

**ARIZONA UNIVERSITY SYSTEM
NORTHERN ARIZONA UNIVERSITY
TECHNOLOGY AND RESEARCH INITIATIVE FUND
(TRIF)**

GROWING BIOTECHNOLOGY

**A Proposition 301-Funded Project at Northern Arizona University
for Arizona**

BUSINESS PLAN

**September, 2002
Revised December, 2002**

Executive Summary

Northern Arizona University (NAU) is positioning itself to be a strategic player in the biotechnology industry through research and development activities, technology transfer initiatives, and workforce training through established academic programs. Coupled with new (Wettaw Biology/Biochemistry Building) and planned facilities (Applied Research and Development Building) NAU is establishing an infrastructure to enhance the development of the biotechnology industry in Arizona. Building on an excellent and growing cadre of scholars in areas related to biomedicine and biotechnology, NAU provides a solid platform for launching a variety of biotechnology initiatives in our region. The outcomes of these endeavors will include several new start up companies in Northern Arizona, additional resources for biomedical and biotechnology-related research in Flagstaff, and a generation of young people trained for the New Economy workforce through their knowledge about and hands-on experience with all facets of state-of-the-art molecular biology and biotechnology processes.

The Growing Biotechnology Initiative will be a part of the newly developed Translational Genomic Research Institute, directly connecting research and development with the treatment and prevention of numerous diseases. It will build on our existing strengths as well as new programs such as the NIH-funded U54 cancer research grant now in place and collaborative with colleagues at the University of Arizona. The Keim Genetics Laboratory will serve initially as a centerpiece in our biotechnology operations. In addition, we are conducting research on heavy metals and cancer, emerging diseases such as hanta virus and plague, halophilic bacteria, and environmental biology, including work on endocrine disrupter chemicals, water quality, agricultural uses of fungi, and various aspect of climate change. All of these are viewed as within the broad scope of modern biotechnology.

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1.0 Core Vision/Project Description

1.1 Industry Overview

Bioscience, biomedicine, and biotechnology are among the most diverse and fastest growing industries in the U.S. and across the globe. Recent advances in the cellular and molecular life sciences over the last 10 years have led to the development of an industry with annual revenues exceeding \$27 billion and a total market value greater than \$200 billion. Since 1999 the biotechnology/biomedicine industry has attracted almost \$70 billion in investments to fuel the development of more than 350 medicines and vaccines in the pipeline targeting more than 200 diseases. In 2001, the industry invested over \$15 billion in research and development, more than triple the amount spent in 1992. Employment in the biotechnology industry has been equally robust with more than 400,000 jobs in the U.S. alone attributable either directly or indirectly to the industry.

States are increasingly looking to attract biotechnology companies to rapidly increase revenues, create new jobs, and provide a foundation for future economic growth. Incentives to drive the formation of biotechnology centers are now considered essential by many economic developers. In 2001, 41 states offered biotechnology incentives that not only included the traditional R&D tax credit but provided substantial funding for incubator facilities, venture capital, and grant funds. Arizona is no exception as evidenced by its recent investment and success in attracting the International Genomics Consortium and the development of the Translational Genomics Research Institute (TGen).

The future of biotechnology is very promising. The foundation for growth has been established with the doubling of the National Institutes of Health research budget over the last five years and continued double digit increases in basic and applied research. Biotechnology patents in the U.S. are approaching 15,000 per year. Industrial and venture capital investments in R&D are also expanding despite the downturn in public stock markets. Biotech companies are strategically forming partnerships and making acquisitions to strengthen their position in the industry (e.g., Amgen offered \$16 billion for Immunex). Finally, biotechnology based products are finding their way to commercial markets at a rate of about 20 per year bringing ever increasing revenues to investors and benefits to society beyond the imagination of most people just a decade ago.

1.2 Mission and Goals

Northern Arizona University (NAU) is uniquely positioned to be a strategic player in the biotechnology industry. The combined teaching and research mission of the University focused on integrating nationally competitive undergraduate and graduate education with significant research programs lends itself to the development of new knowledge (biotechnology) and the training of a highly skilled workforce to meet the demands of a rapidly developing industry.

The overall goal of the Growing Biotechnology initiative is to enhance the development of the biotechnology industry in Arizona as part of a statewide effort to expand the state's economic base and build bioindustry to serve the citizens of Arizona and the world. Specifically

NAU strives to: (1) Increase its core competencies in bioscience, biotechnology, and biomedicine; (2) Expand technology transfer activities including patents, licenses, business start-up companies, and strategic industry partnerships; and (3) Increase the number and competitiveness of graduates to meet the workforce demands of bioindustry in Arizona and beyond.

NAU takes a very broad view of bioscience, biotechnology, and biomedicine and integrates its research and teaching programs across multiple disciplines. Strategically, NAU draws on the strength and expertise of its faculty to selectively pursue a number of R&D venues and at the same time combines its research capacity with a rigorous curriculum to produce highly competitive bachelors, masters, and doctoral graduates. Research activities are currently funded under Proposition 301 are largely focused on infectious diseases (e.g., plague, anthrax, Lyme's disease), genotoxicity (cancer) of metals in the environment, development of new antibiotics and antiviral medicines, muscle physiology pertaining to heart attacks, and the application of molecular techniques to address environmental problems such as environmental chemicals that act as endocrine disrupters, climate change, and global warming.

From a workforce development perspective, NAU has over 2700 students in more than 70 undergraduate and graduate programs across five colleges and schools pursuing degrees in the biosciences and health related professions NAU's efforts for Growing Biotechnology are focused in three of these departments, Biological Sciences, Chemistry, and Exercise Science. We already have collaborative endeavors in place across these three units. Centering our efforts on just these three areas gives us a definition and focus for expending Proposition 301 funds to best advantage and in areas of greatest need. By conducting our efforts on a selective and strategic basis, we can train a competitive workforce in biotechnology and biomedicine related fields. Our curriculum and laboratory experiences provide extensive training in molecular technologies, meeting directly the increasing demand for students with this specialized training.

1.3 Products or Services Provided

The specific products and services we provide are highly diversified.

They will include:

- Patentable technology (e.g., processes, devices, medicines)
- New knowledge for bioindustry through publications and presentations
- Opportunities for collaborative research and technology development
- Specific and strategic business partnerships including R&D services
- Training for students entering the workforce of the New Economy who are prepared to meet the demands of bioindustry.

We also contribute to:

- Partnerships with business and industry for technology commercialization.
- Collaborations with colleagues at other universities in R&D activities
- Aiding in establishment of start-up companies
- Scientific knowledge in areas ranging from cancer and biomedicine to environmental health and climate change
- Consultation with business, industry, and federal laboratories where there is mutual interest in particular projects where we have expertise and knowledge

1.4 Positioning

Northern Arizona University (NAU) is one of the fastest growing research universities in the United States. During the period 2000-2002 new research awards to NAU nearly doubled to \$50 million dollars. A major research area NAU continues to build upon is in the fields of bioscience, biomedicine, and biotechnology. Research in these fields is under the sponsorship of numerous federal, state, and private agencies and organizations accounting for more than 20 % of current sponsored projects. Overall, the impact of externally sponsored research is seen across 13 academic departments, 22 research centers and institutes, and involving approximately 450 faculty, staff, and graduate and undergraduate students.

Bioscience, biomedicine, and biotechnology research is an integral part of the educational mission, experience, and degree programs at NAU. Of the nearly 20,000 students enrolled at NAU over 2,700 are pursuing more than 70 undergraduate and graduate degrees in the biosciences and health related professional programs. These programs of study are based in the Colleges of Arts & Sciences, Ecosystem Science and Management, Engineering and Technology, Health Professions, and Social and Behavioral Sciences. A major part of NAU's mission is to be a national leader in providing biomedical educational opportunities for under-represented students. Current funding from the National Institutes of Health, the National Science Foundation, Howard Hughes Medical Institute, the Flinn Foundation and the Beckman Corporation are providing bioscience and biomedical research opportunities for NAU's more than 2,200 Hispanic and 1,300 Native American students. NAU also delivers numerous classes and health related degree and certificate programs through distance learning centers located at 26 sites across urban and rural Arizona.

Northern Arizona University research in the biosciences (including biomedicine and biotechnology) has been greatly enhanced through funding from the State of Arizona's Proposition 301 (Prop 301). Prop 301 funds have been used to develop the Growing Biotechnology Initiative, which includes a set of major interdisciplinary projects across a broad array of bioscience research. The overarching purpose of the Initiative is to attract both highly trained biotech-oriented scientists and biotechnology firms to Northern Arizona, to stimulate technology transfer in the biosciences, and to expand current research capabilities for the University. Current research activities include studies related to new and emerging diseases, forensic genetics, antiviral and antibacterial drug development, and environmentally related cancer. After five months of operation the Growing Biotechnology Initiative has increased external funding 300% over what was projected, faculty have applied for two patents with a third nearing the point for filing, and more than 130 students are involved in research projects. Numerous research partnerships have also been established with universities and organizations such as the University of Arizona, Arizona State University, Los Alamos and Livermore National Laboratories, the Centers for Disease Control, and the Federal Bureau of Investigation.

NAU currently has in place one new building and another one is being planned. Combining that infrastructure with existing faculty and student expertise is a great starting point for launching the various pieces of our Growing Biotechnology Initiative. In addition, we will be adding personnel resources through a NIH U-54 cancer research grant, Proposition 301 funds, the operations of the Keim Genetics Laboratory, and the leveraged funds that are already be

secured from our efforts to obtain external funding using Proposition 301 funding as seed money. We have already 4-6 internationally recognized scientists and the additional funds hold the promise of hiring both established investigators to enhance our reputation and excellent young scientists who can, through mentoring and experience, develop into the next generation of scholars.

1.5 How initiatives will be accomplished

Our plans, already operational, are built around two major thrusts. First, we have, at present, four investigative teams, each with its own leader. These teams are working in areas related to heavy metals and cancer, halophilic bacteria, emerging diseases such as hanta virus, and the area involving anthrax, plague and other possible weapons of bioterrorism. Second, through a series of minigrants in the Departments of Biological Sciences and Chemistry we have succeeded in establishing a number of new initiatives that eventually will achieve their own external funding. In a very real sense these latter funds are seed money, helping as in a business incubator to launch new projects. All of these endeavors are using undergraduate and graduate students as an integral part of their operations, providing students of all levels with excellent, first-hand experience and training.

2.0 The Market

We can best break the market down in several ways:

- (1) Students who wish to obtain an undergraduate education with training that prepares them for the 21st century
- (2) Graduate students looking for advanced training and a chance to be involved in cutting-edge research.
- (3) The significant amounts of funding (> \$20 billion/year) that are available for work in biotechnology and related areas
- (4) There is a market for partnerships and collaborations with other universities and with businesses in the areas of research and development, and
- (5) There is a market for the processes (via licensing) and any devices that we can patent through our endeavors

2.1 Choices Available to Potential Customers

If we consider our customers as students needing an education, we have competition, primarily within Arizona for excellent undergraduates. At the graduate level, our competition is with the other 260 research universities in the US. Students looking for undergraduate training like institutions that offer small class sizes, something we have in abundance. These students also like to find opportunities to do research as undergraduates, something for which we are a national leader – more than 120 undergraduates in Biological Sciences and Chemistry are intimately involved each year in research endeavors in our various laboratories. In, addition, both departments offer specialized courses in research methods – projects that were funded by grants from the National Science Foundation.

Graduate students who come to NAU are also looking at places like the University of California at Davis, the University of New Mexico, Colorado State University, Stanford, and UCLA. Students applying to graduate schools look at, among other things, the stature and reputations of the faculty with whom they might work. They look for groups of people who share their interest in terms of an area of science in which they want to make a career. We have major clusters of people (with considerable overlap) in our two departments. These clusters include Biochemistry, Cell, Molecular, and Microbiology; Environmental Chemistry; Physiology and Functional Morphology; and Ecology, Ethology, and Evolutionary Biology.

The faculties in Biological Sciences and Chemistry have garnered significant resources from external agencies in the past. These external funds amounted to about \$2.5 million several years ago, but have ramped up to more than \$6 million annually in the past several years. The addition of Proposition 301 Growing Biotechnology Initiative funds should further enhance our capabilities in terms of successfully competing for these external funds. It is noteworthy that our external funding comes from a variety of federal (USDA, USFS, NIH, NSF, NPS, DOE, USGS), state (ADEQ, AZGFD, ADCC), and foundations (Beckman, Howard Hughes, Dreyfuss, Flinn) sources. Further, a modest but important portion of this funding is for education and training, something we value and want to continue to improve.

There are several business partnerships under consideration at the present time. As we make further progress with the Initiative we expect the contacts in this arena to increase. We have already made an excellent contact with the Greater Flagstaff Economic Development Council and will continue such avenues. We are already engaged in collaborative arrangements with colleagues at the other Arizona universities. One collaboration, the U54 grant for cancer research and education, from the NIH involves cooperation with colleagues at the University of Arizona. A second collaboration, pertaining to water quality and the possible effects of endocrine disrupters from the environment involves a colleague at Arizona State University. A third collaboration with the University of Arizona, supported by the NIH, is concerned with the effects of eccentric exercise on recovery in heart disease patients and in osteoporosis.

Lastly, there are several patent applications already in process from our various endeavors. Clearly, with a good start in this area, we are building momentum. We hope that one or more of these patentable processes or devices can result in several start-up companies in northern Arizona.

2.2 Market Size and Trends

The funding for various research and development projects that fall under the Growing Biotechnology Initiative comes from a variety of sources, as detailed elsewhere in this plan. Our funding for projects under this initiative will, in the future be more likely to come from industry and possibly venture capital sources than from the federal government. Some of these funds are competitive proposals, while others are of a defined contract nature in terms of specific targeted projects that are mission oriented

We believe, and industry data support the claim, that as we move out of the current recession, one of the areas that will receive added attention involves research and development in a broad spectrum of topics tied to biotechnology. These areas will range from drug development to bioterrorism on the one hand, and from agriculture to environmental issues on the other hand. We feel we are well positioned to take advantage of the upcoming trends.

2.3 Rivals and Competition

Northern Arizona University can be viewed as competing at several levels. We compete with a number of institutions, as noted above, with regard to matriculation of the best undergraduate and graduate students. It is clearly the case that for graduate students we are in a position where additional resources will be needed to continue to attract and retain the best graduate students for our programs. We are currently using Proposition 301 funds to leverage additional external dollars that will aid in raising the stipends available to graduate applicants.

On another plane we compete for funds to conduct our work. We have, as noted in the next section, a significantly higher than average rate of success with regard to competitive funding from various federal and state agencies, as well as with foundations. We are moving into new territory in terms of seeking better ties with industry, partnerships that we feel ready to establish, particularly in terms of chemistry. Given our selective attention to particular areas of research in terms of the Growing Biotechnology Initiative we will be seeking assistance in terms of targeting particular industry groups in our attempts to establish these partnerships.

2.4 Suppliers

Students come to NAU from a variety of places. Within Arizona we obviously compete with the University of Arizona and Arizona State University for undergraduates. We have stepped up our recruitment efforts with particular emphases on biotechnology, microbiology, and preprofessional curricula. We also target selected areas outside Arizona with regard to recruitment of undergraduates. At the graduate level we find that our strong reputation is the best recruiting tool. In today's world the web page(s) for our Departments of Biological Sciences and Chemistry are the chief entry point for students who want to explore our offerings and look for potential graduate mentors.

Our external support, as noted earlier is from a wide variety of entities. We continue to explore new possibilities in terms of locating resources that match with the particular projects on which we are working. With the assistance of the capable staff in the Office of Grants and Contract Services, we are quite successful in the granting process. Whereas the national averages with the NIH and NSF are about 18-20% in terms of successful, funded applications, in our departments, we are successful about 40-45% of the time with these applications. One of our goals is to continue the increase in external funding, with a primary focus on areas related to biomedicine and biotechnology. To that end, our funding in these areas has more than doubled just since the start of Proposition 301. With the addition of 5-6 new faculty in areas pertaining to biotechnology and biomedicine in the next 3 years, and the recent addition of 2 such faculty for the 2002-2003 academic year, we should see significant further increases in external funding in areas related to Growing Biotechnology.

Though the Federal Government has traditionally been the primary supplier of funds for research and development activities, many other sources are available. We are making more contacts with a variety of non-governmental organizations (NGOs) and potential business partners. In addition, we have an established track record in terms of competing successfully for funds from a number of different foundations, such as the American Heart Association and the Alzheimer's Research Foundation. In our program it has also proven fruitful to work in

partnership with organizations like the Arizona Disease Control Commission and the Arizona Department of Environmental Quality.

2.5 Alternatives to Traditional Approaches

This matter can be examined from two perspectives. On the one hand, our approaches will be, for the most part, a traditional pathway of discovery → research → possible products. On the other hand, this does not mean that we are not also engaging in many activities that would be considered non-traditional. The work in the Keim Genetics Lab is unique and pioneering in terms of the system of markers that they have and are developing for typing strains of various pathogens. The work on heavy metals and cancer is rather unique to our part of the western US. Efforts on biotechnology aspects of agriculture and climate change are also relatively non-traditional.

2.6 Estimated Sales

This item is not yet applicable to Growing Biotechnology. Once business partnerships have been established, exclusive licensing agreements are in place, and start-up companies are formulated, we will have a better picture of expectations in this area. We estimate that several of these sales-producing outcomes can be in place during years three and four of the first five-year plan.

3.0 Operational Strategies

3.1 Development and Production

3.1.1 Development Status – The current funding from Proposition 301 has enabled us to launch more than 15 different and exciting initiatives in terms of Growing Biotechnology. At the core we have four principal projects, all with significant funding and all with high likelihood of achieving significant new external funding for extending these projects. Between the Departments of Biological Sciences and Chemistry we also have a series of 12 projects, each of which received \$10,000 - \$30,000 in funding during FY02. These projects have proven to be a remarkably good investment with some intellectual property, numerous grants, and many students trained as outcomes. We are thus moving forward with both the larger projects and the smaller grants to be awarded each year. To facilitate growth in other emerging areas it is our plan to have the larger grants rotated after three years to other individuals. It is our expectation that by that time these larger projects will have been successful in achieving sufficient external funding through grants or partnerships with industry and that they will be self-sustaining.

3.1.2 Production Processes – Not yet applicable

3.1.3 Cost of Development – The costs for development involve equipment, consumables (supplies), and personnel (see 3.1.4). We are using a combination of funds for the equipment and consumables, successfully combining funding from Proposition 301 with other resources such as external grants, foundation funds, and state funds. It is exactly this sort of synergy in terms of putting the pieces of the funding puzzle together that we believe was the

intent of ABOR when this mechanism for funding research was established after passage of the Proposition 301 ballot initiative.

3.1.4 Labor Requirements – Each of the many laboratories involved in the ongoing research under this initiative have a number of personnel – ranging from laboratories with 3-5 individuals to some with more than 20 people working on various projects. Because we are quite successful in terms of leveraging funds from Proposition 301 for personnel, we have not committed significant funds from the initiative to personnel. We do have 4 post-doctoral/technician positions, 6 graduate students, and 8-10 undergraduate students supported by Proposition 301 funds. In addition, as our budget plan shows, we are to hire one new established investigator in each department in the coming year. These new hires will be specific to biotechnology with a clear intent to have both research and training missions high on the agendas of those we select for these positions.

3.1.5 Expenses and Capital Requirements – As noted in 3.1.3, we have used a significant portion of the Proposition 301 for what might be termed one-time expenses, purchases of equipment needed for specific projects and buying consumables that we use up on a continuing basis. In general, we have supplied the necessary infrastructure support for our Proposition 301 Growing Biotechnology Initiative from existing funds. This infrastructure support includes clerical and bookkeeping assistance, computer resources, and general maintenance of laboratories and equipment.

3.2 Marketing and Promotion

3.2.1 Strategy – Our marketing strategy to attract good students involves enhanced recruitment at the undergraduate level. This will include visits to target schools by those who are actually involved with the various research projects. It will also involve one-to-one student contacts between our undergraduates who are conducting research in these various laboratories and prospective students who have expressed interest in areas related to biotechnology. At the graduate level we rely on our varied contacts through colleagues at other institutions and via professional meetings. We also use our web pages to advertise our areas of skill and expertise. The many publications from our faculty and students, across a broad spectrum of areas related to biotechnology, enhance both our reputation and our visibility.

A second area in which we will be seeking to be more active concerns the cultivation of partnerships with business and industry. We have begun to move down this pathway and, with advice from various people who have the appropriate knowledge; we should become quite successful in this arena as well.

3.2.2 Method of Promotion – Our efforts to promote what we do will take on several forms. One of these, traditional research approaches will entail:

- Publishing articles in professional refereed journals,
- Submission of contract reports to appropriate funding agencies,
- Working with science writers and public relations personnel to enhance the public's general knowledge of the importance of biotechnology in today's world,
- Sponsoring professional conferences,
- Serving as consultants to and on the advisory boards of corporations, and

- Serving on government advisory panels.

A second area where we will endeavor to promote our Growing Biotechnology Initiative will be through cultivation of business partnerships and public outreach via:

- Building on already established relationships with local, state, national, and tribal governments,
- Outreach to important community groups in business and education,
- Establishing new partnerships with local business and fostering the development of start-up companies by working with the local economic developers, and
- Striving, where possible, to help the public understand the impact of modern biotechnology developments via such avenues as workshops and newspaper articles.

3.2.3 Advertising and Promotion Plans – We have already begun to act upon the various points made in 3.2.2 concerning our methods of promotion. One conference has been held on campus in the past year and another is slated for the summer of 2003. More than 10 publications have appeared from our work or are in press in professional journals. These publications serve as an advertisement vehicle through their visibility with professional colleagues and they aid in recruitment in terms of students seeing what we have to offer, and the fact that both undergraduate and graduate students are co-authors on published articles. Further, faculty and students at professional meetings have made some 20+ presentations during this past year related to the work they are conducting with Proposition 301 funding under the Growing Biotechnology Initiative. Several of our Proposition 301 Project Managers have received statewide and national attention for their research work, making our entire program much more visible in the process.

3.3 Project Management

3.3.1 Organizational Structure - The organizational plan involves a Project Coordinator for the Growing Biotechnology Initiative. There are currently four separate main projects, each of which has a faculty member as the leader – Research Project Managers. These individuals are the ones receiving major support from Proposition 301 funds including personnel monies, plus funds for equipment and supplies. There is a variable number of individuals (10-13/year) who are faculty members receiving smaller grants from our Proposition 301 funding in the form of allocations for small piece of equipment, modest amounts of supplies, or partial payment for graduate students. These we call Small Grants. All of the Project Managers and those in charge of small grants report to the Project Coordinator.

3.3.2 Advisory Board or Other Oversight

An Advisory Committee comprised of the various Project Leaders and NAU Administrators handles oversight of Proposition 301 funds. The Growing Biotechnology Initiative has a Steering Committee Comprised of the principal laboratory directors, the Project Coordinator, and the two department chairs involved in the project.

3.3.3 Support Services Required

To accomplish our goals, several types of support will be necessary. We already have a capable and helpful staff in the Office of Grants and Contract Services, Office of the Vice-Provost. In addition, as we develop contacts with industry, along the road to establishing partnerships, we will need advice from individuals who have been involved previously in these sorts of negotiations and discussions. Lastly, we will want to have regular access to legal counsel to aid in preparing documents such as those involved in patents, exclusive licensure agreements, and codifying partnerships with business and industry.

3.4 Risks and Plans to Overcome Them

3.4.1 Legal Risks

Legal risks will primarily be related to litigation associated with technology transfer activities and specific contractual agreements with private industry. Additional risks would also be evident if research included laboratory animals and human subjects. Current policies are in place through the Arizona Board of Regents (ABOR) to address technology transfer issues. Research conducted with private organizations is carefully negotiated in advance by NAU's Office of Grants and Contracts following ABOR and State of Arizona policies. NAU policies relating to animals and human subjects stringently follow federal guidelines and regulations.

3.4.2 Regulatory Problems

The research, development, and commercialization of biotechnology products is tightly controlled by numerous federal agencies, policies, and guidelines. As a university we comply with all federal and state laws regarding biohazardous materials, animal use and care, radiation safety, scientific conduct, and the use of select agents. NAU has in place federally mandated oversight committees to provide for public safety and insure compliance with all regulations.

3.4.3 Political Risks

NAU maintains the highest degree of integrity in its research and teaching programs. We strive to work in close partnerships with governmental leaders, businesses, and public officials. Where an extra degree of sensitivity is present, (e.g, biohazardous materials) we maintain several extra layers of security. There is much to be gained by being an active participant institution in aiding our national initiatives in areas such as bioterrorism, cancer research, and maintaining a safe and non-toxic environment.

4.0 Goals/Metrics/Outcomes

The following table provides a picture of our current goals, metrics, and outcomes.

	FY2002	FY2003	FY2004	FY2005	FY2006
<u>Return on Investment</u>					
Increased external funding (1000's)	1,300	850	1,500	1,500	1,500
Increased No. of scholarly publications	7	3	2	3	3
<u>Technology Transfer</u>					
Industry partnerships	1	2	2	2	3
Patents & licensing apps	2	2	1	1	1
Products Generated	0	1	1	1	1
Business Expansions	2	1	1	1	1
Start-up companies	0	1	0	0	1
<u>Economic Development</u>					
Incubation/Formation of Bio-Tech Concerns in Flagstaff/N. AZ	0	1	1	1	1
<u>Workforce Contributions</u>					
M.S./Ph.D Grad Inc.	3	2	2	2	3
Graduate students in pipeline	57	60	65	70	75
Undergraduates W/rsrch exp	96	80	90	100	110

Post-doctorals in training	2	2	2	2	2
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Specific Collaborations

New Research Collaborations	4	2	2	1	2
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5.0 Pro Forma Financials

5.1 Cash Flow Statement

Not Applicable

5.2 Income Statement

See projections in Table 5.3 below

5.3 Funding Request

	FY2002	FY2003	FY2004	FY2005	FY2006
Operating Budget					
FTE Positions		2.00	2.00	3.00	3.00
Personnel	191,324	554,000	168,000	89,000	93,000
ERE @19.5%	28,234	147,500	33,000	17,000	18,000
Other Operating	387,384	833,982	761,000	676,200	583,100
TOTAL OPERATING	601,520	1,535,482	962,000	782,200	694,100
Capital Budget					
Building Renovation	0				
Debt Service			1,557,000	2,057,000	3,337,000
TOTAL CAPITAL	0		1,557,000	2,057,000	3,337,000

GRAND TOTAL

Notes: Positions filled in FY03 become incorporated into the state budget starting in FY05. Likewise the position filled in FY05 becomes part of the regular state budget in FY07.

The figures in the FY02 and FY03 columns are adjusted to fit the amounts we have been given for those two fiscal years. The Capital Budget funds listed here have been subsumed into the New Building or Green Building funds, combined with those from the ERDENE initiative portion of Proposition 301.