelihood that the wildly creative idea could root and grow.
4) Collaboration would be influenced by neither funding bureaucracy nor university policy. It wouldn't matter who was on whose payroll.
5) Universities would become far more "family friendly." A problem pregnancy (for example) that currently would lead to missed proposal deadlines, funding interruptions, stymied students, and (possibly) destroyed careers would instead simply be a time away from the lab, with students still funded, still productive, and not threatened by economic disaster. What other change could have such a positive impact on the demographics of the academic workforce, or the quality of life for the entire scientific community?

The counterargument is obvious: without repeated oversight as provided by peer-reviewed proposals (most of which are declined), second-rate science might flourish to the detriment of first-rate science. I know of no hard evidence that this would occur. Peer review of proposals is a highly effective way to say "no." It is a terrible way to say, "it's risky, it's different, it's creative, but YES." Perpetual oversight makes the assumption that a highly-skilled, creative workforce is in fact typically inept, in perpetual need of being blocked from being counterproductive (by misspending public funds), and that peers are better able to perceive the flaws in someone else's ideas than to generate ideas of their own. Vast amounts of time and energy are spent just trying to keep one's students in lab with even minimal resources. Wouldn't we be better off with less oversight and less short-term accountability, even with a few boondoggles, if, as a result, we had a demographically better balanced workforce and greater creativity in an atmosphere of free inquiry?

B. Inconsistency of Policies and Practices Among Federal Agencies

The modular budget procedure at NIH acknowledges that the typical proposal (80% of new proposals) will not be funded, and it is thus a waste of time for researchers to justify a budget in detail that has only 1 chance in 5 of ever having tangible effect. An approximate indication of budget is necessary to adequately evaluate a proposal, but detailed budgeting is typically not a significant factor in a funding decision (in fact, do we want errors of a few dollars here or there to be decisive in funding decisions? I think not.). The NSF model for electronic submission of proposals, coupled to the NIH model of only approximate budgeting until funds are likely to be forthcoming would be a winning combination. Matching forms for Current and Pending Support, Curriculum Vita and budgets among agencies would help, since it is common for similar numbers and forms to apply to many simultaneous proposals.

E. Regulatory Requirements

Rather than requiring institutional certification of compliance to be included with every proposal and a presumption of non-compliance made of every principal investigator (lacking a signature to the contrary), why not maintain a list of complying organizations and electronically stamp "in compliance" on all proposals from that institution? A strong audit of actual performance rather than signatures that simply slow down proposal routing should insure accountability while cutting bureaucracy. I recently had a proposal rejected in part because a certification of a particular type of oversight wasn't included – even though the proposal stated that such oversight would be sought if necessary, and in no case would the regulated work be carried out during the first two years of a grant. The lack of a photocopied form, irrelevant to over 2/3 of the work, was used as a bureaucratic excuse (admittedly by reviewers, not a federal agency directly) to shut down a project. Enforce compliance? Of course. Use paperwork as a life-or-death decision on a project? WHY? Who benefits? No one!

F. Research Support

A recent proposal declination said (slight paraphrase): the ideas are creative, the track record is strong, not everything that is proposed can be accomplished in 3 years, there are doubts about a few of the sub-projects, there is insufficient preliminary data (despite the strong track record in closely related areas), therefore don't fund. How is one supposed to get preliminary data without funds? One frequently gets the feeling that the proposal/funding game is Russian roulette, where one is trying to hit a moving pinhole. At some point, productive people should having funding in proportion to the number of students they can convince to do research. Now, it's backward. Students gravitate to funded groups. There is an aspect of self-organization at work. A large group can stay funded if 25% of the students are productive. A small group with any gap in productivity can become defunded and then, lacking "preliminary data" have no way to restart. The typical research budget, in the absence of a grant, is ZERO. One can do a lot with a little, but nothing with nothing. Federal support should encourage scientists to continually push back scientific and technical frontiers. Current policies encourage them to write nearly unlimited numbers of proposals. The toughest problem in science is NOT the science. It is probably not the interpersonal issues of disparate collaborators. It is keeping enough funds in the kitty to allow any work to happen. So long as this is the case, only the super-aggressive will be attracted to academic science. Is it demonstrated that aggressiveness, quality, creativity, and productivity are correlated? Or is it that only aggressive people can survive in the current system? Is such aggressiveness the *sine qua non* for scientific excellence in industry? If not, why should it be the pre-requisite to teaching (a helping profession) in the University? In industry, proposals are turned around in minutes (small money) to months (big money), usually a page or two as bullet lists. In academia, a 15 page, carefully crafted, lavishly illustrated masterwork of a proposal can take months to write, minutes to shred intellectually, and nearly a year to turn around for a revised request. In a world where most communication takes place in seconds, proposal review occurs glacially, and any tiny fault can set back or destroy an entire research program. If we funded people and institutions, not projects, scientists would feel free to move from area to area quickly and flexibly. The current system funds incrementalism well, but makes field changes for mid-career scientists or mid-degree students nearly impossible.