The Information-Seeking Habits of Engineering Faculty

Debra Engel, Sarah Robbins, and Christina Kulp

Many studies of information-seeking habits of engineers focus on understanding the similarities and differences between scientists and engineers. This study explores the information-seeking behavior of academic engineering faculty from twenty public research universities. This investigation includes an examination of how frequently engineering faculty seek or access information, how they keep abreast of current developments in the field and find less recent journal articles, how often they visit the library in person, and how important library services and resources are in meeting their information needs. The responses from the survey participants emphasize the importance of electronic access to current and archived scholarly journals for meeting the research and information needs of engineering faculty.

Understanding the nature of the user community and the information-seeking habits and practices of the users are common themes in library literature. With improved understanding of the information-seeking behavior of engineers in academic environments, librarians can better develop information services and resources, implement policies that help engineering faculty access quality information, and improve collection development practices.

Literature Review

Engineers as Practitioners

King, Casto, and Jones compiled a comprehensive literature review of engineers’ information needs, noting that “the 1960s yielded a plethora of STI [scientific and technical information] user studies and surveys largely funded by the federal government.” The information-seeking habits and practices of the users are common themes in library literature. With improved understanding of the information-seeking behavior of engineers in academic environments, librarians can better develop information services and resources, implement policies that help engineering faculty access quality information, and improve collection development practices.
behavior of engineers within the corporate and government environment has been well documented since that time. Many of these studies illustrate the differences between scientists’ and engineers’ information-seeking behaviors. Several studies of engineers as practitioners indicate that engineers do not use library resources or libraries as a primary information source for their work. In a study that identified accessibility as the key factor that influenced an engineer’s information-seeking behavior, Fidel and Green aptly stated, “The information-seeking behavior of engineers is a complex phenomenon.”

Thomas E. Pinelli documents forty years of information-seeking behavior among engineers and compares and contrasts their behavior to scientists’. He asserts, “Engineers, unlike scientists, work within time constraints; they are not interested in theory, source data, and guides to the literature nearly as much as they are in reliable answers to specific questions. Engineers prefer informal sources of information, especially conversations with individuals within their organization.” In the early 1990s, Cynthia Steinke wrote, “Despite an abundance of studies, we still don’t understand the information-seeking habits of our user communities well enough and thus, we probably are not meeting them. In addition, different fields have developed varying systems of communication which must be identified and recognized.” Jean Poland reviewed engineers’ communication behavior with an emphasis on informal communication. She concluded that “[i]ibraries are in effect part of the formal spectrum of information transfer, and as such, among the last places scientists and engineers look for information.”

Holland and Powell investigated the habits of engineering graduates who had taken a technical communications class during their senior year as compared to engineering graduates who had not taken the technical communications class. They concluded that engineers in both groups showed similar information-gathering preferences and “prefer word of mouth and their own library of information when they seek information.” In a subsequent article, Holland discusses the value of current engineering information and engineering back files within the engineering user community. She asserts that “[t]here is also mounting proof that engineers and their students pragmatically select the closest source of information.”

In a study of two product development companies, Hertzum and Pejtersen investigate the information-seeking habits and practices of engineers and suggest that engineers value timely access to information that did not waste their efforts. They write, “[w]e find that engineers search for documents to find people, search for people to get documents, and interact socially to get information without engaging in explicit searches.” They confirmed earlier research work about the information-seeking behavior of engineers: “Previous work has repeatedly found that engineers’ primary source of information is their colleagues within the organization and that the major reason for this is that colleagues are easily accessible.”

An investigation on how aerospace engineers and scientists select information providers confirmed a strong preference to gain information from their colleagues and collections within their own organizations. Lishi Kwasitsu examined the information sources used by design, process, and manufacturing engineers within one corporate environment. The researcher discovered that the higher the respondents’ academic degree, the less likely they were to rely on colleagues or their own personal files for information and the more likely they were to rely on the corporate library. Kwasitsu notes, “Many of the respondents had used libraries extensively for their degree work and were not only aware of library resources but had acquired a culture of finding and using reliable, published information.”

Mueller, Sorini, and Grossman studied one corporate firm with an engineer-
ing function and suggested that the tight delivery times and a distributed workforce may provide different challenges to engineers’ information-seeking behavior in the corporate environment than in the academic environment. The best practices identified by this research group include development of personal relationships with the engineers, balancing virtual and physical library services, and integrating library services into the engineering Web models developed by their engineering constituents. Madely Du Preez provides a review of studies concerning the information-seeking behavior of engineers. The author confirms the observation by other researchers that engineers prefer interpersonal communications and information from their trade journals as opposed to information found in scholarly journals.

**Engineers as Faculty**

In 1993, Barbara D. Farah surveyed engineering faculty at eight universities and asserted that computer engineering faculty chose accessibility as the most frequent reason for selecting an information provider. Farah concluded that “[a]cademic computer engineering faculty showed a clear preference for consulting their own academic library to assist them with their information problems in work-related situations.”

Steve Hiller investigated the similarities and differences between scientists and engineers and other academic areas in library use and information needs at the University of Washington. He concluded that “[t]he decrease in physical visits to the library was most pronounced among faculty and graduate students in health sciences, sciences and engineering.” Hiller further asserts that faculty in the sciences and engineering were more likely to use library resources remotely and viewed desktop delivery as the highest priority for library support.

In a subsequent conference presentation at the American Library Association/Canadian Library Association meeting in 2003, Hiller reaffirmed this position: “Many recent studies confirm strong preference for remote access to electronic information.”

In 2004, Finn and Johnston surveyed index use and other primary information sources by engineering faculty and concluded that journals were selected as the most important resource. M. Doraswamy conducted a case study of 126 engineering faculty in India and concluded that the engineering faculty used monographs more in teaching than in research and used journals significantly more in research than in teaching. In a recent investigation of the information-seeking behavior of academic researchers in natural science, engineering, and medical science, the researchers identified that the most often used resources were journals, Web pages, and personal communications.

**Comparison of Engineers as Practitioners and Engineers as Faculty**

According to Leckie, Pettigrew, and Sylvain, studies of information-seeking behaviors of engineers have illustrated the preference for oral communication in both universities or corporate research and development settings. The literature suggests that accessibility is the key issue for practitioners. Tenopir and King provide an in-depth analysis of the literature on how engineers communicate, with an emphasis on information resources used by engineers to perform their work. The researchers conclude that “[e]asy access is an engineer’s top priority, particularly for practitioners.” A consistent theme among the studies of information-seeking behaviors of engineers as practitioners is that they rely on their own knowledge base, interpersonal communication with colleagues, or information from within their own organization. In contrast to the engineers in corporate organizations, Tenopir and King assert that “[i]n academia, engineers tend to be more aware of the services available through formal sources like libraries.”
Methodology
The researchers surveyed engineering faculty members at twenty large research institutions across the United States. The 12-item survey consisted of demographic, open-ended, and close-ended questions (see Appendix). The survey gathered both qualitative and quantitative data and was designed to take less than ten minutes to complete. In September 2009, an e-mail invitation to participate in an online survey was sent to approximately 4,900 engineering faculty members at twenty public research institutions. The institutions were selected as a purposive sample and represented different regions of the United States with engineering programs and relatively large libraries. Student assistants gathered e-mail addresses of all faculty listed on the institutions’ Web sites for their Engineering department or college. This typically included both tenured and nontenured faculty as well as researchers and faculty emeritus; the survey was sent to the entire population as denoted on the institutional Web sites. Faculty members were given three weeks to respond; a reminder e-mail was sent after two weeks.

Results and Discussion

About the Respondents
Of the 4,905 e-mail invitations sent, 903 engineering faculty members responded, for a response rate of 18.4 percent. The majority of the respondents were ranked as professors (35%), associate professors (24%) and assistant professors (23%). The remaining 17 percent of respondents were ranked as adjunct faculty, instructors, lecturers, professors emeriti, and “other.” A total of 45 percent of the engineering faculty members and researchers had been in their position for sixteen or more years, followed by 22 percent who had been in their position for five years or less, 19 percent who had been in their position six to ten years, and 14 percent who had been in their position for eleven to fifteen years. Thus, almost 60 percent of the respondents had been in their positions more than eleven years.

Meeting Research Needs
The survey found that engineering faculty rely heavily on scholarly journals, Internet resources, and face-to-face discussions with students and colleagues to assist them with their research (see figure 1). It is not a surprise that scholarly journals

<table>
<thead>
<tr>
<th>Percentage of Respondents Reporting the Following Information Sources as Very Important, Important, Neutral, or Unimportant</th>
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<tbody>
<tr>
<td>Face-to-Face discussion with students</td>
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<tr>
<td>Email discussion with students</td>
</tr>
<tr>
<td>Face-to-Face discussion with colleagues</td>
</tr>
<tr>
<td>Email discussion with colleagues</td>
</tr>
<tr>
<td>Attendance at conferences</td>
</tr>
<tr>
<td>Textbooks</td>
</tr>
<tr>
<td>Books</td>
</tr>
<tr>
<td>Internet resources</td>
</tr>
<tr>
<td>Scholarly journals</td>
</tr>
</tbody>
</table>

Rigor
The researchers used a survey to collect data on the information-seeking habits of engineering faculty members. The survey was designed to be brief and easy to complete. The researchers also used a purposive sample of institutions to ensure that the sample was representative of the population of engineering faculty members. The researchers also used descriptive statistics to analyze the data and present the results.
and Internet resources are the two most important resources for the engineering faculty. In many studies about information-gathering behaviors of faculty, the reliance on and demand for electronic journals and desktop delivery of materials has increased exponentially in the last five years.\textsuperscript{29}

The results from this study indicate that the third and fourth most important resource for engineering faculty was face-to-face discussion with students and face-to-face discussion with colleagues. The reliance on personal communication among the engineering faculty closely mirrors the reliance on personal communication for information among practicing engineers in the corporate environment.\textsuperscript{30}

\textbf{Frequency of Information Seeking and/or Accessing Information}

Engineering faculty were asked how frequently they sought and/or accessed information to complete seven tasks: preparation for student lectures, preparation for a conference presentation, determining protocols for laboratory procedures, researching patents, research or writing for publication, preparing a new research proposal or grant application, and professional development. In this question, respondents were asked to choose daily, weekly, monthly, once or twice per semester, annually, or not applicable (see table 1).

The frequency of information-seeking behaviors among the engineering faculty respondents relate to their primary responsibilities as faculty members within research and teaching institutions. Fully 81 percent of the engineering faculty seek or access information at least weekly to prepare for student lectures. Nearly three-quarters, or 74 percent, seek or access information at least monthly for professional development or to stay current in their field. Almost eight out of 10 (79\%) of the respondents seek or access information at least once or twice per semester to prepare for conference presentations. Nearly 84 percent seek or access information at least once or twice per semester to prepare for conference presentations, and 62 percent seek or access information at least annually to determine protocols for laboratory procedures. Fewer than half of the survey respondents seek or access

<table>
<thead>
<tr>
<th>Tasks</th>
<th>Daily</th>
<th>Weekly</th>
<th>Monthly</th>
<th>1-2/ Semester</th>
<th>Annually</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prepare for student lectures</td>
<td>32%</td>
<td>49%</td>
<td>5%</td>
<td>5%</td>
<td>1%</td>
<td>7%</td>
</tr>
<tr>
<td>Prepare for a conference presentation</td>
<td>2%</td>
<td>11%</td>
<td>32%</td>
<td>39%</td>
<td>11%</td>
<td>6%</td>
</tr>
<tr>
<td>Determine protocols for laboratory procedures</td>
<td>4%</td>
<td>13%</td>
<td>15%</td>
<td>17%</td>
<td>13%</td>
<td>38%</td>
</tr>
<tr>
<td>Research patents</td>
<td>1%</td>
<td>3%</td>
<td>8%</td>
<td>13%</td>
<td>21%</td>
<td>53%</td>
</tr>
<tr>
<td>Write/research for publication</td>
<td>23%</td>
<td>30%</td>
<td>21%</td>
<td>16%</td>
<td>5%</td>
<td>5%</td>
</tr>
<tr>
<td>Prepare a new research proposal/grant application</td>
<td>4%</td>
<td>12%</td>
<td>28%</td>
<td>35%</td>
<td>12%</td>
<td>8%</td>
</tr>
<tr>
<td>Professional development/remain current in the field</td>
<td>25%</td>
<td>34%</td>
<td>18%</td>
<td>11%</td>
<td>8%</td>
<td>5%</td>
</tr>
</tbody>
</table>
information to investigate research patents annually. These results closely align with the primary responsibilities of an engineering faculty member, with more than 80 percent seeking and/or accessing information most often for student lectures, secondarily for professional development or staying current in their field, and third for research and writing.

In-person Library Visits
Given the value that engineering faculty place on library services available electronically, the results to the question about how often the engineering faculty had visited the library in person during the past twelve months should not be a surprise. Close to three-fourths of the respondents (73%) indicated that they had visited the physical library fewer than five times in the past year. Only 5 percent of the respondents indicated they had visited the library 24 or more times during the past year. These results are similar to the results from the recent study of academic researchers who reported, with the exception of one university of the five universities studied, that “37%–48% of academic scientists visit their library less than five times a year.”

Because engineering faculty increasingly use electronic resources and services, their use of the physical library space has decreased. Of the twenty academic institutions surveyed, fifteen have a separate facility identified as an engineering branch library, although many are combined with other libraries. For example, some of these engineering libraries include a science and engineering library, an engineering and physical science library, and an art, architecture and engineering library. In the current economy that has stressed the budgets of public and private academic institutions across the country, it will be interesting to observe whether these engineering branch libraries remain viable or are closed or consolidated with larger collections in the next five to ten years.

Keeping Current in the Engineering Field
The respondents were asked how they keep abreast of current developments in engineering and allowed to choose all of the options. As shown in table 2, engineering faculty rely on conference attendance, references from an article of interest, current issues of journals, and personal communication to keep abreast of current developments in their field. To a lesser extent, the engineering faculty rely on abstracting or indexing tools, electronic discussion lists, RSS feeds, and current awareness services.

Awareness of Less Recent Journal Articles
The engineering faculty also responded to a question that asked how they became aware of less recent journal articles. This question presented the following options: citations at the end of journal articles, citations at the end of book chapters, retrospective searching of indexing and abstracting tools, personal communication, browsing of older volumes, and “other.” As shown in figure 2, engineering faculty rely most heavily on citations at the end of journal articles to track less recent information. To a lesser extent, they rely on retrospective searching of indexing and abstracting tools, personal communica-

<table>
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<th>Table 2</th>
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<tr>
<td>Percentage of Respondents Who Selected Methods to Keep Abreast of Current Developments in Their Field</td>
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<tr>
<th>Methods for Current Awareness</th>
<th>%</th>
</tr>
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<tbody>
<tr>
<td>Conference attendance</td>
<td>22%</td>
</tr>
<tr>
<td>Follow references from an article</td>
<td>21%</td>
</tr>
<tr>
<td>Scan current issues of journals</td>
<td>21%</td>
</tr>
<tr>
<td>Personal communication</td>
<td>18%</td>
</tr>
<tr>
<td>Scan recent abstracting or indexing tools</td>
<td>10%</td>
</tr>
<tr>
<td>Electronic discussion lists</td>
<td>4%</td>
</tr>
<tr>
<td>Other</td>
<td>2%</td>
</tr>
<tr>
<td>RSS feeds</td>
<td>2%</td>
</tr>
<tr>
<td>Current awareness service</td>
<td>1%</td>
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</table>
tion, citations at the end of book chapters, and browsing of older volumes.

**Importance of Library Services**
The engineering faculty were asked to rate eleven library services as very important, important, neutral, unimportant, or not applicable to their needs. As illustrated in figure 3, an overwhelming 96 percent of the respondents indicated that electronic access to scholarly journals—both current and archives—is important or very important; maintaining print access to journals is important or very important to only 37 percent of the respondents. The physical book collection is valued as important or very important to 71 percent of respondents, whereas the electronic book collection is seen as important or very important to only 56 percent of respondents. Interlibrary loan services are seen as important or very important by 70 percent of the respondents, whereas document delivery is important or very important to only 56 percent of the respondents. Library databases are important or very important to 69 percent of the respondents, but access to laboratory protocols is minimally important to engineering faculty, with only 23 percent indicating it is important or very important. Providing library space to conduct research is seen as important or very important by only 36 percent of respondents. Assistance from library personnel is rated important or very important by 47 percent of respondents.

These results parallel the findings of Hiller, who concludes that faculty and graduate students in engineering rank desktop delivery as the highest priority for library support. He confirms that many recent studies indicate that faculty in the sciences and engineering prefer remote access to electronic information. As budgets allow, most university libraries are working to meet the demands of faculty who consider online access to library resources and materials essential to their research and teaching. The data support the popular belief that the physical space of the library as a repository for materials is of decreasing importance to engineering faculty.

One finding that surprised the researchers was that almost half (47%) of respondents rated assistance from library personnel as very important or important. Particularly in an environment of increasing multidisciplinary research among...
engineering faculty, librarians are continuously reinventing their role in higher education to remain relevant to faculty and students as teachers, as navigators, as procurement agents for the thousands of electronic resources available, and as organizers of these materials to make them relevant and easily accessible to faculty. Almost half of the engineering faculty who responded to this survey found value in the role of library personnel providing assistance in accessing relevant information.

Branch of Engineering and Value Placed on Library Services
The researchers conducted a chi-square test of association to determine the statistical significance of the relationship between the faculty members’ branch of engineering and the value they placed on library resources and services for meeting their information needs. Of the eleven library services rated, seven showed a statistically significant relation to a branch of engineering (see table 3). Those that were statistically associated to a branch of engineering include: interlibrary loan \((p<0.001)\), physical book collection \((p<0.001)\), assistance from library personnel \((p<0.001)\), access to laboratory protocols \((p<0.001)\), library databases \((p=0.001)\), document delivery \((p=0.001)\), and print subscriptions to journals \((p=0.002)\). This suggests for many services that the importance engineering faculty place on library services is predicated somewhat by the faculty member’s discipline and area of emphasis.

As expected, faculty members from all branches of engineering valued electronic access to journals—both current issues and archives. More than 90 percent of the respondents in every branch of engineering rated electronic access to journals as important or very important. Library space to study and conduct research was not valued highly by any branch of engineering. Industrial engineering had the highest number of faculty, indicating that space was important or very important; but, even so, only 45.9 percent of
<table>
<thead>
<tr>
<th>Engineering Discipline</th>
<th>ILL</th>
<th>Physical book collection</th>
<th>Assistance library personnel</th>
<th>Access lab protocol</th>
<th>Library databases</th>
<th>Document delivery</th>
<th>Print scholarly journals</th>
<th>E-access current scholarly journals</th>
<th>Space for study &amp; research</th>
<th>E-access archives scholarly journals</th>
<th>E-book collection</th>
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</thead>
<tbody>
<tr>
<td>Aerospace</td>
<td>0.001</td>
<td>0.001</td>
<td>0.001</td>
<td>0.001</td>
<td>0.001</td>
<td>0.002</td>
<td>0.075</td>
<td>0.172</td>
<td>0.189</td>
<td>0.931</td>
<td></td>
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<tr>
<td>Biomedical / Bioengineering</td>
<td>0.001</td>
<td>0.001</td>
<td>0.001</td>
<td>0.001</td>
<td>0.001</td>
<td>0.002</td>
<td>0.075</td>
<td>0.172</td>
<td>0.189</td>
<td>0.931</td>
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<tr>
<td>Chemical</td>
<td>0.001</td>
<td>0.001</td>
<td>0.001</td>
<td>0.001</td>
<td>0.001</td>
<td>0.002</td>
<td>0.075</td>
<td>0.172</td>
<td>0.189</td>
<td>0.931</td>
<td></td>
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<tr>
<td>Civil</td>
<td>0.001</td>
<td>0.001</td>
<td>0.001</td>
<td>0.001</td>
<td>0.001</td>
<td>0.002</td>
<td>0.075</td>
<td>0.172</td>
<td>0.189</td>
<td>0.931</td>
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<tr>
<td>Computer Science</td>
<td>0.001</td>
<td>0.001</td>
<td>0.001</td>
<td>0.001</td>
<td>0.001</td>
<td>0.002</td>
<td>0.075</td>
<td>0.172</td>
<td>0.189</td>
<td>0.931</td>
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<tr>
<td>Electrical</td>
<td>0.001</td>
<td>0.001</td>
<td>0.001</td>
<td>0.001</td>
<td>0.001</td>
<td>0.002</td>
<td>0.075</td>
<td>0.172</td>
<td>0.189</td>
<td>0.931</td>
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<tr>
<td>Environmental</td>
<td>0.001</td>
<td>0.001</td>
<td>0.001</td>
<td>0.001</td>
<td>0.001</td>
<td>0.002</td>
<td>0.075</td>
<td>0.172</td>
<td>0.189</td>
<td>0.931</td>
<td></td>
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<tr>
<td>Industrial</td>
<td>0.001</td>
<td>0.001</td>
<td>0.001</td>
<td>0.001</td>
<td>0.001</td>
<td>0.002</td>
<td>0.075</td>
<td>0.172</td>
<td>0.189</td>
<td>0.931</td>
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<tr>
<td>Mechanical</td>
<td>0.001</td>
<td>0.001</td>
<td>0.001</td>
<td>0.001</td>
<td>0.001</td>
<td>0.002</td>
<td>0.075</td>
<td>0.172</td>
<td>0.189</td>
<td>0.931</td>
<td></td>
</tr>
<tr>
<td>Petroleum</td>
<td>0.001</td>
<td>0.001</td>
<td>0.001</td>
<td>0.001</td>
<td>0.001</td>
<td>0.002</td>
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<td>0.172</td>
<td>0.189</td>
<td>0.931</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>0.001</td>
<td>0.001</td>
<td>0.001</td>
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<td>0.001</td>
<td>0.002</td>
<td>0.075</td>
<td>0.172</td>
<td>0.189</td>
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</table>
respondents gave it this rating. A mere
22.9 percent of the aerospace engineering
faculty members rated space to study or
conduct research as important or very
important.

**Longevity in the Field and Value Placed on
Library Resources and Services**

The researchers conducted a chi-square
test of association to determine the sta-
tistical significance of the relationship
between a faculty member’s longevity
in the field and the value placed on li-
brary resources and services for meeting
information needs. Of the eleven library
services rated, four showed a statistically
significant relationship to the number
of years in the field (see table 4): access
to laboratory protocols \( (p=0.002) \), docu-
m ent delivery \( (p=0.003) \), interlibrary loan
\( (p=0.003) \), and print subscriptions to jour-
nals \( (p=0.011) \).

The data illustrate that the longer a
faculty member has been in the field, the
greater the importance he or she places on
print access to scholarly journals. How-
ever, only 44 percent of those with more
than sixteen years in the field indicated
that it was important or very important
to maintain print subscriptions. In addi-
tion, those with eleven to fifteen years
in the field value assistance from library
personnel more than other groups, but
only 52.6 percent of them indicated that
it was important or very important.

Electronic access to journals con-
tinues to reign supreme for both current
and archival content; it was valued as
important or very important by over
90 percent of the respondents in every
longevity category. Electronic access to
monographs was ranked as important
or very important by 62 percent of the
faculty respondents who had been in the
field less than five years, as compared
to the low of 52 percent of the faculty
respondents who had been in the field
sixteen or more years. Access to physical
book collections was ranked important or
very important by all respondents at ap-
proximately 70 percent. It would appear
that electronic access to journals is more

<table>
<thead>
<tr>
<th>Library Resources &amp; Services</th>
<th>p= 0-5 years</th>
<th>6-10 years</th>
<th>11-15 years</th>
<th>16+ years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access to lab protocols</td>
<td>0.002</td>
<td>27.1%</td>
<td>27.2%</td>
<td>33.6%</td>
</tr>
<tr>
<td>Document delivery</td>
<td>0.003</td>
<td>53.9%</td>
<td>51.8%</td>
<td>61.5%</td>
</tr>
<tr>
<td>Interlibrary loan</td>
<td>0.003</td>
<td>72.8%</td>
<td>72.6%</td>
<td>80.7%</td>
</tr>
<tr>
<td>Print subscriptions scholarly journals</td>
<td>0.011</td>
<td>29.0%</td>
<td>30.0%</td>
<td>39.0%</td>
</tr>
<tr>
<td>Electronic book collection</td>
<td>0.058</td>
<td>61.9%</td>
<td>56.9%</td>
<td>59.3%</td>
</tr>
<tr>
<td>Space to study/conduct research</td>
<td>0.096</td>
<td>34.8%</td>
<td>37.6%</td>
<td>40.2%</td>
</tr>
<tr>
<td>E-access to current scholarly journals</td>
<td>0.181</td>
<td>98.0%</td>
<td>95.8%</td>
<td>99.0%</td>
</tr>
<tr>
<td>Library databases</td>
<td>0.224</td>
<td>62.0%</td>
<td>75.1%</td>
<td>77.7%</td>
</tr>
<tr>
<td>E-access to archives scholarly journals</td>
<td>0.413</td>
<td>97.5%</td>
<td>94.6%</td>
<td>98.3%</td>
</tr>
<tr>
<td>Physical book collection</td>
<td>0.726</td>
<td>70.5%</td>
<td>70.5%</td>
<td>71.8%</td>
</tr>
<tr>
<td>Assistance from library personnel</td>
<td>0.814</td>
<td>42.6%</td>
<td>44.5%</td>
<td>52.6%</td>
</tr>
</tbody>
</table>
Imaging: A Laboratory Manual
Edited by Rafael Yuste
This manual describes the theory and practice of a wide array of imaging methods. From the basic chapters on optics, equipment, and labeling to detailed explanations of advanced, cutting-edge methods like PALM, STORM, light sheet and high speed microscopy, this volume is a vital resource for the modern biology laboratory.
2011, 952 pp., illus., appendices, index

RNA: A Laboratory Manual
Edited by Donald C. Rio, Manuel Ares, Jr., Gregory J. Hannon, and Timothy W. Nilsen
Originating in four of the field’s most prominent laboratories and written with novices as well as more advanced researchers in mind, this manual provides the necessary background and strategies for approaching any RNA investigation. In addition to detailed step-by-step protocols, it includes extensive tips and troubleshooting information.
2011, 586 pp., illus., appendices, index
Hardcover $246 ISBN 978-0-879698-90-4

RNA: Life’s Indispensable Molecule
By James Darnell
James Darnell provides a comprehensive and captivating account of RNA research, illuminated by his own life-long and celebrated engagement in the field. The book is geared toward scientists from the graduate level on up, and will particularly appeal to active investigators in RNA biology, educators of molecular biology and biochemistry, and science historians.
2011, 416 pp., illus., appendix, index
Hardcover $40

Live Cell Imaging: A Laboratory Manual
Edited by Robert D. Goldman, Jason R. Swedlow, and David L. Spector
The second edition of Live Cell Imaging: A Laboratory Manual expands upon and extends the collection of established and evolving methods for studying dynamic changes in living cells and organisms. This manual presents hands-on techniques as well as background material, and can serve as a text in advanced courses.
2010, 736 pp., illus., appendix, index

Essentials of Glycobiology, Second Edition
Edited by Ajit Varki, Richard D. Cummings, Jeffrey D. Esko, Hudson H. Freeze, Pamela Stanley, Carolyn R. Bertozzi, Gerald W. Hart, and Marilynn E. Etzler
The new edition of Essentials of Glycobiology covers general principles and describes the structure and biosynthesis, diversity, and function of glycans and their relevance to both normal physiologic processes and human disease. Written and edited by glycobiologists with experience in teaching and in research, this volume will be an invaluable resource for both students and established investigators.
2009, 784 pp., illus., glossary, study guide, index

Experimental Design for Biologists
By David J. Glass
Experimental Design for Biologists explains how to establish the framework for an experimental project, how to set up a system, design experiments within that system, and how to determine and use the correct set of controls. This handbook is an essential source of theory and practical guidance in designing a research plan.
2007, 206 pp., illus., index
Means to an End: Apoptosis and Other Cell Death Mechanisms
By Douglas R. Green
Douglas Green, a leader in the field, provides a clear and comprehensive view of apoptosis and other cell death mechanisms. The book is of great use to all biologists interested in how cells function in the context of multicellular organisms and will appeal to everyone from undergraduates encountering the topic for the first time to researchers actively working in the field.
2011, 220 pp., additional reading, index
Hardcover $81.00 ISBN 978-0-879698-87-4
Paperback $46.00 ISBN 978-0-879698-88-1

The Nucleus
Edited by Tom Misteli and David L. Spector
Including an historical introduction to the field and discussion of the numerous pathological conditions involving disruption of nuclear structure and function, this volume is essential reading for all molecular and cell biologists, as well as pathologists interested in the role of nuclear architecture in disease.
2011, 517 pp., illus., index

Calcium Signaling
Edited by Martin D. Bootman, Michael J. Berridge, James W. Putney, and H. Llewelyn Roderick
This volume explores the channels and pumps that transport calcium between different compartments and the regulation of calcium fluxes. The contributors discuss calcium buffers and sensors and how these produce distinct spatiotemporal calcium signals in different circumstances.
2011, 499 pp., illus., index
Hardcover $135 ISBN 978-0-879699-03-1

Protein Homeostasis
Edited by Richard I. Morimoto, Dennis J. Selkoe, and Jeffrey W. Kelly
Proper expression, folding, transport, and clearance of proteins is critical for cell function. This volume covers the entire spectrum of protein homeostasis in healthy cells and the diseases that result when control of protein production, folding, and degradation goes awry.
2011, 349 pp., illus., index
Hardcover $135 ISBN 978-1-936113-06-4
highly valued than any other information resource. The recent Faculty Survey 2009 issued by ITHAKA confirmed that faculty members in many disciplines are increasingly comfortable not only with current scholarly electronic journals but also with electronic journal back files.\textsuperscript{34}

Faculty attitudes suggest that a tipping point has been passed for journal current issues, and, with certain narrow exceptions, that print editions of current issues of scholarly journals are rapidly becoming a thing of the past. And although faculty attitudes on journal backfiles have not yet experienced the same nearly-complete shift, they are changing in parallel with library resources constraints such that backfile print collections will increasingly be replaced exclusively by digitized versions.\textsuperscript{35}

### Longevity in the Field and Sources of Information for Research

The researchers also compared the association between a faculty member’s longevity in the field and the importance placed on selected sources of information for the member’s research. Of the nine information sources provided in the survey, only one showed a statistically significant relationship to longevity in the field—face-to-face discussions with students (\(p=0.026\)) (see table 5). However, while there may be a statistically significant relationship between longevity in the field and the value placed on face-to-face discussions with students for research, an in-depth examination of the responses would indicate that there is little differentiation, even in this area, between those with more than sixteen years in the field and those with less than five years. For faculty with more than sixteen years in the field, 87.3 percent indicated that face-to-face discussions with students was important or very important; for those with less than five years of experience, 89.3 percent indicated it was important or very important.

**Engineering Faculty Narrative Comments**

The researchers included an open-ended question in the survey that asked the engineering faculty whether there were services or improvements that their library did not currently provide that would assist them in meeting their information needs. Of the 903 respondents, 167 (18.4\%) answered the open-ended ques-
The researchers coded the responses by category such as collections, services, compliments, complaints, and communication (see table 6). Not surprisingly, 34.5% of the narrative responses indicated that the engineering faculty wanted more journals, more electronic access to journals, or more electronic access to journal archives. The second most frequently requested improvement was in document delivery services, with 11% of the respondents making statements to this effect. The remainder of the open-ended questions represented 10% or less of the total responses to the open-ended question.

The narrative comments showed a wide range of compliments and complaints from the engineering faculty that are not surprising to the researchers. For example, “I am not aware of any colleague whose library provides more resources than ours. As such, I am very pleased with the library’s offerings” and “Our library is excellent” to “The books our library has in my research area are mostly too old. Many of those books were published in the 1980s” and “The library is woefully lacking in recent online access to many journals in which I’m interested.” While few (2.9%) of the narrative responses indicated that the engineering faculty needed assistance from librarians in their institutions, those who commented were specific in their requests for personalized services, such as, “There’s basically too much information available. I need librarians to come to my office to assist [me]… Now that faculty access all the archives from their offices, librarians need to go to faculty offices to have the wonderful impact that they used to have before the [I]nternet.” The wide range of responses also addressed the physical space of the library and ranged from “There is NOT enough space in the library or elsewhere so I resort to coffee shops to do my research and meet with students!” to “I wish they’d dispense with the physical library and use the cost savings to subscribe to more e-journals and buy more e-books. The leather-patched-jacket-wearing professor smoking a pipe at the library doesn’t work anymore. If it’s not electronic access, it isn’t useful.” In general, the narrative responses reinforced the high value that faculty place on the availability of electronic resources for their research and teaching.

**Conclusion**

The researchers studied the information-seeking behavior and habits of engineering faculty in academic environments. The responses from survey participants confirmed the findings of other stud-

<table>
<thead>
<tr>
<th>TABLE 6</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Engineering Faculty Narrative Responses</strong></td>
</tr>
<tr>
<td><strong>Ranked Narrative Responses</strong></td>
</tr>
<tr>
<td>Increase journals, E-journals, journal back files</td>
</tr>
<tr>
<td>Improve document delivery services</td>
</tr>
<tr>
<td>Compliment (general)</td>
</tr>
<tr>
<td>Increase E-book collections</td>
</tr>
<tr>
<td>Compliment (electronic resources)</td>
</tr>
<tr>
<td>Increase E-access to databases, indexes, citation indexes</td>
</tr>
<tr>
<td>Increase monograph collection</td>
</tr>
<tr>
<td>Complaint (budget)</td>
</tr>
<tr>
<td>Complaint (journal cut)</td>
</tr>
<tr>
<td>Improve communication w/ library personnel</td>
</tr>
</tbody>
</table>
ies that electronic access to current and archived scholarly journals and Internet resources are important to meeting their research and information needs. Similar to their engineering colleagues in the corporate environment who rely on coworkers as trusted information sources, academic engineering faculty also rely on face-to-face discussion with their students and colleagues to help with their research and teaching.

As the most recent ITHAKA study on faculty attitudes indicated, faculty in all disciplines increasingly rely on electronic resources for their research and teaching. The study verified the trend that “the library’s physical edifice and catalog have declined steadily as starting points for research.” As a result, faculty are using online services for their discovery path, with the library becoming the ‘behind the scenes’ procurement agent. Unless branded by the library, it may not be obvious to the faculty member that the library has any role in providing these resources and services for research and teaching. The ITHAKA report asks a relevant question of the academic library community: “Can the academic library reengage with scientists?” The researchers of this paper would suggest a corollary question: “Can the academic library reengage with engineering faculty?”

Is the library becoming more or less relevant to engineering faculty in the academic environment? The mission of the university library is to provide resources and information services that help the engineering faculty meet their research and teaching goals. This study’s respondents clearly indicate that electronic access to journals, journal back files, and even monographs are important to their research and teaching. The library has a unique opportunity to develop its role as the procurer and curator of the electronic resources that engineering faculty demand. Simultaneously, the physical space of the library is less important to the engineering faculty surveyed. Librarians are thus challenged to expand and promote their role as educators, onsite research consultants at the engineering faculty members’ point of need, procurement agents, and organizers of access to electronic resources that will continue to serve the needs of engineers within their universities.

Further research on engineering faculty must be conducted to answer additional questions. Do the information-seeking behaviors of academic engineering faculty mirror the behavior of researchers in other disciplines, or do they more closely mirror that of their peers in engineering corporate environments? In addition, how have academic librarians used Web 2.0 applications to integrate new models of information discovery through blogs, RSS feeds, Facebook, Twitter, and other social networking tools for engineering faculty? Is the information-seeking behavior of academic engineering faculty influenced largely by what is available at their local university library? Further research will help address these questions and assist librarians in fulfilling the core library mission of supporting the research and teaching needs of academic engineering faculty.
Appendix: Information-Seeking Habits of Engineering Faculty Survey

1. What is your status within your university?
   - Professor
   - Associate Professor
   - Assistant Professor
   - Adjunct Professor
   - Instructor
   - Lecturer
   - Professor Emeritus
   - Other (please specify):

2. Which branch of Engineering is your area of emphasis? (Please select the answer most closely aligned with your area.)
   - Aerospace
   - Biomedical/Bioengineering
   - Chemical
   - Civil
   - Computer Science
   - Electrical
   - Environmental
   - Industrial
   - Mechanical
   - Petroleum
   - Other (please specify):

3. How long have you been a faculty member/researcher in your area of study?
   - 0-5 years
   - 6-10 years
   - 11-15 years
   - 16+ years

4. Which of the following are included in your departmental duties? (Select all that apply.)
   - Undergraduate Instruction
   - Graduate Instruction
   - Laboratory Research
   - Field Research
   - Commercial/Proprietary Research
   - Supervision of Doctoral Research
   - Grant Preparation
   - Other (please specify):

5. How many of the following have you completed within the last 5 years?

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>1-3</th>
<th>4-7</th>
<th>8-11</th>
<th>12+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Refereed journal articles or book chapters</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-refereed journal articles or book chapters</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
6. How frequently do you seek and/or access information to complete the following tasks?

<table>
<thead>
<tr>
<th>Task</th>
<th>Daily</th>
<th>Weekly</th>
<th>Monthly</th>
<th>1-2 times/semester</th>
<th>Annually</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prepare for student lectures</td>
<td></td>
<td></td>
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<td>Prepare for conference presentation</td>
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<td>Determine protocols for laboratory procedures</td>
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<tr>
<td>Research patents</td>
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<tr>
<td>Write/research for publication</td>
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<tr>
<td>Prepare new research proposal/ grant application</td>
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<tr>
<td>Professional development/ remain current in field</td>
<td></td>
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</tbody>
</table>

7. How important are the following in helping you with your research?

<table>
<thead>
<tr>
<th>Resource</th>
<th>Very Important</th>
<th>Important</th>
<th>Neutral</th>
<th>Unimportant</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scholarly Journals</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Internet resources</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Books</td>
<td></td>
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<tr>
<td>Textbooks</td>
<td></td>
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</tr>
<tr>
<td>Attendance at conference</td>
<td></td>
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<tr>
<td>Email discussion with a colleague</td>
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<td></td>
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<tr>
<td>Face to face discussion with a colleague</td>
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<tr>
<td>Email discussion with a student</td>
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</tr>
<tr>
<td>Face to face discussion with a student</td>
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</tbody>
</table>

8. How do you keep abreast of current developments in your field(s)? (Please check all that apply.)

- [ ] Scanning current issues of journals
- [ ] Scanning recent issues of abstracting/indexing tools
- [ ] Personal communication
The Information-Seeking Habits of Engineering Faculty  565

☐ Attendance at conference
☐ Follow references or leads from an article or item of interest (citation trail)
☐ Electronic discussion lists
☐ RSS feeds
☐ Current Awareness service
☐ Other (please describe):

9. How do you become aware of other less recent journal articles? (Please check all that apply.)
☐ Citations at end of journal articles
☐ Citations at end of book chapters
☐ Retrospective searching of indexing/abstracting tools
☐ Personal communication
☐ Browsing through older volumes
☐ Other (please describe):

10. How often did you visit the library in person in the last 12 months?
☐ Never
☐ 1-2 visits
☐ 3-5 visits
☐ 6-12 visits
☐ 13-23 visits
☐ 24 or more visits

11. How important are the following library services in meeting your information needs?

<table>
<thead>
<tr>
<th>Service</th>
<th>Very Important</th>
<th>Important</th>
<th>Neutral</th>
<th>Unimportant</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electronic access to current scholarly journals</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Electronic access to archives of scholarly journals</td>
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</tr>
<tr>
<td>Print subscriptions to scholarly journals</td>
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<tr>
<td>Physical book collection</td>
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<tr>
<td>Electronic book collection</td>
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<tr>
<td>Access to laboratory protocols</td>
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<tr>
<td>Library databases (e.g. INSPEC)</td>
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<tr>
<td>Interlibrary loan</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Document delivery</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Space to study/conduct research</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assistance from library personnel</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>Other (please specify)</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

12. Are there services your university library does not currently provide, but you wish they did? If so, please explain how these services would assist you in meeting your information needs.
Notes

7. Ibid., 69.
11. Ibid., 776.
15. Ibid., 7.
18. Ibid., 95.
20. Ibid., 12.


27. Ibid., 58.

28. Ibid.


35. Ibid., 15.

36. Ibid., 5.

37. Ibid.

38. Ibid., 14.