Note: Due to the nature of this particular focus group, the format of this analysis differs from Sections 2.3.1.-2.3.6.

Part of this difference in focus may have to do with the nature of the questions asked and direction of discussion in the focus groups. (See individual transcript analyses).

2.3.7. Discussions by Scientists at a National Laboratory

2.3.7.1. Introduction to Journals

The scientists felt that student interaction with journals usually begins when they start work on their thesis, because that is the point when the student must use journal literature. Also, in most universities, the best place to study is always the library, which happens to be where the journals are located.

Some scientists were exposed to journal literature as undergraduates through a one-credit introductory class to library science. In their senior year, they had to give a research seminar.

One scientist remembered a professor who used 1950 physics articles considered useful to "stump" everyone. Journals were very daunting because the literature assumed the student was an Einstein to read and understand them. They used equations such as, "It follows from here that … and such and such."
Another scientist felt there was a paradigm shift. They did not have much exposure as an undergraduate, but as a graduate student focusing on a specific subject (as opposed to a broad, remedial base of information), they made a self-imposed "Journal Day" and spent one entire day in the library locating chemical and physical abstracts, writing down the numbers, and looking up articles of interest. It took approximately an hour for someone behind the desk to retrieve the articles and books only to find out they were not relevant. During the 1970's, for $.05 per page, they "Xeroxed" the pages over 4-5 hours. They feel that now even undergraduates can use Google effectively to find research articles and print them out within 30 seconds. Although the process is similar intellectually, it is so much easier that it's revolutionary. These scientists feel current graduates take to [journal literature] like fish to water.

A problem associated with the point of introduction of journal literature to students concerns the, "Student's lack of recognition of research articles dated prior to 1990; to them they never existed. They will not go back and review the great organic chemistry done in the 1950's and 1960's, which might be available only in print. They have never done that before; they have always sat at a computer. They wouldn't look up something in Chem Ed abstracts if you paid them. They've never done it before and nobody ever told them how. They just know they can sit down and type a few keywords and it is instantaneously done for them. If you have to go down the hall, that is work!"
Scientists feel in some cases journal requirements vary by discipline and sometimes there is no need to look at information older than 3-5 years back. There are, of course, exceptions such as the first article on artificial intelligence. In chemistry, some graduate classes are studying research from 1956 because that is the best way to do it.

2.3.7.2. Print Journals

2.3.7.2.A. Advantages and Disadvantages

Overall, these scientists say they prefer print journals as their favorite mode of reading. They rely on their company library and do not like reading journals electronically, citing feelings of being "chained to a computer". They prefer to sit down at night with a journal, review the Table of Contents, and locate material to read at their leisure.

Scientists believe it is very important to maintain print journals because of the depth of research available in them that is not available in electronic versions. In addition to the date range and omissions of important information, research progresses in cycles. Some current projects such as space reactors, MHTGR reactions, and gas cold reactors are based in historical data from 10-20 years ago. The availability of older journals is very important for printing considerations also. There is a retrospective consideration that is very important that can be accessed in print but not electronic.
The major disadvantage of print journals is access. Subscriptions are too expensive. If scientists do receive a print journal it is part of a membership to a professional society; they do not maintain personal subscriptions. For example, an organic chemist will receive the Journal of Organic Chemistry as part of his/her membership in the American Chemical Society otherwise, they would have to rely on the library. This group stated they are not aware of anyone in their building who personally subscribes to print journals.

2.3.7.3. Electronic Journals

2.3.7.3.A. Advantages and Disadvantages

The scientists in this focus group believe one main advantage of electronic journals is that an article in an electronic journal will be highly cited which is advantageous for the author and for reference.

Also, an organization like the APS is funded to archive issues going back to Issue 1, Page 1. The scientists know the archives are linked to the actual article so they can be printed.

Another advantage of electronic articles is the high retrieval factor. If a hard copy is made of an article and put away, the chances of locating it can be minimal, but with electronic, it will still be in the system. They feel bound compilations of journals in libraries do not print well, but electronic does.

Scientists see a plus in electronic format is the ability to post PowerPoint presentations instead of using overheads. They feel presentations look good when a picture or article from another journal is used. The quality is much better than scanning or hard copy.
The scientists use electronic journals frequently but did not quantify with a time estimate.

A chemist discussed the ability to transform chemicals such as chlorine, bromine and iodine different ways using the resources. They used to spend 3-4 days searching through journals and information but now can input a structure and ask, "Give me something that contains this, or looks something like that" and will retrieve a thousand suggestions. They can scroll through those thousand structures in 15 minutes to determine what they need. It may cost more but it saves a week's worth of library work.

One major disadvantages discussed is the unavailability of "all" journal literature electronically although some is just becoming available online such as ChemAbstracts and Elsevier Journals. Older research may not be available electronically. The scientists like to browse and skim historical articles; their interests are wide-ranging and they see electronic searches as difficult, particularly when browsing.

The participants discussed the fallacy of the accessibility of electronic journals. The libraries are dropping not only the hard copies, but also electronic versions due to confusion over packaging and high cost. Some companies package many journals into a single product. The journal that evolved from hard copy to an electronic version may not be available because of the cost increase.
Some products are discounted in the electronic-only package and, in some cases; there is an added fee to have both the electronic and the print version. Sometimes a facility will buy the print version but not have the extra money to purchase the electronic version. Publishers are still changing their model on pricing. A company will periodically check with the researchers and verify which journals are used, preferred and whether specific divisions will share the cost.

Another pricing difference concerns page charges. The American Nuclear Society has page charges and even pursues people to pay their bill. Problems include, "My project is finished, I published the paper and my grant has ended. I don't have any money." If all of the journals had page charges, it would probably work; however, because page charges are inconsistent between vendors and people resist paying them.

The evolution of journals has mirrored the expansion of scientific interests into many disciplines. It has been noted that in universities, scientists tend to follow a particular line of research over a long period of time. Journals have evolved in tandem with research in numerous fields. For example, one scientist began as an organic chemist but his projects have now moved into polymer chemistry because that is where there is opportunity.
Another problem with electronic journals is omitted content. For example, if a scientist writes an article for Physical Review with extensive tables, the publisher will encourage them to include tables in the electronic version but not the print version. The print version may be less expensive but will be incomplete. In a society journal there may be articles that are 400 pages long. The publisher may tell the author he/she may have only 30 pages, so they submit 30 pages to the journal with 370 pages as "Supplementary Material" in the electronic version. The journal may make note of this but not explain it thoroughly, such as, "We don't have the money so we are not buying the electronic version." The scientists believed this short-changing was unacceptable. The American Chemical Society has done this for a while; directions to order supplemental material are available on the masthead.

2.3.7.3.B. Virtual Journals

Since the trend of number of articles per journal is increasing, online searching in electronic journals now means scientists have access to a progressively larger number of journals. For example, in the 1970's, scientists read 10-13 journals, but currently it is over 20.

One great advantage of virtual journals is the combining of articles, for example, The Virtual Journal of Nanotechnology combines 15+ journals together. The participants strongly felt articles have been found that never would have been looked at before.
Further discussion included how an editor from a discipline community chooses articles from a number of journals and makes concise linkings of all of them. For example, the American Physics Society has several on nanotechnology and things of this nature. The links bring in articles within the journal families that have the right to cross.

2.3.7.3.C. Search Engines

Scientists use Google for searching, but prefer discipline-specific databases such as Chem Abstracts for scientific information believing "you are only as good as the coverage of that search engine and how good it does. If you miss a key article you could waste a year in the lab on something that has already been done."

Although they feel Google retrieves too many worthless items, it can find obscure articles such as those from Nuclear Instruments and Methods that may not be indexed in other search engines.

The computer science scientists learn about nuclear jets and current events and projects by networking at conferences, workshops, and through the grapevine. They liken this approach to using Google feeling that most of the time they are lucky and locate what they need quickly. Google can retrieve the name of a project, research index, or citation and point them to the correct place in the library for electronic copies.
2.3.7.3.D. Preprint Services

These scientists are very familiar with preprint services such as DOE PrePrint and the Los Alamos Labs systems and use them frequently because they want timely advantages to learn new ideas.

Some did not feel the peer review issue is important for them. The scientists feel the articles have been reviewed indepth prior to being published, they have confidence in their professional knowledge, and feel they can determine what is right and what is wrong. The preprint service reflects serious work, authorship and reputation.

One scientist is the Chair of the Fuel Division of the American Chemical Society where everyone produces preprints. Their publications are going electronic because it is very expensive to publish. The group discussed discontinuing preprints but the majority of opinion was that everyone appreciates them, especially people in the industry. They feel they can publish great data easily, and it's not refereed so they don't have to go through all the internal hoops and patent clearances. They feel preprints offer information they would not know about otherwise. This particular industry is going in new directions, fuel cells, for example, with many small companies now starting to publish information. Preprints are an excellent way to stay abreast of developments.

In contrast, people in academia do not like preprints because they feel an unrefereed publication gives them no credit and precludes them from publishing in journals.
The scientists also discussed the overall scientific communication process where university scientists author approximately 76% of science articles, but around 70% of the readers are in industry. Since a majority of scientists are in industry or outside of universities, it does seem preprints offer an opportunity to improve communication for those readers.

One scientist felt the internal review process was poor for preprint articles, much more so than someone who is sitting right next to you who gets a journal article. He is going to review it more carefully than internal reviewers.

Authorship is an important factor in preprint credibility. Some scientists believe you can determine whether or not it's good by the author name. When these scientists submit a preprint, they are very aware their scientific reputation and career are represented by their name.

### 2.3.7.3.E. Review Journals

Review journals were highly praised as being very useful. These scientists believe the importance of review journals is increasing along with those scientists' tendencies to jump fields. In that event, they need a few good review articles, links and references to prime themselves so they can speak knowledgeably. Surveys have shown interest and usage has increased greatly.
2.3.7.4. **Electronic Journal Features**

2.3.7.4.A. **Browsing**

The scientists feel that because they are interested in so many areas, electronic sites or virtual journals that index articles by topic are very useful. They feel it is a kind of "browsing" when a range of different journals linked electronically.

Older research may not be available electronically and the scientists like to browse and skim older historical articles. Their interests are wide-ranging and see electronic searches as difficult, particularly when browsing.

One feeling is that article titles do not accurately reflect article content. However, skimming and browsing electronic journals can be very serendipitous. An example is a chemist who found a solution to a problem he had been working on for a long time and found a relevant article by skimming through an electronic journal.

The new virtual journals collect articles from a range of different journals and link them all electronically so browsing many journals in one place is simulated. However, some scientists still prefer print to browse.
2.3.7.4.B. Graphics

Scientists like pictures that reflect article content believing they can be good indicators of interest. However, pictures and images take up space, which can make them slow to download and take up screen space. Some feel scientific information should be simple, downloadable in black-and-white.

Also, today's graphic quality has greatly improved in color and pictorial quality. The pictures are smaller, more descriptive and look better. The downside is sometimes the pictures are so "artsy" they are difficult to print. Scientists want specific, black-and-white research articles that are easy to download.

The participants noted many electronic journals are in .pdf format, which can be difficult to read. They thought perhaps the format is supposed to make the page look like a print journal.

They also discussed the trend today of posting PowerPoint presentations, instead of overheads, which can be found on the Web. They feel electronic graphics are very beneficial in enhancing presentations visually and the quality is much higher than scanning or hard copy.
2.3.7.4.C. Other

A favorite tool of these scientists is Citations although the ISI citations databases are very expensive. For example, a single citation can cost $1.50 to print out. If they want to research a person's participation in a particular area, they should have cited a certain paper but by checking the paper, they can find out.

A few participants used alert services. One uses Current Contents with weekly searches emailed with abstracts in 2-3 different areas. They find it is useful in keeping up with projects from diverse areas without overlap.

In reference to multi-discipline work, the scientists appreciate electronic books and pamphlets from different fields. They also believe electronic glossaries and dictionaries for different fields are very useful for reference.

2.3.7.5. Predictions

These scientists believe that print and electronic journals will exist side-by-side in complementary fashion in the future with forthcoming differences. The library has taken on a new meaning and expanded capacity by holding both hard copy and electronic.

The topic of whether or not scholarly journals will be replaced by author websites and archives was raised. Participants felt that would never happen because of the lack of peer review. (It is interesting to note that this somewhat contradicts their earlier discussion of peer review.)
Scientists in a government laboratory need journals to concentrate on discipline or industry specialties, yet follow specific lines of research. One scientist said, "When I started out I was working as an organic chemist and almost all my projects have moved into polymer chemistry now. Why? There is opportunity there."

Another scientist discussed the evolution of journals. "When I started in atomic physics, atomic collision physics sounded quite big and Physical Review Society is dominated by things that did not exist long ago, so the journals themselves sort of evolved in reflection of the submissions obviously. Journals change over time as well. You can use the same journals even if you switch fields."

2.3.7.6. Conclusions

Economics are a major consideration of electronic journal literature. The faculty and scientist focus group participants believe personal journal subscriptions are too expensive for individuals to bear. Their journal access is either through professional society membership benefits or through their business place library. Additional economic issues include print costs, and changing database and electronic journal subscriptions.

One substantial difference between faculty and scientists were the frames of reference from which they spoke. Faculty comments and opinions were focused on access issues such as search engines, search keywords and print journals. Scientists referred more to the content of the journals, print or electronic, such as peer review, referred journals, and how journal content evolves along with the discipline(s).
The scientists prefer to browse select print journals in an "orderly" routine. The journals reflect their discipline and "industry". That orderly approach also applies to electronic journals they browse through virtual journals, citations, Table of Contents, and databases.

Scientists are conscious of the peer-review and referee processes and consider them valuable and necessary to establish author and research credibility. However, they assign more value to preprints than faculty members. A scientist said, "I think you can determine by whom it comes from whether or not it's good. When I put out a preprint, my name is on it and it's my scientific reputation and career, I am going to put out a good product, which I think is honest and truthful."

The scientists were introduced to journal literature in undergraduate school by attending a one-time class in the university library about journal literature and being assigned small papers to research and write out, for the most part when they had declared majors. This echoed faculty comments that they followed the same pattern in teaching their students.

Both the faculty and scientists groups agree that undergraduate students should receive an introduction to scholarly literature carefully early in their academic careers, most likely when a student declares a major. The introduction should be individualized, perhaps on a specific topic pertinent to the student's interests as opposed to a class topic, to increase the student motivation. Students should be required to use the journal literature for reinforcement and skills development, otherwise, they will not do it.
The scientists also discussed using a large variety of electronic journal resources, for example, "That is the electronic books and pamphlets, for example, in different fields are useful and also the glossaries and dictionaries for different fields are good to refer to if they are in the library in electronic form, that's very good." Faculty appeared to concentrate on discipline-specific journals and discipline-specific search engines for their resources.