# Report of Provost's Advisory Council for Strategic Advancement
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## Executive Summary

As a process for major University Transformation was launched in July 2008, the Strategic Advancement Advisory Council was appointed by Provost Meredith Hay to provide recommendations for ways to enhance the competitiveness of University of Arizona faculty for large grants and contracts in science and engineering fields.

The Council's recommendations fall into three areas: a general structure of the University's teaching and research programs that will allow broadly interdisciplinary research to flourish, mechanisms that would enhance research by physician scientists, and a process for strategic investment in large science and engineering projects in selected areas of high potential return.

**University Structure.** Transformation of the UA should keep tenure homes in units that roughly resemble current departments in their administrative organization and should protect and enhance the ability of faculty from multiple units to form and affiliate with interdisciplinary centers or institutes that would organize around important issues. These institutes could be modeled after existing entities such as the BIO5 Institute, the Arizona Respiratory Center, and the Institute for the Study of Planet Earth. The institutes generally would not have their own faculty FTE's, though the Director might be appointed in the institute, but they would control significant funding that would seed faculty hires, research, and teaching activities within a thematic area. In particular, they could be the platforms for obtaining large, collaborative grants and contracts by bringing together the necessary faculty.

Institutes would take advantage of the large size of the UA faculty and its broadly distributed strengths in numerous areas of importance in future large research initiatives. Along with the creation of these institutes would be a renewed emphasis on the desirability of faculty ranging from junior to very senior in participating in interdisciplinary ventures together. Institutes would be reviewed regularly – perhaps every five years – and continued only as they continue to meet a clear need. The dissolution of institutes and replacement with new ones over time would provide a flexible mechanism for addressing emerging research opportunities.

Coordinated with the creation of interdisciplinary institutes would be the creation of a larger Development Fund under the control of the Vice President for Research to seed and promote cutting-edge activities not just in "big" science but across all areas. The Council envisions a Development Fund exceeding $20M in the near future, in order to provide adequate funding to launch new ideas and to carry the increasing burden of research support and compliance oversight. In areas of "big science and engineering," seed funds would directly leverage large external grants and contracts.

**Clinical Research.** The UA's portfolio of clinical and translational research is weak compared to its strengths in basic biomedical science. UA faculty support from the NIH did not keep pace with the doubling of NIH funding, with a particular paucity in the number of large grants (Program Projects, Core grants) in the clinical sciences. Most flagrant is a near absence of Clinician-scientists, a type of researcher that is absolutely essential to a vibrant academic medical center.

To address this problem, we must create a strong and lively culture of clinician-scientists in the Health Sciences. The Council proposes the creation of a clinician scientist Training Initiative that would provide the funds needed to protect 75% of the time of clinician scientists for research for three years and a formal mentoring program to support their entrance into the research arena. Initially, 10 scientists would be supported.

**Strategic Investment in Large Projects.** In the coming decade, as federal and other research funding is likely to get tighter, UA faculty will want to be even more competitive than in the past in winning large awards for large, complex projects. Winning large sums of federal, and potentially state, research dollars for "big science" will require serious investment – presumably into centers or institutes of the type described above -- and a clear process for selecting projects for such investment must be developed.

To provide faculty input into the selection process for "big" projects and institutes for central investment, the current Strategic Advisory Council will become the Standing Committee on Strategic Initiatives. (Other members may be added for seamless coverage of potential areas of research.) This committee will advise the Vice President for Research on opportunities for strategic investment of indirect cost recovery funds aimed at bringing in large research grants and contracts.

Prioritization of areas for special investment, including new faculty hires, will use the following criteria (all of equal importance):

1) Cost and likely return on investment
2) Importance to societal issues, human health or well-being, or truly innovative scholarship
3) Interdisciplinary nature
4) Building on existing strength: A leader currently in place
5) Building on existing strength: A core of high-quality faculty currently in place
6) Impact on teaching and training
7) Impact on the reputation of the UA.

Areas of targeted investment will be constantly monitored to determine the impact of the investment, and, because the institutes will be loose confederations, they can be nimbly refocused or replaced over time.

## Background

The University of Arizona is one of our nation's premier research universities. We currently rank 13th among U.S. public universities, 20th among all U.S. universities, and 2nd only to Caltech in the physical sciences, based on FY06 research expenditures. We are Arizona's only member of the prestigious Association of American Universities (AAU). We also provide the majority of Ph.D. degrees in the state. President Robert Shelton has set an ambitious goal for the UA: to become one of the ten best public universities. We can achieve that goal, but only if we strategically develop our research base.

Hallmarks of research and education at the UA are their breadth and their interdisciplinarity. At a time when state funds cover a decreasing proportion of the operations of the university, federal and other outside grants and contracts to the UA must increase to provide critically needed support for the research engine. One important way in which research at the UA can grow is through increased success in areas of "big" science and engineering, areas in which clusters of faculty bring in multi-million-dollar grants and contracts that enable research and education focused on major societal challenges. These faculty clusters may be most competitive when they take advantage of the particular range of expertise available within the university. Currently, the UA has especially strong records of achievement in interdisciplinary science and technology in the areas of space exploration, bioscience (including biomedical and agricultural areas as well as basic biology), environmental sustainability, and optics and information technology.

As a process for major University Transformation was launched in July 2008, a Strategic Advancement Advisory Council was appointed by Provost Meredith Hay to provide recommendations for ways to enhance the competitiveness of University of Arizona faculty for large grants and contracts in science and engineering fields. The Council met four times and consulted extensively by email in preparing the report that follows.

The Council's recommendations address three areas:

- a general structure for the University's teaching and research programs that will allow broadly interdisciplinary research to flourish
- mechanisms that would enhance research by physician scientists, currently in very short supply
- a process for placing strategic investment in large science and engineering projects in selected areas of high potential return.

These recommendations will cover only the "big science" portion of balanced portfolio of mechanisms for support of both the big projects that bring in multiple millions of dollars and the smaller projects that engage so many smaller research groups across the campus. In our view, "big" science is an emergent property of a great faculty that is supported in all of its high-quality research endeavors, from small to large. To enhance maximally the UA's capacity for contributing new knowledge in existing and nascent areas of excellence, support must be available for the full range of research modes. Here we focus on the special needs of "big" science and engineering.

## University Structure Needed to Engender and Support Multidisciplinary and Interdisciplinary Research

**The Case:**

Multidisciplinary and interdisciplinary research activities have enhanced UA's reputation over the past four decades. While many institutions struggle to create environments fostering such interactions (see recent reviews in *Nature* highlighting successes and challenges), UA has been quite successful. As we move forward with strategic planning, enhancing interdisciplinary engagement will be paramount.

**<u>Current UA attributes associated with excellence in multi- / interdisciplinary research</u>**

1. *Flexible unit and college boundaries*: Established and productive researchers have the ability to move their programs easily across campus and directly connect many different units.
2. *Ease of new unit creation*: Creating new identities and homes for emerging research initiatives has eased the speed at which multi- / interdisciplinary interactions develop.
3. *Faculty size and demographics*: Interdisciplinary research capacity derives from the total number of research faculty along with balanced senior and junior faculty recruitment over the last four decades.

**<u>Threats for maintaining excellence in interdisciplinary / multidisciplinary research:</u>**

1. *Acknowledging the expected evolution of multi- / interdisciplinary research to established science*: Cutting-edge research becomes common. The full transfer of knowledge from lab to application should be supported, yet this comes at the expense of potential resource allocation to new initiatives. Managing this trade-off is key to maintaining research capacity in an environment of declining resources.
2. *Difficulty of eliminating units created to increase interdisciplinary interactions:* The two key attributes that foster multi- / interdisciplinary research also operate to inhibit new interactions as the research landscape (and funding) at the university is 'chopped up'. We must acknowledge when units have met their mission and when they no longer contribute to the key elements of the research capacity of UA.
3. *Entrenchment of funding mechanisms designed to support interdisciplinary efforts*: The legacy of special funding to promote specific research programs institutionalizes a lack of flexibility to sponsor new initiatives and the ability to rapidly reallocate resources among developing or re-energizing programs. The ballot initiative programs (*TRIF*) and the stakeholder-driven science (e.g., *land grant cooperatives*) that initially promote interdisciplinary interactions have the potential to limit new investment down the road (e.g., see risk #1). A steady source of new interdisciplinary "investment" funds is needed.
4. *The ease of moving across boundaries for non-tenured faculty*: Activities that contribute to generating multi- / interdisciplinary research capacity for senior faculty is risky for the career development of junior faculty absent appropriate review mechanisms – and strong support from department heads and deans – that effectively evaluate the performance of individuals outside a traditional department setting.

**The Proposal:**

Key to growing the research ranking and reputation of UA is capitalizing on this historic strength, while enacting measures that prevent the loss of this important component of our university.

1. ***Establishing frequent and action-generating internal program review tied to flexible funding mechanisms*:** Shortening the time-period to first program review and effectively moving resources (funding and space) early are key to taking advantage of our faculty demographic. Following the NSF-STC or Physics Frontiers Center review framework would provide effective program evaluation when compared to the current protocol. An internal and open process, in which review committees are tied to resource allocation initiatives, would be highly effective.
2. ***Eliminating units created for interdisciplinary interactions when they are no longer useful:***
Effective program retirement both alleviates the strain of decreasing resources and generates capacity in the university research landscape. It allows support staff and space reallocation across units.

3. ***Developing a mechanism to consistently judge the value of early career faculty participation in multi- / interdisciplinary research activities:*** This is a subtle, but important, issue that is compounded by the fact that many highly productive research faculty are currently near retirement. Fostering the next generation of interdisciplinary faculty – and leadership – is key to maintaining research capacity.

4. ***Developing a new flexible space allocation model to support emerging research activities*:** We should revisit the legacy of space allocation to faculty upon hire in a modern university setting. Important to this is noting that the 'pay as you go' model for space allocation is likely to emerge as an additional risk.

5. ***Flexibly arranging teaching and research commitments to foster both departmental identity and research excellence*:** We need flexible models that reward teaching and research in ways that promote the flexible allocation of research active faculty

6. ***A matrix organizational model can help to facilitate university response to emergent funding opportunities and to evaluate existing unit contributions to new initiatives:*** Such decision support for evaluating unit scale contributions to cross-disciplinary research efforts is needed and can help in strategic hiring decisions driven by optimizing functional requirements. (The example is only for illustration and not necessarily accurate.)

| **Example Emergent Funding** | **Disciplinary Units** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | AME | ASTR | ATMO | BMB | CHEM | EEB | GEOSC | HWR | PTYS | SWES |
| Nanoscience and Technology | X | | | X | X | | X | | | |
| Energy and Sustainability | | | | X | X | X | X | X | | |
| Carbon Sequestration | | | X | | | X | X | | | X |
| Environmental Pollution & Health | | | X | | | | | | | X |
| Water Sustainability | | | X | | X | | | X | | X |
| Environment and Society | | | | | | X | X | X | | |
| Space & Planetary Sciences | X | X | | | | | | | X | |

**The Cost:**

The costs associated with this proposal are difficult to assess. The major costs will relate to the need to provide seed funds to establish interdisciplinary centers or institutes. Smaller costs relate to faculty participation in effective review (both of centers and in promotion and tenure) and coordination associated with developing a flexible teaching model (for example, streamlining the teaching of undergraduate biology across the colleges). These latter would be easily offset by the gains associated with potential faculty involvement in additional sponsored projects. A Development Fund of at least $20M would be needed to support the proposed flexible research and teaching models, including new centers with the ability to draw faculty into groups that will be effective in attracting large grants and contracts, *and* to continue to provide more standard support for research done at the level of individual faculty or small groups.

The coordination of flexible space allocation may be difficult in the absence of new construction designed for the purpose of investing in emerging research centers.

**Return on Investment:**

A fund to invest in emerging issues and a model to quickly assign space would increase the likelihood of establishing externally funded cooperative research centers (e.g., NSF Science and Technology Centers) by providing early activities that act as proof-of-concept. This is likely to accelerate technology transfer significantly if the model for potential funding includes more public-private partnership strategies. At minimum, changing the demographic of research centers will act to free up resources for re-allocation, rapid response to emerging needs. The goal would be for UA scientists to at least double the number of large (**over $8-10M**) grants and contracts within 5 years.

## Meeting the Clinician-Scientist Challenge

**The Case:**

A serious limitation that affects the UA College of Medicine and the Health Sciences-related Colleges is the lack of a large and vibrant population of Clinician-Scientists (CSs). Positioned at the interface of clinical and basic biomedical research, CSs are recognized by the NIH as the preeminent group that requires nurturing. The NIH Road Map (which aims at integrating basic and clinical research to promote human health) is embodied in the CSs, who can tackle fundamental human health questions using the most advanced basic science tools. The NIH still offers good opportunities to CSs through the K-type awards, which protect 75% of the CS' time so that they can vigorously pursue research while remaining clinically active. Of note, approximately 40% of K award applications are successful, and approximately 50% of K awardees subsequently secure RO1 or R21 grants. Thus, investment in CS training and education is a wise long-term choice towards developing and expanding academic medicine.

The September 2008 NIH CRISP database lists less than 20 UA-based K awards, of which only a subset is at the College of Medicine. Thus, a major source of current and future federal support is left untapped, and a major tool for training the next generation of biomedical scientists remains underutilized.

**The Proposal:**

A mentoring program (the Clinician-Scientists Training Initiative) that would support up to **10 CSs** per year for three years would begin the process of addressing the current CS challenge. We favor a two-Department/Center, two-mentor model (equivalent to a major/minor), which would best train the Road Map CSs of the future, and would be attractive to the best CS candidates.

To achieve the critical mass necessary to build a vibrant community and, in time, a new CS culture, we advocate support for **10 CSs**. CS positions would be filled over a three year-period (5 positions in year 1, 3 positions in year 2, and 2 more in year 3). Once CSs secure K awards, their positions would be released for new applicants. At the end of five years, the program will be re-evaluated.

**The Cost:**

Developing a strong cadre of successful CSs has three major requirements:

- Excellent mentors, i.e., senior biomedical scientists with a solid record of good NIH funding. Many such mentors exist at the UA, both in the College of Medicine and in related Colleges.
- Excellent core facilities, readily providing the most advanced technologies. Such facilities also exist throughout the University campus and are highly accessible for both experimental and training purposes.
- Funds to protect 75% of a CS's time for up to three years, as per K award guidelines (~$75k/CS/yr x 3 yrs = $225K, with matching funds from departments/centers of 25%: $25K/CS/yr x 3 yrs= $75K). An investment of **$2.25M** from the COM ($375K in year 1, $600K in year 2, $750K in year 3, $375K in year 4 and $150k in year 5) and **$750K** from departments/centers ($125K in year 1, $200K in year 2, $250K in year 3, $125K in year 4, and $50K in year 5) would allow **10 CSs** time to develop competitive K proposals.

**The Return on Investment:**

Biomedical funding is under siege, but investing in CSs will have high returns:

- Attract federal K awards, which will support further CS education, releasing funds to support additional CSs. Average K awards are 75% of salary and $20-50k in research support.
- Increase the number of NIH RO1 grants and larger "big science" program-style grants based on the success of the K awards. An average RO1 award provides $250k/yr in direct costs for five years.
- Raise the quality and visibility of the UA academic medicine by attracting some of the best and the brightest and fostering the creation of a much needed, interactive community of medical scholars.
- Provide support and leadership for the establishment of the Phoenix Biomedical Campus.
- Create a reservoir of talented junior translational researchers for the UA faculty of the future.

# Moving Forward with Strategic Initiatives

To provide faculty input into the selection process for "big" projects and institutes for investment by the UA's central administration, the current Strategic Advisory Council will become the Standing Committee on Strategic Initiatives. Other members may be added as needed for seamless coverage of potential areas of research. This committee will advise the Vice President for Research on opportunities for strategic investment of indirect cost recovery funds aimed at bringing in large research grants and contracts. For prioritization of areas for investment, including those recommended to the Provost for faculty hires, the following criteria will be considered. No one criterion is paramount and any decision will be a function of all of these factors.

1) ***Money***: Cost and Return. How much would it cost to put the new initiative in place? What would the anticipated return be based on the funding levels of similar successful faculty already at the U of A? ( A realistic measure?) What would the anticipated/optimistic return be in terms of larger grants (center grants, program project, space missions, etc)? What economic impact on the state would the initiative have?

2) ***Importance:*** How important is the initiative to societal issues, human health or well-being, or truly innovative scholarship?

3) ***Interdisciplinary Nature:*** Initiatives of interdisciplinary nature cutting across departmental and college boundaries have the potential to impact broader areas of the university community and to create new powerful synergies.

4) ***A Leader:*** The successful initiative will require a strong, internationally recognized, effective leader already in place. New initiatives that require the recruitment of a leader are anticipated to be more expensive and possibly less successful.

5) ***A Current High Quality Faculty Core:*** Successful initiatives will build on grass roots efforts already in place by high quality faculty to advance science and technology. The presence of such a faculty creates wider support and potential for success of any initiative, and reduces the cost of a new initiative since it builds on existing strengths.

6) ***Training:*** Initiative should synergize/impact on teaching and the training of the next generation of scientists.

7) ***Impact:*** Will the initiative have a significant positive effect on the reputation of the U of A at national and international levels?