UNIVERSITY-INDUSTRY RELATIONSHIPS

UNIVERSITY OF MINNESOTA HEALTH SCIENCES

BIOMEDICAL PILOT STUDY

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June 8, 1984
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INTRODUCTION

Growth of health research and development in the United States is at a critical crossroad. Research intensive academic institutions whose biomedical research activities have been largely dependent on federal, particularly National Institutes of Health (NIH) funding, face the reality that they can no longer look to NIH to support expansion of present activities - or even to assume that present levels of support will be maintained.

A quick scan of NIH appropriations from 1953 to the present (Table 1) makes clear that the years of NIH's explosive growth - and the biomedical research enterprise that was built as a result of that growth - are a thing of the past. More alarming than the actual NIH appropriations figures is the fact that the cohort of research scientists trained during NIH's expansionary period are now competing for ever-tightening resources. The drop in award rate (the percent of grants found eligible through the NIH peer review system actually awarded) has strikingly declined - from 59 percent in 1972 and 60 percent in 1975 to an estimated 29.7 percent for 1985 (Table 2).

The University of Minnesota, on the basis of NIH monies awarded to national institutions of higher education, has "held its own", ranking eighth in 1970 and thirteenth in 1983 (Table 3). A careful look at monies allocated to the Health Sciences from 1976 to 1983 (corrected to 1971 dollars) reveals a small but definite decline in resources (10%) (Figure 1). In addition, a
recent graduate school review of national rankings of the graduate programs in biological sciences at the University of Minnesota has revealed a disturbing downward trend in national standing which cross-cuts nearly every biological science program. With the bleak national outlook as depicted in Table 1 and 2, and an erosion of excellence in the biological sciences, the University of Minnesota is compelled to begin an active and aggressive program to seek complementary outside sources of research support, and to simultaneously "look within" to correct slippage of national rankings in the biological sciences. Private industry is one key potential source of funds for academic research and thus the focus of this report. Not only is industry a potential source of critical monies needed to fund research in the academic environment, but industry can also serve as an important source of enrichment to the academic environment.

In its "peer group" of the top 25 research and development (R&D) performing academic institutions in the United States, the University of Minnesota ranks high (number 11) as judged by percent of R&D funded by industry. These figures are based on industry funding of all R&D at the University of Minnesota. In sharp contrast to aggregate industry funding of University activities by industry, the Health Sciences share is surprisingly low. In 1983, industry support for the entire University of Minnesota was $7,140,279; support for the Health Sciences by industry was only $898,682, 12.6 percent of industry funding of University activities. From 1976 to 1983, while industry monies awarded to the total University (corrected to 1971 dollars) has increased by 26 percent, the Health Sciences share dropped by approximately 50 percent (Figure 1).
In view of both a compelling national outlook and a disturbing situation in the biological sciences at the University, this study was undertaken to obtain the perceptions of personnel from Twin Cities headquartered biomedical firms to assist the University of Minnesota Health Sciences to develop recommendations for improving ties with local biomedical industry. The study emanated from the Office of the Vice President for Health Sciences and has been guided by a University-wide advisory committee. The study was officially endorsed on January 15, 1984, by the Board of Directors of the Minnesota High Technology Council.

METHOD

The study was performed in two phases.

Phase I

Phase I was an exploratory study directed at obtaining the views of personnel from a Twin Cities headquartered biomedical device firm. Respondents were high to top-level management personnel from different divisions of the firm with diverse responsibilities within the firm. The purpose of Phase I was three-fold:

1) to refine the interview procedure and quantitative methodology,
2) to assist in the planning of Phase II of the study, and
3) to obtain a set of preliminary results.

The Phase I Interim Report is attached (Attachment 1).
Phase II

Phase II was a refined expansion of the Phase I study to eight additional Twin Cities headquartered firms (or biomedical divisions within larger firms) whose mission includes the advancement of biomedical science and technology.

Phase II Procedure

Firms were selected using seven selection criteria: Respondents were personnel in high to top level positions within their firm, with parallel levels of responsibility within their firm/division. [See Attachment 2 for details.]

Thirty-two personnel from eight Twin Cities headquartered biomedical firms were interviewed using a modified interview document and numerical rating system. Respondents were asked to answer 24 open-ended questions; they were also asked to rate 17 issues on a scale from 0 to 10 (0 = of no importance) and to rank order from 1 to 17 the items in terms of importance to their firm. Since many respondents did not assign rankings on the 1 to 17 scale only results obtained with the 0 to 10 scale are used in this analysis. The interview document is attached (Attachment 3).
PHASE II RESULTS (KEY POINTS)

A graphic presentation of aggregate ratings of all 17 elements by all respondents from 0 to 10 (0 = of no importance; 10 = of major importance) is attached (Attachment 4). Mean numerical ratings by respondents are presented in rank order (Attachment 5). Rankings by respondents in individual companies differed somewhat from the aggregated figures and are presented numerically and graphically (Attachment 6). Differences within the set are related to the types of product(s)/process(es) produced by the individual firms.

Issues Ranked Of High Importance (All Phase II Firms)

- Access to hospital clinical testing services, facilities and physician expertise.
- A Health Sciences focal point for industry to interface with the University of Minnesota Health Sciences which will have the authority to facilitate industry interactions with all units of the University.
- Facilitation of involvement of the firm's personnel in the University of Minnesota's continuing education programs.
- Development and participation in biomedical university-industry seminar series.
- Facilitated access to University seminars, courses.

Issues Ranked Of Low Importance

- A central focal point for industry to interface with the University which will have the authority to facilitate industry interactions with all units of the University.
- Participation in the recruiting and training of graduate students/post doctoral fellows.
- An "off campus" biomedical research center.
PHASE II RESULTS (DISCUSSION)

There is genuine interest on the part of the respondents interviewed in local biomedical firms in intensifying interactions with the University as a whole and with the University of Minnesota Health Sciences in particular. A corporation that needs expertise to pursue an endeavor that it may or may not need on a long term basis, perceives establishment of time limited arrangements with University faculty as a mechanism much preferred to the hiring of additional personnel. Appropriate expertise is needed to drive relationships. Historically, most University-industry relationships have been initiated by a 1:1 mutual need between a University scientist (or group) and an industrial need, thus administrative structure(s) put in place should serve to foster these one-to-one relationships.

General problems revealed in Phase I of the study were confirmed by Phase II respondents. An "ivory tower" - negative attitude on the part of University personnel toward local industry was repeatedly referred to by respondents. Respondents also reported a lack of aggressive overtures, lack of promotional activities, high indirect costs, and a cumbersome, confusing bureaucratic "tangle" at the University that more often served to hinder rather than to facilitate interactions at the University, as serious problems.

The lack of a focal point for industry access or information as to expertise available, combined with poor national standing of some of the University's biological science programs were cited as serious problems. In aggregate, such problems present a formidable set of barriers which must be overcome if closer ties are to be formed with local biomedical industry.
The University has much to gain by intensifying ties with local biomedical industry. If this is to happen, negative attitudes expressed by respondents must be overcome; changing attitudes is one of the most difficult things to achieve – a task that is not to be underestimated.

Industry Interest In Access To Clinical Facilities

When asked whether personnel from the firm had interest in performing clinical tests/trials (at various stages of product development) in collaboration with University staff – at the University Hospitals, the answer to this question was an unqualified yes (see Attachment 7). This item is an extremely high priority item to local biomedical industry. These organizations develop and manufacture products/processes but have neither the facilities nor the staff to perform requisite clinical testing. In addition, an appropriate academic physician is critical to industry, not only in the testing process, but also to serve as a "key opinion leader" or "champion" in academic circles – to which industry does not always have either direct or appropriate access.

Industry Interest In A Health Sciences Focal Point (Communication Facilitation)

Respondents assigned the item "a Health Sciences focal point for industry to interface with the University, with the authority to facilitate industry interactions with the Health Sciences units in particular", a very high ranking. Examining the issue further (Attachment 7), it is seen that poor communication was a critical problem:

° that no focal point for industry access exists

° that disaggregation and confusion exists at the University
that industry personnel not only have a lack of knowledge of what expertise exists at the University, but this problem is exacerbated by the impression that the University is a "Black Box" and that they do not know how to get at available expertise.

The University not only does not promote expertise that is available, but when industry does "connect" with appropriate expertise, many respondents reported problems of the bureaucracy "getting in the way" rather than facilitating the process.

When asked to state preference for a Health Sciences university-industry interface unit versus a central university interface unit, most respondents stated preference for a Health Sciences unit since, in their perception, this unit would be most directly related to their needs. In addition, many respondents expressed concern that a University-industry interface unit responsible for appropriate coverage/representation of a faculty/institution as large as the entire University of Minnesota would be hard pressed to perform quality service. One the other hand, some respondents stated that a Health Sciences University-industry interface office would not provide adequate "coverage" for their need, since they relate not only to the Health Sciences, but also to units of the school such as the College of Biological Sciences and the Institute of Agriculture, Forestry and Home Economics. Several respondents suggested that a Health Sciences unit which would be apprised of critical expertise, services, etc., in other areas of the University system concerned with biological sciences would best fit their needs.

Industry Interest In Continuing Education Programs/Seminars
Respondents expressed a high interest in:

- Facilitation of involvement of their firm's personnel in the University's continuing education programs.
- Development and participation in biomedical university-industry seminar series.
- Facilitated access to University seminars, courses.

These three items are highly interrelated. University seminars and courses available to individuals outside of the University system are an integral part of the University's continuing education efforts. Most respondents indicated high interest in increased opportunity to participate in the University continuing education programs, if program content was appropriate to the needs of the firm's personnel. Again, respondents stated that they were inadequately informed as to what was in fact available. Several respondents stated that the University does not adequately promote its continuing education programs to the business community. One respondent stated that St. Thomas, in contrast to the University of Minnesota, vigorously promotes and markets its continuing education programs and that personnel from his firm participate in the St. Thomas continuing education programs, including a number of graduate programs. One respondent from a major Twin Cities headquartered firm, which has its own continuing education program for its employees, stated that properly structured, the University program could serve as a constructive complement to that program. Subject interest areas indicated by the respondents covered a broad spectrum: accounting, business, several aspects of engineering, "biotechnology", and included both basic and applied aspects of medicine.
Respondents expressed high interest not only in facilitated access to University seminars, but also expressed interest in active participation. Many respondents indicated that they were not informed of what was currently available and would like to be informed. Respondents from two firms with closer ties to the University stated that they were not only informed of what was available at the University, but also were presently participating in seminars at the University; in the case of these respondents, time was the critical factor limiting increased participation.

Respondents from one firm that had recently "spun off" from the University were in very close communication with the University and reported excellent access. Respondents from this organization in particular emphasized that the firm was sponsoring a series of lectureships at the University. The Phase I biomedical device firm also sponsors a prestigious University lecture series.

[Information distributed to industry regarding continuing education courses, seminars, rounds, and the like cannot be mere listings of such offerings. Clear information must be provided as to how this material is critical for "cutting edge" work. In addition to mailings, telephone calls will also be necessary to emphasize University interest, concern and commitment.]

RESULTS: A COMPARISON OF PHASE I AND PHASE II FINDINGS

Phase I findings that were confirmed in Phase II of the study were that access to hospital clinical testing services, facilities and physician expertise is of high priority to local biomedical firms. Conversely, establishment of an "off campus" biomedical research center is of low priority to local biomedical firms.
Phase II respondents confirmed the strong interest expressed by Phase I respondents in increased involvement in the University's continuing education programs. Phase II respondents confirmed the Phase I finding that development and participation in university-industry seminar series was a high priority.

Aggregate rankings by Phase II respondents on the item - "facilitated access to University seminars, courses" - were higher than the parallel rankings by Phase I respondents. This item received disparate ranking by individual Phase II firms (Attachment 6B) and can be related to the closeness of present "ties" with the University. The Phase I firm has existing close ties with the University; those of the Phase II firms that have close existing ties indicated that they did not need assistance in access to seminar series; for other firms (less closely tied with the University), facilitation of access is perceived as an important item.

A modified interview document (Attachment 3) was used in Phase II, allowing respondents to differentiate between a Health Sciences industry access focal point, a Health Sciences expertise referral mechanism, and a Health Sciences monthly newsletter versus these same three functions on an all-University level. As the Phase II aggregate rankings demonstrate (Attachment 5) - and as indicated in the summarized respondents' answers to interview questions (Attachment 7) - respondents indicated a preference for these functions on a Health Sciences rather than the all-university level. This result is easily related to the fact that respondents selected were personnel from biomedical firms - creating a bias in results obtained.

Other Phase I findings, however, were not confirmed in Phase II. There were three key discrepancies between the two sets of results.
First: Phase I respondents ranked strengthening of the University program in Biomedical Engineering as a high priority item for their firm; in contrast, Phase II respondents ranked this item of moderately low priority (rank 12 out of 17 items). The Phase I firm was a biomedical device firm; of the eight Phase II firms, only four of the firms (or divisions within the firms) manufactured medical devices; the other four Phase II firms did not manufacture medical devices. Of all Phase II companies, only two companies assigned this item a high priority (Attachment 6); one of these companies was a medical device firm - the other was not. The reason why three Phase II medical device firms did not confirm the interest of the Phase I firm in strengthening of the University program in biomedical engineering is unclear.

Second: Phase I respondents expressed high interest in participation in the recruiting and training of graduate students and post doctoral fellows whereas Phase II respondents (in aggregate ranking) assigned this item a low priority.

A third difference between Phase I results and Phase II results is that respondents in Phase I assigned access to laboratory equipment a low priority; In contrast, Phase II respondents assigned this item a moderate priority (rank 8 out of 17). When the attached Phase I Interim Report was circulated for comment to personnel in the Phase I biomedical device firm, several personnel commented that although access to laboratory equipment was not a high priority item for personnel working in the more established part of the firm (where the majority of those interviewed were employed), access to laboratory equipment could be a very important item for personnel working in areas of the firm’s developing efforts.

See attached summarized responses for detailed answers to interview questions (Attachment 7).
GENERAL CONCLUSION

There is genuine interest on the part of local biomedical firms in intensifying interactions with the University as a whole and with the University of Minnesota Health Sciences in particular. In light of problems revealed, the path to achieving this end will not be an easy one.

RECOMMENDATIONS

The following recommendations are offered to spur University activities to meet the challenge of improving University-industry relationships.

1) Develop a plan first, to prevent further "slippage" of the national standings of the University's biological science programs, and second, to attempt to regain strength by selective recruiting of outstanding faculty with concurrent appropriate administrative reorganization. [Areas targeted for development could appropriately include, but not be limited to: biochemistry, genetics, molecular biology, cell biology, regulatory biology and biomedical engineering.]

2) Establish a model University-industry clinical trials center at the University Hospitals with a local biomedical device firm (Note: plans for this are already underway).

3) Transmit information regarding the high interest by local industry personnel in the University's continuing education efforts to the Office of the Vice president for Academic Affairs, to the Assistant Vice President for Health Sciences, and to Health Sciences units sponsoring continuing education programs.
4) Establish a central University-industry interface office to administer interactions with local industry in a standard manner, that will be knowledgeable about faculty expertise, and equipment, and will establish an inventory of Minnesota firms (Note: plans for this unit are in progress).

5) Develop an incentive plan to promote interactions with local industry.
   [One important incentive might be the establishment of a uniform reduced indirect cost rate for local industry - about 20% for local industry and about 20% contribution from the State of Minnesota.]

6) Develop strategies for facilitation of transfer of "in-house" technology to the marketplace.

7) Establish a visible Health Sciences/Biological Sciences industry-interface office that will serve primarily a liaison and promotional/public relations function - interacting as appropriate with the central University-industry interface office that is currently in the planning stage, and with the Director of Public Relations, Health Sciences. [Key among the activities of this office could be the setting up of "meetings" between Health Sciences/Biological Sciences faculty and personnel from local biomedical firms; a second important activity of this office could be the publication of a carefully designed quarterly newsletter.]
1) NIH has been, and still is, the major supporter of all health research and development funding in the United States, furnishing roughly 70 percent of the federal support and nearly 40 percent of the total national support. In colleges and universities, NIH supports nearly two-thirds of health research and development. [J. Perpich "Agency Perspectives: National Institutes of Health", in Research and Development and the New National Agenda, Colloquium Proceedings 25-26 June of the AAAS, 1981.]

2) Internal University of Minnesota Memo, March 9, 1984, Regarding Biological Sciences. To: Vice President Ken Keller and Vice President Neal Vanselow, From: Dean Robert Holt and Associate Dean Judson Sheridan.

3) "University-Industry Research Relationships - Myths, Realities and Potentials", Fourteenth Annual Report of the National Science Board, NSB 82-1, Table 1, p. 8.

4) These monies are those officially reported (identifiable) as industry dollars - dollars channelled through the University Foundation, the Minnesota Medical Foundation, or given directly to departments or programs may not be included in these figures.

5) Since Phase II of the study included only 32 respondents, study conclusions cannot be generalized beyond the sample interviewed.

6) One could conceivably extend the obligations of this unit to encompass activities in the biological sciences at the University of Minnesota at Duluth and Morris.
# TABLES

Table 1  
NIH Appropriations (Dollars in Thousands)

<table>
<thead>
<tr>
<th>Fiscal Year</th>
<th>Current Dollars</th>
<th>Constant Dollars</th>
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<tbody>
<tr>
<td>1953</td>
<td>41,141</td>
<td>72,674</td>
</tr>
<tr>
<td>1955</td>
<td>60,848</td>
<td>104,766</td>
</tr>
<tr>
<td>1957</td>
<td>161,576</td>
<td>261,070</td>
</tr>
<tr>
<td>1959</td>
<td>255,436</td>
<td>387,142</td>
</tr>
<tr>
<td>1961</td>
<td>468,239</td>
<td>694,820</td>
</tr>
<tr>
<td>1963</td>
<td>756,704</td>
<td>1,068,489</td>
</tr>
<tr>
<td>1965</td>
<td>831,091</td>
<td>1,115,259</td>
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<tr>
<td>1967</td>
<td>1,045,956</td>
<td>1,297,873</td>
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<tr>
<td>1969</td>
<td>1,118,153</td>
<td>1,257,199</td>
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<tr>
<td>1971</td>
<td>1,212,847</td>
<td>1,212,847</td>
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<tr>
<td>1973</td>
<td>1,762,565</td>
<td>1,602,477</td>
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<tr>
<td>1975</td>
<td>2,092,897</td>
<td>1,616,261</td>
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<td>1977</td>
<td>2,544,078</td>
<td>1,693,230</td>
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<td>1979</td>
<td>3,189,976</td>
<td>1,825,660</td>
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<td>3,423,935</td>
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<td>1981</td>
<td>3,569,406</td>
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<tr>
<td>1982</td>
<td>3,640,186</td>
<td>1,614,703</td>
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<td>*1983</td>
<td>4,023,969</td>
<td>1,716,710</td>
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<tr>
<td>1984</td>
<td>4,477,335</td>
<td>1,788,073</td>
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Source: Courtesy of the Office of the Director, NIH.  
Note: The table excludes Programs Transferred Out - for example, National Institutes of Mental Health, Bureau of Health Manpower and Bureau of Biologics. Constant dollar calculations (base year 1971 = 100) for years 1950-1960 were extrapolated using the percent change in the GNP implicit price deflator. All other constant dollar calculations were made using the Biomedical Research and Development Price Indicator.  

Table 2
NIH Number and Percent of Competing Research Project Applications
Eligible and Awarded FY 1972-1983

<table>
<thead>
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<th>Year</th>
<th>Eligible</th>
<th>Awarded</th>
<th>Percent of Eligible Awarded</th>
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<tbody>
<tr>
<td>1972</td>
<td>6,141</td>
<td>3,625</td>
<td>59.0</td>
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<tr>
<td>1973</td>
<td>6,668</td>
<td>2,592</td>
<td>38.9</td>
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<tr>
<td>1974</td>
<td>7,803</td>
<td>4,540</td>
<td>58.2</td>
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<td>1975</td>
<td>7,701</td>
<td>4,663</td>
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<tr>
<td>1976</td>
<td>7,171</td>
<td>3,464</td>
<td>48.3</td>
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<tr>
<td>1977</td>
<td>9,932</td>
<td>3,840</td>
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<td>11,489</td>
<td>5,200</td>
<td>45.3</td>
</tr>
<tr>
<td>1979</td>
<td>11,510</td>
<td>5,944</td>
<td>51.6</td>
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<tr>
<td>1980</td>
<td>11,301</td>
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<td>5,107</td>
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<tr>
<td>1982</td>
<td>14,477</td>
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<tr>
<td>1983</td>
<td>14,482</td>
<td>5,389</td>
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<td>*1984</td>
<td>15,853</td>
<td>5,272</td>
<td>33.3</td>
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<tr>
<td>*1985</td>
<td>16,818</td>
<td>5,000</td>
<td>29.7</td>
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Source: Courtesy of the Division of Research Grants (DRG) NIH.
A competing application is one reviewed by the traditional NIH peer review process. An eligible application is one approved for funding. Applications awarded are those approved for funding for which funds are available and subsequently committed.

*NIH Budget estimates.
Table 3
Ranking of University of Minnesota Among all Domestic Institutions,
Based on NIH Total Extramural Awards
FY 1970 - 1983

<table>
<thead>
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<th>Year</th>
<th>Rank</th>
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<td>1970</td>
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<td>1982</td>
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<td>1983</td>
<td>13</td>
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Source: Courtesy of the Division of Research Grants, NIH.
Figure 1
Eight Year Trend (Dollars in Millions)

- Total University
- Total Health Sciences
- Health Sciences ORA
- Health Sciences PHS
- Total Industry
- Health Sciences Industry

Extracted from University of Minnesota Annual Financial Reports.
Base Year 1971 = 100
INTERIM REPORT

(Summary of Interview Results of Local Biomedical Device Firm Personnel)

University of Minnesota
Biomedical Pilot Study: University-Industry Relationships
Phase I: A Local Biomedical Device Firm

Procedure:

45 minute interviews were conducted at a Local Biomedical Device Firm (16 formal, 4 informal). Interview document used basically as is. Attachment A. Questions referring to $ from industry - deleted. Questions referring to expertise - key word part deleted.

Key Points to Date:

14 elements were to be rank ordered in terms of importance to firm (with particular emphasis on the respondent's unit and his obligations).

Graphic Presentation of Ranking of Items 1-14 (1 = most critical) attached. Attachments B1 and B2.

High Importance:

- Access to Clinical Testing Facilities.
- Strengthening of the Program in Biomedical Engineering.
- Expertise Referral Mechanism (focal point for industry access).
- Participation in recruiting and training of graduate students/postdoctoral fellows.

Low Importance:

- "Off campus" Biomedical Research Facility.
- Access to Laboratory Equipment.

General Conclusion:

There is an apparent genuine interest on the part of the local biomedical device firm on intensifying interactions with the U of M. Information obtained from this first phase of the study will serve to refine the interview procedure, the method of analysis, and assist in the planning of Phase II of the study. Phase II of the study will be an expansion of the Phase I pilot study to other Twin Cities headquartered firms interested in biomedical science and technology and an analysis of university-industry relationships at institutions other than the University of Minnesota. At the end of Phase II, recommendations for positive action to intensify interactions with local biomedical industry will be developed and incorporated in a Final Report.
Summary of Responses to 21 Questions:

1) Do you have interactions with the University of Minnesota? What are your perceptions of your interactions with the University of Minnesota vis a vis those you have with universities other than the University of Minnesota? What would persuade you to intensify your interactions with the University of Minnesota?

2) What kind of obstacles, hindrances has your firm encountered in attempts to interact with the University of Minnesota?

Appropriate expertise needed to drive relationships (historically, most university-industry relationships were initiated by a 1:1 mutual need between a University scientist (or group) and an industrial need). The University scientist generally supplying expertise (or technology) not available "in house" in industry.

U of M as a "Black Box" (many scientists are trained elsewhere). Do not know what is happening or how to find out what is happening. The local biomedical device firm uses national meetings, bibliographic search systems and the "human referral chain" to find expertise needed. Regardless, opinions were expressed that appropriate expertise, in fact, existed at the U of M that they were not aware of - and could not easily find. Cumbersome bureaucracy. Poor physical access and no clear route as to how to gain access to expertise or information needed at the University of Minnesota.

Lack of aggressive overtures on the part of the U of M, as contrasted with actions by other universities.

Lack of clear focal point for interfacing and facilitating interactions with industry.

Ivory Tower attitude perceived by industry on the part of some senior U of M officials.

Meetings with U of M personnel - followed by no action or inadequate follow-through on the part of the U of M or problems of the bureaucracy "getting in the way" rather than facilitating the process.

Element of "non-receptivity" on the part of the U of M.

No obvious focal point for biomedical engineering in particular.

3) What kind of expertise would be of benefit to your firm at the University of Minnesota?

Strengthened programs in Biomedical Engineering.

Materials compatibility/polymer science.

Strengthened program in Electrical Engineering.

Cardiophysiology/electrophysiology, neuro-physiology.
Basic biology physiology, increased understanding of biological processes on a cellular, molecular level - inflammatory processes.

Veterinary medicine, toxicology.

4) What is your perception of the set of mechanisms and services that the University could realistically set in place that would be most beneficial to your firm?

Focal contact point for industry which will facilitate interactions with the U of M. (As unbureaucratic as possible.)

Formalization of graduate student program in biomedical engineering including "internships" at local industries.

Building of engineering strength at U of M.

5) Would it be beneficial to your firm to be able to perform clinical tests/trials (at various stages of product development) in collaboration with University of Minnesota staff--at the University Hospitals?

Yes!!!

6) What is the time range of publication delay, of industrially sponsored research projects, that would be consistent with protection of your firm's proprietary rights?

No one answer; each case must be assessed separately--often it is in the best interests of industry to press for fast publication.

7) Would a central university service that would quickly refer you to and facilitate access to faculty expertise that you need and do not have "in house" be useful to your firm?

Yes, minimal bureaucracy.

8) Would a central university service that would keep track of possible opportunities for collaborations with university faculty and also keep track of conflicts as well as opportunities for collaborations with other industrial firms be useful to your firm? In your perception, would it be beneficial that this same service would also facilitate the negotiations of grants, contracts of faculty members with your firm?

Generally no--concern that this could lead to too much bureaucracy.

9) Would referral and access to laboratory equipment which you may not have "in house" as well as the opportunity to utilize appropriately trained technicians to run this equipment be helpful?

Good concept--at the local biomedical device firm (which is an established firm), equipment needed has, in general, already been purchased; this item should be of far greater interest to smaller "start-up" companies.
10) In your perception, would a central office whose staff would serve as first contact to the business community and include individuals who serve as liaison to the business community for units of the school with distinctly different academic missions seem a plan that would be helpful to your firm?

Generally positive response--first contact--then do not "overbureaucratize" so as to create a hindrance. Idea of decentralization of contact personnel for distinct academic units may be workable since such individuals may be more cognizant in distinct expertise areas. Another positive suggestion was the decentralization of authority to distinct academic units in order to facilitate university-industry relations.

11) Would you see any benefit to your firm in the establishment of an "off campus" biomedical research center—a center for contract research of particular interest to industry?

Generally no--too expensive, too early.

If concept includes building or renovating a structure - analogous to building a marital home prior to the marriage.

12) Would you be interested in participating in the recruiting and training of a select cohort of graduate students and post-doctoral fellows who would train both at the University and at your firm?

Mixed reactions obtained--generally favorable, particularly as a form of early access to future leaders--possible employees.

13) Would adjunct professorships for your key "in house" staff be useful to your firm? Would you be interested in participating in an exchange program with the University (involving personnel at different levels of your firm)?

Mixed responses obtained--depending on obligation and role of respondent in the firm.

14) Would you be interested in an expansion of the UNITE broadcasting series (which can be viewed at your firm) with respect to biomedically related topics?

Mixed responses obtained--cost and substance must be appropriate. Continuing education, however, is a very high priority.

15) Have you had any dealings with the University in matters that were affected by the University patent policy? If so, did you encounter any obstacles or hindrances in that process? From your vantage point, what are the most critical elements that you would like to see included in the University patent policy?

Most respondents had too limited experience with the University patent policy to feel qualified to answer this question.

16) How does the educational program at the University fit in with your corporate goals? What changes would you like to see in the educational process that would best serve your firm's interests?
Strengthen programs in biomedical engineering.

Increase use of main University facilities (and adjunct institutions) for continuing education--engineering courses; courses leading to advanced training in business.

17) In your perception, would it be beneficial to your firm to have a program in Biomedical Engineering with a commitment to the training of undergraduate and graduate students?

Yes--in general, respondents wanted a firm base and B.S. at the undergraduate level (mechanical engineering, electrical engineering, chemistry) -- perhaps with senior elective with a biomedical emphasis. Concern that specialization too early (at the undergraduate level) tends to weaken the firm base that an undergraduate should have -- and can build on over time was expressed by several respondents.

18) One perception, which may not be valid, is that your firm has a greater interest in engineering activities at the University of Minnesota than in research in basic biological processes. Is this perception correct?

The local biomedical device firm is interested in both engineering and research in basic biological processes. In the past, they had greater interest in engineering. This view has largely changed as the needs of the company have evolved and changed.

19) Would you be interested in easy access to, and establishment of a seminar series in biomedical research? Would you care to have early input into the content/structuring of such a seminar series?

Yes--but already happening.

Seminars are perceived as an enrichment process only, which should be built on a firmer educational exchange base between the University and industry.

20) Would it be useful to your firm for the University to provide a monthly newsletter describing programs at the University of potential industrial interest?

Mixed response obtained--content? length? Perhaps a quarterly or annual report better. Personnel dealing generally with information overload.

21) What are your views on the conditions under which it is appropriate to pay indirect costs?

General view--willing to pay real costs in total--in particular, respondents were positive when industry has identified a need and comes to the University for expertise/service. Attitude less positive when a University scientist approaches industry for funding.
PHASE I
INTERVIEW QUESTIONS

1) Do you have interactions with the University of Minnesota? What are your perceptions of your interactions with the University of Minnesota vis-à-vis those you have with universities other than the University of Minnesota? What would persuade you to intensify your interactions with the University of Minnesota?

2) What kind of obstacles, hindrances has your firm encountered in attempts to interact with the University of Minnesota?

3) What kind of expertise would be of benefit to your firm at the University of Minnesota? What are you willing to do to facilitate developing that expertise here?

4) What is your perception of the set of mechanisms and services that the University could realistically set in place that would be most beneficial to your firm?

5) Would it be beneficial to your firm to be able to perform clinical tests/trials (at various stages of product development) in collaboration with University of Minnesota staff - at the University Hospitals?

6) What is the time range of publication delay, of industrially sponsored research projects, that would be consistent with protection of your firm's proprietary rights?

7) Would a central University service that would quickly refer you to and facilitate access to faculty expertise that you need and do not have "in house" be useful to your firm?

What are your suggestions for "key words" to be used in a coherent categorization of biomedical research expertise at the University of Minnesota?

8) Would a central University service that would keep track of possible opportunities for collaborations with University faculty and also keep track of conflicts as well as opportunities for collaborations with other industrial firms be useful to your firm? In your perception, would it be beneficial that this same service would also facilitate the negotiation of grants, contracts of faculty members with your firm?
9) Would referral and access to laboratory equipment which you may not have "in house" as well as the opportunity to utilize appropriately trained technicians to run this equipment be helpful? Would you be sufficiently interested in such a service to provide partial support for this activity?

10) In your perception, would a central office whose staff would serve as first contact to the business community and include individuals who serve as liaison to the business community for units of the school with distinctly different academic missions seem a plan that would be helpful to your firm?

11) Would you see any benefit to your firm in the establishment of an "off campus" biomedical research center - a center for contract research of particular interest to industry?

12) Would you be interested in participating in the recruiting and training of a select cohort of graduate students and post-doctoral fellows who would train both at the University and at your firm?

13) Would adjunct professorships for your key "in house" staff be useful to your firm? Would you be interested in participating in an exchange program with the University (involving personnel at different levels of your firm)?

14) Would you be interested in an expansion of the UNITE broadcasting series (which can be viewed at your firm) with respect to biomedically related topics?

15) Have you had any dealings with the University in matters that were affected by the University patent policy? If so, did you encounter any obstacles or hindrances in that process? From your vantage point, what are the most critical elements that you would like to see included in the University patent policy?

16) How does the educational program at the University fit in with your corporate goals? What changes would you like to see in the educational process that would best serve your firm's interests?

17) In your perception, would it be beneficial to your firm to have a program in Biomedical Engineering with a commitment to the training of undergraduates and graduate students?
18) One perception, which may not be valid, is that your firm has a greater interest in engineering activities at the University of Minnesota than in research in basic biological processes. Is this perception correct? If so, in your opinion what could the University do to increase interest in basic biological research?

19) Would you be interested in easy access to, and establishment of, a seminar series in biomedical research? Would you care to have early input into the content/structuring of such a seminar series?

Post sessions/other mechanisms for keeping up to date with ongoing, biomedical research?

Facilitation of enrollment of your "in house" staff in University courses, etc.?

If a new University-industry series of seminars in biomedical sciences were established, would your personnel in fact have time to attend?

20) Would it be useful to your firm for the University to provide a monthly newsletter describing programs at the University of potential industrial interest?

21) What are your views on the conditions under which it is appropriate to pay indirect costs?
22) Given all of the above issues that we have discussed, how would you rank order these issues in terms of priorities for your firm? How would you rate them on a scale of 1 to 7?

ONE = of very minor importance
SEVEN = of critical importance

Would you please assign a numerical rating of 1 to 7 for the issues that we have discussed and also put them in rank order of importance:

<table>
<thead>
<tr>
<th>Rating 1-7</th>
<th>Ranking</th>
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<tbody>
<tr>
<td>A central University &quot;expertise referral&quot; service</td>
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<td>University liaisons to industry from distinct academic units.</td>
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<td>Access to laboratory equipment.</td>
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<td>An &quot;off campus&quot; biomedical research center.</td>
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<td>Adjunct professorships for your firm's scientists.</td>
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<td>Expansion of the UNITE service to include biomedical topics.</td>
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<td>Changes in the University patent policy.</td>
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<td>Development and participation in a biomedical university-industry seminar series.</td>
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<td>Program in Biomedical Engineering with a commitment to the training of undergraduate and graduate students.</td>
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<td>Monthly newsletter containing information on university programs.</td>
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The following chart shows the number of persons out of the 16 interviewed who rank ordered each item from 1 to 14 (1 = most critical):

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FOLLOWING IS THE LIST OF ITEMS IN RANK ORDER. THE AVERAGE RANK FOR EACH ITEM WAS OBTAINED BY MULTIPLYING THE NUMBER OF PERSONS BY THE RANK THEN DIVIDING BY 16 (THE NUMBER OF PERSONS INTERVIEWED):

A program in Biomedical Engineering with a commitment to the training of undergraduate and graduate students. (Average rank: 3.7)

Access to hospital clinical testing services. (Average rank: 4.0)

Participation in recruiting and training of graduate students/postdoctoral fellow. (Average rank: 6.1)

A central University "expertise referral" service. (Average rank: 6.4)

Development and participation in a biomedical university-industry seminar series. (Average rank: 6.7)

Faculty/staff exchange programs. (Average rank: 6.3)

University liaisons to industry from distinct academic units. (Average rank: 7.0)

Changes in the University patent policy. (Average rank: 8.2)

An "off campus" biomedical research center. (Average rank: 8.3)

Adjunct professorships for your firm's scientists. (Average rank: 8.4)

Facilitated access to University seminars, courses. (Average rank: 8.5)

Expansion of the UNITE service to include biomedical topics. (Average rank: 8.6)

Access to laboratory equipment. (Average rank: 9.1)

Monthly newsletter containing information on university programs. (Average rank: 9.3)
A) A CENTRAL UNIVERSITY "EXPERTISE REFERRAL" SERVICE

B) UNIVERSITY LIAISONS TO INDUSTRY FROM DISTINCT ACADEMIC UNITS

C) ACCESS TO LABORATORY EQUIPMENT

D) ACCESS TO HOSPITAL CLINICAL TESTING SERVICES
E) AN "OFF CAMPUS" BIOMEDICAL RESEARCH CENTER

F) PARTICIPATION IN RECRUITING AND TRAINING OF GRADUATE STUDENTS/POSTDOCTORAL FELLOW

G) FACULTY/STAFF EXCHANGE PROGRAMS

H) ADJUNCT PROFESSORSHIPS FOR YOUR FIRM'S SCIENTISTS
I) Expansion of the Unite Service to Include Biomedical Topics

K) Development and Participation in a Biomedical University-Industry Seminar Series

J) Changes in the University Patent Policy

L) Facilitated Access to University Seminars, Courses
M) A PROGRAM IN BIOMEDICAL ENGINEERING
WITH A COMMITMENT TO THE TRAINING OF
UNDERGRADUATE AND GRADUATE STUDENTS

N) MONTHLY NEWSLETTER CONTAINING
INFORMATION ON UNIVERSITY
PROGRAMS

Attachment B2-4
SELECTION CRITERIA FOR FIRMS FOR PHASE II

1) The firm as a whole (or a division(s) of the firm) must be committed to the development of the future of biomedical science and technology.

2) Firms selected are locally headquartered.

3) Two of the firms are recent "spin-offs" of the University of Minnesota; others in contrast have limited involvement with the University. One privately held firm is included.

4) Firms selected represent a reasonably diverse cross-section of biomedical areas.

5) Firms selected are diverse in size (operating revenue 1982 (if available) was used as an indicator for comparison purposes).

6) Appropriate access to the firm was provided by a key industrial contact person - either a member of the Board of Directors of the Minnesota High Technology Council (MHTC), a member of the Governor's Economic Recovery Commission on Medical Technology, or an individual who has an expressed interest and commitment to intensifying university-industry relations with the University of Minnesota.


SELECTION CRITERIA FOR PHASE II RESPONDENTS

1) Divisional or Corporate Vice President.

2) Vice President, Research and Development, or Vice President, Clinical Research.

3) Senior Staff Scientist.
1) What are your main responsibilities at your firm? How many people do you supervise?

2) Do you have interactions with the University of Minnesota? What are your perceptions of your interactions with the University of Minnesota vis-a-vis those you have with universities other than the University of Minnesota? What would persuade you to intensify your interactions with the University of Minnesota?

3) What kind of obstacles, hindrances has your firm encountered in attempts to interact with the University of Minnesota?

4) What kind of expertise would be of benefit to your firm at the University of Minnesota?

5) What is your perception of the set of services that the University could realistically set in place that would be most beneficial to your firm?

6) Does your firm have any interest in performing clinical tests/trials (at various stages of product development) in collaboration with University of Minnesota staff - at the University Hospitals?

   What specific needs do you have that could be met by collaboration with University of Minnesota staff - at the University Hospitals?
   How would you suggest that collaborative arrangements with the University of Minnesota Hospitals be structured?

7) What is the time range of publication delay, of industrially sponsored research projects, that would be consistent with protection of your firm's proprietary rights?

8) Would a central university service that would quickly refer you to and facilitate access to faculty expertise that you need and do not have "in house" be useful to your firm?

9) Would referral and access to laboratory equipment which you may not have "in house" as well as the opportunity to utilize appropriately trained technicians to run this equipment be helpful?
10) In your perception, would a central office whose staff would serve as first contact to the business community and include individuals who serve as liaison to the business community for units of the school with distinctly different academic missions seem a plan that would be helpful to your firm? Obligations of that office would include facilitation of interactions with industry.

11) From your vantage point as a biomedical firm (division), would a Health Sciences university-industry office seem to better suit your needs than a central university-industry office for the entire university?

12) Would you see any benefit to your firm in the establishment of an "off campus" biomedical research center - a center for contract research of particular interest to industry?

13) Would you be interested in participating in the recruiting and training of a select cohort of graduate students and post-doctoral fellows who would train both at the University and at your firm?

14) Would adjunct professorships for your key "in house" staff be useful to your firm? Would you be interested in participating in an exchange program with the University (involving personnel at different levels of your firm)?

15) Would you be interested in an expansion of the UNITE broadcasting series (which can be viewed at your firm) with respect to biomedically related topics?

16) Would you be interested in easy access to, and expansion of, existing seminar series in biomedical research? Would you care to have early input into the content/structuring of such a seminar series?

17) Would you or your personnel be interested in increased opportunity to participate in the University's continuing education programs? Health Sciences programs? Which continuing education programs specifically?

18) Have you had any dealings with the University in matters that were affected by the University patent policy? If so, did you encounter any obstacles or hindrances in that process? From your vantage point, what are the most critical elements that you would like to see included in the University patent policy?
19) In your perception, would it be beneficial to your firm to have a strengthened program in Biomedical Engineering with a commitment to the training of undergraduate and graduate students? Can you cite examples of programs in other Universities that you find particularly good?

20) What specific problems, if any, do you have with the current program in Biomedical Engineering? In your perception, strengthening of which other programs in the Institute of Technology would be of benefit to your firm?

21) Would it be useful to your firm for the University to provide a monthly newsletter describing programs at the University of potential industrial interest? Alternatively, a quarterly or annual report?

22) Would it be useful to your firm for the University of Minnesota Health Sciences to provide a monthly newsletter describing programs in the Health Sciences of potential industrial interest? Alternatively, a quarterly or annual report?

23) What are your views on the conditions under which it is appropriate to pay indirect costs?
Given all of the above issues that we have discussed, how would you rank order these issues in terms of priorities for your firm? How would you rate them on a scale of 0 to 10?

**Rating:**

- **ZERO** = of no importance
- **TEN** = of major importance

**Rank Ordering:**

- **ONE** = of highest importance
- **SEVENTEEN** = of lowest importance

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<th>Rating 0-10</th>
<th>Ranking 1-17</th>
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1. A central focal point for industry to interface with the University which will have the authority to facilitate industry interactions with all units of the University.
2. A Health Sciences focal point for industry to interface with the University of Minnesota Health Sciences which will have the authority to facilitate industry interactions with Health Sciences units in particular.
3. A central university expertise referral mechanism.
4. A Health Sciences expertise referral mechanism.
5. Access to laboratory equipment.
6. Access to hospital clinical testing services, facilities and physician expertise.
7. An "off campus" biomedical research center.
8. Participation in the recruiting and training of graduate students/postdoctoral fellows.
9. Faculty/staff exchange programs.
10. Adjunct professorships for your firm's scientists.
11. Facilitation of involvement of your firm's personnel in the University's continuing education programs.
12. Expansion of the UNITE service to include biomedical topics.
14. Facilitate access to University seminars, courses.
15. A strengthened program in Biomedical Engineering with a commitment to the training of undergraduate and graduate students.
16. A monthly newsletter containing information on University programs.
17. A monthly newsletter containing information on Health Sciences programs.
25) Now that we have talked in some detail about university-industry relations and you have had a chance to rank order your preferences for services to be gained through that relationship, what would you consider to be the most important item in persuading you to intensify your interactions with the University of Minnesota?
1) A CENTRAL FOCAL POINT FOR INDUSTRY TO INTERFACE WITH ALL UNITS OF THE UNIVERSITY

2) A HEALTH SCIENCES FOCAL POINT FOR INDUSTRY TO INTERFACE WITH THE UNIVERSITY OF MINNESOTA HEALTH SCIENCES

3) A CENTRAL UNIVERSITY EXPERTISE REFERRAL MECHANISM

4) A HEALTH SCIENCES EXPERTISE REFERRAL MECHANISM

= of no importance
of major importance
5) ACCESS TO LABORATORY EQUIPMENT

6) ACCESS TO HOSPITAL CLINICAL TESTING SERVICES, FACILITIES AND PHYSICIAN EXPERTISE

7) AN "OFF CAMPUS" BIOMEDICAL RESEARCH CENTER

8) PARTICIPATION IN THE RECRUITING AND TRAINING OF GRADUATE STUDENTS/POSTDOCTORAL FELLOWS
9) FACULTY/STAFF EXCHANGE PROGRAMS

10) ADJUNCT PROFESSORSHIPS FOR YOUR FIRM'S SCIENTISTS

11) FACILITATION OF INVOLVEMENT OF YOUR FIRM'S PERSONNEL IN THE UNIVERSITY'S CONTINUING EDUCATION PROGRAMS

12) EXPANSION OF THE UNITE SERVICE TO INCLUDE BIOMEDICAL TOPICS
13) DEVELOPMENT AND PARTICIPATION IN BIOMEDICAL UNIVERSITY-INDUSTRY SEMINAR SERIES

14) FACILITATE ACCESS TO UNIVERSITY SEMINARS, COURSES

15) A STRENGTHENED PROGRAM IN BIOMEDICAL ENGINEERING WITH A COMMITMENT TO THE TRAINING OF UNDERGRADUATE AND GRADUATE STUDENTS

16) A MONTHLY NEWSLETTER CONTAINING INFORMATION ON UNIVERSITY PROGRAMS
17) A MONTHLY NEWSLETTER CONTAINING INFORMATION ON HEALTH SCIENCES PROGRAMS
## ITEM

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<td>Access to hospital clinical testing services, facilities and physician expertise. (Mean: 8.2)</td>
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<td>7</td>
<td>An &quot;off campus&quot; biomedical research center. (Mean: 3.6)</td>
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<td>Participation in the recruiting and training of graduate students/postdoctoral fellows. (Mean: 4.2)</td>
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<td>Adjunct professorships for your firm's scientists. (Mean: 5.6)</td>
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<td>A monthly newsletter containing information on Health Sciences programs. (Mean: 6.3)</td>
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ALL UNITS OF THE UNIVERSITY

[Bar charts for FIRM A to FIRM H]

2) A HEALTH SCIENCES FOCAL POINT FOR INDUSTRY TO INTERFACE
WITH THE UNIVERSITY OF MINNESOTA HEALTH SCIENCES

[Bar charts for FIRM A to FIRM H]
3) A CENTRAL UNIVERSITY EXPERTISE REFERRAL MECHANISM

4) A HEALTH SCIENCES EXPERTISE REFERRAL MECHANISM
5) ACCESS TO LABORATORY EQUIPMENT

FIRM A
FIRM B
FIRM C
FIRM D
FIRM E
FIRM F
FIRM G
FIRM H

6) ACCESS TO HOSPITAL CLINICAL TESTING SERVICES, FACILITIES AND PHYSICIAN EXPERTISE

FIRM A
FIRM B
FIRM C
FIRM D
FIRM E
FIRM F
FIRM G
FIRM H
7) AN "OFF CAMPUS" BIOMEDICAL RESEARCH CENTER

8) PARTICIPATION IN THE RECRUITING AND TRAINING OF GRADUATE STUDENTS/POSTDOCTORAL FELLOWS
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12) EXPANSION OF THE UNITE SERVICE TO INCLUDE BIOMEDICAL TOPICS

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13) DEVELOPMENT AND PARTICIPATION IN BIOMEDICAL UNIVERSITY-INDUSTRY SEMINAR SERIES

14) FACILITATE ACCESS TO UNIVERSITY SEMINARS, COURSES
15) A STRENGTHENED PROGRAM IN BIOMEDICAL ENGINEERING WITH A
COMMITTMENT TO THE TRAINING OF UNDERGRADUATE AND GRADUATE
STUDENTS

FIRM A
FIRM B
FIRM C
FIRM D
FIRM E
FIRM F
FIRM G
FIRM H

1 2 3 4 5 6 7 8 9 10

mean

16) A MONTHLY NEWSLETTER CONTAINING INFORMATION ON
UNIVERSITY PROGRAMS

FIRM A
FIRM B
FIRM C
FIRM D
FIRM E
FIRM F
FIRM G
FIRM H

1 2 3 4 5 6 7 8 9 10

mean
17) A MONTHLY NEWSLETTER CONTAINING INFORMATION ON HEALTH SCIENCES PROGRAMS
### INDIVIDUAL FIRMS

#### RANK ORDER OF ITEMS

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FIRM A

RANK ORDER OF ITEMS IN IMPORTANCE

ITEM

9) Faculty/staff exchange programs. (Mean: 9.0)

17) A monthly newsletter containing information on Health Sciences programs. (Mean: 8.5)

2) A Health Sciences focal point for industry to interface with the University of Minnesota Health Sciences which will have the authority to facilitate industry interactions with Health Sciences units in particular. (Mean: 8.0)

4) A Health Sciences expertise referral mechanism. (Mean: 7.0)

10) Adjunct professorships for your firm's scientists. (Mean: 7.0)

6) Access to hospital clinical testing services, facilities and physician expertise. (Mean: 6.5)

8) Participation in the recruiting and training of graduate students/postdoctoral fellows. (Mean: 6.0)

14) Facilitate access to University seminars, courses. (Mean: 5.0)

11) Facilitation of involvement of your firm's personnel in the University's continuing education programs. (Mean: 4.5)

15) A strengthened program in Biomedical Engineering with a commitment to the training of undergraduate and graduate students. (Mean: 4.0)

13) Development and participation in biomedical university-industry seminar series. (Mean: 3.5)

3) A central university expertise referral mechanism. (Mean: 2.5)

5) Access to laboratory equipment. (Mean: 2.0)

16) A monthly newsletter containing information on University programs. (Mean: 1.5)

12) Expansion of the UNITE service to include biomedical topics. (Mean: 1.0)

1) A central focal point for industry to interface with the University which will have the authority to facilitate industry interactions with all units of the University. (Mean: 0.5)

7) An "off campus" biomedical research center. (Mean: 0.5)
FIRM B

RANK ORDER OF ITEMS IN IMPORTANCE

ITEM

2) A Health Sciences focal point for industry to interface with the University of Minnesota Health Sciences which will have the authority to facilitate industry interactions with Health Sciences units in particular. (Mean: 8.3)

4) A Health Sciences expertise referral mechanism. (Mean: 8.3)

6) Access to hospital clinical testing services, facilities and physician expertise. (Mean: 8.3)

13) Development and participation in biomedical university-industry seminar series. (Mean: 8.3)

14) Facilitate access to University seminars, courses. (Mean: 7.7)

5) Access to laboratory equipment. (Mean: 7.0)

12) Expansion of the UNITE service to include biomedical topics. (Mean: 6.0)

3) A central university expertise referral mechanism. (Mean: 5.7)

17) A monthly newsletter containing information on Health Sciences programs. (Mean: 5.7)

11) Facilitation of involvement of your firm's personnel in the University's continuing education programs. (Mean: 5.0)

1) A central focal point for industry to interface with the University which will have the authority to facilitate industry interactions with all units of the University. (Mean: 4.7)

16) A monthly newsletter containing information on University programs. (Mean: 4.7)

7) An "off campus" biomedical research center. (Mean: 4.0)

10) Adjunct professorships for your firm's scientists. (Mean: 3.7)

15) A strengthened program in Biomedical Engineering with a commitment to the training of undergraduate and graduate students. (Mean: 3.7)

8) Participation in the recruiting and training of graduate students/postdoctoral fellows. (Mean: 3.0)

9) Faculty/staff exchange programs. (Mean: 2.3)
### FIRM C

**RANK ORDER OF ITEMS IN IMPORTANCE**

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FIRM D

RANK ORDER OF ITEMS IN IMPORTANCE

12) Expansion of the UNITE service to include biomedical topics. (Mean: 8.3)

6) Access to hospital clinical testing services, facilities and physician expertise. (Mean: 8.2)

14) Facilitate access to University seminars, courses. (Mean: 7.6)

2) A Health Sciences focal point for industry to interface with the University of Minnesota Health Sciences which will have the authority to facilitate industry interactions with Health Sciences units in particular. (Mean: 7.0)

4) A Health Sciences expertise referral mechanism. (Mean: 7.0)

13) Development and participation in biomedical university-industry seminar series. (Mean: 6.8)

11) Facilitation of involvement of your firm's personnel in the University's continuing education programs. (Mean: 6.4)

9) Faculty/staff exchange programs. (Mean: 5.6)

10) Adjunct professorships for your firm's scientists. (Mean: 5.6)

17) A monthly newsletter containing information on Health Sciences programs. (Mean: 5.4)

15) A strengthened program in Biomedical Engineering with a commitment to the training of undergraduate and graduate students. (Mean: 5.3)

1) A central focal point for industry to interface with the University which will have the authority to facilitate industry interactions with all units of the University. (Mean: 4.8)

5) Access to laboratory equipment. (Mean: 4.8)

3) A central university expertise referral mechanism. (Mean: 4.6)

7) An "off campus" biomedical research center. (Mean: 4.0)

16) A monthly newsletter containing information on University programs. (Mean: 4.0)

8) Participation in the recruiting and training of graduate students/postdoctoral fellows. (Mean: 3.8)
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<td>7</td>
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<td>12</td>
<td>Expansion of the UNITE service to include biomedical topics.</td>
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<td>15</td>
<td>A strengthened program in Biomedical Engineering with a commitment to the training of undergraduate and graduate students.</td>
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<td>Faculty/staff exchange programs.</td>
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<td>8</td>
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<td>3.0</td>
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<td>10</td>
<td>Adjunct professorships for your firm's scientists.</td>
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<tr>
<td>1st</td>
<td>Access to hospital clinical testing services, facilities and physician expertise. (Mean: 7.7)</td>
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<td>17th</td>
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<tr>
<td>2nd</td>
<td>A Health Sciences focal point for industry to interface with the University of Minnesota Health Sciences which will have the authority to facilitate industry interactions with Health Sciences units in particular. (Mean: 4.0)</td>
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<tr>
<td>4th</td>
<td>A Health Sciences expertise referral mechanism. (Mean: 3.5)</td>
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<tr>
<td>12th</td>
<td>Expansion of the UNITE service to include biomedical topics. (Mean: 3.0)</td>
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<tr>
<td>7th</td>
<td>An &quot;off campus&quot; biomedical research center. (Mean: 0.5)</td>
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FIRM H

RANK ORDER OF ITEMS IN IMPORTANCE

ITEM

6) Access to hospital clinical testing services, facilities and physician expertise. (Mean: 9.3)

2) A Health Sciences focal point for industry to interface with the University of Minnesota Health Sciences which will have the authority to facilitate industry interactions with Health Sciences units in particular. (Mean: 8.3)

4) A Health Sciences expertise referral mechanism. (Mean: 8.3)

1) A central focal point for industry to interface with the University which will have the authority to facilitate industry interactions with all units of the University. (Mean: 8.0)

13) Development and participation in biomedical university-industry seminar series. (Mean: 8.0)

15) A strengthened program in Biomedical Engineering with a commitment to the training of undergraduate and graduate students. (Mean: 8.0)

16) A monthly newsletter containing information on University programs. (Mean: 8.0)

17) A monthly newsletter containing information on Health Sciences programs. (Mean: 8.0)

3) A central university expertise referral mechanism. (Mean: 7.3)

5) Access to laboratory equipment. (Mean: 7.3)

12) Expansion of the UNITE service to include biomedical topics. (Mean: 7.3)

14) Facilitate access to University seminars, courses. (Mean: 7.3)

11) Facilitation of involvement of your firm's personnel in the University's continuing education programs. (Mean: 6.0)

7) An "off campus" biomedical research center. (Mean: 5.0)

9) Faculty/staff exchange programs. (Mean: 5.0)

10) Adjunct professorships for your firm's scientists. (Mean: 5.0)

8) Participation in the recruiting and training of graduate students/postdoctoral fellows. (Mean: 3.0)
Summary of Responses to 24 Questions  
(All Phase II Firms in Aggregate)

**Question No. 1**

What are your main responsibilities at your firm? How many people do you supervise?

Respondents included three firm presidents, one chairman of the board, vice presidents for research and development on clinical affairs, divisional directors, and senior staff scientists.

**Question No. 2**

Do you have interactions with the University of Minnesota? Do you have interactions with other universities?

Of 25 respondents, 24 in fact had interactions with the University of Minnesota. Only a small percentage of the respondents named the other universities with which they were working; most respondents did not answer this part of the question. Among institutions cited were MIT, California Institute of Technology, the University of Utah, the University of Wisconsin, Rice, and the University of Toronto.

**Question No. 3**

What are your perceptions of your interactions with the University of Minnesota vis a vis those you have with Universities other than the University of Minnesota? What would persuade you to intensify interactions with the University of Minnesota? What kind of obstacles, hindrances has your firm encountered in attempts to interact with the University of Minnesota?
Respondents reported a number of problems in dealing with the University of Minnesota. Problems most often cited were:

- Negative, officious attitudes on the part of University personnel toward local industry personnel (an anti-industry bias - a "culture clash").
- Disaggregation and confusion at the University.
- Problems of the bureaucracy "getting in the way" rather than facilitating interactions.
- Poor communication and lack of assistance in response to industry approaches.
- Lack of a focal point for industry interaction (access).
- Lack of knowledge of what expertise/assistance is available (the University as a "Black Box").
- Lack of promotional activity by the University as to expertise available.
- Apparent lack of appropriate expertise for a particular industry need.
- Poor national standing of some of the University's biological science programs.
- Financial barriers; in particular, the indirect charge rate is perceived perceived by some as prohibitive; in contrast, other respondents viewed the indirect cost rate as acceptable and as a necessary and integral part of the cost of performance of work.
Question No. 4

What kind of expertise would be of benefit to your firm at the University of Minnesota?

Responses to this question varied across a fairly wide spectrum related to the product produced by the firm (division). Responses included expertise in:

- Chemical engineering with an emphasis on biomaterials.
- Physiology/biochemistry/histology of wound healing, tissues/bone growth.
- Transdermal and other mechanisms of administration of drugs.
- Pharmacology/pharmacokinetics.
- Electromedicine (pain intervention).
- Research oriented-practicing academic physician/surgeon.
- Animal pathology.
- Animal "clinical" testing services.
- Electrical engineering/mechanical engineering.
- Biomedical engineering.
- Library assistance.

Question No. 5

What is your perception of the set of services that the University could realistically put in place that would be most beneficial to your firm?
The most common answer to this question was either a Health Sciences or Central University interface point for industry access and communications with personnel in that unit having the authority to speak and act for the institution.

Question No. 6

Does your firm have any interest in performing clinical tests/trials (at various stages of product development) in collaboration with University of Minnesota staff - at the University Hospitals?

The general answer to this question was an unqualified yes. This item seems to be of extremely high priority to local industry. The one exception was one firm that prepared products for animal use. This firm expressed high interest in access to animal clinical testing facilities.

Question No. 7

What is the time range of publication delay of industrially sponsored research projects that would be consistent with protection of your firm's proprietary rights?

The responses to this question varied widely - ranging from one month to two years. This is an issue that really must be handled on a case-by-case basis. Often (particularly in the more basic research areas) it is in the best interests of industry to publish as soon as possible; it is in the more applied (developmental) end of the research and development effort that industry is more concerned about publication delay.
Question No. 8

Would a central University service that would quickly refer you to and facilitate access to faculty expertise that you need and do not have "in house" be useful to your firm?

The general answer to this question was yes. Two issues of concern were raised by respondents. First, that if such a service were set up at the University that it be extremely efficient so as to not add a cumbersome layer to the already existing bureaucratic "series of hurdles". Second, several respondents raised concern that a danger exists that quality could be compromised in an expertise referral service that would be both thorough and accurate that encompasses a faculty as large as that of the entire University of Minnesota faculty.

Question No. 9

Would referral and access to laboratory equipment which you may not have "in house" as well as the opportunity to utilize appropriately trained technicians to run this equipment be helpful?

The majority of respondents answered yes to this question. There is particular interest in access to very specialized expensive equipment (i.e. electron microscopes). Several respondents answered that this access is particularly important for small developing firms - however, more information is needed not only as to what equipment is actually present at the University - but additionally what would be the general terms for leasing with respect to both time available and charges. One respondent answered that industry generally has more up-to-date and better equipment than universities, causing access to University equipment to be in fact of little value to industry.
Phase I personnel interviewed in the design part of the study rated this item much lower than respondents in the succeeding eight firms. After reviewing the summary of Phase I interview results, several personnel from this firm noted that this item although not very important for the more established parts of the company's efforts (in which the majority of the personnel interviewed actually worked), could be expected to be of far greater value to new development efforts of the company.

[Responses to this question varied greatly between respondents; if the University is to undertake a comprehensive equipment "catalogue", it will require a major commitment of both time and money.]

Question No. 10

In your perception would a central office whose staff would serve as first contact to the business community and include individuals who would serve as liaison to the business community for units of the school with distinctly different academic missions seem a plan that would be helpful to your firm? Obligations of that office would include facilitation of interactions with industry.

Responses to this question were mixed. Yes responses were often qualified by concerns that the obligations of a central office would be too large and the spectrum covered too broad to be effectively implemented. Concerns were again raised that the establishment of an office intended to facilitate could potentially backfire, adding to the quagmire of already existing bureaucracy. Some viewed a Health Sciences office as potentially too limited in scope, not fully "covering" their needs since they needed (and were already drawing on)
units of the University such as the College of Biological Sciences and the Institute of Agriculture, Forestry and Home Economics.

Question No. 11

From your vantage point as a biomedical firm, would a Health Sciences university-industry office seem to better suit your needs that a central university-industry office for the entire university?

Again, responses to this question were mixed. As reflected in the numerical ratings, many respondents preferred a Health Sciences university-industry office to a central office. Others expressed concern that a Health Sciences office would not provide adequate "coverage" to meet their needs; that a Health Sciences office appropriately apprised of other biological sciences efforts of the University would be more useful than one drawn along present organizational lines. These responses are fundamentally "mirror image" responses to those of question no. 10 regarding a central university office with some respondents suggesting concurrent establishment of both offices—others expressing concern that a Health Science office would be too limited in scope — again emphatic concern was raised that the establishment of any office meant to facilitate could end up as yet another bureaucratic obstacle.

Question No. 12

Would you see any benefit to your firm in the establishment of an "off campus" biomedical research center?

Most respondents answered no to this question as reflected in their numerical responses. In accord with responses from Phase I personnel, many respondents
stated that the timing was premature – that an institute could not be established before clear university-industry relationships were established delineating collaborative research and development efforts that would be performed in such an institute. Several respondents raised concerns that simultaneous housing of university-industry collaborative efforts involving different (and perhaps competing) industrial firms could lead potentially to situations posing conflict of interest problems.

Question No. 13

Would you be interested in participating in the recruiting and training of graduate students and post-doctoral fellows?

Responses to this question were either a qualified yes or a definite no. Small firms, and particularly newly established small firms, expressed views that they could not easily make such commitments at this point in their development. The qualifications to the yes responses mainly centered around the fact that it was difficult to find an appropriate fit and that students took a fair amount of time to come "up to speed". Personnel from one well-established larger firm said this in particular was an area of great frustration in dealing with the University. For one particular project, this firm was very interested in hiring summer student interns; this firm made several requests to the University and received no response. Ultimately, summer interns were hired from other universities.

On a more positive note, respondents from one firm that has recently "spun-off" from the University indicated that it was already involved in such programs, viewed them as beneficial to the firm and stated that this route provided early access to potential future employees.
Question No. 14

Would adjunct professorships for your key "in house" staff be useful to your firm? Would you be interested in participating in an exchange program with the University (involving personnel at different levels of your firm)?

Responses to this question were mixed depending particularly on the size of the firm. Respondents from smaller firms did not view themselves as yet appropriately positioned to enter into these kind of exchange programs. Respondents from larger firms were more receptive to these ideas - granted that their personnel in fact would have time for participation. Respondents from one larger firm expressed the fact that negative disparaging attitudes existed among University faculty toward personnel at their firm (regarding the qualifications of industry personnel to contribute academically to the University). These attitudes created a definite barrier to the establishment of exchange programs or adjunct professorships.

Question No. 15

Would you be interested in an expansion of the UNITE broadcasting series (which can be viewed at your firm) with respect to biomedically related topics?

Responses to this question were generally positive. Concerns were raised regarding issues both of cost and the feasibility of developing programs that would fit industrial needs. Several respondents stated that they would be very interested if the subject material was appropriate to their needs and of high quality. Many respondents indicated an interest in access to the University's continuing education programs but stated that they were
unfamiliar with what is available and definitely would like to be better informed.

Question No. 16

Would you be interested in easy access to, and expansion of, existing seminar series in biomedical research? Would you care to have early input into the content/structuring of such a seminar series?

Responses to this question were generally positive. Many respondents indicated that they were not informed of what was presently available and would like to be informed. Other respondents with closer ties to the University stated that they were not only informed but also were presently participating in seminars at the University - time in the case of these respondents was the critical factor limiting increased participation. Respondents from one firm that had recently "spun off" from the University were in very close communication with the University, and reported excellent access. Respondents from this same firm emphasized that the firm was sponsoring a series of lectureships at the University. (The Phase I biomedical device firm also sponsors a prestigious University lecture series.)

Question No. 17

Would you be interested in increased opportunity to participate in the University's continuing education program? Health Sciences programs? Which continuing education programs specifically?

Most respondents indicated high interest in increased opportunity to participate in the University continuing education programs - as program content was appropriate to the needs of the firm's personnel. Again, (as in
response to the previous two questions) many respondents stated that they were inadequately informed as to what was in fact available. Several respondents stated that the University does not adequately promote its continuing education programs to the business community. One respondent stated that St. Thomas in contrast to the University vigorously promotes and markets its continuing education programs and that personnel from his firm participate in the St. Thomas continuing education programs. One respondent from a large firm, which has its own continuing education program for its employees, stated that properly structured, the University program could serve as a constructive complement to that program. Subject interest areas indicated by the respondents covered a broad spectrum from accounting, business, several aspects of engineering, "biotechnology", and included both basic and applied aspects of medicine.

Question No. 18

Have you had any dealings with the University in matters that were affected by the University patent policy?

Most respondents interviewed did not feel that they had adequate interactions with the University in this regard to respond knowledgeable to this question.

Question No. 19

In your perception, would it be beneficial to your firm to have a strengthened program in Biomedical Engineering with a commitment to the training of undergraduate and graduate students? Can you cite examples of programs in other universities that you find particularly good?
In this second set of biomedical firms, all respondents in four of the eight firms stated that the University biomedical engineering program has no bearing on their firm's obligations. Three of these four sets of responses are relatively easily related to the fact that products manufactured by three of these four firms are not in the medical device category. The not applicable responses by four personnel working in a single medical device firm are not easily explained and should perhaps at some future time be clarified. Responses from personnel in the remaining four firms whose obligations were related in some manner to the production of medical devices were mixed, most responded yes to this question - other respondents stated that the biomedical engineering program had no bearing on their efforts.

The general view expressed by most Phase I respondents was reiterated by respondents in the second set of firms - that in developing training programs for biomedical engineers care must be taken to assure that the student has a firm base in a traditional engineering discipline with enrichment in biomedical science.

Among programs in Biomedical Engineering cited by respondents as quality programs were those at Case Western, Purdue, and the University of Utah. National ranking of biomedical engineering programs can be referred to if one wishes to pursue this part of the question further.

Question No. 20

What specific problems, if any, do you have with the current program in Biomedical Engineering?
Many respondents felt that they were not adequately familiar with the University program in biomedical engineering to comment on this question. Those respondents that were familiar with the program had similar comments to those of Phase I respondents. The main comments were that the program lacked focus, was fragmented, poorly organized, and has poor national standing.

Question No. 21

Would it be useful to your firm for the University to provide a monthly newsletter? Alternatively, a quarterly or annual report?

Responses to this question varied as reflected in the numerical ratings of the respondents. The majority of respondents stated that a quarterly newsletter (report) would be more useful than a monthly newsletter and potentially more informative. (Programs do not change significantly from month to month).

Question No. 22

Would it be useful to your firm for the University of Minnesota Health Sciences to provide a monthly newsletter describing programs in the Health Sciences of potential industrial interest? Alternatively, a quarterly or annual report?

The responses to this question were basically "mirror image" to those of the preceding question. Again, respondents endorsed a quarterly report rather than a monthly or annual publication. Most of the respondents queried expressed preference for a Health Sciences publication rather than an all-university publication. This preference is demonstrated in the respondents' rating figures.
[Information distributed to industry cannot be a mere listing of seminars, courses, etc. Clear information must be given as to how this material is critical for "cutting edge" work – perhaps prior or post mailing telephone calls will also be necessary to emphasize University interest, concern and commitment.]

Question No. 23

What are your views on the conditions under which it is appropriate to pay indirect costs?

Responses to this question varied particularly depending on the size of the firm. Respondents from larger companies more often took the stance that indirect costs are an essential part of "doing business". One respondent from a large firm stated that indirect cost charges were a sensitive issue that could constitute a barrier and that a high fixed indirect cost charge put the University in a poor competitive position. This respondent suggested further that it would serve the University well to institute a flexible indirect cost policy with preferential rates for local industry.

Question No. 24

Now that we have talked in some detail about university-industry relations, what would you consider the most important item in persuading you to intensify your interactions with the University of Minnesota?

The most common response to this question was improved industry access (in particular a focal point for industry contact, information and communication).
FIRM CODE

PHASE I FIRM

Medtronic, Incorporated

PHASE II FIRMS

Firm A: Control Data Corporation
Firm B: American Medical Systems
Firm C: Immuno Nuclear Corporation
Firm D: 3M Corporation
Firm E: The Pillsbury Company
Firm F: Bio-Medicus, Incorporated
Firm G: Molecular Genetics, Incorporated
Firm H: LecTec Corporation