Five-Year Administrative Review Parker B. Antin Associate Vice President Division of Agriculture, Life and Veterinary Sciences, and Cooperative Extension Associate Dean College of Agriculture and Life Sciences

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Introduction:

This document provides a review and self-assessment of the objectives, achievements and challenges I have faced during the five years that I have been privileged to serve as the CALS Associate Dean for Research, and since 2018 as the Associate Vice President for Research for the Division of Agriculture, Life and Veterinary Sciences, and Cooperative Extension (ALVSCE).

Successes where they have occurred in advancing CALS research have relied heavily on advances and accomplishments across the College. One example is the impressive progress made by the CALS Business office in updating general business practices, including developing transparent budgets and budgeting practices. Advances in data collection, analysis and visualization led by the Data Solutions Team has allowed us to be data informed in assessments and strategic planning. Similarly, the significant efforts by CALS Career and Academic Services to advance our educational mission has provided the financial resources to hire many outstanding new faculty. Vice President Burgess has led a culture change across CALS that has infused the College, and now the Division, with mission, values and purpose, along with wholesale transformation of expectations and management practices. In my opinion, CALS has benefitted from the University's transition to the Responsibility Center Management (RCM) approach to budgeting because CALS' culture, goals, values and practices are well aligned to take advantage of the prioritized incentives of (RCM). The fact that CALS is the only STEM college to increase federal funding for research over the past five years reflects our success under RCM in aligning resources with Unit, College and University level objectives.

Background:

I came to the CALS ADR position from an atypical background and so feel it will be helpful to briefly review my academic career. Following graduate and postdoctoral training in medical schools at the University of Pennsylvania and the University of California, San Francisco, in 1992 I joined the Department of Animal Sciences as a tenure track assistant professor in what was then the College of Agriculture. Following promotion in 1998 to associate professor with tenure, I moved to the UA Medical School with a primary appointment in the Department of Cellular and Molecular Medicine (formerly Cell Biology and Anatomy). Since then I have maintained an active research laboratory focused primarily on cardiovascular system development and bioinformatics. The ADR position brought me back to CALS, with a 0.5 FTE appointment in administration and 0.25 FTE in research. I retain 0.25 research FTE in the College of Medicine. This review and self-assessment therefore pertains to my 0.5 FTE CALS administrative appointment.

I assumed the ADR role with little formal administrative experience beyond that obtained through standard faculty activities of laboratory research, undergraduate and graduate education, committees and participation in national scientific organizations. Relatively early in my career I became intrigued by leadership concepts after experiencing instances in which shortcomings in leadership were a contributing, if not the primary, factor leading to the failure of department and college level initiatives.

In the early 2000s, I began exploring leadership principles through reading, workshops and conferences. From my experiences and by observing department, college and university level activities, I came to realize that "getting things done" required more than a good plan, and cultivating effective leadership qualities were crucial to motivating colleagues, students and staff to achieve common goals. Management and implementation processes could be skillfully conceived and crafted, but without effective leadership that follows principles of trust and transparency, being data informed in decision making, and respecting disparate views, any initiative faces serious headwinds.

I was particularly drawn to vision and mission as integral to effective leadership. I have come to realize that when effectively conceived and written, vision and mission statements articulate purpose and the "why", and indirectly also values. Without effective communication and general alignment with overarching purpose, defining and implementing the "what" and "how" becomes far more difficult, and even impossible. A well-conceived vision and mission also sets the stage for effective strategic planning to pursue shared goals. I also believe that a leader's principle job is to create an environment in which others can succeed. Looking back on my research career, I can recall times when I garnered fewer personal accolades because I focused time and resources on endeavors that helped others progress. Transitioning from the faculty goal of striving for one's own success to a mission of enabling the success of others has therefore been natural for me.

The First Six Months

In February 2014, I became the inaugural CALS Associate Dean For Research (ADR). Although my predecessors held the dual titles of Associate Dean and Director of the Experiment Station, Dean Burgess separated these positions to elevate the importance of research in the College and human resources allocated to it.

Because I was relatively uninformed about the diverse research activities in the College and the level of administrative support available to researchers, during the first months of 2014 I embarked on a meeting and listening tour. I met with CALS leadership, unit heads, unit business managers, and many faculty and staff. I also engaged with ADRs from other colleges to learn about their programs and management processes and with the heads of several University administrative offices relevant to research. Finally, I reviewed internal programs in the CALS Research Office. Most people were remarkably candid and I was surprised how motivated many were to tell me about strengths but also their concerns. Many had not been previously asked their opinions and were pleased to "tell all". I came away from these meetings and discussions with a number of impressions that helped form my initial view of CALS research and the activities related to research administration. I also developed a sense of the overall culture in CALS. I realized that in order to effectively move forward with important strategic initiatives, serious work was needed to improve the culture because there was a pervasive feeling of "resigned frustration" regarding many CALS administrative activities, the ability to get things done or to effect change. The frequently referenced quote attributed to Peter Drucker, "culture eats strategy for breakfast", nicely encapsulates my concerns.

Following are additional impressions from my listening tour:

- Many CALS faculty and staff were highly motivated and working hard to accomplish the CALS research mission; many faculty were conducting highly productive and impactful research programs.
- Research was moving forward because it was largely driven at the unit level, though there was a general lack of awareness of any overarching mission.

- Many unit and College level management practices were considered to be overly bureaucratic and frequently perceived as adversarial to the efforts of faculty and staff.
- CALS had the reputation among other colleges and University administrative units as being "difficult to work with".
- There was a high frustration level among faculty and staff regarding CALS Research Office management practices, which were perceived to be hindering research.
- CALS Research Office staff were working hard but also appeared to be operating with outdated practices and processes.
- No systems were in place for data informed assessment of research productivity, investments, quality, impact or outcomes beyond basic annual productivity data provided by the University.
- Although Tech Launch Arizona had recently been reorganized, there remained a high level of frustration among faculty about the barriers to commercializing laboratory discoveries through patents, licensing and startups.

Implementing the CALS Research Strategic Plan

A primary objective in my role as the CALS ADR has been to advance the research mission by implementing the research strategic plan. Dean Burgess developed a research strategic plan in 2012 as part of the overall CALS strategic planning process that provided an initial template for my prioritized activities. This plan was updated in late 2014, and again in 2015. The full current version is in the Appendix.

Because my efforts have been directed towards implementing this strategic plan, in the pages that follow I will discuss objectives, achievements and challenges in the context of the plan's five strategic goals. The research strategic plan is aligned with and contributes to achieving the CALS aspirational strategic goals, attainment of which are directly relevant to achieving culture change discussed above.

CALS Strategic Goals

- 1) Be an economic development engine for Arizona.
- 2) Produce employable graduates, who can do jobs that do not yet exist and create new jobs.
- 3) Be the most sought after place to be part of.
- 4) Be effective, efficient, responsive, flexible, and financially stable.

<u>CALS Research Mission Statement:</u> To advance knowledge across the continuum of basic to applied research in the mission areas of the College, and to convey the products of our efforts to the citizens of Arizona, the US and the world.

We will accomplish our mission by increasing the size and improving the quality of our research workforce, maximizing the ability of our research workforce to conduct research and our ability to measure its impact, and by effectively communicating the products of our research to the world.

RESEARCH STRATEGIC GOAL ONE:

Build on Existing Strengths and identify strategic new investment areas to maximize research activity.

Maximizing research achievement requires that resources be optimally aligned with strategic objectives, and that measures of success be clearly defined. The University's Never Settle strategic plan set an initial goal of doubling research expenditures from 2010 to 2021. However, faced with multi-year reductions in state budget allocations and other headwinds, the doubling goal was subsequently reduced to merely incremental increases commensurate with student enrollment growth. I felt that this new institutional target was overly timid and that CALS was capable of much more. I therefore set a more ambitious CALS goal of increasing research expenditure 50% by 2023 from 2012 levels. To meet this goal, investments would be needed in our physical infrastructure, support programs and processes, and most importantly for new faculty hires that align with our research strengths and strategic goals.

Faculty Hiring

Outstanding faculty are the most important driver of research success, and so facilitating faculty hires has been among my most important objectives. Sustained reductions in allocations to state universities beginning in the 1990s and continuing in the 2000s, exacerbated by the great recession beginning in 2008, led to a progressive reduction in tenure track/continuing faculty and therefore also a reduced capacity to conduct research. Between 2007 and 2016, the number of CALS tenure track/continuing faculty had dropped approximately 20% (from ~245 to 198) while total research FTE had dropped by 25% (from ~115 to 87).

By the time I began as ADR in 2014, the work of Dean Burgess and Associate Dean Ratje to develop transparent real time budgeting and a plan for retiring College financial obligations had laid the groundwork for a sustained period of faculty hiring. During the years FY15-FY18, 69 Tenure Track/Continuing faculty were hired across CALS units. More than thirty tenure track/continuing faculty hires were approved in FY16 alone, leading to the hiring of twenty-eight faculty during FY17. These hires brought total research FTE by the end of FY18 to 101, a 16% increase from the FY16 low, though still approximately 15% below total College research FTE in the mid 2000s. The total number of tenure track/continuing faculty in FY18 remained 7% below the FY14 levels (195 versus 209) while the number of Professors of Practice increased from 18 to 41. This reflects a specialization trend across higher education whereby teaching and research missions in research intensive colleges and universities are being progressively segregated.

The graph below shows the percentages of college faculty research FTE and aggregate MTDC (modified total direct costs [research expenditures subject to indirect cost return]) in FY18 in each of CALS six major research focus. The research areas shown in this graph were developed by unit heads and agreed to by CALS faculty prior to my arrival.

Research FTE allocations across these areas reflects decades of investment decisions made by individual units, by CALS and the University. For example, the UA is a leader in environmental research, and for many years preferential investment was made across several colleges to hire faculty with interests in the environment. Faculty investment and research strengths in plant sciences aligns with our historical land grant mission, and also received differential investment in the 1990's and 2000's. In contrast, the low percentage of research FTE and research activity in animal systems reflects the loss of capacity driven by sustained budget cuts and difficult prioritization decisions.



For the first two years following my appointment as ADR (FY14 and FY15), the research focus of new faculty hires was driven primarily by Unit needs to restore programs that were depleted due to the loss of faculty, though all faculty hiring requests were reviewed for alignment with CALS strategic objectives. By FY16, careful budget management coupled with increases in teaching and research revenues resulted in significant resources for new faculty hires. As units formulated their hiring requests, we began to discuss broader programmatic themes as a mechanism to increase our long term research impact. These efforts dovetailed with the University's cluster hiring initiative, and in one instance led to six new hires over a two year period in the area of ecosystems genomics. Several of these cluster hire finalists had the opportunity to join units in other colleges. Conversations with these faculty members revealed that they consistently chose CALS units because they felt it was a more inclusive environment with superior faculty support services. This was gratifying feedback because it personifies CALS Strategic Goal Three, *Be The Most Sought After Place To Be Part Of.*

Five Year Vision for Research

Drawing on extensive discussions with faculty, unit heads, the Dean's Research Advisory Council, and CALS leadership, at the February 5, 2018, State of the College meeting I presented a five year strategic research vision for the College that included four high level objectives:

- 1. Sustain Preeminence in Our Strengths: CALS has world class programs in several research areas. For example, environment and natural resources is an area of University strength and is our largest research area, with 37% of faculty research FTE and 40% of overall research expenditures. The Department of Entomology is ranked highest in the country by some measures, and the Aquaculture Pathology Laboratory is the world reference lab for crustacean diseases. As we consider new research investments over the five year horizon, it's crucial that we continue to support these and other presently strong programs in the College.
- 2. Engage Across the Continuum from Discovery Research to Application: As the Land Grant College and given our close relationship with Cooperative Extension, we have the mission and capacity to engage across the continuum from discovery to application and to extend our impact to the citizens of Arizona. With the reorganization and strengthening of Tech Launch Arizona a number of years ago, we now have robust capacity to move discoveries towards patent protection, to pursue commercial licensing agreements and launch startup companies.

- **3.** Infuse data sciences into all research areas: Leverage our unique resources for supporting data sciences: The ability to acquire, manage, analyze and derive knowledge from large datasets has become critical to advancing science across all domains. CALS has unique capabilities for supporting data science, including the Department of Communications and Cybertechnology (CCT), conceived by Dean Burgess to help achieve our goal of being the most cyber savvy college at the UA, and the most cyber savvy College of our kind in the nation. CALS was also the birthplace in 2008 of the iPlant Collaborative, with an unprecedented \$50M National Science Foundation Award. This transformative project, now known as CyVerse, is in its eleventh year and has received \$115M of funding to date. I am privileged to be the project's lead Principle Investigator. All faculty hires are now being considered with regards to their ability to increase our capacity in data sciences.
- 4. **Expand in Health Sciences:** With our historical strengths in animal and food health and production, human nutrition and food safety, expanding programs in microbiology, and new initiatives in precision nutrition and anti-infectives and therapeutics, CALS is extraordinarily well positioned for dramatic growth in the health sciences. With strengths in animal and human sciences, and the launching of the College of Veterinary Medicine, this is envisioned in a holistic One Health approach.

Integration around *Food Systems* encompasses several of CALS strengths. These include personalized (precision) nutrition including nutrigenomics, metabolomics and food for health (better nutrition), animal and plant food production (more and better food), food safety that includes microbiology/pathology, food preservation and security (more and safer food), and the concept of wellness that encompasses metabolic disease research, behavioral science and exercise science (better health). This framework provides a template for ongoing differential research investments that will continue in the coming years.



Training and Workshops

Well-conceived training programs and information workshops are an important component of growing research because informed faculty save time and experience less frustration. Developing these programs were an important component of our overall effort to stimulate research by "reducing the friction".

At the time I became ADR in February 2014, CALS offered no faculty/staff training programs and few were available across the university. Dr. Sangita Pawar, Assistant Dean for Research< had developed several programs during her time in the College of Medicine though most ceased soon after she moved to CALS in July 2014 (below). Using those programs as a starting point, Dr. Pawar led the effort to develop a suite of training programs so that CALS faculty and staff could become more familiar with research-related processes at the UA, increase their competitiveness for grant awards, and increase research networking and collaboration. The following new programs have been developed:

Research Workshops introduce faculty, post-docs, and administrators to the University of Arizona research environment and the resources available to support investigators over the life cycle of their research projects. These "onboarding" workshops are offered twice a year. All new faculty, postdocs, administrators and research related staff are encouraged to attend. CALS and University offices presenting at these workshops include Sponsored Projects Services, Contracting & Research Services, Conflict of Interest, Export Control, Research Compliance Services, Research Development Services, Tech Launch Arizona, Human Subjects Protection Program, ALVSCE Data Solutions Team.

The Research Essentials Series is a monthly seminar that provides a forum for learning about and discussing topics related to research administration.

CALS Research Workshops and Research Essentials Series have been used as templates for developing University-wide training activities offered by the Office of the Vice President for Research.

Grant Panels provide an opportunity for faculty to discuss federal funding mechanisms and agency specific strategies for obtaining grant funding. Each panel discussion involves faculty with in depth experience concerning the funding strategies and processes of a specific federal agency.

Pivot Training provides faculty and staff with training for using the PIVOT portal, a comprehensive web interface for identifying external funding opportunities.

The Postdoc Support Program provides a forum for postdocs to network and access career resources and professional development opportunities. Postdocs are a relatively neglected group on many campuses, including at the UA. Dr. Pawar developed this CALS program because the University offered no formal postdoctoral support activities. This CALS program stimulated a broader discussion that led to the establishment of a University office of postdoctoral affairs and hiring of a Director of Postdoctoral Affairs.

The Poster Forum showcases CALS research and provides an opportunity for information exchange, networking and collaboration. The Poster forum is held annually during the spring semester, and has grown to become a highly popular event.

Links to all of these programs are available at https://research.cals.arizona.edu/

Financial Support for Research

Another important objective for growing CALS research has been to identify mechanisms to provide financial support for research. Although the CALS central budget provided partial support for startup packages, when I arrived in CALS no funds were specifically available to support and stimulate research. Two mechanisms to support research have been developed, totaling approximately \$750,000 per year.

Research Innovation Pool (RIP): Working with Associate Dean Ratje and Dean Burgess, the Research Investment Pool (RIP) was created to provide funds to stimulate and support research. The RIP provides approximately \$500,000 per year of Federal Capacity Funds to support a variety of

research initiatives and needs, including partial support for startup funds, purchase of new and replacement equipment, miscellaneous emergency needs, faculty retentions, and occasional project support.

Research Development Programs: In 2016, CALS' Unit Heads agreed to allocate \$200,000 of College funds to support several research investment programs. Dean Burgess indexed the total amount available to the amount of indirect cost return (ICR) coming to CALS, so that growth in externally funded research would increase the funds available for these programs. The programs below were developed in collaboration with Unit Heads and the Dean's Research Advisory Council (DRAC), with significant input from faculty across the college. CALS is the only College on campus with internal programs to fund research projects. Funding programs are as follows:

Bridge Funding: The CALS Bridge Funding program provides financial support to minimize disruption of existing research programs and projects that have temporarily lost external funding but show high promise of success in the next round of competitive review, in particular for proposals that just missed the payline or were ranked highly but not funded.

Innovation Venture Investment Program (iViP): This funding program supports novel and potentially transformational ideas that might be too exploratory to be fundable through external mechanisms. The period of support is generally from six months to two years, total budgets are generally below \$100,000.

Early Career Seed Grants: Early career grants provide one time support of up to \$10,000 for research activities in the mission areas of the College leading to the submission of grant proposals to external funding agencies or private foundations. Applicants must hold tenure-track or continuing eligible status with a primary appointment in a CALS unit and be within 8 years of their first faculty appointment.

Invited Speaker Support: This funding mechanism provides support for each CALS academic unit to bring a prominent scientist to the UA campus each year.

Links to these programs are available at <u>https://research.cals.arizona.edu/cals-research-development-programs</u>

Measures of Research Accomplishment

Conducting a successful research program requires highly qualified people, outstanding creative ideas, physical infrastructure, financial resources and productive sustained project execution. Individual research projects can span many years and the initial output is often new knowledge, the ultimate impact of which is only sometimes immediately apparent.

There has long been tension between the desire for all research to have an obvious path to immediate impact with the reality that discoveries build on one another and the impact of a particular advance might not be realized for many years, and then only in the context of other discoveries. There is a funnel effect in which many initial discoveries coalesce towards fewer translatable ideas.

During the dramatic growth in federal research funding in the decades following World War II, the value of basic research and knowledge creation was broadly accepted. Beginning in the early 2000s, however, political pressure to perceive more immediate return on tax dollars invested led to increased scrutiny of research proposals for immediate translational potential. For a few years around 2010, obtaining federal funding required that researchers convince reviewers that their work would have

immediately translational impact, even if this was not the case. Fortunately (in my opinion), over the past several years this stance has softened. I believe that we have arrived at a new balance whereby the importance of fundamental research is again being valued, while researchers have become more acutely aware of aligning their research towards eventual impact. I believe that this new balance is becoming part of the fabric of universities, whereby creating impact has become a higher profile part the overall mission. This is evident in the transition at many universities from the position of Vice President for Research to a Vice President for Research and Innovation, with increased emphasis on technology transfer, commercialization, and having more objective impact at the local, regional and national levels.

How then does one best measure research accomplishment? Ideally, research would be evaluated according to its ability to positively impact the world around us. However, for reasons discussed above impact can be devilishly difficult to assess (you know it when you see it...). Because universities highly value financial resources and so have elaborate systems in place to keep track of them, and because we are frequently evaluated by quantitative criteria related to grant and contracts acquisitions, we often default to numbers of grants obtained, dollars received and spent, and publications as the primary measures of research accomplishment. However, even using publications can be a problematic measure because all publications are not created equal and the publication rate varies considerably across disciplines. Shapiro et al have argued that touting the about the amount of research funding received is akin to an airline bragging about the amount of fuel it consumes (Shapiro et al, 2015. Proc Natl Acad Sci USA 112:9496-7). While this analogy may be a modest stretch, we are nevertheless frequently evaluated largely on the "fuel" required to conduct research rather than on the outputs and outcomes.

Since FY14, CALS has seen impressive gains in awards received and research expenditures. During the period FY14-18, CALS federal research expenditures increased by 23.2% (from \$27,006,961 to \$33,266,971), while all other UA STEM colleges experienced declines of 18-27%. This puts CALS on track to meet our goal of increasing research expenditures 50% by 2023. During this period, the F&A return to CALS increased by 47.8% (from \$1,309,701 to \$2,055,701), and our effective F&A rate (weighted average percentage) increased from 22.4% to 26.8%. By these measures, over the past five years CALS has performed well in research and is outpacing other STEM colleges on campus. With many new faculty hired over the past few years whose research programs are just beginning to ramp up, I anticipate that our quantitative measures of research activity will continue to increase. A full dataset of research expenditures across UA colleges appears in the appendix.

Challenges:

By several measures, CALS has performed well in advancing our research programs during the past five years. Despite our record and the important grand challenge areas that we are engaged in (for example climate change, human and animal health, feeding the world), I am concerned that CALS research programs have relatively little presence in the new UA Strategic Plan. While we have done well under RCM as dollars have flowed to those who are most productive, potential changes to the present budgeting model in order to fund UA Strategic Plan initiatives could limit our ability to achieve near and long term goals. With the creation of ALVSCE and the new College of Veterinary Medicine, we have tremendous opportunities to grow research in highly impactful ways. I will be working hard to ensure that our accomplishments and future potential are fully recognized and supported.

RESEARCH STRATEGIC GOAL TWO Optimize CALS Research Infrastructure to Support the CALS Research Mission

In my opinion, research infrastructure consists of the physical facilities in or with which research is conducted (buildings, labs, equipment etc), and the many talented people who in a myriad of ways support the conduct of research. Research conducted by CALS units spans many disciplines, with correspondingly diverse physical infrastructure needs. These includes laboratories, work spaces and equipment in buildings on campus, as well as the Experiment Station Facilities located throughout the state.

During my listening tour of the College in 2014, it became apparent that the quality of the physical research infrastructure across CALS was highly variable and that many faculty and staff were operating in substandard and even antiquated facilities. Several decades of reduction in state budget allocations (beginning around 1990) led to chronic under investment in renovating and updating research facilities and in the construction of new facilities By 2014, there was a critical need to update our research infrastructure. Several research buildings occupied by CALS units were more than 50 years old and in need of comprehensive refurbishing. An added complexity for CALS are the Experiment Station Facilities spread across the state. Although I am not directly responsible for these facilities, the ability of faculty and staff to conduct research at these facilities directly impacts the overall research capacity of the College.

Since the total resources needed for physical infrastructure improvements was in the tens of millions of dollars, and since only minimal funds were available in the FY14 CALS budget, it became clear that a multi-year plan was needed to address infrastructure needs. The issue was complicated by the fuzzy boundaries between what was CALS' responsibility and what was properly the responsibility of UA central administration. In general, colleges were responsible for lab renovations while the University was responsible for major building refurbishment, which could total \$30M per building. Many campus buildings needed major refurbishment, including several occupied by CALS (Vet Sci-Micro, Shantz, Forbes, BioSciences East). However, in 2014 there were no funds in the UA budget for refurbishments and no obvious mechanism was being communicated to develop a funding plan.

With this state of affairs, our only near term option was to address the most critical issues within our budget constraints and encourage the University to develop a funded plan for building refurbishment. Since 2014, CALS has budgeted approximately \$250,000 per year to fund the most critical repairs, renovations, and remediations.

The chronic deteriorating conditions in the Veterinary Science/Microbiology Building (Building 90; now called the ACBS Building), leading to serious health issues among faculty and staff, have been well documented. Despite many communications with central administration about the state of the building and the seriousness of the health impacts on building occupants, from our perspective the University's initial response seemed to be one of denial and obfuscation. Quotes in the press from senior UA officials were particularly egregious and unhelpful. This was extremely disconcerting to CALS leadership because it went against our long held principle of putting the well-being of our employees first, as part of CALS Strategic Goal #3, *be the most sought after place to be part of.* Some in the UA senior administration were dismissive of this goal. In my opinion they seriously underestimate the powerful positive effect that living this goal can have on employee morale and productivity.

Beginning in late 2016, the UA administration became more receptive to our serious concerns about Building 90. This change closely followed approval by the state of several hundred million dollars in bonding authority to finance new construction and building refurbishment. In early 2017, Provost Andrew Comrie formed a Building 90 Task Force that was co-chaired by Bob Smith and me. From this time forward, the process went relatively quickly, thanks to a great deal of work by Mitch McLaran, André Wright and others to assess and fully document the space needs for faculty who would need to relocate during the refurbishment time period. Associate Vice President Caroline Garcia identified space mostly in Biosciences West, and faculty began moving out of Building 90 in summer of 2017. The refurbishment was largely completed by January 2019, and faculty and staff have begun moving back into the building. Many issues arose related to moves into and out of the building and the refurbishment process that further stressed faculty and their programs. As I write this assessment, issues are continuing as faculty and their programs were being moved back into the building before labs were completed and utilities fully restored. Hopefully, these experiences will provide lessons to improve the process for the next building renovation.

Several additional buildings occupied by CALS are scheduled for refurbishment, although the timing has not yet been determined. These buildings include Shantz, BioSciences East and Forbes. The lack of updated facilities represents a serious challenge to maintaining our most competitive research programs and developing new initiatives. Fortunately, our longstanding connection with BIO5 has enabled us to place a number of faculty in relatively new space in the Keating Building, and more recently in new laboratories and offices in the BSRL Building, both north of Speedway on the medical campus. Our presence in these buildings aligns exceptionally well with our five year vision of investment in health sciences.

Equipment

As buildings and labs have aged, so has major equipment needed to conduct research. Numerous Federal funding mechanisms available in the 1970s-1990s for the purchase of laboratory equipment have disappeared or become highly competitive, and persistent budget reductions highlighted above limited the ability of the University, CALS and individual units to commit funds for new and replacement equipment.

In 2018, Federal Capacity Funds became available on a one time basis for the purchase of major equipment. We were pleased to entertain equipment requests from units, and to fund approximately \$1.3M in equipment purchases. These purchase are being cost shared approximately 20% by CALS units.

CALS Research Office

In February, 2014, the CALS Research Office consisted of an administrative assistant and a five person team that provided grants and contracts pre award services to two CALS units. Most units were performing pre award within their business offices. I quickly realized that investment in additional human resources was needed to achieve the near term objectives of providing comprehensive pre award services across the college, developing robust training programs, implementing research investment programs, and developing support for large interdisciplinary project and initiatives. Creating this infrastructure of people, services and programs would be crucial to support sustained research growth.

In this regard, the most important action that I have taken during my five years as ADR has been to hire Dr. Sangita Pawar as the CALS Assistant Dean for Research. Prior to joining CALS, Dr. Pawar directed the Research Administration Office at the College of Medicine. There she supervised pre award services at the college level, developed and implemented a process for contracts coordination and approval, created a suite of training workshops and information tools, developed a networking program for postdocs, oversaw the Dean's Advisory Council, and implemented a number of science communication activities, including a highly popular seminar series/graduate course and a college-wide

poster forum. Sangita joined the CALS Research Office in July, 2014, and together we began the task of overhauling services and implementing new programs.

Pre award Services: In 2014, the five person CALS Research office pre award team was serving two of the ten CALS units (Schools of Plant Sciences and Natural Resources and the Environment). The remaining eight on-campus academic units and the fifteen Cooperative Extension county offices were performing pre award activities within their business offices.

The CALS pre award team was formed by my predecessor, Dr. Ron Allen, in response to broad concerns about the functioning of pre award services in the college. Although this team was working hard to provide services to the Schools of Plant Sciences and Natural Resources and the Environment, a detailed assessment revealed that their processes were overly complicated and redundant. Through discussions with our pre award staff we learned that their overriding objective was to prevent errors. This led to excessive paperwork and unnecessary budget auditing that significantly lengthened the grant submission process, wasted faculty and staff time and led to significant faculty frustration and friction with Sponsored Projects Services and other unit across the campus. It was clear that a culture change was needed along with an overhaul of pre award processes.

Following the unexpected departure of the CALS pre award office manager in summer of 2014, we initiated a comprehensive overhaul of pre award processes in the college, instilling a new objective of providing outstanding service in support of the research mission. Over the ensuing 1.5 years, staff turnover, the recruitment of three highly qualified pre award grants and contracts managers, and streamlining of processes resulted in a highly efficient and effective team that today provides pre award services for five CALS academic units and the entire Cooperative Extension network of fifteen county offices (pre award services for the remaining five CALS academic units are performed competently by unit business offices). This group of talented managers under Dr. Pawar's supervision are now considered a particular strength of the college and are frequently praised for their outstanding performance. The high level performance of the pre award team was specifically mentioned by more than one faculty recruit as a deciding factor in accepting a position in CALS. In 2018, the CALS Pre Award Team received the CALS Outstanding Team Award.

Federal Capacity Funding Projects and Reports

CALS receives approximately \$2.5M in Federal Capacity funds each year from the USDA's National Institute of Food and Agriculture (NIFA) to support research activities in the College. Approximately \$500,000 per year goes to fund the Research Innovation Pool (page 8 above). The remainder is used primarily to support faculty salaries. All funds must be allocated through approved research projects, which are often called Hatch projects.

In 2015, the CALS Research Office assumed responsibility for overseeing these federal research projects as part of a budget reduction driven administrative consolidation. Ms. Alma Enciso had been administering these projects since the 1980s and became part of my office staff. Dr. Pawar led an assessment of existing management practices related to these projects, which included preparing and submitting an annual report. Her assessment revealed that over more than 20 years lacking of coordination and oversight of the annual report preparation process led to several fold more work was being conducted than necessary to prepare and submit the report. We also concluded that the College was carrying an excessive number (approximately 185) of active federal projects.

Over the course of the next year, Dr. Pawar reorganized the annual report preparation process to dramatically reduce the amount of effort needed. A multi-year plan was also developed and

implemented to reduce the number of Federal projects to approximately 80. These two actions have reduced the effort related to administering Federal Capacity funds by several fold.

Graduate Education

For at least 20 years prior to my arrival in 2014, there was little if any College-level involvement in graduate education beyond dispersal to individual programs of support funds provided by CALS and the Graduate College. I had spent many years working with and leading graduate programs at the Medical School, and so when I arrived in CALS I began to informally assess the state of CALS' PhD programs. I learned that choices made by units to relinquish graduate support during multiple years of budget cuts had left several PhD programs almost entirely reliant on grant funds for student support. In several cases this resulted in a degradation of overall program operations. Across CALS, PhD program enrollments we down more than 30%. It became clear that an in depth assessment was needed along with an overarching plan for program rejuvenation.

In August 2017, Dr. Kirsten Limesand joined the CALS Research Office on a temporary assignment as Graduate Education Advisor, tasked with developing an overview of graduate education in the College and solutions to maximize future success. Dr. Limesand began with College PhD programs. Working with a small task force consisting of Associate Dean Mike Staten, Assistant Dean Sangita Pawar and me, finances and operations were assessed of the eight CALS PhD programs and the two GIDPs that are closely associated with CALS units. The lack of financial resources was a primary issue across all programs that was precipitating declining enrollments and program disfunction. Due to the diversity of PhD programs, it was most feasible to develop five overarching principles that all graduate programs have agreed to:

- 1. First year funding for all PhD students will come from institutional sources (UA, CALS, Grad Program) or fellowships or institutional training grants, and not from individual faculty grants
- 2. All matriculating PhD students should be guaranteed full support for the duration of their graduate training up to a maximum of 5 years
- 3. All students should receive 12 months of stipend support
- 4. Stipend levels should be standardized within a program and be at a nationally competitive level for the discipline
- 5. All PhD students will have a meaningful teaching or mentoring experience

Significant progress has been made to bring all PhD programs in alignment with Principles 1-3. Following discussions with graduate programs, text was developed to include in all position offer letters that ensures five years of support for all students in good standing. A detailed financial assessment determined that in addition to TA funding, approximately \$320,000 of additional GA funding was needed across programs to provide each unit with the funding to achieve Principle 2, assuming 40 first year graduate students across CALS PhD programs. These funds are being made available to graduate programs for the FY20 entering class of students. Work is in progress to ensure that all programs are in alignment with Principles 4 and 5.

In March, 2018, Dr. Limesand became the inaugural CALS Assistant Dean for Graduate Education. This appointment recognizes the importance of graduate education to CALS mission and the permanent need for College level administrative support and guidance. CALS Masters programs are an important next focus for Dr. Limesand.

Challenges:

I am pleased that many new programs and improvement to services that we have implemented have led to significantly improved support for research. I believe that the programmatic advances and culture change that we have helped to enable are unprecedented across the University.

Despite some progress updating the CALS physical research infrastructure, significant challenge remain. With the renovations of Building 90 essentially completed, CALS has three buildings (Shantz, Forbes and BioSciences East) on the University's top ten list of buildings most in need of upgrading. It appears that the University is handling refurbishments sequentially, and so updating all of these buildings will likely take many years. In the meantime, old and substandard facilities have a negative effect on existing programs and limits recruitment of new faculty. Similarly, there remains a significant need for equipment despite the \$1.3M in purchases that were approved earlier this year. The School of Plant Sciences, in particular, requires approximately \$2M to replace and/or renovate aging and non-functioning plant growth chambers.

RESEARCH STRATEGIC GOAL THREE DEFINE AND MEASURE RESOURCE GENERATION FOR RESEARCH

Aligning how resource generation is measured with desired outcomes is an important component of incentivizing outcomes and evaluating success. Over the past five years, CALS has transitioned from having essentially no data available for assessment to being a leader on campus in developing approaches and tools for acquiring and visualizing education and research metrics. This transition has been met at various times with significant concern from faculty who have feared that the use of metrics would supersede other evaluation criteria, and that they would be reduced to "dots on a graph".

These are justified concerns that were exacerbated by our initial enthusiasm regarding the availability of new data and visualization tools. It took several years to adequately reassure faculty that data would be used to inform decisions rather than drive them (data-informed versus data-driven decision making). Having robust data assessment capabilities has been an important contributing factor to CALS' high level of performance relative to other colleges over the past five years.

Most of the work to develop and implement tools for data acquisition and visualization was performed by the CALS (now ALVSCE) Data Solutions Team under the direction of Jeffrey Ratje, the Associate Vice President/Associate Dean for Finance, Administration and Operations. To develop tools pertinent to research, Dr. Pawar worked with the Data Solutions Team to develop a number of UAccess Dashboards and other web visualization tools.

Collectively, these tools have powered a transformation in the way that we assess research productivity and success, and importantly also the time it takes us to do so. To cite one example, in 2015 unit heads spent many days preparing data in advance of our annual research assessment meeting. This year, all of data acquisition and visualization is automated through the CALS Tableau dashboards. It's important to highlight that all of these tools are available to anyone, ensuring transparency. In my opinion, it's difficult to overstate the impact that the Data Solutions Team has had on the ability of CALS to achieve its mission.

Dr. Pawar has also worked extensively with the University Analytics and Institutional Research (UAIR) and the Data Solutions Team to design and implement a number of dashboards and tools that have advanced CALS, the University. The UAIR group frequently lacked an understanding regarding the key needs of users and what would best provide a solution. Dr. Pawar was able to provide this real world

perspective. Following is a partial list of her work with UAIR and the Data Solutions Team. Much of what was designed by the Data Solutions team has been adapted and rolled out across the University.

- Designed the **Unit Review and faculty performance metrics dashboards** for CALS and worked with the ALVSCE Data Solutions Team to get them built and keep refining them. <u>https://research.cals.arizona.edu/research-metrics</u>
- Worked on redesigning and simplifying UAccess Analytics Research Dashboards for Proposals and Awards for quick and easy access to relevant information. This work was done with UAIR. <u>https://analytics.uaccess.arizona.edu/analytics/saw.dll?Dashboard</u>
- Worked with **UA Contracts** office to design the Negotiation log to keep track of Contract Status. <u>https://analytics.uaccess.arizona.edu/analytics/saw.dll?Dashboard</u>
- Designed **Graduate Student Information** reports with the ALVSCE Data Solutions Team.
- Designed Quarterly Award reports with the ALVSCE Data Solutions Team.
- Helped design **Faculty Profile Dashboard** for quick and easy overview of every faculty on campus. This work was done with **UAIR**. https://analytics.uaccess.arizona.edu/analytics/saw.dll?Dashboard

CALS metric dashboards are available here to anyone with a UA NetID login: <u>https://research.cals.arizona.edu/research-metrics</u>

RESEARCH STRATEGIC GOAL FOUR: EXPAND COMMUNICATION ON RESEARCH ACTIVITIES

With increasing competitiveness for research resources, effective communications regarding research activities, outcomes and impacts is becoming increasingly important to advancing our research mission. Competing effectively for large funded projects (more than \$5M) generally requires interdisciplinary capabilities that span departments, schools and colleges. Effective and persistent communications is needed so that federal agencies and private foundations view these interdisciplinary groups, and the UA in general, as "players" in the specific research area. It's estimated that 90% of funding by private foundations is handled through direct solicitation of qualified teams, and not publicized through requests for proposals. Going forward, we need to be competitive for this funding.

When I arrived as ADR in 2014, all CALS media coverage was provided by the CALS Communications Office. Due to the competing needs across the College, research related communications were intermittent and there was no organized strategy for communicating about research. This situation persisted for several years.

In September, 2016, Jennifer Yamnitz was appointed the new CALS Director of Branding and Marketing. Jennifer was tasked with creating and implementing branding, marketing and communications strategies for CALS. For two years, her group focused primarily on student recruitment and retention because this was considered the most critical need for the College. In Fall 2018, it was agreed that Jennifer's group would expand their scope to include research communications. Recruitment of a communications specialist is underway, and I am hopeful that with the hiring of this person we can begin to implement a more comprehensive research communications strategy.

Another important component of our research communications strategy involves developing an effective website that provides useful information to external and internal stakeholders. Because the needs for internal constituents tends to be highly specialized, we have developed an outward facing web page (<u>https://cals.arizona.edu/research-home</u>) and a page specifically tailored for faculty and staff

(<u>https://research.cals.arizona.edu/).</u> This latter webpage contains detailed information about CALS research, resources for researchers, and training and events.

RESEARCH STRATEGIC GOAL FIVE: BUILD TECH TRANSFER, IP DEVELOPMENT, EXTERNAL BUSINESS RELATIONS/DEVELOPMENT

Maximizing the transfer of knowledge to the private sector is a core University mission. For decades, however, the University offered only modest support for faculty who wished to commercialize their discoveries. The patent process was onerous, filing a patent depended on identifying an external partner to provide funding, and only modest support was available for faculty who wished to launch startup companies.

In 2012, David Allen became Vice President and Director of Tech Launch Arizona (TLA). He reorganized TLA and changed the culture to one that aggressively supports faculty to commercialize discoveries. Among the new initiatives was an embed program that locates a TLA licensing manager in colleges to educate faculty and staff and oversee technology transfer activities. Shortly after I arrived as CALS ADR, Tod McCauley became the new CALS TLA embed, reporting to me. Tod's early efforts led to a significant increase in commercialization activity (table below). In FY15 and FY16, thirty-six patents were filed and six startup companies were launched by CALS faculty. The number of startups has since fallen off, suggesting that the six companies launched in FY15-16 represented pent up demand. The number of invention disclosures and US Patents filed have increased each year, while the number of licensing agreements has been flat. These trends approximately mirror those for the entire University. It remains to be seen if the amount of IP being generated by CALS faculty will continue to increase. It is apparent that some faculty are excited to move their discoveries towards

Metric	FY2015	FY2016	FY2017	FY2018 Total
Invention Disclosures	19	18	23	24
Exclusive Licenses & Options	8	4	6	4
Startups	2	4	-	1
US Patents Filed	18	18	22	26
Total Agreements	12	10	10	9
Asset Development Awards	2 \$112,623 awarded	1 \$47,307 awarded	0 new; \$37,688 carryover from FY2016	2 \$41,717 awarded
US Patents Issued	3	2	4	3

College Totals

University-wide Totals

· · ·						
Metric	FY2013	FY2014	FY2015	FY2016	FY2017	FY2018
Invention Disclosures	144	188	213	250	261	275
Exclusive Licenses & Options	22	39	45	49	57	54
Startups	3	11	12	14	15	16
US Patents Filed	145	167	200	278	334	353
Total Agreements	48	72	83	95	105	112
Asset	19	19	17	27	15	16
Development Awards	(\$703,449 awarded)	\$703,449 awarded	\$814,788 awarded	\$1.22M awarded	\$466,667 awarded	\$646,072 awarded
US Patents Issued	27	24	35	36	47	36

commercialization, while others are less motivated to do so. While certain areas of research are clearly more amendable to commercializing discoveries (for example, infectious disease research [high] versus environmental sciences [lower]), faculty appear to have innate differences in their proclivity towards commercialization.

In September 2018, Emre Toker was hired as a CALS Mentor In Residence to deliver entrepreneurial resources and educational programs. Emre is a UA alumnus who has founded three successful companies and developed educational programs in entrepreneurship. Emre is working with CALS Career Services to expand internship and mentoring opportunities and is partnering with the Department of Agricultural Education's Innovation Collaboratory to assist entrepreneurial development for all CALS undergraduate and graduate students. He is also implementing programs that target rural development. Emre's hire represents a CALS investment to aid in fulfilling the intent of the final phrase of our research mission, "…to convey the products of our efforts to the citizens of Arizona, the US and the world."

Challenges

Overall I am pleased with our progress in technology transfer and commercialization activities and outcomes. From a point of little activity in FY14, we now have two full time employees focused on tech transfer and entrepreneurship and considerable excitement among some faculty. Although it remains to be determined if our rate of IP development will continue to increase, Tod McCauley's efforts have helped to develop a culture in which faculty know that commercialization is valued and that they have highly skilled support to move their discoveries through the commercialization pipeline. Our capacity to support commercialization is a specific concern voiced by many faculty candidates, and so the capacity to do so has broader impacts on faculty recruitment and retention.

The College of Veterinary Medicine (CVM)

The new College of Veterinary Medicine was the brainchild of Vice President Burgess, who began planning for a new veterinary school soon after arriving at the UA in 2012. It is an inherently audacious undertaking, considering that no new school of veterinary medicine has been launched at a Research I university in several decades, the accreditation process is onerous and the finances challenging. Nevertheless, the inaugural CVM Dean recently arrived on campus and the first class is scheduled to begin in fall 2020.

One component of the accreditation process has been to demonstrate capacity to expose students to a meaningful research experience and to ensure that the CVM faculty have the opportunity to pursue scholarly research. The most cost effective way to provide research support for CVM is to leverage the significant capacity that exists in CALS. In 2018, I became Associate Vice President for Research for ALVSCE with new responsibilities to oversee CVM's research activities. I will be working with Dean Funk and Associate Dean Maciulla to develop and implement a research plan for the College.

Summary

I came to the position of Associate Dean for Research with relatively little administrative experience. Over the past five years, I have learned so much about so many things that it's now challenging for me to recall my professional life prior to 2014. I'm already reflecting on these past five years as a "special time" during which I was given an opportunity to participate in and help lead real change that is making a difference. I feel privileged to have worked with a strong leadership team, from whom I have learned a great deal. Even though we have made real progress and have grown the overall research enterprise in exciting ways, old challenges remain and new challenges have arisen as what was once aspirational has become the new reality. I am concerned that we have not done enough to improve our physical research infrastructure—buildings, laboratories, equipment etc. Unfortunately, some of the most impactful improvements in the form of building refurbishment are out of our control. For the Shantz, Forbes and Biosciences East Buildings, it appears that refurbishments will occur sequentially over the next five to ten years. I also regret that we have not moved faster to increase our external communications about research. For many reasons, communicating our activities and strengths to a variety of stakeholders is important to our success, and we need to do better.

A challenge for me going forward is balancing responsibilities, because through our success what began as a half time administrative appointment has grown in scope to become almost full time and with a new title of ALVSCE Associate Vice President for Research, though my other commitments as the lead PI of CyVerse and running an NIH funded lab remain. I often feel that my strongest attribute is the ability to hire the best people and then get out of their way. This is certainly the case with our Research Office Team, without whom most of the accomplishments discussed in this document would not have been possible. Appendix:

- 1. CALS Research Office Organizational Chart
- 2. Research Metrics
- 3. CALS Research Strategic Plan

CALS Research Office Organizational Chart



Parker B. Antin Associate Vice President, Research Associate Dean, Research



Emre Toker Mentor in Residence



David LeBauer Director Data Sciences



Tod McCauley Senior Licensing Manager Tech Transfer Arizona



Sangita Pawar Assistant Vice President, Research Assistant Dean, Research



Rachel Crookston Grants & Contracts Manager



Fatemah Dili Grants & Contracts Manager



Lynn Frazier Grants & Contracts Manager



Alma Enciso Program Coordinator



Zaida Zalbidea Program Coordinator

CALS Research Metrics FY2014-FY2018

	2014	2015	2016	2017	2018
HAZ Health Sci Ctrs & Divisions	23,273,798	21,106,300	22,023,627	28,254,581	23,181,655
Az Health Sciences Division		153,541	85,454	3,831,699	14,623,595
CALS Cooperative Ext	484,294	280,622	632,771	1,106,474	1,026,398
Campus Health and Wellness	181,247	45,461			
🗄 Col Arch Plan & Landscape Arch	103,680	60,960	316,712	353,086	350,602
College of Agric and Life Sci	26,522,667	28,788,696	28,845,578	28,722,497	32,240,574
College of Education	3,017,226	3,777,962	3,534,273	3,689,773	3,624,330
College of Engineering	21,587,060	20,944,118	18,445,105	16,972,304	15,732,874
College of Humanities	397,300	383,479	455,675	304,854	299,882
College of Medicine - Phoenix	3,889,226	3,774,606	3,919,984	3,802,363	4,287,450
College of Medicine - Tucson	41,175,265	40,450,618	49,348,393	52,048,789	63,850,185
College of Nursing	1,854,756	1,625,022	1,472,155	1,693,354	2,658,613
College of Optical Sciences	22,301,020	21,587,006	16,075,176	14,827,864	18,296,306
College of Pharmacy	6,998,073	6,890,000	4,783,117	4,562,278	5,631,543
College of Public Health	6,353,433	5,360,736	7,150,738	7,619,140	8,479,575
College of Science	118,342,059	99,980,571	93,797,774	94,818,557	92,798,447
College of Social & Behav Sci	6,183,514	5,972,423	6,403,180	5,542,950	4,993,605
Eller College of Management	3,634,455	2,880,322	2,215,051	2,772,291	2,537,656
🗄 Graduate College	3,308,860	3,473,907	3,822,450	2,834,532	3,191,867
	32,391			40,258	2
🗄 Libraries	42,759	32,304	18,409		
Ofc of Global Initiatives Div		180,063	742,878	730,213	28,330
RDI Center & Institutes	17,995,799	19,034,094	19,294,697	19,169,481	19,588,337
H RDI Museums Division	996,992	873,736	633,955	280,983	50,630
RDI Research Infrastructure	3,508,097	3,521,222	4,684,597	3,917,592	2,519,925
Grand Total	312,183,971	291,177,768	288,701,749	297,895,913	319,992,381

Federal Research Expenditures By College







CALS Research Strategic Plan January 2016

Overall CALS Research Mission: To advance knowledge across the continuum of basic to applied research in the mission areas of the College, and to convey the products of our efforts to the citizens of Arizona, the US and the world.

We will accomplish our mission by increasing the size and improving the quality of our research workforce, by maximizing the ability of our research workforce to conduct research and our ability to measure its impact, and by effectively communicating the products of our research to the world.

STRATEGIC GOAL ONE

BUILD ON EXISTING STRENGTHS AND IDENTIFY STRATEGIC NEW INVESTMENT AREAS TO MAXIMIZE RESEARCH ACHIEVEMENT.

A. Current situation and gap between current situation and desired situation:

Declining state support for higher education and reduced federal funding for research require that we focus our investments in areas in which we can be disproportionately competitive and successful. The metrics based research objective is to increase research expenditures 50% by 2023 from 2010 levels. This will be accomplished through our projected ability to differentially invest in faculty and research endeavors along the continuum from discovery to applied research. Future investments will leverage key areas of existing strength and support strategically important new research areas. To accomplish this, we need to (i) evaluate diverse characteristics to discriminate between programs as excellent/strong, functional/promising, or unlikely to yield a meaningful return on investment as determined by financial as well as other measures of success; (ii) develop strategies to move programs from the latter categories to the first, or re-evaluate investment in them; (iii) support existing programs with demonstrable return or promise for growth, and identify new emerging programs for additional investment; and (iv) leverage our unique statewide Experiment Station research facilities and ensure full integration of our Extension mission with CALS research activities.

B. Strategies to achieve goal:

- i. Develop hiring strategies that maximize building critical mass in areas of identified research strengths, and that also enable us to respond rapidly to strategically important emerging research areas.
- ii. Incentivize and encourage integrative and interdisciplinary projects that address grand challenge themes.
- iii. Prioritize funding that leverages existing and prospective large project opportunities.
- iv. Align CALS research investments with major University-level initiatives in areas such as information sciences, the environment and biomedicine.
- v. Incentivize research productivity & extramural grant success by recognizing achievement through promotion, program support, formalized merit processes and salary increases.
- vi. Promote CALS leadership in UA-wide and multi-institutional initiatives.
- vi. Prioritize invention disclosures, patent applications and company launches in faculty evaluation.
- vii. Enhance integration of CALS research and extension programs.



C. Actions

- Implement hiring strategies to promote the following: a) achieving critical mass in areas of research strength; b) responsiveness to emerging research needs; c) hiring at all rank levels; d) immediate and long term return on investment; e) research across the continuum from discovery-based to applied research.
- Coordinate with university-wide initiatives to build integrative research centers and programs.
- Institute reinvestment packages for highly productive scientists at the time of promotion to associate and full professor.
- Establish bridge-funding mechanisms to support successful grant-funded programs that have had adverse grant funding decisions, and pilot funding mechanisms to stimulate new and innovative research efforts with promise for significant programmatic growth.
- Encourage and incentivize the use of CALS unique research assets, including Experiment Station Facilities, to build programs that address mission-based grand challenges.
- Recognize research excellence through CALS awards, and ensure that CALS faculty are nominated for University-wide, regional, national, and international awards, and strategically important national committees and advisory boards.
- Educate faculty and staff about technology transfer opportunities and processes, to maximize submission of invention disclosures and patent applications, and launch of startup companies.

D. Inputs Needed to Achieve Goal

- Cooperation of Unit Heads to coordinate hiring objectives with overall CALS strategies and goals.
- Allocation of CALS internal resources to ensure dedicated support for research initiatives and to maximally support and incentivize CALS research programs.
- Coordination of CALS research investments and activities with research strategies of the University, the state of Arizona, and the Nation.
- Support of CALS faculty in priority research areas with potential for high return on investment.

E. Objective metrics that will be used to track progress towards attaining goals

- Upward trends in number of grants awarded, total research dollars, publications, CALS-led multiinvestigator grants, and additional metrics that measure research impact.
- Upward trends in total impact and impact per faculty member.
- Trending increases in invention disclosures, patents and startup companies.
- Identifiable and measured contributions by CALS to improved economic and social conditions in Arizona.



STRATEGIC GOAL TWO OPTIMIZE CALS RESEARCH INFRASTRUCTURE TO SUPPORT THE CALS RESEARCH MISSION

A. Current situation and gap between current situation and desired situation:

Cultural and structural changes over the past two years have improved CALS Research Office functions. Improvements include: i) reorganization and efficiency improvements in all facets of CALS pre award activities; ii) employing the most qualified people available to perform pre award services; iii) Implementing training programs for faculty and staff in grant preparation and submission processes; iv) Streamlining the Federal Capacity Funds grant program application and reporting mechanisms to reduce the overall burden to faculty and staff; v) Integration with University-wide processes to improve project pre and post award activities; vi) Streamlining and rationalization of CALS reporting systems, leading to improved efficiencies and data availability; viii) Cultural transformation in the CALS Research Office from a focus on monitoring and rules enforcement to a focus on service and enablement. This first phase of transformation has "reduced the friction" and optimized processes, thereby increasing the ability of faculty and staff to pursue their research objectives. Ongoing efforts are now focused in the following areas:

1) Research Infrastructure: The quality of the physical research infrastructure (laboratories and large equipment) is highly variable across college units and buildings. The physical infrastructure of all units must be updated to be on par with or exceed that of our peer colleges and institutions.

2) CALS Experiment Station Facilities: Strategic planning efforts have aligned our statewide research facilities to support the overall CALS research mission. This process must continue to determine how these unique research facilities can best directly support research of CALS faculty and staff, and/or provide significant value to stakeholders that is strategically significant to CALS and the UA.

3) Graduate Education: As the training environment for future scientists and also the source of our most important research workforce, CALS graduate programs must be uniformly strong and competitive with programs at the best US and international institutions.

4) Research Data and Metrics: Working with the office of the Associate Dean for Finance and Administration, significant improvements have been made over the past two years in data quality and availability. Continued improvements will enhance our ability to guide our policies through data driven analysis.

B. Strategies to achieve goal

- i. Develop a comprehensive plan for upgrading CALS research space and facilities.
- ii. Develop a strategy for renewed investment in and revitalization of CALS graduate programs.
- iii. Ensure optimal training for faculty and staff in all grants and contracts pre and post award related activities.
- iv. Develop strategies for utilizing CALS unique research facilities (Ag Centers etc.) and integrating with hiring decisions.
- v. Identify data and metrics that will maximally enhance real time analysis and research strategic planning.

C. Actions

- Evaluate all CALS research space and develop a multi-year plan for infrastructure upgrades.
- Engage relevant stakeholders to develop a comprehensive strategic plan for providing long term financial and operational stability to CALS graduate programs.
- Identify data needed to maximize research related activities and analysis, and assist in developing appropriate presentation mechanisms.



• Define the value of each Experiment Station Research Facility to the CALS Research and Extension mission, and encourage the integration of these facilities into unit research strategic plans.

D. Inputs needed to achieve goal

- Engagement of CALS graduate program leaders, unit heads and faculty concerning the future of CALS graduate programs.
- Engagement with UAIR and CALS Data Solution Team
- Engagement of unit heads, Experiment Station Facility Directors, and extension directors.

E. Objective metrics that will be used to track progress towards attaining goals

- Upgrading of substandard research space and facilities.
- Increase in the number and quality of graduate student; increase and rationalization of graduate stipend levels; reduction in average time to degree.
- Increased research activity associated with Experiment Station Facilities.



STRATEGIC GOAL THREE DEFINE AND MEASURE RESOURCE GENERATION FOR RESEARCH

A. Current situation and gap between current situation and desired situation:

The metrics based research objective a 50% increase research expenditures by 2023 from 2010 levels. Although ABOR benchmarks track grants and contracts dollars, additional measures of scholarship productivity are relevant to measuring the total impact of CALS research. Relevant metrics include: number of Masters and PhD degrees; publications and impact factors, faculty and team awards, contribution to complex projects involving teams of scientists; invention disclosures, patents, and startup companies. A calculation of return on investment (ROI) is another important measure of our impact relative to investment. These objectives will be pursued in collaboration with the Associate Dean for Finance and Administration. Coming to consensus on metrics that best define success, collecting the metrics in an accurate and timely manner, and providing stakeholder access is an important component of our ability to strategically pursue research that maximally impacts the citizens of Arizona, the US and the world.

B. Strategies to achieve goal

- i. Use ABOR and UA metrics, plus additional CALS-defined metrics, to measure and track research productivity.
- ii. Identify measures of success and impact beyond funds received and expended, and incorporate these measures into individual, unit and college level evaluations.
- iii. Ensure that accurate data are available in real time through online resources, including UAccess dashboards.
- iv. Calculate, track and use for evaluation purposes return on investment (ROI) for individual faculty and units.
- v. Define, track and use for evaluation purposes measures of success for CALS Experiment Station research facilities.
- vi. Ensure robust training for faculty and staff in the collection and use of research metrics.

C. Actions

- In consultation with faculty, Unit Heads, and other stakeholders, identify a suite of metrics to measure, track and evaluate research performance.
- Work with UAIR, the CALS Data Solutions Team and the CALS for Finance and Administration to implement optimal online data reporting mechanisms.
- Review and optimize existing CALS training programs to provide CALS personnel with data needed for performance evaluations and research strategic planning.
- Work with Unit Heads, Experiment Station Directors, Associate Deans and other stakeholders to define metrics that measure productivity of the Experiment Station research facilities.
- Identify strategies to strengthen the connection between Research and Extension programs.

D. Inputs needed to achieve goal

- Broad input (faculty; HODs, CEDs; DRAC; Dean's Council) and agreement on priority metrics.
- Input on best metrics for ROI calculations in programs across CALS.
- Flexibility for incentives / rewards for individuals and teams / units that have high ROI.

Objective metrics that will be used to track progress towards attaining goal

• CALS units (including college level Associate Deans-Research, Extension, Instruction,



Administrative Services) will have clearly identified metrics and tracking for research productivity and resource generation.

- Data will be available to properly assess the contribution of CALS Experiment Station Research Facilities to the overall research mission.
- CALs faculty and staff will be familiar with and able to evaluate research metrics.
- Identifiable and measured contributions by CALS to improved economic and social conditions in Arizona.



STRATEGIC GOAL FOUR:

EXPAND COMMUNICATION ON RESEARCH ACTIVITIES

A. Current situation and gap between current situation and desired situation:

Communication of research activities and outcomes are a key part of the CALS research mission "...to convey the products of our efforts to the citizens of Arizona, the US and the world." With increasing competitiveness for research resources and the attention of key stakeholders, communication about our research activities and findings is becoming increasingly important to our research mission. Presently the CALS Communications Office provides media coverage for all College endeavors, leaving insufficient resources for research communications. Particularly with the multitude of ways that science can now be communicated, additional resources are needed to expand communications related to ongoing and completed research. Improved internal communications are needed highlight research activities to the public, other scientists, federal and private research entities, and potential donors. A focused effort is needed to highlight our achievements to the public, legislators, other government officials, and higher education stakeholders including ABOR.

B. Strategy:

- i. Increase our capacity to communicate ongoing research activities and research findings to stakeholders within CALS and the UA, and externally to a variety of stakeholders using all available platforms.
- ii. Use increased communications to raise the profile of CALS research locally, statewide, nationally, and internationally.
- iii. Develop a strategy to target industry sectors of relevance to CALS research activities.

C. Actions

- Develop and implement a comprehensive communications strategy for CALS research.
- Develop a comprehensive social media presence for CALS research.
- Invest the resources necessary to implement the communications strategy.
- Coordinate events that highlight CALS areas of excellence to stakeholders in Arizona. Identify and publicize projects that are supported by strategic investments from development sources and that leverage state investments.
- Integrate with communication activities at the UA to assist with information placement through UA venues.

D. Inputs needed to achieve the goal

- Resources to expand research communications capabilities.
- A comprehensive CALS research communications strategy.

E. Objective metrics that will be used to track progress towards attaining goal

- Increased number of media placements; increased social media activity related to CALS research.
- Increased awareness by all stakeholders of CALS research activities.



STRATEGIC GOAL FIVE: BUILD TECH TRANSFER, IP DEVELOPMENT, EXTERNAL BUSINESS RELATIONS/DEVELOPMENT

A. Current situation and gap between current situation and desired situation:

Maximizing the transfer of knowledge and inventions to the private sector is a core University mission. The UA established Tech Launch Arizona (TLA) to strengthen its technology transfer and business development capabilities, and to enhance the impact of UA research, intellectual property (IP) and technology innovation. Similarly, CALS goals are to maximize the ability of faculty and staff to move their research knowledge and inventions to the private sector, and also to create and sustain industry partnerships. Effectiveness of these activities are measured using ABOR designated metrics: invention disclosures, US patents issued, IP revenue, and new companies started. Although CALS has begun to take advantage of the new capacity provided by TLA, including a TLA licensing manager focused on CALS, we do not yet have a strong culture of encouraging and rewarding disclosures, tech transfer and business development. Furthermore, effective mechanisms have not yet been defined for creating and sustaining industry partnerships.

B. Strategies to achieve goal:

- i. Embed technology transfer, business development training and informational workshops into existing CALS faculty and staff training programs.
- ii. Develop strategies and processes to enable and sustain industry partnerships.
- iii. Establish clear faculty performance criteria so that technology transfer activities and business relationships are rewarded in the promotion and tenure process.
- iv. Add entrepreneurship to faculty and staff position descriptions.

C. Actions

- Improve and update existing training modules and workshops for CALS faculty and staff.
- Provide mechanism(s) to support entrepreneurial initiatives proposed by CALS faculty.
- Review promotion and tenure criteria to ensure full consideration of entrepreneurial activities in faculty career progressions.
- Identify and nurture industry partnerships.

D. Inputs needed to achieve the goal

- Cooperation and time of contracting units to develop more efficient mechanisms for establishing and maintaining industry partnerships and support of UA research.
- Faculty time and interest to attend workshops.
- Improved and more transparent reporting of progress on ABOR approved metrics.

E. Objective metrics that will be used to track progress towards attaining goal

- Increased numbers of disclosures, patent applications, patents awarded and companies launched.
- Increased number of faculty reporting patent/IP/other entrepreneurial productivity.
- Increases in contracts and other relationships with industry partners.
- Workshop attendance and interest in IP/contracting activities by faculty and staff.