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International Computer-Based Conference on Biotechnology
A Case Study

Editor: D.A. Balson
Abstract

An international computer conference on the bioconversion of lignocellulosics for fuel, fodder, and food took place from May to December 1983. It was initiated to evaluate the appropriateness of using computer conferencing to facilitate scientific discussions and to explore the application of the subject matter to development purposes. Individuals intimately involved in the organization and evaluation of this activity contributed chapters documenting the background, organization, operation, evaluation, and results. These chapters reflect the personal views of the authors, allowing the reader to view the activity from a number of different perspectives.

Generally, the technique of computer conferencing was accepted by this user group as a viable medium for facilitating scientific research. Although the industrialized-country researchers did not find the content of the discussions very valuable, the developing-country researchers found it extremely pertinent and appropriate. The most important outcome of this activity, however, was its contribution to the body of knowledge concerning the use of this technique in the facilitation of cooperative research activities.

Résumé

De mai à décembre 1983 s’est tenue une téléconférence informatisée internationale sur la bioconversion de matières lignocellulosiques en combustible, fourrage et nourriture. Elle avait pour objet de déterminer le bien-fondé de l’utilisation de la téléconférence pour faciliter les discussions entre scientifiques et d’étudier l’utilisation de ce mécanisme à des fins de développement. Les personnes chargées de l’organisation et de l’évaluation de cette activité ont rédigé des documents sur l’origine, l’organisation, le fonctionnement, l’évaluation et les résultats de la téléconférence. Chaque document reflète les idées et opinions de son auteur, ce qui permet au lecteur de regarder cette activité à partir de différents points de vue.

Les participants ont reconnu, de façon générale, l’utilité de la téléconférence informatisée pour la recherche scientifique. Bien que les chercheurs des pays industrialisés aient jugé peu intéressants les sujets traités, les chercheurs des pays en développement, pour leur part, les ont trouvés très pertinents. Cette activité aura eu pour principal mérite de contribuer à l’approfondissement des connaissances sur l’utilité des téléconférences dans la promotion des activités de recherche en collaboration.

Resumen

De mayo a diciembre de 1983 se celebró una conferencia internacional computarizada destinada a analizar temas relativos a la bioconversión de lignocelulosa en combustible, pienso y alimentos para el ser humano. La conferencia evaluó la conveniencia de la utilización de las conferencias computarizadas para facilitar las discusiones científicas y para explorar la aplicación de los temas discutidos a los esfuerzos de desarrollo. Los expertos que participaron en la organización y evaluación de esta actividad contribuyeron capítulos sobre antecedentes, organización, operación, evaluación y resultados. Los mismos reflejan las opiniones personales de los autores y ofrecen diferentes puntos de vista sobre estas actividades.

En términos generales, este grupo de usuarios opinó que la técnica de conferencias computarizadas resulta un medio viable para facilitar la investigación científica. Los investigadores de los países industrializados no consideraron muy valioso el contenido de estas discusiones; sin embargo, los investigadores de los países en vías de desarrollo estimaron que los temas tratados fueron pertinentes y apropiados. Esta actividad contribuyó sobre todo a aumentar el caudal de conocimientos relativos al empleo de esta técnica para facilitar la colaboración en las actividades de investigación.
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Evaluation of the Communication Mode

John B. Black

In summary terms, from a technical perspective, the 1983 computer conference on the bioconversion of lignocellulosics must be considered a success. This is not to say that there were no technical problems or complications. However, in general terms, the systems involved performed in a reliable manner such that technical considerations were not generally a stumbling block to successful participation in the activity. Not surprisingly, given the fact that even the use of a simple terminal was new to many of the participants, there were a number of individual cases of frustration, difficulty in gaining access, transmission problems, microcomputer operational difficulties, and related technical problems, but in general terms the communications technology aspects went well. As had been anticipated in advance, the one basic and central technical problem that did clearly affect participation was the difficulty (or in some cases the impossibility) experienced by some scientists in developing countries in gaining access to the international data-communications networks.

The decision to choose two well-established computer-conferencing systems as the hosts for this conference largely eliminated the basic host computer-conferencing system as a variable in the successful running of the activity. Both the Electronic Information Exchange System (EIES) and COM are mature systems with solid network access links and several years experience running large computer-conferencing activities. Although both systems underwent some hardware, software, or network access changes during the conference, these alterations did not provide any significant interruption to the conference itself.

In the report to follow, a number of specific technical issues will be identified and addressed along with some related human interaction problems, legal/political/regulatory issues, and the always present question of financial implications.

Technical Problems Identified

(a) Network access (or more specifically, the lack of it) proved to be a major problem for many would-be participants from developing countries and even some in certain industrialized countries. In many developing countries, direct access to the international data networks was simply not available and the alternatives (e.g., direct long-distance voice-line telephone calls to the nearest data network node) were either too expensive or unreliable or both. Although while this situation is improving with some rapidity (e.g., see Appendix 1 for a list of current Telenet access locations) developing-country scientists still face some major obstacles in

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1McLaughlin Library, University of Guelph, Guelph, Ontario, Canada N1G 2W1. (Research reported here was funded by the United Nations University.)
this regard when they contemplate using computer conferencing as a regular research communications tool. Even in the case of some industrialized countries, such as Japan, major difficulties were experienced by participants who attempted to use international access arrangements that were supposed to be in place.

(b) The local telecommunications links into the international data networks also proved to be an area of potential (and real) difficulty for many developing-country participants, particularly those located outside the capital or other major cities. In some cases, the infrastructure simply did not exist (e.g., one participant had to travel 1 hour by car to reach a location with a link to the networks) or reliability was so low as to make regular use of the facilities difficult, discouraging, or impossible.

(c) A number of other local data-access or terminal-related difficulties were reported by participants in response to the general questionnaire. These included unreliable terminals, complexity of still evolving modem/network standards, lack of information on or understanding of particular technical requirements (e.g., Bell 103 vs CCITT modem standards), microcomputer hardware problems, microcomputer communications software problems, lack of training in use of the equipment, and lack of experience in use of terminals, microcomputers, or data networks.

All of these contributed to a feeling of frustration and a lack of regular participation by some of those who had intended to be involved in the conference on a regular basis. Although specific examples of the difficulties encountered by participants in this exercise could be given, it is more useful to recognize the areas that would require particular attention in any future endeavour. Given the rapidly changing technologies involved, the specifics will certainly have changed in the interval since the conference, but the areas identified already highlight some of the potential difficulties.

(d) Conducting the conference on two host systems introduced some technical complications, particularly for the conference organizers. This was especially the case during the synchronous phase in December. Initially, the transfer of conference entries from the EIES-based conference to the COM-based activity was done entirely manually through the use of a microcomputer as a transfer vehicle. Conference entries from EIES or COM or both were downloaded to disk files on a microcomputer, slightly edited to remove any characters (including blanks in the wrong place) that would confuse the other system (such as the "- - - - - -" line in COM entries that on uploading to EIES caused the system to log the user off), and then loaded into the other host by entering its editor program and uploading the message or conference comment. Maintaining the individual nature of conference messages and attempts to provide appropriate links to other related comments made this a complex, laborious, and time-consuming task. During the course of the conference, the initial methodology was improved on by the COM system operator and, toward the end of the activity, the access to the intersystem MAILNET facility was implemented, further improving the transfer operation. This facility, how-

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2 In the spring of 1984, the Stockholm-based QZ computer centre (COM's homebase) began to offer a service to the United States based EDUNET educational computing consortium members to provide home delivery of COM mail and conference entries to the participants' local computer facilities.
ever, has not been fully implemented for conference messages (as opposed to personal messages) and the problem clearly illustrates the still developing state of the art in computer conferencing. Although the situation is improving, much remains to be done.

(e) Individual participants appeared to have varying degrees of success in creating conference comments and messages on their local microcomputer systems and then subsequently uploading them to EIES or COM or both. The problems encountered included:

- Complications introduced by particular characteristics of the international data networks and a lack of understanding by many users of the very complex network parameter settings sometimes required to facilitate such transfers;
- Lack of experience, familiarity, and confidence with the microcomputer communications software being used to upload/download the data; and
- Misunderstandings about the sequences required to interact with the host systems to complete these functions successfully.

It is evident that streamlining this aspect of the process would ease the frustration level of many participants in the future and enhance their effective use of both telecommunications networks and host systems. At low transmission speeds (e.g., 300 baud) the actual cost savings are relatively limited, but the opportunity to use local (and generally much more familiar) editing systems for the creation of conference entries is a great advantage.

(f) The lack of a means of displaying graphics and special symbols proved to be a problem for some participants. Even relatively simple tables represented a complex data input task because no assumptions could be made about the capabilities of the terminals that might be used to access the system. Use of special graphics characters, formatting commands, cursor positioning codes, and other such display tools were eliminated. In addition, particular implementations of the American Standard Code for Information Interchange (ASCII) code occasionally provided some confusion for other participants (e.g., some of the characters used on Scandinavian terminals produced unexpected characters on U.S. terminals and vice versa).

(g) "Information overload" was a term that appeared from time to time in the conference itself and in questionnaire responses, particularly with reference to the December "synchronous phase." From a technical perspective, this clearly indicates the need for simple to use but more sophisticated information retrieval software tools to enable participants to cope with the volume of material that can appear in a very active conference. The existing search and retrieval tools available on the two host systems did not appear to be able to meet the perceived needs of many participants who did not develop sufficient fluency with the host systems to exploit fully the tools available to them (e.g., the "tree" command in COM).

through MAILNET. In this way new entries in COM conferences to which an EDUNET participant is registered can be delivered automatically through MAILNET. Similarly, comments can be entered into COM conferences directly by transferring them through MAILNET to COM. EDUNET News, 31 (Spring 1984), p. 2.
Human Factors Related to Technical Aspects

Although the human aspects of the conduct of this computer-conferencing activity are being discussed in detail elsewhere, there are a number of human dimensions that are very closely related to the technical aspects under discussion here. These include:

(a) An apparent lack of computer literacy on the part of many participants was illustrated by their inexperience in the use of terminals, microcomputers, networks, or electronic messaging systems, let alone previous experience with computer conferencing systems per se. At the same time, it was evident that many of these same participants were very anxious to use this opportunity to develop their own knowledge and experience in this area and approached this exercise in a very positive fashion.

(b) The need for more (and better) manuals and training aids was also evident in the questionnaire responses. Some apparent inaccuracies in the manuals supplied for this conference were reported, but, more important, a number of participants touched on the need for a more extensive (and in some cases more basic) range of manuals and documentation as well as some training sessions for prospective conference.

(c) The lack of local support systems related to the technical aspects of the conference was evident in the case of many participants. This was particularly true for some of the developing-country participants who were faced with situations where there was very limited local support or expertise available in this field. Surprisingly, at least to this evaluator, the same problem was also reported by some industrialized-country participants. To quote one frustrated respondent from a major United States university, “I work surrounded by so called computer experts. I was rarely able to gain help from them. They were just too busy.” It is thus apparent that from the point of view of the technical use of the system, the successful conduct of a computer-conferencing activity is very dependent on the existence and ready availability of good training/operations materials, handholding and local support, and the regular reinforcement of the participants developing skills. Without considerable attention to this aspect, the likelihood of a successful conferencing program is much reduced.

(d) In the context of support systems, the essential role of the communications manager or facilitator in an activity such as this one became increasingly apparent in retrospect. As part of the broader support system, this person (or persons) must be readily accessible to provide assistance, advice, handholding with regard to the host conferencing system, communications networks, terminals, modems, microcomputers, communications software, and, most important, the interconnection and interaction of all of these. More than just technical information and knowledge is required, as such a facilitator must also have: a sympathetic view of the technologies involved; an understanding of human communications processes; broad communications skills; the ability to deal with a wide range of user experience, skills, and personal inclinations; time to deal with problems as they arise and to ensure that users feel there is someone approachable; and the facilities to be accessible to all types of users, by whatever means.
The obverse of this support system should also be noted, participants must be willing to take the time and make the effort to contact the support people who are available. Like most other aspects of human communications, this must be a two-way flow.

(e) The decision was made to operate the bioconversion of lignocellulosics conference as an "open conference" accessible to any user of either host system rather than as some sort of limited access discussion. It is probable that this open atmosphere had some impact on the kinds of discussion that took place (or did not take place) and other alternative formats should be kept in mind for future conference activities. COM provides facilities for public (open) conferences — any user of the system can join, private (closed) conferences — the organizer must enroll the users he or she wishes to admit, restricted — only a certain group can join, and protected — nonmembers cannot even get information about the existence of this conference.

EIES has similar arrangements for public conferences — anyone can join, private conferences — the moderator must enrol the user, and group conferences — membership based on group identification (ids) plus others enrolled by the moderator.

Thus, a number of alternative arrangements are possible to meet the specific requirements of a given conferencing situation and must be considered thoroughly when establishing a conferencing activity.

Political/Legal Issues Related to Technical Aspects

In the context of the technical aspects of the conduct of this computer conference, two political/legal aspects surfaced with some regularity, particularly, but by no means exclusively, in regard to developing countries.

(a) At the governmental level there are a number of political or legal barriers that appear to inhibit access to the international data networks. These took a number of forms including an apparent lack of interest in developing the necessary telecommunications links, excessive or tardy bureaucratic mechanisms for making the appropriate arrangements even where direct technical problems were not a barrier, and the presence of regulations regarding the movement of data within a nation or across international borders.

(b) In many states the telecommunications authorities (usually a government department, state-owned corporation, or other state agency) maintain very rigid control over who can connect what device to the telecommunications network. In some cases, this simply inhibits connection to international telecommunications networks or increases the operating costs. In other cases, these same controls are used to block access to international data networks and services.

(c) A related problem appeared in the form of organizational bureaucracies that inhibited participation even when the direct technical telecommunications access problems had been sorted out. For example, one organization apparently took most of 1983 to straighten out the arrangements for funding for its scientists to participate, by which time the conference itself was virtually over.
Financial Problems

The high cost of systems access and telecommunications was perceived as a problem by many participants, particularly (but not exclusively) those outside the United States. The cost factors involved included: terminal devices and modems, microcomputers and modems, telecommunications, and host-system costs.

The normal EIES monthly charge (US$75.00) was cited as being too expensive (even though alternative arrangements for a usage-based fee had been made for this conference) and the cost for use of the international data networks to reach the host systems was also mentioned in questionnaire responses. For developing-country participants, the lack of direct access to the international packet-switched data networks compounded this problem because it necessitated direct long-distance voice-line telephone calls that were very expensive as well as often being unreliable.

Appendix 2 and Appendix 3 provide some indication of the costs involved in accessing COM and EIES during the period of this conference. For those participants (or would-be participants) without direct access to the international packet-switched data networks, the costs were dramatically higher owing to the necessity of using regular, voice-grade long-distance telephone lines to get to the nearest data-network node. Costs of $1.00 to $5.00 per minute are routine for this type of access and obviously have a considerable impact on the viability of computer conferencing as a worldwide communications and information exchange medium.

Conclusions

A number of general conclusions can be made regarding the technical aspects of this international computer-conferencing activity, and it is clear that the experience gained will provide useful guidance to future conference planners.

(a) The host systems used were reliable and did provide a sound technical basis for the conference activity. Some individual problems with use of the host software were encountered, but often these were due to a lack of training, documentation, or experience. The host systems, per se, were not barriers to participation. Running the conference on two host systems did provide some added technical complications, especially for the conference organizers, and the need for the development of simple and effective intersystem links is indicated very clearly.

(b) The international data networks were largely reliable, where access to them existed. Difficulty of gaining access to these networks, however, highlighted the problem faced by scientists in many developing countries (e.g., Guatemala, India, or Kenya). Even when the access was theoretically available, actually using it was sometimes another matter. The difficulties experienced by participants in Japan, for example, provide some vivid indications of the still tenuous nature of some of these links.

(c) There is a need to bring appropriate persuasion and pressure to bear on governments and telecommunications carriers to expand international data-
network access (and the supporting domestic infrastructure) as a means of improving scientific information exchange with and transfer to developing countries. A failure to take these steps will even further widen the gap between technologically developed and developing countries.

(d) Both the perception and the reality of high cost proved to be something of a barrier to participation in the conference and illustrates the need for the most effective and efficient telecommunications access possible. At the same time, the need for the development of mechanisms that could facilitate low-cost access to such international computer conferences is highlighted (e.g., local/regional nodes that could link into larger international conference activities).

(e) Equipment for accessing the computer conference (i.e., terminals, microcomputers, telecommunications links) needs to be available close at hand if people are to use them readily. It is not just a question of personal convenience, but if use of the computer-conferencing system (and its associated private-messaging facilities) is to become an integral part of the professional life of a scientist (or a scientific group) then the access tools must also be integrated into their regular activity.

(f) Simple, reliable, and low-cost communications software for a wide variety of microcomputer systems should be made available to conference participants to enable them to reduce connect time costs (especially telecommunications costs) and maximize their level of participation. Essential features that must be supported include:

- Terminal emulation (the facility to emulate "dumb" terminals as well as at least a limited range of standard terminal types),
- Redirection of data being transmitted or received to a printer,
- Uploading (transmission from a remote system to a host) and downloading (reception of data from the host to a local system) with at least some error-checking protocol support, and
- Reliable operation at 300 and 1200 baud.

There are a number of communications software packages in the marketplace that could meet these requirements (and more) and selection of one or two of these for use in the context of a specific conference environment would certainly simplify the provision of support to end users.

(g) The essential nature of good technical manuals, training, and ongoing handholding or user assistance is also very clearly indicated as essential to the success of future conference activities. On-the-spot assistance and trouble shooting is most effective, but the same result can be achieved, to some extent, by remotely located "colleague advisers" who are prepared to assist other participants by telephone, telex, electronic message, or post.

(h) Some participants seemed to be relatively easily discouraged and to require considerable positive reinforcement to maintain their status of regular involvement. Some of this discouragement was related to technical aspects of conference participation, such as the case of one questionnaire respondent who reported, "initial transmissions were garbled on my Apple so I terminated." One would hope that his staying power was greater in other fields of scientific endeavour.
Future Technical Possibilities

The technologies used in computer conferencing and related applications are in a constant and rapid state of development and change. The facilities available today far exceed those we would have anticipated even a few years ago and this evolution will no doubt continue in the years ahead. Among trends that are of particular interest in this context one must include:

(a) New and improving access networks and methods. The worldwide web of interconnected digital data networks is expanding and more developing countries are being added constantly. In addition, steps toward the development of a worldwide ISDN (Integrated Services Digital Network) are also continuing even though full realization of such a network is still some time away. Of perhaps more interest to developing countries is some of the work being done in the development of new, low-cost satellite technology for data distribution such as that using spread spectrum transmission techniques. One implementation of this approach, currently in a pilot-project phase, is the IBINET being developed by the Intergovernmental Bureau for Informatics. Other commercial ventures are also emerging. The use of low-cost (high frequency or very high frequency) radio links for "packet radio" systems is being pioneered by many amateur radio operators in Canada and the United States and has considerable potential in many developing countries.

(b) Much more powerful and useful portable computers are appearing on the market with considerable regularity and provide the potential for complete local editing/input stations that are independent of local power supplies (often a source of problems in developing countries) have the facilities to create, edit, and manipulate text and have built-in communications hardware/software. This market has grown rapidly in the past 2 years and will no doubt continue to be one of the most rapidly changing aspects of the microcomputer industry.

(c) International variations in modem standards and requirements haunted a number of participants in this conference (for example, having a terminal with a built in International Telegraph and Telephone Consultative Committee (CCITT) modem when the data port that the participant was trying to use was configured for a Bell 103 standard modem). There is, however, some indication that relief is in sight for this problem with the increased availability of multistandard modems at reasonable prices. As in many other instances, technology is solving the problem with the development of "smart" VLSI (Very Large-Scale Integration) modem chips that can deal with a number of different transmission standards and signalling requirements. Economical, higher-speed modems (e.g., 2400 baud) are also entering the marketplace and will have a significant impact on North American data-communications activity in the next few years.

(d) It is likely that there will be an increasing trend toward the development of local/regional computer-conferencing systems running on smaller, lower-cost computer systems during the next few years. These will, in turn, be linked into other national and international systems to provide participants with broader access to conferencing activities. Development of the PORTACOM system (based

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on the functionality of COM) and the University of Guelph’s COSY system (which will run on virtually any UNIX system) are significant indications of movement in this direction.

Conclusion

The technical aspects of computer conferencing will gradually fade into the background and become less of a factor in the effective use of this powerful tool for scientific communications and information exchange. Nonetheless, in the foreseeable future, the role of the communications or technical facilitator will remain an integral part of the successful use of this application of computer, information, and communications technology. Although the technical basis required is gradually becoming simpler and more readily available, without this facilitating support and ongoing assistance, it will be difficult for scientists (or other users) to concentrate on the main object of the exercise, increasing the effective flow of scientific and technical information.
### Appendix 1

Summary of Telenet Rates (as of June 1984).

<table>
<thead>
<tr>
<th>Country</th>
<th>Connect charge</th>
<th>Volume charge</th>
<th>Service</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Inbound from foreign locations to Telenet/U.S.</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alaska</td>
<td>6.50/Hour</td>
<td>7.00/KP</td>
<td>P/L</td>
</tr>
<tr>
<td>Argentina</td>
<td>30.00/Hour</td>
<td>1.50/KC</td>
<td>P/L</td>
</tr>
<tr>
<td>Australia</td>
<td>12.00/Hour</td>
<td>.60/KC</td>
<td>P/L</td>
</tr>
<tr>
<td>Austria</td>
<td>360.00/Hour</td>
<td>8/KC</td>
<td>P/L</td>
</tr>
<tr>
<td>Bahamas</td>
<td>12.00/Hour</td>
<td>.51/KC</td>
<td>P/L</td>
</tr>
<tr>
<td>Bahrain</td>
<td>5.70/Hour</td>
<td>.29/KC</td>
<td>P/L</td>
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<tr>
<td>Barbados</td>
<td>$19.80/Hour</td>
<td>$10.90/KC</td>
<td>L</td>
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<td>Belgium</td>
<td>360.00/Hour</td>
<td>250/KS</td>
<td>P/L</td>
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<td>Bermuda</td>
<td>10.20/Hour</td>
<td>.45/KC</td>
<td>L</td>
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<td>Brazil</td>
<td>GF138/Hour</td>
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<td>P/L</td>
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<td>.65/KC</td>
<td>P/L</td>
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<td>Colombia</td>
<td>20.00/Minute</td>
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<td>.45/KC</td>
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<td>2.3/KC</td>
<td>P/L</td>
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<td>48/Hour</td>
<td>30/KS</td>
<td>P/L</td>
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<td>French Antilles</td>
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<td>P/L</td>
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<td>.29/KC</td>
<td>P/L</td>
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<td>480.00/Hour</td>
<td>24/KC</td>
<td>P/L</td>
</tr>
<tr>
<td>Mexico</td>
<td>$6.50/Hour</td>
<td>$7.00/KP</td>
<td>P/L</td>
</tr>
<tr>
<td>Netherlands</td>
<td>42/Hour</td>
<td>300/KS</td>
<td>P/L</td>
</tr>
<tr>
<td>New Zealand</td>
<td>12.00/Hour</td>
<td>60/KC</td>
<td>P</td>
</tr>
<tr>
<td>Norway</td>
<td>72/Hour</td>
<td>3.60/KC</td>
<td>P</td>
</tr>
<tr>
<td>Philippines</td>
<td>$12.00/Hour</td>
<td>$0.60/KC</td>
<td>P/L</td>
</tr>
<tr>
<td>Portugal</td>
<td>1.2/Hour</td>
<td>35/KC</td>
<td>P</td>
</tr>
<tr>
<td>Puerto Rico</td>
<td>$5.00/Hour</td>
<td>$4.00/KP</td>
<td>P/L</td>
</tr>
<tr>
<td>Qatar</td>
<td>5.7/Hour</td>
<td>.29/KC</td>
<td>P/L</td>
</tr>
<tr>
<td>Saudia Arabia</td>
<td>5.7/Hour</td>
<td>.29/KC</td>
<td>P/L</td>
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<tr>
<td>Singapore</td>
<td>50/Hour</td>
<td>240.0/KS</td>
<td>P/L</td>
</tr>
<tr>
<td>South Africa</td>
<td>0.29/Min</td>
<td>12/KS</td>
<td>P/L</td>
</tr>
<tr>
<td>Spain</td>
<td>1000/Hour</td>
<td>50/KC</td>
<td>P/L</td>
</tr>
<tr>
<td>Sweden</td>
<td>120/Hour</td>
<td>60/KS</td>
<td>P/L</td>
</tr>
<tr>
<td>Switzerland</td>
<td>15/Hour</td>
<td>15/KS</td>
<td>P/L</td>
</tr>
<tr>
<td>Taiwan</td>
<td>480/Hour</td>
<td>24/KC</td>
<td>L</td>
</tr>
<tr>
<td>Thailand</td>
<td>$12.00/Hour</td>
<td>$0.60/KC</td>
<td>P</td>
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<tr>
<td>UAE</td>
<td>60/Hour</td>
<td>2.5/KC</td>
<td>P/L</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>4.80/Hour</td>
<td>3/KS</td>
<td>P/L</td>
</tr>
<tr>
<td>Virgin Islands</td>
<td>$10.00/Hour</td>
<td>$0.45/KC</td>
<td>P/L</td>
</tr>
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</table>

**Outbound calls from Telenet/U.S. to foreign locations**

<table>
<thead>
<tr>
<th>Country</th>
<th>Connect charge</th>
<th>Volume charge</th>
<th>Service</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alaska</td>
<td>6.50/Hour</td>
<td>7.00/KP</td>
<td>P/L</td>
</tr>
<tr>
<td>Australia</td>
<td>12.00/Hour</td>
<td>16.00/KS</td>
<td>P/L</td>
</tr>
<tr>
<td>Belgium</td>
<td>10.00/Hour</td>
<td>12.00/KS</td>
<td>P/L</td>
</tr>
<tr>
<td>Brazil</td>
<td>12.00/Hour</td>
<td>16.00/KS</td>
<td>P/L</td>
</tr>
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</table>

(continued)
Appendix 1. Concluded.

<table>
<thead>
<tr>
<th>Country</th>
<th>Connect charge</th>
<th>Volume charge</th>
<th>Service</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada</td>
<td>4.50/ Hour</td>
<td>4.20/KP</td>
<td>P/L</td>
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<tr>
<td>Chile</td>
<td>12.00/ Hour</td>
<td>12.00/KS</td>
<td>P/L</td>
</tr>
<tr>
<td>Dominican Rep.</td>
<td>8.00/ Hour</td>
<td>8.00/KS</td>
<td>P/L</td>
</tr>
<tr>
<td>France</td>
<td>10.00/ Hour</td>
<td>12.00/KS</td>
<td>P/L</td>
</tr>
<tr>
<td>Gabon</td>
<td>12.00/ Hour</td>
<td>16.00/KS</td>
<td>P/L</td>
</tr>
<tr>
<td>Greece</td>
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<td>P/L</td>
</tr>
<tr>
<td>Hawaii</td>
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<td>3.75/KP</td>
<td>P/L</td>
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<tr>
<td>Ireland</td>
<td>10.00/ Hour</td>
<td>12.00/KS</td>
<td>P/L</td>
</tr>
<tr>
<td>Israel</td>
<td>12.00/ Hour</td>
<td>16.00/KS</td>
<td>P/L</td>
</tr>
<tr>
<td>Japan</td>
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<td>Luxembourg</td>
<td>10.00/ Hour</td>
<td>12.00/KS</td>
<td>P/L</td>
</tr>
<tr>
<td>Mexico</td>
<td>6.50/ Hour</td>
<td>7.00/KP</td>
<td>P/L</td>
</tr>
<tr>
<td>Netherlands</td>
<td>10.00/ Hour</td>
<td>12.00/KS</td>
<td>P/L</td>
</tr>
<tr>
<td>Puerto Rico</td>
<td>5.00/ Hour</td>
<td>4.00/KP</td>
<td>P/L</td>
</tr>
<tr>
<td>Singapore</td>
<td>12.00/ Hour</td>
<td>16.00/KS</td>
<td>P/L</td>
</tr>
<tr>
<td>South Africa</td>
<td>12.00/ Hour</td>
<td>16.00/KS</td>
<td>P/L</td>
</tr>
<tr>
<td>Sweden</td>
<td>10.00/ Hour</td>
<td>12.00/KS</td>
<td>P/L</td>
</tr>
<tr>
<td>Switzerland</td>
<td>10.00/ Hour</td>
<td>12.00/KS</td>
<td>P/L</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>10.00/ Hour</td>
<td>12.00/KS</td>
<td>P/L</td>
</tr>
</tbody>
</table>

Note: For inbound calls, a superscript "a" indicates charges are in U.S. dollars; all other charges are in local currency. All outbound calls charged in U.S. dollars. P = Public Dial-In Service, L = Leased Line Service, KP = Kilopacket, KS = Kilosegment, and KC = Kilocharacter.

Appendix 2

Examples of Telenet International Access Arrangements
(in place as of June 1984).

ARGENTINA TO TELNET/U.S.:
Public Dial-In Service at 110-300 bps
Leased Line Service at 110-300 bps

RATES:
Subscription Charge: None
Connection Charge: 30 Gold Francs/Hour
Traffic Charge: 1.50 Gold Francs/Kilocharacter
Minimum Charge: 30 Gold Francs
Telephone Access Charge: None

GATEWAY LOCATION:
Buenos Aires

BAHRAIN

BAHRAIN TO TELNET/U.S.:
Public Dial-In Service at 110-300 bps, 1200 bps
Leased Line Service available

RATES:
Subscription Charge: 25 Dinar/Month
Connection Charge: 5.7 D/Hour
Traffic Charge: .29 D/Kilocharacter
Minimum Charge: 1.4 D/Session
Telephone Access Charge: .26 D/Connection

GATEWAY LOCATION:
Hong Kong, New York
(continued)
BRAZIL/INTERDATA

BRAZIL TO TELNET/U.S.:  
Public Dial-In Service at 300 bps  
Telex Access at 50 bps (dial in service)  
Leased Line Service up to 1200 bps  

RATES:  
- Subscription Charge: 180.00 Gold Francs (one time fee)  
- Traffic Charge: 3.80 Gold Francs/Kilocharacter  
- Connection Charge:  
  - Public Dial Service: 138.00 Gold Francs/Hour  
  - Telex Access: 54.00 Gold Francs/Hour  
- Minimum Charge: for dedicated service only  
- Taxes: 5% surcharge on all charges  

GATEWAY LOCATION:  
Rio de Janiero  

HONG KONG/IDAS

International Database Access Service

HONG KONG TO TELNET/U.S.:  
Leased Line Service at 110-300 bps and 1200 bps  

RATES:  
- Subscription Charge: 300.00 HK/Month for 300 bps  
  450.00 HK/Month for 1200 bps  
- Line Charge: 148.00/Month  
- Modem Charge: 155.00 HK/Month (110-300 bps)  
  355.00 HK/Month (1200 bps)  
- Connection Charge: 60.00 HK/Hour  
- Traffic Charge: 100.00 HK/Hour  
- Minimum Charge: 2.00 HK/connection + 10 segments  
- Telephone Access Charge: None  
- Installation Charge: 580.00 HK one time for line  
  200.00 HK one time for modem  

GATEWAY LOCATION:  
Hong Kong  

ITALY

ITALY TO TELNET/U.S.:  
Public Dial-In Service at 110-300 bps  
Leased Line Service available up to 1200 bps  

RATES:  
- Subscription Charge: 10000 L Monthly per user name  
- Connection Charge: 277.60 L/Minute  
- Traffic Charge: 160.00 L/Kilocharacter  
- Minimum Charge: 1 Minute/Kilocharacter  
- Telephone Access Charge: Varies with distance  
- Data Transmission  
- Government Tax Charge: 10000 L Monthly  
- Modem Rental (300 bps): 22835 L Monthly (if required)  

GATEWAY LOCATION:  
Rome, Milan  

(continued)
IVORY COAST

IVORY COAST TO TELNET/U.S.:
  Public Dial-In Service up to 4800 bps
  X.25 Leased Lines up to 4800 bps

RATES:
  Subscription Charge: None
  Connection Charge: 82.0 F/Hour
  Traffic Charge: 62.0 F/Kilosegment
  Minimum Charge: 10 Segments

GATEWAY LOCATION:
  Paris, France

JAPAN TO TELNET/U.S.:
  Public Dial-In Service up to 1200 bps
  Leased Line Service up to 9600 bps

RATES:
  Subscription Charge: 300 Y/Account
  Connection Charge: 2700 Y/Hour
  Traffic Charge: 3000 Y/Kilosegment
  Minimum Charge: None

GATEWAY LOCATION:
  Tokyo, Osaka

CARRIER:
  ITT, RCA, WUI

Protocols for Leased Line Service:
  X.25 (LAP-8)
  HDLC (ISO)
  BSC (IBM 2780/3780)

Rates for Leased Line Service:
  Installation Charge: 80000 Y one time for 300 bps
  For 300 bps: 21400 Y/Month
  For 1200 bps: 28200 Y/Month
  For 2400 bps: 48000 Y/Month
  For 4800 bps: 75000 Y/Month
  For 9600 bps: 114000 Y/Month

SINGAPORE

SINGAPORE TO TELNET/U.S.:
  Public Dial-In Service up to 1200 bps
  Leased Line Service up to 1200 bps

RATES:
  Public Dial Service:
    Subscription Charge: 50.0 SGB/Month per ID
    Connection Charge: 30.0 SGB/Quarter
    Traffic Charge: 24.0 SGB/Kilosegment
    Minimum Charge: 10.0 SGB
    Telephone Access: 75.0 SGB/Quarter
    Modem Charge: 50.0 SGB/Quarter
    License Fee: 10.0 SGB/Quarter
    Installation (one time): 100.0 SGB for Modem
    50.0 SGB for Telephone

(continued)
Appendix 3

Systems Access Costs

It is difficult and inappropriate to attempt a direct cost comparison of the use of the two computer-conferencing host systems involved in the bioconversion of lignocellulosics computer conference because the charging philosophies are dramatically different and could only be compared by a detailed examination of individual use patterns. An outline of the basic charging methodologies of the two systems will, however, give some indication of the order of the costs involved.

The usual EIES charges are based on a flat fee of US$75.00 (regardless of the amount of usage) per month for each user ID plus telecommunications costs. This includes a data-storage allowance of US$30.00/month (more than sufficient for most users). In addition, EIES offers “group accounts” at US$200.00/month for the basic account (including one full “class 1” user account) plus US$10.00/month for each additional user ID and then US$8.00/hour for use of the system. For this conference, special arrangements were also made for participants to have “class 2” accounts on the basis of US$8.00/hour for use of the system with a US$25.00 monthly use minimum (class 2 users were subject to a lower priority for access at certain times of day and did not have access to private storage facilities).

In addition to these costs, users must also cover the necessary telecommunications costs to reach EIES. For North American users, the packet-switched network access is on a “collect call” basis with EIES billing the costs back to users at the following hourly rates: US$7.00 for Uninet, US$9.00 prime time via Telenet, US$6.00 weekends and 2400 to 0600 hours via Telenet, US$10.50 Canada and Hawaii, and US$18.00 Alaska. “Off-shore” users must pay their telecommunications costs at the rates indicated in Appendix 1.

Typical basic costs for a “university user” (subject to a multiplier for other classes of users) are given in a COM paper by Jacob Palme “COM Usage Costs” dated 1983-12-31. Expressed in Swedish Kroner (SEK) these are: fixed fee per month, 12.20; entering COM and exiting directly, 6.40; reading a COM entry of 6 lines, 0.95; writing a COM entry of 6 lines, 5.74; reading a COM entry of 100 lines, 2.51; and writing a COM entry of 100 lines, 10.60.

In the same paper the cost of gaining access to COM from outside Sweden is estimated as being 40 SEK/hour from other Scandinavian countries, 80 SEK/hour from other European countries, and 160 SEK/hour from North America.

The COM charging methodology is more complex than that used by EIES and includes a number of components plus a differential for various types of users as well as the time of day/day of the week when the system is used. Assuming the “university rate” as a basis, other “public research organizations” pay 1.6 times this rate and “other” users 2.2 times the university rate. COM usage charges are based on office hours (0700-1700 weekdays) as 1, 1700-2000 multiplied by a factor of 0.6, 2000-0700 plus all day Saturday and all day Sunday are multiplied by 0.3.
Appendix 4

Examples of Local Site Equipment Costs

Prices of microcomputers, terminals, and modems are changing constantly, therefore, making it very difficult to give any firm cost estimates that will apply at any particular point in the future. The following examples are based on U.S. price levels in early 1984, and by the time such equipment is in place in other countries the cost may well be two or three times the levels indicated here.

Three levels of configurations are indicated:

- "Dumb" video display Terminal and Modem: terminal, US$600; modem (300 baud), US$150; and (optional printer), US$750.
- "Dumb" printing terminal: Terminal, US$1000 and Modem (300 baud), US$150.
- Basic microcomputer system: two disk drives, display, communications software, US$2000; Modem (300 baud), US$150; Modem (1200 baud), US$700; and Printer, US$750.

1The information found in Appendices 1 through 4 is provided for illustrative purposes only; its accuracy cannot be guaranteed.