Why use the internet to teach pathology?

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Each generation of pathologists has its own idea of the technology best suited to teach their subject at all levels. The division is often associated with the age of the teacher—the younger are usually more enamoured with the technology of the day: tapes and slide (1970s), video (1980s), or today’s multimedia either on CD-ROM or the internet. Teaching and learning are complex processes, and how each individual wishes to learn or be taught varies tremendously. The internet has been hailed as the new wave in teaching, but it should not be seen as a replacement for other methods, and will certainly not replace the most important of these—the enthusiasm of the teacher. In this brief article I would like to justify my position as a “multimedia maniac” (Peter Fletcher, personal communication) with a bias towards the internet as an adjunct to formal teaching methods. I would like to show what the internet has to offer, but also temper this youthful enthusiasm with the realities and problems that may be encountered when this new technology is used to teach pathology.

Evolution of the internet

While the internet embraces the entire concept of computers and networks, it is the software that makes the system usable. As with many computer related things, there has been a rapid evolution over the past few years in the way that information is provided and in the sophistication of the facilities. The software has become extremely easy to use and has grown to incorporate the most valuable features of the earlier forms. In the early days (1970s) computers connected to the internet could transfer files from one machine to another using a simple file transfer protocol (FTP). Provided you knew the identity of the computer and had the privileges to gain access to it, you could transfer files across the network.

As networks grew and the amount of freely available information increased there became the need to provide both search and retrieval tools. The Gopher was born. The internet Gopher protocol and the first Gopher software was designed at the University of Minnesota. Gopher was originally created as a fast, simple system to find information around the university campus and then copy it back to your own computer; however, it rapidly established itself as an international facility. Other protocols for supplying and searching for information appeared (for example Wide Area Information Servers (WAIS)); these were incorporated and linked to the Gopher. The internet Gopher is alive and well today, but has been superseded and incorporated into the world wide web.

The world wide web is the system that has come to dominate the internet. It is the world wide web that has made the internet accessible to the most hardened information technology Luddite. The concepts and first programs were designed in the early 1990s by physicists at CERN, the European Particle Physics Laboratory in Geneva, with programs run on server computers to supply information, and browser programs run on client machines to look at the information. Using a simple computer coding technique called Hypertext Mark-up Language (HTML) the text of any document can contain pointers to other documents either on local machines or elsewhere in the world. The process is so seamless that one can jump effortlessly from a local machine to others in Europe, the USA or elsewhere, simply by clicking on the pointer. This pointer is a Universal Resource
**Table 1 Advantages and disadvantages of using the internet for education**

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
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<tbody>
<tr>
<td>An extensive amount of information</td>
<td>Information may not be reviewed or verified</td>
</tr>
<tr>
<td>Combines text, images, sound, and video</td>
<td>It can be difficult to know the original source or publisher</td>
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<tr>
<td>Access is relatively easy</td>
<td>The large amount and poor quality of much of the information can make finding</td>
</tr>
<tr>
<td>Information is easily updated and corrected if necessary</td>
<td>specific resources difficult and time consuming</td>
</tr>
<tr>
<td>Can be accessed by hundreds of users simultaneously</td>
<td>Out of date information may never be removed</td>
</tr>
<tr>
<td>Not restricted to a single make of computer</td>
<td>Copyright controls are unclear</td>
</tr>
<tr>
<td>Resources anywhere on the internet can easily be linked; therefore one is not</td>
<td>Internet access is not encouraged in the NHS, and sophisticated security</td>
</tr>
<tr>
<td>limited to in-house facilities</td>
<td>systems are essential to protect HIS systems</td>
</tr>
<tr>
<td>Information is cheap and easy to produce; few production or distribution</td>
<td>Can be very wasteful of time and in some cases even addictive.</td>
</tr>
<tr>
<td>overheads</td>
<td></td>
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<tr>
<td>Allows users to exploit the power of remote computers to perform complex tasks</td>
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Locator (URL). The elegance of the web is enhanced by the ability to provide URLs that link to pictures, sounds or short clips of video. Text can be entered using electronic forms and manipulated by the remote computer—for example, to search databases or record answers to questions.

**Range of teaching resources on the internet**

Teaching and learning are complex processes, and a wide variety of techniques and facilities are needed for each student and subject, which may vary at different times. The internet will not, and should not, replace textbooks, lectures or tutorials, but it does have the ability to add value to these traditional teaching techniques and to make the life of the student and teacher a little easier, more varied and possibly more interesting (table 1). Outlined below are a few examples of the types of resources available, a more extensive list can be found on the Path-uk web site.1

**Lecture Notes, Multiple Choice Questions, and Laboratory Exercises**

Complete undergraduate courses in clinical pathology are available free on the internet. WebPath2 produced by Ed Klatt and colleagues from the University of Utah is a collection of over 2500 images covering the whole of an undergraduate pathology syllabus. The information is structured in a range of ways, from problem based laboratory exercises to mini-tutorials and MCQs, all of which draw on the WebPath image collection in different ways. In addition, Ed Klatt includes a copy of his own 190 page textbook on AIDS that can be downloaded and printed for US$10. For those without a fast internet connection WebPath can be bought on CD-ROM and used on a personal computer for less than the cost of most pathology textbooks. WebPath is probably the longest established internet based pathology teaching resource, but there are many others such as from Bowman Gray Medical School3 and the University of Alberta,4 all with well illustrated, integrated clinico-pathological cases.

Many pathology teachers—for example, Mark Pallen at Imperial College, make many of their lecture notes available on the internet; why? Publishing information on the world wide web is now so easy—simply requiring the document to be saved in the correct format on a word processor—that it has become one of the simplest ways to distribute information around a group of students or beyond. Production costs are negligible compared with producing paper handouts, and updates or corrections can be made to a web version within seconds. The document can also be interactive with hypertext links allowing the latest resources from other web sites to be linked into the material or to the slide images used in the lecture. Furthermore, the technology behind the web server will allow the lecturer to know who has looked at the handout, when, where and for how long.

**Continuing Medical Education and External Quality Assurance**

CME is in many ways ideally suited to the internet, which can be used to distribute resources and evaluate progress.6 Cases can be posted on the web and accessed from practically anywhere, and feedback by participants can be anonymous. In the USA there are clinical cases such as the Interactive Patient7 where the history can be elicited from a virtual patient, who can then be examined; heart and breath sounds can be heard, and laboratory and other tests are then requested. Finally, you are asked to enter a diagnosis that is submitted to the computer for assessment. Charles Jennette, a renal pathologist from North Carolina, has made renal cases available on the web and completion of these is suitable for CME points.8 The Hippocrates project at New York University is a collection of cases in haematopathology, with micrographs in a range of magnifications, clinical information, and flow cytometer data, with case discussions and references.9

In the UK the results from traditional slide based EQA schemes in renal histopathology are published on the internet10 so that participants can learn from the answers once the slides have been circulated. The UK National External Quality Assurance Scheme provides a well coordinated web site for EQA schemes across several laboratory disciplines.11 It is this type of resource, when available to the pathologist in the laboratory or reporting room during the course of their routine work, that is of considerable educational value, and forms one aspect of the pathologist’s workstation.12

**Bulletin Boards and Discussion Groups**

For many internet users who do not have the luxury of a high speed connection, using image rich web sites is a slow and costly process. Nevertheless, there are many specialised discussion groups that can be accessed with email (see the Path-uk website for details), and these...
provide a valuable, fast way to share information with professional colleagues, or to distribute information to a group of students. Many of the discussion groups are closed or moderated to reduce the amount of junk or unsolicited email. There are public access bulletin boards such as sci.med.pathol that can be useful, but they tend to be rather unfocused and much of the information must be carefully validated.

JOURNALS AND ONLINE INFORMATION
One of the greatest strengths of web technology is the ability to link resources in a seamless way. For example, one can place hypertext links to journal article citations in web based lecture handouts, which link automatically to the article on the publisher's web site. New document encoding systems such as Adobe's Portable Document Format (pdf) can be used to maintain the text formatting and page layout of the original article, and some publishers are now distributing pdf versions of their paper journals. The value of instant access to references and articles greatly enhances the educational value of the information resource allowing one to look at and evaluate the primary data in the context of what is being learnt at the time. Sadly, many publishers have been extremely reluctant to embrace web technology as they see this as a threat to profits from the paper journals, although early evidence suggests this might not be the case. Nevertheless, the days of journals in paper format alone are numbered and new, online, electronically peer reviewed journals are being produced by individuals within academic institutions, without the production overheads charged by traditional publishers.

PROBLEMS AND POTENTIAL SOLUTIONS
Accessing internet resources is not difficult, yet many of us have been frustrated by the speed of the connection, the amount of irrelevant material that clutters the internet, and the lack of any peer review or accreditation of web based material. There are several approaches to addressing these problems. For programs such as WebPath, site licences are available to make the program available over an entire campus. The access is fast and available across the whole university so that many students can use the facility simultaneously, making it ideal for large practical classes. The University of Alberta has allowed us in Cambridge to become a "mirror" site for their internal medicine course and the International Society of Pathology and Nephrology. To do this the entire site is copied from a server in Alberta to one in Cambridge and updated when necessary. This not only benefits us by providing a fast local site available throughout the UK and Europe, but also reduces the transatlantic load on the Alberta server, and therefore enhances the facility for those in North America. Probably the most difficult and contentious issue is the one of validation and accreditation of internet based resources. Anyone can publish on the web and the amount of information is increasing exponentially; there is no peer review or validation for most of the sites. The consequences of this have been highlighted in a recent paper in the New England Journal of Medicine. How can students or anyone else know that what they are reading is correct? A similar problem applies to printed information; not all journals or books are reviewed, however, we worry less about this for several reasons. First, and probably most important, our basic training is designed to help us evaluate printed information. Second, books and journals are usually held in libraries, where acquisitions are bought on the recommendation of academic staff while the cost of these resources serves to ensure that a judgment is made of worth for each acquisition. Pragmatically, the process of finding one cited journal article after another makes moving between resources more difficult than it is on the web, and so is less easy to drift into uncharted territory. These are difficult issues and will require teachers to train students and colleagues how to evaluate web based information.

If any new methods of teaching are to be successfully adopted, they require a coordinated approach from many members of a medical school, hospital or profession, not simply the one or two enthusiasts who champion their use. They need to be incorporated into the curriculum, and students formally assessed on the material both to test the value of the material itself and to encourage the more reluctant students to use these resources. Today's cost conscious society requires us to develop formal methods of evaluation to justify the expenditure on these relatively costly and rapidly outdated resources; anecdotal evidence such as that applied for many years to traditional teaching methods (books) is no longer applicable. However, there is a danger that too much introspection and angst over the efficacy of an individual programme will prevent us even considering using it at all.

Conclusions
In North America, the internet and world wide web have already changed education throughout all sectors of medical education, and approximately 25% of homes have internet access. In the UK, the lack of a national network infrastructure, poorly coordinated and bureaucratic systems, and the general conservative nature of the postgraduate medical academic establishment has hampered the adoption of this newer technology as an adjunct to formal teaching. In an area in which technology advances so rapidly, (on average, computer power doubles every 18 months (Moore's law)), if decisions and policy take years to implement there is a danger that we will be caught in a world of rolling obsolescence.

The pathology community has begun to address the complex issues that arise from these new advances. August organisations such as the Royal Colleges and the Association of Clinical Pathologists are beginning to look at the issues related to coordinating, evaluating, accrediting, and distributing electronic information resources to all disciplines of the profession. The problems are not simple ones,
but they will not go away and need to be addressed with some urgency. The solutions have the potential to change the way we teach and learn pathology for years to come.

1 Path-uk. www.his.path.cam.ac.uk/path-uk/welcome.html
2 Webpath. www-medlib.med.utah.edu/WebPath/webpath.html
3 Bowman Gray Pathology Cases. www.bgsm.wfu.edu/pathology.html
4 University of Alberta Pathology Teaching. www.his.path.cam.ac.uk/big/synapse/000p002b.htm
5 Mark Pallen’s lecture notes. www.qmw.ac.uk/~rhbm001/intro.html
7 The Interactive Patient. musom.marshall.edu/medicus.htm
8 Charles Jennette’s Renal Pathology cases. www.gamewood.net/pathcase/uncpath.html
9 Haematopathology from NYU. mchip00.med.nyu.edu/hematopath/bfhomedocs/bfhomz.html
10 NEQAS renal scheme images. www.le.ac.uk/ps/prf1/eqa/pacs.html
11 UK NEQAS home page. www.wcl.bham.ac.uk/nejas/
14 Highwire press. highwire.stanford.edu
15 Journal of Interactive Media in Education. www.jime.open.ac.uk/index.html
16 International Society of Nephrology (mirror site). www.his.path.cam.ac.uk/mirrors/isn/000i0000.htm