Introduction to the Internet and World Wide Web

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A family plans a ski vacation in Utah, and their 10-year-old daughter browses the World Wide Web (WWW[1] or Web[1]) to find an inexpensive package tour. A college student plugs into the Internet jack in his residence hall room to communicate daily with friends and family via electronic mail (e-mail[1]). A health professions student subscribes to an electronic mail list and gains instant access to a lively dialog among her future colleagues on hot topics in their field. A man, worried about a tick bite a friend got on a Sunday hike, connects to the Centers for Disease Control in Atlanta to read the latest information about Lyme disease and to download color images of its characteristic skin rash. These are just a few examples that I know of the amazing ways the Internet and the WWW have changed our way of life.

The Internet originated in December 1969 as a primitive link-up of 4 computers located at the Los Angeles and Santa Barbara campuses of the University of California, the Stanford Research Institute, and the University of Utah. It is doubtful that anyone then could have imagined just how fast their tiny computer network would grow. At the time of this writing, approximately 1/4 million registered local computer networks comprise more than 15 million host computers that serve more than 50 million users worldwide. These local networks are in turn joined into a single, vast, unified network, spanning more than 170 countries and linking computers of all different sizes, types, and operating systems with people who speak many different languages.

One commonality among all these computers is their use of the same procedures for transmitting and receiving information over the net. These standards are embodied in the Internet Protocol (IP[1]), which determines the conventions for addressing and routing information, and the Transmission Control Protocol (TCP[1]), which governs how electronic messages are broken up into uniform-sized "packets" of data for transmission across the network and subsequent reassem-

bly. Thus, each of our computers uses TCP/IP software to send and receive data packets over the Internet. These packets flow from their origin (such as a disk drive on a remote computer) to their destination (such as the display screen of your computer) by means of a series of computers (known as routers) that are arranged along the path between the 2 sites. This entire breaking up of data into packets that are routed across the net (at up to 622 million bits/sec) and the reassembly into a meaningful format take place without the user's involvement or prerequisite understanding!

CONNECTING TO THE INTERNET

The first step in connecting your personal computer to the Internet is to confirm that it is not yet connected. If your computer at work is linked to the other machines at your institution, your local network may already have access to the Internet. This is almost always the case at colleges and universities and other large employers. Such organizations pay sizable annual fees to rent lines that serve as the continuous, permanent connections between their internal computer systems and the Internet. Your local computer system person can demonstrate the necessary steps to access the Internet from your keyboard.

If you cannot connect to the Internet through an institution, you will need to contact a company that provides connections to the Internet for a fee. Internet Service Providers (ISPs[1]) allow you to connect on an as-needed basis to their computers, which have a full-time connection to the Internet. Typically charging a monthly fee, ISPs number in the thousands and have grown at a rate similar to that of the Internet itself. Some ISPs offer only limited services, like e-mail, whereas others offer the full range of Internet facilities. Some ISPs provide their services only to users in a limited region of the country, whereas others operate nationwide. Colleagues and computer store employees are good sources of information regarding regional ISPs.

To utilize the services of an ISP, you will usually need a modem and a telephone line. The modem allows your computer to dial a number that is answered by a modem connected to your ISP's computer. The simple communications software that comes with your modem will then allow your computer to interact with theirs. A modem can also be used to provide your personal computer at home with free dial-in access to a computer at your workplace that is connected to

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[1]Abbreviations used in this article: e-mail, electronic mail; IACUC, institutional animal care and use committee; ILAR, Institute for Laboratory Animal Research; IP, Internet Protocol; ISP, Internet Service Provider; TCP, Transmission Control Protocol; URL, Uniform Resource Locator; Web or WWW, World Wide Web.

the Internet. The computer systems manager at your institution can advise you regarding whether this service is available.

Even with a relatively basic personal computer, you will be able to send and receive text-based e-mail messages. Your computer can serve simply as a "terminal" attached to the remote computer at your institution or your ISP. The software needed to interact with the Internet will be on the remote computer, and you will be able to use only what they have installed. Those with more fully equipped personal computers can alternatively install Internet software on their own machines and then use a modem connection only to provide the necessary access to the Internet. Internet software packages are inexpensive, if not free; and they are available from a variety of sources, including ISPs, software companies, retail computer stores, and possibly your own institution.

INTERNET FACILITIES

The Internet is similar in some ways to the global telephone system: Each allows the establishment almost instantly of 2-way connections between sites anywhere in the world. However, unlike a telephone conversation, the Internet allows us to communicate in a variety of ways. Most importantly, we are not limited to verbal interactions with other people—in many cases, it is possible to gain access to information stored in their computers. The basic facilities available over the Internet are described below and include e-mail, list servers, USNET/newsgroups, File Transfer Protocol, Internet Relay Chat, Gopher facility, and the WWW.

E-mail

E-mail, the Internet equivalent of postal mail, is the most widely used facility on the Internet. E-mail messages routed across the Internet can reach an overseas destination in seconds. You never receive a busy signal and you never play "telephone tag." A variety of e-mail programs offer features allowing you to print, forward, save, and/or reply to another's message. Some include advanced features allowing you to attach a word processing document, spreadsheet, software program, video, or image file.

List Servers

The list server facility allows for the creation of discussion groups to share information about common interests. LISTSERV, the most common list server program, copies incoming messages sent to the list and forwards them to everyone whose e-mail address is on the list (the subscribers). Only subscribers can submit messages to the group, which is monitored by the list manager. A user (the initiator) typically joins a list by sending it an appropriately worded e-mail message, which automatically prompts the LISTSERV program to extract the initiator's e-mail address, add it to the list, and send the initiator an e-mail message of confirmation and information regarding use of the list.

USNET/Newsgroups

Internet newsgroup servers generally provide access to groups that are much less selective than those provided by list servers. Free and unrestricted access to thousands of topic-based newsgroups can be obtained by using specific newsreader software to contact a local computer that acts as a news server. This software allows users to post messages or articles to any newsgroup for other users to read and possibly attach their comments.

File Transfer Protocol

Using the File Transfer Protocol facility, Internet users can transfer software programs, product upgrades, and other types of computer files between computer systems connected to the Internet.

Internet Relay Chat

With Internet Relay Chat, small numbers of users meet in on-line chat groups and "talk" to each other by typing messages on their keyboards.

Gopher

The Gopher facility, created at the University of Minnesota and named after its golden gopher mascot, is one of the first "user-friendly" Internet facilities for obtaining information over the network. Using Gopher, users can connect to thousands of different computers, known as information servers or "gopher holes," via a menu-driven "point and click" program. Hierarchically organized information is stored at each gopher hole. Users click on a descending list of individual topics to retrieve information, which might include text, sound, or images.

World Wide Web

The WWW is such an immensely popular Internet facility that for many users, it has become synonymous with the Internet. Developed in 1992 at the European Laboratory for Particle Physics at Cern, Switzerland, the WWW links users to Internet sites. The basic unit of WWW communication is the page, similar to this printed page. Within a Web page are "links" on which users can click and be automatically connected to related pages at the same or other Internet Websites.

With its ease of use and its multimedia ability to transmit text, graphics, audio, and video and to retrieve detailed information from anywhere in the world in seconds, the WWW has quickly become the interface of choice for Internet users.

COMPONENTS OF THE WWW

Key to the success of the WWW is its powerful system of links, allowing users to explore related sets of data stored in different computers on the Internet. This system of embedding links in the text of a Web page, called "hypertext," allows any sort of data to be accessed from a Web page by clicking on highlighted and/or underlined links that point to other pages. Users are automatically routed to the selected Web page even if it resides in a distant computer. This web of interconnected pages gives the WWW its name.

Every Web page has its own unique title, known as the Uniform Resource Locator (URL[1]). A URL contains both the Internet address of the computer on which a Web page is stored and the name of the computer file that actually contains the page. More than 1/2 million WWW sites exist on the Internet, and each may contain numerous URLs. The result is tens of millions of Web pages!

So that users may view and retrieve Web pages without having to know and type the URL each time, a special type of program, known as a "browser," was developed. A browser program operates on a personal computer, interfacing it with the Internet and allowing users to "surf" the WWW. Browsers are inexpensive and typically available without cost to educators. All browsers allow Internet users to (1) retrieve Web pages from other computers; (2) display these pages on the user's screen, using formatting commands that were specified by the author of the page; and (3) make the Web pages active, progressing to the referenced file or URL by pointing and clicking on a hypertext link embedded in a page. Browsers are very easy to use, and even a computer novice can become accustomed to navigating the Internet within minutes. The new user will soon realize, however, that navigating effectively through millions of Web pages requires skill in searching. To deal with this abundance of information, Internet users take advantage of WWW software tools known as "search engines."

A search engine is a powerful program for finding Websites that contain information about key words. Search engines scan Web pages, Gopher sites, File Transfer Protocol sites, newsgroup articles, and so forth. Many of these programs are currently available, and their designs differ in subtle ways. Readers can select among the popular search engines offered by their Web browser simply by clicking on the relevant button of the browser's opening page. Users generally try several until they find those that seem easier to use and more productive. Skilled Web surfers typically use a search engine to launch a search and then use the hypertext links embedded in the Web pages found by the search engine to jump from page to page across the Web.

EXAMPLES OF WEB PAGES

If you type the URL *http://www2.nas.edu/ilarhome* into your Web browser and direct it to open a connection to that location, the document shown in Figure 1 will appear on your computer screen. This Home Page of the Institute for Laboratory Animal Research (ILAR[1]) appears at the top of the hierarchically organized set of hypertext-linked pages and data files that ILAR provides for your use. As you move your cursor across this page, it will change from an arrow to a "pointing hand" whenever it crosses over an "active" spot that designates a link to a related page.

Clicking on the word "Personnel" reveals a page that contains links to 5 successive pages of groups of people involved in the work of ILAR (Figure 2).

If you click on the link entitled "ILAR Council," you will see a list of the names and e-mail addresses of those of us serving on the Council at the time of this writing. I invite you to send me a message!

Return to the Home Page (either by clicking on the small box labeled "ILAR" at the bottom of the ILAR Council page or by using your browser's "Back" command); then click on the word "Publications." This takes you to a page that lists the following 4 publication groups (Figure 3): (1) *ILAR Journal* (Figure 4), which contains links to successive pages about the journal, its Editorial Board, and information about the Associates program of membership that includes a subscription to *ILAR Journal*; (2) titles for which full texts are available online; (3) titles for sale at the National Academy Press; and (4) free publications available from ILAR.

Clicking on the word "Links" on the Home Page reveals a categorical list of many pages. Each page provides you with more links for direct access to ILAR-compiled information across the Internet. Here in 1 location are hundreds of continually updated links to topics of interest for readers of *ILAR Journal* (Figure 5).

Taking the time to browse through the ILAR Web pages will confirm how easy it is to first navigate across the WWW from a personal computer to ILAR's computer in Washington, DC, and to then gain access to detailed information on a wide variety of very specific topics from computers scattered across the Web. The subsequent articles in this issue of the *Journal* focus on ways that researchers, institutional animal care and use committee (IACUC) members, attending veterinarians, and other laboratory animal medicine specialists can obtain and exchange information electronically. The Internet and the WWW afford access to an amazing array of topics related to the use of animals in teaching and research. Furthermore, in addition to professional use, you may even find that affordable ski trip mentioned at the beginning of this article.
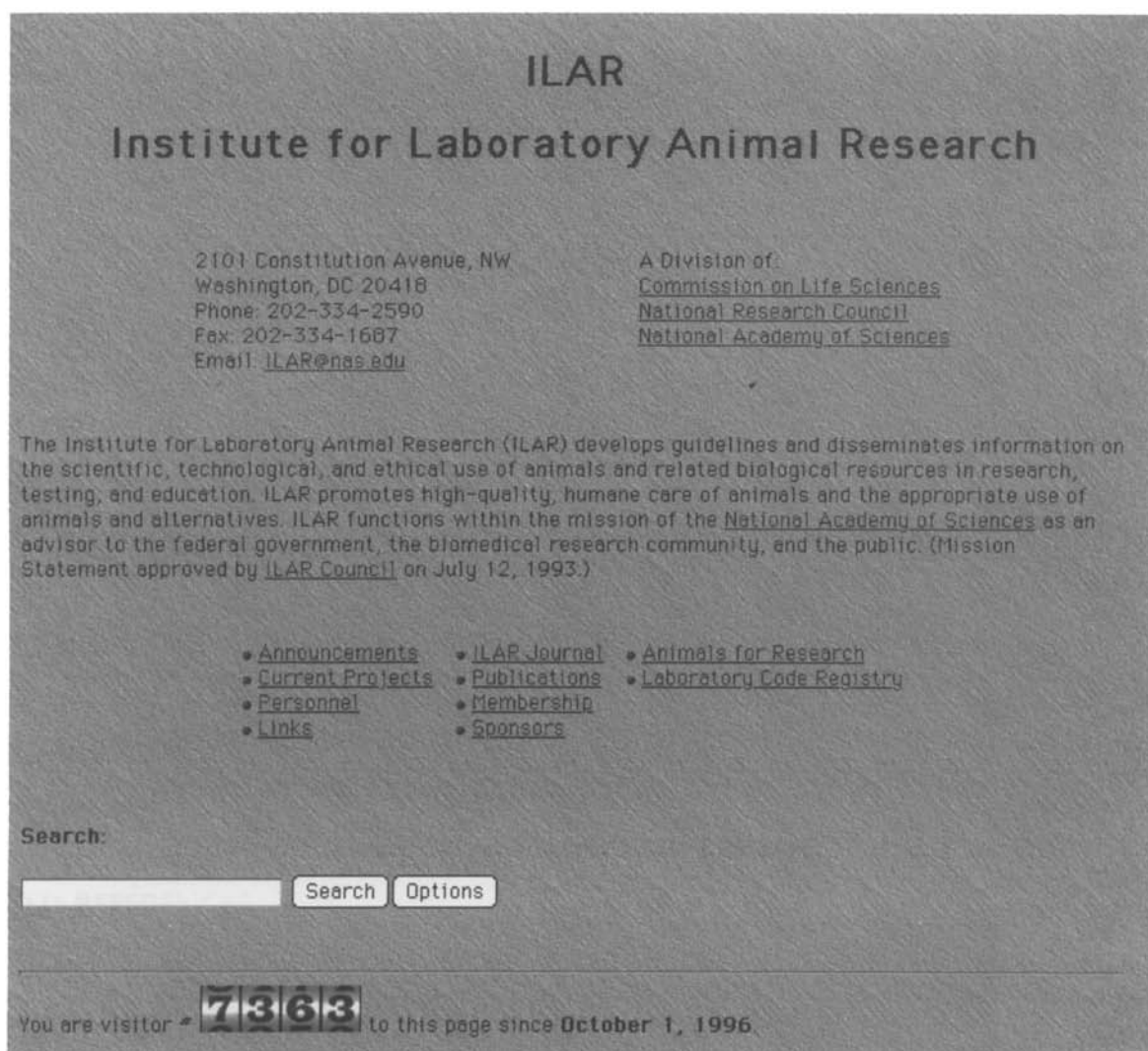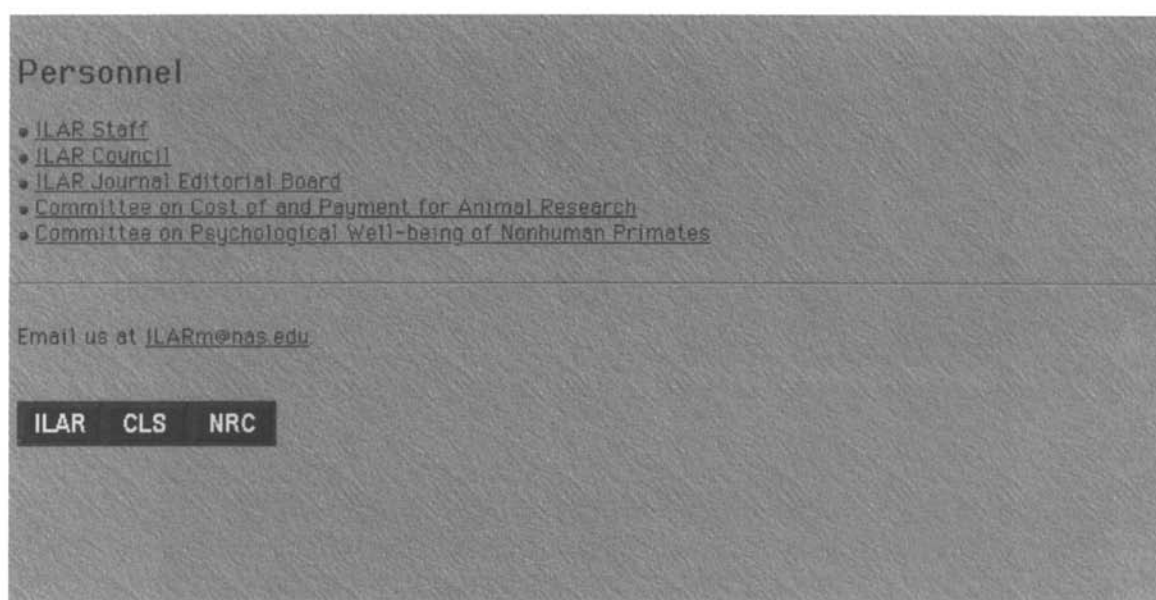
FIGURE 1   ILAR's home page.

FIGURE 2   ILAR's Personnel Web page.

FIGURE 3   ILAR's Publications Web page.

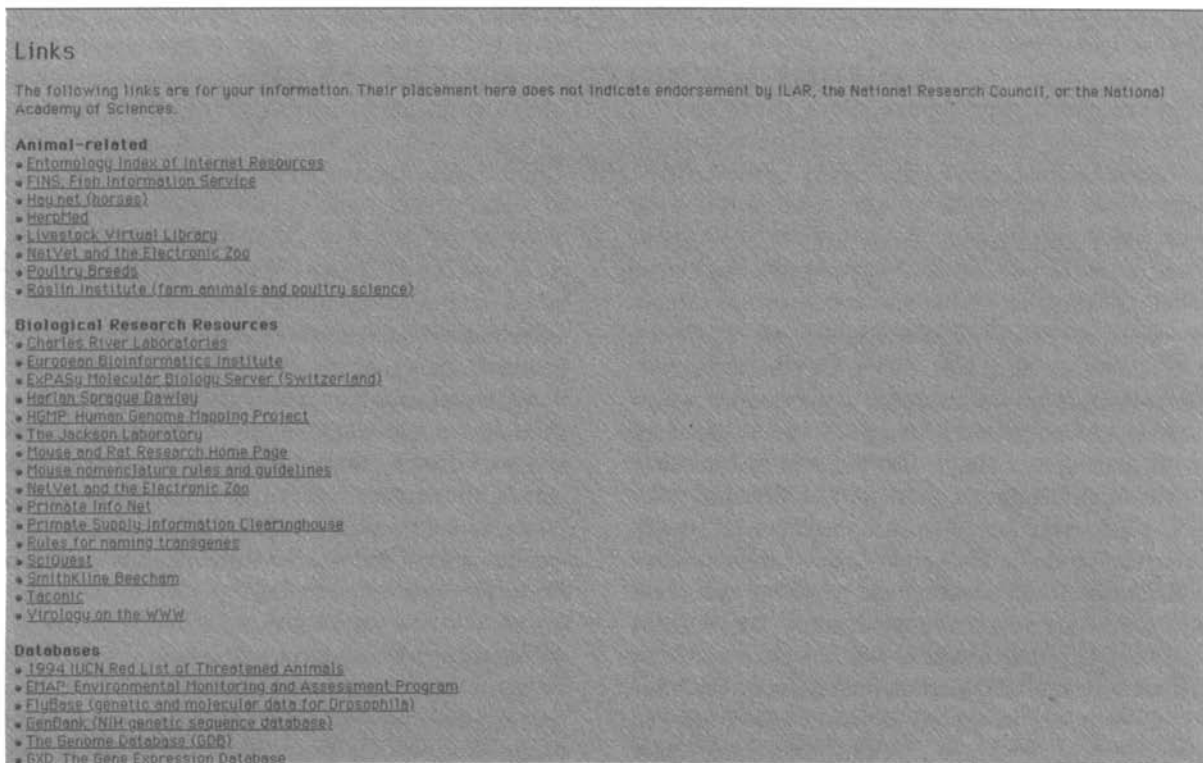**FIGURE 4   *ILAR Journal*'s Web page.**

FIGURE 5   Top section of ILAR's Links Web page.

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