

Group for Research in Pathology Education Online Resources to Facilitate Pathology Instruction

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● **Background.**—The Group for Research in Pathology Education (GRIPE) is an organization of pathology educators whose purpose is to promote and facilitate excellence in pathology education. One important function of GRIPE is the maintenance of image and multiple-choice test question data banks. These resources have recently been made available online via the GRIPE Digital Library Web site. The purpose of the GRIPE Digital Library project was to develop an online searchable database that would facilitate access to the GRIPE resources for pathology education.

Design.—The GRIPE image bank—containing approximately 3000 peer-reviewed gross and microscopic pathologic images along with textual descriptions—was linked with the GRIPE test question bank using Gossamer Thread's DBMan Web database management program. The search and display templates create a functional user interface that integrates images, image descriptions, and test ques-

The Group for Research in Pathology Education (GRIPE) began in 1971 as a forum for teachers of medical school pathology courses to discuss educational objectives and evaluation techniques, and to share instructional materials.¹ GRIPE currently comprises 70 institutional members and 220 individuals, representing medical schools in the United States and Canada, as well as 7 other countries, including the United Kingdom, India, Israel, Grenada, and Tanzania. The biannual meetings provide opportunities for educators to share ideas, discuss innovations in pathology education, and participate in the many faculty-development programs. One of the goals of GRIPE has been to serve its members as a resource for peer-reviewed instructional materials that are continually updated and improved. These materials include medical student objectives, multiple choice and clinical case examination question databases, and a pathology teaching image collection.

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tions into a single online digital library. Using any Web browser, faculty can access the GRIPE Digital Library and search for images and/or test items that can be used in teaching.

Results.—In the first 18 months (February 2000 through July 2001), users at 40 GRIPE member institutions signed up and used the GRIPE Digital Library to perform more than 6000 individual searches and view more than 37 500 images. These digital images were used to produce lectures and laboratory modules that were posted on Web pages and made available to students remotely.

Conclusions.—The GRIPE Digital Library provides a unique resource that can facilitate development of educational materials for pathology instruction and helps to fulfill the educational mission of GRIPE.

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Historically, these materials have been available to GRIPE members in hard copy format and, in more recent years, in a succession of computerized image and database formats distributed on floppy disks or CD-ROMs. The growing utilization of computer-based curriculum delivery systems (eg, digital slide presentations, course Web sites, and computer-based testing), however, means that digital distribution of these resources is becoming even more important to many GRIPE members.

The World Wide Web (WWW) offers another distribution medium to allow easy, timely access to these educational resources.^{2,3} Offering these resources via the Internet affords numerous benefits. Users on different computer platforms are able to access Internet-based resources without concern of software compatibility, as may be seen with the use of proprietary databases. Multiple users at a given institution may access resources without the need to internally duplicate and distribute hard copies or to maintain an intranet-based distribution model. Updates are immediately available online, thus alleviating the need to update each institution and each user within an institution. Finally, as members' needs change, a WWW-based delivery system can be quickly modified to provide new offerings.

To further facilitate sharing and utilization of the GRIPE instructional resources, we have developed the GRIPE Digital Library Web site. Teaching faculty from GRIPE member institutions are provided online access to the pathology image collection and the test item banks using a Web browser. The purpose of this report is to describe the

development of the GRIPE Digital Library and to demonstrate how this online resource has been used to augment the teaching of pathology.

MATERIALS AND METHODS

GRIPE instructional resources consist of greater than 7000 test items and approximately 3000 35-mm transparencies, including gross and microscopic pathologic specimens, as well as a small number of clinical and radiologic images (1400 of which are utilized in image-referenced test items). These materials are submitted by GRIPE members and are peer reviewed, classified, and cataloged by subcommittees at each biannual GRIPE meeting. In addition, the multiple-choice question bank undergoes regular updating and revision to maintain item currency. At the time that this project began, GRIPE databases were being distributed electronically in a proprietary database format (FileMaker Pro, <http://www.filemaker.com>), which contained digital image thumbnails for reference. Larger digital representations of each 35-mm transparency were available in Kodak PhotoCD format.

For development of WWW resources, we wanted a system that would be portable and cross-platform (Unix vs Windows) and for which licensing could be easily transferred. Gossamer Thread's DBMan Web database management (<http://www.gossamer-threads.com/scripts/dbman>) was selected because of its built-in user management system, its portability across all Windows- and Unix-based server systems, and for its low cost (free for academic and nonprofit use). DBMan is a common gateway interface (CGI) program written in the Perl language that requires only that a Perl interpreter and Web server software be installed on the host computer, both of which are available free of charge for both server platforms. The database backend for the free academic version of DBMan consists of an ASCII text flatfile; the program can be made to operate as a relational database by the use of multiple flatfiles that have at least 1 field in common. Three main tables—image information, test bank items with associated images, and test bank items without associated images—were exported from the FileMaker Pro-based GRIPE databases into ASCII text format. The 2 test bank tables were modified to align common fields, such that the 2 tables could be combined into a single ASCII flatfile. The resulting image and test bank files were then loaded onto the Web server and made available to the Web database management program.

Any image located on the Web server can be integrated by DBMan into its display of textual information from the associated ASCII flatfiles. However, GRIPE images that had been previously digitized into the Kodak PhotoCD format would not be viewable within a WWW-based delivery system, since most current WWW browsers are only able to display images in 3 image formats, namely, GIF, JPEG, and PNG. The "batch" feature of Adobe Photoshop image-editing software (<http://www.adobe.com/products/photoshop>) was thus used to automatically convert each PhotoCD image to a JPEG image with dimensions of 768 × 512 pixels at a 10:1 compression ratio. These image files were placed on the Web server and thereby made available to the database management program.

DBMan query and display templates were designed to create an attractive and functional user interface that integrated images, image descriptions, and test questions into a single online digital library. Using any Web browser, faculty can access the GRIPE Digital Library and search for images and/or test items. From the search results page, images or test items of interest can be saved to a "shopping cart." The image files can be copied to the user's local drive and used in PowerPoint presentations or saved for Web development. Test questions can also be added to a shopping cart and either saved in HTML format for Web-based examinations or as a text file for generating hard copy examinations.

RESULTS

The GRIPE Digital Library Web Site

The GRIPE Digital Library search interface allows users to search for images of specific types using keyword searches augmented by "and"/"or" Boolean search enhancements (Figure 1). The user can also choose the number of thumbnail images to display on each page. The search results contain a thumbnail image and the descriptive information about the image contained in the database (Figure 2). The user has the option of viewing a small, medium, or large version of each image. These 3 different image sizes were chosen to facilitate use of these images in a variety of multimedia applications. Small images are compressed JPEG images that are well suited for Web-based applications. The medium-sized images are somewhat larger and are best suited for applications that will be run over a fast Internet or intranet. Large, high-quality images are specifically designed to be inserted into Microsoft PowerPoint presentation slides for lecture presentations. In all instances, images can be downloaded to the user's computer and modified to suit individual needs. Additional features built into the GRIPE Digital Library improve the system's ease of use. A shopping cart feature allows the user to rapidly scan search results and save images of interest to the shopping cart for a more thorough subsequent review. To facilitate retrieval of related materials, targeted search links allow the user to quickly recover "related" images based on topical, organ, or diagnostic criteria. A link associated with each image allows "1-click" retrieval of examination bank questions that utilize that particular image. Finally, an advanced search mode is available for users familiar with the GRIPE image coding system to query by specific image type, topic, and subtopic, in addition to keywords.

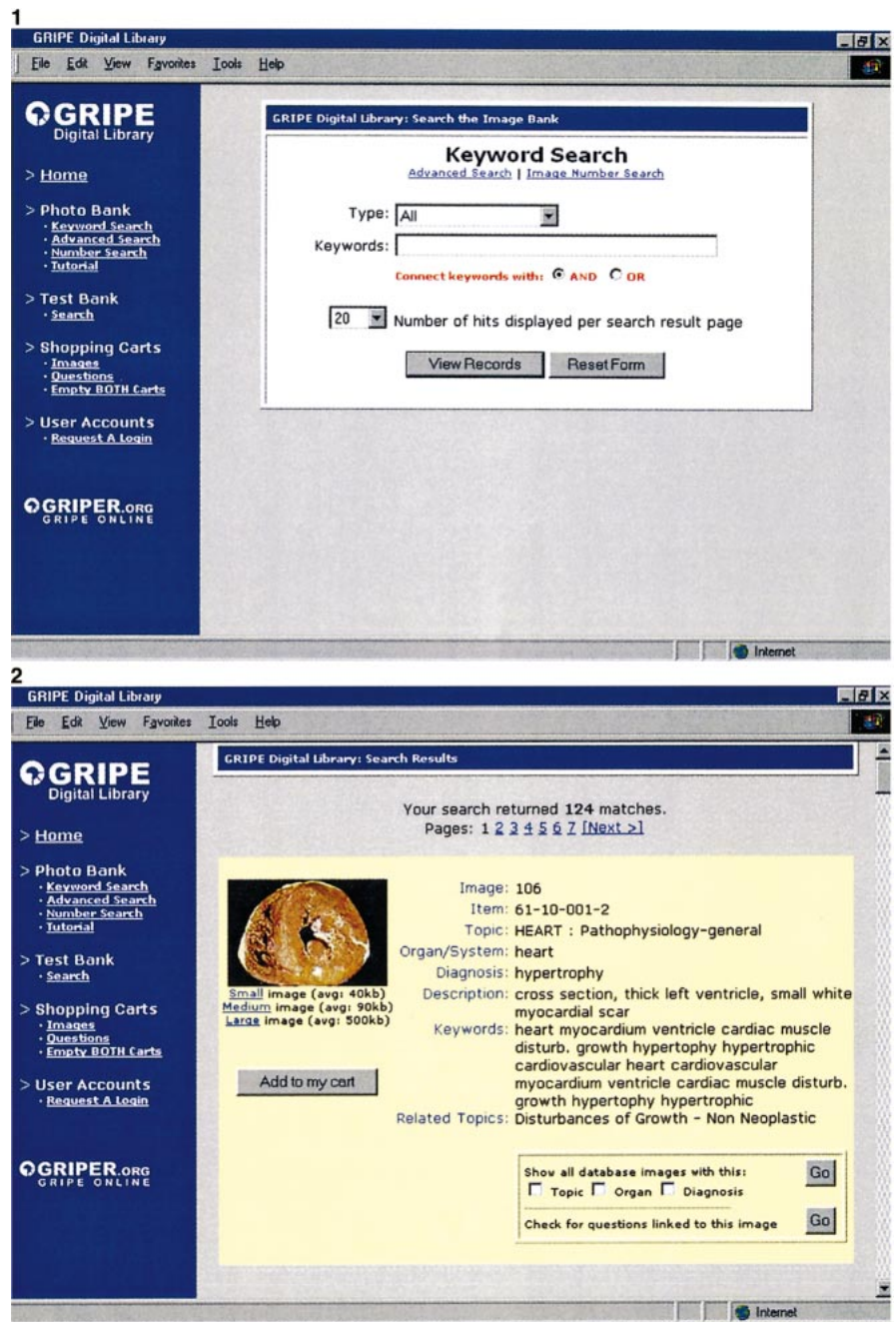
The peer-reviewed GRIPE examination question bank is also fully searchable online via the GRIPE Digital Library. The search interface is similar to that used for images. Searchers can choose the question format and specify whether they want questions with or without associated images. Additional search categories include scope (eg, general or systemic pathology), topic (eg, inflammation, immunopathology, heart, or neuropathology), and subtopic appropriate for each topic (eg, mediators, inflammatory cells, or exudates for the topic of inflammation), as well as keywords (Figure 3). Again, users have access to a shopping cart, where they can preselect interesting questions and then view the cart to perform a final review. To facilitate examination preparation, the user may either convert the items of interest from the test bank into a text file, or the questions along with the accompanying image information can be sent to the user by e-mail (Figure 4).

Use of the GRIPE Digital Library

In the first 18 months (February 2000 through July 2001), users at 40 GRIPE member institutions signed up and used the GRIPE Digital Library to perform more than 6000 individual searches and view more than 37500 images. To characterize the impact that the GRIPE Digital Library had on pathology instructional activities, we developed an online survey for the users of the database, and we polled pathology course directors at the GRIPE Course Director's Workshop (Park City, Utah, July 2001). Of the 20 online survey responses, the majority of faculty used

Figure 1. The Group for Research in Pathology Education Digital Library image search menu. The navigation bar on the left can be found on every page and provides ready access to all areas of the Web site. The image search interface allows the user to search for images by type (gross, microscopic, etc.) and by using keywords. The option of “and” or “or” Boolean searches are also available.

Figure 2. Example of a typical search result showing a small (thumbnail) version of the image and description from the database. The image can be viewed in better detail by clicking on the thumbnail to open a large-sized version of the image, and images can be added to the “shopping cart” for further review. The image may also be downloaded in small, medium-sized, or large formats for Web-based applications, intranet-based applications, and for Microsoft PowerPoint slide presentations, respectively. Each image also has several search enhancement features allowing the user to perform additional searches for database images from the same topic, the same organ, or the same diagnosis. It is also possible to check to see if any examination questions are associated with the selected image.



both the image database and the text item bank. Faculty from institutions with classrooms containing video projectors and computers were able to use the digital images to create PowerPoint lectures that could then be uploaded to a course Web site and/or archived. Faculty reported that the students liked having the lectures “online” so they could go back and review the materials. A few course directors reported that virtually all of the pathology lectures were converted to PowerPoint format and that faculty were strongly encouraged to use the digital format rather than traditional 2 × 2 slides. This total conversion to electronic files facilitated distribution of teaching materials and made it much easier for faculty to revise and upgrade these materials from year to year.

Most faculty members used the online test item bank during their courses. The majority of users were course

directors, and they were the ones primarily responsible for developing quizzes and examinations. They used the search engine to identify individual questions and used the cut-and-paste feature to insert these test items into a word-processing document. Some faculty used the shopping cart feature to identify groups of test items for a specific topic and then e-mailed these items to colleagues for review and editing. Several course directors reported that the easy access and the utility of the Web-based search engine made it significantly easier to develop examinations for their students.

COMMENT

One of the main goals of GRIPE has been to serve as a resource for peer-reviewed instructional materials that are continually updated and modified, and which can then be

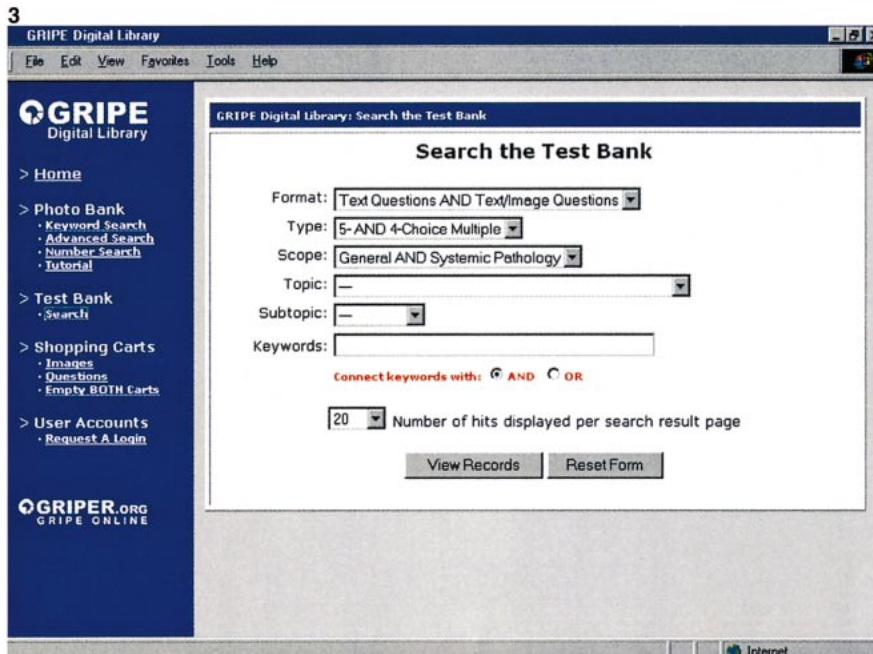


Figure 3. The Group for Research in Pathology Education examination question bank search interface allows the user to pick the examination questions with or without associated images and allows for precise definition of question content area. The peer-reviewed GRIPE examination questions are cataloged according to scope (eg, general or systemic pathology), topic (inflammation, immunopathology, heart, neuropathology, etc), and subtopic appropriate for each topic (eg, mediators, inflammatory cells, or exudates for the topic of inflammation), as well as keywords.

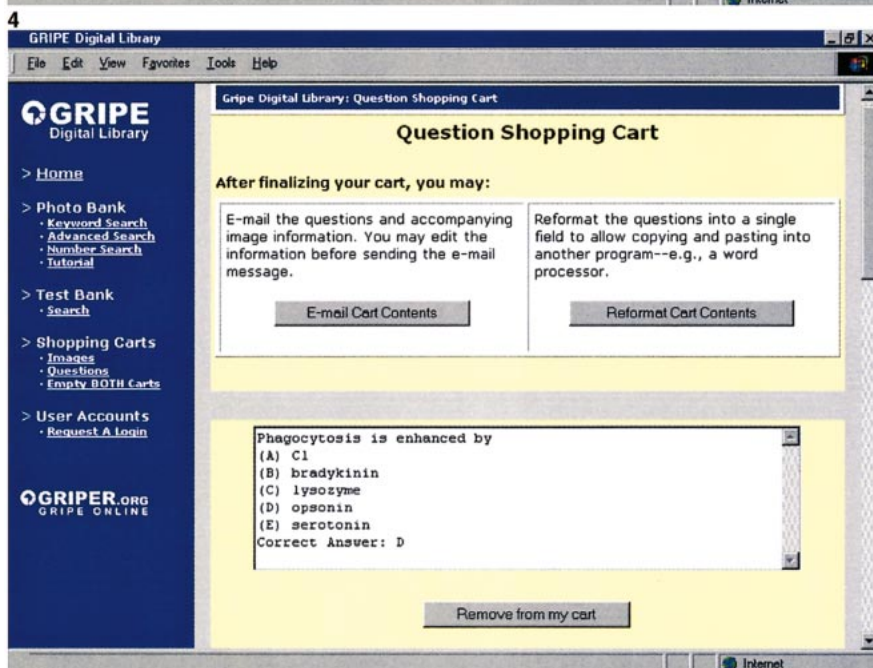


Figure 4. Example of an examination question "shopping cart." The user can either convert the questions to a text file that can be used to prepare a paper examination or the questions—along with the accompanying image information—can be sent to the user by e-mail.

shared among the GRIPE members. To facilitate the sharing of these instructional resources, the GRIPE Digital Library Web site has been developed and is being used by GRIPE member institutions to augment their teaching programs.

Curricular reform is a common theme in most medical schools. The need for "just-in-time" information access and the desire to develop "information-seeking behavior" in our medical students necessitates creative modifications in medical curricula.^{4,5} Distance learning strategies with information access via local intranets and the Internet can help to fulfill these goals.^{2,6-9} In many of these types of learning/teaching modalities, access to clinically relevant instructional materials is important both for the student seeking clinical correlations and for the instructor trying to develop clinically relevant learning environments.

Ready access to high-quality clinical materials, including patient histories, laboratory data, radiographic studies, and pathology images via an Internet/intranet-compatible database would augment these teaching/learning opportunities.^{7,10,11} In addition, Web-based programs for storage and authoring of these instructional resources could facilitate collaboration among faculty from other departments and from other campuses.¹² The unique role of pathology as the bridge between basic and clinical sciences and as a repository for laboratory data and images makes the discipline a logical key player in the development of these instructional resources.¹³ GRIPE serves as an essential resource for the development, peer review, and dissemination of instructional materials. The GRIPE Digital Library allows ready access to these instructional materials and serves as a valuable resource for pathology teaching fac-

ulty as they work to develop new and innovative medical education curricula.

References

1. Kent TH. The Group for Research in Pathology Education. *Arch Pathol Lab Med.* 1977;101:279.
2. Klatt EC. Web-based teaching in pathology. *JAMA.* 1997;278:1787.
3. Nguyen AN, Uthman MO, Johnson KA. A web-based teaching program for laboratory diagnosis of coagulation disorders. *Arch Pathol Lab Med.* 2000;124:588–593.
4. Spencer JA, Jordan RK. Learner centred approaches in medical education. *BMJ.* 1999;318:1280–1283.
5. Bland CJ, Starnaman S, Wersal L, Moorehead-Rosenberg L, Zonia S, Henry R. Curricular change in medical schools: how to succeed. *Acad Med.* 2000;75:575–594.
6. Rashbass J. Why use the internet to teach pathology? *J Clin Pathol.* 1998;51:179–182.
7. Klatt EC, Dennis SE. Web-based pathology education. *Arch Pathol Lab Med.* 1998;122:475–479.
8. DiGiorgio CJ, Richert CA, Klatt E, Becich MJ. E-mail, the Internet, and information access technology in pathology. *Semin Diagn Pathol.* 1994;11:294–304.
9. Horn KD, Sholehvar D, Nine J, et al. Continuing medical education on the World Wide Web (WWW): interactive pathology case studies on the Internet. *Arch Pathol Lab Med.* 1997;121:641–645.
10. Boisauvin EV, Winkler MG. Seeing patients and life contexts: the visual arts in medical education. *Am J Med Sci.* 2000;319:292–296.
11. Furness PN. The use of digital images in pathology. *J Pathol.* 1997;183:253–263.
12. Lowe HJ, Antipov I, Hersh W, Smith CA. Towards knowledge-based retrieval of medical images: the role of semantic indexing, image content representation and knowledge-based retrieval. *Proc AMIA Symp.* 1998:882–886.
13. du Boulay C. Learning pathology: why? how? when? [editorial]. *J Clin Pathol.* 1997;50:623–624.