

The Internet for Pathologists

A Simple Schema for Evaluating Pathology-Related Web Sites and a Catalog of Sites Useful for Practicing Pathologists

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● **Context.**—With the increasing popularity of the Internet as a primary medical information source, it is critical for pathologists to be able to use and evaluate both general medical- and pathology-related Web sites. Several published models for evaluating Web sites prove cumbersome to use and often involve computer- or statistic-based algorithms.

Objectives.—To develop a simple group of scoring criteria to objectively evaluate medical Web sites and provide a list of the highest-scoring pathology-related sites that will be useful to the practicing pathologist.

Design.—Using 11 commonly used Internet search en-

gines, the top 50 “hits” retrieved from the search term *websites for pathologists* were scored using 5 criteria, including accuracy, ease of navigation, relevance, updates, and completeness. A possible 6 to 12 points per area were awarded, and the total score was summated.

Results.—Scores obtained ranged from 12 to 21. Thirty-five Web sites, all scoring 15 or higher based on these criteria, were listed as most useful.

Conclusion.—A simple, easy-to-use, 5-category scoring system can prove useful in evaluating pathology- and medical-related Web sites.

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The use of the Internet as a source for medical information has resulted in a steadily growing level of interest. Data from the Nielsen/Netratings Group estimate that by September 1, 2004, 202 million people in the United States used the Internet, representing a 112% growth since 2000.¹ The diversity of information obtainable to those navigating the World Wide Web, its ease of use, and increasing availability often make it the first resource used by those seeking information.

Medical data are no exception. Using the term *medical website*, more than 7.2 million results were returned in a recent search using a well-known Web search engine. These sites encompass topics that range from diagnosis and treatment of conditions to support groups and commercially supported advertisements. The level of complexity of information varies, with many sites targeted to both the public and health professionals. Such resources can prove incredibly valuable but also come with a series of caveats. Great concern exists regarding the accuracy and bias of the information presented on Web sites. Unlike most journals and texts, publicly accessible Web sites usually lack expert or peer review to validate their contents.

The specific aim of this review is to present a short, indexed list of a broad range of highly useful pathology-related Web sites, as well as to comment on their uses and

pitfalls. Other benefits and resources of the Internet are beyond the scope of this review, such as e-mail, virtual microscopy, electronic patient charting, and Internet results reporting; these topics are discussed elsewhere.^{2–8}

MATERIALS AND METHODS

A search for pathology-related Web sites was performed using 11 widely used search engines to identify all sites found by the keywords *websites for pathologists* (Table 1). This was done to ensure that the search was broad enough to include Web sites that focused specifically on content for pathologists and those that had relevant content for other medical professionals.

For a Web site to be included in our review, the following criteria had to be met: (1) free access with no fee for use and (2) minimal login required (no more than a user name and password). If these criteria were met, the Web site was evaluated and scored according to the guidelines in Table 2. The resulting sites were then categorized into 18 groups according to the clinical or anatomic area of pathology that was described. Only the first 50 sites obtained from each search were evaluated, and the best Web sites were selected for final tabulation.

RESULTS

The results generated by each of the 11 search engines used varied slightly. A mixture of sites was identified, including those of professional organizations, patients, support groups, cancer treatment centers, charity organizations, government-sponsored institutions, and the occasional law firm that specialized in medical malpractice. Many of these sites were present in the lists generated by multiple search engines. The Web sites evaluated had scores that ranged from 12 to 21. The 35 highest-scoring Web sites (those with a score of at least 15) grouped by their area of focus are listed in Table 3.

It became evident that in some areas the search per-

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Search Engine	URL
Alta Vista	www.altavista.com
Ask Jeeves	www.ask.com
Direct Hit	www.directhit.com
Excite	www.excite.com
Google	www.google.com
Hot Bot	www.hotbot.com
Lycos	www.lycos.com
Microsoft Network	www.msn.com
Netscape Netcenter	http://home.netscape.com
Webcrawler	www.webcrawler.com
Yahoo	www.yahoo.com

formed had failed to highlight some Web sites that were known to be of benefit to pathologists. An example was Lab Tests Online (<http://www.labtestsonline.org/>). This site, although not specifically directed at pathologists, is of great interest and use to pathologists in the clinical setting. To address this issue, we validated our list of Web sites in Table 3 by performing narrower searches for each category. For example, in the chemistry section, we searched for *chemistry websites pathologists*. In each category we obtained approximately the same sites and did not encounter any Web sites that scored higher than those listed in Table 3. The Lab Tests Online site did not show up in the top 50 Web sites in any of our searches. Finally, when modifying the search to *laboratory tests*, the Web site was found.

COMMENT

The Internet is a rich and valuable source of current information for patients and physicians. The volume of data available is staggering, but great heterogeneity exists in the objectivity, relevance, and timeliness of what is presented. One of the greatest pitfalls, however, is the potential inaccuracy of the facts offered, a point that becomes even more important as Web sites advocate treatments.⁹⁻¹¹

The medical community has begun to address concerns

of the accuracy and quality of medical information presented on the Internet.^{12,13} In 2000, the American Medical Association published a series of guidelines for medical and health information Web sites,¹⁴ but these guidelines remain unenforceable and few Web sites adhere to them.¹⁵ A number of Web-based tools have been developed to evaluate the quality of health information on the Internet, although these are often complicated and difficult to use.^{16,17}

We propose a simple, 3-tiered grading system based on 5 variables. The system does not require input of data into tables or Web-based analysis tools and is modified from those previously used to evaluate other health-related Web sites.¹⁸ The variables allow interactive participation of the user and should form the foundation of any medically relevant Internet site.

This grading system we propose is, by its very nature, subjective and subject to interobserver variability. This is understandable, since not all users of a particular Internet site will score each category the same, simply based on personal and technological preferences. However, the global score (summation of the score of all 5 variables) should provide any user with an indication of the relative benefit of the Internet site. We propose that an Internet site with a global score of at least 15 should be considered relevant and sites with scores below 10 of minor educational impact. The weighting of the criteria can be modified by each individual user to suit the particular needs or preferences; for example, one user may place more emphasis on updates than relevance and can weight these categories accordingly.

The criteria used allow a quick analysis of the Web site to determine if the information is accurate, complete, relevant, updated, and easy to access.

- Accuracy—This is determined by the Webmaster by comparing the information presented on the Web site with currently published peer-reviewed medical literature. Preferably, all material should be referenced as to source.
- Ease of navigation—Although this is subjective, there

Criterion	Poor	Good	Excellent
Accuracy	Some statements (<25%) are incorrect compared with standard medical literature (3 points)	Most statements (75%–90%) are correct or are not referenced (4 points)*	Statements are correct, material provided is referenced (5 points)
Ease of navigation	Data presented in a disorganized fashion, many “pop-ups” and commercial banners; too much information on 1 page, need to scroll through many pages (1 point)	Systematic organization of the data presented; commercial banners excluded to one side; no search index; navigational links on bottom of page—user must scroll to find them (2 points)	Short, concise screen pages with easily readable display of information; visible search index; navigational links on top or side of page (3 points)
Relevance	Of little relevance to pathologists, clinicians, or patients diagnosed as having the condition (3 points)	Of some relevance to pathologists, clinicians, or patients (4 points)	Relevant material for all groups present (5 points)
Updates	Either unable to determine or less than quarterly (1 point)	Monthly (2 points)	Weekly (3 points)
Completeness	Information provided is superficial and only discusses isolated issues (3 points)	Information provided is of general depth; various issues discussed but no links provided to other Web sites of possible interest (4 points)	Information provided is in depth, covering a range of relevant issues and/or provides links to other Internet sites of possible interest (5 points)

* Sites that were primarily lists of links to other Web sites were arbitrarily given a score of 4 in the accuracy category.

Table 3. Most Useful Pathology Web Sites Categorized as to Area of Anatomic or Clinical Pathology

Web Site	URL
Forensic pathology	
Forensic Medicine for Medical Students	http://www.forensicmed.co.uk/
Johns Hopkins Autopsy Resource: Image Archive	http://www.autopsydb.org/iadbimag.htm
Biostatistics	
Electronic Stats Book	http://www.statsoft.com/textbook/stathome.html
Introductory Statistics	http://www.psychstat.smsu.edu/
Cytopathology	
Syracuse Dysplasia Tutorial	http://www.ec.upstate.edu/cyto/
Cytopathnet	http://www.cytopathnet.org/
Dermatopathology	
DermPath Tutor	http://tray.dermatology.uiowa.edu/DPT/Path-Index.htm
Dermatology Online Atlas	http://www.dermis.net/bilddb/index_e.htm
Gastrointestinal pathology	
Pancreas cancer and dysplasia	http://pathology.jhu.edu/pancreas/
Frozen sections	
Frozen consult	http://www.pathologie-fuerth.de/methods.html
Frozen section case reports	http://www.pathologie-fuerth.de/case_case.html
Genetics and molecular pathology	
Genetics Home Reference	http://grh.nlm.nih.gov/ghr/conditionsByName
Atlas of Genetics and Cytogenetics in Oncology and Hematology	http://www.infobiogen.fr/services/chromcancer/
Cytogenetics Gallery	http://www.pathology.washington.edu/Cytogallery
Hematopathology	
Hematopathology Phenotypes	http://web2.airmail.net/uthman/cdphobia/cdphobia.html
Protein Reviews on the Web	http://www.ncbi.nlm.nih.gov/projects/prow/
Lymphoma Network	http://www.lymphomainfo.net/nhl/classify
Immunohistochemistry	
Immunoquery	http://immunoquery.com/login.cfm?IQMessage=1
Neuropathology	
Brain Atlas	http://www.med.harvard.edu/AANLIB/home.html
Neurology on the Internet	http://www.neuropat.dote.hu/
Ob-Gyn pathology	
Tumors of the Female Reproductive Organs	http://www.bioscience.org/atlas/tumpath/freprod/freprod.htm
Pediatric/placental pathology	
Pediatric Pathology—Cornell University	http://edcenter.med.cornell.edu/CUMC_PathNotes/Pediatrics/Pediatric.html
Placental Pathology Index	http://medlib.med.utah.edu/WebPath/PLACHTML/PLACIDX.html
Pulmonary pathology	
Pneumo Tox	http://www.pneumotox.com/
Surgical pathology	
University of Pittsburgh	http://path.upmc.edu/casemonth/ap-casemonth.html
Pathmax	http://www.pathmax.com/main.html
Pathology Outlines	http://www.pathologyoutlines.com/
Urinary tract/male pathology	
World Health Organization/International Society of Urologic Pathology Urothelial Neoplasms Classification	http://162.129.103.34/bladder/
Gleason's Grading of Prostate Cancer	http://162.129.103.34/prostate/
Transplant pathology	
University of Pittsburgh	http://tpis.upmc.edu/
Chemistry	
Lab Tests Online	http://www.labtestsonline.org
Interpretation of Lab Test Profiles	http://web2.airmail.net/uthman/lab_test.html
Clinical Laboratory Science Internet Resource	http://members.tripod.com/~LouCaru/index-5.html
Blood Bank	
American Red Cross	http://www.redcross.org/services/biomed/0,1082,0_557_,00.html
U.S. Food and Drug Administration	http://www.fda.gov/cber/blood.htm

Table 3. Extended

Description	Ease of					Total
	Accuracy	Navigation	Relevance	Updates	Completeness	
A concise review of forensic topics with links to recent publications	5	1	5	1	5	17
Autopsy images, searchable by keyword	4	3	4	1	4	16
Searchable online text for statistical methods	4	3	5	1	4	17
Links to several online statistics texts	5	2	4	1	5	17
Basic cervical dysplasia tutorial, useful for clinicians	4	2	4	1	4	15
Cytology bulletin boards, image archives, links to current articles and news	4	3	4	3	5	19
Tutorial on basics of skin pathology with descriptions of many uncommon lesions	4	3	4	1	4	16
Disease descriptions, photographs, and differential diagnoses for dermatologists	5	3	4	1	5	18
Pancreatic cancer classification	5	3	5	1	5	19
Suggestions for frozen sections	4	3	4	1	3	15
Frozen section cases with common problem diagnoses	4	3	4	1	3	15
Listing of common genetic disorders by name, specific gene defect given with links to publications and testing agencies	5	3	5	3	5	21
Disease entities indexed by chromosome with lists of important genes present on each	5	3	4	2	5	19
Basic cytogenetics tutorial for clinicians or patients	4	3	5	1	3	16
Antigen profiles of hematopoietic tumors	4	3	4	1	5	17
National Institute of Health Web site listing all antigens with links to genetic locus information	5	2	4	1	5	17
Patient-oriented database indexed by lymphoma subtype	4	2	5	1	5	17
Database of tumor immunophenotypes	5	3	4	2	4	18
Radiographic images of normal brains and pathology	4	4	4	1	4	17
Comprehensive neuropathology site with numerous links to imaging and gross and micro photos	5	3	4	2	5	19
Synopsis of lesions with descriptions and images	4	3	4	1	4	16
Synopses of common pediatric pathology with gross and micro images	4	1	5	1	4	15
Gross and micro images with explanations	4	3	4	1	4	16
Drug-induced lung injury database, indexed by drug name or radiologic findings	5	2	5	2	5	19
Interesting case review in surgical pathology published monthly	5	3	4	2	4	18
General site with numerous specialized links	4	3	4	1	5	17
Surgical pathology by organ system	5	3	4	2	5	19
Tutorial using current guidelines for classification	5	3	4	1	4	17
Tutorial of grading prostate cancer using Gleason scoring system	4	2	4	1	4	15
Organ transplant pathology by organ	5	3	5	2	5	20
Clinical laboratory tests information resource on interpretation of results and type of specimen required	5	3	3	3	4	18
Panels of laboratory tests with interpretations with factors or drugs that may alter values	4	1	5	1	4	15
Meta collection of annotated links to various clinical pathology Web sites	4	2	5	3	5	19
Current blood donor criteria	4	2	5	1	4	15
Updated policies on current blood bank issues	5	2	5	1	4	17

are universal features that make any Web site more amenable to use, such as pages that contain a single screen, navigational toolbar either at the top or side of the page, systemic organization of the data, and large, well-spaced text that is easy to read. If commercial banners are displayed, they should not be of the "pop-up" type and preferably limited to no more than 3 per page; not-for-profit Web sites tended to score higher in this regard, because they had no prominent advertising banner or only a small institutional icon.

- **Relevance**—The applicability of the information is directly linked to the type of information desired by the browser. Web sites were selected with content that could be useful on a daily basis for practicing pathologists.
- **Updates**—If a Web site has not been updated in at least 6 months, it could be considered a stagnant site. If 12 months have passed without documentation of additions or modifications, the information provided must be viewed as possibly out of date.
- **Completeness**—This is an indication of the depth and breadth of discussion provided (eg, whether the information only discusses one type of ancillary technique or a number of options). Further, sites scored higher in this tier if they provided access to more in-depth information via either URL links or bibliographic references to other possible sources.

It was found that a possible source of frustration for those using search engines to find information on even narrow topics lies in the volume of "hits" returned. As mentioned, searches generally tend to return sites numbering in the thousands. Although extremely comprehensive, this tends to defeat the object of a focused search: to find relevant information on the subject desired in a short amount of time. This is exponentially more difficult if the user must sift through more than 100 pages to analyze the selected results. It is necessary to note, however, that the sites that we ranked as highly useful were obtained in the first 50 links provided by search engines such as Yahoo (www.yahoo.com). One pitfall noted with the use of commercial search engines for pathology-related Web sites was the fact that in our broad search of Web sites for pathologists some Web sites that were not specifically directed at pathologists but were of great interest and use to pathologists in the clinical setting were not found. In particular, the Lab Tests Online Web site is an excellent resource for clinical pathologists and patients, offering information in laboratory specimen type, collection, and results interpretation. However, even by narrowing our search to a particular field of pathology, the Lab Tests Online site did not show up in the top 50 Web sites in any of our searches. Finally, when modifying the search to *laboratory tests*, the Web site appeared in the search. This raises an interesting point in that there are some useful Web sites on the Internet that may not be picked up with commercial search engines. This could be explained by too broad a search, improper keywords, or failure of the Web site to correctly index its site.

The benefits of the Internet for the practicing pathologist can be divided as follows:

- **Diagnosis-related Web sites** are extremely useful, such as those relating to immunohistochemistry that provide updated, referenced information on the immunohistochemical phenotypes of numerous lesions. Further, oth-

er locations exist on the Web that fully present the molecular abnormalities associated with various diseases. This group of Web sites forms the bulk of the material presented in this review.

- The latest developments with regard to the diagnosis, screening, and treatment of pathologic entities can be assessed.
- Most pathology journals offer online access to published articles in PDF format.
- Patients who are better educated about their disease make better treatment decisions and have superior outcomes.¹⁹⁻²¹ Although pathologists are often not directly involved with patient care, there may be occasions when patients wish to know more about their diagnosis from the pathologist. Many of these "empowered" patients can be referred to excellent patient-oriented educational sites that discuss a variety of topics on cancer.

To enhance their practices, pathologists can use the power of the information available on the Internet; however, the burden of determining the accuracy and relevance of the content falls on the user.

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