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Internet user profile in the field of parasitology

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Abstract This study determined a profile of current Internet users in parasitology, their use patterns on the Internet for parasitologic purposes, and the Web sites they would recommend. In a European survey, 689 parasitologically engaged scientists were asked to fill out a questionnaire about Internet access, current problems, current and future use, and which Web sites they would recommend as well as about the use of e-mail. In all, 153 (22.2%) of the interviewees returned the questionnaire. Only one participant had no access to the Internet. Time expenditure was considered the main problem involved in use of the Internet. The Internet was mainly used for e-mail (96.1%); for literature research (93.5%); for reading of electronic journals (51.6%); and for gathering of information, e.g., about institutes and colleagues (58.2%) and about congresses (49.7%). In the future, 71.9% of the respondents would like to read electronic journals more often and 49.7% would like to use the web more intensively for acquisition of information about congresses, universities, and institutions. Requests for the future included an easier application of the browser software (33%) and a shorter response time (47.7%). The survey demonstrates that the Internet has assumed a definite place in the lives of researchers in the field of parasitology. Survey responses indicate a need for electronic journals. In our opinion, universities and parasitology societies should be urged to publish journals electronically on the Web. To diminish current problems involved in the finding of relevant information on the Internet, we strongly recommend careful reading of the instructions regarding the search engines used.

Web pages with clear structures, small file sizes, precise HTML (hypertext markup language) key-word editing, and page titles would facilitate more accurate discovery of specific sites. In addition, there seems to be a need for regular publication of reviewed parasitology-link collections.

Introduction

The Internet has revolutionized the computer and communications world like nothing before. It simultaneously provides a worldwide broadcasting capability, a mechanism for information dissemination, and a medium for collaboration and interaction between individuals and their computers without regard for geographic location (Leiner et al. 1998). The Internet represents significant advances in the retrieval and dissemination of scientific information and in the advancement of education (Barrie and Presti 1996; Lawrence and Giles 1998). It is becoming of increasing importance in the field of parasitology (Coppel 1996; Taverne 1997, 1998a–d).

The aim of the present study was to evaluate the extent to which parasitologists (with the main focus being placed on parasitologists working in the field of water-related parasitology) use this new medium and the purposes for which they take advantage of the Internet.

Methods

A European survey was conducted among researchers working in the field of parasitology. To establish a current data base of active researchers, we search the Medline (NLM), Current Contents (ISI), and Embase (Elsevier) data bases for scientists who had published articles related to parasites from the beginning of 1992 until May 1999. The corresponding author was chosen as a contact for the study. In a subsequent mailing, 689 parasitologically engaged scientists were asked to fill out a questionnaire and to return it per mail or fax.

The interviewees were asked for a self-assessment of their computer knowledge, of where (e.g., office, library, home) and how

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often they had access to the Internet, and of what prevented them from using the Net. Further questions covered the frequency of use (more than once daily, daily, weekly, monthly, sometimes, never), the time spent browsing the Internet on average, and the purpose of its use (e.g., e-mail, electronic file transfer, literature research, congress information). Contributors were asked how easy it was to find information on the Internet and whether they were satisfied with the available parasitology-related contents. Participants indicated the parasitologic purpose for which they used e-mail and the numbers of e-mail messages they sent and received per week. Further questions were related to the existence of their own home page, and they were asked if they recommended any Internet address. Participants were asked what they expected from the development of the Internet in the future. Finally, researchers were asked to give personal data (sex, age, country, profession). The results were summarized descriptively in tables and graphs. For purposes of statistical determination, chi-square tests with Cramer's *V* were applied.

Results

In reply to the 689 questionnaires originally sent out, 153 (22.2%) responses from 20 countries were received by November 30, 1999. Most responses came from Great Britain ($n = 37$, 24.2%), Germany ($n = 28$, 18.3%), and France ($n = 22$, 14.4%). The distribution of respondents by profession showed 71.2% ($n = 109$) to be parasitologists; 11.8% ($n = 18$), microbiologists; 2.0% ($n = 3$), students; and 17.0% ($n = 26$), others (e.g., physicians, molecular biologists, veterinarians, mycologists). In all, 22.2% ($n = 34$) of the respondents were department heads working as parasitologists and microbiologists.

The self-assessment of the level of computer knowledge showed a computer-literate group. Overall, 27.5% ($n = 42$) rated their computer knowledge as being either low or very low, whereas 64.7% ($n = 99$) indicated their level of knowledge as being high or very high and 5.2% ($n = 8$) found their level to be intermediate (2.6% did not specify their level of knowledge). Half of the interviewees (52.3%) accessed the Internet from two or more locations. The office was the most common access point

for the Internet (92.8%), followed by home (40.5%) and the library (22.2%; Fig. 1). All persons who had Internet access at home had it in the office as well. Only one participant had no Internet access.

Time expenditure was the major problem associated with Internet use, according to 49.7% ($n = 76$) of the responses (Fig. 2). The long response time ($n = 52$, 34.0%) and the superfluity of information ($n = 37$, 24.2%) were mentioned as further obstacles. Costs were mentioned by 8.5% ($n = 13$) as a hindrance. The availability of a connected PC was cumbersome for 7.2% ($n = 11$). Although 1.3% ($n = 2$) of the respondents indicated that use of the browser software posed a difficulty, none had a problem with the use of a PC. Overall, 35 (22.9%) respondents either did not have or did not specify any problem in using the Internet.

The Internet appeared to be a constant companion in the lives of the majority of the respondents. In all, 80.4% ($n = 123$) of them used the Internet more than once a day or daily; 13.7% ($n = 21$), weekly; 1.3% ($n = 2$), monthly; and 1.3% ($n = 2$), sometimes. Since the survey did not specify whether the Internet use was related to parasitology, we can assume that some portion of the use involved activities not related to parasitology. One-third ($n = 51$) of interviewees browsed the Internet for less than 15 min on average, 43.8% ($n = 67$) spent between 15 and 30 min on the Net, 11.8% ($n = 18$) used it for periods of 30–45 min, and 6.5% ($n = 10$) browsed for periods ranging from 45 min to 1 h. Only 2.0% ($n = 3$) spent more than 1 h on the Net on average (Fig. 3).

The Internet was used for different parasitologic purposes. The majority of respondents used the Net for e-mail (96.1%, $n = 147$) and literature research (93.5%, $n = 143$; Fig. 4). Additionally, they used the Internet for reading of electronic journals (51.6%, $n = 79$), for accessing of information about institutes and colleagues (58.2%, $n = 89$), and for gathering of information concerning scientific congresses (49.7%, $n = 76$). Responses revealed that the Net was used for acquisition of infor-

Fig. 1 Location of Internet access

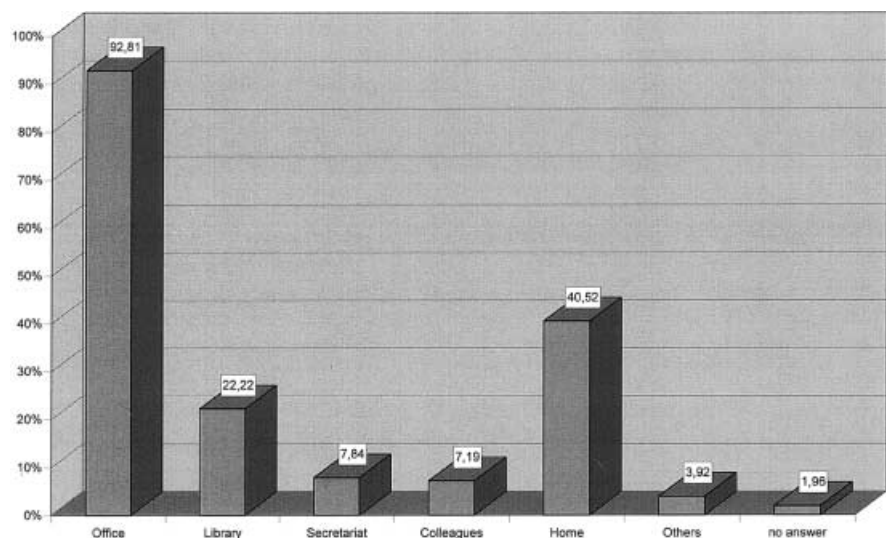


Fig. 2 Problems with the Internet

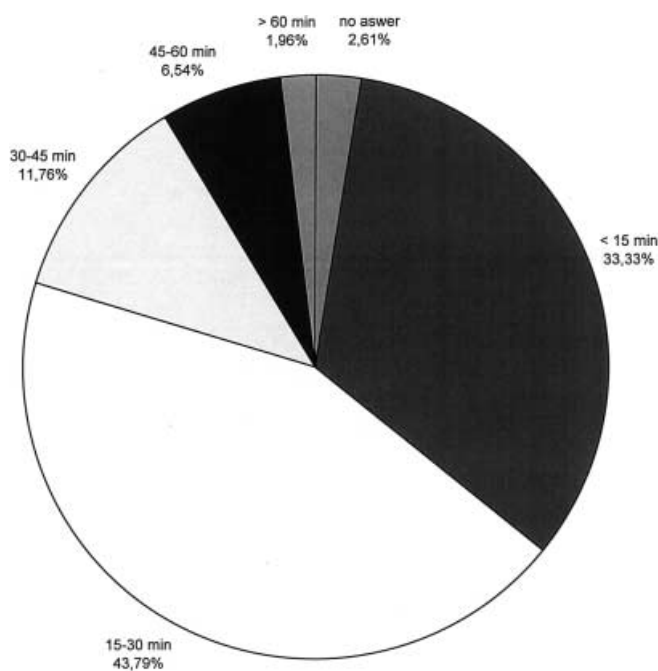
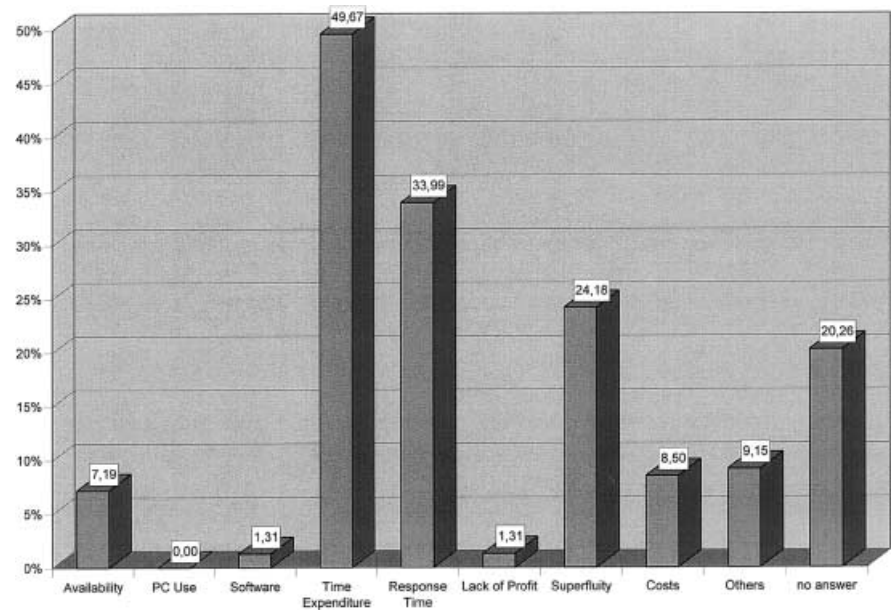


Fig. 3 Time spent browsing the Internet

mation about sequences (48.4%, $n = 74$) and techniques (24.2%, $n = 37$). In all, 45.8% ($n = 70$) of respondents applied the Internet for electronic file transfer, 30.1% ($n = 46$) used it for various Internet services (e.g., book shopping, travel information, reading of newspapers), and 19.6% ($n = 30$) used it for acquisition of information about commercials. Overall, 7.8% of the respondents participated in chat rooms and news groups. Three respondents utilized the Net for teleteaching and one microbiologist used it for teleconsulting; none of the interviewees applied it for telelearning.

A major proportion of the interviewees did not seem to have difficulty in finding information on the Internet. In all, 60.8% ($n = 93$) of respondents indicated that the finding of information was either very easy or easy. However, a significant 34.6% ($n = 53$) rated the location of information as not so easy to very difficult. Since the survey did not solicit information about the type of information respondents were seeking, these results may differ, depending on the information sought.

Overall, 58% ($n = 89$) of the interviewees were satisfied with the parasitology-related information available on the Internet, 30.1% ($n = 46$) were unsatisfied, and only 2.6% ($n = 4$) were very satisfied (9.2% did not specify the degree of their satisfaction).

In the future, 71.9% ($n = 110$) of the respondents would like to use the Internet more often for reading of electronic journals, whereas 49.7% ($n = 76$) would like to get more information about, e.g., congresses, universities, and institutions and 47.7% would like to get more specific information through the Net. An easier application of the browser software (33%, $n = 50$) and a shorter response time (47.7%, $n = 73$) were the requests for the future.

Most interviewees (96.1%, $n = 147$) used e-mail; 99.3% ($n = 146$) of those made use of it to communicate with colleagues; 55.8% ($n = 82$), to send papers and manuscripts to publishers; 54.4% ($n = 80$), to take part in a parasitology-related project; and 8.8% ($n = 13$), to communicate with clients (Fig. 5). Use of e-mail among respondents was relatively high; 56.4% ($n = 83$) sent between 10 and 50 e-mails per week, whereas 58.5% ($n = 86$) received as many messages. In all, 80.4% ($n = 123$) of the respondents indicated that they or their institution had their own home page.

Table 1 shows the Web sites that were recommended by the researchers asked. The chi-square test with Cramer's V was applied to show correlations between

Fig. 4 Use of the Internet

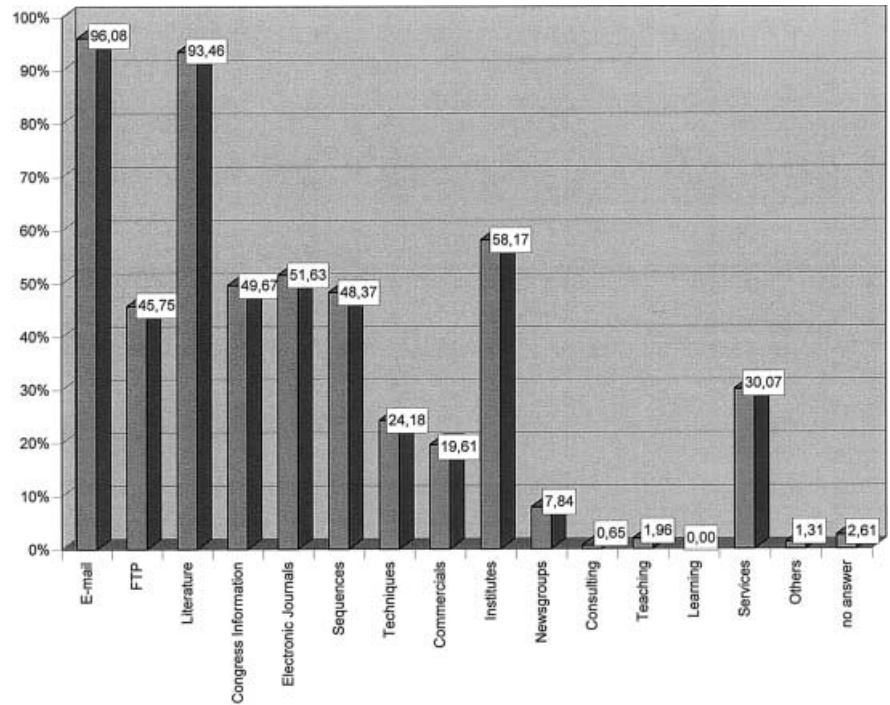
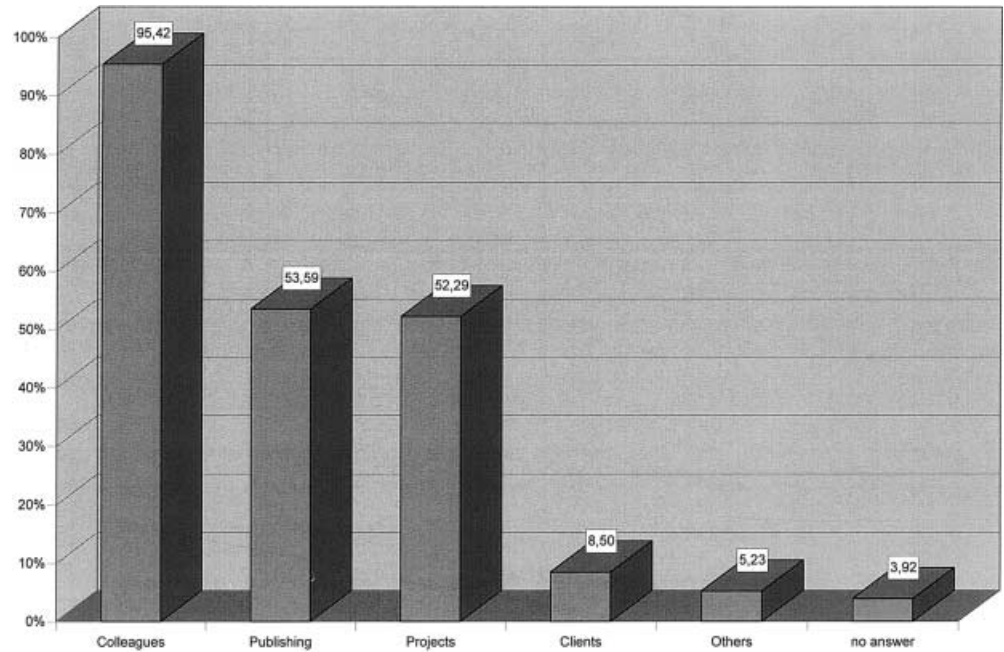


Fig. 5 Use of e-mail



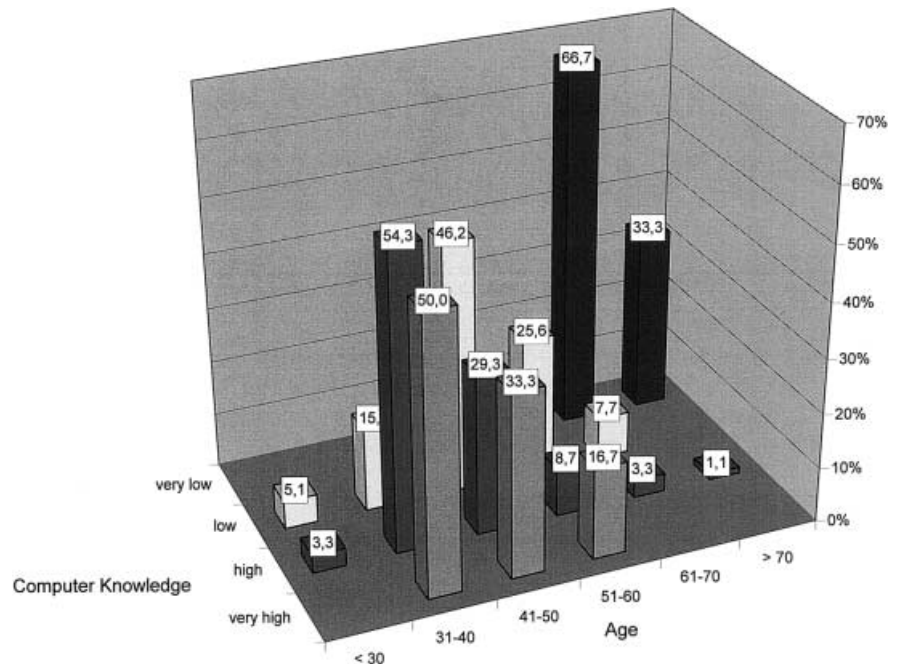
selected variables. The site of Internet access did not seem to have an influence on either the frequency of use or the time spent browsing the Net. The availability of Internet access had a positive effect on the frequency of browsing ($P < 0.001$, Cramer's $V = 0.558$). The chi-square test with Cramer's V did not show a correlation between the time spent browsing and the frequency of Internet use. More frequent browsing on the Net did not make information easier to find. Whereas a highly significant correlation ($P < 0.001$, Cramer's $V = 0.375$)

was found between the level of computer knowledge and the frequency of Internet use, the statistical test did not show a significant influence of the level of computer knowledge on the time spent browsing. That means that individuals with greater computer knowledge do use the Web more often but do not browse longer than those with less knowledge.

The age of the respondents did not have an influence on the ease with which information was found or on the degree of satisfaction with the parasitology-related

Table 1 Web sites recommended by European parasitologists

www.ncbi.nlm.nih.gov/PubMed/ www.tiho-hannover.de	National Library of Medicine, Center for Biotechnology Information Tierärztliche Hochschule Hannover Rouen University Hospital
dspace.dial.pipex.com/town/plaza/aan18/urls.htm www.malaria.org	David Gibson's Parasitological URLs Malaria Foundation International
www.lshtm.ac.uk/mp/bcu/enta/homef.htm www.biomednet.com/home	London School of Hygiene and Tropical Medicine, The <i>Entamoeba</i> Homepage The Internet Community for Biological and Medical Research
www.cdc.gov www.who.org	Centers for Disease Control and Prevention World Health Organization
now.ifmo.ru/amoebae www.ebi.ac.uk/parasites/parasite-genome.html	Institute of Fine Mechanics and Optics, Interactive Atlas of Gymnamoebae European Bioinformatics Institute, Parasite Genome Database and Genome Research Resources
www.nhm.ac.uk/hosted_sites/schisto	National History Museum, The WHO/UNDP/World Bank <i>Schistosoma</i> Genome Network
www.gigermd.com/search.html www.ucm.es/info/parasito	Best Search Engines Universidad Complutense de Madrid, Departamento de Parasitologia
www.inra.fr/ENG/index.htm www.ub.uni-heidelberg.de	Institut National de la Recherche Agronomique Universitätsbibliothek Heidelberg
www.uga.edu/~protozoa/ evol3.mbl.edu/Giardia-html/giardia_data.html	University of Georgia, Society of Protozoologists Marine Biological Laboratory, <i>Giardia lamblia</i> – Genome Sequencing

Fig. 6 Correlation between the level of computer knowledge and the age of the user

material on the Internet. The statistical analysis demonstrated a significance of approximately $P < 0.001$ (Cramer's $V = 0.340$) for the age of the interviewees and the self-assessment of their level of computer knowledge (Fig. 6).

Discussion

This European Internet survey was intentionally conducted by mail so as to avoid preselection of Internet users as contributors to the study due to the use of e-mail as the means of communication. Nevertheless, those researchers without Internet access might not have been interested in the survey and, thus, their response

rate might have been lower. However, only one of the respondents did not use the Internet. This clearly demonstrates that the Internet has assumed a definite place in the lives of researchers in the field of parasitology. Moreover, the relatively high response rate of 22.2% indicates a broad interest in this topic. Therefore, it is surprising that there have been only a few publications on this theme.

In our study, 49.7% of the respondents considered the time expenditure as the main problem. One reason for this is the long response time, which was indicated as a hindrance by 34.0% of the respondents. New technical developments as well as more network capacity will help to solve this problem. However, these improvements must address an increasing number of

users who want to transmit more and more information. Projects such as online broadcasting of TV programs on the Internet will add considerable network load.

One key to faster response times is the Web-page design. "Less is more" is a good guideline, because the smaller the file, the faster it can be transmitted. To speed up Web-page loading, efficient HTML (hypertext markup language) codes should be used, graphics and symbols should be kept small (low resolution, fewer colors), backgrounds should be simple, and images should be sparingly used. If fewer than 256 colors are used for graphics, a GIF (graphics interchange format) file format should be used with LZW (Lempel Ziv and Welch) compression. Colored pictures should be compressed with a progressive JPEG (Joint Photographic Experts Group) file format. Animations, sound, and videos usually take a considerable amount of time for loading and should be used judiciously.

The superfluity of information was mentioned by 24.2% of the interviewees as a problem. A common way of finding information on the Web involves the use of query-based search engines, which enable quick access to information that is often not the most relevant. This lack of relevance is partly attributable to the impossibility of cataloguing an exponentially growing amount of information in ways that anticipate users' needs (Huberman et al. 1998). Searching for the relevant information is another reason for the expenditure of time. Moreover, scientists often search for information that does not occur in many places on the Web. The amount of the Web covered by search engines is limited. Lawrence and Giles (1999) have reported in their study ("Accessibility of information on the Web") that the major search engines (Northern Light, Alta Vista, Snap, Goggle, Inktomi, Excite, Lycos, Euroseek) cover only about 42% of the Web.

The simplest means of improving the coverage of the Web by search engines is combination of the results obtained with multiple engines, as is done with meta-search engines such as Metacrawler (www.metacrawler.com). However, searching with meta-search engines especially necessitates the choice of clearly specified key words. The search engines look first for the Web-page title and second for the HTML metatag *Keywords* (>META HTTP-EQUIV = "KEYWORD" CONTENT = "Key1, Key2, ..."; Nolden 1997). Some engines even search the entire Web page for key words. Thus, the Internet user must refine his or her search terms. The best results are achieved with clearly defined specific key words. For the Web-page designer, this emphasizes that the title of the page should describe exactly the content of the page, and the HTML code should be edited, with proper key words being specified in the Tag field. We suggest that all parasitology-related Web sites be assigned the key word *parasitology*. The key word *homepage* should identify the home page, and key words such as *research*, *health*, *client information*, and *technique* as well as the names of parasitology-related Web sites should specify the content of the page.

Although the majority (60.8%) of the respondents did not seem to have any difficulty in finding information on the Net and were satisfied (58.0%) with the parasitology-related information found, we strongly recommend that the user carefully read the instructions regarding the search engines used, as this yields better search results. For example, the addition of a minus sign (-) in front of a key word excludes this word from the search. If one wants to be sure that a specific word is always included in the search topic, a plus sign (+) should be inserted in front of the key word involved. By typing a wild-card (*) at the end of a key word, one can search for the word with multiple endings. When quotation marks (" ") are placed around several key words, the search engine will retrieve only those pages on which the key words appear next to each other and in the order typed. If one needs to find Web pages within a certain range of dates or must undertake some complex Boolean searches, the "Advanced Search" would be worth a try (Karzauninkat 1999).

Only 1.4% of the respondents had a problem in handling the browser software, and none of these indicated that use of the PC posed a difficulty; thus, further hard- and software improvements are not major factors influencing Web use.

For the future the majority (71%, $n = 107$) of interviewees responded that they would like to use the Internet more often for reading of electronic journals. This indicates a strong demand for such electronic journals and can be seen as a mandate for universities and parasitology societies to set them up. A significant percentage of the respondents (50%, $n = 75$) said that they would like to use the Internet more to obtain information on scientific congresses. For congress organizers this means that all congress information, including registration, abstract submission, and letters of acceptance, should be manageable over the Net. There seemed to be little interest in parasitology news groups, with only 8% of those surveyed responding that they used news groups.

The Internet provides a vast resource of information, data, and shared programs. In the future, Internet-supported collaboration among research centers will play an important role as computer networking improves the access to widely distributed information and expertise. Although the present study indicates widespread use of this new medium by parasitologically engaged scientists, parasitologists should be aware of the possibilities offered by the Internet and of its challenges and should play an active role in this development.

References

- Barrie JM, Presti DE (1996) The World Wide Web as an instructional tool. *Science* 274: 371-372
- Coppel RL (1996) Internet and the parasitologist: the what, where and why of the Web. *Parasitol Today* 12: 85-87
- Huberman BA, Pirolli PLT, Pitkow JE, Lukose RM (1998) Strong regularities in World Wide Web surfing. *Science* 280: 95-97

- Karzauninkat S (1999) Zielfahndung. Suchmaschinen, Kataloge, Spezialisten und kommerzielle Datenbanken richtig einsetzen. CT Mag Comput Tech 23: 172–179
- Lawrence S, Giles CL (1998) Searching the World Wide Web. Science 280: 98–100
- Lawrence S, Giles CL (1999) Accessibility of information on the Web. Nature 400: 107–109
- Leiner BM, Cerf VG, Clark DD, Kahn RE, Kleinrock L, Lynch DC, Postel J, Roberts LG, Wolff ST (1998) A brief history of the Internet. <http://www.isoc.org/internet-history/>
- Nolden M (1997) Web-Design. Sybex, Duesseldorf
- Taverne J (1997) Facts, logic and wit on the Web. Parasitol Today 13: 288–289
- Taverne J (1998a) Life, hope and lecture material from the Web. Parasitol Today 14: 222–223
- Taverne J (1998b) Quality, quantity and function on the Web. Parasitol Today 14: 347
- Taverne J (1998c) Words and language on the Web. Parasitol Today 14: 445
- Taverne J (1998d) Questions and answers on the Web. Parasitol Today 14: 477–478