INTERNET RESOURCES AND BIOCHEMISTRY

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ABSTRACT

The Internet is a massive expanding body of information, which is likely to play a significant role for clinical Biochemists and researchers in patient health care across the world. This expansion has been matched by an increase in the number of individuals using the Internet. Since its inception in December 1969 the Internet has grown rapidly and is anticipated to expand 100% in the coming next few years. This review illustrates to the Biochemists many uses of the Internet and hopefully provides a useful resource for professional and personal use. To explain the origin, functions, use and impact of the Internet and to provide a list of important website addresses related to Biochemistry. We undertook a detail scan of the Internet and identified a large number of websites pertaining to Biochemistry. The sites were then thoroughly searched to evaluate their potential usefulness to Biochemists, clinicians and researchers. This overview of the Internet and a compilation of important web-site addresses are expected to stimulate and inculcate Biochemists in the use of the web in teaching, training and research.

KEY WORDS

Internet, Biochemistry, and World.Wide.Web

INTRODUCTION

The Internet is a massive expanding body of information, more popularly known as the 'Information superhighway'. There has been a massive expansion in the amount of information available through the Internet over recent years. This expansion has been matched by an increase in the number of individuals using the Internet. With an estimated 320 million web pages available (1), the Internet has had an influence on everyday life. The last few years have seen an exponential growth in the number of people with access to the Internet. In the UK, there are estimated 15 million regular Internet users, a second biggest number of users after the USA world-wide (2). Its power is most strongly seen among scientists, as more

and more information is made available through "the NET". Be it gene sequences, experimental data, chromosome maps, or whole journal articles (3). Despite its growing commercial contents, the Internet remains, as it was originally perceived, a powerful instrument for the exchange of scientific knowledge (4). The availability of well-organized, reliable information is essential for education and research, and in the current climate of evidence based decisions, it has become an economical necessity. This has resulted in expansion of scientific information and the number of electronic journals on the Internet. The Internet and World Wide Web (www) represent significant advancements for the recuperation and propagation of scientific and other literature for the advancement of education. It is literally serving as a lifeline for the human community. Thousands of websites pertaining to pure medical information are available on the net. Immediate access to all scientific literature has long been a dream of scientists and the web search engines have made a large and growing body of scientific literature and other information resources accessible within seconds. Data that previously would have required hours of research in a medical library can now be found easily by anyone with access to the Internet. This has enhanced the medical professional's ability to gain extensive knowledge of research findings from many different medical specialities. The Internet provides no separation of scientifically proven conclusions from

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anecdotal information or commercially biased reports. Hence the aim of this paper is to explicate the impact, origin, functioning and content of the Internet and to amass important website addresses related to Biochemistry.

BRIEF HISTORICAL NOTE

The Internet was conceived in 1969, when the US Defense Advance Research Projects Agency developed a computer network (ARPANET) specifically designed to survive foreign attack. Later on, the scientific community adopted ARPANET as a means of information exchange between researches workers separated geographically. In 1990 the National Science Foundation Network (NSFNET) replaced ARPANET. The WWW was developed jointly in 1989 by the Massachusetts Institute of Technology computer sciences department and the European Center for Practice Research as a standard user interface.

THE WORLD WIDE WEB (WWW)

The WWW is a graphical interface to sites all over the world, which contain images, sound and even video images. The Internet is a large, worldwide network of interconnected computers. It consists of several communication media, the best known of which is the WWW. Because of its user-friendly interface, World Wide Web is Internet's most exciting and popular development. Based on the use of the hypertext (a fragment of text that refers to information elsewhere that can be accessed with a mouse click), web pages are written in the Hypertext Mark-up Language (HTML) are sent through the Internet by the corresponding hypertext transfer protocol (http). The www consists of many 'websites', each of which has a unique digital address and a uniform resource locator (URL). This URL has the general form <http://www.rug.ac.be/>, where 'http' refers to the protocol used, and 'rug.ac.be' refers to the server (computer) where the information is stored.

The information on a web page is made visible by a WWW client program or a 'browser'. Browsers are now available for most operating systems, the most commonly used being the Netscape Navigator and Microsoft Internet Explorer. Biochemists, like most clinicians, have too little time to learn complex and obscure computer commands or systems. Therefore, the 'point and click' strategy of the WWW has increased the demand by the medical and health arena to be linked to this global computer network, which has been expanding since the onset of the WWW in 1990. Web pages can offer products, interactive forums and multimedia programs for education or to assist users to obtain more information or services. Modern biochemists should also learn to use Internet resources, its language (5) and tools, not

only to improve their efficiency and work skill, but also to enjoy the wealth of other information available through the electronic 'information superhighway'.

SEARCHING THE INTERNET

Because of the enormous content of the 'world wide web', it is important to know how to search the web effectively to avoid wasting time and obtain maximum information. The easiest way is, of course, trying to obtain the exact URL. The secret of advance searching is simple: ask the right question. It may seem obvious, but it is not always easy and it needs a two-prolonged attack. First, one has to specific about what one is looking for, and second, is picked the search tool best suited for the job. Selecting a search tool begins with a simple choice; directory or search engine. The main difference between a search engine and a directory is that of automation. There are many search engines and each has its own method of gathering and sorting data, producing a different set of results from the same query. A list of search engines is given on Table 1.

Table 1. List of search engines

Search Engines	
Google	http://google.com
Yahoo	<http://www.yahoo.com>
Exite	<http://www.exite.com>
In-foseek	<http://www.infoseek.com>
Galaxy search	http://www.galaxy.com/
Webcrawler	http://www.webcrawler.com/
Alta Vista	<http://www.altavista.digital.com>
Lycos	<http://www.lycos.com>
Northern Light	<http://www.nlsearch.com>
Looksmart	<http://www.looksmart.com>
Hot Bot	<http://www.hotbot.com>
Meta Search Engines	
Dogpile	<http://www.dogpile.com>
Eliter.com	<http://www.eliter.com>
CurryGuide	<http://services.currguide.com/>
PopularSites.com	<http://www.popularsites.com>
The BigHub.com	<http://www.thebighub.com>
JUGALUG MP3	<http://www.jugalug.com/>
Megasources	<http://www.acr.ryerson.ca/~journal/> Megasources.html
Indian Search Engines	
123 India	<http://www.123india.com>
Agni	<http://www.indiawatch.org.in/agni/>
Khoj	<http://www.khoj.com>
Indian Homepage Search	<http://indiatime.com/urls/indiaurls.htm.com>
Search Engine for India	<http://searchg.keralanuada.com/internetservices/>

OPEN DIRECTORY PROJECT

The Open Directory Project is the largest, most comprehensive human-edited directory of the web. It operates with the goal of creating a useful information resource. It is managed by a network of approximately 10,000 active volunteer editors. The Open Directory follows in the footsteps of some of the most important editor/contributor projects of the 20th century. The Open Directory is the only major directory that is 100% free. There is not, nor will there ever be, a cost to submit a site to the directory, and/or to use the directory's data. The Open Directory data is made available free to the user who agrees to comply with the free use license. The Open Directory powers the core directory services for the Web's largest and most popular search engines and portals, including Netscape Search, AOL Search, Google, Lycos, HotBot, DirectHit, and hundreds of others. URL for DMOZ is (<<http://dmoz.org/>>) and alternate URL is (<<http://ch.dmoz.org/>>).

BIOCHEMISTRY ON THE INTERNET

A large and rapidly growing volume of medical information can be found on the web. In the field of Biochemistry, the Internet offers the ability to: (i) read and send worldwide electronic mail; (ii) join mail list and discussion groups; (iii) visit hospitals and universities; (iv) read on-line journals, textbooks (including graphs, photographs, video samples etc) and database (such as MEDLINE) on Biochemistry; (v) consult professional and commercial organizations, and (vi) obtain information about postgraduate courses, symposia, research and job opportunities.

There are many databases available on the Internet that may be very useful not only to Biochemists but people from other medical and science streams. One example is MEDLINE, a large database with abstracts of all medical articles that appear in the international refereed medical journals. MEDLINE is a premier bibliographic database of the National Library of medicine (NLM), covering the fields of medicine, nursing, dentistry, veterinary medicine, the health care system, and the pre-clinical sciences. The MEDLINE file contains bibliographic citations and author abstracts from approximately 3,900 current biomedical journals published in 70 countries. Citations for MEDLINE are created by the NLM, International MEDLARS partners, and co-operating professional organizations. MEDLINE records are incorporated into PubMed (<http://www.ncbi.nlm.gov/PubMed/>) weekly, and are also assigned a PubMed unique identifier.

IMPACT OF THE INTERNET

Until recently, many feared that increased use of the Internet would further widen the knowledge gap between industrialized and developed countries. But

Table 2. File types common on the Internet, and their function or content

Type	Function/content
.pdf	Adobe Acrobat portable document format
.exe	executable file; a program, run by typing the name (no extension)
.bat	batch file, run by typing the name (often install.bat or setup. bat)
.gif	used for GIF image files
.xls	used for Microsoft Excel documents
.txt	usually ASCII text
.mpg	MPEG; video or animated sequence
.wav	sounds, music
.zip	a compressed files; file can be uncompressed (unzipped)
.htm	HTML, hypertext (can be read by a web browser)
.jpg	JPEG; graphics, pictures (high resolution)
.tif	TIFF; tagged image file format (graphics)
.doc	usually a word-processor format files
.avi	video sequences, 'films'

such pessimism has given way to optimism with the hope that this new technology may instead help spur a resurgence of science and technology in poorer countries. Use of the Internet in developing countries is now growing faster than in developed ones. Widespread access to the Internet allows scientists to use an enormous range of tools, literature and databases. Many journals are now made available or published online. These versions have lower the prices and cost of distribution than the print versions. An organization named High Wire Press, a not-for-profit body set by Stanford University (hwmg.Stanford.edu/developing.html) (6). Free flow of information on the Internet permits anyone with good computer skills to establish a website with whatever information they wish to share. In this respect, the Internet has become the great equalizer: experts, specialists, authorities, professionals, alternative therapy promoters, interested lay people, hucksters, all may set up sites containing information on specific topics of interest. New pager technology now allows suitable pagers, which receive alphanumeric messages to be synchronized with the Internet. Biochemists no longer need to be at a computer to check their e-mail, nor do

they need to make additional telephone calls simply to get a piece of information. Although misleading or inaccurate information may be present in a small number of web pages the Internet has the potential to be helpful to both physicians and patients. The Internet can be a powerful, positive partner to the health care provider in patient education. Better health care results when patients are more informed regarding their disease and become more involved in participating in the choice of their treatment.

Computer documents which have particular file extensions (e.g. *.wav, *.avi and *.gif or *.jpg; * represents any file name and the extension denotes the file type, see (Table 2) can be downloaded from the Internet or from Internet service providers (ISPs).

Recently there has been an explosion of interest in the use of the Internet to conduct clinical trials of new pharmaceutical products. Approximately, 60 companies have supplied software or services using the Internet to some degree.

LIMITATIONS OF INTERNET

Using the WWW to access computerized medical records is a prototypical application of Internet technology to patient data. However, Web-based access to medical charts best illustrates the potential and the pitfalls of using a publicly accessible network to transmit confidential patient information. The advantage of using a Web interface to provide access to patient data is the growing ubiquity of the Web. The Web is also home to a number of specific computerized and electronic medical record projects. Physicians contemplating the purchase of their own record keeping systems will probably benefit from perusing the Web first. Given computers obvious impact on clinical practice, when we review these cutting edge projects on line we are peeking into our profession's future.

Security on the Internet is a very complex issue requiring solutions that go well beyond username and password protection. The online availability of patient data poses significant threats to privacy and confidentiality. Despite the host of advantages to transmitting and sharing patient data on the Internet, it presents the potential for misuse through inappropriate linkages and distribution. Large-scale medical databases, particularly if a universal patient identifier is implemented, will link information from multiple sources and disseminate this information across the network. As new threats to privacy emerge, new technologies to combat them will be needed. Computer virus is simply a computer program that is intentionally written to attach itself to other programs or disk boot sectors and replicate whenever those programs are executed or those infected disks are accessed. The most common viruses that infect

computers today—viruses such as Concept, Nuclear, Showoff, Adam, Wazzu, and Laroux—are macro viruses. A lot of downloading, or diskette accessing from the outside world on a regular basis should develop an antivirus strategy. The most important weapon in an antivirus arsenal is a clean, write-protected bootable system diskette. Booting from a clean write-protected diskette is the only way to start up the system without any viruses in memory. No virus scanner/cleaner of any quality will run if there is a virus in memory because more programs can be infected by the virus as the scanner opens the files to check them. A second effective defence against viruses is a clean backup of hard drive. Many antivirus packages will attempt to disinfect infected programs so that the virus is no longer in the system. A third part of the antivirus strategy should be antivirus software i.e. Virus scan, Norton-Antivirus, f-prot (<<ftp://ftp.datafellows.com/pub/f-prot/free/>>), Thunder-BYTE Anti-Virus (<<http://www.thunderbyte.com/>>), McAfee AntiVirus (<<http://www.mcafee.com/>>) etc. Preferably more than one package should be recommended since no product can do everything alone. There are many products available to help the Internet user guard against viruses.

CONCLUSION

The Internet is a rich source of valuable information that can be used to great advantage, for keeping up with the recent developments in the fast moving disciplines of Clinical Biochemistry. The modern Biochemists cannot afford to ignore the Internet anymore. The human genome project is almost complete and the entire information on human genome is available on the Internet. Various useful databases already exist and many more are being added constantly. The future of Biochemists is in the handling of information and getting connected in time.

Computer literacy and an Internet connection must be a part of postgraduate clinical Biochemists education to enable us to help our patients. The reality is that the Internet is here, growing, and will play an ever increasing role in health care. The best approach to coping with the reality is to be proactive and to recognize the opportunity that the Internet can provide for improvement of patient care.

The Internet is an ever-expanding source of information covering almost any topic. On one hand, it may provide access to archival databases and on the other 'real time' information is presented. Access is simple, but handling this amount of information probably remains the biggest problem currently facing most users. Confidentiality and security are major concerns; hence, safeguards have been built into many of the Internet's applications. With 128-bit encryption used by Netscape and Microsoft, credit-

card transactions for making payments over the Internet are becoming more secure each day. A systemic strategy for the development of medical services on the Internet and a focused approach to their use is essential.

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