

12 January, 2000

Final Report

Task Force for the Integration and Enhancement of the Life Sciences at the University of Nebraska-Lincoln

Lloyd Bullerman, Food Science & Technology
Timothy Carr, Nutritional Sciences & Dietetics
Raymond Chollet, Biochemistry
Martin Dickman, Plant Pathology
James Estes, Nebraska State Museum
Kyle Hoagland, Natural Resource Sciences
Anthony Joern, Biological Sciences [Co-chair]
Daniel Leger, Psychology
Mark Morrison, Animal Sciences [Co-chair]
David Mortensen, Agronomy
Ellen Paparozzi, Horticulture
Carolyn Price, Biochemistry and Chemistry
Blair Siegfried, Entomology
David Smith, Chemistry
Connie Soucie, Soucie and Associates
Charles Wood, Biological Sciences and Biochemistry

Co-Chairs Acknowledgments

The following report represents the culmination of 12 months effort by a dedicated group of 15 faculty, working with the common belief that the University of Nebraska-Lincoln has the potential to become – and must become – a more nationally prominent player in the life sciences. The following report is multi-faceted, brought about largely by the need to develop an overall theme in response to the charge provided by the Vice-Chancellors, while also addressing specific issues of relevance to College Administrators. As co-Chairs, we thank this group of faculty who made the effort so stimulating. We also wish to thank Task Force members who took on additional responsibilities to meet all the goals set for the Task Force: Tim Carr for organizing the visit by Professor Roger Sunde; Blair Siegfried for leading efforts on the discussion of mission-oriented research activities as part of the research cluster concept; Marty Dickman and Charles Wood for their efforts on the Molecular Biology section; Ellen Paparozzi, Kyle Hoagland and Dave Mortenson for their efforts on the Life Sciences curriculum coordination section; and Ray Chollet, Carolyn Price, David Smith and Charles Wood for their efforts in relation to the organization of Biological Chemistry and Biochemistry expertise at UN-L.

We also acknowledge the input of those faculty not officially assigned to the Task Force, but who made meaningful contributions to our efforts presented in this report: Steve Baenzinger, Ken Cassman, Terry Klopfenstein, James Stack, and James Specht (mission-oriented research and research clusters); Lori Allison, Audrey Atkin, Mark Griep, and John Osterman (Molecular Biology); and Paul Blum, Kathleen Keeler, Jack Morris, Brent Nickol, Norm Schneider, and Steven Waller (curriculum coordination).

The financial support of IANR and College of Arts and Sciences is also gratefully acknowledged, as it provided the funds necessary for the visit by Professor Sunde and the involvement of Ms. Connie Soucie; the latter played an important role in the organizational and data collation aspects of the entire process.

Finally, we wish to thank all members of the Task Force for maintaining a commitment to the goal of scientific excellence for the betterment of UNL as a whole, rather than focusing on specific departmental and/or college needs or objectives.

“The 21st century can, most certainly, be an exciting time for Higher Education if we have the wisdom to be inclusive rather than exclusive in program development, expand our horizons to meet changing needs of the clientele, and provide cutting-edge programs”.

Statement by IANR Department Heads in a memo dated July 28, 1998, sent to Deans Donald Edwards (CASNR), Brian Foster (CAS) and Darrell Nelson (ARD)

Executive Summary

The Life Sciences Task Force considered the current state of Life Sciences at the University of Nebraska-Lincoln (UNL), along with more specific issues considered important by the three pertinent College Administrations (CAS, CASNR, ARD). The Task Force was asked to provide recommendations and a process for the overall enhancement, increased visibility and integration of Life Sciences at UNL.

Perception of the “State” of Life Sciences at UNL

- The "whole" of Life Sciences offerings in research and teaching at UNL does not exceed the "sum of its parts". While disappointing, this situation provides exceptional potential for enhancement. The need for enhancement is clearly reflected in a direct comparison of UNL's research profile with other Universities offering doctorate-granting programs.
- Current mechanisms at UNL to coordinate research and teaching efforts among units and colleges are too unresponsive and unwieldy, leading to missed opportunities. For the most part, faculty capable of important contributions in critical areas of life sciences research and teaching are scattered throughout UNL, with insufficient opportunities to maximize interactions, productivity and quality. In other life sciences disciplines, little or no critical expertise exists. Collectively, this situation hampers UNL's ability to be a leader in life sciences research and education.
- The current administrative model is not sufficiently flexible nor does it lead to creative solutions to meet UNL's changing needs. No administrative mechanism currently exists that effectively removes the negative consequences of inter-departmental and inter-college “turf battles”.
- Despite some excellent programs and scientists, UNL is poorly positioned for future success in the rapidly changing landscape of the life sciences, and is unlikely to meet the needs and expectations that Nebraskans have of its primary research institution. Change is needed to direct future research and teaching activity in the life sciences at UNL, or we will not keep pace with the increased demands of this exciting, dynamic field.

Recommendations to Enhance and Integrate Life Sciences at UNL:

- UNL must forcefully identify unproductive and antiquated approaches and programs in the Life Sciences, and then refocus individual and collective goals toward the establishment of excellent, innovative programs in research and teaching. A *balanced* commitment throughout UNL between activities that do not necessarily provide immediate or provisional practical applications (basic research and discoveries) and mission-oriented research and responsibilities typical of a Land-Grant Institution should be the goal.

- Life sciences research programs at UNL must be nimble to meet rapidly changing research landscapes. As a State with limited resources to invest in higher education and research, clever decisions are required to best leverage opportunities to maximize their impact. The State's commitment to providing UNL with cutting-edge technologies and infrastructure must be matched by an increase in faculty commitment to utilizing such resources, and procuring the funds necessary to maintain their viability and sophistication.

Opportunities for Enhancing and Integrating Life Sciences at UNL

- A new, intercampus administrative structure for the Life Sciences at UNL is needed. A new College of Biological Sciences will be coupled with a reorganized College of Agricultural Sciences, providing a greater balance between mission-oriented and basic research activity in the life sciences. These two colleges will be administered and, more importantly, *their activities coordinated* through a Vice Chancellor for the Life Sciences. The actual mission of this office and the duties of the key individual filling this role will require a strong emphasis on developing balanced, forward-looking goals. This proposed organization will greatly improve the capabilities of UNL to contribute to nationally recognized and valued research that meets the needs of the State of Nebraska and the world. This proposal should not be interpreted as a simple mechanism to move the School of Biological Sciences into an IANR-like structure. Unless all phases of life sciences research and teaching are reassessed, new forward-looking goals and expectations developed, and new model for a better life sciences program at UNL produced in such a plan, nothing should be done. Half a loaf is not sufficient or appropriate.
- UNL must redirect funds to provide short-term financial support to develop an increased number of high quality, cutting-edge, faculty-generated research programs in groundbreaking areas. Creation of self-supporting "Research Clusters" in the life sciences provides a mechanism to foster creative new research programs that can successfully compete for nationally available funds and raise UNL's national stature in life sciences research. We present details for the formation, evaluation and expected contributions of research clusters in the life sciences.
- Strong, University-wide programs must be developed in several disciplines that not only emphasize quality research, but also quality undergraduate and graduate instruction. We were specifically asked to examine Biochemistry and Molecular Biology, but other extremely viable areas at UNL deserve equal attention (e.g., Ecology and Evolutionary Biology, Microbiology, or newly focused programs with immediate, mission-oriented application). In biochemistry, the current coordinating structure (Center for Biological Chemistry) is not functioning optimally and its reorganization is hampered by department- and college-focused philosophies. The administrative reorganization described above is perceived as the only mechanism capable of improving and fully exploiting UNL's expertise in these core Life Sciences disciplines.
- Our proposed administrative model will also serve to coordinate the overall Life Sciences curriculum, to remove the existing impediments and duplications in curriculum

coordination at the intercampus and intercollege levels. Such a structure is also considered vitally important for providing the resources necessary for regular and predictable staffing of courses, especially those serving students in many departments and the establishment of laboratory-courses in molecular biology. However, even with improved coordination, departments will remain the fundamental unit for curricular changes, especially concerning course and syllabus development and establishing requirements for the individual undergraduate majors in the Life Sciences. In this sense, stability in teaching activities must be accomplished, by clarifying and codifying issues relating to course ownership by departments.

- In many Life Sciences disciplines, new technologies (e.g., molecular and structural biology, bioinformatics/genomics, among others) have increased the probability that fundamental breakthroughs resulting from biomedical research may have implications in agriculture, and vice-versa. UNL must more closely examine how the current research capabilities at UNL interface with those of the University of Nebraska Medical Center, and how UNL's future research expertise on both campuses can be structured to facilitate a more cohesive interaction with this institution.

The Prominence of American Research Universities: A Brief Background

UNL is a land-grant, research university with high aspirations. As described by Robert Rosenzweig (then president of the Association of American Universities), research universities in the United States have chosen to combine basic research, applied research, graduate education in research and undergraduate education in the same place, by the same people and often at the same time. Most informed observers throughout the world would agree that the American research university must be judged a success by virtually any imaginable standard (Graham & Diamond 1997).

A form of social organization barely known anywhere else in the world has so clearly demonstrated its value in the United States that the wisdom of sustaining it is almost beyond serious debate. (Robert Rosenzweig 1982, in Graham & Diamond 1997, p. 1)

Research in the life sciences (broadly defined) at American research universities now flourishes. UNL is one of about 130 public and 30 private doctorate-granting institutions. Universities such as UNL provide typical cross-sections of the types of life sciences research that occurs nationally (with the exception of no significant medical research at UNL), with obvious increases in productivity and quality in programs compared to the past. Pressures to excel continue to fuel the strong competitive “juices” among research universities to rank high within these disciplines as a measure of accomplishment and relative competence. Yet, in the same competitive vein that describes research universities in general, resources to support research in the life sciences are disproportionately allocated among institutions. Success in this nationally competitive environment requires that UNL organize and facilitate its efforts in the life sciences in such a way that we can compete, so that we eventually will rank high among our peers as the result of UNL’s appropriate level of commitment and effort. Many degrees of freedom exist for the types of strategies and tactics to employ to accomplish this goal, but they must be carefully identified and tailored to suit UNL’s needs because resources and opportunities are not unlimited.

How does UNL fare in national comparisons with our programs in the life sciences? How will UNL fare in the future given the current funding climate and anticipated resource allocation? How can UNL expand available resources to meet a rapidly expanding national emphasis on research and teaching in the life sciences? In evaluating life sciences research programs at UNL, it is worth reminding ourselves of several key points (nicely documented in several recent evaluations of research activities in US universities). **While UNL is undoubtedly getting better, so it is for most research universities. In fact, other institutions are typically getting better at a faster rate than is UNL (1999 presentation, Vice Chancellor for Research Marsha Torr). Some organizational and reinforcement models foster success better than others and these must be recognized, studied and implemented.**

Inherent advantages to university success in research have been recognized by Graham & Diamond (1997): (a) private universities have an immediate advantage that derive from their affluence, traditions and their entrepreneurial freedom from growing legislative constraints,

governmental bureaucracies and public accountability. (b) The presence of a medical school on campus automatically secures an advantage in the competition for research dollars and scholars. The budget at NIH greatly surpasses budgets of most sources for university research activity combined, and these dollars mostly go to university campuses with medical schools. (c) A significant advantage is gained by public sector institutions that are specifically designated as research-oriented institutions. UNL has none of these advantages with the possible exception of a land-grant research emphasis in IANR and an understanding that UNL proper is the research university within the State system. How can UNL compete and succeed as a national player in life sciences research in an increasingly competitive and aggressive research landscape? What resources and advantages exist at UNL that position us to make real contributions? What constraints and limitations at UNL will hinder our development toward such a goal? Is there a best strategy or set of strategies that will best foster our opportunities for future growth as a significant contributor at the national level, and if so, how do we best develop and implement such a plan? To the Integration of the Life Sciences Task Force, these questions concerning the future research environment at UNL defined many of our deliberations.

As with most public universities, educational needs in the life sciences at UNL also deserve much attention when planning for the future. Large student enrollments exist in life sciences based courses, and a large number of departments participate in teaching these courses. As with research, it is important that UNL excel in both undergraduate and graduate education. This is a daunting challenge as our understanding of basic principles in the life sciences is in a full state of intellectual revolution. Old paradigms melt away and new synthetic views emerge. Yet, departmental teaching reflects time-honored understanding of life sciences disciplines that does not fully integrate the rapid changes that are often occurring at break-neck speed. For example, some areas such as molecular biology are now part and parcel of research in all life sciences disciplines and students with many career goals need coursework and hands-on experience in this area. In a different vein, applied research relies on current breakthroughs in basic areas more than ever, in fields ranging from molecular biology and genomics to ecology and evolutionary biology.

Careful consideration of what, how and why we teach life sciences courses is needed. Just as we evaluate research needs in the life sciences as a problem of resource acquisition and allocation, educational needs are the flip side of the same coin. Many of the personnel and resource needs for both teaching and research come from the same pool. Time and resource budgets in full-service universities exhibit tradeoffs between these and related areas; UNL is no exception. **The challenge facing UNL is to determine the optimal allocation of time and resources between teaching and research activities in the life sciences such that both thrive and achieve excellence, and that both meet the high expectations of students, faculty, administrators and staff at UNL, as well as the increasing expectations of the citizens of Nebraska.**

Charge to the Integration of the Life Sciences Task Force

At the request of Vice Chancellors Richard Edwards and Irvin T. Omtvedt, the Task Force for the Integration of the Life Sciences Task Force was organized and charged by Deans Darrell W. Nelson (ARD), Brian A. Foster (CAS) and Donald M. Edwards (CASNR). Our overall charge was to search for scenarios and mechanisms that would specifically enhance UNL's scholarly reputation in the life sciences, including: developing a strategy to develop stronger research programs in the life sciences, provide better graduate education, produce enhanced research capabilities and productivity, and a better ability to deliver courses and serve undergraduate educational needs. The Plant Science Initiative, Animal Molecular Biology and Center for Biotechnology were considered “foundational” as a central assumption for the task force’s efforts. Deliberations were expected to address an institutional perspective, and *not necessarily* cater to current institute, college or departmental programs or perceived needs. Successful recommendations are expected to enhance UNL's reputation in the life sciences. A university's reputation is important in its own right and a successful set of recommendations will provide an opportunity to solidify and enhance our stature. However, reputation *per se* is not the primary goal of this task force since existence of quality programs must precede any consideration of reputation, and quality programs are predicated on exceptional performance. A main goal of our task force is to identify solutions (or strategies for determining a solution) for developing programs of excellence, with selected high quality programs of national impact. How should these programs be identified and nurtured in the UNL environment? In this same vein, it is critical to develop high quality graduate programs to facilitate success in life sciences research. What are the basic issues associated with graduate education at UNL? How can recruitment of quality graduate students be enhanced? What can UNL offer to make graduate programs more attractive to potential students? Finally, while we were specifically directed by the Deans not to examine ways to reorganize academic structures at UNL for delivering life sciences programs, we were encouraged to search for general organizational schemes to repackage what we have in a way that better uses available resources; i.e., State resources will not increase substantially so they must be targeted to programs that can attain national prominence and provide opportunities to obtain even more resources.

The Life Sciences Task Force was also asked by the Deans charging our mission to examine and provide recommendations regarding the following specific items:

- (a) What is the best way to coordinate the life sciences curriculum?
- (b) How can UNL develop a rational approach for molecular biology education, and what can UNL do to develop and teach courses in molecular biology as needed by students in so many disciplines given the high cost?
- (c) How should biochemistry at UNL be organized? Is there a better solution for organizing biochemistry than the current intercollege/interdepartmental structure, the Center for Biological Chemistry (CBC)?

Part I. General Conclusions: Future of Life Sciences Research at UNL

At its most fundamental level, the task force believes UNL is not well positioned for future success in critical new areas of life sciences research unless fundamental shifts in attitude, productivity, reward and administrative oversight are implemented. UNL must have high expectations if it expects to truly succeed. Yes, it is appropriate to expect to be one of the top 25% of national research universities, a least on a per faculty member basis. Yes, faculty should be expected to secure research funds necessary to perform both basic and mission-oriented research. Yes, graduate programs should strive to be nationally recognized as a source of innovative graduate training. And, yes, mission-oriented research in the life sciences should be expected to break new ground, develop new ideas and explore frontiers rather than be content to only do the clientele's bidding. Quite frankly, much of the life sciences research enterprise at UNL is stodgy, tradition-ridden, and lacking in the aggressiveness so necessary to compete in the current and future national research environment. This situation does not bode well for UNL's future in this area unless significant changes in attitude and policy are developed.

Both basic research in the life sciences and activities supporting UNL's land-grant mission must be strong. While we feel that UNL is underperforming in many ways, there are strong cores within UNL upon which to build. These areas should receive support based on merit and the likelihood that the program will achieve significant research gains. We acknowledge the reality of political factors within and outside of UNL in setting the university's agenda (including research directions). However, the ultimate test of the correct decisions for targeting scarce resources will be performance on the national stage, including successes in traditionally land-grant areas. While Nebraska's needs must be satisfied, UNL must develop a strategy so that research addresses tomorrow's important questions. Many current tasks and services may not be as important to UNL's future success in this area as going in new directions. A no-holds-barred discussion on the future of the land-grant mission at UNL, including setting research priorities is critically needed. Moreover, securing significant external funding must be a larger expectation from this mission-oriented research sector at UNL. Although we believe that there will be significant resistance to change of current policies and activities from many sectors that must be resisted if we are to grow and succeed. UNL should rank among the top fifteen land-grant universities based on any metric; our failure to do so is reason for concern that must be addressed.

Basic research efforts in the life sciences at UNL also exhibit some strong pockets of expertise, even though much remains to be done before we are a quality research institution in this area. Our immediate problem with regard to national recognition in this area will be that other universities are getting better in this area faster than is UNL. Quite frankly, this is happening because expectations are too low and too many UNL faculty and administrators are content with the status quo. National recognition requires quality research programs. Quality research programs require significant dedication and motivation on the part of individual faculty to perform excellent research. The immediate goal then is to increase the number of quality research programs in the life sciences as quickly as resources and effort allow. Because of limited resources, initial investments should be allocated in areas that UNL can compete at the

national level. The university should not emphasize research areas that, while important, are the strengths of already large, balanced programs elsewhere. We will not even get a toehold into the area if we follow this path. Of course, this is always the problem – how does one guess the future? **Since UNL has not been particularly good at predicting new opportunities before they are established elsewhere, we need new models. The Task Force concludes that faculty interests and motivation hold the key on this front. Top-down directives for research success will not work. UNL should support faculty-driven initiatives and provide a means to support successful activities with real resources if the groups have a legitimate track record and can make a cogent argument that research excellence and national recognition are likely to follow.** Successful faculty groups who show the initiative and ability to succeed will define the local research landscape, particularly in basic research efforts. External meddling by administrators in determining the shape of new research directions should be resisted.

UNL can do much to regain momentum in life sciences research. The following report provides suggestions for some of the important issues that we considered in depth. The following recommendations will greatly facilitate increased excellence in life sciences research at UNL:

- (a) A more aggressive attitude to obtain research funding is required.
- (b) UNL must develop organizational means to get new research groups together, to coordinate activities if appropriate, and to provide additional incentives to increase the overall quality of research.
- (c) Mechanisms must be sought to change institutional/faculty attitudes regarding aspirations – shoot higher, reject the *status quo*.
- (d) Facilitate cooperation among intercollege administrative units to the degree that more can be done with less.
- (e) Carefully evaluate current administrative structures at UNL as they impinge on life sciences research – is there a better way to structure departments, colleges, other?
- (f) Increased faculty participation in development of research policy and implementation is needed, with the recognition that faculty must not be overloaded with tasks that take away from research productivity or teaching excellence.
- (g) A successful strategy will put its emphasis on flexibility to pursue new opportunities.
- (h) It will be productive for UNL to develop strong and meaningful working relationships with UNMC.

With these eight points in mind, UNL must carefully design a strategy that matches available resources, opportunities, faculty expertise and capabilities, research unique to Nebraska and a reasonable chance to compete at the national level. Moreover, steps must be taken to collectively elevate expectations and performance among faculty, graduate students and administrators so that we accept nothing less than excellence. It is worth noting that relatively small research universities can excel if faculty exhibit the diligence and aggressive attitude consistent with a will to succeed (Graham & Diamond 1997). Our recommendations are made with these goals in mind.

Organization and Administrative Structure in Life Sciences at UNL

At present, expertise in the life sciences at UNL is distributed among multiple units, mostly in three colleges. IANR supports a wide variety of research in the life sciences, a list too diverse to describe in detail here. The School of Biological Sciences (SBS) and the Department of Chemistry (DOC) from the College of Arts and Sciences (CAS) and the Nebraska State Museum contribute the main thrust in the life sciences outside of IANR. Departments in CAS and IANR do not routinely interact in a significant way. The most common avenue of interaction is mutual research interest among individual faculty, but there are also a limited number of joint degree programs, e.g., Plant Pathology, and some faculty have joint appointments. Interactions with the UN Medical Center (UNMC) exist both as programs and as interactions among individual investigators, but the linkages with UNL are generally few. The Nebraska State Museum interacts with multiple departments (primarily SNRS, SBS and Geosciences). Finally, some Centers and Initiatives have played the important role of organizing faculty from multiple colleges into areas of concentrated expertise with mixed success and uneven support from upper administrators.

Many factors contribute to the current state of affairs in the life sciences at UNL and challenge the development of creative solutions.

- (a) In part, this division of faculty expertise results from the geographic separation among departments and because of different missions between the colleges; each hinders close association and development of common goals. The split campus situation cannot be easily remedied but remains a problem. We did not discuss mechanisms to address this issue.
- (b) Mission-oriented research largely dominates IANR programs while faculties in CAS and Nebraska State Museum primarily pursue basic research programs. There should be more touch points between the programs than presently exist, but current attitudes on both sides of the issue often hinder interaction. Many exceptions to this general statement exist of course, as basic molecular biology, biochemistry, evolution, and ecology are directly incorporated into applied programs with increasing frequency. However, a remarkable number of research programs also exist in CAS that contribute directly to research problems of public interest, and this expertise and contribution generally goes unrecognized. Clearly much integration is possible and desirable.
- (c) Legislative directive dictates that the IANR budget and programs remain separate from that of the rest of UNL in an attempt to protect programs in agriculture from reduced emphasis and university-wide reallocation. While this may have been an important issue in the past, the Life Sciences Task Force foresees potential problems if this organizational constraint remains. The potential and need for research success in the life sciences (*sensu latu*) at UNL is too great to justify encumbering future programs with administrative structures that detract from UNL's ability to reach its maximum capability.

As described above, the research landscape in the life sciences at the national and international levels has changed dramatically over the last decade, reflecting the changing face of the complementary disciplines. Things have changed so much that the Life Sciences Task Force believes that the existing organizational model at UNL will *not* best serve the interests of

Nebraska citizens with regard to the life sciences in the future (including agriculture, environmental, and biomedical sciences). Existing impediments to the exchange of ideas and the opportunities to build strong research programs in the life sciences must be addressed. The boundaries between basic and applied research are now so blurred in many cases that the traditional organizational schemes no longer suffice. To date, UNL has recognized the need for integration of the life sciences in this changing national climate by establishing several somewhat successful centers serving as valuable structures and several ongoing research initiatives: e.g., Center for Biotechnology, Plant Sciences Initiative, Initiative for Ecological and Evolutionary Analysis, and the Center for Biological Chemistry. Faculty from both CAS and IANR contribute actively to the present and future success of these programs. In each case, however, the road to success is rocky at critical junctures, so much so that none of these current programs alone has facilitated faculty research productivity to the degree that seems possible and necessary if UNL is to continue to compete at the national level. For example, the Center for Biotechnology has done much to elevate expertise in molecular biology at UNL, by hiring faculty, by providing seed support, by providing core facilities, and by establishing and supporting a seminar series. Dwindling administrative support for the Biotechnology Center has led to reduced morale and a cloudy future for this organization. It is worth the effort to reorganize this center so that it (and others) can be better integrated with research initiatives. The Life Sciences Task Force confronted intercollege/intercampus structural impediments repeatedly as we discussed issue after issue in both research and teaching activities. **We conclude that a critical organizational barrier exists at UNL that will prevent the successful integration of life sciences, a barrier that arises directly from the current partitioning between IANR and the rest of UNL, and a barrier that arises as a consequence of interactions among administrative units and their competition for limited resources with no satisfactory administrative path to resolve differences.**

The task force sought a plan for administering life sciences programs across UNL in a way that:

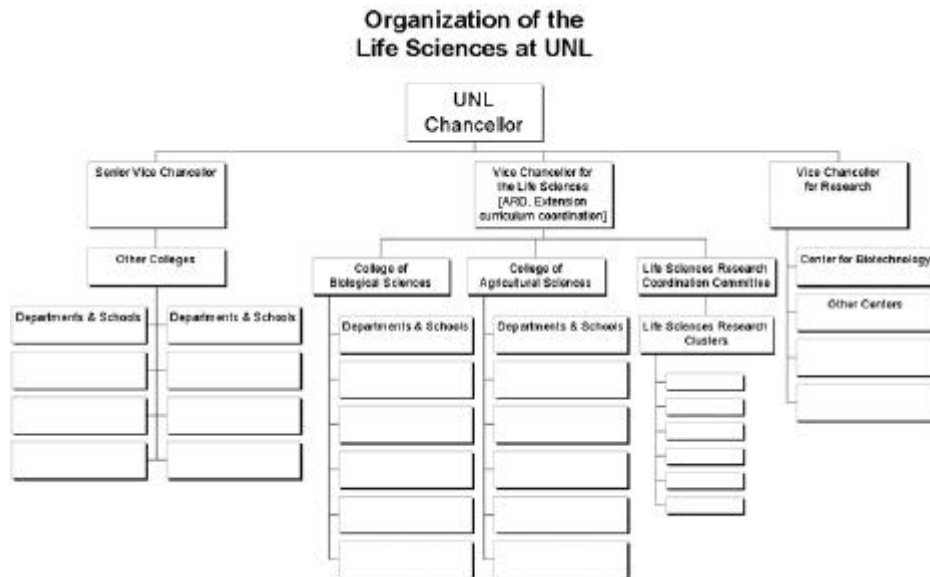
- facilitates cooperation among units while maintaining the appropriate level of competition that keeps programs sharp,
- coordinates instructional programs and curricula,
- develops cutting-edge research consortia among faculty with complementary research expertise from different administrative units,
- prepares UNL to be flexible and nimble with respect to changing research needs,
- positions UNL to obtain necessary competitive funding well beyond current levels to enhance research, and
- provides a mechanism for maintaining UNL's land-grant mission.

It is important to emphasize that we are not suggesting that all research in the life sciences should be placed under the umbrella of the UNL land-grant mission; many faculty members pursue important research that does not fit well. Rather, we feel that an administrative structure that positions strong UNL research programs in all facets of the life sciences for success at the national level must be developed.

In our discussions, the biggest obstacle that we perceived with the current administrative structure is the consistent and recurring competition between CASNR/ARD and CAS in ways that prevented the full expression of the potential in the life sciences at UNL. The recurring theme was the inability of the current administrative structure to resolve problems if colleges and/or departments disagreed with proposed solutions or resource allocations. **In our opinion, the basic reason for so many conventional and destructive “turf battles” is that the current administrative structure focuses all such decisions at the level of the colleges with no responsible mechanism to resolve differences when they occur. We recommend that this problem be carefully examined; in this spirit, we propose a possible solution below.**

A Proposed Administrative Structure to Integrate the Life Sciences at UNL

The accompanying administrative structure solves problems affecting the maximal development of the life sciences as described above. This administrative structure results in some potentially important consequences that we did not fully examine. However, we recommend an administrative realignment that will facilitate a better life sciences program for both teaching and research, and our proposal suggests a way to make this possible. This proposal goes far beyond merely moving faculty now in CAS or the Nebraska State Museum into the current IANR structure. We are proposing a different structure that is sensitive to the needs of agriculture *and* to the needs of basic research in the life sciences. This new structure must foster an attitude and supportive framework that emphasizes quality basic research in the life sciences as well as its incorporation into applied, mission-oriented research. Moreover, coordination of teaching and curricular needs throughout the life sciences can be accommodated in this plan in a way that does not currently exist at UNL, and is unlikely to exist if only slight modification of current administrative structures are implemented. *Specifically, we recommend against retaining the current IANR and CAS structures for organizing teaching and research in the life sciences.*



Primary Benefits

- Faculty in the life sciences will be members of one of two colleges. Primarily, mission-oriented research in agriculture will be performed in the College of Agricultural Sciences. Basic research in the life sciences will primarily be located in the College of Biological Sciences. Teaching in the life sciences will be appropriately split between units in both colleges depending on curriculum revisions, faculty appointments, and specific needs with the recognition that it must be balanced. Current faculty appointments must be evaluated based on such needs.
- **This organizational arrangement aims to balance the emphasis between basic and mission-oriented research efforts in the life sciences at UNL. Our recommendation is that a new administrative structure will be implemented that requires a much broader view of the life sciences and the role of UNL in investigating the life sciences than currently exists. Unless two balanced colleges are formed, UNL will not become more competitive for external research funds or develop research initiatives in new, innovative directions. Moreover, this plan should not be interpreted as merely a mechanism to move the School of Biological Sciences (SBS) into an IANR-like structure with little emphasis on refocusing all life sciences research and teaching at UNL. If no serious refocusing of life sciences programs is the outcome, nothing should be done and SBS should remain in CAS!** Keep in mind that UNL falls near the bottom of land-grant universities in combined attributes of securing external funds and in research productivity based on per faculty publication rates (Appendix A). We believe that current structural impediments at the intercollege/intercampus administrative level and sometimes low expectations by individual faculty and administrators contribute to this situation. New opportunities must be created to address the ability of UNL researchers to maintain nationally competitive research programs in all appropriate areas in the life sciences.
- Current organizational problems that remain unresolved at UNL (e.g., “the biochemistry problem” or curriculum coordination among others) are readily solved with the proposed administrative organizational plan, and new initiatives that follow the model of linking faculty among units can be better developed and managed as well. Note that this administrative model solves most potential organizational problems anticipated with future research initiatives and curriculum coordination as well.
- The creation of the College of Agricultural Sciences and placement of the ARD/Extension Director(s) in the Office of the Vice Chancellor for the Life Sciences maintains a focus for agricultural research required to fulfill UNL’s land-grant mission and addresses any legislative concerns. In addition, this proposed reorganization provides a real opportunity to reevaluate goals that underlie quality mission-oriented research efforts in order to develop new research strategies for the future. We must make sure that our emphasis is on tomorrow’s questions, not yesterday’s or today’s – in all disciplines. UNL should seriously investigate all alternative models to expand what we currently deliver and make sure that we are positioned for the future.
- Mechanisms must be developed for the ready exchange of ideas between the two proposed colleges in the life sciences. Coordination under our proposed scheme is expected, unlike

the one that currently exists; each of the two new colleges reports to the same coordinating Vice Chancellor for the Life Sciences, an organizational level responsible for coordinating both research and teaching.

- The proposed administrative structure provides for increased emphasis for external research funding and increased research productivity. Coupled to the “Research Cluster” proposal below, we feel that new emphasis and increased expectations on research performance will greatly enhance UNL’s national stature. Of course, the real goal is not funding *per se*, but the new opportunities and productivity in life sciences research that will accrue from increased funding activity.
- The land-grant mission will be split between the two colleges. Current ARD and Extension activities will be allocated among individuals in the two colleges as a lateral form of administration. These activities are housed in the Office of the Vice Chancellor for Life Sciences.
- Other units outside of the primary, two-college structure can be readily integrated into this organization as a unit included in the College of Biological Sciences. An obvious example includes the Nebraska State Museum, but others exist as well.

Potential Costs

While we believe that there are real benefits to the proposed administrative structure, there are significant potential costs to this administrative rearrangement as well. Under the above proposal, the College of Arts and Sciences will be significantly disrupted, with the possible loss of all science units coalesced into two new colleges of science (College of Biological Sciences, College of Physical Sciences). Moreover, it may be appropriate to expand the title and responsibilities of this new vice chancellor position to include the environmental sciences (with an appropriate college) since this area melds life and earth sciences into one package. We did not pursue this point but wish to raise the issue. The Life Sciences Task Force only dealt with the ramifications of this plan with respect to the life sciences, but was cognizant of the need to maintain a strong liberal arts program to maintain a quality, overall program at UNL.

Moreover, IANR must be restructured in some fashion and the current CASNR/ARD faculty will be split into two colleges based on the nature and intent of individual research activity. How traditional, important activities can be maintained must be determined. While this reorganization activity does provide for real opportunities to reassess our goals in mission-oriented research, it also provides some loss of other functions that many consider important. UNL cannot continue to be all things to all people. Some disruption of “activity as usual” is inevitable for UNL to grow and prosper in the 21st century!

Action

Major administrative changes such as the one outlined here will require careful and timely planning. A Nebraska EPSCoR sponsored symposium that addresses organization and integration of the life sciences with a focus on universities such as UNL is scheduled for April,

4, 2000. However, UNL must not wait too long to act or we will fall further behind other rapidly developing universities. The symposium could serve as a useful yardstick against which to measure developing ideas if serious discussions on the reorganization of the life sciences begins immediately. Planning and discussions of our reorganization proposal at all administrative levels should begin as soon as possible. The symposium should *not* be the starting point for such discussions.

With this new administrative scenario in mind, current administrative job descriptions will likely change, the most dramatic being that of the current Vice Chancellor for the Institute of Agriculture and Natural Resources. This position will now have responsibility for the life sciences at UNL that goes well beyond agriculture. Given the timing of this task force report, the recommendations for reorganization and shifting responsibilities, and the current search for this Vice Chancellor position, it is important that the new role of this position be carefully defined as soon as possible. It would be a mistake to hire an individual with one set of expectations when the administrative responsibilities and constituency might actually be quite different. It makes sense to suspend this search for a permanent Vice Chancellor until a careful strategic plan for integrating the life sciences is developed.

The Concept of Life Science Research Clusters

UNL must develop mechanisms to better identify and support faculty programs with opportunities to reach national prominence in critical research areas of national need. **We propose the creation of research clusters as a mechanism to foster flexible opportunities to mobilize faculty from multiple units to develop programs that can track important, productive research opportunities. Our intent is to provide the opportunity to attain national prominence to groups of faculty with innovative ideas.** Faculty-initiated research clusters will be formed based on intellectual alignments rather than departmental or college membership, will be self-sustaining to the degree that the group secures sufficient external research funding with sufficient indirect cost returns, and will disband when the research focus no longer maintains significant national prominence and funding capabilities. Research clusters will also provide a focus for graduate education and should help in both faculty and graduate student recruitment.

There are numerous examples of organized cross-disciplinary, faculty consortia in the Life Sciences at UNL that are consistent with the following definition, goals, and philosophy of research clusters. Examples include the Plant Science Initiative, the CBC, the emerging focus groups or Initiatives in Ecological and Evolutionary Analysis, Molecular Virology, and Animal Molecular Biology, and the Area of Concentration (AOC) group in Comparative Pathobiology. However, while these consortia might be consistent with the research cluster concept, each has arisen from a unique set of circumstances, and they differ in terms of priorities and function. Moreover, the administrative support and funding necessary for taking these consortia beyond the Initiative stage has not been consistent, evidenced by the variability in funds dedicated to each of these Initiatives, and the origin of such funds.

The following is a series of recommendations designed to promote an aggressive, consistent commitment to the establishment of research clusters for the betterment of Life Sciences Research at UNL.

Definition of Research Clusters

Organized collections of faculty from two or more Administrative Units and/or Colleges, which conduct cross-disciplinary, high quality research and graduate education in fields of the life sciences. After short-term assistance, research clusters are expected to become "self-supporting" entities, their administrative and structural needs financed from IDC or other extramural sources of funds directly arising from research cluster activities. Research clusters are considered to be a mechanism which allows faculty to introduce new research approaches and graduate programs in a proactive fashion.

Goals and Anticipated Benefits of Research Clusters

To create the critical mass and diversity of research expertise necessary to achieve excellence in research and graduate education in a cross disciplinary fashion. To provide flexible and desirable programs in strategic research areas, which enable faculty for productive careers, and promote UNL's capability to make fundamental scientific breakthroughs in the life sciences. The anticipated benefits associated with achieving these goals should include: a heightened national reputation and increased federal funding opportunities for UNL and its Life Sciences faculty; an academic environment more conducive to the recruitment and retention of high quality faculty, postdoctoral researchers, and graduate students; and an improved awareness of the breadth of Life Sciences faculty dedicated to meeting the needs of the life sciences, Nebraskans, and the nation at large.

Philosophy Underpinning Creation of Research Clusters

"The institutions that will succeed are those that can reorganize themselves to address scientific and educational questions in an interdisciplinary manner. The institutions that will have difficulty are the ones that keep the same rigid structure that prevents pollination among disciplines" (Dr. Mark Rodgers, Vice Chancellor for Health Affairs, Duke University; as quoted by Dr. James Moeser, Chancellor, UN-L) *in* How Research Clusters Fit Within Unls Existing Framework For Graduate Education:

Creation of a Research Cluster

We propose the following process to facilitate the purposeful creation of research clusters:

1. *Creation of a Life Sciences Research Coordination Committee:* This committee would be chaired by the Vice Chancellor for Research or a designee, and be comprised of 8 to 10 middle- and senior-level UNL faculty which represent the breadth of Life Sciences Research at UNL, and are also recognized for their outstanding productivity and creativity in Life

Sciences research. The faculty chosen to serve on the first coordination committee will be selected from a pool provided by the co-chairs of the Life Sciences Task Force, developed with input from other members of the Task Force. The initial charge for this Committee would include:

- to review preproposals for creation of research clusters, establish a select set for full proposal submission, and facilitate the selection of independent review teams for full proposals, which will include external, independent examiners.
- ratify the criteria by which research clusters will be evaluated, and oversee research cluster development and progress.
- identify and promote the emerging needs of research clusters, for example, faculty hires and technology upgrades and purchasing.

2. *Creation of a Research Cluster Initiative Fund:* The fund would be held in an account under the control of the Vice Chancellor for Research. We propose an annual contribution of \$2,500,000 comprised of funds from the new College of Biological Sciences and College of Agricultural Sciences (each contributing no less than 10% of the total requested), UNL's allocation from the Nebraska Research Initiative, current indirect cost returns to the University, and from the Research Challenge Fund proposed in the latest biennial budget forwarded by Chancellor Moeser. These funds (\$2,500,000) would initially be used to support the activities of new and existing research clusters, according to criteria recommended by the Life Sciences Task Force as augmented and ratified by the Life Sciences Research Coordination Committee. Such funds are believed capable of supporting a minimum of five, and not more than ten "research cluster initiatives". Funds could be used in the following ways:

- As matching funds (1:1) for research training, infrastructure and(or) other multi-investigator grants.
- To supplement graduate student stipends, placing them no lower than the 25th percentile available in the nation.
- To promote seminar series, colloquia, or workshops pertinent to the clusters' activities, designed to attract potential graduate students, postdoctorates, and prominent scientists to visit UNL.

3. *Research Cluster Promotion, Evaluation, and Liaison:* A portion of the above funds (no less than \$20,000 and not more than 10% of the total annual budget) will be used for the promotion, evaluation and the liaison needs of research clusters. Promotional materials include financing the human and other resources needed for high quality mailing, world wide web, and video materials describing the research clusters. Distinct forms of materials should be created for prospective graduate students, postdoctoral researchers, and the general public. Evaluation needs include funds necessary to compensate external examiners asked to review applications to initiate research clusters, as well as mid-term evaluation of research clusters. Liaison materials should also include funds to promote faculty interaction with federal granting agencies and(or) bringing agency representatives to UNL, as well as representatives of possible industry partners.

4. *Application Criteria for a Research Cluster Initiative:* Proposals will provide a five-year plan which aims to establish a research cluster sustained by direct and indirect cost returns from cluster grants and contracts, as well as other monies derived as a result of research productivity (e.g. patent royalties, anonymous donors, etc.). The preproposals would be required to address point (a) below. Those selected for further evaluation would address points (a) through (d) below:

- (a) Outline and justification for creating a specific research cluster, relative to the goals and philosophy described above for research clusters. The application will need to address the following:
 - (i) scientific expertise, caliber and number of the faculty within the proposed research cluster (is there a critical mass of relevant expertise?);
 - (ii) potential of obtaining extramural support for research and graduate training in the proposed research cluster area (is this an area worthy of funding and training graduate students for future careers?);
 - (iii) availability of infrastructure and facilities critical to the investigative needs of the research cluster (are the research activities supported by cutting-edge technologies and resources?);
 - (iv) existence of similar programs at other universities, and the comparative advantage(s) associated with creating such a research cluster at UNL (will this cluster fill an unoccupied niche in scientific research, or will it be overshadowed by similar programs elsewhere? Does UNL and/or the State of Nebraska have a comparative advantage in this area in relation to faculty expertise, infrastructure, or natural resources?). Sufficient technical detail should be provided in the preproposal to facilitate evaluation from a scientific based peer-review.

- (b) A proposed curriculum, including a list of the required and elective courses for students supported by the research cluster. Funds cannot be used for the support of postdoctoral level researchers or technical/professional staff. All students funded by the research cluster must satisfy the cluster's curricular requirements. However, because the degree-granting entities will be Departments or Schools, the cluster will be identified as an "area of specialization" on the student's transcript. It will also then be the cluster's responsibility to identify how Departmental and cluster curriculum requirements are both satisfied. If necessary, this may require that some cluster members receive a courtesy appointment in another Department or School. Persons holding courtesy appointments would be considered bona-fide members of the Department with respect to graduate committees and in return, must make a minimal contribution to the Department's teaching program; the amount of time committed will be defined by that Department's faculty.

- (c) A time-line should be provided, containing specific milestones in relation to submission of applications in response to EPSCoR announcements, RFP's and RFA's of funding agencies, as well as other possible sources of grant monies, to support the research cluster. At least one multi-investigator grant application must be submitted within two years of creation of the cluster. A cluster's contribution to, or direct submission of, grant applications for infrastructure procurement should also be listed, along with a list of support facilities and

services critical to the function of the research cluster. The time-line should also indicate how recruitment materials will be developed and distributed, beginning the first year of an award, with documentation of the success or otherwise of the recruitment efforts.

- (d) A detailed budget, which outlines both funds sought from the Initiative Fund and any existing funds which could be used to support the research cluster. The expectation is that extramural funding directly attributable to the existence of the research cluster will be obtained within five years, and the viability of the cluster will be dependent on this funding, and a portion of the IDC arising from those grants and contracts. A budget page similar in structure to that used with Hatch projects may be successfully transformed to meet these needs. For example, the budget is presented on an annual basis and divided into three sections: "Needs", "Resources Available" and "Resources Needed from the Initiative Fund". Successful awards and IDC returns to the cluster occurring during the five-year period will result in a 1:1 decrease in the allocation from the initiative fund the following year.

Evaluation of Research Clusters

The creation and progressive evaluation of research clusters will be conducted by internal and external participants. Any cluster not preparing at least one multi-investigator grant application of any form after two years of support, will be terminated immediately. Once a cluster is approved for support, a major review of performance will be conducted in the third year, including the following criteria:

- (a) Scientific expertise, quality of the research, and potential for obtaining extramural support: In lieu of successful awards, the cluster will provide the review team with the evaluation sheets and assigned priority scores for any multi-investigator grants submitted. There should be a description of how the cluster has responded to suggestions/criticisms. A listing of publications with multiple authors from within the research cluster should be made available. Likewise, publications arising from a cluster member that represents an alteration in research approach attributable to involvement with the cluster should also be included.
- (b) Potential for enhanced graduate student recruitment: In lieu of successful training grants, the research cluster would be expected to outline how their recruitment materials have generated interest in their activities. Probably the most straightforward way to provide documentation is to have initial interest directed to the Office of Graduate Studies, which can tabulate the number of inquiries processed.
- (c) NRC and related criteria used for University rankings: Simply stated, refereed publications and grant funds per FTE, before and after creation of the research cluster, should be provided. Moreover, there must be a positive impact on these numbers from the support of the Initiative fund by the third year, otherwise funding is terminated. It is presumed that research cluster members will already possess monies for graduate assistantships outside those provided by the research cluster initiative fund, and students will have to be reverted back to such funds.

Research clusters that are making satisfactory progress will maintain funding for a further two years, after which, all form of support via the cluster Initiative Fund will be terminated. A provision should be in place, however, that provides partial support of a research cluster for an additional two years on a one time basis when application(s) fall marginally short of the priority scores needed for funding or competitive renewal. The Task Force also feels that such a concept should be extended by the Vice Chancellor's for Research Office to federal grant applications by an investigator(s) not formally affiliated with a research cluster.

Financial Requirements of Research Clusters

The viability and sustainability of the research clusters will be directly proportional to the participants' success in obtaining extramural funds and associated indirect cost returns. Because the synergistic activities of faculty from multiple Departments/Colleges are the foundation of successful research clusters, we propose that two ninths of any IDC arising from cluster grant applications be returned to accounts held in the VCR office, on behalf of each research cluster.

Termination and Evolution of Research Clusters

The above areas of activity are considered pivotal to establishing the research cluster concept at UNL over the next five or so years. Successful research clusters are likely to evolve with time, both in terms of research focus and faculty composition. The activities of the Research Coordinating Committee and the Initiative Fund are also likely to evolve with time, but both will remain of continued importance relative to identifying emerging areas of science and technology, and providing proactive leadership in shaping life sciences research at UNL. As the indirect cost base increases in size and stability, a portion of these monies should be utilized to provide a new source of support for future faculty hires in the Life Sciences at UNL. A similar and very successful role was played by the Center for Biotechnology during the late 1980's and early 1990's.

Anticipated Benefits of Research Clusters

This approach is viewed as a "repackaging", and in some cases, "illumination" of faculty expertise, both inside and outside the University. Promotion of research clusters should elevate overall research productivity and funding, and a heightened national prominence of the research activities and collaborations in place at UNL. This should not only positively impact the attractiveness of UNL for faculty and postdocs, but also increase the quantity and quality of the student pool. Augmentation of graduate student stipends will also improve the probability of recruiting desired students. It should be easier to document how the research and curriculum at UNL abides by the criteria used for ranking Life Sciences Programs and elevate the ranking of various subprograms. In short, the goals associated with research clusters are expected to achieve these benefits.

Implications of Research Clusters

To some extent, college administrations will be required to relax their control over funds by redirecting monies to a centralized fund under the control of the Vice Chancellor for Research. The inclusion of Deans on the Coordinating Committee partially compensates for this reallocation of funds, but it will be important to outline how any redirection of funds in this manner will ultimately benefit the respective College administrations and provide them with greater financial flexibility (more funds) than they currently possess. A similar scenario exists with Unit administrators: there will need to be an assurance that teaching, research and outreach programs will be either unaffected, or even enhanced by the existence of research clusters.

Clearly, not all faculty would be expected to or be best served by their inclusion within a research cluster. These faculty need to be assured their own efforts are not being sacrificed, or negatively impacted, by the creation of research clusters. Although their structures might be less formal, there are a number of interdisciplinary teams spanning IANR units which are dedicated to mission-oriented activities and derive support from commodity groups and existing appropriations. Research clusters merely are an analogous version of these teams, simply dedicated to a cross-disciplinary exploration of the more fundamental aspects of the Life Sciences. If research clusters achieve the goals they are designed for, there should be greater financial flexibility for all aspects of research at UNL.

Part II. Responses to Specific Items in The Task Force Charge

The Life Sciences Task Force was also asked to discuss several specific issues in need of resolution. This section describes task force recommendations for these specific charges.

Teaching Molecular Biology at UNL

Molecular biology, both as a field of research endeavor, and as a suite of tools applied in more pragmatic fields of study, will have a major impact on the Life Sciences during the 21st Century. What does UN-L offer its current and future students in this area? The Life Sciences Task Force appointed a subcommittee to examine the Molecular Biology course offerings at UNL. The subcommittee met and solicited input from relevant faculty. Based on these efforts, the Life Sciences Task Force recommends: (a) we believe that a strong, rigorous, broad-based curriculum in Molecular Biology is very important for the future of Life Sciences at UNL and can be created at both the graduate and undergraduate levels through better coordination among departments and investment of new teaching faculty; (b) there is an urgent need to better incorporate molecular biology and related subject material into existing majors, especially within CASNR and; (c) a commitment is needed by multiple colleges to create a laboratory course capable of accommodating ~50 students per semester. Creation of a new department is not needed, but a coordinating body is needed. Since the subcommittee's primary focus is on the undergraduate curriculum, we feel that the graduate training aspect should be dealt with at the research cluster or program level. With that in mind, the following sections will detail a defined curriculum for both an undergraduate major and minor in Molecular Biology. In addition, a discussion

of the needs, deficiencies, and a process to successfully establish a formalized curriculum in Molecular Biology will be presented.

The Molecular Biology Major and Minor

In addition to basic requirements for the baccalaureate degree, an undergraduate Molecular Biology major would require 36 credits (at least 18 from "core courses", plus 18 from Biological Sciences above the 200 level). For the Molecular Biology Core Curriculum the following courses are recommended:

- Biological Sciences 312 - Fundamentals of Microbiology (3cr)
- Biological Sciences 301 - General Genetics (4cr)
- Biological Sciences 305 - Genetics, Molecular and Cellular Biology Laboratory (2cr)

(This course would provide introductory exposure to the applications of molecular and cellular techniques to interested non-majors)

- Biological Sciences 401 - Advanced Cell Structure and Function (3cr)
- Biological Sciences 420 - Molecular Genetics (3cr)
- Biological Sciences 451 - Advanced Molecular Biology laboratory (2cr)
- Biochemistry 431, 432 - Biochemistry I and II (6 cr)

All prerequisites are assumed to be necessary.

The list of courses above totals 23 credits. We feel this core set of courses should be required for all majors, and students should enroll in these courses as early as the sophomore year. For the Molecular Biology Minor a total of 18 credits from the above list is required, and should also begin during the sophomore year.

Additional electives include the following:

- Biological Science 201 - Cell Structure and Function (4cr) (minors only)
- Biological Sciences 313 - Microbiology Lab (2cr)
- Biological Sciences 407 - Biology of Cells and Organelles (4cr)
- Biological Sciences 412 - Human Genetics (3cr)
- Biological Sciences 418 - Advanced Genetics (3cr)
- Biological Sciences 430 - Molecular Phylogenetics (3cr)
- Biological Sciences 443 - Immunology (3cr)
- Biological Sciences 453 - Advanced Cell Biology Lab (3cr)
- Biological Sciences 497T - Plant Biotechnology (2cr)

While this listing of courses is a reasonable start, we feel that important deficiencies exist as well. The lack of any Developmental Biology and Developmental Genetics courses are major deficiencies that we feel MUST be rectified. Cell Biology at UNL needs more emphasis as well. Moreover, the paucity of any "Bioinformatics" related courses needs to be remedied. A course on Molecular Virology at the undergraduate level should be added

when it is developed. Other deficiencies include mammalian cell biology, mammalian developmental biology and cancer biology.

General Comments

The current course catalog with regard to courses in molecular biology is very unreliable. The course catalog **MUST** be revised to accurately reflect the courses actually taught at UNL as well as **WHEN** they are taught. It is very difficult for students to design programs if courses are not listed, or courses listed are not taught. It is also important in planning to know when the course is taught on a regular basis. At present this is not the case with the current catalog. Curriculum coordination is discussed below under the topic of curriculum coordination.

There are also instances of course overlap. For example, BiolSci420 and Biochem432 have a great deal in common. Clearly a great deal of coordination is needed to make Life Sciences in general and Molecular Biology in particular a program that is successful.

Recommendations

Implementation of the proposed creation of Colleges of Biological Sciences & Agriculture Sciences as proposed above with oversight by a Vice Chancellor for the Life Sciences is critical to ensure broad support and coordination. This structure will provide the necessary impetus for a quality molecular biology curriculum and provide a mechanism that will suitably coordinate this program using existing departments.

A Faculty Steering Committee constituted at the level of Vice Chancellor for Life Sciences should be created to coordinate course offerings, set a timetable, avoid duplication especially in course contents, and ensure the accuracy of the course catalogs. The committee should be comprised of faculty who teach the relevant courses.

Coursework needs to be taken in an orderly and timely fashion so that courses build on one another in a logical fashion. For example, Biochemistry 431, 432 should be taken in the junior year at the latest, not the senior year. Many other relevant examples also exist in this sense.

If possible, this major should be coordinated with UNMC, particularly with respect to biomedical courses. We acknowledge the lack of CASNR courses listed in our recommendations, especially in the mammalian area. However, this reflects the lack of expertise presently available within the present CASNR to contribute to a molecular biology curriculum. Considering that future hiring decisions are likely to have some emphasis in the "genomics" and "molecular biology" areas, CASNR could strengthen the molecular biology course offerings in the mammalian area.

Two persons need to be hired by the Molecular Biology Steering Committee for overseeing teaching of molecular biology within various units of both colleges associated

with the life sciences. These individuals would not have department affiliations and performance would be evaluated by the Molecular Biology Steering Committee. These individuals will have 100% teaching appointments and be responsible for the coordination of molecular biology labs, offered every semester in 2 sections of 25 (50 per semester). This laboratory course should be taken by 2nd semester sophomores or 1st semester juniors and will be available to students of all majors with appropriate standing. To ensure students gain the optimal research experience as part of their baccalaureate program, the Biology Honors Program should be reinstated within, with Senior Honors Theses being completed in molecular biology related research laboratories.

In terms of dollar amounts we estimate the following. Such figures are tentative, and need to be refined by additional research of similar programs at other universities:

- (i) Lab renovations in Beadle \$500,00 to 1 million
- (ii) cost/student/semester \$150-500
- (iii) charge /student/semester \$ 50
 (laboratory fee)

Organization of Biochemistry at UNL

Needs for biochemistry at UNL currently crosses three current colleges (A&S, CASNR, HR&FS), ARD, two major contributing departments (Biochemistry, Chemistry), and the CBC “umbrella structure” formulated in March 1987 by an *ad hoc* committee of UNL faculty (Chollet, Schuster) and administrators (Arnold, Ballinger, Furgason, Meisels, Omtvedt, Yost [Chair]) appointed by then Chancellor Massengale. The NU Board of Regents formally approved the CBC in June 1987. This sub-committee’s major task was to consider two separate documents from the Department of Biochemistry and the Department of Chemistry. The first was a formal proposal by the Department of Biochemistry’s faculty to Deans Edwards, Foster, and Nelson, dated Spring 1998, to transfer the Biochemistry Program at UNL, including the undergraduate and graduate components, from CBC to the Department of Biochemistry and, at the same time, transfer partial teaching FTEs (0.25 each) of the biochemists in Chemistry (Griep, Price, Song) to the Biochemistry Department for instructional purposes only. The second was a draft “position paper” from the Chemistry Department’s Executive Committee regarding the relationship between the biochemistry and chemistry disciplines. This document was received in September 1999. Based on these two documents and our related discussions during Fall 1999, the sub-committee put forward a written report. The Task Force discussed this report and made the following recommendations.

UNL administration should establish a cross-college Biochemistry program to meet the needs of biochemically-oriented faculty in the various life sciences departments and Chemistry in a broader program than currently exists. The Life Sciences Task Force

strongly endorses the need for a strong cross-campus Biochemistry program that involves all biochemically-oriented faculty in Biochemistry, Chemistry and the more biologically oriented biochemists in other departments. Such a cross-campus program will enhance faculty recruitment to both colleges (CAS, CBS), attract a larger and better-qualified pool of graduate students, and generally promote interdisciplinary research. The establishment of the College of Biological Sciences (CBS) solves many of the current coordination problems that have proved so vexing. However, a complete solution for establishing a full-campus biochemistry program will still require careful nurturing. One disadvantage of possibly establishing a College of Physical Sciences along with the Colleges of Biological Sciences and Agricultural Sciences is that there will be greater separation between biochemically oriented faculty in Chemistry and the biochemists in other departments. To alleviate this problem, a cross-college umbrella organization must be established. Depending on what departmental structure remains after the reorganization described above, this program could be called the Center for Biological Chemistry, or simply the Biochemistry Program. The mandate of this program would be to ensure that the needs of biochemists in Chemistry and the various life sciences departments are met in terms of graduate program development, graduate student recruiting, overall course offerings, and teaching assignments. A broadly based *ad hoc* faculty committee should be established to work out the details of this cross-campus program.

To reorganize an umbrella program for biochemistry, two steps are needed. Both steps should be implemented immediately.

- (a) UNL administration should establish a broadly-based, *ad hoc* faculty committee, reporting to the Vice Chancellor for the Life Sciences to develop the overall Biochemistry Program at UNL with respect to course offerings, course ownership and teaching assignments for the program within the College of Biological Sciences. This *ad hoc* committee will be comprised of faculty representatives from Biochemistry (2), Chemistry (2), Biological Sciences (1), and Agronomy, Animal Science, Food Science & Technology, Plant Pathology, and Veterinary & Biomedical Sciences, among others (total of 2).
- (b) Second, an external review committee should be established to recommend an appropriate resolution of the final structure of the umbrella program within the College of Biological Sciences based on recommendations of the *ad hoc* faculty committee (above). The major charge of the external committee will be to decide whether to fix (and how) or dismantle the current CBC. If it is decided that this intercollege, interdepartmental Center should be retained in some modified form, specific items of discussion must include:
 - (i) a variety of pressing budgetary matters (e.g., the imminent loss of \$55,000 in annual NRI funding from the Center of Biotechnology that funded graduate assistantship support for teaching and research, which essentially has not increased significantly since the creation of CBC, recruiting funds for the graduate program, how to implement the program with respect to a new College of Biological Sciences).
 - (ii) The nature of the CBC Directorship must be revisited. For example, should the Director continue to be the Head of Biochemistry, whose faculty comprise the bulk of the active participants in the current Center from both a teaching and advising

point of view, or should it be a rotating responsibility or one that is charged to the CBC Executive Committee?

- (iii) The possibility of “subscription fees” for CBC-affiliated faculty not significantly participating in the teaching program on a regular basis should be carefully considered.
- (iv) And, *most important*, the assignment of biochemistry teaching duties by the Director among the major participating CBC faculty (e.g., see plans A and B below). This committee should seek input from the relevant Deans and Department Chairs/Heads on a regular basis. This external committee should be appointed early in the Spring 2000 semester so that any proposed changes can be implemented during AY 2000-01.

In seeking long-term solutions to the biochemistry organization problem at UNL, some immediate short-term problems must be resolved. It is important to **immediately address the undergraduate and graduate teaching needs of the CBC, presently involving CASNR faculty (Biochemistry) formally budgeted in CBC and A&S faculty (Chemistry) not budgeted in CBC.** In the short-term, biochemistry teaching must be addressed. Both CASNR and CAS biochemistry faculty currently teach CBC courses. Only the former is under partial budgetary control by the Director of CBC, a situation that sometimes causes staffing problems. Two different scenarios address the present needs of CBC’s course offerings. The intent of both scenarios is to give the CBC Director much-needed control of teaching assignments so that he/she can make long-range plans to meet teaching obligations. The Life Sciences Task Force supports the need for both short-term and long-term solutions with regard to biochemistry at UNL

Plan A: To transfer partial teaching FTEs (0.25 each) from the participating biochemists in Chemistry (Griep, Price, Song) to CBC’s teaching budget, thus duplicating what has already been done with Biochemistry faculty’s teaching FTEs. Just as the Biochemistry FTEs have remained formally in CASNR, Chemistry’s partial FTEs would remain in A&S. However, such a lateral, intracollege transfer of 0.75 FTE, total, from Chemistry into CBC for teaching purposes only *must be coupled simultaneously* to a new “bio-related” (e.g., biochemistry, biophysics, molecular or structural biology) faculty hire in Chemistry, with 0.75 FTE budgeted in Chemistry and 0.25 FTE in CBC (1.0 FTE in A&S). Thus, there would be *no* net loss of FTEs from Chemistry, and the CBC would gain a total of 1.0 teaching FTE, *under the control of its Director*, to meet the demands of its service and graduate courses and, most especially, its ever-growing undergraduate major (as of mid-August 1999, 127 students in A&S and 37 in CASNR). This plan is actually a variant of that proposed to the Deans by the Department of Biochemistry during the Spring of 1998.

Plan B: To establish a formal, written “memorandum of agreement” between the Director of CBC and the Chair of Chemistry, countersigned by the A&S and CASNR Deans, for the delivery of three core CBC lecture courses each academic year by the participating biochemists budgeted in Chemistry. The specific core courses to be taught would be based on overall CBC needs, but would be chosen from among BIOC 321 and BIOC/CHEM 431/831, 432/832, 436/836, 486/886, 839, 932, 933, 934. This plan actually reiterates what is already stated in

the formal documents that established the CBC in 1987. These two mutually exclusive plans are presented because one (Plan A) is favored by the current Director of CBC and the Department of Biochemistry, while the other (Plan B) would likely be favored by Chemistry. The task force could *not* reach unanimous agreement as to which Plan might be acceptable to the CBC Director and both departments involved.

Curriculum Coordination

An important challenge faced by universities today is to provide higher quality learning experiences for undergraduate and graduate students with decreasing per capita resources. Members of the Curriculum Coordination sub-committee and the Life Sciences Task Force felt that this could be accomplished at UNL by encouraging a partnership among life sciences units that results in an equitable, respectful and broad-based distribution of course responsibilities among faculty on both campuses. The lines between faculty members with *basic* versus *applied* interests have grown increasingly vague as more and more faculty from both campuses have strong, underlying basic science backgrounds. This appears to be particularly true of the fields of molecular biology and ecology. While the sub-committee did not go so far as to recommend one school of life sciences, the group expressed strong feelings that much more could be done to coordinate curricula in the life sciences. It is also clear that beyond coordination, more must be done to empower qualified life scientists to teach in their area of expertise (irrespective of department). This empowerment will come about only if significant barriers between departments and schools are removed and if the faculty takes a more open-minded view and ownership of a life sciences curriculum at UNL.

Recommendations

The committee feels that there is a pressing need to develop a more encompassing "life sciences" curriculum in order to meet the instructional needs of our current undergraduate and graduate students in the current College of Arts and Sciences and the College of Agriculture Sciences and Natural Resources. The committee recognizes that existing procedures for developing new curricula, reviewing course offerings and evaluating the instructional needs of our students are inadequate. The committee also recognizes that no useful mechanisms currently exist to enable "life sciences" faculty in the two Colleges to effectively cooperate in developing a better curriculum for our students and in making recommendations to secure the necessary resources to implement a better curriculum. Our primary goal in making the following recommendations is to begin the process of improving cooperation between the Colleges.

Create a curriculum coordinating committee. We recommend creating an Inter-college committee or group consisting of the appropriate Life Sciences faculty and administrators who have responsibility for curriculum matters in their respective units. If the administrative organization model described above is adopted, this coordinating committee would be housed in the Office of the Vice Chancellor for Life Sciences.

Rationale. An opportunity to discuss and implement important campus-wide curricular issues in the life sciences is needed but presently does not exist. In practice, this group would meet at least once per semester and serve as a vehicle to discuss the important issues raised by this subcommittee of the Life Sciences Task Force. Some issues to be addressed further include concerns about overlap of course content, scheduling conflicts, voids in coverage resulting from curricular revisions, and departmental as well as campus-wide shifts in faculty expertise.

Clarify issues related to course ownership. The Life Sciences Task Force feels that each course needs to have an academic home department or unit clearly designated. This effectively places the responsibility for course development in a specified area of the total "Life Sciences" curriculum on the faculty in the unit deemed most appropriate for assuming responsibility for the course. The unit in which the course resides has the responsibility for teaching the course (i.e. designation of a qualified instructor) on a regular basis and initiating procedures necessary to secure resources to ensure the regular instruction of the course.

Rationale. The committee appreciates that teaching expertise in basic biology is distributed among faculty across the various life sciences units and is not the exclusive property of any one unit. Hence, there is a need for devising a system of course ownership that encourages broader participation among all *life sciences* units in the teaching of basic life sciences courses. The committee also recognizes that reward and credit for teaching must be properly addressed in order for participating units and faculty to enthusiastically contribute to the effort. Hence, the committee additionally and specifically recommends that the Curriculum Coordinating Committee (above) should also meet with the appropriate administrators (e.g., Earl Hawkey and/or Anthony Schkade) for the purpose of devising a system of course ownership that recognizes "home departments" for cross-listed courses and assigns appropriate credit.

Improve the Availability Of Course Information. There needs to be a group of individuals identified who are savvy with databases and interested in Life Sciences curriculum coordination to guide the creation of an easily accessible, searchable database to allow students, faculty and advisors to deal with current and future course scheduling.

Rationale. The curriculum subcommittee met with Rebecca Carr, viewed the database "Mynulook", and felt that much of the information needed to coordinate the life sciences curriculum was already assembled. Amy Stephen and Randy Goldenstein, the individuals involved in creating "Mynulook", indicated that it would be possible to create a version that would serve the needs of curriculum coordination. They indicated that they would be willing to work with this group and could start this project February/March 2000.

Appendix A

UNL Research Profile: State of Affairs

Without doubt, research in the life sciences is a major thrust at UNL, historically reflecting the land-grant status of the University. This focus will remain. Future success in this area requires

that we remain strong in life sciences research and that we look to new developments and opportunities in directing resources for future research. Planning for research at the local level requires that we assess where UNL stands in research productivity at the national level in comparison with similar programs in other universities. This comparison provides the necessary baseline against which to develop recommendations.

This appendix reviews recent, representative studies that evaluate life sciences and total research for research universities throughout the U.S. These standard metrics provide a general glimpse of our standing among peers research universities with doctorate granting graduate programs. Describing productivity at university levels requires that one aggregate assessments, usually in the form of (a) overall research funding, (b) publication rates, and (c) "reputational" surveys. This appendix is not exhaustive in its analysis but summarizes UNL's status and accomplishments based on the well recognized available rankings: Carnegie Research Status (1994), NRC Ranking of Research-Doctorate Programs (1995), NRC Profile of Colleges of Agriculture at Land-grant Universities (1995), and an analysis based on individual faculty effort by Graham & Diamond (1997). Such aggregate rankings will, of course, often miss areas of excellence, misrepresent certain aspects of a program, or not recognize structural constraints on what UNL can and cannot achieve. These last issues must be evaluated with local analyses.

The following summaries describe conclusions of the original reports and do not indicate new research summaries.

NRC Profile of Colleges of Agriculture at the Land-grant Universities (1995)

The National Research Council (National Academy of Sciences) Board on Agriculture recently released a report on the Colleges of Agriculture at land-grant universities (NRC 1995). The main thrust of the report is to evaluate the current state of the educational and research units of these universities in the context of the current and evolving role of these Colleges of Agriculture in addressing societal needs and concerns. How does UNL stand in this analysis? Aggregate data are employed to assess the program so that comparisons with other units can be made.

As land-grant universities, colleges considered in this report represent the state-based component of the public agricultural research system. For the data reported (1980-1995), about 30% of the research money allocated to the USDA was available for CSRS/CSREES funding, \$386.9 million dollars in 1994. However, agricultural research at universities nationally accounts for only a small proportion of all federally funded university research. Most agricultural colleges had to seek out traditionally non-agricultural dollars to expand or even maintain research levels, reducing over time USDA's traditional role as the federal partner in agricultural research.

The financial base of research in land-grant universities is shifting. A basic form of support to colleges of agriculture exists in the form of formula funding (Hatch Act, McIntire-Stennis,

animal-health research, Evans-Allen funds) and congressionally earmarked funds. In 1992, UNL received \$2.9 million (~6% of experiment station expenditures).

The UNL Agricultural Experiment Station (1992) relies primarily on private and formula funding (NRC 1995). Total research expenditures by the UNL agricultural experiment station rank 10th among experiment stations based on this report. Research expenditures as a percent of total break down as follows (of \$51,858,000): Formula funds, 6.5%; Competitive Research Funds, 2%; Special Research Funds, 5.6%; Other Federal Funds, 9.7%; State Appropriations, 45%; and Private Funds, 23.6%. In percent allocation, UNL funding patterns can be compared to the national average for experiment station budgets (%): Formula funds, 18%; Competitive Research Funds, 2.9%; Special Research Funds, 4.8%; Other Federal Funds, 10.2%; State Appropriations, 48.5%; and Private Funds, 16.2%.

Of the 28 land-grant universities ranked in the top 100 universities receiving federal funds, UNL Agricultural Experiment Station ranks 27th in percent of funds received from primary federal funding agencies. UNL is included as one of only four universities that receives most of its federal funding from USDA, and each of these universities (N.C. State, Iowa State, Virginia Polytechnic Institute and State U, and UNL) is in the bottom third of the overall federal funding rank. Overall, the universities least reliant on USDA formula funding and most diversified toward a combination of other federal funds and USDA competitive grants receive large percentages of federal research and federal development funding and rank much higher overall in research funding.

Per capita Comparisons of Research Productivity

The analysis presented by Graham & Diamond (1997) evaluates American university output for all fields of study standardized by individual faculty number using data from 1980-1990, not just science or life science. Categories are more restrictive than that employed by the Carnegie classification. Thresholds based on publications per faculty and federal R&D funds per faculty must each be obtained in order to be classified into a specific category: Research 1 (>2.0, >\$28,000), Research 2 (1.5, \$14,000), Research 3 (1.0, \$9,000), and Research 4 includes the remaining institutions. The number of public universities in each category are: Research 1, 32; Research 2, 26; Research 3, 22; and Research 4, 51.

Among American public universities, UNL (1.51 publications, \$12,850 R&D per faculty) is classified as a Research 3 institution in this classification, with 65 public institutions ranked above it. UNL barely meets the publications rate threshold for Research 2 category, but falls short in R&D funding for inclusion into this category. In general, flagship institutions hold strong advantages over other institutions in the same state, usually land-grant universities, a point clearly evident in comparing categories 1 and 2. However, about two thirds of institutions in category 2 are land-grant institutions, compared with land-grant universities comprising about 30% of category 1 institutions. Distribution of land-grant universities by research category is: Research 1, 10; Research 2, 17; Research 3, 15; Research 4, 7. In this classification, based on per capita output for entire university programs, 31 land-grant

institutions are ranked above UNL. Faculty at larger universities tend to somewhat outperform those at smaller universities, but many exceptions to this rule exist.

In summary, based on the Graham and Diamond (1997) classification, UNL is not meeting its research expectations on a per capita basis commensurate with the often-expressed goals of the faculty or the legislature. These benchmarks provide realistic assessments of overall research quality at UNL, and provide an important challenge to which UNL *must* respond to be a more respected research institution in this 21st century.

References

Graham, H. and N. Diamond. 1997. *The Rise of American Research Universities: Elites and Challenges in the Postwar Era*. Johns Hopkins Press.

Board on Agriculture, National Research Council. 1995, *Colleges of Agriculture at the land-grant Universities: A Profile*. National Academy Press. Washington, DC.